Ministry of Industry and Trade
Socialist Republic of Viet Nam

No.

The Study on Master Plan for Energy Conservation and Effective Use in the Socialist Republic of Viet Nam

Final Report (Main Report)

December 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

ELECTRIC POWER DEVELOPMENT CO., LTD.

IDD
JR
09-075

PREFACE

In response to a request from Government of the Socialist Republic of Viet Num, the Government of Japan decided to conduct a study on The Energy Master Plan for Energy Conservation and Effective Use in the Socialist Republic of Viet Num and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Kimio Yoshida of Electric Power Development Co., Ltd. (J-POWER) and consisted of J-POWER between June 2008 and December 2009.

The team held discussions with the officials concerned of the Government of the Socialist Republic of Viet Num and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Socialist Republic of Viet Num for their close cooperation extended to the study.

December 2009

Atsuo KURODA,
Vice President
Japan International Cooperation Agency

December 2009

Mr. Atsuo Kuroda

Vice President
Japan International Cooperation Agency

Dear Mr. Kuroda,

Letter of Transmittal

We are pleased to submit our report on the Study on Master Plan for Energy Conservation and Effective Use in the Socialist Republic of Viet Nam.

This study was conducted for the purposes of establishing a road map and action plans for expediting the National Strategic Program on Energy Saving and Effective Use approved by the Prime Minister in April 2006, and also for the purpose of providing advice and necessary support to the Ministry of Industry and Trade for the formulation of the Master Plan on Energy Saving and Effective Use.

During the study, we made our best effort to establish the optimum road map and action plans from the technical, economic and social points of view. We sincerely hope that the output of this study will contribute toward the promotion of energy saving and effective use in Viet Nam

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, and the Ministry of Economy, Trade and Industry. We also wish to express our deep gratitude to the Ministry of Industry and Trade, the Embassy of Japan in Viet Nam, the JICA Viet Nam Office, and other agencies concerned in Viet Nam for the close cooperation and assistance extended to us during our study in Viet Nam.

Very truly yours,

Kimio Yoshida

Team Leader
The Study on Master Plan for Energy Conservation and Effective Use
in the Socialist Republic of Viet Nam

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Acronyms/Abbreviations

AC	Air Conditioner
AC	Alternating current
AFD	French Development Agency
AHU	Air Handling Unit
APEC	Asia-Pacific Economy Cooperation forum
APLAC	Asia Pacific Laboratory Accreditation Cooperation
ASEAN	Association of South-East Asian Nations
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BAS or BA	Building Automation System
BAU	Business as Usual
BEMS	Building and Energy Management System
BRESL	Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project
BTU	British Thermal Unit
CC	Continuous casting machine
CDM	Clean Development Mechanism
CEEP	The Commercial Energy Efficiency Pilot Program
CFL	Compact Fluorescent Lamp
CGO	Chief Green Officer
CNG	Compressed Natural Gas
CO_2	Corbon Dioxide
CY	Calender year
DANIDA	Danish International Development Assistance
DB	Database
DC	Direct current
DOC	Department of Construction
DOE	Department of Education
DOI	Department of Industry
DOIT	Department of Industry and Trade
DOST	Department of Science and Technology
DSM	Demand Side Management
DSO	District Statistical Office
DWL	Down Light
EA	Energy Audit
EC	Energy Conservation
EC&EU	Energy Conservation and Efficient Use
ECC	Energy Conservation Center
ECCJ	The Energy Conservation Center, Japan
ECO	Energy Conservation Office
EE	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EECO	Energy Efficiency and Conservation Office
EEREP	Energy Efficiency and Renewable Energy Project
EIRR	Economic Internal Rate of Return

EM	Energy Management
EMS	Energy Management System
ENERTEAM	Energy Conservation Research and Development Center
EPP	Efficiency Power Plant
EPU	Electric Power University
ESCO	Energy Service Company
EU	Europe Union
EVN	Electricity of Vietnam
EWH	Electric Water Heater
FAU	Fun Air-suply Unit
FCU	Fun-Coil Unit
FDI	Foregn Direct Investment
FRG	Refrigerator
FTL	Fluorescent Thin Tube Lamp
G	Generator
GDP	Gross Domestic Product
GEC	Global Environment Center
GEF	Global Environment Facility
GHG	Green House Gas
GSO	General Statistics Office
HCMC	Ho Chi Minh City
HCMECC	Ho Chi Minh Energy Conservation Center
HRD	Human Resource Development
HTML	HyperText Markup Language
HUT	Hanoi University of Technology
IE	Institute of Energy
ILAC	the International Laboratory Accreditation Cooperation
INV	Inverter
IPP	Independent Power Producer
ISO	International Organization for Standardization
IT	Information Technology
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JMF	The Japan Machinery Federation
LAN	Local Area Network
LED	Light Emitting Diode
LMP	Lamp
MEPS	Minimum Energy Performance Standard
METI	Ministry of Economy, Trade and Industry
MMU	Multi Meter Unit
MOC	Ministry of Construction
MOCST	Ministry of Culture, Sport and Tourism
MOET	Ministry of Education and Training
MOI	Ministry of Industry
MOIC	Ministry of Information and Communication
MOIT	Ministry of Industry and Trade

MOJ	Ministry of Justice
MOST	Ministry of Science and Technology
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
NEDO	New Energy and Industrial Technology Development Organization
NEEP	The National Energy Efficiency Program
NGO	Non-Governmental Organizations
NSP	New Suspension Pre-heater
NTP-RCC	National Target Program to respond to Climate Change
ODA	Official Development Assistance
OJT	On-the-Job Training
PA	Policy Action
PC	Portoland Cement
PC	Power Company
PC50	Portland Cement 50
PCB 30	Blended Portland cement 30
PCM	Project Cycle Management
PDCA	Plan, Do, Check and Action
PDF	Portable Document Format
PDP	Power Development Plan
PECSME	Promoting Energy Conservation in Small and Medium Scale Enterprises
PIR	Passive Infra Red
PM	Prime Minister
PS	Pressure Sensor
PSO	Provincial Statistical Office
PV	Photo Voltaic
R&D	Research & Development
RAC	Room Air Conditioner
RET	Renewable Energy Technology
S&L	Standards & Labeling
SEA	Strategic Environmental Assesment
SEAISI	South East Asia Iron & Steel Institute
SIDA	Swedish International Development Agency
SEDP	Socio Economic Development Plan
SP	Suspended preheater
SP-RCC	Support Program to Respond to Climate Change
SWH	Solar Water Heater
T	Transformer
TC	Ton of Carbon equivalent of CO_2
TOE	Ton of Oil Equivalent
TOR	Terms Of Reference
TOT	Training of Trainers
TOU	Time of Use
TSL	Two-Step Loan
U.K.	United Kingdom of Great Britain and Northern Ireland
U.S.	United States of America

UBP	Utility Bill Payback
UNDP	United Nations Development Program
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UPS	Uninterruptible Power Supply
US-EPA	U.S. Environmental Protection Agency
UVAST	Union of Vietnam Association of Science and Technology
VAST	Vietnam Agency of Science and Technology
VAV	Variable Air Volume
VDB	Vietnam Development Bank
VEEPL	Vietnam Energy Efficient Public Lighting Project
VILAS	Vietnam Laboratory Accreditation Scheme
VND	Vietnam Dong
VNEEP	Vietnam National Energy Efficiency Program
VRV	Variable Refrigerant Volume
VSD	Variable speed drive
WB	World Bank
WG	Working Group
WH	Water Heater

EXECUTIVE SUMMARY

Executive Summary
(Proposal to Implement Optimal Program for Promoting EE&C in Vietnam)

Since July 2008, when the Study started, the Study Team has held dozens of discussions and exchanged much information with the counterpart, Ministry of Industry and Trade (MOIT) and related organizations. Taking into consideration these processes, a summary of the major results of analysis, confirmed issues, direction to be targeted and proposals for optimal EE&C promotion are described as follows;

1. Outline of Basic Research

Basic research was conducted to focus on 9 issues below;

(1) Data collection and analysis on Vietnamese economic situation and energy supply and demand

(2) Vietnamese legal framework and inter-organization structure which had been enacted and formulated in the past

(3) Interim overview of the progress of National Strategic Program on EE&C (Includes some of another programs)

(4) Present condition on energy consumption data collection mechanism

(5) Present condition to promote EE&C in national level and local level

(6) Education and Training scheme for EE&C

(7) Activities of international and domestic organizations in support of EE&C

(8) On-site and questionnaire survey on industries and commercial buildings to understand the current conditions of EE&C implementation

(9) On the basis of the information above, clarification of the current condition and issues to be solved for promoting EE&C

The key information collected and issues clarified to be solved through the Study are described below: (→ : issues to be solved)

(1) GDP growth are expected to be 5-8% and national energy consumption growth are expected to be 10-15%/ year.

(2) Electricity supply deficit in the evening becomes an urgent and major issue (Refer Figure 1). And in urban area peak hours is moving to daytime cause of increasing cooling demand in buildings.

(3) Electricity tariff has been politically and historically set at a lower level than realistic cost. So people's incentive to reduce energy expenditure is so small that it is hard to promote EE&C.

→ **To formulate a countermeasure for this distortion is the biggest issue**

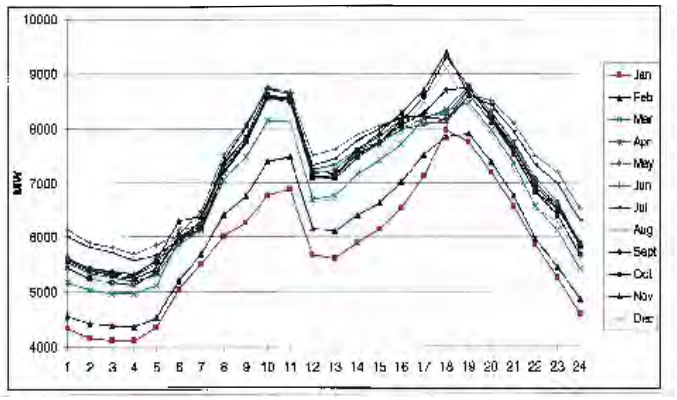


Figure 1 EVN Daily Load Curve

(4) Fuel switching from oil to cheaper coal is on-going in generation, but several of the construction of planed power plants are delaying. It takes 4-5 years to complete the construction of power plant , So the electricity shortage after 2013 becomes a big concern.

(5) In the legal framework under the EC Law which is expected to be enforced in July 2010, Vietnamese government is mainly focus on designated factories, buildings and transport enterprises program, certified energy manager program and standard and labeling program

→ **However the inter organizational structure has not been decided, and the practical tools and materials to operate the program has not been prepared yet. This becomes an urgent issue.**

(6) The labeling programs for magnetic ballasts, street lightings and T8 lamp have been finalized as the first such program in Vietnam. And from now on MOIT has a plan to formulate labeling programs on CFLs, electronic ballasts, refrigerators, air conditioners, fans and water heaters, whose energy consumption is increasing rapidly. And it is investigated to change from enforcement label to comparative one and from voluntary to mandatory.

(7) The major programs drawn up, proposed and supported by international organizations are as follows:

UNIDO: International energy manager program (ISO50001 basis) 2009-2013
UNDP: International labeling program 2009-2013
DANIDA: Implementation of energy management system supporting programs

2009-2015

→ **Functional linkage among these international organizations is an indispensable issue for Vietnamese EE&C.**

(8) On the basis of on-site and questionnaire surveys, the state of the implementation of EE&C practices in factories and buildings was analyzed. The key obstacles for EE&C were identified as follows. The interrelations among the constraints are also shown in Figure 2

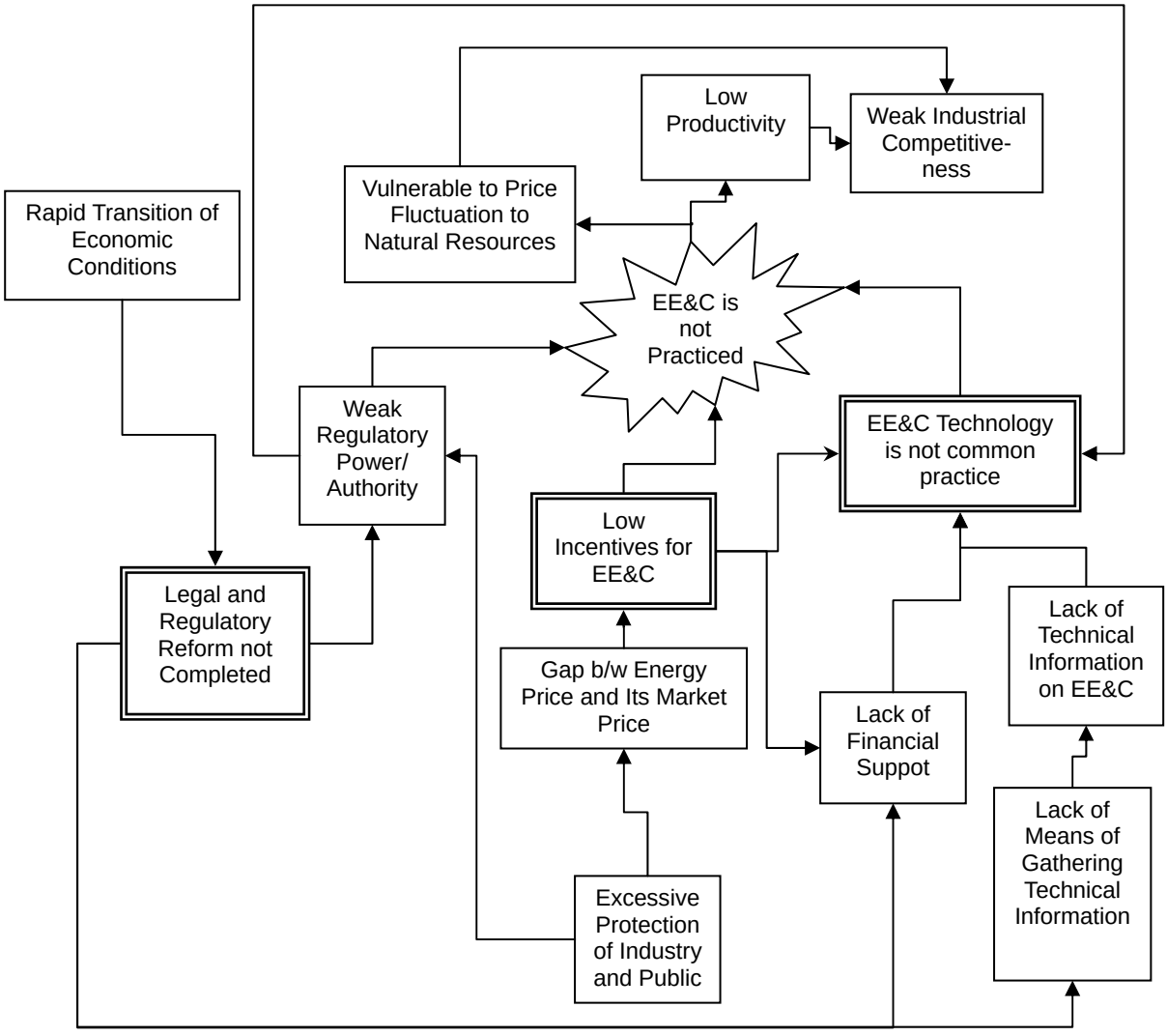


Figure 2 Problem Structure Analysis of the Constraints of EE&C Promotion in Vietnam

1) Lack of (quantitative) evidence-based management

2) Apathy and lack of interest in EE&C (especially in top management)

3) Lower electricity price compared with international market price

4) Lack of regulation to promote EE&C

5) Hardship to access useful technical information

6) Improper facility design and equipment

7) Insufficient standards in operations and procedures

8) Improper maintenance

9) Insufficient understanding of production process and facilities

→ **Practical countermeasures to breakthrough these 9 issues should be formulated**

(9) Outline of results of market research and analysis on electricity supply and demand are described as follows:

1) Conversion from incandescent lamps to CFLs has the quite comprehensive effect of achieving not only EE&C but also electricity peak cut, financial benefits for users and reduction of generating cost.

→ **Promoting CFL dissemination in rural area is a quite promising countermeasures for EE&C**

2) EE&C potential in cooling is the largest in commercial buildings

→ **Promoting high efficiency air conditioners and chillers is also promising. A major issue to be clarified is the dissemination speed (scenario) of the inverter type**

3) Formulating programs to promote EE&C equipments' implementation and labeling programs for TVs and refrigerators before their full scale spread is an effective countermeasure to mitigate the future growth of electricity consumption.

4) The EE&C potential of introducing high efficiency motors is quite large.

2. Proposal of Roadmap (Master Plan) and Action Plans

On the basis of the results of the Study, the "Basic Strategy for Promoting EE&C" was figured out in Figure 3.

In this strategy three strategic fields, namely "Enhancement of Awareness and Consciousness of EE&C", "Strengthening Support from the Government", and "Enforcing Rules and Regulations" are focused. **The final goal to be targeted is not " regulation " and " support" but self reliant EE&C activity of users should be understood.**

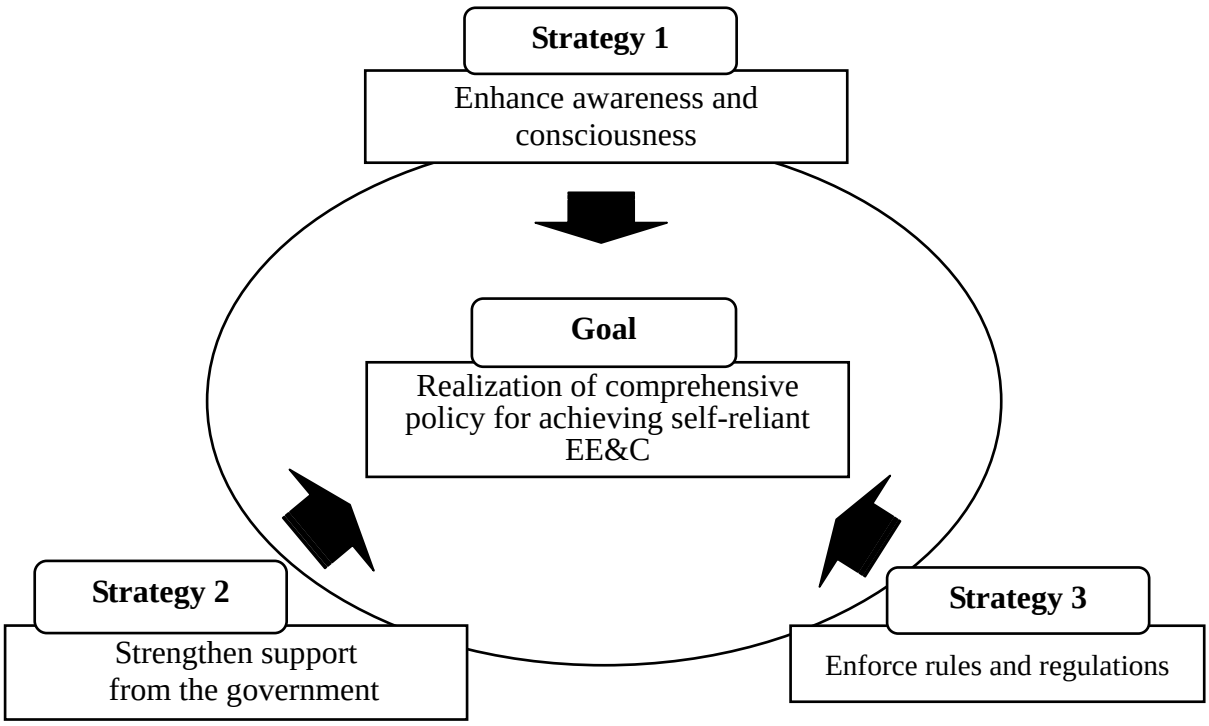


Figure 3 Basic Strategy for Promoting EE&C

Considering the present Vietnamese condition and expected supports from international donors, the proposed roadmap and master plan are illustrated. And prioritized short term issues are summarized as action plan. The procedure of analysis and proposal is shown in Figure 4.

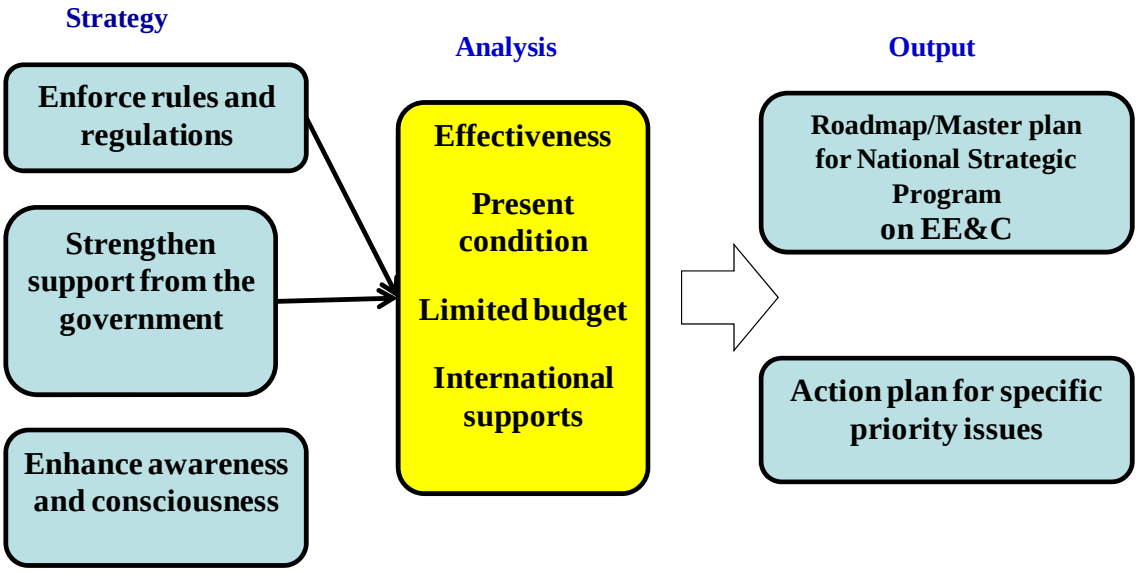


Figure 4 Flow of Analysis and Proposal

Basic grounds for proposed programs under roadmap and master plans are as follows:

- ✓ From Japanese experiences by introducing energy management system and steadily operating it (applying the PDCA cycle), at least 5 % EE&C can be achieved. Vietnamese government should continue and accelerate the preparation and enactment for legal frame work of national certified energy manager program. And also Government should strongly focus on awareness program for governmental organizations and private companies about the merit of introducing energy management system.

- ✓ Following up the labeling program on magnetic ballast, street lighting and T8 lamp, it is quite effective to formulate next labeling programs on ACs, TVs, water heaters and refrigerators etc. and go into steady operation, which will be sure to be spread in the near future in Vietnam, before their popularization. There are several failures in other countries without controlling the energy efficiency criteria on these electric appliances. But introduction of labeling program (awareness) is not sufficient to achieve the targeted EE&C level. Appropriate transmission of information for consumers, manufacturers and retailers, mandatory label & MEPS and incentive and disincentive program which has a strong linkage to electricity DSM measures should be formulated in parallel.

- ✓ Compared with Japan and surrounding countries, national budget and other resources available for EE&C activity per capita and GDP in Vietnam is quite small. In order to achieve the national target of EE&C level, it is necessary to invest at least several times larger financial resources. And to achieve the target, firstly road map (total figure) for EE&C promotion should be prepared. Then to secure the budget needed, functional and also technical support from eligible international supporting programs (organizations) should be formulated.

  Until 2015 utilizing financial and technical assistance from various donors, the government should concentrate on 1) formulating national energy manager certification program and introducing the target setting agreement program with designated factories, buildings and transport enterprises, 2) disseminate labeling program of selected electric appliances and 3) accelerating DSM measures in electricity. Employing these priority measures, 5-10% EE&C is achievable, while the programs do not require much financial resource.

  DSM in electricity is an effective and speedy measure to promote EE&C and is an effective measure to reduce the electricity peak demand when applying an appropriate electricity tariff mechanism (e.g. raising the lower price of coal and gas for electricity generation.) The expected benefit is not only achieving EE&C, but also mitigating peak demand

- ✓ For promoting EE&C in building and transportation, not only enforcement of EC Law but also these measures are considered to be quiet effective;

  1) Controlling the rapidly increasing demand by newly construction (especially enhancement of the application of building code)
  2) Early establishment of master plan on national transportation. And under this master plan especially introduction of public transportation and modal shift is considered to be quite

effective.

And the overview of roadmap and master plan of each program under National Strategic Program, which reflects the direction of recommended priority programs, is summarized in Table 1.

As far as the analyzed sectors of this study, more significant EE&C could possibly be achieved by investment of larger scale to replace existent equipment with energy-efficient one. EE&C of respective sectors could be achieved in the following ways:

- ✧ Iron & steel: over 10% EE&C by introducing high-efficiency reheating furnace would be possible. (Utilizing NEDO model project result)
- ✧ Textile: 20% EE&C mainly through heat recovery in dyeing process would be possible. (Utilizing NEDO model project result)
- ✧ Food: EE&C is expected by introducing heat recovery system like VRC (Vapor Re-Compression) system. (Utilizing NEDO model project result)
- ✧ Cement: It looks promising to convert the kiln into rotary kiln (-2020).
- ✧ Building: roughly 50-60% of electricity demand comes from cooling and 20% from lighting. So introducing high efficient chilling system (especially inverter type) and electronic ballast for lighting are the highest priority programs. In the middle term the desiccated air conditioning will be able to achieve over 10% EE&C.
- ✧ Two-Step Loan (low interest loan) which will be disbursed by JICA this year would be an effective option for the introduction of promising but costly EE&C technologies which have been implemented as NEDO's pilot projects or study etc. As a first stage, utilizing the project financing loan using ODA from international financial institutions like JICA, ADB and the World Bank will be functional, but as a next stage Vietnamese self financial mechanism shall be formulated.,

To realize EE&C investment, not only 1) formulating low interest loan mechanism, but 2) dissemination of effective technologies and loan scheme and 3) reinforcement of the skill of engineers who propose and design the EE&C project shall be done.

Especially regarding EE&C engineer, unfortunately the eligible engineering firms are quite limited in Vietnam. The capacity development program for EE&C engineers shall be prepared in parallel as a middle term issue.

Table 1 Summary of EC Roadmap and Master Plan (abstract)

Group	Program	Contents	Items to be confirmed	2010-2012	2013 -2015	2016-
Group 1 Legal flamework	Program 1	State Administration (MOIT)	EC Law and Decrees	Enforcement		Amendment
			Electricity Tariff Revision		To market price	
			ECC (central and local)		Establishment of the Central EC Agency	
			Energy Manager (examination, accreditation, training)	National Training Center JICA expert	2,000 managers or more	Enforcement
			Another doners' support	Training materials DANIDA	Training materials DANIDA	
			EC data collecting mechanism	Pilot Program	Full fledged operation	Full fledged operation
Group 2 Awareness raising	Program 2	Awareness raising (MOIT)	Focus on specified Projects Effective Priority Program Design	$200,000	ditto	ditto
	Program 3	National education (MOET)	Endorsement of Programs(MOET) Financial Support (MOF)	Enhancement	Enhancement	Enhancement
	Program 4	Pilot campaign for household" (MOIT)	Rural CFL Home appliances (AC, refrigerator, heater) (MOIT) Financial Mechanism Linkage to DSM	Program design Pilot projects	Implementation Enforcement	Implementation Enforcement
Group 3 Promotion of high efficiency equipments	Program 5	Energy performance standards and Labeling scheme (MOST/MOIT)	UNDP/BRESL - METI/methodology (Nov. 2008-)	UNDP TA for testing model	UNDP	
			Calibration	Calibration	Calibration	Calibration
				Voluntary	Mandatory	Mandatory
			Endorsement or Standards and Labeling should be amended once every 3 to 5 years	Endorsement	Comparative	Comparative
	Program 6	Technical assistant for domestic energy efficiency product manufacturers (MOST)	Not only manufactures but also retailers (MOIT)	5 cases done	5 cases	5 cases
Group 4 Energy efficiency in manufacturer	Program 7	Establishment of management model (MOIT)	Target Setting Agreement under the EC Law	Enforcement	Operation	Operation
			UNIDO (ISO50001, energy audit, training)	UNIDO	UNIDO	
	Program 8	Assistance for energy efficiency in production line (MOIT)	JICA TSL ($45 mil)	Disbursement TA	Vietnamese Loan TA	Vietnamese Loan TA
			NEDO model projects		Implementation	
			Other donors			
Group 5 Energy efficiency in building	Program 9	Establishment of management model (MOC)	Target Setting Agreement under the EC Law	Enforcement	Operation	Operation
			Building Code	Enforcement	Enforcement	Enforcement
	Program 10	Creation and promotion of energy efficiency building model (MOC)	EE&C building award ECO building Financial mechanism	Enforcement Promotion Program design	Operation Implementation	Operation Implementation
Group 6 Energy efficiency in transport	Program 11	Minimizing fuel consumption and decrease of emission (MOT)	Target Setting Agreement under the EC Law	Enforcement	Operation	Operation
			Mater plan for natinal transportation (modal shift and city planning)			
			Shift to public transportation (Inter city; bus/LNG, LPG Inner city; railway, maritime)	Preparation for introduction of Shinkansen, railways	Bus (LPG, CNG, Hybrid, electricity, biofuel)	Enhancement Introduction of Shinkansen
Budget				VND40 billion	-----	VND400 billion
Energy consumption			Comparing to BAU	-----	-5%	-----

Outline of the proposal for major issues (action plans) are described below:

(1) Certified energy manager program, designated factories, buildings and transport enterprises program and related training mechanism

To establish and operate certified energy manager and designated factories, buildings and transport enterprises (target setting agreement) programs, the packaged sub programs and organization structure shown in Figure 8 should be formulated.

Strong leadership of MOIT, Establishment of national steering committee which consists of intellectuals from industry, government and academy, and shall be a decision making body on standard and competency of the programs, establishment and operation of national EE&C training center and establishment of related legal framework are the major tasks to be managed by central government.

Besides the local governments are expected to manage the programs which have been authorized in the central government. Regarding the role, responsibility and functional linkage of local government and ECC, program management and awareness should be handled separately.

Regarding the training for certified energy managers, the competency standard shall be decide by MOIT (steering committee). As the first stage eligible universities such as HUT and EPU shall be in charge of it and as the second stage local ECCs which will have been educated by the universities shall also be in charge of it.

To formulate the training programs, the functional linkage and support from international cooperation agency such as JICA, DANIDA and UNDO etc is indispensable for documentation of curriculum, strengthening of auditing skill and support for introduction of ISO50001 (energy management), etc.

Figure 5 shows the flow of the EC Law and the concept of ISO50001 management.

There exist no difference in PDCA cycle operation in energy management, but it should be understood that the EC Law regulates, besides ISO is an operating system.

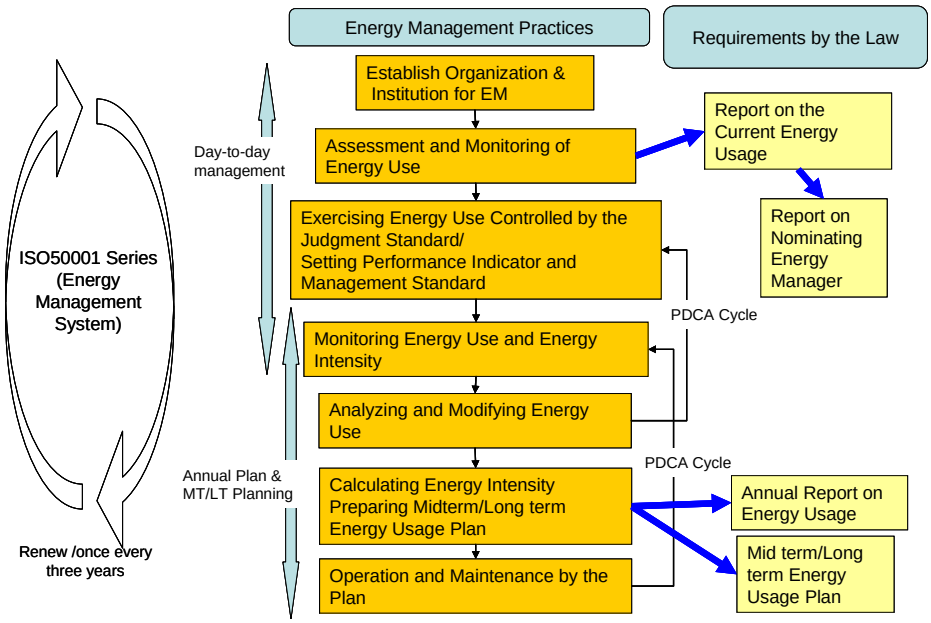


Figure 5 Deference between the EC Law and ISO50001

(2) Establishment of energy data collection mechanism

The purpose to establish energy data collecting mechanism is (1) getting and supplying the information of energy production and consumption, (2) promoting EE&C through the submission of "Periodical Report" and "5 years EE&C plan" from designated factories, buildings and transport enterprises, and finally contributing the reduction of energy cost and GHG (especially CO_2.)

Vietnamese government is preparing to formulate a mandatory program that the designated factories, buildings and transport enterprises whose annual energy consumption excess the defined criteria should submit the documents above mentioned. Utilizing WEB system which is proposed by the Study Team is shown in Figure 6. The flow of energy data collecting between GSO and related ministries is shown in Figure 7.

At the first stage, both paper application and web application shall be introduced. And gradually web application ratio shall be increased. Data analysis software, mechanism to utilize and publish the analyzed information, data server and back up system etc shall be prepared and financial source and human resource shall be secured.

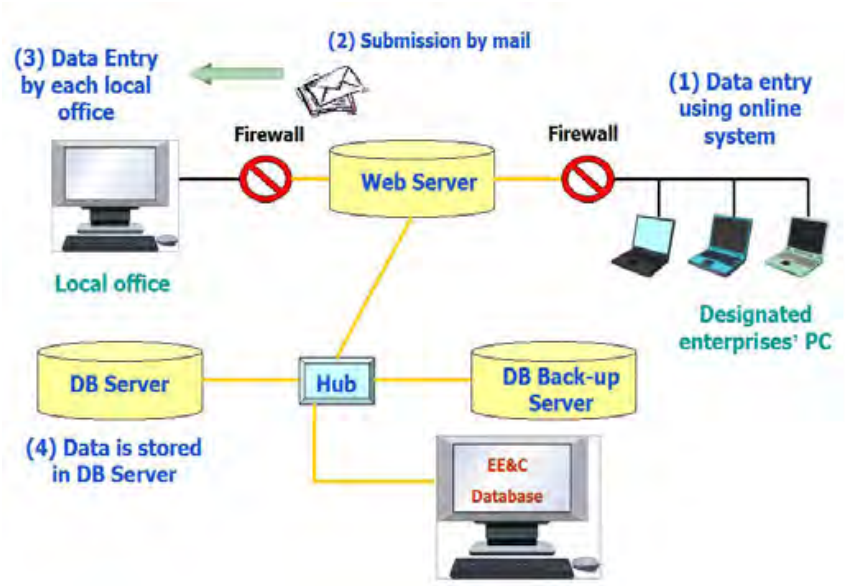


Figure 6 Network of Energy Data Collection Mechanism (draft)

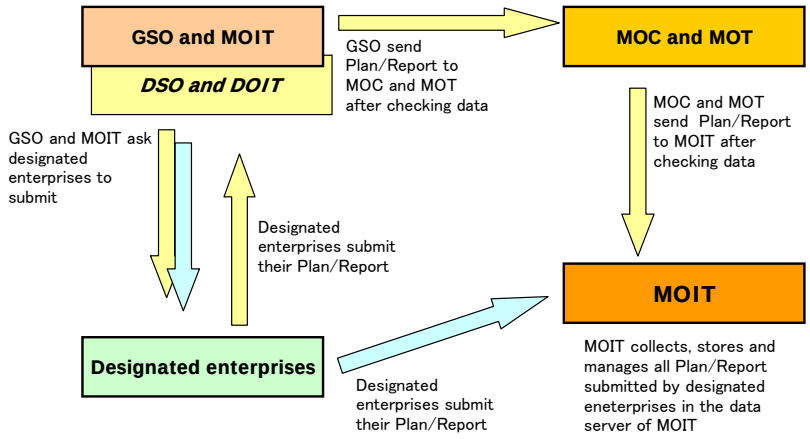


Figure 7 Flow of Energy Data Collecting Mechanism

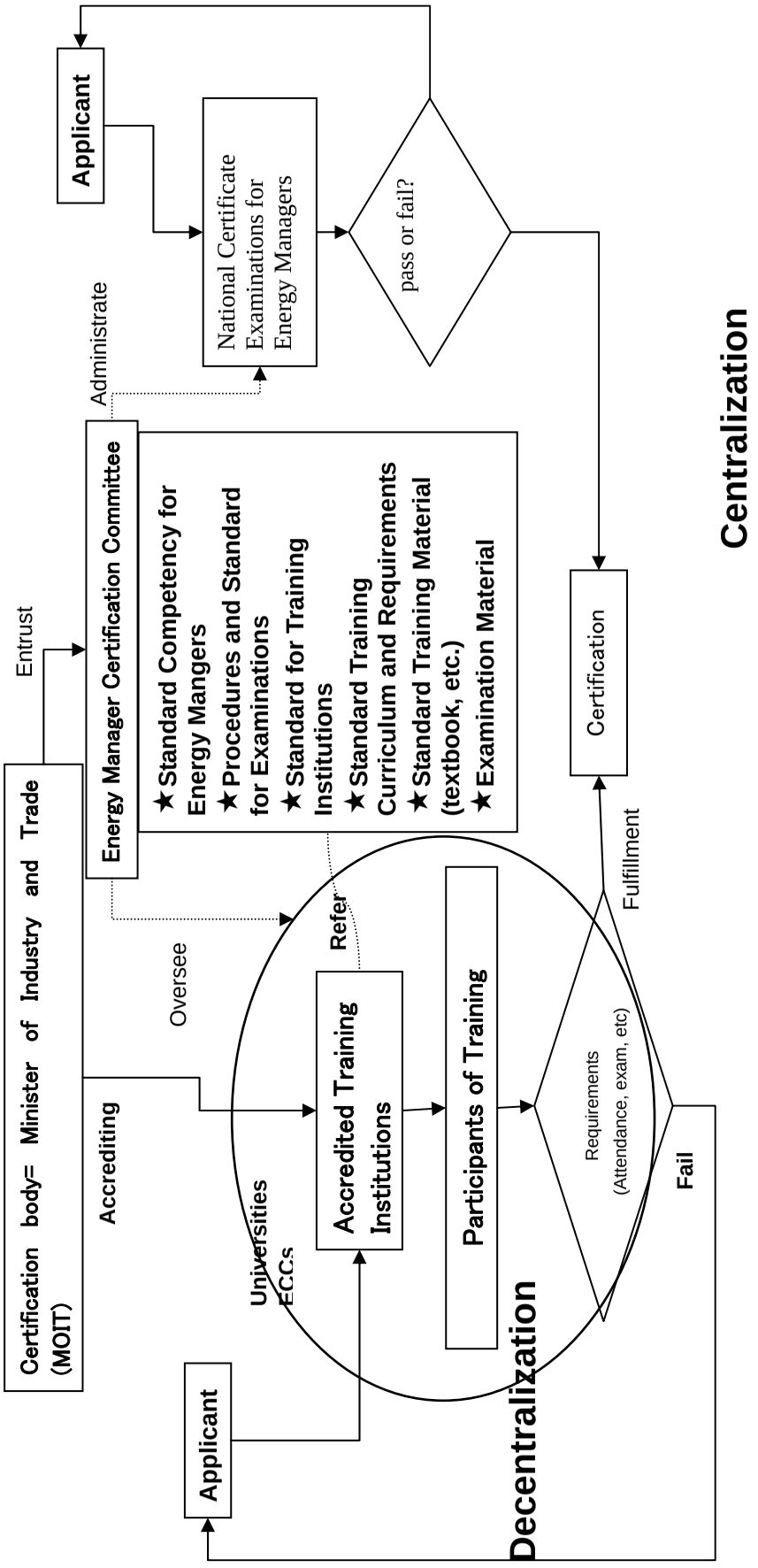


Figure 8 Framework of Certified Energy Manager Program Operation

(3) Establishment of standard and labeling and related electricity DSM program

Table 2 shows the progress to formulate energy standard and labeling. It is quite effective to formulate standard and labeling program. But introduction of mandatory labeling program (regulation) is not sufficient to achieve the targeted EE&C level. Awareness program for consumers, manufacturers and retailers, and incentive and disincentive program which has a strong linkage to electricity DSM measures should be formulated in parallel.

Table 2 Progress of Standard and Labeling Program Implementation

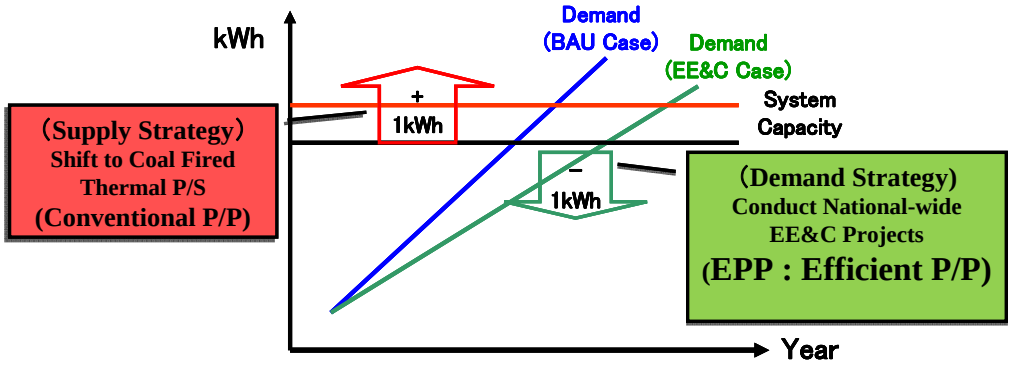
voluntary←|→mandatory

	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
T8 fluorescent lamp	F																			
	F																			
CFL						F														
Street lamp						F														
						F														
Electric ballast						F														
Magnetic ballast	F																			
	F																			
Air conditioner			F																	
Electric fan			F																	
Refrigerator			F																	
Electric water heater						F														
Solar water heater						F														
3-phase motor	F																			
Washing machine																				
Electric rice cooker																				
Other home appliances (*)																				
Equipments for commercial use(*)																				
Equipments for industrial use(*)																				
Materials(*)																				
Renewable enegies(*)																				

Standard
Labeling

Note: F means completion

Especially the promising spread of refrigerators, ACs, TVs and water heating heaters are worth being prepared the subsidy and/or low interest loan program (incentive mechanism). In this context ODA low interest loan from international cooperation agency like JICA can be a useful option To formulate nation wide EE&C appliances distributing project, mitigation for tight electricity supply and demand which is worth constructing big coal thermal power plant can be achieved in shorter time. (Refer Figure 9)



Source: IEA

Figure 9 Two Measures to Answer the Shortage of Electricity Supply

(4) Inter Organization Structure between Central and Local Government

The role and responsibility between central and local government, firstly the central government shall prepare the EC Law and related legal frame work, and following this the local government shall operate the procedure which has been defined in the law.

ECC shall have the role and responsibility to supplement the local government to promote EE&C and will be the responsible organization for awareness.. And the mechanism how to develop ECCs expertise should be programmed by the leadership of MOIT.

To complete EE&C effectively in shorter time, it is indispensable to reinforce the function, resource and budget of MOIT. (Figure 10)

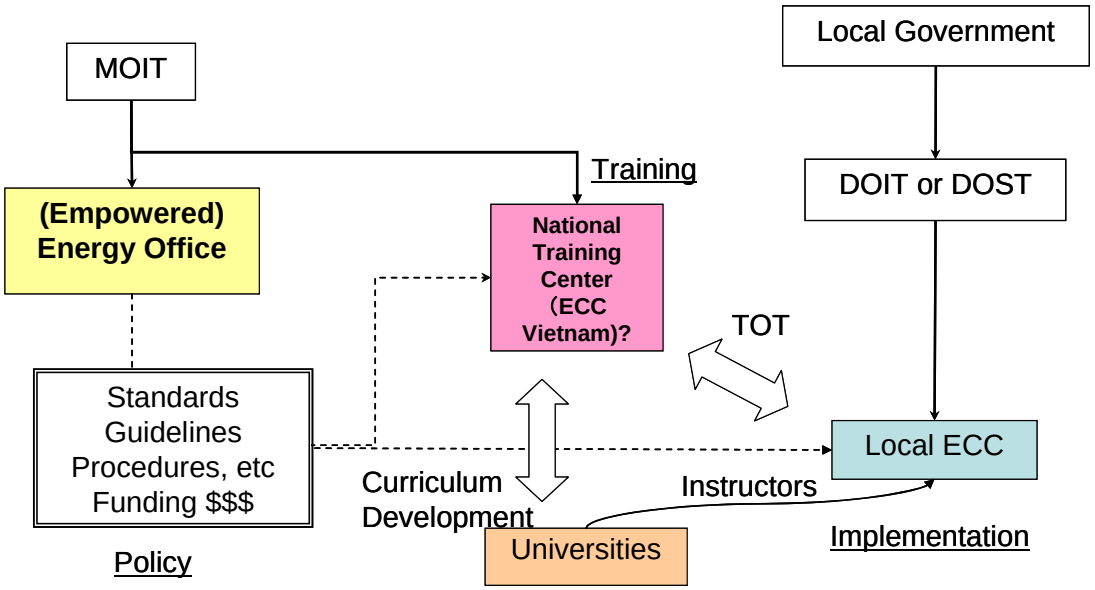


Figure 10 Proposal of establishing ECCV which supplement and strengthen MOIT

(5) Financial Support Program for promoting EE&C

To improve the efficiency of production line, it is effective to enhance the energy management and to introduce the high efficient equipments. And especially financial program to support the implementation of EE&C equipment is quite important.

JICA and Vietnamese government are preparing to establish a financial support mechanism to implement EE&C equipments. That is an ODA two-step low interest loan program, MOF is the borrower, Government of Japan is the lender (through JICA). VDB borrows from MOF and provides to industrial investors. The loan scheme is shown in Figure 11. The Energy Efficiency Equipment List for loan application will be prepared to make the loan assessment easier

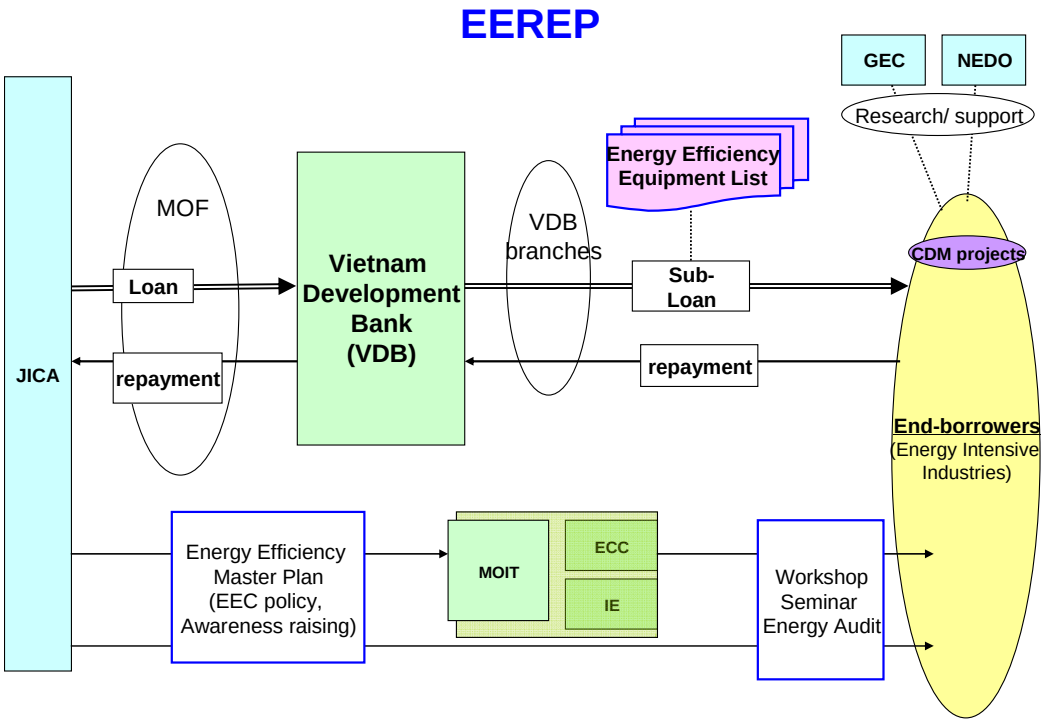


Figure 11 JICA Loan Mechanism for EE&C

JICA also has a plan to formulate Support Program to Respond Climate Change (SP-RCC) in Vietnam jointly with the international donors such as AFD (France). Vietnamese government established the "National Target Program to respond to climate change" (NTP-RCC; Prime Minister's Decision 158, December 2008). This program intends to accelerate the implementation of the Policy Action (PA) for the major issues under 3 major pillars as follows:

(1) Mitigation (promoting renewable energy and energy efficiency, forestry and agriculture management, waste management and promoting CDM projects etc.),

(2) Adaptation (improvement of water quality and quantity, irrigation management, integrated coastal management and fishery, disaster prevention etc), and

(3) Cross-cutting (storage of basic data for climate change and promoting research, establishing financial mechanism, mainstreaming climate change issues into Socio-Economic Development Plan (SEDP) and awareness raising and HRD, etc.)

Together with the TSL scheme mentioned above, it is expected that these financial support mechanism work for promoting EE&C in Vietnam.

CHAPTER 1

INTRODUCTION

Chapter 1 Introduction

1.1 Background of the Study

Current economic growth in Vietnam has been achieved over 8% per annum. However, it will be predicted down to 5 % per annum in 2009 by World Credit Crisis, and return to 7-8% per annum from 2010. Along with this high economic growth, the growth rate of energy consumption is also increasing higher than that of economic growth. The average growth rate of energy consumption from 1990 to 2006 reached 10% per annum. According to an energy demand forecast, energy demand in Vietnam will increase at 8.1% per annum up to 2020. At present, Vietnam is the net exporter of energy resources, but it is said that crude oil will be shifted to import by 2015, coal by 2016, and major development of hydropower will be completed by 2017. Regarding electricity, imbalance in demand and supply in the dry-season due to water shortage grows into a serious problem. In this situation, it is necessary for Vietnam to promote energy efficiency and conservation (EE&C) to keep high economic growth.

"Government Decree No.102/2003/ND-CP on Energy Efficiency and Conservation" was issued in 2003. In response to this decree, Ministry of Industry issued "Circular No.01/2004/TT-BCN: The Guidance of Energy Efficiency in Industrial Facilities" in 2004. Moreover, in April 2006, "National Strategic Program on EE&C (2006-2015)" was approved by the Prime Minister. Ministry of Industry and Trade (MOIT) was appointed as the responsible organization, and Energy Efficiency and Conservation Office (EECO) has been established in the MOIT. The National Strategic Program on EE&C consists of 11 projects including dissemination of EE&C knowledge, EE&C education, promotion of EE&C for commercial, residential, industrial and transportation sectors, and EE&C for buildings, etc. Detailed implementation plan of the program has not been formulated yet, and it is an urgent issue to establish EE&C implementing organization/institution, legal system, and road maps/action plans.

Japan is the largest trading partner for Vietnam, and also has been the largest donor for Vietnam since 1995. Japan-Vietnam Joint Initiative started from 2003 to have a comprehensive approach about improvement of investment climate in Vietnam, and advanced to the 3rd phase from 2008. Moreover, cooperative relationship between Vietnam and Japan in energy sector is being strengthened through political dialogues.

1.2 Objectives of the Study

The government of Vietnam requested a technical assistance on energy efficiency and conservation to the government of Japan. The objectives of this study are to formulate an implementation plan for promoting "National Strategic Program on EE&C", to assist in formulating "Master Plan on EE&C", and to enhance a capability of counterparts through collaborative work.

Direct objectives of EE&C are as follows according to JICA:

- Reduction of energy consumption,
- Reduction of greenhouse gas (CO_2) emission, and
- Reduction of energy costs.

And the final targets to be obtained by the EE&C will be as follows:

- Energy security,
- Global environment protection measures, and
- Enhancement of competitiveness for domestic industry.

1.3 Methodology of the Study

1.3.1 Priority Issues of promoting EE&C

The Study has been conducted to pay special attentions to the following five priority issues on promoting EE&C:

Issue 1: Delay in establishment of public-private partnership to promote EE&C which should be linked to policy formulation by the government

Japanese experience indicates that mere regulating policies cannot drive effective EE&C on the ground. Encouragement of private initiatives through balanced policies is critical for effectively promoting EE&C. The current condition in Vietnam, however, is that the private sector (i.e. service providers) as a main actor is yet to come into sight because the central government concentrates on policy formulation and is raring to do something about it without plan. In order to stride sustainable promotion of EE&C in Vietnam, development of schemes allowing private sector-driven EE&C is indispensable.

Issue 2: Unpopular Circular No.102/2004 on periodical reporting mechanism on energy consumption – Absence of data collection mechanism and database for promoting EE&C

The decree stipulates the designation of factories subject to reporting and reporting format, etc. The designated factories are subject to reporting their energy consumption. The requirements are hardly observed because of fundamental problems such as (1) that the factories cannot fill the form for its complexity, and (2) that the departments receiving the reporting in local government (DOIT) are not aware of the requirements and are not able to review and advice to the report submitted. The Study aims at creating an effective legal framework which won't repeat the same mistakes.

Issue 3: The functions and roles of the organizations responsible for human resources development for energy management are not clarified.

The nomination of the organizations responsible for human resources development is still under consideration, although the needs and effectiveness of energy management have

been acknowledged. The institutional framework has not been completed from viewpoints of responsible organizations/institutions, their functions and roles, and future plans. These elements should be defined upon the enactment of the EE&C Law.

Issue 4: Roles, responsibility, and future vision for the proposed Energy Conservation Centers are not clear.

The government of Vietnam has a plan to establish eight (8) ECCs. Some of them already established are not capable enough to promote EE&C because their technical capacity is still limited, for a relatively short period from their establishments. Capacity development programs, current tasks with higher priority, future roles and responsibility are not yet defined.

Issue 5: Demarcation of roles and contents of communication among the central and local governments and ECCs are not clarified.

Building healthy relationship among the central and local governments and ECCs is indispensable for achieving effective EE&C. For instance, close collaboration and clarification of each role, function and responsibility are necessary. In addition, the current relationship between MOIT and MOST is not so strong and functioned well. Therefore, roles and responsibility and distribution of two ministries should be clarified for promoting EE&C in Vietnam.

1.3.2 Methodology of the Study and Work Flow

The Study has been carried out with the schedule below. Figure 1.3.2-1 shows the major study work flow.

The first year

Preparatory work	July 2 - July 23, 2008
The 1st work period in Vietnam	July 24 - August 9, 2008
The 1st work period in Japan	August 10 - September 16, 2008
The 2nd work period in Vietnam	September 17 - October 17, 2008
The 2nd work period in Japan	October 18 - November 1, 2008
Counterpart training in Japan	October 28 - October 30, 2008 (hosted by METI)
The 3rd work period in Vietnam	November 2 - November 22, 2008
The 3rd work period in Japan	November 23, 2008 - January 31, 2009
The 4th work period in Vietnam	February 1 - February 17, 2009

The second year

The 4th work period in Japan	April 28 - May 19, 2009
The 5th work period in Vietnam	May 20 - June 13, 2009

The 5th work period in Japan	June 14 - July 14, 2009
The 6th work period in Vietnam	July 15 - August 1, 2009
The 6th work period in Japan	August 2 - September 5, 2009
Counterpart training in Japan	August 17 - August 26, 2009
The 7th work period in Vietnam	September 6 - September 19, 2009
The 7th work period in Japan	September 20 - December 15, 2009

The Study Team held three workshops at six sites with MOIT during the study. The purpose of these workshops are 1) sharing the direction, concerns, output and progress, 2) EE&C awareness for participants, and 3) collecting and opinions for the study. The outline of the workshops are written below.

First workshop

Purpose: Explanation of the contents of the inception report (study outline and target etc), and collection of the comments from related stakeholders

Date: August 5, 2008, 08:30 ~ 13:00

Venue: Melia Hanoi

Participants: About 100

Second workshop

Purpose: Explanation of the contents of the interim report , and collection of the comments from related stakeholders.

(HCMC)

Date: May 29, 2009, 08:30 ~ 13:00

Venue: Equatorial Hotel

Participants: About 60

(Da Nang)

Date: June 2, 2009, 08:30 ~ 13:00

Venue: Green Plaza Hotel

Participants: About 80

(Hanoi)

Date: June 5, 2009, 08:30 ~ 13:00

Venue: Melia Hanoi

Participants: About 120

Third workshop

Purpose: Explanation of the contents of the draft final report , and collection of the comments from related stakeholders.

(HCMC)

Date: September 11, 2009, 08:30 ~ 13:00

Venue: Sofitel Plaza Hotel

Participants: About 120

(Hanoi)

Date: September 15, 2009, 08:30 ~ 13:00

Venue: Melia Hanoi

Participants: About 100

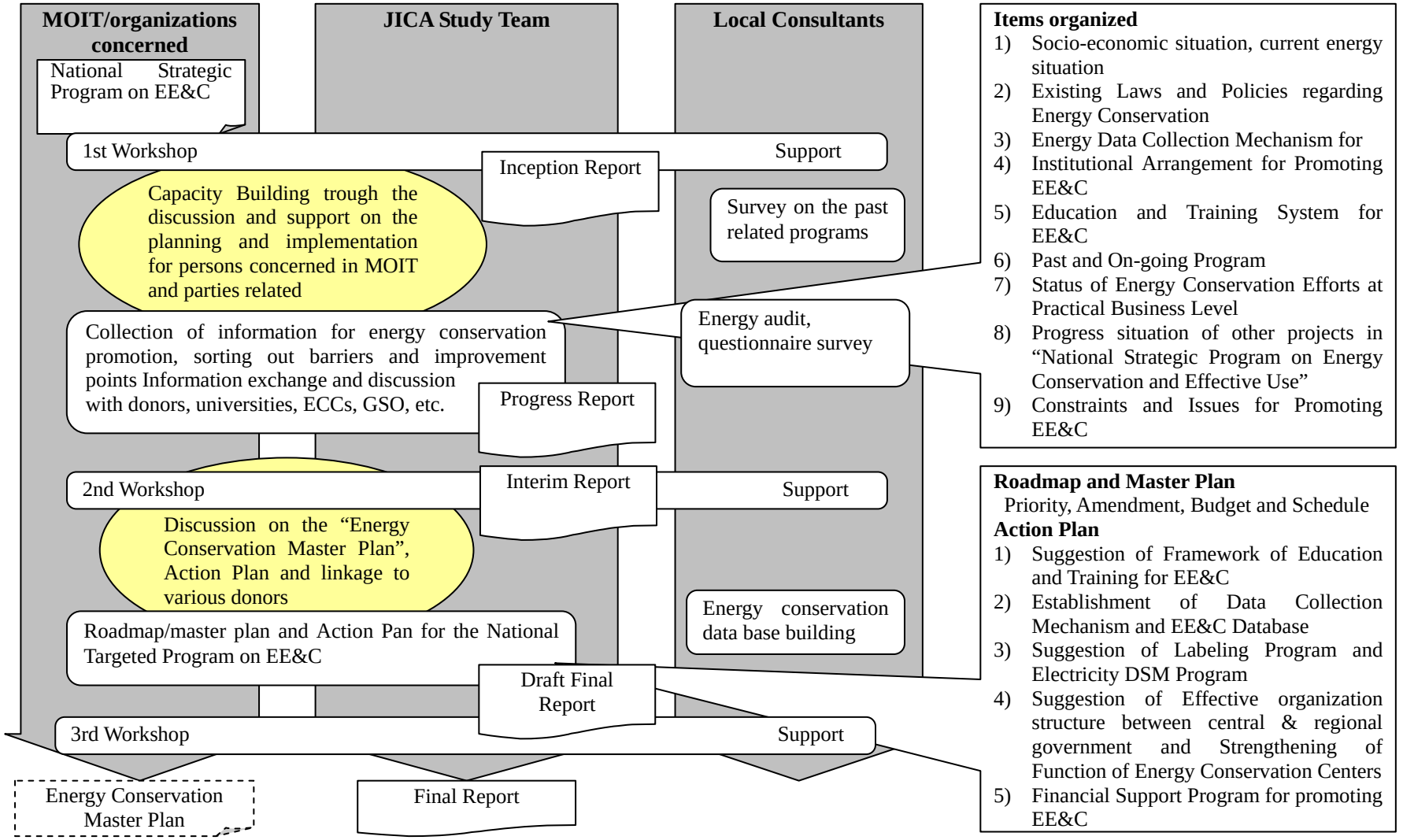


Figure 1.3.2-1 Work Flow of the Study

CHAPTER 2

CURRENT STATUS OF MATTERS RELATING TO ENERGY CONSERVATION AND EFFECTIVE USE IN VIETNAM

Chapter 2 Current Status of Matters relating to Energy Conservation and Effective Use in Vietnam

2.1 Socio Economy

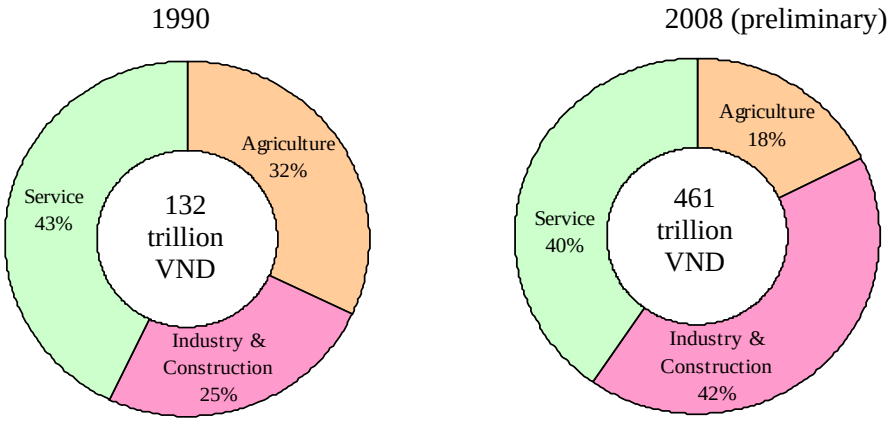
2.1.1 Economy of Vietnam

Remarkable economic development has been achieved in Vietnam through adoption of "Doi Moi (the Reform)" policy since 1986, implementing several "Socio-Economic Development Plans." In the energy field, Vietnam was also successful in domestic energy resource development by effectively introducing foreign capitals. Thus, the country changed from an energy importing country to an exporting one after 1990. In this report, the following exchange rate[1)] is adopted:

US$1.0 = VND17,624 = JPY94.39 (July 25, 2009)

According to the preliminary data of the General Statistics Office (GSO), the real economic growth rate for the period of 1990-2008 was 7.6%/year, the real GDP increased from US$7.49 billion (VND 132 trillion) to US$27.79 (VND 489.8 trillion). Vietnam experienced very high economic growth rate of 8.3%/year until the "Asian Currency Crisis" in 1997. Economic growth rate temporally slowed down to 5.8% in 1998 and 4.8% in 1999. After then, its economic growth gradually recovered to high level and recorded over 8% in 2005 and 2006.

During the period of 1990-2008, the industry and construction sector recorded the highest growth rate at 10.6% among the demand sectors followed by the service sector at 7.2% and the agriculture sector at 4.0%. The industry sector in Vietnam is rapidly developing. In the same period, share of agriculture sectors decreased from 32% to 17.6% and on the other hand, the manufacturing and mining sector rapidly increased from 25% to 41.6% and the service sector decreased slightly from 43% to 40.8%.



Source: GSO

Figure 2.1.1-1 Economic Structural Changes (1990-2008)

1) http://www.oanda.com/convert/classic

2.1.2 Role of Socio-Economic Development Plan and Energy

The scope of socio-economic development of Vietnam is set out in the "Socio-Economic Development Strategy" formulated every ten years and "Five-Year Socio-Economic Development Plan" formulated every five years. While the "Development Strategy" covers ten years of 2001-2010, more detailed plan was set out for the first five years and implemented as the "Five-Year Socio-Economic Development Plan: 2001-2005". Succeeding the first five-year plan, the "Five-Year Socio-Economic Development Plan: 2006-2010" is being carried out at present as the second half plan to achieve the objectives of the "Development Strategy".

1) Target of Socio-Economic Development Strategy (2001-2010)

The Socio-Economic Development Strategy 2001-2010 set forth as its target that the national economy of Vietnam in 2010 should grow up to double of that in 2000. The detail targets of each sector are as follows.

- Agriculture Sector Growth rate: 4 - 5 %, Composition: 16 - 17 % (23 % at 2000)
- Industry Sector Growth rate: 10 - 15 %, Composition: 40 - 41 % (35 % at 2000)
- Service Sector Growth rate: 7 - 8 %, Composition: 42 - 43 % (42 % at 2000)

Comparing to the situation at 2000, the agricultural sector will reduce its share while the industry sector will expand instead.

2) Five-Year Socio-Economic Development Plan: 2001-2005

Annual economic growth rate of Vietnam from 2000 to 2005 showed at 7.5% under "Five-Year Socio-Economic Development Plan: 2001-2005". In this period, the manufacture and construction sector grew up at 10% per annum and the service sector also grew up at 6-8% per annum. Export sector also contributed a great deal to the development of national economy.

Despite high economic growth, inflation rate in this period showed a moderate increase. Consumer price index was relatively high compared with other Asian countries at 5.2% per annum. Inflation rate from 2004 to 2005 slightly went up because increase of salary for government employee[2)] and government controlled-prices such as petroleum products. Economic growth of Vietnam was pulled up by FDI (Foreign Direct Investment) as well as other Asian countries. Investment rate to GDP increased from 31.2% in 2001 to 35.6% in 2005. According to Vietnamese statistics, investments of Vietnam are classified into five categories; investment from National budget, investment from government credit, investment from state-owned enterprise, investment from private company, and FDI.

Investment to the manufacturing sector is aggressively at present. However, investment of public

2) Despite increase of salary for government employee, their salary is still lower than that of private companies.

service such as power plant is not accelerated because electricity tariff is set in low level by the government. In order to solve this problem, Prime Minister agreed to raise an electricity tariff in 2009. Ministry of Industry and Trade is proposing to increase electricity price for the residential sector by 20%. Electricity tariff for the residential sector in Vietnam is lower than other countries. Vietnamese government is analyzing that is why private enterprises dose not want to invest in power sector. Although according to the Circular on Electricity tariff issued by MOIT in March 1, 2009, electricity tariff for the residential sector under 100 kWh/month increased very much, other tariff more than 100 kWh/month is almost same level (Circular: electricity Tariff in 2009 and Instructions: MOIT: Hanoi, 26/02/2009).

3) Five-Year Socio-Economic Development Plan: 2006-2010

In 2006, the government of Vietnam issued "Five-Year Socio-Economic Development Plan: 2006-2010". According to the Plan, the target of average GDP growth rate during the period set 7.5%-8.0% (agriculture; 3.0-3.2%, industry; 9.5-10.2%, service; 7.7-8.2%) and the target of GDP per capita will be increased from US$640 in 2005 to US$1,050-US$1,100 in 2010. The goal of Vietnam is to become middle-income country until 2010. In order to achieve these targets, the government is aiming to increase investment share to GDP at 40% until 2010, of which investment in the public sector will be kept by 20% and private investment will be increased up to 23% and more. Inflation rate will be keep less than GDP growth rate. Though inflation in September 2008 grew just 0.18%, limiting the nine month consumer price index to 21%, saying Vietnam will strive to curb inflation to a single digit rate by early 2010. In the wake of world economic crisis since early April, the Vietnamese government has immediately refocused on inflation control instead of high economic growth by cutting the growth target to between 6.5 and 7.0% from 8.0-8.5% for 2008 and 2009 (Viet Nam News, September 22, 2008).

Table 2.1.2-1 Target of Five-Year Socio-Economic Development Plan: 2006-2010

Item	2006	2007	2008	2009	2010
Nominal GDP (trillion VND)	974	1,114 - 1,126	1,279 - 1,304	1,471 - 1,514	1,693 - 1,760
Real GDP growth rate (%)	8.2	7.5 - 8.0	7.5 - 8.0	7.5 - 8.0	7.5 - 8.0
Inflation rate (%)	7.3	6.7 - 7.4	6.9 - 7.2	6.9 - 7.4	7.0 - 7.7
Investment (Nominal, trillion VND)	350	418 - 428	493 - 509	581 - 605	686 - 722
Investment to GDP (%)	36.0	37.5 - 38.0	38.5 - 39.0	39.5 - 40.0	40.5 - 41.0

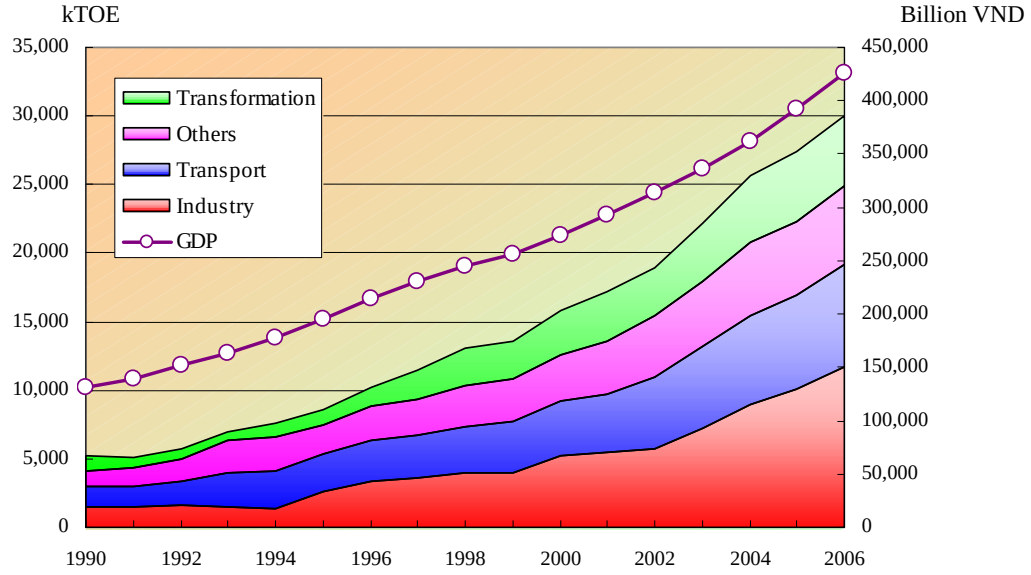
Note: Actual in 2006

2.2 Current Energy Situation

2.2.1 Energy Demand

Reflecting economic development and structural change, the energy demand increased form 5.187 million TOE (ton oil equivalent) to 13.128 million TOE during 1990-1998, with an annual growth rate of 12.3% and the GDP elasticity of energy of 1.53 (12.3/8.0). Though energy demand in 1999 was affected downward during the Asian Currency Crisis, it regained afterwards and recorded same growth rate of annual 12.0% through 2006. The energy to GDP elasticity rose to 1.60 (12.0/7.5). Although GDP elasticity below 1.0 was seen in single year records, the growth rate of energy was largely higher than the economic growth rate for the medium term of five to ten years.

During the same period, energy consumption increased from 5.187 million TOE to 30.026 million TOE by five times and more. The energy consumption structure among industry sector, transportation sector and other sector changed form 36:36:28 to 47:30:23. The share of industry sector expanded greatly, while the shares of transportation sector and other sector declined. The rapid increase of the energy consumption reflected the vigorous development of the industry sector, while consumption increase in other sectors were relatively small. Anyway, reflecting the vigorous economic growth, every sector recorded two-digit growth of energy consumption.



Source: Energy Supply Companies and others

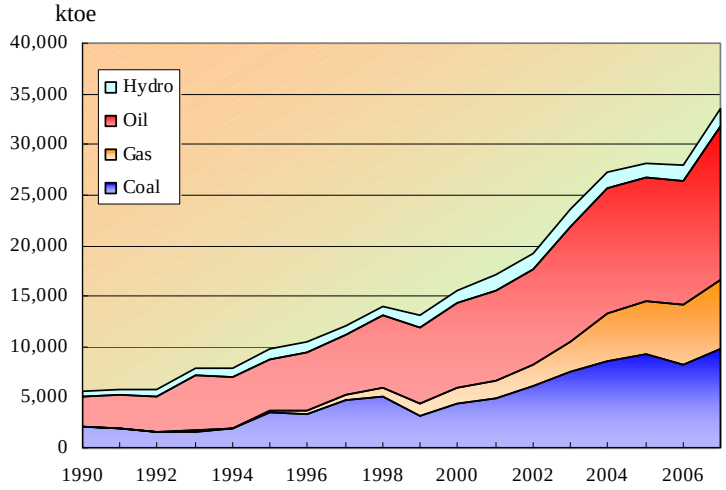
Figure 2.2.1-1 Economic Development and Energy Demand Trend in Vietnam

GDP per capita of Vietnam reached US$724 in 2006, though the country is still among the late developing group of the ASEAN countries. Energy consumption per capita is also small with 0.3 TOE compared with the ASEAN countries. Vietnam has rich energy resources such as coal, oil, natural gas, hydro, and renewable energy. Vietnam is a net energy export country right now.

However, according to high economic growth, energy demand will increase rapidly and energy demand will exceed domestic energy supply capability in the future. Energy demand in Vietnam will increase at 2.5 times in 2015 and 5 times in 2025 compared with present consumption level even allowing promotion of energy conservation. Therefore, after 2015, energy supply structure in Vietnam will be changed dramatically.

2.2.2 Energy Supply

At present, commercial energy consumption in Vietnam such as coal, oil, and gas is increasing continually. However, share of non-commercial energy such as biomass is still high with 40% of total primary energy supply. It is considered that non-commercial energy will be shifted to commercial energy. Average growth rate of primary energy supply from 1995 to 2007 was 11%. Especially, natural gas consumption increased in power plants. On the other hand, coal and petroleum products were mainly consumed in the industry and transport sectors. Now Vietnam is net oil export country. Oil export contributes to acquisition of foreign currency for Vietnam. So far, resources of oil, natural gas, coal, and hydro were successfully developed. Currently, however, it is difficult to keep present production level for crude oil and to secure coal and natural gas production to meet domestic demand. In order to meet electricity demand, Vietnam is considering introduction of nuclear power, import of electricity from neighbor countries, and construction of imported coal-fired power plants.



Source: Vietnam Institute of Energy

Figure 2.2.2-1 Trend of Primary Energy Supply

2.2.3 Energy Price

Dung Quat refinery, the first operating refinery in Vietnam, begun its operation in February 2009. Its capacity is 130,000 barrel/day which is reported to be 50% of the petroleum demand in Vietnam. Up to now, petroleum products had been imported from the international petroleum market and their

prices had been based on the international market prices. Although the second and the third refinery project have been planed, next construction of refinery should be requested for the Asian market taking into account of small oil demand in Vietnam.

As for coal and natural gas prices, their prices for power plants are set to be lower than other users. For example, in 2006, coal price for power plants was US$20/ton. On the other hand, export coal price was US$35/ton. Regarding gas price, there are two kinds of gas price, natural gas and associated gas. Domestic gas price is also lower than international price that is US$7-8/million BTU. Vietnam is planning to move domestic coal price into international price. However, coal price for power plants is still lower than market price and export price. For example, coal price for power plants in 2008 is 70% of domestic market price and 50% of export price. Electricity price is also very low due to the government policy and average electricity price is 5 cents/kWh. Raising electricity tariff was examined in 2008 and new tariff system was created in March 2009. But different from the original plan, electric tariff for household are almost same level as before except electricity user of small demand volume under 100kWh/month. However, Vietnam will become net oil and coal import country around 2015 according to increasing electricity demand and began to import fossil energies. There may come some more problems around 2015 if energy prices still remain low compared with international price.

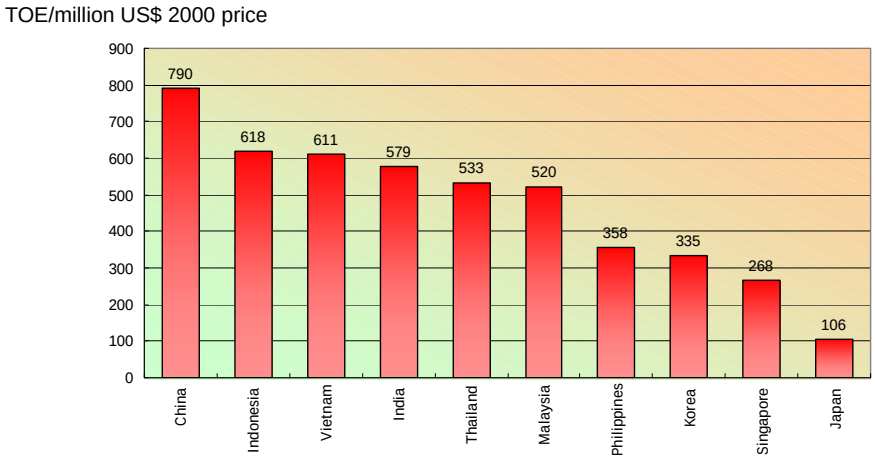
Table 2.2.3-1 Energy Price in Vietnam (2006)

	Unit	VND	US$
Coal for domestic use	ton	336,800	21.05
Coal for export	ton		35.7
Natural gas	million BTU		3.2
Associated gas	million BTU		2.1
Gasoline	litre	10,279	0.64
Diesel	litre	8,029	0.50
Kerosene	litre	8,029	0.50
Fuel oil	litre	5,400	0.34
LPG	kg	14,842	0.93
Electricity for agriculture	kWh	660	0.04
Electricity for industry	kWh	829	0.05
Electricity for commercial	kWh	1,359	0.08
Electricity foe residential	kWh	695	0.04
Average electricity	kWh	789	0.05

Source: Vietnam Institute of Energy

2.2.4 Potential of EE&C

As for primary energy consumption per GDP, Vietnam is the third largest consuming country among Asian countries and has a high potential of energy conservation. Transmission and distribution loss in 2004 was 13%. This is very high compared with 3% of Singapore, 7% of Malaysia, and 9% of Thailand. So far, heavy and chemical industries which consume a large amount of energy have not yet developed, but they will be developed in the future, therefore, Vietnam should promote energy conservation systematically in the field of industry, commercial and transport sector.



Source: Handbook of Energy & Economic Statistics in Japan 2008, IEEJ

Figure 2.2.4-1 Primary Energy Consumption per GDP (2005)

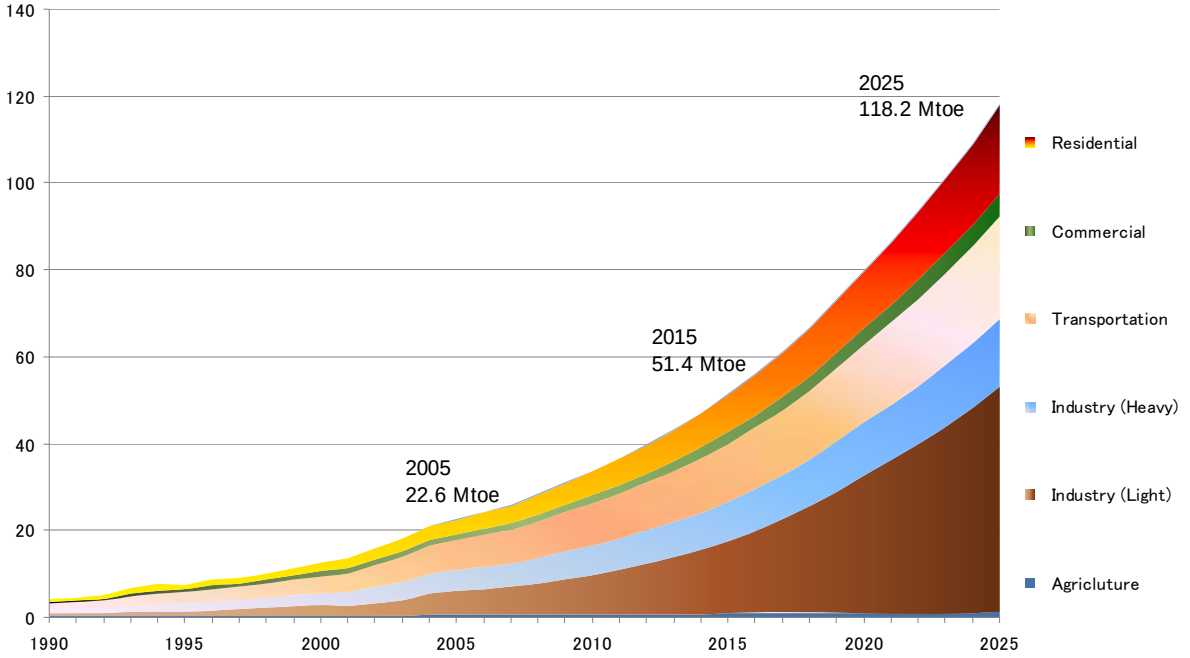
2.2.5 Energy Demand Forecast

According to the Study on National Energy Master Plan by JICA, energy demand will increase rapidly mainly in light industry pushed by high economic growth. Energy demand in the transport sector will increase gradually because diffusion rate of motorbike will stagnate in the future. Residential sector will remain to consume non-commercial energy mainly. Final energy consumption will increase from 22.6million TOE in 2005 to 51.4million TOE in 2015 and 118.2million TOE in 2025 by 5.2 times of current level. To mitigate energy demand and supply balance, promotion of energy conservation is requested very much.

Table 2.2.5-1 Energy Demand Forecast up to 2025

	2005 Ktoe	2015 Ktoe	2025 Ktoe	2005 %	2015 %	2025 %	5-15 %	15-25 %	05-25 %
Agricluture	570	830	1,159	2.5	1.6	1.0	3.8	3.4	3.6
Industry (Light)	5,626	16,743	52,029	24.9	32.6	44.0	11.5	12.0	11.8
Industry (Heavy)	4,922	9,091	15,503	21.8	17.7	13.1	6.3	5.5	5.9
Transportation	6,687	13,285	23,645	29.6	25.9	20.0	7.1	5.9	6.5
Commercial	1,322	2,724	5,362	5.9	5.3	4.5	7.5	7.0	7.2
Residential	3,341	8,508	20,142	14.8	16.6	17.0	9.8	9.0	9.4
Total	22,590	51,384	118,195	100.0	100.0	100.0	8.6	8.7	8.6

Source: National Energy Master Plan Study, JICA



Source: National Energy Master Plan Study, JICA

Figure 2.2.5-1 Energy Demand Forecast by Sector in Vietnam

2.3 Existing Laws and Policies regarding Energy Conservation

Figure 2.3-1 and Table 2.3-1 show laws and policies concerning energy conservation in Vietnam. In 2003, "Decree of Government on Energy Conservation and Energy Efficiency" was approved and (a) a circular guiding the energy conservation and energy efficiency in production units (Circular No.1, July 2004), (b) "Energy Efficient Commercial Building Code", (c) guidelines of energy labeling for energy used product (Circular No.8, November 2006), (d) financial system for EE&C promotion were established ((d) is currently under consideration). "Electricity Law" promulgated in 2005 stipulates efficient use of electricity in production, transformation, distribution and demand side. Based on "Decree of Government on EE&C" and "Electricity Law", "National Strategic Program on EE&C" and "Electricity Saving Program for the period of 2006-2010" were established in 2006. In addition, based on "National Strategic Program on EE&C", "Law of Energy Conservation and Efficient Use (EC Law)" is currently under draft (final version as of July 2009), which is planed to be in force in July 2010. "Instruction for management method, using fund, implementing program of national target for conservation and effective use of energy" (Joint Circular No.142, MOIT/MOF) was issued in 2007.

Table 2.3-1 Laws, Decrees, Decisions and Circulars related to Energy Conservation

Date	Type & Number	Title	Mainly Pursuant to or related to
Sep. 2003	Decree No.102	Decree of Government On Energy Conservation and Energy Efficiency	
Jul. 2004	Circular No.1	CIRCULAR Guiding the energy conservation and energy efficiency in production units	Decree No.102
Jul. 2005	Law	Electricity Law	
Apr. 2006	Decision No.79	National Strategic Program on EE&C	Electricity Law Decree No.102
Apr. 2006	Decision No.80	Electricity Saving Program for the period of 2006-2010	Electricity Law
Nov. 2006	Circular No.8	Guideline procedure of energy labeling for energy used product	Decree No.102 Decision No.80
Nov. 2007	Joint Circular No.142	Instruction for management method, using fund, implementing program of national target for conservation and effective use of energy	Decision No.79
Jul. 2010 (expected)	Law	Law of Energy Conservation and Efficient Use	Decision No. 79

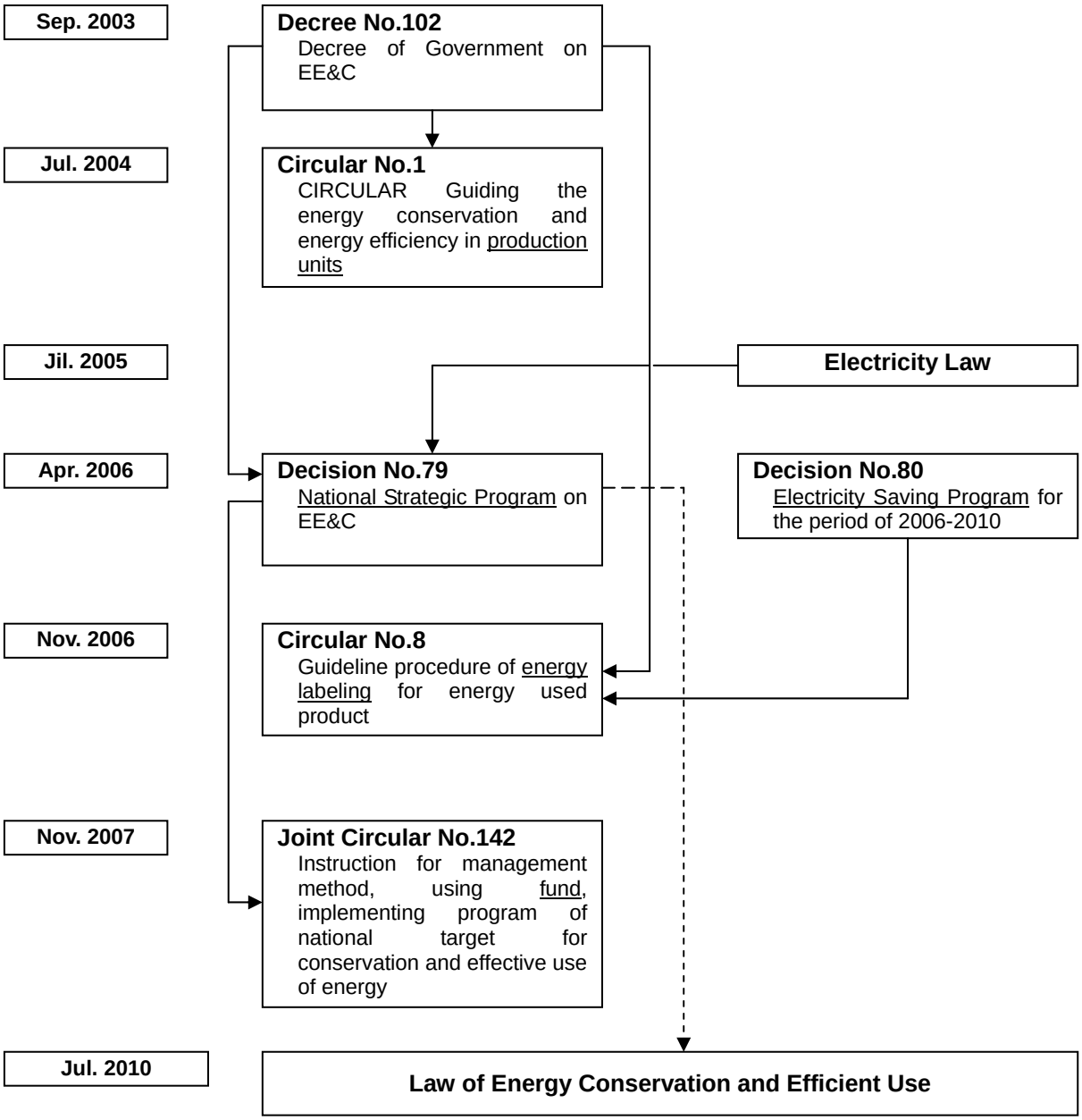


Figure 2.3-1 Relationship among Laws related to Energy Conservation

2.3.1 National Targets for Energy Efficiency and Conservation

As the quantitative targets concerning EE&C promotion, the government of Vietnam established the followings:

- The target in "National Energy Policy" approved in 2007

  The energy elasticity which is about 1.5 at present should be decreased to less than 0.8 by 2025.

- The target in "National Strategic Program on EE&C" approved in 2006

  The EE&C target should be 3 to 5% of business as usual (BAU) amount in the period from 2006 to 2010, and 5% to 8% of BAU from 2011 to 2015.

In order to achieve these targets, more specific guidelines are required, so the government plans to draw up the "Master Plan on EE&C." This master plan will include prioritization, preparation of a road map, establishment of an effective action plan. Implementation of the master plan will be divided into following two phases.

- Phase 1 (2006-2015): Provision of measures and plans for action
- Phase 2 (2016-2025): Provision of a standard road map and policy options

2.3.2 Domestic EE&C Institutions and Organizations in Vietnam

1) Government-affiliated Organization

The MOIT organized "National Steering Committee" which consists of 10 related ministries and government offices for promoting EE&C shown in "National Strategic Program on EE&C."

The followings are the governmental organizations related to promotion of EE&C in Vietnam.

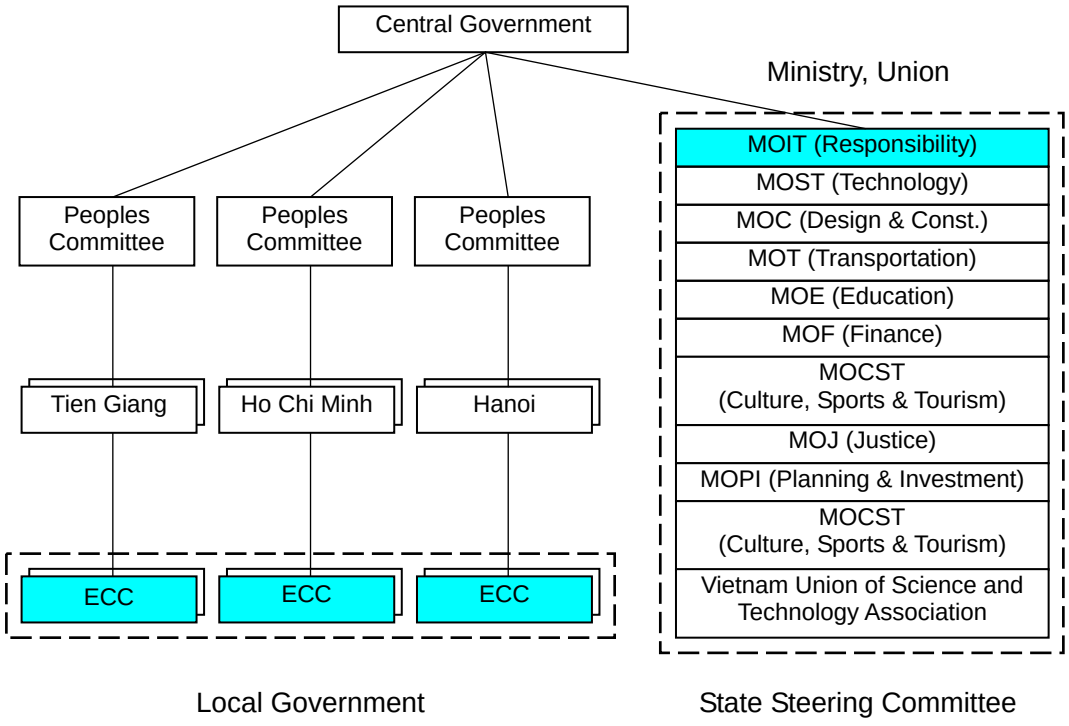


Figure 2.3.2-1 Structure for promotion of EE&C in Vietnam

Energy Efficiency and Conservation Office (EECO), Ministry of Industry and Trade (MOIT)

The EECO is an administrative organization concerning EE&C promotion in Vietnam. It

consists of 14 staffs and the number of full-time staffs are only two, shortage of personnel lies as one of the major obstacles to inhibit its activities.

Local Energy Conservation Center (ECC)

The ECC is an agency established under the local government for the purpose of dissemination of EE&C. So far, four ECCs have established in four cities, Ho Chi Minh in 2002, Hanoi in 2007, Tien Giang in 2007 and Phu Tho in 2008. However, since three ECCs other than that in Ho Chi Minh were established very recently, they have little actual achievement. Although five or six ECCs once had been established under the MOST, they were closed except that in Ho Chi Minh. Recently, ECCs are again to be established in some cities under the MOIT. Now the ECC in Ho Chi Minh is in a leading position, and the MOIT has a plan to establish eight ECCs in the northern, central and southern regions.

2) University and Private Organization

There are two universities in Hanoi which have energy management and energy saving curriculums and training courses.

Hanoi University of Technology

Since 2002, Dr. Luong, Vice President of the university, has played a central roll in many EE&C and energy management training projects shown below. Among others, "Curriculum Development and Preparation of Training on Energy Management and EE&C in Vietnam" consigned from the MOIT in 2007 has high relevance to energy manager training which is one of the important themes in this Study.

- Energy management and EE&C training curriculum development project
  - Supported by the MOIT, implemented in 2008, for steel and chemical industries.
- Energy management and EE&C training curriculum development project
  - Supported by the MOIT, implemented in 2007, for CEOs, energy managers and energy auditors.
- EE&C and productivity improvement in food (seafood) processing industry
  - Supported by DANIDA, implemented in 2004-2005, for food processing industry.
- Green House Energy Reduction Project in chemical, cement, steel-making and textile industry
  - Supported by SIDA, implemented in 2003-2005 for chemical, cement, steel –making and textile industry.
- EE&C promotion project in industrial sector by improvement in productivity and environmental management

- Supported by the GEF and the UNEP, implemented in 2002-2004 for industrysector.

Electric Power University

Dr. Hoang, Dean, played a central roll in establishing the Energy Management Faculty that is the first one in Vietnam. This faculty has high relevance to energy manager training in Vietnam. The faculty has conducted ten cases of energy audit in 2007 and 2008 on paper manufacturing, cement, textile, beer and other industries with consignment by the MOIT.

Electricity of Vietnam (EVN)

The EVN has carried out DSM programs supported by WB/GEF proactively.
The power generation capacity in Vietnam is about 11,200MW, of which hydro is 4,200MW, coal is 1,500MW, oil and gas is 5,500MW. On the other hand, the power demand in 2010 is forecasted to be 18,000MW, The difference of 7,000MW is planed to be made up by hydro and coal thermal plants now under construction.
According to the DSM assessment, it is possible to reduce construction of power plants with the total capacity of 770MW by implementation of EE&C.

2.3.3 Framework of EE&C Policy in Vietnam

1) Decree No.102/2003 on EE&C (issued by the Government in September 2003)

The promulgation situation of notification (Circular) based on the Decree is as follows.

a) Guideline for Industrial EE&C, Circular No.1/2004 (issued in July 2004)
Factories which consume much energy are specified as a “designated factory” and these factories are obliged to submit a report on energy consumption to the local government. However, submission of the report is not observed well by these factories.

b) Energy Efficient Commercial Building Code No.40/2005/QB-BXD (promulgated in November 2005)

c) Decision on Guiding Order and Procedures for Energy Efficiency (EE) Labeling for Energy Consuming Products (issued in November 2006)
The Decision specifies that the MOST determines standards and the MOIT manages labeling system.

d) Financial System for EE&C Promotion (under discussion between MOIT and MOF)
The MOIT is the responsible department and is discussing with the Ministry of Finance about this issue.

2) National Strategic Program on EE&C, Decision No.79/2006 (issued by Prime Minister in April 2006)

The main objectives specified by the program are as follows.

a) Establishing numerical targets for EE&C from 2006 to 2015

- 3 to 5% energy reduction of Business as Usual (BAU) amount in the period from 2006 to 2010.
- 5 to 8% energy reduction of BAU from 2011 to 2015.

b) Establishing "Law of Energy Conservation and Effective Use" (Draft) and the related legal framework by 2010.

c) The target of introducing the energy management system (EMS) to designated factories is 40% by 2010 and 100% by 2015.

d) Applying Vietnamese Construction Standard of EE&C compulsorily for construction of new buildings after 2006.

e) Establishing a functional energy tariff mechanism to promote EE&C by 2010.

f) Facilitating introduction of high-energy-efficient devices. (Announcing the minimum energy performance standard for five devices within the period from 2006 to 2010 and for another five devices by 2013.)

g) Promoting EE&C in the transportation sector such as making best use of transport capacity, minimizing fuel consumption, and trial introduction of alternative fuels.

The outline of the program and its progress that is closely related to this JICA Study are shown below.

The program consists of 11 projects and these projects are carried out by six groups. Some projects have made sufficient results, but many projects have not been well implemented. Therefore, establishment of medium- and long-term forecast, or road maps, and establishment of an effective action plan shall be one of the main subjects of this Study.

Group	Project
Group 1	Project-1: Developing legal frameworks of EE&C in industrial, construction, and commercial and residential sectors (MOIT)
Group 2	Project-2: Educational campaign for awareness of EE&C (MOIT)
	Project-3: Putting EE&C education into the national education system (Ministry of Education and Training)
	Project-4: Campaign to promote "Energy Saving in Each Household" (MOIT)
Group 3	Project-5: Developing EE&C standards and labeling criteria on targeted equipment (MOST) The MOST draws up standards of energy-efficient equipment replying to the request from the MOIT. Establishment of standards has been progressing for 11 items. The labeling on energy-efficient equipment was introduced for 3 items.
	Project-6: Providing a technical assistance system to domestic manufacturers of energy-efficient devices who have to meet the standards of energy efficiency (MOIT)
Group 4	Project-7: Establishing a energy management system in the manufacturing sector (MOIT)
	Project-8: Assisting manufacturers to improve the efficiency of their energy consumption through energy audits, etc. (MOIT) Present situation of energy audits in Vietnam: Energy audits on factories have been conducted as "Projects" with support from international cooperation agencies such as GEF. Recently, the energy audits become to be conducted with financial support by the MOIT or enterprises' own finance. In 2007, 200 cases of energy audits were conducted with financial support by MOIT. In 2008, a survey of energy use in 250 key companies was implemented with MOIT's financial support. In 2007, the MOST also conducted a survey of energy use in medium- and small-size factories in the brick, ceramic, textile, paper and food processing sectors.
Group-5	:Project-9: Educational activities for promoting EE&C in buildings (Ministry of Construction)
	Project-10: Energy management in buildings (Ministry of Construction)
Group-6	Project-11: Promoting EE&C in the transportation sector (Ministry of Transport)

3) Electricity Law (enforced on July 10, 2005)

In the Electricity Law, efficiency of generation, transmission, transformation, distribution and usage are stipulated.

4) Electricity Saving Program for the period of 2006-2010, Decision No.80/2006 (issued by Prime Minister on April 14, 2006)

The contents of the program which have relevance to JICA Study are as follows.

a) EE&C in Offices

- Promotion of utilizing daylight, setting cooling temperature of air conditioners at 25ºC, use of high-efficiency fluorescent lamps and compact fluorescent lamps (CFL).
- Formulation of regulations aiming at 10% energy (power) saving per year. The achievement of energy saving should be reported to ministries/agencies concerned, the people's committees, etc., quarterly and yearly.
- Check of the report by the Ministry of Finance.

b) EE&C in Industries

- Establishment of benchmarks of energy consumption for energy-intensive industries.
- Capacity development of staffs in charge of EE&C in factories, local governments such as the DOITs and the DOSTs.
- Assistance for introducing a energy management system into 40% of energy-intensive enterprises in the period from 2006 to 2010.

c) Others

- Public relation activities for power saving
- EE&C in daily life
- EE&C by electric power suppliers
- EE&C of electric equipment
- Lighting plans taking EE&C into account
- Promotion of utilization of solar water heater and alternative energy

5) Circular on Guidance for Implementation of the Government Decree on EE&C, Circular No.1/2004 (issued by MOIT in July 2004)

The Circular specifies the definition and application forms for the designated factories. The definition of designated factory is "a factory whose consumption of fuel and heat is 1,000 toe or more per annum" or "a factory whose power use is 500 kW or more or 3,000MWh/year or more." As of 2008, about 1,500 factories are targeted nationwide, and about 250 in Hanoi.

The designated factories are obliged to report their energy consumption and to implement energy audit, etc., that are specified in the decree and the circular. However, the following problems obstructs functional management of the designate factory program.

- The application form is complicated and factories cannot deal.
- The local government department (DOIT) which receives applications does not fully understand the meaning and contents of the designated factory program.

6) Guideline procedure of energy labeling for energy using product, Circular No.8 (issued by the Government in November 2006)

a) Target: Individuals and organizations engaging in manufacturing and importing energy using products that is in the selected list to labeling have the right to propose the Ministry of Industry assessment and license for products meeting the technical standards regulated by the Ministry of Industry.

b) Label: "Endorsement label" (certifying the product whose energy performance exceeds a standards) and "comparative label" (providing the energy performance level, which facilitate consumers to compare energy performance among products)

c) Labeling scheme is voluntary.

d) The testing laboratories are professional laboratories certified by VILAS systems or other organizations such as ILAC, APLAC or laboratories that have not been certified by VILAS systems but have qualified to test parameters of energy consumption and appointed after supervising and evaluating by the Ministry of Industry to test energy used products for labeling.

7) Instruction for management method, using fund, implementing program of national target for conservation and effective use of energy, Joint Circular No.142 (issued by MOF/MOIT in November 2007)

a) Expenses on "National Strategic Program on EE&C"

PR, education program, pilot program, MEPS, labeling, energy audit, transportation energy conservation, inspection of each program, overhead, seminar, training.

b) Specified expenses

- Maximum 30% subsidy for residential energy conservation program
  Example 1: 2 CFLs and Solar water heater: 1,350,000VND
  Example 2: 2 CFLs and biogas cellar: 800,000VND
  For low income household, subsidy doubles.
- 30 % subsidy for energy management in the building and factories (maximum 70 million VND/site).
- 50 % subsidy for energy audit (maximum 50 million VND/enterprise).
- 30% subsidy for labeling the products (maximum 60 million VND/enterprise)

8) Law of Energy Conservation and Effective Use (EC Law)

"Law of Energy Conservation and Effective Use" is currently under draft (final draft as of July 2009). It is planned to be in force in July 2010.

2.4 Data Collection Mechanism for Energy

2.4.1 Data Collection Mechanism in Japan

1) Revised Law of Energy Conservation and Reporting System

In Japan, the Energy Conservation Law (the Law Concerning the Rational Use of Energy) was revised partially and implemented since April 2000. The reasons to revise the law are as follows: "reinforcement of energy conservation policy in the business and household sector which amount of energy consumption is increasing rapidly in order to promote mitigation policy further more against the global warming" and "reinforcement of energy conservation policy in the offices/convenience stores etc. and houses/buildings by revision of the law to this end".

Points of revision are as follows.

a) Revision of Designation Standard

Energy management was changed from factories and business places base to total enterprises base. If annual energy consumption by enterprises in total excesses more than 1,500kl (of crude oil equivalent), these enterprises are specified designated enterprises by reporting their energy consumption by enterprise unit.

According to this revision, as for franchised chains like convenience stores, energy management in total business is obliged. As for businesses done by the heads of franchised chains, the heads of franchised chains are specified designated franchised chains by reporting their energy consumption when annual energy consumption by enterprises in total excesses more than 1,500kl (of crude oil equivalent).

As for specifying designated energy management factories, factories and business places using more than specified amount of energy consumption are specified designated energy management factories as well as the past.

b) Change of Units Obliged Reporting

Of obligations by designated energy management factories, submission system of Periodical Report and Five-year Plan is changed from submission by factories and business places unit as well as the past to enterprises unit (designated enterprises and designated franchised chains).

c) Creation of Energy Manager, etc.

Designated enterprises and designated franchised chains select one energy manager, who is director class with right to speak about management of the enterprises, and one promoter of energy management plan, who support energy manager practically, and then promote energy management system as whole enterprises.

2) Collection Mechanism of Each Report

In Japan, the collection system that Periodical Report and Five-year Plan were submitted in the form filled out has been adopted. Intent of submitted report is input in the database by the stuff of METI and outsourcing. They are analyzing the submitted report and giving some guidance in necessary. Number of designated enterprises reached 14,000 companies in FY 2007 and work volume is becoming tremendously big. Before revision of the Energy Conservation Law, amount of energy consumption by designated enterprises covers about 90% of total manufacturing industry and about 13% of total business places. Based on the revision of the Law, covering rate by designated business places would increase 50% of total business places. Covering rate of Periodical Report and Five-year Plan has already reached 100%.

To confirm the intent of the report, field investigation by outsourcing (for example, ECCJ) is executed at random. As the result of these activities, 111 enterprises of 1,650 enterprises received guidance in the form and 10 enterprises received on-the-spot inspection. But there is no adjustment of penal regulations.

Table 2.4.1-1 New Definition of the Revised Japanese Energy Conservation Law (factories/business places and transportation)

	Up to now	Revision	Remarks
Factories & Business Places	Type 1 designated energy management factories	Designated enterprises	Revision makes an increase of coverage of energy consumption data in the business sector
	(Energy consumption 3,000kl or more /year)	Enforcement of energy managemant to energy users more than energy consumtion standard at their factories	
	Selection of Type 1 Energy Manager	Selection of Energy Manager	
	Submission of Middle/Long-term Plan	Submission of Middle/Long-term Plan	
	Periodical Report on Energy consumption	Periodical Report on Energy consumption	
	Type 2 designated energy management factories	Designated franchised chain stores	
	(Energy consumption 1,500kl or more /year)	Introduction of energy regulation in fanchised chain stores as one enterptise	
	Selection of Type 2 Energy manager		
	Periodical Report on Energy consumption		
Transportation		Implemented since last revision (FY2007)	
		Designated transportaion enterprises (freight & passengers)	
		(Number of fleet: truck; more than 200, rail vehicle; more than 300)	
		Submission of Middle/Long-term Plan	
		Periodical Report on Energy consumption	
		Designated cargo owner	
		(Amount of transportation per year; more than 30 million tons)	
		Submission of Plan	
		Periodical report on energy consumption with consignment transportation	

Table 2.4.1-2 New Definition of the Revised Japanese Energy Conservation Law (houses/buildings)

Designated buildings (Type 1 designated buildings)	Type 2 designated buildings	Investigation by the registered cosultant for buildings	Provisions for enterprises of housing business	Recommend/advice to improve and indicate the performance of energy conservation to the designer/constructor of buidings
(Total floor space: more than 2,000m2)				
Constructor must report method of energy conservation to the governing agency when they build newly and/or rebuild largely designated buildings	Constructor must make a report on small/meddium sized buildings -Govering agency give a recommendation if it is infufficient very much.	Report on maintenance and reveration is exempted if the situation of buildings are suitable for judgement standard based on the investigation	Introduction of method for promoting energy conservation of designated house to the enterprises construcing and selling houses	
Govering agency make public a support or order (penalty), if it is infufficient very much refering from judgemnet standard.		Training of reserchers by the registered training organizations	(Guarantee by recommendation and order etc. to the constructors/sellers of many houses)	
Periodical Report should be made on situation of maintenance and reservation				

2.4.2 Data Collection Mechanism in Vietnam

In Vietnam, General Statistics Office (GSO) under the Ministry of Planning and Investment collects socio-economic data. The GSO distributes questionnaire sheets of periodical economic survey to all state enterprises, all foreign investment enterprises, and all non-state enterprises that have more than 10 employees. While the GSO distributes questionnaire sheets to 15% of non-state enterprises of less than 10 employees as sample survey so as to estimate socio-economic statistic of all the non-state enterprises less than 10 employees.

The GSO collects more than 131,000 questionnaire sheets and receives questionnaire sheets by electronic files or filled-out sheets. When the GSO receives filled-out sheets, its staff input the data into personal computers. The network system of GSO has been already established between district offices, province offices and Headquarter. Once district/province offices enter the data, all the data are stored in a database in the headquarter of GSO.

1) Network System of GSO

Computer system at GSO is configured as a local area network system consisting of six servers and 250 client terminals. 250 client terminals are connected via HUB and installed in each division of GSO. The GSO's system is also well equipped with security measures including firewalls and UPSs which enable to minimize the risk of hacking and system breakdown due to power failure. The GSO's server systems have an external connection via internet and make possible the direct connection access via FTP (File Transfer Protocol) for transmission of statistical data not only to Hanoi and HCMC but also all Provincial Statistical Offices (PSOs) in 64 locations in the country.

The GSO's systems also have LAN connection with three IT centers located in Hanoi, HCMC and Da Nang. While PSOs and their affiliated District Statistical Offices (DSOs) equipped with personal computers have only dial-up connections, and are not hosted within the LAN system. Also GSO's file server is connected with the tax office using a leased circuit line for transmission and establishment of company statistical database.

2) Database

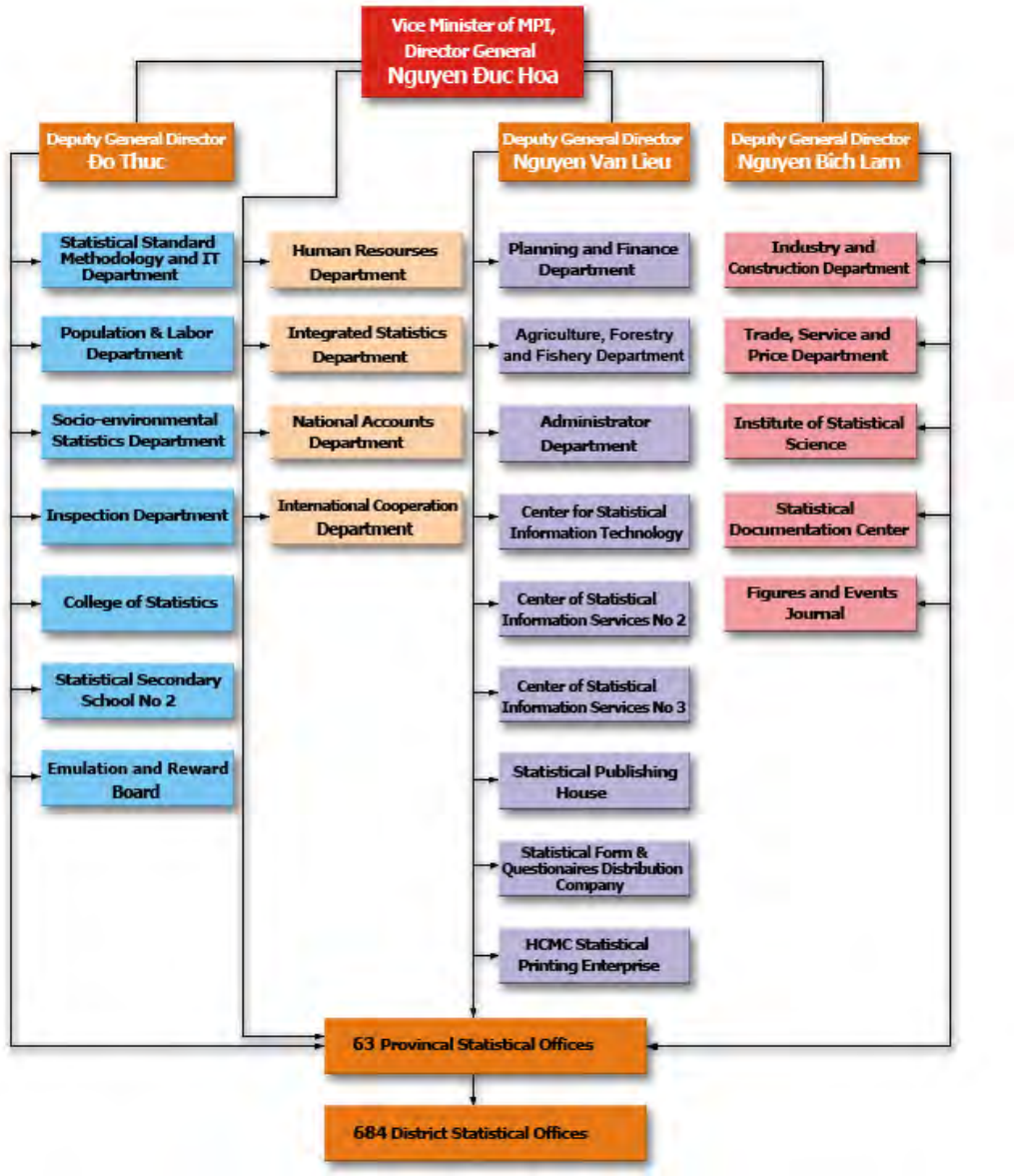
The GSO's website is designed and developed by the System Division of GSO. Contents to be published are prepared and edited by each division of GSO and get an approval from the directors of each division, followed by a final authorization from the Director General of GSO. The System Division converts these files to HTML or PDF files and finally publishes them on the website.

3) Overview of GSO System Division

The GSO System Division belongs to Center of Statistical Information Service. Major functions of the System Division are as follow:

- Integration of computer system within GSO
- Selection, procurement and setting up of systems
- Software development
- Development and implementation of network systems
- Maintenance and support of hardware and software

Figure 2.4.2-1 shows organization of GSO and Figure 2.4.2-2 shows the present data collection mechanism by GSO.



Source: GSO home page (http://www.gso.gov.vn/default_en.aspx?tabid=494&itemid=1595&idmid=1)

Figure 2.4.2-1 Organization Structure of GSO

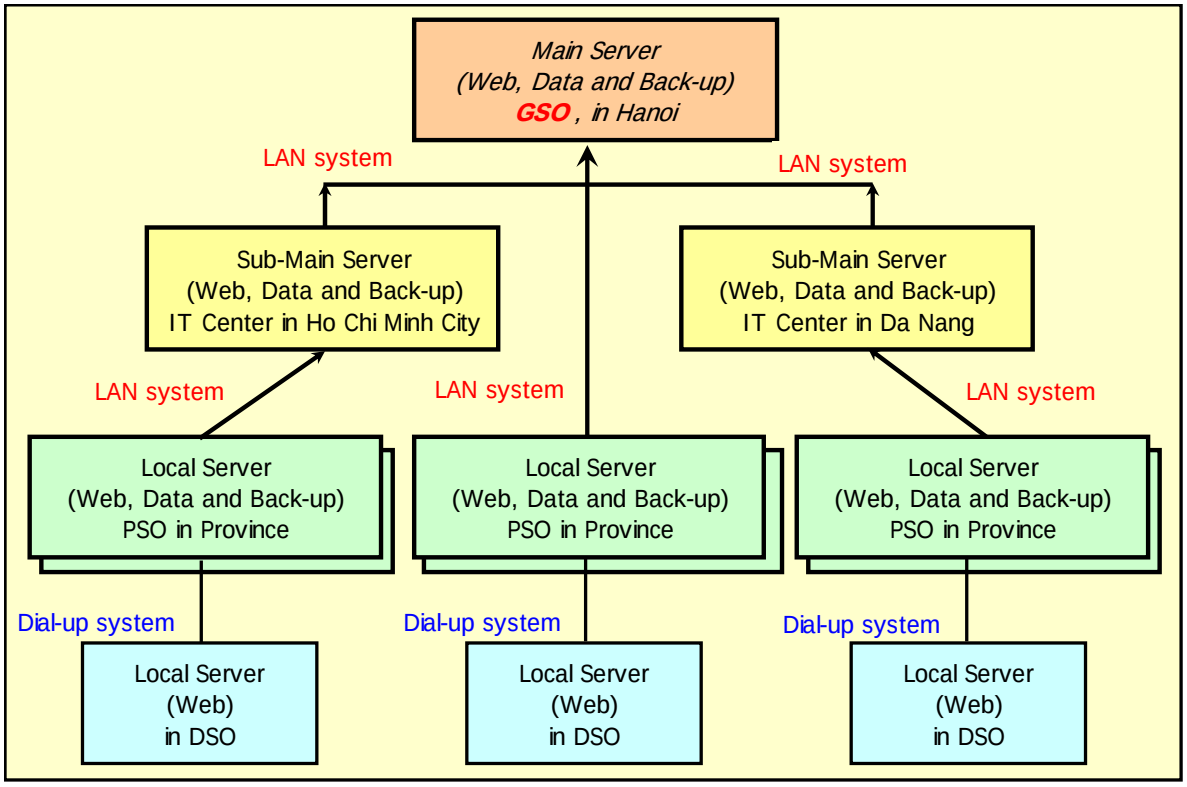


Figure 2.4.2-2 Present Data Collection Mechanism by GSO

2.5 Institutional Arrangement for Promoting EE&C in the National and the Local Levels in Vietnam

2.5.1 Administration of Implementation of EE&C Policy

MOIT is the responsible ministry for implementation of EE&C policy of Vietnam. It established the Energy Efficiency and Conservation Office (ECO) under the department of Science and Technology [1)]. Working closely with experts from universities and local ECC, ECO plans and implements EE&C policy in Vietnam [2)].

The Study Team has found that the policy coordination among various sub-sector in Vietnam is not sufficient enough to ensure successful implementation of the National Strategic Program on EE&C. Without sufficient policy coordination, the past strategy and plans are prepared and approved. This makes it difficult for Vietnam to carry out sustaining EE&C policy.

2.5.2 Current Status of ECCs in Vietnam

MOIT has initiated to establish a network of Energy Conservation Centers (ECC) and Energy Conservation Offices (ECO) in major cities in Vietnam to play central roles in promoting EE&C in Vietnam. The activities of these centers include promoting EE&C and in providing the related technologies to local industries and other major energy users. At the time of writing, however, they have been reorganized into three (3) active ECCs in HCMC (established in 2002), Hanoi (2007), and Phu Tho (2008) due to low level of activities. The remaining local ECCs is to be reopened or to be revitalized at some cities (e.g. Da Nang) based on the current EE&C Programs disbursed through respective local People's Committees in Vietnam.

The Study Team has found that the only ECC in HCMC plays a leading role in promoting EE&C assessed the capacity of the ECCs from the view points of availability of technology, human resources and its business record. The above EE&C program intends to extend a network of ECCs to eight (8) industrial regions throughout the country including HCMC, Hanoi and Phu Tho under MOIT's leadership (Table 2.5.2-1).

In addition, MOIT is considering establishment of National Energy Conservation Center (ECC Vietnam) as the national EE&C center for promoting and implementing EE&C policies. The study team is in review to propose a total restructuring to eliminate duplications and redundancy of coverage for effective policy implementation.

1) Ministerial Decision No. 919／QD-BCN, April, 2006

2) Duties of ECO include: (1) to formulate and plan EE&C policy and measures, (2) to formulate short and mid term action plans, (3) to promote and supervise EE&C activities, (4) to disseminate EE&C to public, (5) cooperation with international organization, (6) to take necessary EE&C actions with ministries and agencies concerned, and (7) to monitor the progress of the actions. The ECO currently working to improve energy efficiency at all levels, and to develop an administrative system to use energy consumption database.

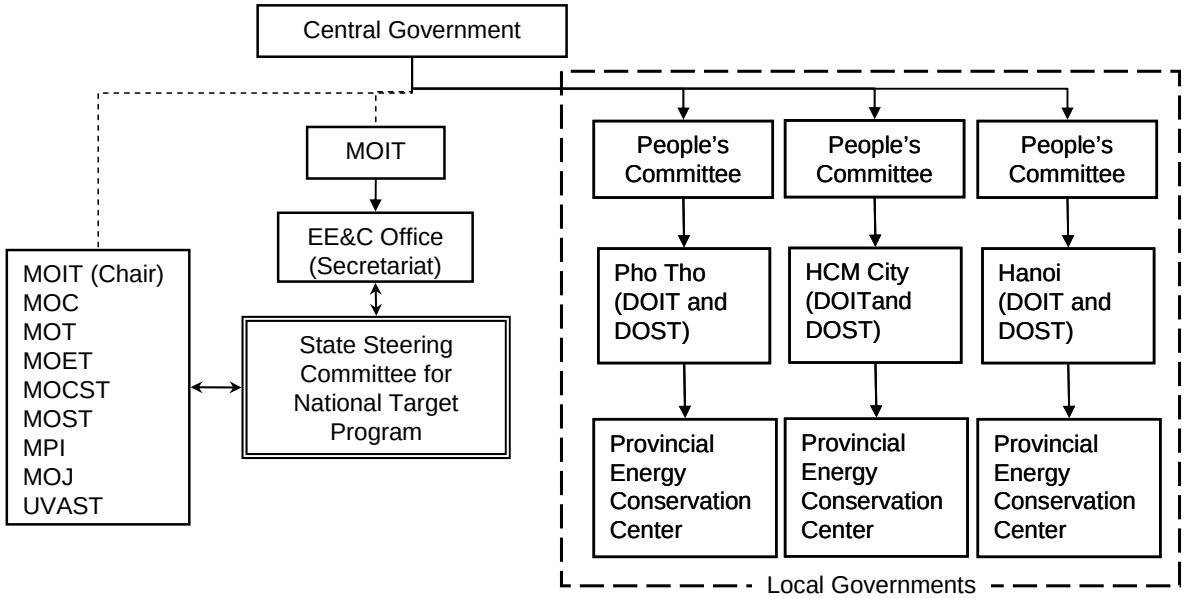


Figure 2.5.2-1 Present Administrative Structure for Implementing EE&C Policy in Central and Local Government [3)]

2.5.3 Problem in Institutional Arrangement in EE&C Promotion

1) Problems of ECCs

Except the ECC in HCMC, other ECCs faces problems in limited experiences, equipment and human resources currently available. As discussed in 2.5.2, MOIT has a plan to establish eight (8) ECCs in Viet Nam. The plan, however, lacks a business strategy in operating future network of eight (8) ECCs under the coherent strategy linking the national center. The team has identified that each ECC links together loosely because of funding provided by MOIT. The network, however, does not function as integrated national initiative for implementing one EE&C policy of Vietnam. In reality, most ECC has loose tie with either MOIT or MOST because they are established by receiving some financial and manpower support from MOST or MOIT. Most fixed cost is covered by the People's Committees.

[3)] MOC: Ministry of Construction, MOT: Ministry of Transportation, MOET: Ministry of Education and Training, MOCST: Ministry of Culture, Sports and Tourism, MOST: Ministry of Science and Technology, MPI: Ministry of Planning and Investment, MOJ: Ministry of Justice, and UVAST: Union of Vietnam Associations of Science and Technology.

Table 2.5.2-1 List of Prospective Energy Conservation Centers (ECCs) in Vietnam

No.	Name & Location	Established or planned year	Upper organization to report	Main budget & salary paid by	Number of employees	Function & activities implemented				
						E.C. education & training	E.C. audit of enterprises	E.C. data collection & analysis	E.C. propagandizing & publishing	Assisting local project consulting
1	ECC Ho Chi Minh City	2002	DOST	People's Committee	41	A	A	A	A	A
2	ECC Ha Noi	Feb., 2007	MOIT or DOIT	People's Committee	12	A	A	A	A	C
3	ECC Tien Giang	July, 2007	MOIT or DOIT	People's Committee	7	B	B	B	C	C
4	ECC Da Nang	2009	DOST	People's Committee		C	C	C	C	C
5	ECC Hai Phong	2008	MOIT or DOIT	People's Committee		C	C	C	C	C
6	ECC CanTho	2009	DOST	People's Committee		C	C	C	C	C
7	ECC Ba Ria Vung Tau?	2009	DOIT	People's Committee		C	C	B	C	C
8	ECC Phu Tho	2008	DOIT	People's Committee	22*	C	C	B	C	C

Legend: "A" means actual activity, "B" means activity in near future, "C" means future plan.
Source: MOIT adapted by Mr. Ogura, METI expert, et al.
Note: All data prepared on December 14, 2007 except (*) below.
(*): Updated on November 15, 2008.

Substantive EE&C activities are covered by MOST and MOIT through providing the funding to People's Committee. The EE&C programs implemented are, in most cases, National Program. Because two central ministries and local peoples committees are involving the programs, unique know-how, good practices and experiences may not be able to accumulate systematically for further application. The projects implemented by ECC are carried out through multiple funding channels from various ministries and are not nationally cohesive EE&C promotion yet. The local ECCs are good bases to implement activities utilizing local resources. A national standard for the quality of services provided by the ECC is, therefore, not available because no manuals and standards are nationally recognized. When ECCs play a significant role to promote EE&C and its technology in Vietnam, they should equip a function to accumulate technical and managerial know-how systematically. Their knowledge and resources are dispersed without functioning effective accumulation of useful common knowledge for promoting EE&C. This is one of constraints to accelerate the early adoption of EE&C in Vietnam.

2) The Impact of the Proposed EC Law still in Review

As discussed in the section 2.3, the legal framework to be defined in the EC Law (draft) and the related regulations in review is still uncertain. This situation has led ECCs difficult to find its directions and activities in line with promoting prospective EE&C policies and regulations which should be also defined in the law. The action plan and activities of ECCs, rules and regulations, and technical standards are indispensable. Clarity of legal frameworks is a minimum requirement for implementing EE&C activities effectively. On-going discussion about ECCs has been limited to how the physical outlook should be furnished. The most significant elements of the organization, such as defining its client, the services it provides and, more importantly, the mission of the organization have not been decided. In addition, the national target of 3 to 5% energy consumption reduction by 2010, and 5 to 8 % reduction by 2015 may not be easy because the necessary mechanisms for EE&C, such as development of reporting procedures and the database, rigorous promotion of various EE&C measures at enterprises, etc stipulated in the EC Law will be enacted as early as July 2010. Achieving such numeric objectives for EE&C may be challenging because it needs some while from the time these measures would be launched. The early enactment of the EC Law is desired.

3) Locations of the Prospective ECCs

As shown in the Table 2.5.2-1, the existing and prospective ECC locations cover five major industrial and populated districts in Vietnam in surface. The location has been strategically selected to promote EE&C effectively from relatively large industry to smaller ones. The territory of Vietnam spread from north to south and its business climates enjoys huge diversity. The economic booming of Vietnam has created favorable investment climates effectively utilizing regional characteristics and the strength. ECCs, therefore, have created and managed in accordance

to such diversity in the business climates with initiatives from the People's Committees. The concerned ministries, particularly MOIT needs to continue discussion to find out the most suitable plan for establishing and utilizing ECC through inclusive dialogue with stakeholders.

4) Financial Support to EE&C Promotion

In order to realize the network of EE&C as shown in the Table 2.5.2-1, increase of financial support is necessary. It has estimated that the current national EE&C budget administered MOIT is 200 to 400 million dong. The amount, however is not sufficient enough to cover the expenditure necessary to promote EE&C and additional financial support is necessary.

5) Technical Capacity for Energy Audit in Vietnam

The assessment result by the Study Team indicates that the technical capacity of only HCMC ECC is equipped with sufficient for basic energy audit. Besides other ECC, such as Hanoi and Da Nang, has a limitation because of unavailability of machinery and equipment, lack of experienced auditors, and limited expertise in auditing. Currently energy audit is provided by ECC , consultants such as IE and ENERTEAM. In addition, technical universities provide such services. The following section discusses about the ECC's capacity on energy audit in Vietnam.

(1) Analysis of Basic Audit Services

ECC provides advices on EE&C to local enterprises (factories and commercial building). Though limited, each ECC has been equip with basic measuring devises to provide the services. The centers, therefore are able to provide limited energy audit (up to a few days of basic audit services through site visit and observation). Basic audit services in Vietnam follows the following procedures: (1) hearing based on the questioner, (2) analysis based on the existing documents, etc. (3) Site visits and data collection for few days, (4) Analysis based on the data collected, and (5) Reporting. This is almost comparable to the similar services provided by ECCJ or free consultation provided by municipal government in Japan.

The past audit services provided by HCMC ECC were limited to basic audit service to some factories and commercial building. Sub sector covered are also limited to commercial building, textile, and food processing industries. Technical areas covered are also limited to common utility areas such as heat, motors and compressed air. Some audit services were performed with an assistance from foreign consultants. It was observed that the level of the analysis on EE&C potentials and its quality was inconsistent.

The Team has observed during the on-site survey that the Vietnamese side is proficient to use of measuring devises. They have much to improve in analysis and developing recommendation for EE&C because the Vietnamese side generally lacks knowledge accumulated in a variety of good practices in the field, so information share and accumulation on the success cases are

desired.

(2) Capacity to Provide Advanced Energy Audit Services (HCMC ECC)

Past audit services are limited to provision of basic energy audit of selected commercial building and some factories in Vietnam. Among the factory audit, very few experiences included the diagnosis of energy efficiency covering production processes.. In order for HCMC ECC to provide highly professional audit services to industry in commercial purpose, knowledge and experience in specific production process and efficient operation are indispensable. To do so, long-term efforts to ensure capacity including securing resources such as personnel, equipment and technology is one of a challenge in EE&C in Vietnam. By continuing extending energy audit, ultimately heighten the level of audit capacity in Vietnam.

(3) Human Resources Development System for Promoting Energy Audit

In addition to the item (1) and (2) above, the government of Vietnam needs to accelerate the system to secure human resources to provide energy related services.. EE&C technology, like any other technology, is developed at the position close to the production lines, therefore such knowledge is closely related to the production site. Human resources in EE&C in Vietnam, however is mostly developed in academia. Historically, Vietnamese industries rely on technical universities for the source of trained engineers. Many industrialized nations, including Japan, has sufficient number of trained EE&C experts who are trained by industry themselves through OJT. Vietnamese industries may need to ensure capable human resources by themselves in the long-run while the current industrial and market conditions does not permit it yet.

(4) Comprehensive Capacity on Energy Management and Analysis (Conclusion)

In summary, HCMC ECC has the most advanced capacity in promoting EE&C in Vietnam. It has a sufficient capacity to conduct a basic energy audit services with some assistance. The Study Team envisions that the HCMC ECC may play a central role to promote EE&C technology to other ECCs in Vietnam.

In the other hand, when local ECCs are operated independently by providing professional EE&C services to local industries, the ECCs need to upgrade their capacity significantly to meet advanced knowledge in energy audit and specific engineering for improvement. In this connection, much efforts are needed to realize this, because even the ECC HCMC is not able to provide such a high level of services at the present. In particular, there is not enough personnel to provide such services. Establishment of organizational and institutional arrangement to accumulate EE&C knowledge (technology, good practices, analysis, measures to improve, etc) is essential to change the situation in Vietnam (see Table 2.5.2-2).

Table 2.5.2-2 Current Status of ECC's Capability of Energy Audit in Factory

Item	HCMC	Da Nang	Pho Toh	Hanoi
Capacity for Basic Audit Services				
✓ Knowledge in Methodology and Approach	A	B	N/A	B
✓ Sufficient Staffing Available	A	C	C	C
✓ Machinery and Equipment	A	B	C	B
✓ Experience	B	C	C	C
Advanced Analytical Capacity Including Knowledge in Production Process	C	---	---	---
Engineering Capacity for Improvement of Production Lines	---	---	---	---
Human Resource Development System	C	---	---	---

(Note) A: sufficient level, B: some improvement is required, C: major Improvement is required, N/A: not applicable, ---: no reliable data available

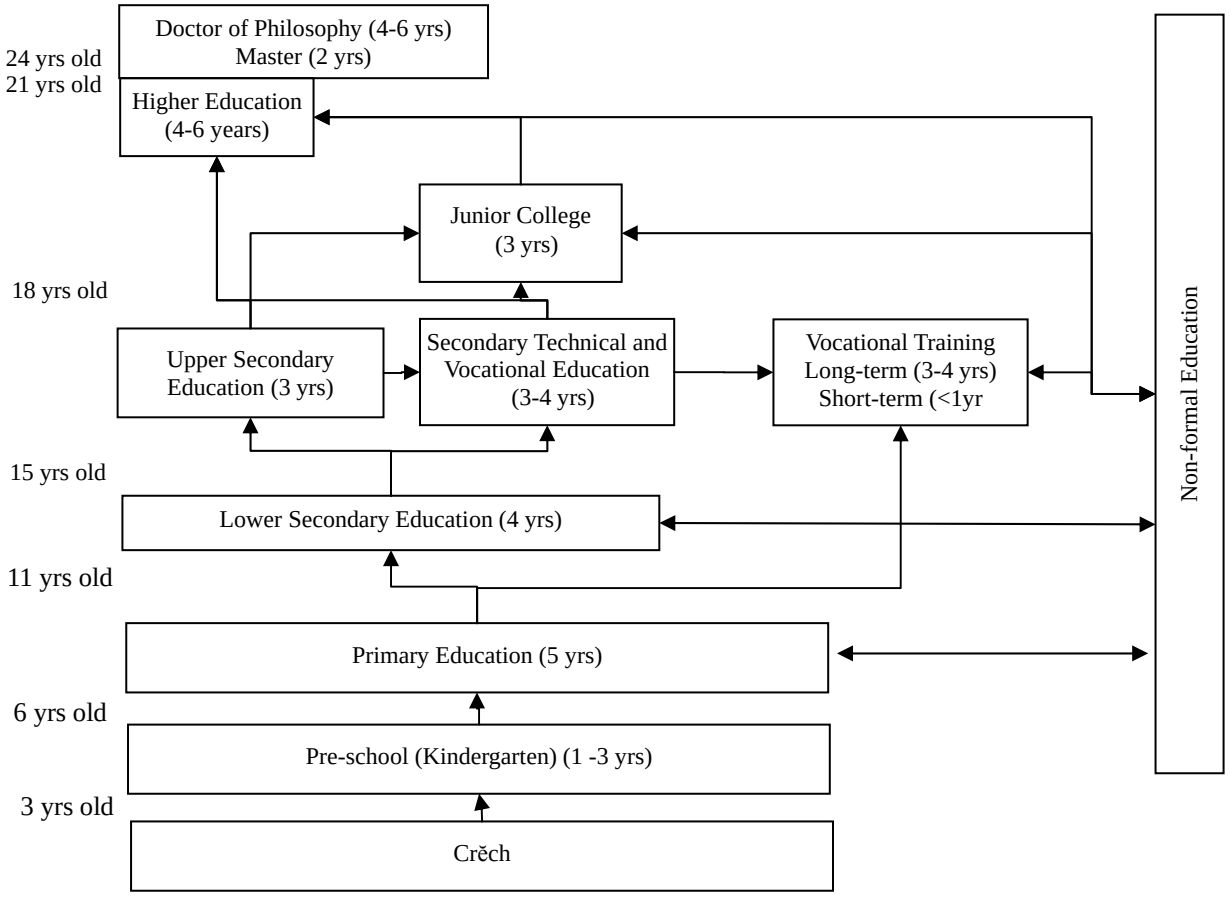
The Study Team has compiled an analysis on constraints observed through on-site survey. The results are shown in "2.10 Constraints and Issues for Promoting EE&C". In addition to above, roles of technical universities in Hanoi, Da Nang and HCMC are discussed in "2.6 Education and Training System for EE&C."

2.6 Education and Training System for EE&C

2.6.1 Education System in Vietnam

The education system in Vietnam has been stipulated in the Education Law which was enacted by the 10th National Assembly in 1998. The ideological dogma of the law is “Marx-Leninism” and “Ho Chi Minh Ideology” ,which is the foundation of the educational philosophy. The Ministry Education and Training oversees the education system from the pre-school to the higher education.

Practically 12-year education (primary to secondary education) is considered compulsory in urban areas while 9-year compulsory education is generally provided in Vietnam. This gap in educational attainment between urban and local areas, because of household income, has increased for market economy prevails in Vietnam. The law stipulates rules and regulations of all levels from pre-school to higher education. The Figure 2.6.1-1 shows the outlines of the structure of the education system in Vietnam.



Source: Vietnam Education and Training Directory (MOET 2004)

Figure 2.6.1-1 The Structure of the Education System in Vietnam

2.6.2 Status of Higher Education

Post secondary educational institutions with the names of "Dại Học" in Vietnamese language are mostly 4-year (sometimes 5 to 6 years, depending on the courses) educational institutions. They are very diverse schools, though most of them call themselves "university". According to the survey by MOET, there are 322 higher educational institutions in 2007. 139 institutions are categorized as university (see Table 2.6.2-1). They include 109 national universities and 30 private universities.

Vietnamese universities have a variety of courses including graduate programs with master's degree and doctor's degree. Many students studied abroad at universities of former communist countries prior to Doi Moi. More and more students have graduated from universities of industrialized countries including Japan. 2,582 Vietnamese students are the fourth largest group of foreign students in Japan in 2007 (see Table 2.6.2-2). Many lecturers still pursue postgraduate degree while they are teaching as teaching assistant of other universities in Vietnam.

Table 2.6.2-1 Number of Higher Educational Institutions in Vietnam

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Institution	153	178	191	202	214	230	277	322
College	84	104	114	121	127	137	154	183
Public	79	99	108	115	119	130	145	166
Non-public	5	5	6	6	8	7	9	17
University	69	74	77	81	87	93	123	139
Public	52	57	60	64	68	71	98	109
Non-public	17	17	17	17	19	22	25	30

Source: MOET

Table 2.6.2-2 Country of Origin of Foreign Students in Japan (as of May 1, 2007)

Country (Territory)	Number of Foreign Students		Percentage (%)	
	May 1, 2007	May 1, 2006	May 1, 2007	May 1, 2006
China	71,277	74,292	60.2%	63.0%
South Korea	17,274	15,974	14.6%	13.5%
Taiwan	4,686	4,211	4.0%	3.6%
Vietnam	2,582	2,119	2.2%	1.8%
Malaysia	2,146	2,156	1.8%	1.8%
Thailand	2,090	1,734	1.8%	1.5%
USA	1,805	1,790	1.5%	1.5%
Others				
Total	118,498	117,927	100.0&	100.0%

Source: Japan Student Services Organization (URL=http://www.jasso.go.jp/statistics/intl_student/data07.html#no41)

Table 2.6.2-3 Distribution of Teachers and Lecturers in the Higher Education in Vietnam

	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
No. of teachers/lecturers	9,565	10,189	9,327	10,247	11,121	13,937	14,230	14,540
No. of female teachers/lecturers	4,038	4,329	3,720	4,353	7,296	6,231	6,183	6,106
No. of teachers/lecturers with ethic minorities origin	350	369	363	420	390	462	440	321
Professional division								
PhD	40	34	42	53	56	94	290	219
Master	486	549	524	727	986	1,249	2,093	1,914
University & collage	7,238	8,012	7,378	8,336	7,981	9,112	10,677	11,339
Professional secondary	1,394	1,154	1,063	781	994	733	768	737
Other degree	407	440	320	350	310	311	402	331
Total No. of students graduated	51,751	53,925	49,888	92,047	115,844	138,839	180,399	163,529

Source: MOET

2.6.3 Problems of Higher Education

According to a study [1)] conducted in 2006 by U.S. Vietnam Education Foundation, the following constraints were identified as common problems of higher education in Vietnam:

1) Teaching and Learning Methodologies

- Inappropriate teaching methodologies (i.e. lack of knowledge, experience and skills, emphasis on memorizing ability, one-way communication from lecturer)
- Inadequate facilities and other teaching resources

2) Curriculum

- Excessive required units and subjects (typical minimum requirements for graduation are over 200 units for 4-year programs)
- Many subjects, less electives (inflexible course design)
- Many contents are outdated. Educational standards are low compared to university-level education with higher levels. Rare opportunities to study the latest and the most advanced theories. Much emphasis on memorizing ability of knowledge.
- Inadequate balance between the class teaching theories and practices. (Emphasis on

1) U.S Vietnam Education Foundation (2006) Observation on undergraduate education in computer science, electrical engineering, and physics at select universities in Vietnam, a report presented to the Vietnam Education Foundation by the site visit teams of the national academies of the United States, August 2006 pp.1 - 5

memorizing ability of knowledge rather than theories and rules. Very few practical experiences)
- Lack of opportunities to learn common skills useful for practical business (very little opportunity for group work, lack of opportunity for writing technical documents in English, project management, problem-solving, etc.)
- Inflexibility for course design and transfer of units

2.6.4 State of EE&C Education and Training in Vietnam

As discussed in 2.3.2 2), both Hanoi University of Technology (HUT) and Electric Power University (EPU) provide programs specialized in energy management. They are categorized as higher education. The linkage between training for certification and higher education at universities, particularly engineering education, should be carefully differentiated. The government of Vietnam has stipulated "introduction of energy education in national educational programs" in the National Strategic Program on EE&C. MOET is in review to work energy conservation into the formal education program. It should be noted that the goal of programs provided by higher education is different from trainings aiming at professional certificates. Direct link between higher education program in energy management and professional certification program should be carefully re-examined. The following is a brief analysis on the existing educational programs in Vietnam.

1) Hanoi University of Technology (HUT)

HUT is the most prestigious technical university in Vietnam. It has a long history of training and educating skilled engineers and educators in Vietnam for years. HUT is a good bolometer of assessing the level of the technology in Vietnam. HUT does not have the department specialized energy use. There is a course on EE&C and management under the Mechanical Engineering Department. Like other courses in HUT, the four and half year course is slightly gear toward learning theories through lectures. HUT has been equipped with some measuring devises for heat and electricity. Most students chose to take internship during the fourth or fifth year of the study to gain practical experiences. On the contrary, the laboratory has equipped with some simple machines such as refrigerator, motors, and generators.

As with all technical university in Vietnam, the mission of HUT is education and academic study. This influences the educational program for EE&C which rather focus on wide range of subjects on energy management. HUT provides several consulting services in energy auditing every year, but the number of services is limited because its main mission is university research and education. Such audit services are considered as extension service of the university. Coordination of the policies on education and training for energy management should be reviewed further by stakeholders.

2) Electric Power University (EPU)

The EPU was originally established as a training institution under Electricity of Vietnam (EVN). The objective of the institution was to provide mid-carrier training to the engineers of EVN. EPU was established as university in 2005. It consists of six thousand students of seven faculties of Electric Engineering, Mechanical Engineering, Electric Power System Engineering, Electromechanical Engineering, Information Technology, Energy Engineering, and Energy Management. The faculty of Energy Management, which has a strong linkage to EE&C promotion, consists of 400 students (approximately 100 each class). Established in 2005, the program consists of a three year diploma course (with 163 unit requirement) and a four and a half year bachelor program (with 230 unit requirement). The first 30 students graduated with diploma in 2007 and another 70 graduates with bachelor's degree have completed the program on May 2009.

Table 2.6.4-1 Minimum Requirement for the Degrees at EPU

Course Category	Diploma	Bachelor
Duration	3 years	4.5 years
Core Subjects	60 units	88 units
Required Subject	103 units	101 units
Internship	N/A	27 units
Thesis	N/A	14 units
Total	163 units	230 units

Source: EPU

The growing demand of human resources capable for energy management is one of the reasons for the establishment of the new faculty of Energy Management at EPU. In addition, the current move of MOIT drafting the EC Law has pushed the universities to create the energy management programs in order to develop potential candidates for energy manager certificates.

EPU is currently under the control of MOIT because of its historical association with EVN. The curriculum and various issues related to the administration of courses, however, are overseen by MOET. EPU prepared master's degree course on energy management, and submitted it to MOET for approval. EPU further envisions the expansion of training facilities with a support from MOIT (EPU once received a financial support for training facilities from the World Bank in the past). EPU has a relationship with the National Testing Laboratory and are currently working with a program in EE&C labeling and developing standards with MEPS. And EPU implemented a seven day-long intensive training course for energy auditor on October, 2008. The course participants were granted the certificate of participation from MOIT. Energy manager training course is also scheduled following this training course for energy auditor.

The relationship between the proposed national professional certification and the on-going training

program is unclear at present. The current program is designed as original qualification separated from professional certification. The requirements for the proposed national-level professional qualification should be defined. The study team will inquire the best possible measures to collaborate MOIT and MOET to promote implementation of the national EE&C program.

3) Collaboration with University for the Proposed Energy Management Program

Because of the limited resources available, the roles that university can play for the implementation of the proposed Energy Manger Certification Program is significant in developing country such as Vietnam. In the National Strategy, MOIT has emphasized strengthening EE&C education in university curriculum. The strategy, however, focuses on EE&C in general education and it only support universities' initiatives to strengthen EE&C related subject in specialized course. Currently general energy education is considered important because of fluctuation of energy prices, environmental issues on green house effects gas, etc. The curriculum development, however, is relied on knowledge and experience of few scholars. New development such as advanced training for teachers and lecturers are highly expected to realize this initiatives.

Like any other countries, mission of university is considered academic research and education. The business in Vietnam expects the university training more practical training. EE&C training expected by the industries is practical one which delivers solutions to meet the needs of industry. In addition, the promotion activities may need to work closely with wide audience including general public. It is necessary for university to define themselves how it will collaborate with MOIT to promote EE&C.

2.6.5 Adopting EE&C in Basic Education in Vietnam

Under the National Strategic Program on EE&C, early adoption of EE&C in all levels of education system was identified as one of main strategy for promoting EE&C in Vietnam. MOET has carried out a special educational program to promote effective use of energy, EE&C, electric power safety, etc. The Science and Technology Department of MOET has completed syllabus and curriculum on energy education for all levels designated by 2008 ready for distribution. The plan includes to distribute side readers with pictures to kindergarten and primary schools. EE&C education is adapted by various subjects of high school and junior high school levels including geography, moral education, economy and social education, etc.) in side readers to be referred by teachers. The side readers for these levels are also ready for distribution.

In the post secondary and vocational education program in Vietnam, a syllabus and curriculum on EE&C to be taught in science and art education programs are developed and completed. The side book prepared for science education, however, is only for primer for introduction of the subject.

2.7 Past and On-going Programs for EE&C in Vietnam

2.7.1 Outline of Past and On-going EE&C Programs

In Vietnam, many EE&C-related surveys/projects have been implemented. Table 2.7.1-1 shows outlines of these programs, Figure 2.7.1-1 shows numbers of projects by contents, and Figure 2.7.1-2 shows the time schedule of these programs.

The first effort for promoting EE&C in Vietnam was initiated in 1995 by MOST with "EC and Efficiency Program for Vietnam" which focused on development of legal system for EE&C. Following this program, MOIT and EVN played an important role in implementing DSM programs in power sector for cut-down of peak demand. These DSM programs, such as establishing a DSM cell in EVN and training for energy audit, etc., contributed to development of human resources for promoting DSM.

Among many kinds of programs, introduction of high-efficiency equipment and energy audit are considered to be two of main programs. Eight programs have been implemented for encouraging broad use of high-efficiency lighting, home electric appliances, and industrial equipment such as motors, heaters, ventilating and air-conditioning systems. Among them, high-efficiency lighting draws attention as an important player for cutting down peak demand in the evening.

Energy audit also plays an important role in EE&C programs. Nine programs in which energy audit activity is included have been implemented for industrial and commercial facilities. Implementation of energy audit programs has secondary effects such as human resource development of local consulting firms and contribution of equipment for energy audit.

Financial support to end-users for purchasing high-efficiency equipment and training for EE&C has been provided in eight programs.

The National Strategic Program on EE&C is the biggest program covering all fields of EE&C. Activities in this program are expected to play important roles in promoting EE&CU in Vietnam for the period from 2006 to 2015. In this program, various activities are planned for the industrial sector and lighting of commercial facilities because of potential for EE&CU and cut-down of peak demand for electricity.

These programs for EE&C have been implemented with support from the government of Vietnam and internationas donors. WB, GEF and SIDA contributed significantly in the initial stage of promoting EE&C. Recently importance of aid agencies of Japan is increasing in the field of supporting implementation of EE&C programs in Vietnam.

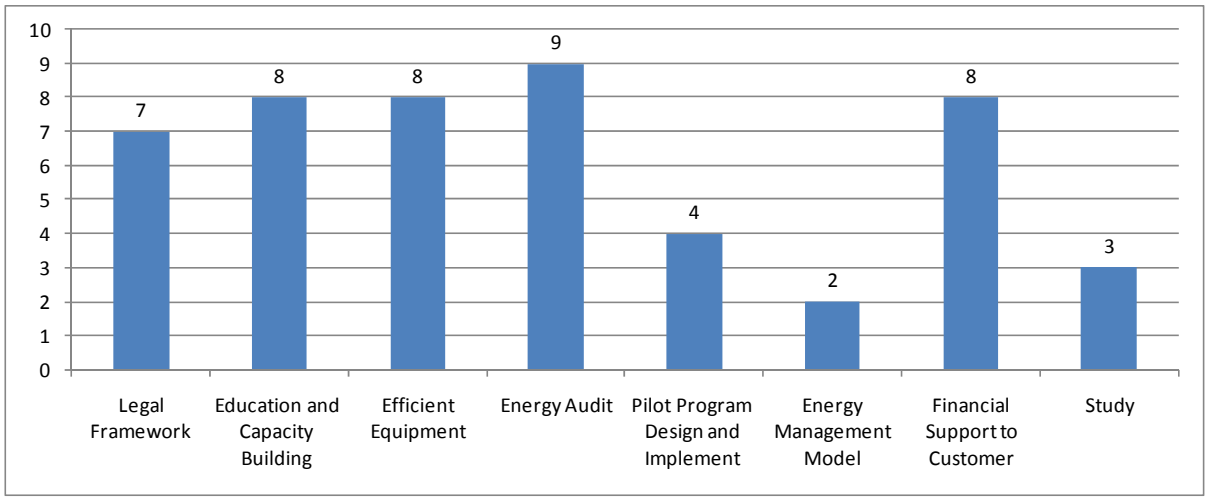


Figure 2.7.1-1 Number of EE&C Programs by Contents

Program	Year																				
	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
EC and Efficiency Program for VN																					
Vietnam EC Program																					
Promoting EC in SME (PECSME)																					
Promoting EC in SME																					
DSM&EE Phase 1																					
DSM&EE Phase 2																					
The Commercial EE Pilot Program																					
CFL Promotion Campaign																					
FTL Promotion Campaign																					
National Strategic Program on EC&EU																					
Vietnam EE Public Lighting																					
EA for 10 Major Industrial Consumers																					
EA for 30 Commercial Buildings																					
Promotion of EE Appliances in VN																					
Master Plan on EC&EU in VN																					
Main achievements	Assessment of energy efficiency Establish ECC TOU tariff Establish DSM cells Standards for EE motors 1 million CFLs sold Prepare EC&EE Law Establish EEC office Roadmap & Action plan EE&C data base & collecting system																				

Figure 2.7.1-2 Time Schedule of EE&C Programs

Table 2.7.1-1 Outline of EE&C Programs in Vietnam (1/2)

No.	Program	Time Frame	EE&C Field								Targeted Sector	Implementing Agency	Donors	Project Costs
			Legal Framework	Education and Capacity Building	Efficient Equipment	Energy Audit	Pilot Program Design and Implement	Energy Management Model	Financial Support to Customer	Study				
1	Energy Conservation and Efficiency Program for Vietnam	1995-1999	x	x	x	x	x			x	All Sectors	MOST	The Royal Netherland Government	US$ 1.55 million
2	Vietnam Energy Conservation Program	1999-2001	X	x							All Sectors	MOST	Government of Vietnam, The Royal Netherland Government, EU, SIDA, UNDP, US-EPA	US$ 1.24 million
3	Promoting Energy Conservation in Small and Medium Enterprises (PECSME)	2002-2004	X						x		Industrial	MOST	Government of Vietnam, GEF and Co-Funding	US$ 458.250 thousand
4	Promoting Energy Conservation in Small and Medium Scale Enterprises (VIE01/G41)	2006-2010	X	x		x	x		x		Industrial	MOST	UNDP and GEF	US$ 28,769 thousand
5	Vietnam Demand Side Management and Energy Efficiency (DSM&EE) - Phase 1	2000-2003	X	x	x	x	x				Industrial, Commercial, Residential	MOI	World Bank and SIDA	29 million SEK (US$ 2.96 million)
6	Vietnam Demand Side Management and Energy Efficiency (DSM&EE) - Phase 2	2003-2007		x	x	x					Industrial, Commercial, Residential	MOI/EVN	World Bank and GEF	US$ 16.72 million
7	The Commercial Energy Efficiency Pilot Program (CEEP)	2004-2009		x		x			x		Industrial, Commercial	MOI	World Bank and GEF	US$ 10.5 million

Table 2.7.1-1 Outline of EC&EU Programs in Vietnam (cont.) (2/2)

No.	Program	Time Frame	EE&C Field								Targeted Sector	Implementing Agency	Donors	Project Costs
			Legal Framework	Education and Capacity Building	Efficient Equipment	Energy Audit	Pilot Program Design and Implement	Energy Management Model	Financial Support to Customer	Study				
8	Compact Fluorescent Lamp (CFL) Promotion Campaign	2004-2007			x						Residential	EVN	GEF	US$ 237,500
9	Fluorescent Thin Tube Lamp (FTL) Promotion Campaign	2005-2007			x						All Sectors	EVN	GEF	US$ 400,000
10	National Strategic Program on EC&EU	2006-2015	X	x	x	x	x	x	x		Industrial, Commercial, Residential, Transport	MOIT	Government of Vietnam	US$ 30 million
11	Vietnam Energy Efficient Public Lighting (VEEPL)	2006-2010			x				x		Public Lighting	UNDP/VAST	GEF	US$ 3.0 million
12	Energy Audit for 10 Major Industrial Consumers	2007				x			x		Industrial	Hanoi EC Center	Local Government	US$ 85,000
13	Energy Audit for 30 Commercial Buildings	2008				x			x		Commercial	Hanoi EC Center	Local Government	US$ 150,000
14	Project for Promotion of Energy Efficient Appliances in Vietnam	2007-2008			x			x	x	x	Residential	Jukankyo Research Institute	METI	US$500,000
15	The Study on Master Plan on Energy Conservation and Effective Use in Vietnam	2008-2009	x	x		x				x	All Sectors	J-POWER	JICA	US$1.9million

2.7.2 Analysis of the Past and On-going EE&C Programs

The main activities for EE&C of past and on-going programs in the industrial sector are human resource development, energy audit and introduction of high-efficiency equipment. So far, the programs on establishing legal framework and human resource development are mainly implemented, but those on development of energy management models and financial support have not yet implemented well because these programs are still in an initial stage.

Regarding the introduction of EE&C equipments, the improvement of the lighting efficiency in residential sector is a very important approach for cut-down of peak demand of electricity in the evening. In this context two campaigns for dissemination of CFL and TFL in household and other sectors have been implemented. Recently, a program which focuses on dissemination of high-efficiency home electric appliances in household sector has been implemented with support from METI (Japan).

Other international cooperation agencies contribute in many programs, such as establishing legal framework, human resource development, dissemination of high-efficiency equipment and energy audit etc. Table 2.7.2-1 shows the cost and estimated effects of these programs.

Table 2.7.2-1 Cost and Estimated Effects of EE&C Programs

Programs	Project Cost (USD million)	Estimated Effects			
		TOE	GWh	MW	Mt CO2
Energy Conservation and Efficiency Program for Vietnam	1.55				
Vietnam Energy Conservation Program	1.24			150 - 200	1.5
Promoting Energy Conservation in Small and Medium Enterprises (PECSME)	0.458				
Promoting Energy Conservation in Small and Medium Scale Enterprises (VIE01/G41)	0.0287	14.5			0.054
Vietnam Demand Side Management and Energy Efficiency (DSM&EE) – Phase 2	16.72		3,000	120	0.64
The Commercial Energy Efficiency Pilot Program (CEEP)	3.5		1,540		1.85
Compact Fluorescent Lamp (CFL) Promotion Campaign	0.2375		243.3	30.1	
Fluorescent Thin Tube Lamp (FTL) Promotion Campaign	0.4		25.2	14.4	
The National Energy Efficiency Program (NEEP)	31.4	5% of Total Energy Consumption			
Vietnam Energy Efficient Public Lighting (VEEPL)	3		398.1		0.171

2.7.3 Issues in the Future

Many programs for promoting EE&C have been implemented for about ten years. They contributed for determining the direction of EE&C activities in Vietnam. From now on, it is necessary to reevaluate the potential of EE&C, to develop practical programs for each sector, and to establish a roadmap and a medium-term plan to promote EE&C.

As shown in Table 2.7.2-1, the programs DSM&EE, CEEP and PECSME put emphasis in the fields of establishment of legal framework, human resource development, training for energy audit, and pilot projects. But these programs were not harmonious as a whole. Lack of accommodation among these programs sometime led overlapping of contents in two or more projects.

The past programs did not put weight much on capacity building of local ECCs. And the energy audit on heavy energy consumers are much needed for promoting EE&C and many audits have been conducted. However, few consumers, who were proposed measures for EE&C through the energy audit report, have invested in EE&C. The issue is that they cannot figure out if they get return on investment (incentive), since they do not have appropriate knowledge and information on EE&C.

Database of energy consumption is very useful for estimating of potential of EE&C, evaluation of EE&C activities, etc. And it is expected to play a important role for EE&C. At present two databases of energy efficiency have been developed separately; one was developed in the program PECSME and the other in the program NEEP. Integration or linkage of these databases should be considered for effective use of collected data.

2.8 Status of Energy Conservation Efforts at Practical Business Level

The Study Team conducted two types of survey, questionnaire survey and on-site survey, on status of energy conservation efforts at practical business level, in order to obtain basic data for estimating potential for energy conservation in Vietnam and to figure out issues for introduction of energy manager program.

In this section, progress of questionnaire survey and outline of results of on-site survey are reported.

2.8.1 Questionnaire Survey

1) Outline of the Questionnaire Survey

Targets of the survey are factories and buildings, 90 factories/buildings (36 in Hanoi area, 18 in Da Nang area, 36 in HCMC) were selected as the target factories/buildings.

The targets were selected to cover main sub-sectors such as steel, cement, textile, brick, food, chemical, paper, hospital, office, hotel, school, retailer, etc.

Schedule of the questionnaire survey is shown in Table 2.8.1-1.

The questionnaire survey was conducted by the Institute of Energy (hereinafter referred to as “the IE”) that has much experience on similar work.

In the selection of questionnaire respondent, the IE had listed up as draft idea according to the following conditions, and the list had fixed finally through discussion between MOIT and the Study Team. The condition in selection of questionnaire respondent is following;

- Target factories are the ones that consume total annual fuels and heat equal or more than 1,000 TOE, or have electric capacity equal to or more than 500 kW, or electricity consumption equal to or more than three millions kWh.
- Target buildings are the ones that consume electricity with total capacity equal or more than 750 kVA or consume total commercial energy including heat and electricity equal to or more than 10 million MJ.

These criteria above is defined in Decree No.102/2004 by the Vietnamese Government. Besides regarding buildings, we have selected buildings that consume less annual electricity than above mentioned, because there are particularly a few hospitals and schools that fit the condition above.

According to the EC Law (draft) designated factories for energy management are the factories of annual energy consumption of 1,000 TOE or more, and designated buildings for energy management are the buildings of annual energy consumption of 800 TOE or more or floor area of 2,500 m^2 or more.

The Study Team made draft questionnaire. And the IE arranged to obtain effective answer considering Vietnamese local condition, translated into Vietnamese, distributed, collected the

questionnaire, answers and summarized the results.

In order to improve the answering rate, we obtained support of the PC (power company that is one of group company under EVN having connection between end users) in each area. That contributed well to improve the answering rate.

Table 2.8.1-1 Schedule of the Questionnaire Survey

Step of Task	Assigned to	Date	Remarks
1. Selection of target factories/buildings	MOIT (IE) / JICA Team	Jul. to Sep. 2008	JICA Team 1st, 2nd mission
2. Preparation of questionnaire	JICA Team / IE	Jul. to Sep. 2008	JICA Team 1st, 2nd mission
3. Delivery of questionnaires	IE	Oct. to Nov. 2008	
4. Collection of answers	IE	Nov. to Dec. 2008	
5. Interview with target factories/ buildings	IE / JICA Team	Nov. to Dec. 2008	JICA Team 3rd mission
6. Data analysis	IE	Dec. 2008 to Jan. 2009	
7. Report making	IE / JICA Team	Jan. to Feb. 2009	JICA Team 4th mission

2) Questionnaire Respondent

Contents of questionnaire survey respondent are shown in Table 2.8.1-2 and 2.8.1-3.

Table 2.8.1-2 Distribution of Factory in the Questionnaire Survey

	Steel	Cement	Building material	Textile	Food	Chemical	Paper	Total
Hanoi	4		1	7	5	5	1	23
HCMC	3	2	2	7	4	5	2	25
Danang	3	1	2	2	2		2	12
Hai Phong		1						1
Phutho		1						1

Source: IE report

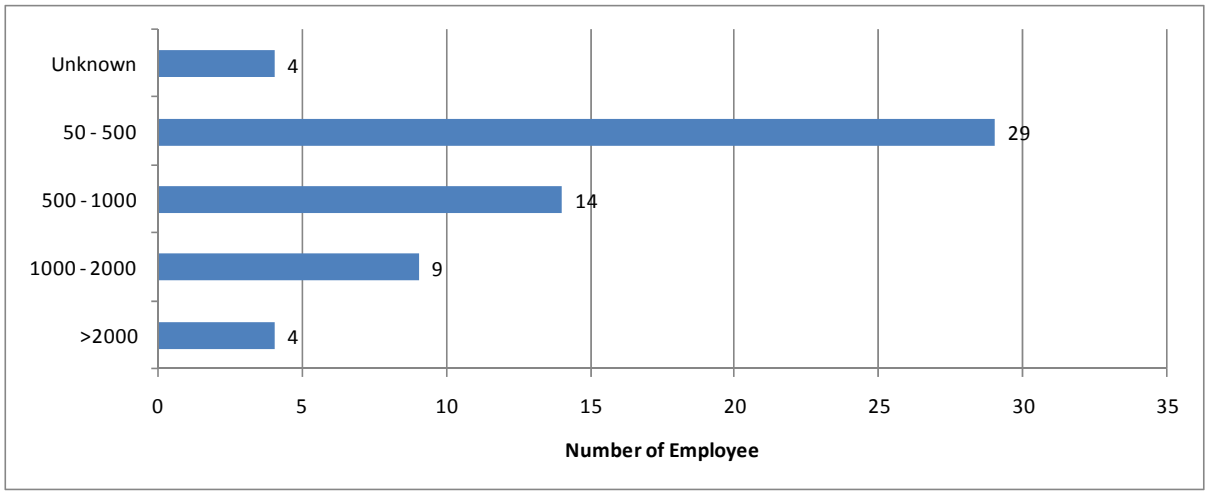
Table 2.8.1-3 Distribution of Commercial Building in the Questionnaire Survey

	Hotel	Office	Hospital	School	Retail	Total
Hanoi	3	2	2	2	2	11
HCMC	4	2	2	1	2	11
Danang	2	1	1	1	1	6

Source: IE report

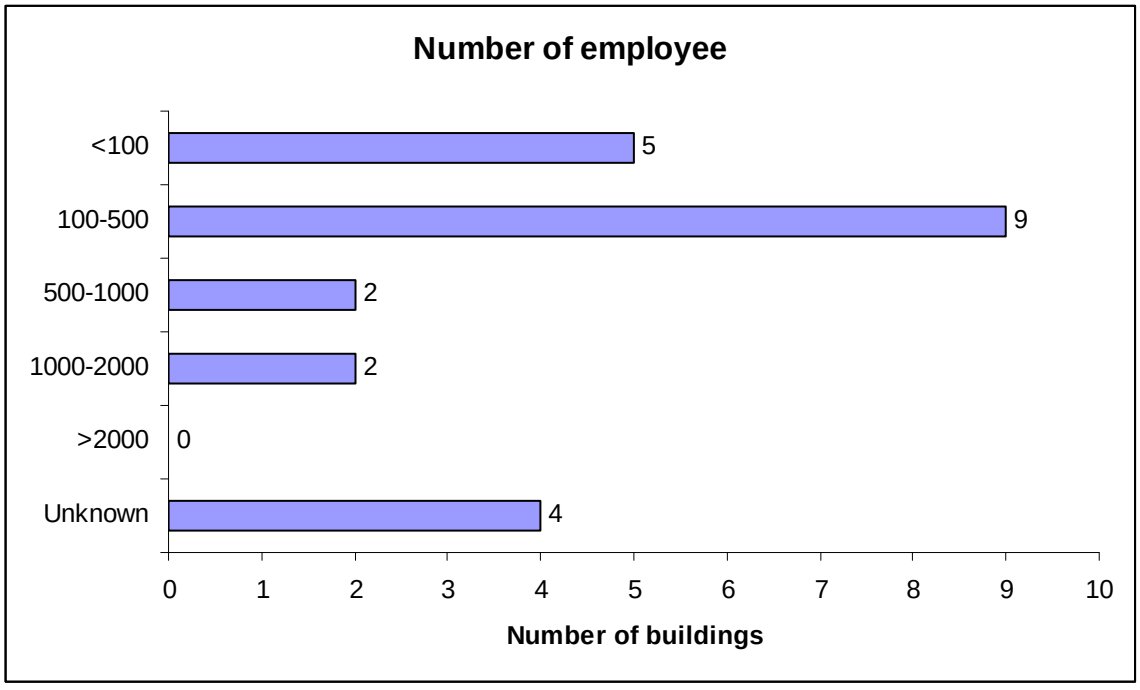
The total number of distribution above is 90. The number could not be collected is two in factory, one in building. As this kind of questionnaire survey, it was extremely high answering rate of 96.7%.

Distribution of number of employee in factory is shown in Figure 2.8.1-1, distribution of number of employee and gross floor area in building is shown in Figure 2.8.1-2 and Figure 2.8.1-3.



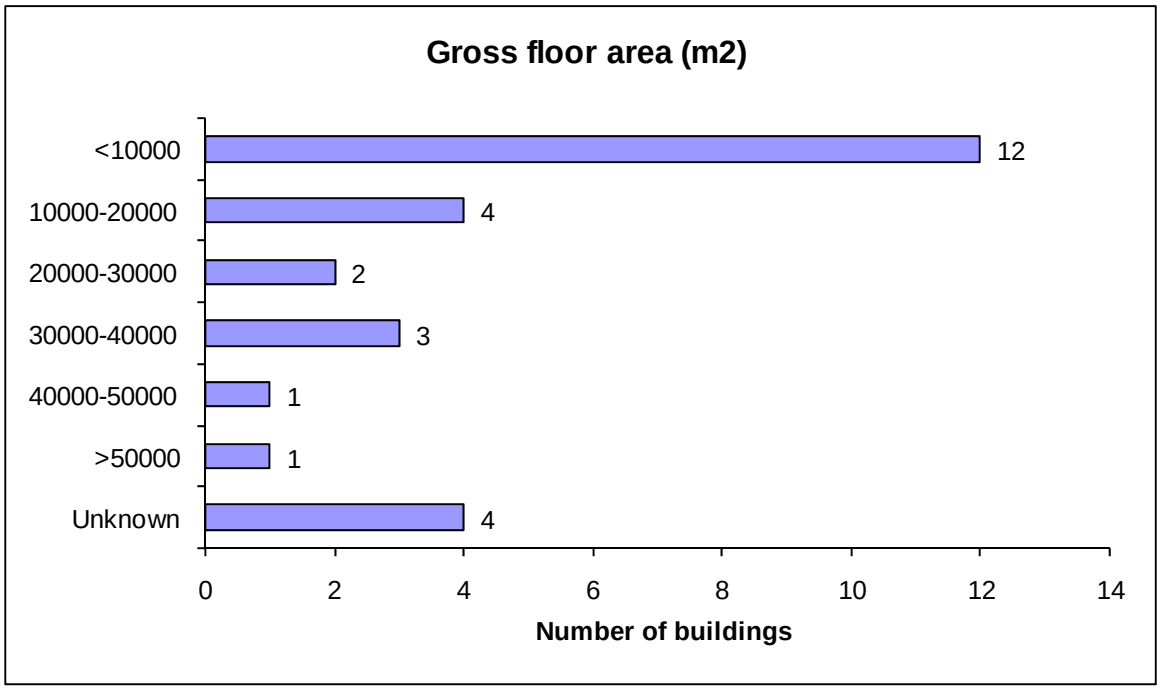
Source: IE report

Figure 2.8.1-1 Distribution of Factory by Number of Employees



Source: IE report

Figure 2.8.1-2 Distribution of Building by Number of Employees



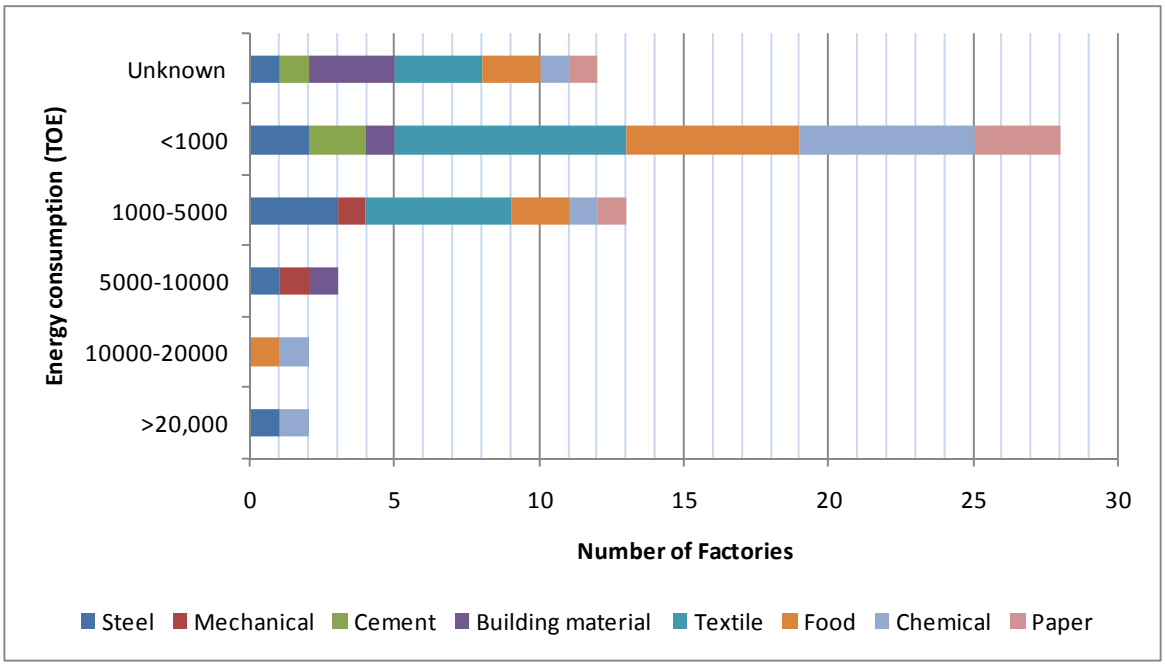
Source: IE report

Figure 2.8.1-3 Distribution of Building by Gross Floor Area

3) Outline of Energy Consumption

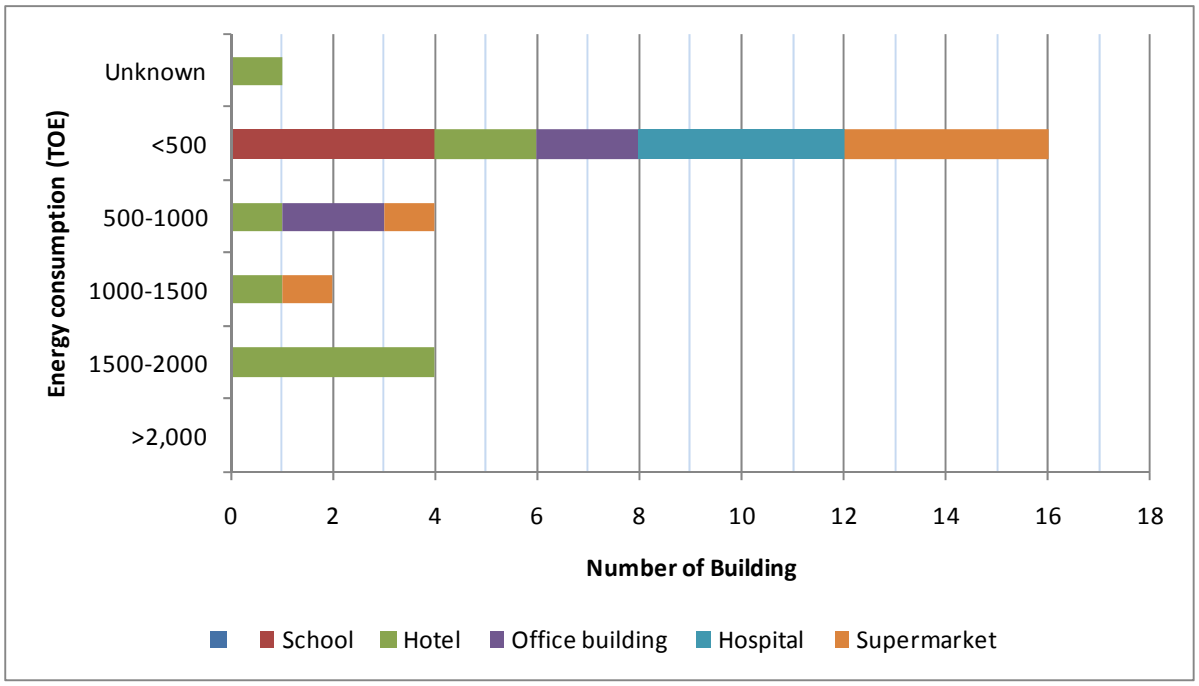
(1) Annual Energy Consumption

Distributions of annual fuel consumption of factory and annual energy consumption of building in 2007 are shown in Figure 2.8.1-4 and Figure 2.8.1-5.



Source: IE report

Figure 2.8.1-4 Annual Fuel Consumption of Factory in 2007 (excluding electricity)



Source: IE report

Figure 2.8.1-5 Annual Energy Consumption of Building in 2007 (including electricity)

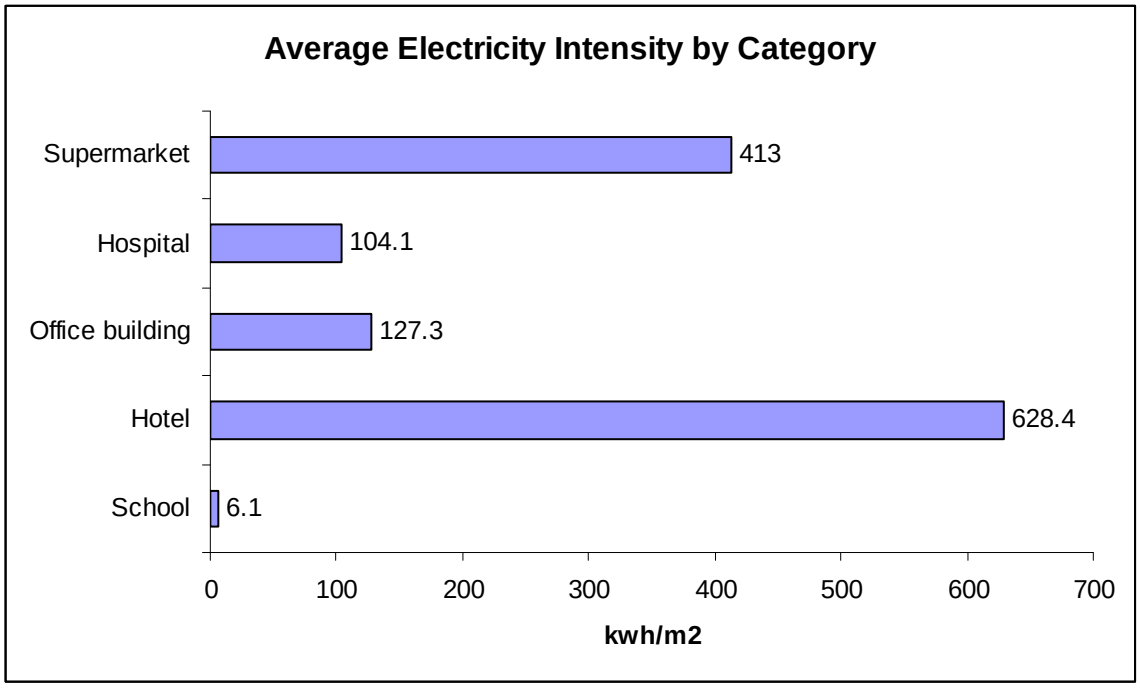
Questionnaire survey respondents whose annual energy consumption is more than 1,000 TOE are 20 in 60 respondents of factories and 7 in 27 buildings. Regarding buildings, hotel consumes more energy per floor area than the other sectors.

(2) Energy Intensity

It is difficult to compare simply the energy intensity between questionnaire participants in both of factory and building, because there are differences of product, raw material, form of energy use, and climate, etc. In the energy intensity of factory in particular, there are some factories which consumes more than 10 times much energy than the other factories in the same sub-sector. So when we compare the energy intensity as benchmark, it is useful only in comparison between this year's intensity and the previous year's one or the next year's one on the same object (factory or building). As next step, it is desirable procedure that energy intensity is utilized as a benchmark of each subsector's one after execution of analysis about a difference between factories and confirmation of data precision.

The average electricity intensity (2007 annual electricity consumption per gross floor area) of building on each subsector is shown in Figure 2.8.1-6. Hotel and supermarket ones are big, office and hospital are small and school is extremely small because it needs only minimum electricity consumption such as illumination in daytime or air conditioning in the limited rooms. In comparison with Indonesia (and Japan), hotel's intensity is over 2 times (4 times), supermarket is 1.5 times (a little less than 2 times). On the other hand, office is 0.7 times (equal with Japan). In Vietnam, it seems that the intensity is bigger in the buildings which had

done retrofit (installation of an air conditioning system for old building of the non-air conditioning that insulation / air tightness is bad for example), besides the intensity is smaller in old buildings which had not yet done retrofit.



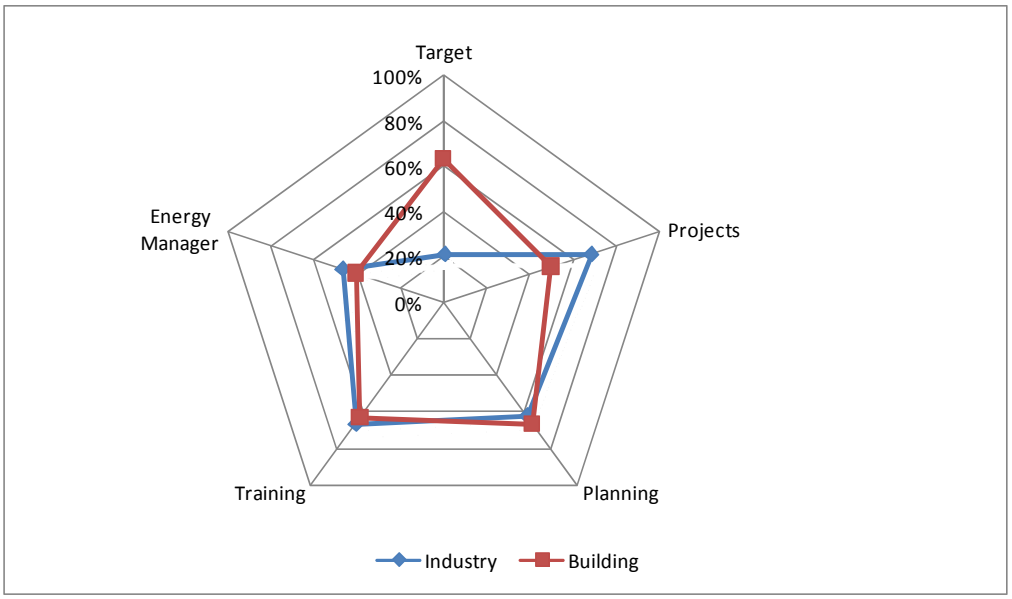
Source: IE report

Figure 2.8.1-6 Average Electricity Intensity of Building

4) Energy Conservation Activity

(1) Outline of Activity

Present activity for the energy conservation by the viewpoint of target setting, appointment of an energy manager, training program for education enlightenment, planning of energy conservation, and project for enforcement is shown in Figure 2.8.1-7.



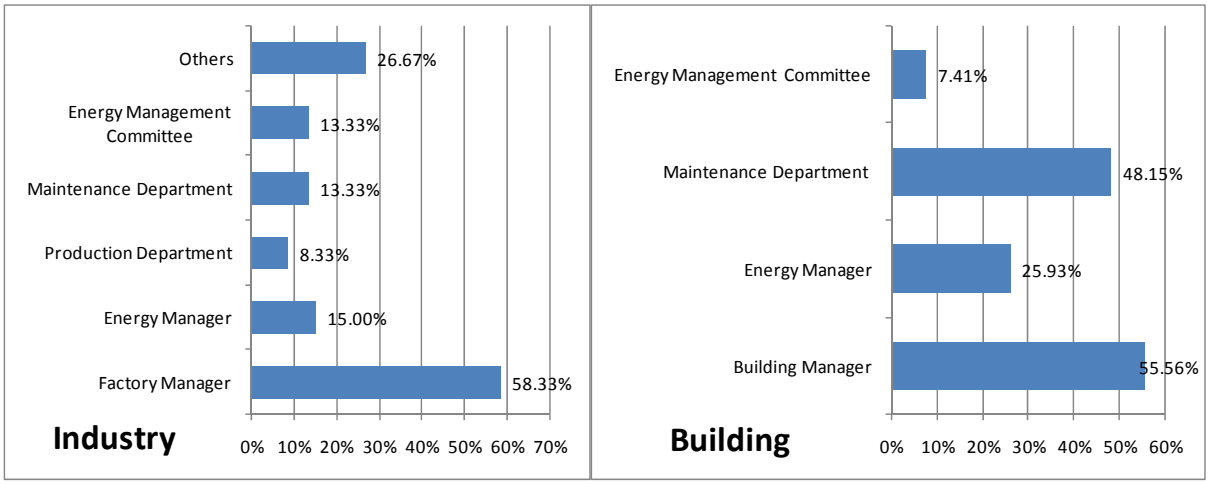
Source: IE report

Figure 2.8.1-7 Energy Conservation Activity

Factory setting a target is limited to 20%, but in building it exceeds 60%. And factory carried out EE&C project was a little less than 70%, but in building remained 50%. Therefore, it seems that setting target in a building is easier than in a factory which has complicated production process. On the other hand, it seems to be the implementation of the project in a factory is easier than in a building.

(2) Outline of Main Department in charge of Energy Conservation

Outline of main department in charge of energy conservation activities in a factory and a building is shown in Figure 2.8.1-8.



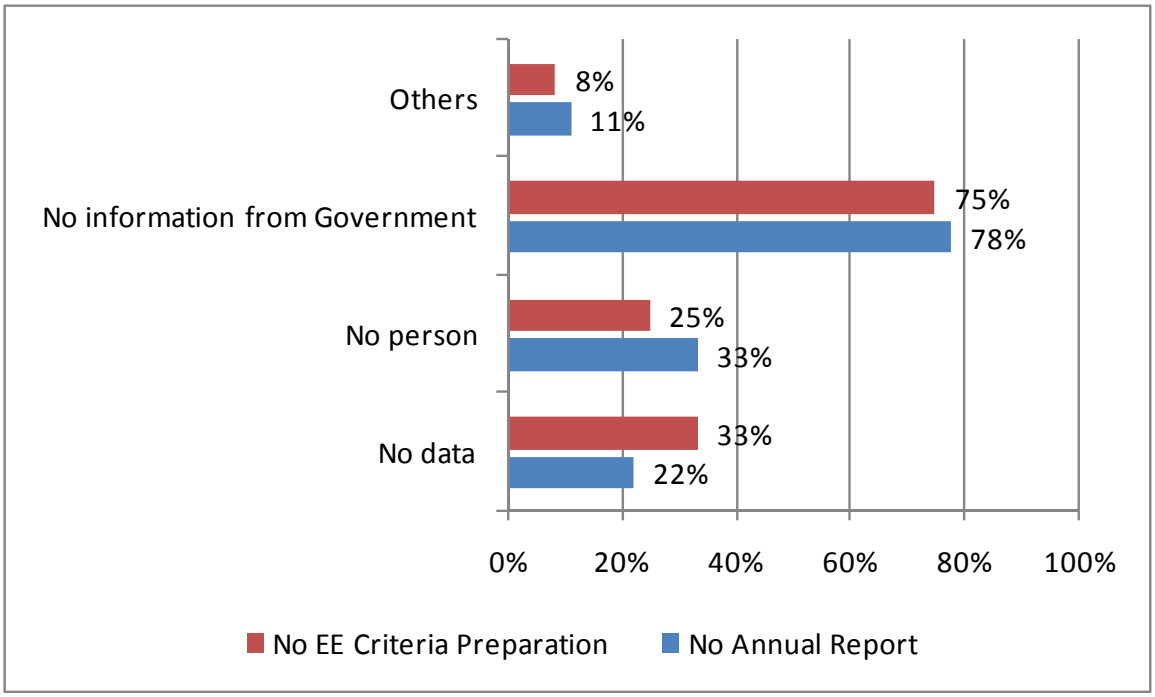
Source: IE report

Figure 2.8.1-8 Main Department in charge of Energy Conservation Activities

In both of a factory and a building, the front man like a chief of the factory becomes a person in charge of energy conservation activity in most case. Regarding a building, maintenance department in charge of utilities maintenance becomes a section in charge of energy conservation activity in many cases.

(3) Observance Situation of Energy Conservation related Laws/Decrees and Expectation to the Government

It is prescribed in decree No.102 of 2004 that the designated energy consumers that consume total annual energy more than the defined amount have duty to make an annual report and submit it and energy efficiency criteria etc. 52 factories should be applied this restriction under this prescription among questionnaire respondent 60 factories. However, 12 factories do not submit energy efficiency criteria. The main reason why they do not submit is shown in Figure 2.8.1-9.

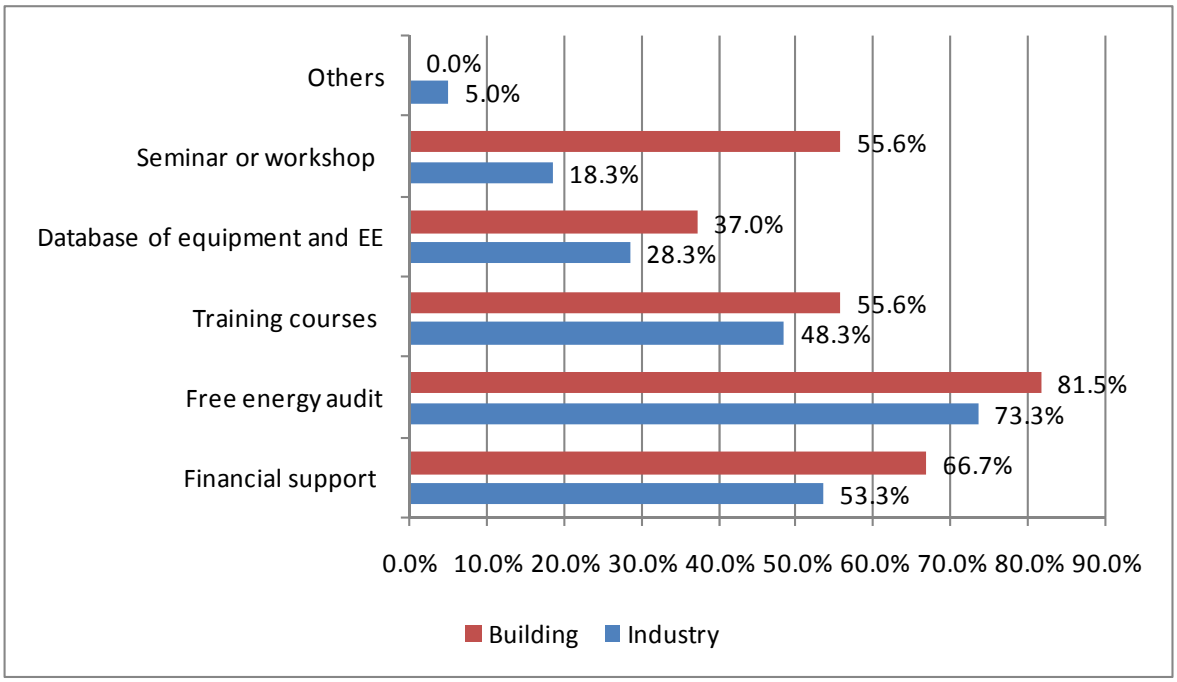


Source: IE report

Figure 2.8.1-9 Main Reason of without Submission

It seems that information from government for energy conservation activity and substantiality of enlightenment activity of laws/decrees observance are necessary.

Next, the governmental support for energy conservation activity expected by a factory and a building is shown in Figure 2.8.1-10.



Source: IE report

Figure 2.8.1-10 Expected Government Support for Energy Conservation Activity

Regarding the expected, governmental support for energy conservation activity for a factory and a building, high priority issues are firstly free energy audit, and secondly financial support. In addition, there is an expectation for technical assistance.

2.8.2 On-Site Survey

1) Outline of the On-Site Survey

The on-site survey was carried out for ten factories/buildings shown in Table 2.8.2-1.

Table 2.8.2-1 Outline of On-Site Survey

No.	Sub-Sector	Area	Date of survey (resurvey)	Overview
1	Office	Hanoi	Sep. 24 - 26	Completion: 1998 Gross floor area: 11,000 m^2
2	Ceramic factory (brick)	Hanoi	Sep. 29 - 30	Main products: floor tile, red brick Shipment volume: 1,439,000 m^2/year
3	Government office (MOIT)	Hanoi	Sep. 29 - Oct. 1 (Oct. 22 - 24)	Completion: 1959 Gross floor area: about 8,000 m^2
4	Steel factory	Hanoi	Oct. 1 - 3	Main products: wire rod, deformed bar Shipment volume: 240,000 ton/year
5	Cement factory	Da Nang	Oct. 6 - 8	Main product: Portland cement Shipment volume: 110,000 ton/year
6	Ceramic factory	Da Nang	Oct. 9 - 10	Mani product: sanitary ware Shipment volume: 200,000 pieces/year
7	Textile factory	HCMC	Nov. 6 - 7, 12	Main products: cloth, T-shirt Shipment volume: cloth 1,900,000 m^2/year, T-shirt 417 ton/year
8	Hotel	HCMC	Nov. 6 - 8	Completion: 1998 Gross floor area: 11,000 m^2
9	Food factory (milk)	HCMC	Nov. 10 - 11	Main products: milk, yogurt Shipment volume: milk 28,400 kl/year
10	Shopping center	HCMC	Nov. 10 - 11	Completion: 1880 Gross floor area: 15,000 m^2

2) Brief Summary of the On-Site Survey Results

(1) Factory

The Study Team carried out on-site surveys of two ceramic factories (building floor tile factory and sanitary ware factory), one steel-making factory, one cement factory, one food processing factory (milk) and one textile factory.

a. Energy management activity

Evaluation of energy management activity of six factories is shown in Figure 2.8.2-1 in average value.

- Organized activities and EE&C target setting:
  Most of top management of the factories are in lack of leadership and awareness of EE&C, and so EE&C target is not set clearly.
- Measurement and recording of energy consumption:

Some factories implement the recording of power consumption, but they do not use recording data effectively.

- Equipment maintenance:
  Inspection and repairing of equipment are not sufficient.
- Energy consumption management:
  The surveyed factories have overall energy consumption data, but most of factories do not manage energy consumption by production line and process.
- Energy intensity management of main products:
  Integrated process industry sector such as steel-making factory and cement factory manage energy intensity as important factor, but labor intensive industry sector such as textile factory is insufficient in energy intensive management.

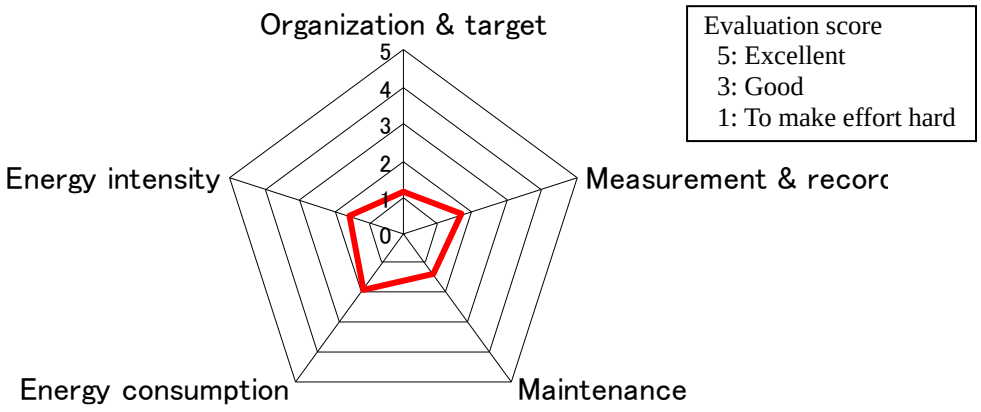


Figure 2.8.2-1 Evaluation of energy management activity

b. EE&C potential

EE&C potential of surveyed factories is shown in Figure 2.8.2-2. EE&C potential for present equipment is 4% to 18% respectively and 10% in average by energy management reinforcement and equipment modification. EE&C potential by technology innovation and production process change is 15% to 28%, which is comparatively large in spite of its big investment needed.

In the calculation of conversion factor of electric power to primary energy, the conversion factor of 2,770 kcal/kWh (= 860/0.31) is applied referring Japanese calculation method and the present Vietnamese thermal efficiency in thermal power station (31%).

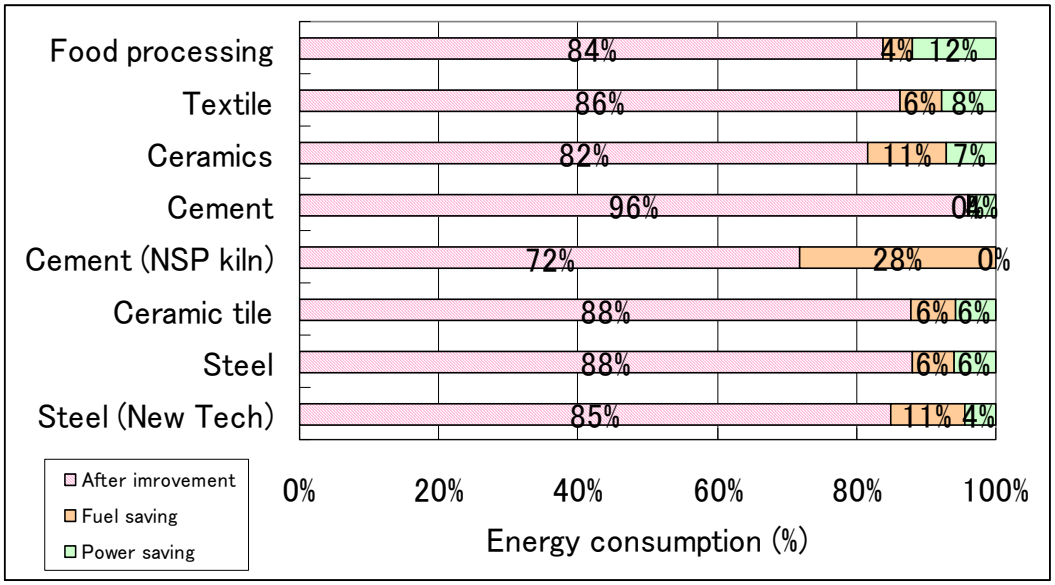


Figure 2.8.2-2 EE&C potential of surveyed factories

Steel factory

The steel factory surveyed has modern rolling equipment. There are four other factories which have similar equipments in Vietnam. This factory does not have a plan to install a steel billet production including an electric furnace.

Fuel intensity of the billet reheating furnace is 320,000 kcal/ton in average, which is high rank among steel-making factories in Vietnam. To improve fuel intensity more, high efficient reheating furnace with regenerative burners is to be introduced.

Cement factory

The cement factory surveyed uses a shaft kiln. A shaft kiln has the following characteristics compared with New Suspension Preheater (NSP) dry type rotary kiln:

- Lower construction cost
- Higher fuel intensity
- Smaller production capacity
- More deviation of clinker quality due to difficulty of stable operation

Therefore Japanese cement companies have changed shaft kilns to NSP dry type rotary kiln. In 2008, the Vietnamese government decided the following modification policy for cement kiln:

- Not to admit new construction and capacity increase project of shaft kiln
- To indicate to change shaft kilns of 300 ton/day to more efficient cement kilns of 1,000 ton/day or more such as NSP dry type rotary kilns

The surveyed factory makes the plan of a new cement plant with NSP dry type rotary kiln of 1,000 ton/day near the limestone mine.

Ceramics factory

The surveyed factories are a building floor tile factory and a sanitary ware factory, which have modern burning kilns of a roller hearth furnace and a tunnel kiln respectively which are imported from Italy. Therefore the products quality is stable. But they use the parameter of manufacturer standard values, and so energy loss is large. They can promote EE&C according to the establishment of their own standard system.

Food processing factory

The food processing factory of dairy products surveyed is a modern factory which operation started in 2003. As the factory uses modern equipment imported from Europe, recording of energy consumption data is good, but equipment maintenance is not so good. Engineering of utility equipment in overall factory such as compressed air system and feed water line is not good, and so energy loss is large. Though an energy audit was conducted about one year ago, any measures for improvement have not been taken because the factory does not have enough funds and knowledge for improvement and also it has a plan to relocate in near future.

Textile factory

The surveyed factory is a medium sized textile factory, which has the process of twist thread, clothe weaving, knitting, dyeing of cloth and thread, sewing of T-shirt, and finishing. Dyeing shop is a big consumer of steam and water. Coal fire steam boiler was installed in stead of oil fire steam boiler in 2008 to reduce fuel cost. Steam condensate generated in dyeing process is not recovered and also water saving measures are not implemented. EE&C measures by energy audit conducted in 2007 are not studied and implemented because of the movement plan of the factory.

Energy audit conducted by the regional government

Consultants, who were consigned by HCMC, conducted the energy audit program of a food processing factory and a textile factory. The consultants submitted the energy audit report to the factory after five months and 11 months of the audit. Moreover, the consultant neither explained the result of audit to the factory nor conducted follow-up of its recommendation to the factory. It is necessary to enhance the quality of energy consultants that conduct energy audits.

c. Estimation of the number of designated factories for energy management

Designated energy intensive factories are the factories of annual energy consumption of 1,000 TOE or more specified in the bill of the EC Law. It is necessary for MOIT to examine the numbers of designated factories to estimate the required number of energy managers and the data processing volume of periodical report and five years EC plan.

Among six factories which the Study Team implemented on-site survey, four factories are the candidates of designated factories as shown in Table 2.8.2-2. These four factories have

200 employees or more. Therefore manufacturing factories having more than 200 employees are the candidates of designated factories. Annual energy consumption of on-site surveyed factories is shown in Table 2.8.2-2.

Number of the companies of manufacturing, mining and energy supplying industry having more than 200 employees are 3,400 as shown in Table 2.8.2-3, and so the numbers of designated factories are estimated at 3,000 to 4,000 factories.

Table 2.8.2-2 Energy consumption and designated factories of surveyed factories

No.	Factory	Nos. of Employee	Fuel	Power (TOE)	Total energy consumption (TOE)	Designated factory
1	Steel-making	245	5,700	1,548	7,248	To be designated
2	Ceramic Tile	253	2,700	658	3,133	To be designated
3	Cement	305	11,000	609	8,254	To be designated
4	Ceramic sanitary	281	494	128	655	No
5	Textile	420	747	244	994	No
6	Food processing	300	952	556	1,624	To be designated

Table 2.8.2-3 Numbers of company having more than 200 employees

Industrial sub-sector	Nos. of all enterprises	Employees with 200 or more persons
Mining	1,369	99
Manufacturing	26,863	3,260
Energy supply	2,566	48
Total	30,798	3,407

Source: The situation of enterprise through the results of surveys conducted in 2005, 2006, 2007, Statistics Publishing House, Hanoi, 2008

(2) Building

a. On-site survey

The Study Team carried out on-site surveys for four buildings, three of them were built several decades ago and the last one was relatively newly constructed.

The former three buildings have been expanded keeping its exterior appearance in original one, and air-conditioning equipment has been installed. Because of the expansion and additional equipment, there are a lot of imbalances in installation of energy using equipment and the way of using energy as the whole building system. The other old buildings in Vietnam are believed to be also in the similar situation.

Regarding the latter building, on the other hand, the latest equipment at that time were installed, the system of building balances as a whole, and the several measures for energy saving have been adopted from a viewpoint of cost saving.

Though the main energy source of these four buildings is electricity, they grasp their

electricity consumption only by invoices from a power company. They are interested in energy-cost saving, but they do not have any specific plans of introducing energy saving measures such as Building Air-conditioning Automation System (BAS) and Building Energy Management System (BEMS). Since some buildings have renewal/expansion plans and renewal timing of existing air-conditioning equipment is in a couple of years in some buildings, specific measures for energy conservation should be considered in the whole renewal/expansion plan.

The present energy management situation and the implementation situation of EE&C measures is described as follows. (Refer to 2.8.9 - 2.8.12)

b. Energy management situation

	A building	B building	C building	D building
Energy management system	Partial	No	No	No
Enforcement situation of measurement / recording	No	No	Partial	No
Maintenance management of Machinery	Good	No	Good	No
Energy use quantity management	No	No	No	No
Energy use intensity management	No	No	No	No
PDCA management cycle	No	No	No	No
ISO14001	No	No	Good	No
The setting of operating manual (considered EE&C)	Partial	No	Partial	Partial
Electric management	Good	No	Partial	Good

<u>Energy management activity</u>

To promote energy saving, grasping and managing the energy usage is indispensable, but every site lacks in this activity.

And regarding the maintenance of equipments, it remains the level of preliminary building management.

<u>Lack of systematic energy saving information</u>

The energy consumption of the building relates to the building structure, the purpose of the building, the installed equipments, the operation management, the climate condition and so on. And there exists a complicated human relations among various stakeholders such as the building owner, the administrator, the tenant and the users. Different from the production process, we must implement the energy saving measures in such a complicated situation. Original know-how and the noticing based on the understanding of this situation are required. In three sites out of these four sites, the support for them is demanded. They are interested in energy saving and wondering how to promote energy saving.

Lack of information on the practical energy saving measures

For example, the energy consumption by air conditioning system accounts for the big ratio (30-50%) of the whole building. And energy consumption fluctuates depending on the quality of the operation management.

For energy saving promotion, in addition to the daily management of operation and maintenance, the high energy saving operation standard which suites for the site condition shall be prepared.

Lack of electricity management

Although these are rudimentary issues, the line voltage fluctuation and poor power factor management of the air conditioning system has been seen in the half of sites. It means the waste of electricity and invalid electric power consumption is going without the consciousness of the building users.

c. Implementation status on EE&C measures

	A building	B building	C building	D building
1) Introducing FL/CFL	Good	Good	Good	Good
2) Capacitor for involving power factor	Good	No	No	Good
3) Control of operating AC utility number	Good	Good	Good	Good
4) Chiller control by temperature of chilled water	Good	No	Good	Partial
5) Inverter control of elevator's motor	Good	---	Good	Good
6) Air curtain	No	No	No	Good
7) Introducing BEMS	No	No	No	No
8) Introducing night-purge	No	No	No	No
9) Reduction AC load (Utilizing of Latent heat)	No	No	No	Good
10) Reduction AC load (Insulation painting)	No	No	No	No
11) Introducing desiccation system	No	No	No	No

Lack of the energy saving technical information

The implementation status of EE&C measures in each site are summarized in the Table above. As for 1) FL/CFL, it has been thoroughly introduced already. As for 2), 3), 4) and 5), at the design and the installation of equipments, EE&C measures have been implemented based on the proposal by the manufacturers of these equipments. The implementation has not been done by the intention of the site (user).

As for 6) and 9), these are introduced by the self judgment of D Building to cover the small effect of air-conditioners. These described measures are introduced based on the information of the equipments. As for 7), the necessity of above-mentioned energy management is widely understood, three sites out of four are interested in it and seeking the information without understanding the markets condition. As for 8), 9), 10) and 11), every sites are interested in them as the total engineering technologies. Concerning them, every sites request continuous provision of the related information.

Above-mentioned measures shall be introduced in new construction buildings one after another in the future. On the other hand, it is also important to provide the information to the administrators and energy managers of existing buildings.

The energy saving potential was estimated as follows;.

	A building	B building	C building	D building
Potential (Possibility) of EE&C	3.8%	15.0%	10.8%	11.6%
plus Introducing Deci-Kant (Dehumidification) system	12.4%	35.0%	-	-

Because the humidity of A and B buildings in Hanoi is higher than C and D buildings in HCMC, introducing desiccation (dehumidification) system seemed to be much effective. So, in the estimation of energy saving potential above, it was calculated both with it and without it in the cases of A and B building.

d Analysis and extraction of issues for EE&C

Focusing on the result of questionnaire survey, on site survey and obtained hotels information, the Study Team extracted the main issues for EE&C measures in a building.

Analyzed buildings are, from questionnaire survey 26 buildings (office, hotel, supermarket, hospital, school), from on-site survey three buildings (office, hotel, supermarket), and from Saigon Tourist 11 hotels, and the total is 40 buildings.

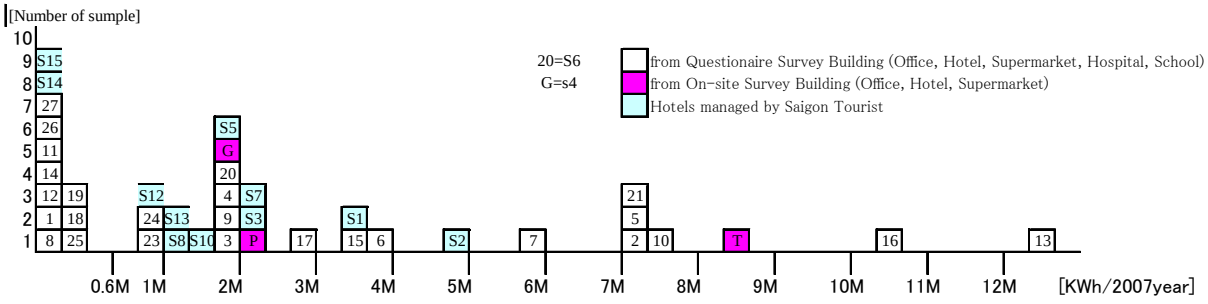
In order to profile these 40 buildings by power consumption of 2007, the Study Team showed the distribution of building numbers by each theme in the following figures. The scale is set by every 0.2 million kWh from 0 to 1.0 million kWh, by every 0.33 million kWh to more than 1.0 million kWh. As the whole, there are many buildings with little power consumption

But if the scale becomes bigger, the number of buildings decreases. And 11 hotels operated by Saigon Tourist also shows the similar distribution pattern.

Among the surveyed buildings, two buildings' electricity consumption is less than 2.8 million kWh per year , consumption stipulated in Decree No.102/2004. And one big building is more than 8 million kWh. So the Study Team extracted two buildings from a small building group with much number of building, and one building from large scale

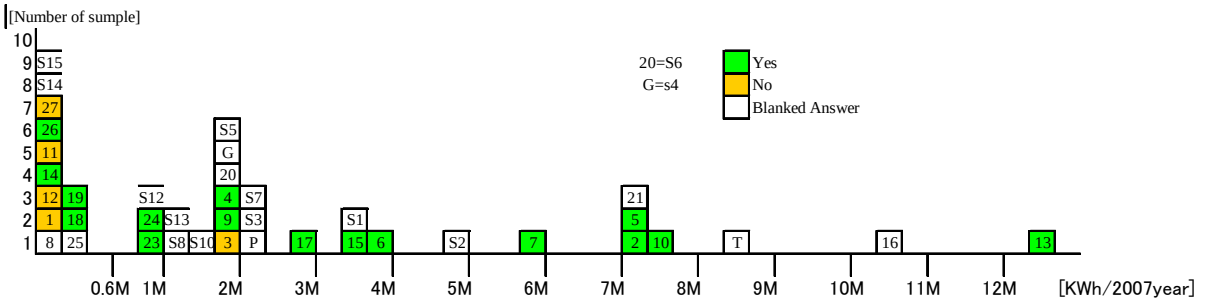
building group.

Profile of Surveied Buildings

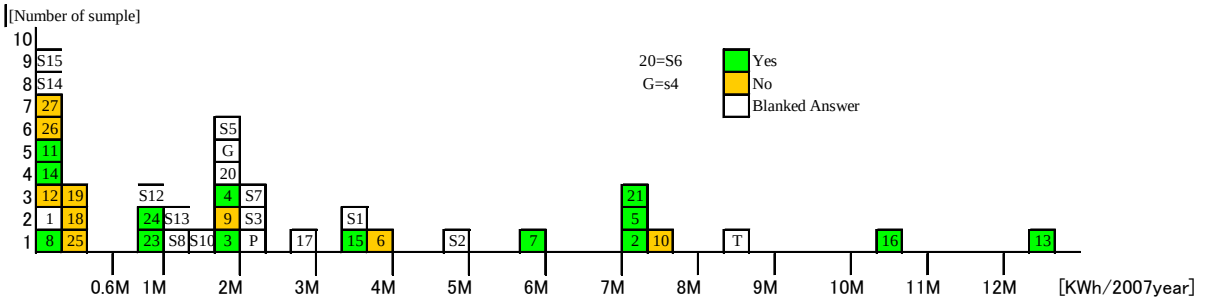


The major findings from the questionnaire survey is shown as follows. (26 buildings) Colored boxes means indicative answers.

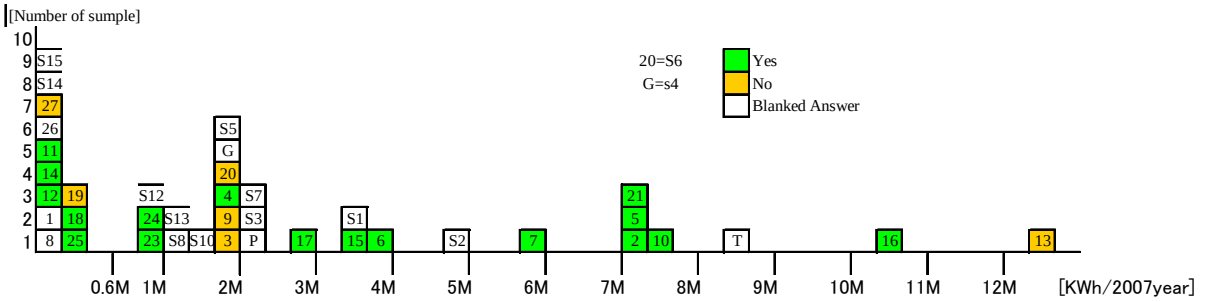
1. Do you have targets of energy conservation?



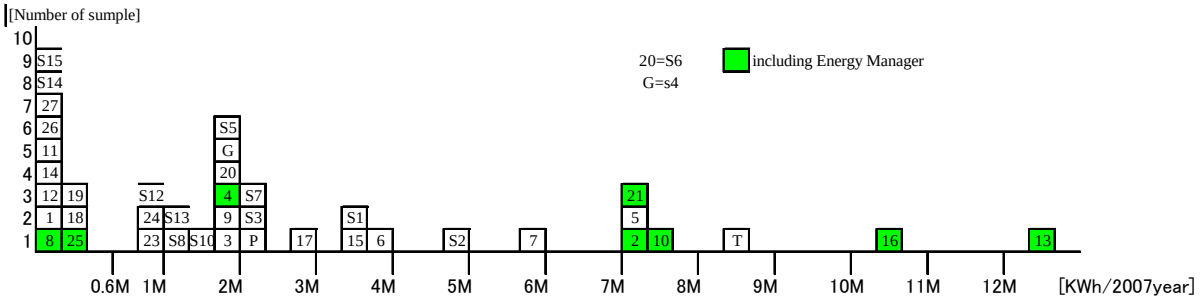
2. Have you ever taken any measures for energy conservation in the last five years?



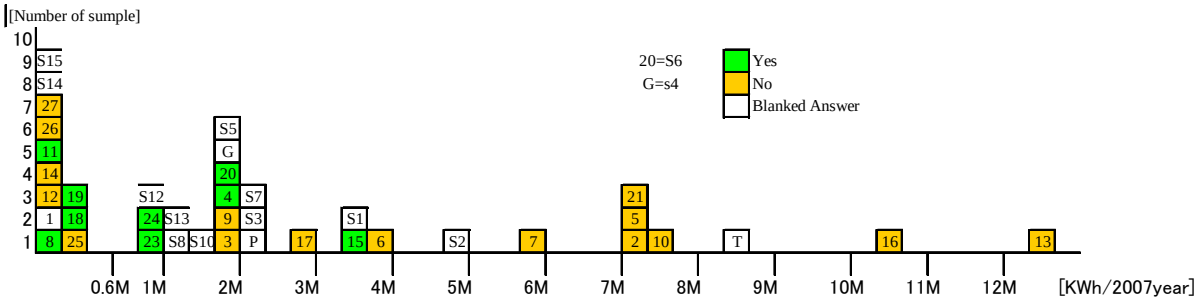
3. Do you have energy conservation plans for coming five years?



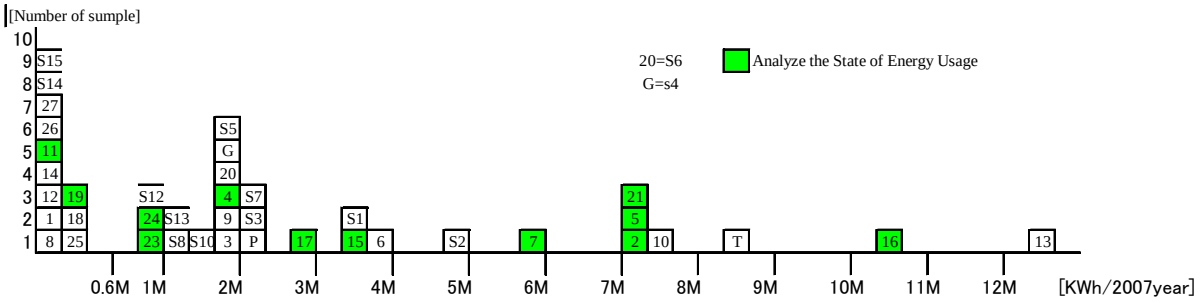
4. When energy conservation activities are organized in your building, who organizes them?



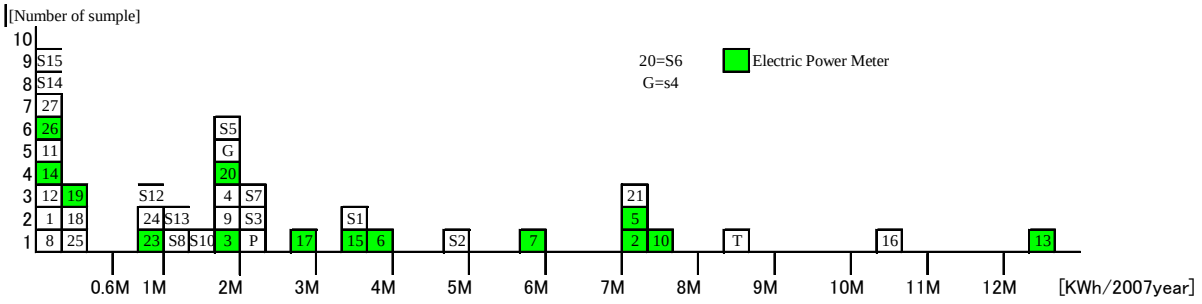
5. Do you have energy management meetings of managers in your building?



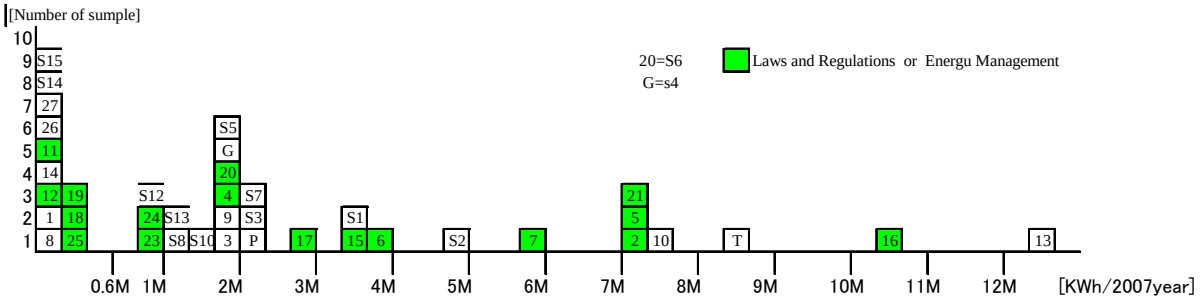
6. What purpose is the energy consumption data used for?



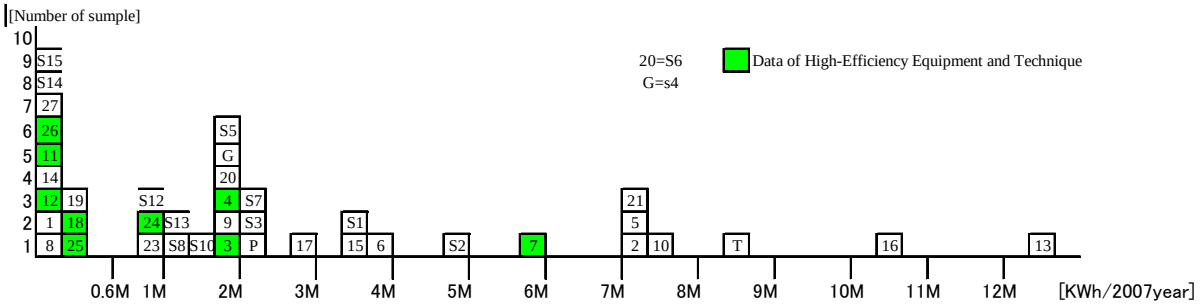
7. What kind of portable measuring instruments do you use for energy management?



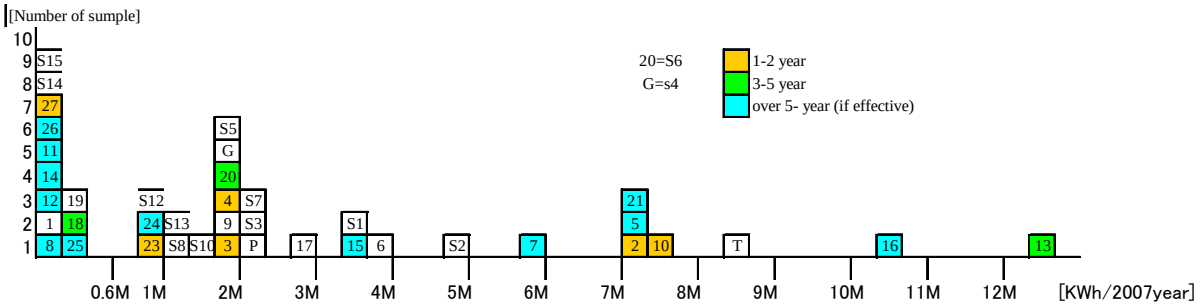
8. What kind of education and training of employee do you do for energy conservation?



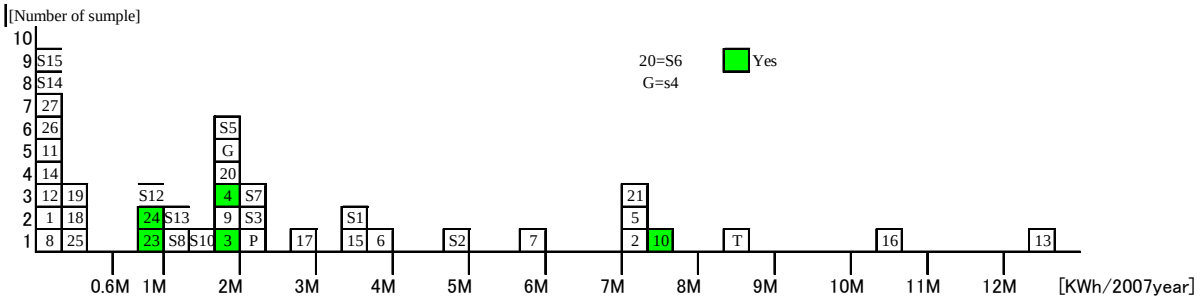
9. What do you expect the government to support buildings for promoting energy conservation?



10.Do you have any basis for simple payback period for investment in energy conservation?

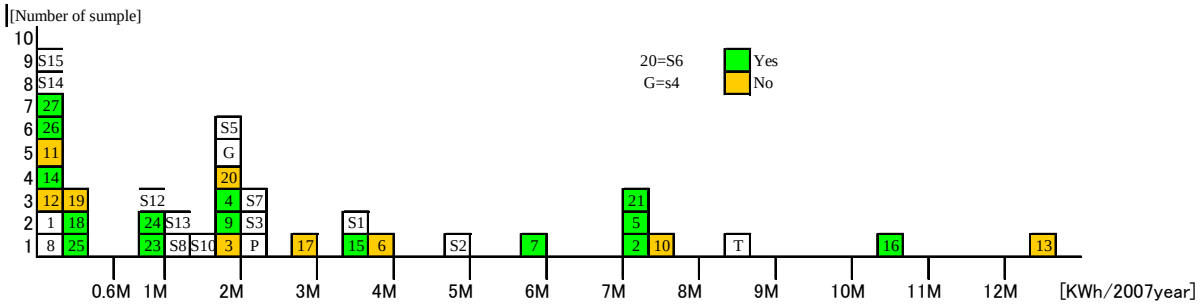


11. Has your building ever subjected any energy audits?

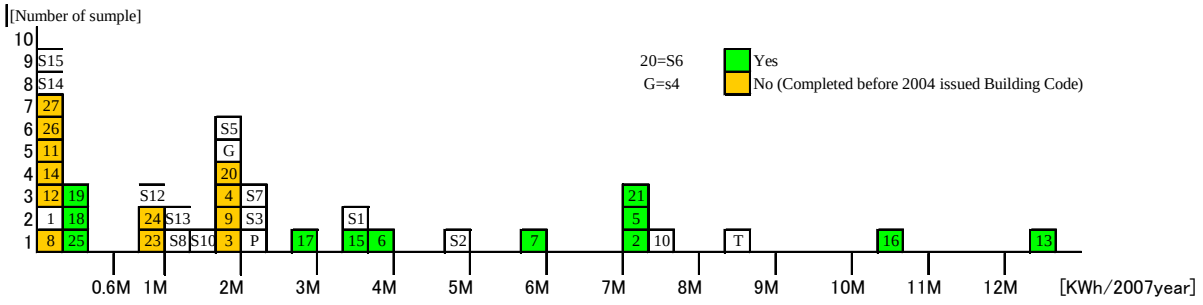


Question and answer relating to the Decree (No.102/2004) of Government on Energy Conservation and Energy Efficiency is shown in the following.

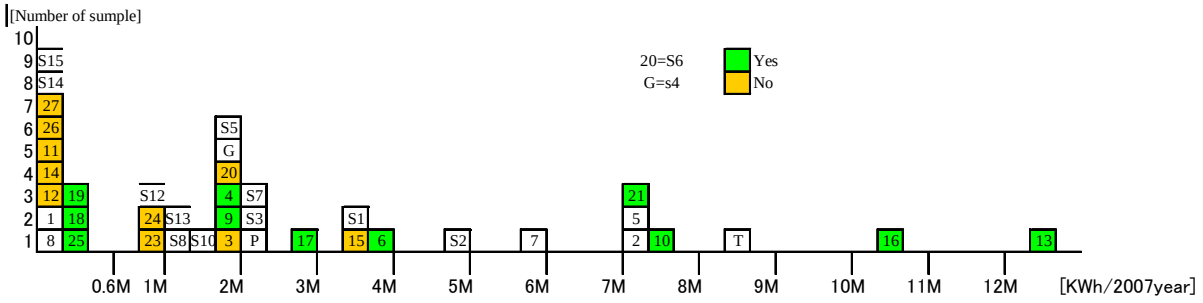
1. Is Your building a Designated Building in accordance with Paragraph 5 of Article 3?
"Total capacity of transformer is equal or more 750 KVA"
or "Consuming commercial energy is over 10 MJ or electricity is over 2.8 MKWh per year"



2. When be built, your building complied regulations on EE standards in accordance with Paragraph 1and 2 of Article 8?
"Comply regulation on EE stardards (=Building Code) in Point C, Paragraph 3 Article 20 of this Degree"
and "Application documents for building permission must includes EE measures"



3. Do you have staff who are specialized in energy management in accordance with Paragraph 3 of Article 6?
"Building must have staff in charge on energy management who graduated univercities and be trained in energy"



About above-mentioned questionnaire survey's findings, major findings are as follows.

(1) Regarding the organized activity of energy management (target setting, meeting), particularly in a big building, the targets have been set well but there are not much meetings among the persons concerned.

(2) Regarding the consciousness for energy management and recognition to education and training, particularly in big a building, the appointment of the technical staff and the enforcement of employee education has been considered as an important issue.

(3) Regarding the data measurement for energy management, the purpose remains in only cost management in a small building, but in big building it is filled up in

measuring devices more and tries to utilize the data for EE&C.

(4) Regarding expected government support, particularly in small scale building, concrete EE&C technology information such as data or high efficiency equipment is strongly desired.

(5) As the whole, there are a few experiences of energy audits.

(6) Regarding an investment for EE&C promotion, there are many buildings thinking about simple payback year as more than five years.

(7) Regarding the recognition for Decree No.102/2004, in particular bigger buildings, there are ones not being understood that they are designated buildings.

On the above about EE&C promotion in a building, some problems are extracted.

(1) In large-scale building, action to more comply of Vietnam Energy Efficiency Building Code (Decision No.40/2005 by MOC) is necessary as a design standard for the new, expanded and the renewable construction.

(2) For EE&C management and operation of an existing medium or small scale building, an appointment of an energy manager EE&C education to employee and offering systematic EE&C awakening (technology and equipment information), all of these action is necessary to be executed more effectively.

(3) Regarding in particularly existing medium or small size scale building, for EE&C technology application, for positive information disclosure and joint ownership of awakening, and for digging up application needs of EE&C technology and to offer a hint for EE&C technology application, filling up demonstrated action is needed.

In a clause of “3.2.9 program No.9: Capacity building for energy efficiency-design and management in buildings” and “3.2.10 program No.10: Creation and promotion of energy efficiency building model”, the Study Team wrote down the suggestion to answer these problems confirmed by on site and questionnaire survey.

2.8.3 On-site Survey Report (Steel-making factory A)

1) Outline of the factory

(1) Name: Steel-making factory A

(2) Location: Hanoi City

(3) Description of business

a) Type of industry: steel rolling mill industry

b) Main products: wire rod (D = 6 to 8 mm), deformed reinforcing bar (D = 10 to 40 mm)

c) Production capacity: 250,000 ton/year

d) Annual production: 180,000 ton/year (2006), 240,000 ton/year (2007)

e) Annual fuel consumption: heavy oil 5,700 ton/year (2006)

f) Annual power consumption: 18,000 MWh/year (2006)

g) Number of employees: 245 persons

(4) Outline of the factory

This factory is a rolling mill, it began production of wire rods and deformed reinforcing bars in 2001. The factory does not have steel-making facilities, the raw material (billet of 130 mm square × 12 m long) is supplied from one of its group companies. The rolling mill equipment is made in Italy, and the steel billet continuous type reheating furnace has heavy oil combustion side burners, the walking hearth and side charging and side extraction. The rolling mill equipment is a full continuous type bar and wire rod rolling mill with DC motor drives.

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team: Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano, Mr. Yoichi Isobe, Mr. Takeshi Onoguchi

Institute of Energy: Mr. Hung, Mr. Song, Mr. Hoang Anh, Mr. Hau

(2) Survey period: October 1 - 3, 2008

(3) Surveyed equipment: steel billet reheating furnace, cooling tower, receiving and transforming equipment, and air compressor.

3) Results of energy on-site survey

(1) Activity of energy management

a) Energy management system

Targets of EE&C activities such as a target of energy intensity improvement have not been set up. Since the equipment is new, the energy intensity is good. The indicator values for appropriate operation of equipment are set at manufacturer's default values, and for the more effective operation, these values should be reset by the company itself.

b) Implementation of measurement and record

Sensors and control units required for production are installed. However, measurement and record required for energy management has not been implemented because of failure of a reheating furnace temperature sensor, non-installation of pressure gauges at the inlet and the outlet of compressed air filter, non-installation of oxygen concentration meter for exhaust gas of reheating furnace, and non-installation of electric power monitoring system.

c) Maintenance of equipment

Equipment is dirty although it is new. Cleaning and maintenance are required.

d) Energy consumption management

Though data on energy use are gathered at the rolling mill operation room, the data have not been well utilized. The electric room is well maintained, but the number of meters for measurement of electric power consumption is insufficient. Therefore, the detail of electric power consumption is not figured out.

e) Energy consumption intensity management

Energy consuming intensity and production yield are on the high level in Vietnam.

f) PDCA management cycle

The PDCA cycle has not been carried out yet. Establishment of energy measurement system is the indispensable requirements for the PDCA management cycle.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.3-1.

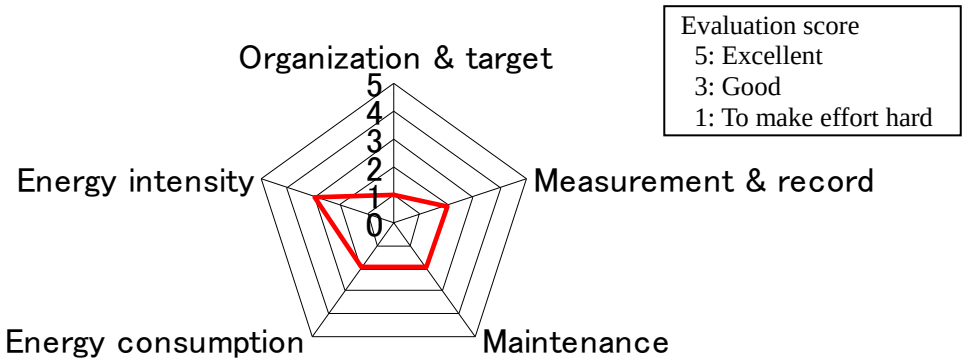


Figure 2.8.3-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Steel billet reheating furnace

As a result of heat balance calculation of the steel billet reheating furnace with operation data and measured values, the following items are recommended.

- Excess air ratio is 0.96, which means 4 % or more of heat loss by non-burning of heavy oil. Fuel intensity will be improved by 4 % by changing the excess air ratio to 1.1.
- The pressure in the furnace is 0.08 kPa, which has blow out of high temperature gas in the furnace. Fuel intensity will be improved by 2% by changing the setting value of pressure in the furnace to 0.02 kPa.
- Annual operating days are 240 days. Improvement of heat holding method of reheating furnace at a shutdown period of a couple of days will save fuel consumption by 3 %.
- A variable speed drive (VSD) by an inverter should be introduced for controlling air flow rate of combustion air fan.
- The surface temperature of furnace roof and side walls is 100 ºC or more in most areas. It is recommended that the refractory of furnace be changed to ceramic fiber at the period of repairing of furnace for improving heat insulation and thermal storage effects.
- Fuel consuming intensity will be improved by 20 % by introducing a regenerative burner. The introduction of regenerative burner requires modification of reheating furnace body structure and change of fuel from heavy oil to natural gas.

Regenerative burner system is recommendable to improve fuel consumption intensity. Regenerative burner system is shown in Figure 2.8.3-2.

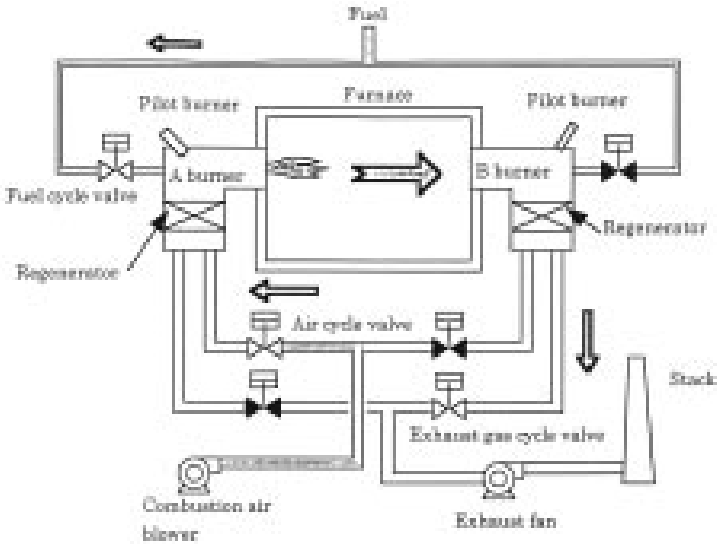


Figure 2.8.3-2 Regenerative Burner System

b) Cooling tower

Difference in water temperature is 3.4ºC between the inlet and outlet of cooling tower of indirect cooling water system for the steel billet reheating furnace and the rolling mill lubricant system. The flow of cooling water will be reduced by setting the difference in water temperature at 5ºC. A variable speed drive by inverter should be introduced for the flow control of water feed pump.

c) Air compressor

Four sets of screw type air compressors are operated with a low load factor. A multiple unit control system should be introduced for improving load balance, and one set of inverter control type air compressor should be introduced for partial load condition.

d) Power receiving/transforming equipment

An electric power monitoring system should be introduced, which contains volt-ampere meter on main feeder line to measure amount of power consumption in the company's divisions.

e) Rolling mill electric motors

A DC driving system controlled by thyristor Leonard is installed at present. But an AC driving system has better performances than a DC driving system. An AC driving system has many advantages against DC driving, such as easiness of management (commutatorless), high quality and yield on the production, improvement of stability in production, etc.

(3) Potential of EE&C

Estimated potential of EE&C of the factory by the on-site survey is shown in Table 2.8.3-1 and Table 2.8.3-2. EE&C potential in present equipment is 11.9%, and EE&C potential and EE&C ratio are shown in Table 2.8.3-1. EE&C potential by the introduction of regenerative burner system is 15.1%, and EE&C potential and ratio are shown in Table 2,8.3-2.

Table 2.8.3-1 Energy Conservation Potential of the Steel-making Factory A by Improvement of Operation and Equipment

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (fuel oil)	626 TOE/year	11%
Electric power	2,338 MWh/year	13%
Total	1,274 TOE/year	11.9%

Table 2.8.3-2 Energy Conservation Potential of the Steel-making Factory A by Introduction of New Technology

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (fuel oil)	1,140 TOE/year	20%
Electric power	1,719 MWh/year	9.6%
Total	1,616 TOE/year	15.1%

4) Remarks

This steel rolling mill factory has modernistic rolling equipment, and there are four other factories in Vietnam which have the similar equipment. This factory does not have a plan to install an electric arc furnace equipment for steel-making.

2.8.4 On-site Survey Report (Ceramics factory B)

1) Outline of the factory

(1) Name: Ceramics factory B

(2) Location: Hanoi City

(3) Description of business

a) Type of industry: ceramics industry, pottery manufacturing industry

b) Main product: floor tile, brick

c) Annual production: 1.4 million m^2 (2007)

d) Annual fuel consumption: light oil 2,703 kl/year (2007)

e) Annual power consumption: 7,648 MWh/year (2007)

f) Number of employees: 253 persons

(4) Outline of the factory

Production began in 2001 with equipment introduced from Italy. Almost all raw materials used are domestics and partly imported from Spain. Production of tile by this factory accounts for 5 % of the total production in Vietnam, and they are exported to Taiwan, South Korea, the U.S., the U.K. and Japan. It has a plan to a suburb of Hanoi City constructing a new factory, and begin production in 2010.

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team: Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano
Institute of Energy: Mr. Song, Mr. Hoang Anh
ECC Hanoi: Mr. Huynh, Mr. Hai, Ms. Linh

(2) Survey period: September 29 - 30, 2008

(3) Surveyed equipment: roller hearth kiln, power receiving and distributing equipment, fan, and air compressor

(4) Requirement from the factory: recommendation by the survey team for necessary improvements to be done in the new factory

3) Results of energy on-site survey

(1) Activity of energy management

a) Energy management system

Neither the energy management organization nor targets of energy intensity and energy conservation activity have been established. State-of-the-art equipment has been introduced, there is no problem in hardware. But in software, the problems are how to introduce firing technology and management technique.

b) Implementation of measurement and record

The equipment is not different from that of Japan, but a part of measuring instrumentation and recorders are broken down. Therefore energy use condition has not been grasped.

c) Maintenance of equipment

Some oil leakage is found in the piping of oil pump. Measurement equipment is broken down and proper maintenance has not been done. It is necessary to determine the items and interval of inspection and to carry out Inspection.

d) Energy consumption management

Measurement equipments have not been set properly and some of them are broke down. The amount of used fuel has been measured and recorded, but these data have not been utilized in energy consumption management. Establishment of measuring control system such as installation of necessary number of measuring equipment and maintenance of them is a starting point for energy conservation.

e) Energy consumption intensity management

Since management of energy consumption has not been carried out, energy consumption intensity management has not been done.

f) PDCA management cycle

Maintenance of measuring instrument is one of the essential requirements for the PDCA management cycle.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.4-1.

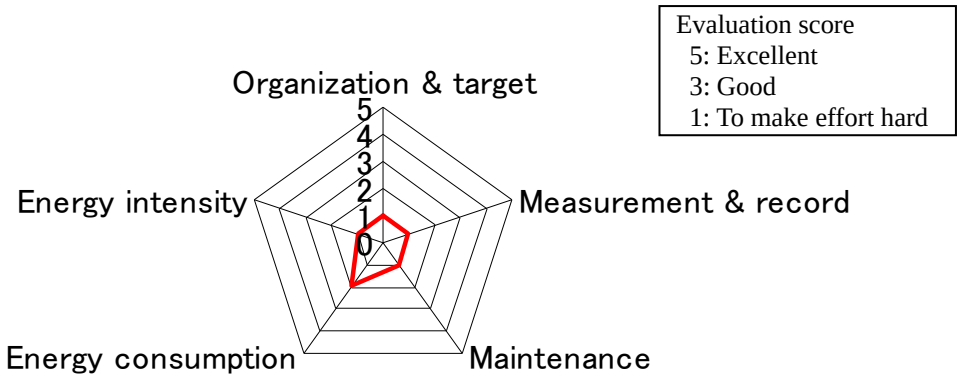


Figure 2.8.4-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Roller hearth kiln

Heat balance calculations were carried out for obtaining the heat efficiency of kiln. Table 2.8.4-1 shows heat balance of the roller hearth kiln

- Heat efficiency: 27.4 %
- Energy intensity (fuel): 568 kcal/kg (energy consumption for firing per weight of product)

These figures are average as those of roller hearth kiln for tile.

The followings are recommendations for improvement.

- Since burners in operation are too many compared with the production volume, some of them near the entrance should be extinguished.
- The amount of waste heat used for a drier should be reduced and difference in blowing temperature in pre-heating zone should be also reduced.
- The sensible heat of exhaust gas should be recovered with heat exchanger and it should be used to preheat combustion air.
- The kiln pressure should be made at ± 0 mmH_2O at the first burner and heat radiation should be reduced.

The energy saving by the above-mentioned measures is expected to be about 12 %.

Table 2.8.4-1 Heat Balance of the Roller Hearth Kiln

		Heat input		Heat output	
		$\times 10^3$kcal	%	$\times 10^3$kcal	%
	Heat from combustion of fuel	2,091.0	99.9	–	–
	Heat carried in from pre-firing goods	0.2	0.1	–	–
Heat output	Heat carried by firing goods	–	–	6.7	0.3
	heat carried by exhaust gas	–	–	663.5	31.7
	Heat carried by steam evaporating from water in the pre-firing goods	–	–	45.4	2.2
	Heat loss due to waste heat, radiation, conduction and so forth	–	–	1,375.6	65.8
Total		2,091.2	100	2,091.2	100
Effective heat	Effective heat par ton of firing goods				
	Heat required for evaporating the water adhered	5.5×10^3kcal			
	Heat required for evaporating the crystallized	53.5			
	Heat required for decomposing the clay	139.9			
	Heat required for firing of pre-firing goods	373.1			
	Total	572.0×10^3kcal/t			
	Thermal efficiency of firing goods	27.4%			
	Energy intensity	568 kcal/kg			

b) Fan and pump

The load factor of drier fan is low. On the other hand, load factors of other equipment such as water supply pumps and exhaust fans of kiln shows proper figures, but the flow of water/air might be excessive.

Flow of water/air should be controlled in accordance with load fluctuation by selecting suitable size of equipment and introducing variable speed drive system.

c) Air compressor

When two units are in operation, quality control seemed to be carried out adequately. In the case of three or four units in operation, however, efficiency control would be difficult. Delivery air pressure at compressor has been set relatively high (0.6 MPa ~ 0.7 MPa). Since the piping configuration is a tree style, the pressure drop at the end of piping is relatively large.

It is recommended that a quality control system be installed to ensure better control and a compressor driven by variable speed drive motor be installed in order to improve performance under partial load condition. Furthermore, piping configuration should be changed to a loop type to reduce pressure drop in the piping.

d) Power receiving/transforming equipment

Since a static condenser has not been installed at the power receiving point, the receiving power factor is low. The number of instrument for power measuring is not enough and some of them do not work. Introduction of power management system, which includes power measuring at main branch feeders, for monitoring power consumption is

recommended to improve management.

(3) Potential of EE&C

EE&C potential in present equipment is 12.3%, Estimated potential of EE&C of the factory by the on-site survey is shown in Table 2.8.4-2.

Table 2.8.4-2 Energy Conservation Potential of the Ceramic Factory B

Energy	Energy conservation potential	Energy conservation ratio
Fuel (light oil)	324 kg/year	12%
Electric power	966 MWh/year	12.7%
Total	565 TOE/year	12.3%

2.8.5 On-site Survey Report (Cement factory C)

1) Outline of the factory

(1) Name: Cement factory C

(2) Location: Da Nang City

(3) Description of business

a) Type of industry: cement manufacturing industry

b) Main product: Portland mixture cement PCB 30 (28-day strength: 30 N/mm^2)

c) Production capacity: cement 140,000 ton/year

d) Annual production: 110,000 ton/year (2007)

e) Annual fuel consumption: coal 11,000 ton/year (2007)

f) Annual power consumption: 7,081 MWh/ year (2007)

g) Number of employees: 305 persons

(4) Outline of the factory

This factory introduced a vertical type cement shaft kiln imported from China in 1992, and it started production in 1995. In 2003, the company was privatized from a state-own enterprise to a private company.

Its production equipment consists of one vertical type cement shaft kiln with production capacity of 300 ton/day, one ball mill for raw material crushing, and two ball mill for cement finishing. The main material (limestone) is conveyed from a mine owned by the company which is 50 km away from the factory. In accordance with the government policy announced in September 2008, the company has a plan to replace the shaft kiln by a rotary kiln with a production capacity of 1,000 ton/day. The present production equipment can manufacture Portland mixture cement PCB30, but it can not manufacture high-strength Portland cement PC50 (28-day strength is 50 N/mm^2).

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team: Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano
Institute of Energy: Mr. Hung, Mr. Song, Mr. Hau
ECC Da Nang: Mr. Van Ban, Mr. Vy

(2) Survey period: October 6 - 8, 2008

(3) Surveyed equipment: cement shaft kiln, rotary drier for raw material, ball mill for raw material and finishing, fan for cement shaft kiln, exhaust blower for

cement shaft kiln, and power receiving equipment

3) Results of energy on-site survey

(1) Activity of energy management

a) Energy management system

Since 99 % of fuel (coal) is used for the cement shaft kiln, operation control of cement kiln is nothing less than energy management. The stability of operation contributes to energy saving. Standardization of energy management has not progressed.

b) Implementation of measurement and record

Some measuring instruments of cement shaft kiln are damaged and do not read values. It is necessary to set priority in importance on the measuring instruments and take care of them.

c) Maintenance of equipment

Equipment has not been well cleaned. Cleaning and maintenance of equipment are required.

d) Energy consumption management

Coal consumption is measured at the discharge port of coal stock bin, but collected data have not been well utilized. Receiving power is recorded periodically, but it is not clear how the data is utilized in electric energy management. Utilization of collected data should be considered.

e) Energy consumption intensity management

Fuel consumption intensity has been calculated monthly, at present, but it should be calculated once a day at least.

f) PDCA management cycle

The PDCA management cycle has not been carried out. It should be made use for energy consumption intensity management and improvement of equipment.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.5-1.

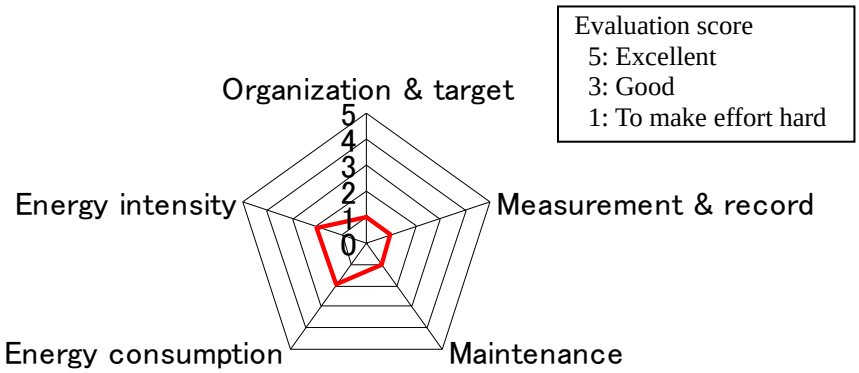


Figure 2.8.5-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Cement shaft kiln

This factory has a plan to replace the present shaft kiln by a rotary kiln with daily production capacity of 1,000 ton in accordance with the government policy. Therefore, the factory can not implement improvement of present equipment which requires large investment.

Replacement of the present shaft kiln (300 ton/day) by a coal combustion rotary kiln with a new-type suspension preheater (NSP) will improve the fuel intensity by 36 %. It is recommended that a rotary kiln be constructed on the premise of company's limestone mine which is 50 km away from the present factory to cut transportation cost of raw material. Figure 2.8.5-2 shows Dry type cement rotary kiln with NSP.

Figure 2.8.5-2 Dry Type Cement Rotary Kiln with NSP

b) Rotary drier

The surface temperature of rotary drier which dries clay and coal is 274 ºC in maximum. But investment in additional inner lining with fire-resistant refractory is not financially efficient. The rotary drier will become unnecessary if a vertical type roller mill is introduced when the cement kiln is replaced.

c) Exhaust gas fan for cement kilns

A bag filter type dust collector and an exhaust gas fan of 90 kW were newly installed in the exhaust gas system in 2006. Since the exhaust gas fan runs at a constant speed with a load factor of 50 % and the opening of damper is fixed at about 50 %, the fan and motor seem to be oversized. Employment of a variable speed drive system will reduce electricity consumption by 30 %.

By oxygen concentration measurement in the exhaust gas recovery pipe of shaft kiln and exhaust gas at the outlet of exhaust gas fan, it was found that the volume of infiltrated air is 1.4 times as large as that of generated gas. Electric power consumption will be reduced by 18% by reducing the volume of infiltrated air and dilution air.

Pressure loss by the bag filter type dust collector was 226 mmAq by the measurement of pressures at the inlet and outlet of the dust collector. If the pressure loss of the dust collector is improved to 150 mmAq by maintenance of filters and reduction of exhaust gas volume, electricity consumption will be improved by 18 %.

d) Blower for cement kilns

The blower for burning coal in shaft kiln is one root blower with the motor capacity of 155 kW. Load factor of the motor of kiln blower is as low as 60 to 70 %. Installing variable speed drive to meet gas flow rate with flow sensor and controller will improve electricity consumption by about 20 %.

Compressed air is blown out from a bleeder of air line to the shaft kiln in the case of low production rate of shaft kiln or failure of peripheral equipment. If variable speed drive by the inverter is used for motors, power consumption will be improved by 50 % during the time of air bleeding.

e) Power receiving system

Receiving power consumption is recorded every 10 days and main feeder current data is recorded every day. But it is not clear whether the record is used for the management of electricity power or not. Introduction of electric power management system which include volt-ampere meters on main feeder lines to measure power consumption in the company's divisions is recommended.

f) Electric motor for ball mill

In order to improve the power factor, a static condenser should be installed at the power line of finishing mill motor working in low voltage. Expected improvement is about 2 % in

resistance loss of the cable line.

(3) Potential of EE&C

Estimated potential of EE&C of the factory by on-site survey is shown in Table 2.8.5-1 and Table 2.8.5-2.

EE&C potential in present shaft kiln is 4% as shown in Table 2.8.5-1.In case the present shaft kiln is replaced with a dry type rotary kiln with NSP, EE&C potential is 28% as shown in Table 2.8.5-2.

Table 2.8.5-1 Energy Conservation Potential of the Cement factory C by Improvement of Operation and Equipment

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (coal)	49 TOE /year	0.4%
Electric power	1,269 MWh /year	17.7%
Total	386 TOE/year	4%

Table 2.8.5-2 Energy Conservation Potential of the Cement factory C by Replacement with Dry Type Rotary Kiln with NSP

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (coal)	3,880 TOE /year	35.2%
Electric power	0 MWh /year	0%
Total	2,697 TOE/year	28.0%

4) Remarks

In the case of vertical type cement shaft kilns, since preheating of material, quicklimizing and clinker generation is dome in a furnace, fuel intensity is relatively low. But, stable operation for ensuring quality is difficult. Moreover, the scale of plant is relatively small. Therefore, all cement plants in Japan have replaced from shaft kilns to rotary kilns. Though replacement of kilns requires large investment, it is recommended that the factory replace its shaft kiln to a rotary kiln with a new suspension preheater (NSP), taking into account the future increasing demand for cement and energy conservation need in Vietnam.

2.8.6 On-site Survey Report (Ceramics factory D)

1) Outline of the factory

(1) Name: Ceramic factory D

(2) Location: Da Nang City

(3) Description of business

a) Type of industry: ceramics industry

b) Main product: sanitary ware

c) Productive capacity: 200,000 pieces/year

d) Annual production: 58,000 pieces (2006), 100,000 pieces (2007)

e) Annual fuel consumption: LPG 483.9 ton/year (2007)

f) Annual power consumption: 1,489 MWh/year (2007)

g) Number of employees: 281 persons

(4) Outline of the factory

The equipment was introduced from Italy in 2001 and production began in 2003. Originally, this company was a state-run enterprise, but it was privatized in 2006. All raw material is domestics, and products are not exported. The tunnel kiln sometime stops because the volume of sales is smaller than production capacity.

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team:	Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano, Mr. Takeshi Onoguchi
Institute of Energy:	Mr. Song, Mr. Hau
ECC Da Nang:	Mr. Van Ban, Mr. Vy

(2) Survey period: October 9 - 10, 2008

(3) Surveyed equipment: tunnel kiln, power receiving system, fan, air compressor, and ball mill

3) Results of Energy On-site Survey

(1) Activity of energy management

a) Energy management system

The company has not had any energy management system, and targets of energy intensity and energy conservation activity are not set up.

There is no problem in equipment because state-of-the-art equipment has been introduced. The problem is how to introduce efficient firing technology and management technique.

b) Implementation of measurement and record

There are not any problems on equipment. Necessary measuring instruments have been equipped and essential data are recorded.

Electric power monitoring system has not been installed, and measuring and record necessary for electric power management has not been implemented.

c) Maintenance of equipment

The equipment is new. But maintenance has not been well done, filter cleaning of fan in particular, because they do not understand the importance and purpose of maintenance.

It is necessary to establish maintenance criteria such as items, interval, purpose, etc. of maintenance for all equipment and implement maintenance in accordance with the criteria.

d) Energy consumption management

Fuel consumption of tunnel kiln, which consumes energy most, has been recorded, but energy intensity management with these data has not been carried out. Consumption of electricity has not been well grasped.

e) Energy intensity management

Energy intensity management and heat efficiency management has not been carried out. Awareness of energy conservation seems insufficient.

f) PDCA management cycle

It is necessary to introduce the PDCA energy management cycle.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.6-1.

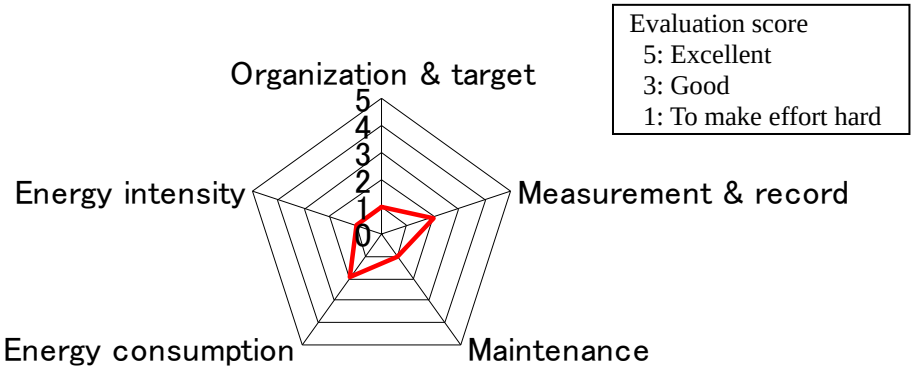


Figure 2.8.6-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Tunnel kiln

Heat balance calculation was carried out to obtain heat efficiency of the kiln. Table 2.8.6-1 shows heat balance of the tunnel kiln.

- Heat efficiency: 37.7 %
- Energy intensity (fuel): 1,828 kcal/kg (energy consumption for firing per weight of product)

These figures are average as those of tunnel kiln for manufacturing sanitary ware.

The following are recommendations for improvement.

- Spaces between the ceiling of kiln and products, and between car tops and shelves should be properly designed to make combustion gas flow efficiently in the kiln.
- Since burners in operation are too many compared with the production volume, some of them near the entrance should be extinguished.
- The amount of waste heat used for the drier should be reduced and difference in blowing temperature should be also reduced.
- The sensible heat of exhaust gas should be recovered with heat exchanger and it should be used to preheat combustion air.
- The inner pressure of kiln should be made at ± 0 mmH_2O at the first burner and blowing-out of heat should be reduced.
- The seal of kiln car joint should be taken care properly.

The energy saving by the above-mentioned measures is expected to be about 20%.

Table 2.8.6-1 Heat Balance of Tunnel Kiln

		Heat input		Heat output	
		$\times 10^3$kcal	%	$\times 10^3$kcal	%
Heat input	Heat from combustion of fuel	1,356.6	99.3	–	–
	Heat carried in from pre-firing goods	2.4	0.2	–	–
	Heat carried in from kiln furniture	0.9	0	–	–
	Heat carried in from refractory	5.1	0.4	–	–
	Heat carried in from iron parts	1.0	0.1	–	–
Heat output	Heat carried by firing goods	–	–	7.4	0.5
	Heat carried by kiln furniture	–	–	5.7	0.4
	Heat carried by refractory	–	–	31.1	2.3
	Heat carried by iron parts	–	–	2.4	0.2
	Heat carried by waste heat	–	–	493.0	36.1
	Heat carried by exhaust gas	–	–	423.0	31.0
	Heat carried by steam evaporating from water in the pre-firing goods	–	–	70.0	5.1
	Heat loss due to radiation, conduction and so forth	–	–	333.4	24.4
Total		1,366.0	100	1,366.0	100
Effective heat	Effective heat par ton of firing goods				
	Heat required for evaporating the water adhered	6.6×10^3kcal			
	Heat required for evaporating the crystallized	90.4			
	Heat required for decomposing the clay	193.4			
	Heat required for firing of pre-firing goods	373.8			
	Total	664.2×10^3kcal/t			
	Thermal efficiency of firing goods	37.7%			
	Energy intensity	1,828kcal/kg			

b) Kiln fan

Load factor of both exhaust fan and ventilation fan are low, as much as 40 % to 50 %, The fans seem to be oversized. Air flow should be controlled in accordance with operation of the kiln by selecting suitable size of equipment and introducing variable speed drive system.

c) Air compressor

Delivery air pressure ranges from 0.6 MPa to 0.8 MPa, and the set pressure is relatively high. Pressure drop at the end of piping is relatively large because of a tree-shape configuration of piping.

It is recommended that two units of compressors be installed, one is operated constantly in the rated output and the other is a variable speed drive (VSD) compressor for partial load control. Moreover, the piping should be changed to a loop configuration which contributes reduction of pressure drop for lowering delivery pressure.

d) Power receiving system

Since the capacity of static condenser is insufficient, receiving power factor is low. The amount of power consumption is kept up by only electricity bills score, electricity

consumption management has not been well done. Capacity of static condenser should be increased and an electric power management system should be introduced to monitor electricity consumption.

(3) Potential of EE&C

Estimated potential of EE&C is shown in Table 2.8.6-2. EE&C potential of the factory by on-site survey is 18.3%.

Table 2.8.6-2 Energy Conservation Potential of the Ceramic Factory D

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (LPG)	97 TOE /year	20%
Electric power	242 MWh /year	16.3%
Total	172 TOE/year	18.3%

2.8.7 On-site Survey Report (Textile factory E)

1) Outline of the factory

(1) Name: Textile factory E

(2) Location: Ho Chi Minh City

(3) Description of business

a) Type of industry: textile industry of weaving, dyeing and sewing

b) Main product: cloth, T-shirt and sport shirt

c) Annual production: cloth: 1,900,000 m^2/year, T-shirt: 417 ton/year (export ratio: 50%)

d) Annual fuel consumption: Fuel oil: 747 ton/year

e) Annual power consumption: 2,843 MWh/year

f) Number of employees: 420 persons

(4) Outline of factory

This factory is a medium-scale textile, dyeing and sewing factory, which began production in 1992 as a state-run enterprise, and it was privatized in January 2008. Since the surrounding area has been urbanized, the factory was directed by the local government to move to the suburbs in two years. An energy audit of this factory was carried out in December 2007 as a project of Ho Chi Minh City.

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team: Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano
Institute of Energy: Mr. Hung, Mr. Hoang Anh
ENERTEAM: Mr. Hien, Mr. Linh

(2) Survey period: November 6 - 7 and 13, 2008

(3) Surveyed equipment: heat medium boiler, steam piping, power receiving equipment, tenter (drying and heat set), motor load, and illuminance of sewing shop

3) Results of Energy On-site Survey

(1) Activity of energy management

Since flow meter of heat medium boiler is broken, fuel oil consumption is measured only once a month, and flow-rate of heat medium has not been indicated. The management and engineers do not aware of importance of energy management. An energy audit was carried out in 2007 and some measures for energy conservation were proposed. But any of them have

been neither implemented nor examined.

Watt-hour meters have been installed in each section, and the data are utilized for only cost management but not for energy management.

a) Energy management system

Energy management organization has not been established. As top management does not have awareness of EE&C, Top management has to establish the energy management organization and promote awareness of EE&C.

b) Measurement and recording

Most of instrument meter is out of service, and so gathering and measurement of data are not implemented. Instrument meter has to be replaced for measurement.

c) Maintenance

Many leakage points of steam and water are found. Heat insulation material of steam piping is broken in some place and is not repaired. Broken insulation material is to be replaced soon, and periodical inspection is to be conducted with checklist.

d) Energy consumption management

Recording of energy consumption is not made.

e) Energy intensity management

Energy intensity management has not been made. Water intensity is important as well as fuel and electricity intensity.

f) PDCA management

PDCA management cycle is important element for energy management and small group activities. PDCA management is evaluated by measurement data, so measurement system is to be established.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.7-1.

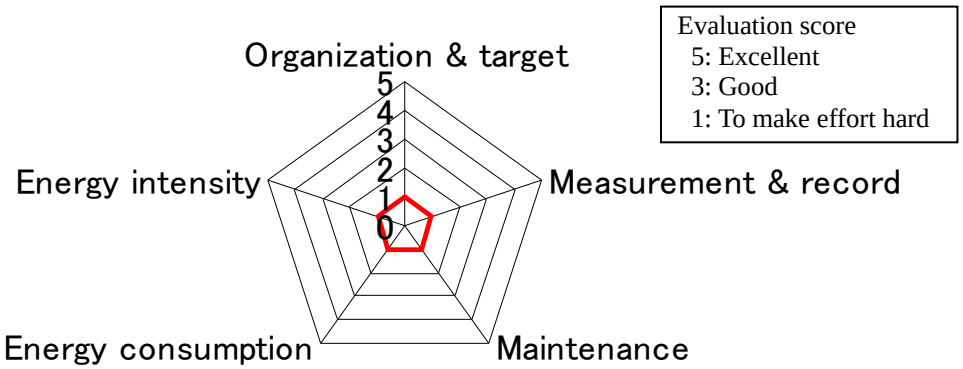


Figure 2.8.7-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Heat medium boiler

As the result of calculation heat balance of the heat medium boiler based on measurement data, the following measures are recommended

Heat medium boiler is operated at air ratio of 1.9, and so the heat loss of exhaust gas is 17%. When air ratio is set at 1.2 to 1.3, boiler efficiency can be improved by 6.7 %.

b) Heat insulation of heat medium piping

The temperature of heat medium is 230 °C to 250 °C. Heat loss of piping is large due to broken insulation material. When not-insulated piping is covered with glass wool material of 25 mm thickness, 90 % of heat loss can be recovered.

c) Steam piping

Steam leakage can be stopped with the replacement of flange gasket and grand packing. Six points of steam leakage in piping stands for 43 tons of annual coal consumption.

d) Recovery steam condensate

Large amount of steam is consumed in heat dyeing process through heat exchangers, but all the steam condensate is not recovered. In this factory, it is effective that condensate is used to soaping water after dyeing step, because the distance of dyeing shop and boiler room is long. When 1 ton/h of condensate is recovered and is used to soaping water, recovered energy stands for 30 tons/year of coal.

e) Maintenance of steam traps

Some steam traps are mal function in steam piping and dyeing machines. When steam traps are inspected and overhauled every 2 years, steam consumption loss can be reduced.

f) Pump of jet dyeing machine

8 sets of jet dyeing machine are installed in the factory. A jet dyeing machine is a machine of continuous operation of breaching, dyeing and washing, and a circulation pump of 30 kW is operated continuously for 6 to 10 hours with manual control of water volume. Necessary water volume is to be controlled according to material and thickness of cloth.

When Motor speed of pump is controlled with inverter, annual power saving stands for 220 MWh. Figure 2.8.7-2 shows a jet dyeing machine.

Figure 2.8.7-2 Jet Dyeing Machine

g) Tenter (drier and heat setter of cloth)

Tenter is a unit for drying and heat-set after dyeing process.

Although the tenter is modern equipment which has inverters in each motor, rotating speed of motors is fixed, motors are operated at a constant speed, variable speed control by humidity of the inside of machine chamber is not carried out.

When relative humidity of the inside of machine chamber is controlled at 65% with variable speed drive of exhaust fan, productivity and energy saving can be performed.

h) Receiving power equipment

Extreme lead-phase power factors are observed during night, when the load is low. This might be caused by too high voltage at power receiving point. Timer control and/or capacitance control is proposed to cut off the power condenser from the line in low load condition.

When electric power management system is introduced, power consumption can be monitored, and so power saving is performed by 5%

i) Sewing shop

Fluorescent lumps (40 W) are used. Illuminance is 450 to 500 lux on sewing machine tables, but it is insufficient for sewing work. Installation of reflective boards and shades can be improved to 680 to 760 lux of illuminance.

(3) Potential of EE&C

Estimated potential of EE&C is shown in Table 2.8.7-1. EE&C potential of the factory by

on-site survey is 13.7%.

Table 2.8.7-1 Energy Conservation Potential of the Textile Factory E

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (Fuel oil)	92 TOE /year	12.3%
Electric power	431 MWh /year	15.1%
Total	211 TOE/year	13.7%

2.8.8 On-site Survey Report (Food-processing factory F)

1) Outline of the factory

(1) Name: Food-processing factory F

(2) Location: Ho Chi Minh City

(3) Description of business

a) Type of industry: dairy product manufacturing industry (fresh milk and yogurt)

b) Main product: fresh milk, yogurt, plastic container and spoon

c) Annual production: fresh milk 28,400 kl/year

d) Annual fuel consumption: Fuel oil: 952 kl/year

e) Annual power consumption: 6,469 MWh/year

f) Number of employees: 300 persons

(4) Outline of factory

This factory is a new factory which began production in 2003, all equipment is made in Europe. But the plant engineering of overall factory seems not adequate. The factory has plastic molding machines and a tinning can manufacture line for containers of milk and yogurt. The holding company of this factory has a plan to merge three fresh milk factories including this factory in a couple of years, and move to another industrial complex.

2) Outline of energy on-site survey

(1) Survey team member:

JICA Study Team:	Mr. Norio Fukushima, Mr. Wataru Ishikawa, Mr. Hisashi Amano
Institute of Energy:	Mr. Hung, Mr. Hoang Anh
ENERTEAM:	Mr. Vinh, Mr. Tan

(2) Survey period: November 10 - 11, 2008

(3) Surveyed equipment: fuel oil combustion steam boiler, steam piping, power receiving equipment, air compressor, water pump and motor load

3) Results of Energy On-site Survey

(1) Activity of energy management

a) Energy management organization

The organization structure has been established and internal communication has been done smoothly with four heat engineers and 12 electricity engineers ,though there is no energy

management organization.

The target of energy conservation has not been set because of cheap energy price , and measures for energy conservation which was proposed through the energy audit executed in November, 2007 has not been executed.

It is important that the top management shall lead the execution of the energy conservation.

b) Measurement and record

Data has been collected, managed periodically, and management criteria has been set. The base for efficient energy management has been prepared.

c) Maintenance of equipment

The fuel leak from the boiler, the steam leak and the breakdown of steam trap etc. are found and they have not been maintained properly, in spite of the periodical maintenance for major manufacturing equipments.

The energy saving, automation of the main equipments has been executed because of the modern equipment installed. But operation management of the entire factory like the pressure management of compress air and the pressure setting of the feed-water pump etc. should be enhanced. Also the piping system chart of water and compress air has not been maintained. Check list of utility equipments and periodical maintenance scheme should be prepared. The indicator values for appropriate operation of equipment are set at manufacturer's default values, and for the more effective operation, these values should be reset by the company itself.

d) Energy consumption management

The record of energy consumption has been regularly taken, but it is not utilized for the quantity management. More improvement is expected by making the trend graphs of the record (visualization) on the energy consumption, and by the earlier detection of the abnormal operation indicator values.

e) Management of energy intensity

The energy intensity has not been managed. The importance and effectiveness of energy conservation should be aware more.

f) PDCA management cycle

PDCA energy management cycle should be prepared.

g) Evaluation of energy management activity

Evaluation of energy management activity is shown in Figure 2.8.8-1.

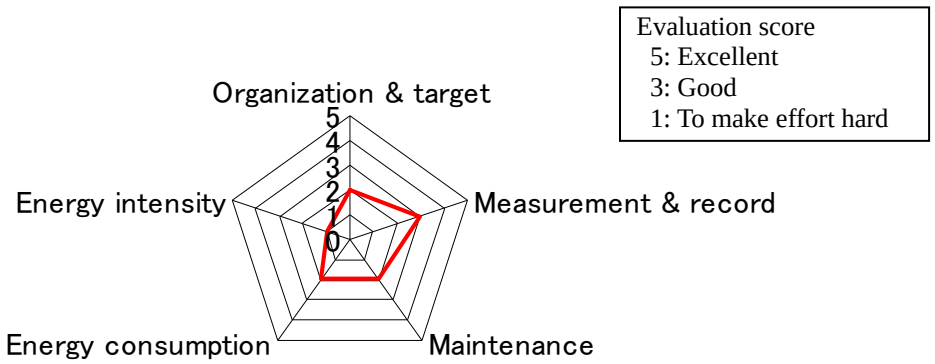


Figure 2.8.8-1 Evaluation of Energy Management Activity

(2) Recommendation for improvement

a) Steam boiler

2 sets of steam boiler of 5 tons/h are installed, and 1 set of boiler is operated normally.

As the result of heat balance of steam boiler No.1, the following measures are recommended. Heat balance is shown in Table 2.8.8-1.

- Since boiler is operated at an air ratio of 1.4, exhaust gas loss is 8.2 %. If the air ratio is set at 1.2, thermal efficiency of boiler can be improved by 1.2%.
- Load factor of boiler No.1 is 24%, so the capacity of boiler is too big. If instead of existing 5t/h steam boiler, 2 t/h one installed, the expected annual fuel oil saving would be 92 tons. Section drawing of small size once-through steam boiler is shown in Figure 2.8.8-2. A small size through steam boiler can be operated in high efficiency of 90% or more even at low load operation.

Table 2.8.8-1 Heat Balance of Steam Boiler

Input heat	%	Output heat	%
Fuel heat	100	Generated steam heat	80.5
		Exhaust gas heat loss	8.2
		Radiation heat loss from surface	3.0
		Others	8.3
Output heat total	100	Output heat in total	100

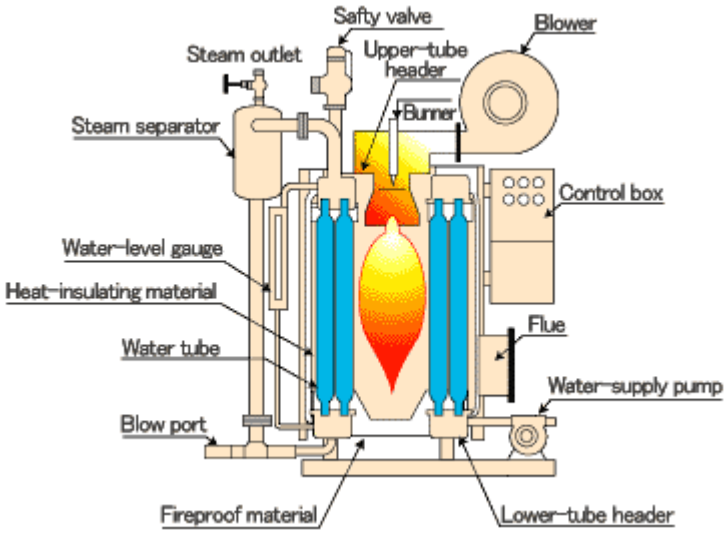


Figure 2.8.8-2 Section Drawing of Small Size Once-through Steam Boiler

b) Steam piping

Many steam valves have not been heat-insulated. Failures of steam traps are found.

If non-insulated piping were covered with glass wool material of 25mm thickness, 90% of heat loss could be recovered. Expected annual fuel oil saving stands for 9 tons by insulation works.

c) Maintenance of steam traps

Some steam traps are mal functioned in steam piping and dyeing machines. If steam traps were inspected and overhauled every 2 years, the steam consumption loss could be reduced.

d) Chiller operation control

3 units of 150kW chiller have been installed and usually 2 units have been in operation of partial load. If on/off operation by multiple-unit control along with the demanding volume were applied, expected annual power saving would stand for 209 MWh.

e) VSD control of cold water pump

Normally 2-units cold water pumps have been working in continuous operation. If water volume control of pumps were applied with VSD control through return water temperature, expected annual power saving would stand for 151 MWh.

f) Operation control of supply water pump

2 supply water pumps of 18.5kW pump and 1 of 11kW auxiliary pump have been installed,. And only 1 pump has been operated normally. When delivery pressure of 1st pump lowers, 2^{nd} pump starts its oration. 2^{nd} pump operation stops within 1 minutes. And 2^{nd} pump starts and stops 15 times in 10 minutes. If VSD control with inverter and water pressure control at terminal use were applied, smooth operation of water pumps could be performed and

expected power saving would be 67 MWh/year. Improvement plan of pump system is shown in Figure 2.8.8-3

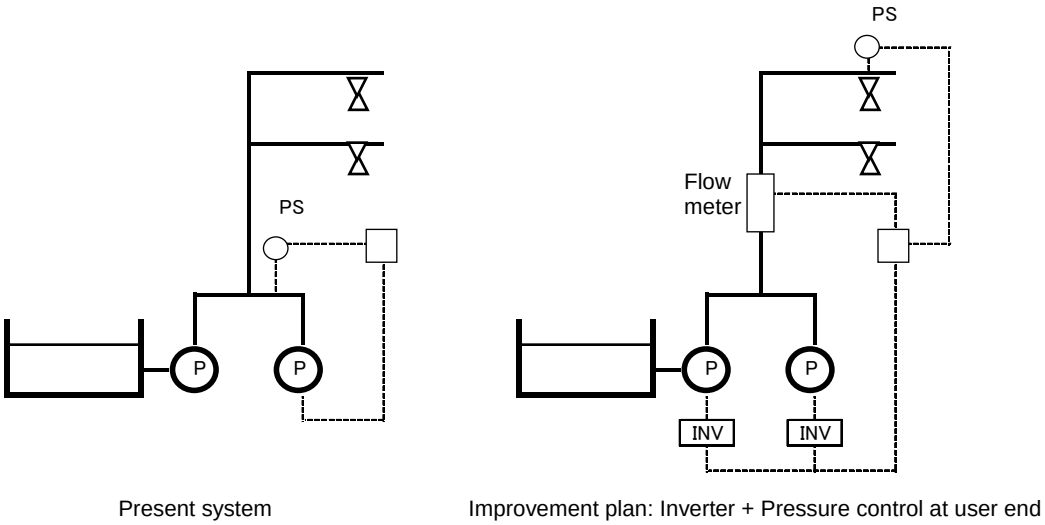


Figure 2.8.8-3 Improvement Plan of Pump System

g) Operation control of air compressors

2 units of 45kW compressor and 2 units of 75kW compressor have been installed in the factory. If in the low load period, the air compressor of 75kW with VSD control were to be operated and air compressor of 45kW were to be stopped, expected annual power saving would stand for 52 MWh.

h) Delivery pressure control of air compressor

Delivery pressure of two air compressors is 0.65~0.75 MPa and 0.8~0.85 MPa respectively. Since most of equipment such as air operated valves and diaphragm pumps are operated with the pressure of 0.4 MPa to 0.6 MPa, the delivery pressure can be reduced. If the delivery pressure of compressors were reduced by 0.1 MPa, expected annual power saving would stand for 105 MWh.

i) Power receiving equipment

Maintenance and management of electric room is good for power receiving. To promote EE&C activities, introduction of power management system is recommended. Power saving can be performed by 5% with introduction and operation of the power management system.

Power management system is shown in Figure 2.8.8-4.

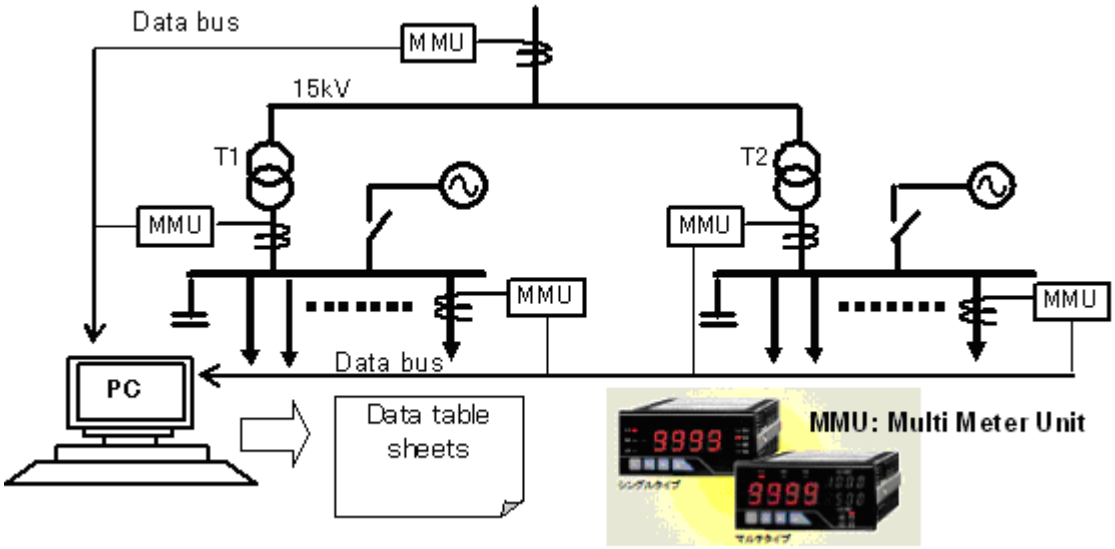


Figure 2.8.8-4 Power Nanagement System

(3) Potential of EE&C

Estimated potential of EE&C is shown in Table 2.8.8-2. EE&C potential of the factory by on-site survey is 16.2%.

Table 2.8.8-2 Energy Conservation Potential of the Food Processing Factory F

Energy	Energy-conservation potential	Energy conservation ratio
Fuel (Fuel oil)	116 ton /year	11.0%
Electric power	1244 MWh /year	19.3%
Total	463 TOE/year	16.2%

2.8.9 On-site Survey Report (Building A)

1) Outline of building

(1) Name and type: Building A (office building for rent)

(2) Location: Hanoi City

(3) Outline of building

a) Completion: 1998

b) Gloss floor area: 11,000 m^2 (16 floors above the ground and one floor underground for parking lot)

c) Lent area: 7,000 m^2

d) Annual electric power consumption: 2,000 MWh

e) Main equipment

Power receiving transformer: 1,250 kVA
Generator: 350 kW × 3
Air-conditioner: central air-conditioner
air-cooled water chiller × 3 units (manual quantity control)
FCU × 7 units (each floor), FAU × 2 units (each floor)
Lighting fixture: rent floors (total 6.2 kW/floor, 100 kW/building)
36 W × 2 lamps × 62 units, 18 W × 2 lamps × 4 units
DWL (18 W) × 14 units, 18 W × 8 units, DWL (13 W) × 13 units
Elevator: 3 units
BAS: Measuring and ON/OFF control panel of FAU and FCU

(4) Implemented EE&C measures

a) Air-cooled water chiller × 3 units (manual quantity control)

b) Elevator: 3 units (variable speed control by inverter)

c) Capacitor for power factor (power condenser)

d) Lighting in common use space such as elevator halls and rest rooms has been replaced by CFLs)

2) Outline of on-site survey

(1) Survey team member

JICA Study Team: Mr. Norio Fukushima, Mr. Tsuyoshi Onoguchi, Mr. Yoichi Isobe
Institute of Energy: Mr. Khanh, Mr. Song

(2) Survey period: September 24 - 26, 2008

(3) Object of survey: energy consumption of the whole building

3) Results of energy on-site survey

(1) Status of energy management

a) Energy management system

The energy management organization has not been established. Targets of energy intensity and energy conservation activities have not been set up, either. However some measures such as delicate operation of air-conditioning system have been carried out mainly for cost saving.

b) Implementation of measurement and record

Voltmeters, ampere meters and power-factor meters for main and sub-main feeder lines have been equipped, but measurement and record necessary for energy management have not been carried out.

c) Maintenance of equipment

Maintenance has been carried out properly. Some lighting fixtures are a little dirty, cleaning is required.

d) Energy consumption management

Energy consumption management with measurement and record has not been implemented. The amount of electric power consumption is able to be known only by electricity bills from the power company. This is not enough for energy conservation activity.

e) Energy-consumption-intensity management

Since energy consumption management has not been carried out, so energy consumption intensity management has not been carried out.

f) PDCA management cycle

The PDCA management cycle has not been carried out yet. PDCA management cycle should be introduced for the energy consumption management and equipment improvement.

(2) Potential of energy conservation

a) Status of energy usage

・Annual energy consumption

Figure 2.8.9-1 shows the annual electricity consumption balance based on bill of power company and measurement. Seasonal fluctuation power load (mainly air conditioning system) ratio is 43% and baseline power load (lighting fixtures in offices, etc.) ratio is 57%.

Continuous power load accounts 54% of baseline and 28% of the total. Therefore energy saving acts shall target on the continuous power load and air conditioning system.

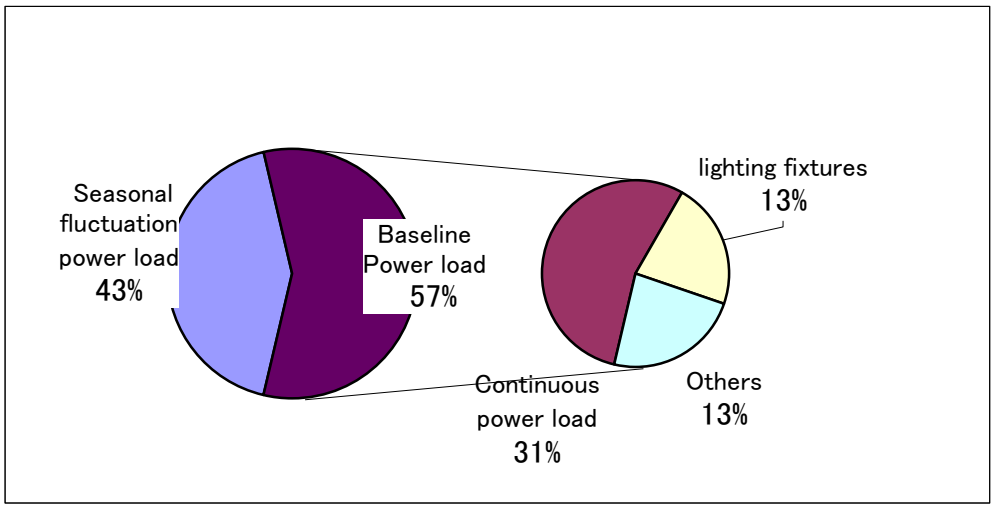


Figure 2.8.9-1 Annual Electricity Consumption Balance

・Daily load and management of power factor

Power factors of this building are 0.87 to 0.93, and these values are managed with capacitors.

Demand factor of receiving transformer fluctuates significantly between the daytime and the nighttime and continuous power load of about 60 kW was observed in the middle of the night, it seems to be used by server computers, air conditioners and lighting fixtures in common space at low level floors.

b) Main countermeasures

・lighting fixtures in offices ---- Introducing electronic ballasts (–8%)

The total power consumption by lighting fixtures in offices is estimated around 70 kW. Introducing electronic ballasts is recommended to reduce it.

・Continuous power load ---- Energy-saving server and energy-saving air conditioning system (–30%)

Continuous power load of about 60 kW was observed in the middle of the night, it assumes 60% of it is to be used in server computer room. In these 10 years, Energy consumption of air conditioning system has improved more than 30%. And in these 5 years, new technology like as blade server has developed there is around 30% potential reduction. (e.g. IBM or Hitachi)

・Introducing desiccant dehumidifier system (–20%)

Air-conditioning system is often used not only for cooling but for dehumidifying which is super cool operation. Introducing desiccant dehumidifier system shall make more than 20% energy saving.

c) Sub countermeasure

・Introducing PIR switching controller in washrooms is recommended to switch off when not being used.

・Variable speed control by inverter

Variable speed control by inverter should be introduced for water feed pumps because a quarter of refrigerated water flows through a bypass valve in January, February and March.

・Reducing no-load loss of the transformer

The demand factor of receiving transformer fluctuates significantly between the daytime and the nighttime. In such case, it is worth considering reducing no-load loss of the transformer by introducing of amorphous transformer or transformer bank for example.

d) Potential of energy conservation (–6.6% (with desiccation system –15.2 %))

・Introducing electronic ballast (–10%)

・Energy-saving server and energy-saving air conditioning system for servers (–30%)

・Introducing desiccant dehumidifier system (–20%)

・0.13 × 0.08(electronic ballast)+ 0.31 × 0.6 × 0.3(server)+0.43 × 0.2(desiccation) = 0.1522 (without desiccation system 0.066)

4) Remarks

This building is one of the modern commercial buildings of rental office in Hanoi, many of the tenants are foreign companies. At present, manual quantity control of chillers and on/off control of FCUs with some measures have been taken from the view of cost saving. Introduction of the variable speed control by inverter was proposed in the past, but this proposal was turned down because it was considered that required investment be too large to expected energy saving.

Not only this building but the other buildings in Hanoi, where it is so humid, are using air-conditioning system to de-humidify. Introducing desiccation system can make setting temperature some degrees up and reduce energy consumption of air conditioning system.

2.8.10 On-site Survey Report (Building B)

1) Outline of building

(1) Name and type: Building B (government office)

(2) Location: Hanoi City

(3) Outline of building

a) Completion: 1959 (an air-conditioner system was installed in 1996)

b) Gloss floor area: 8,000 m^2, four floors above the ground

c) Number of rooms: 137 rooms (about 50 m^2/room)

d) Number of the employees: 300 persons

e) Annual electric power consumption: (no data)

f) Main equipment

Air-conditioner: central air-conditioner
water-cooled water chiller × 2 (quantity control)
FCU × 138 (VAV)

Lighting fixture: 20 W × 4 lamps × 3 units/room

BAS: none (When the chillers are turned the power off, FCUs are also turned the power off.)

(4) Implemented EE&C measures

a) Water-cooled chiller × 2 (manual quantity control)

b) VAV (introduced in each room)

c) CFL (every indoor lighting)

Figure 2.8.10-1 Appearance of Building B

2) Outline of energy on-site survey

(1) Survey team member

JICA Study Team: Mr. Tsuyoshi Onoguchi, Mr. Yoichi Isobe

Institute of Energy: Mr. Khanh, Mr. Song

(2) Survey period: September 29 - October 1, 2008

(3) Object of survey: energy consumption of the air conditioning system

3) Results of energy on-site survey

(1) Status of energy management

a) Energy management system

The energy management organization has not been established. Targets of energy intensity and energy conservation activities have not been set up, either. The central air-conditioning system which was installed in 1996 does not have an automatic control system. Operation indicator values of equipment have been decided by both experience and sense of operators.

b) Implementation of measurement and record

Neither measurement nor record has been done. One of the serious problems is that both the inlet and outlet temperature gauges of cooling water are broken.

c) Maintenance of equipment

Filter cleaning has been carried out every two months and its full-maintenance every three years. Maintenance of measuring instruments has been properly carried except the above-mentioned temperature gauges.

d) Energy consumption management

Energy consumption management with measurement and record has not been implemented. Electric power consumption, which is mainly used in the air-conditioning, is able to be known only by the electricity bills from the power company.

e) Energy consumption intensity management

Since energy consumption management has not been carried out, energy consumption intensity management has not been carried out, either.

f) PDCA management cycle

The PDCA management cycle has not been carried out yet. Installation of energy measuring instruments and setting their proper maintenance scheme is the first and most basic requirement for the PDCA management cycle.

(2) Potential of energy conservation (Refer Report for the customer)

a) Status of energy usage

・Daily load and management of power factor

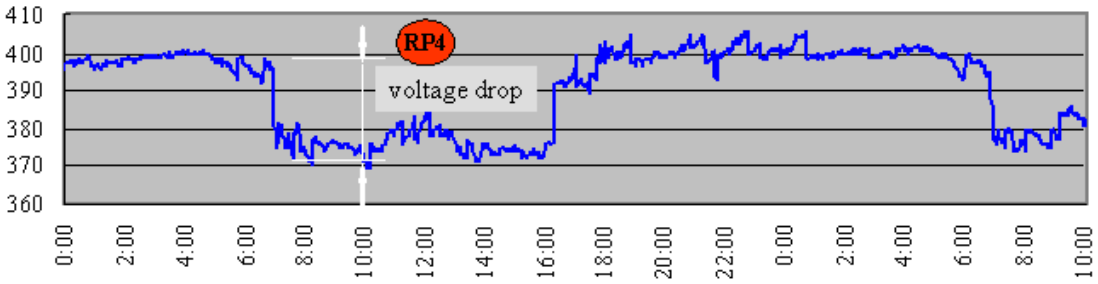


Figure 2.8.10-2 Voltage Fluctuation

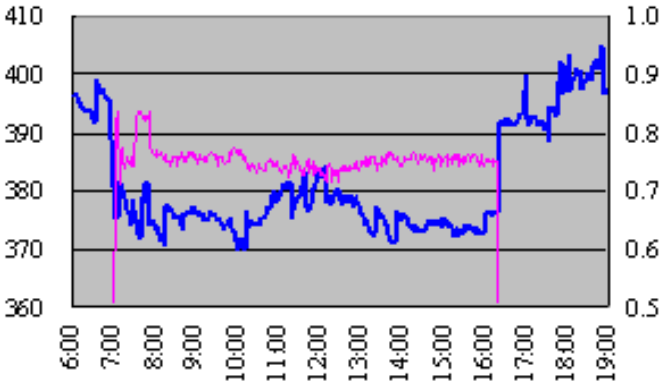


Figure 2.8.10-3 Power Factor

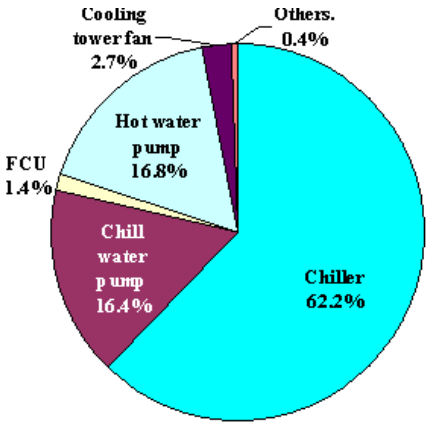


Figure 2.8.10-4 Load Balance of Air Conditioning System

b) Main countermeasures

・Rewiring distribution line in premises (Combined power factor improvement: –7%)

The line voltage declines by 30V (8% or less) when the air-conditioner system operates. Because the rating of chiller is 400V, this is not an appropriate operation. This voltage

drop is mainly caused by the secondary side copper loss of receiving transformer and distribution loss from receiving transformer to board of the air-conditioner system. Revision distribution line in premises including power receiving system to reduce the impedance of them is required.

・Installation of capacitors for improvement of power factor

Power factor is 75% in the operation of air conditioning system. Because power factor of the chiller, whose electricity consumption excess 62% or more of the total consumption of air-conditioner system, is 79.5% as specification, so the peripherals like FCU, pump, cooling tower, etc. may make it worse. Because this poor power factor shall increase the apparent current also, it shall be the factor of above-mentioned voltage drop. (The required power factor is equal to or more than 85%.)

・Setting an operating rule on consideration of energy saving and enforcement of energy management (–8% = –3% + (–5%))

The current operation of air conditioning system is based on the experience, sensation of operators and request from persons in the building. Furthermore, setting of temperature has been carried out based on temperatures measured with inaccurate temperature gauges. Air-conditioning system should be operated under the rule and temperature should be adjusted based on temperature gauges.

Setting “Operating rule on consideration of energy saving” as below and operating it shall surely reduce the energy consumption.

i) Usage cold energy of cold water (–3%)

Shutdown of only chillers 30 minutes before whole system shutdown is also effective for energy conservation.

For example, in case of operational hours from 07:00 to 17:00, shutdown only chillers at 16:30 and the other whole system shutdown at 17:00.

At present, both the inlet and outlet temperature gauges are broken. Repairing and calibration of both required. And rules for measuring, calibration and record should be established.

ii) Expanding difference between inlet and outlet water temperature (–5%)

According the specification of chiller, the inlet temperature is set at 12ºC and the outlet temperature 7ºC, which is the default value. And there is 5 degrees difference between them. Expanding the difference from 5 degrees to 7 degrees is known as one of the effective way for energy conservation.

This building is well-heat insulated, so in comparison, capacity of air conditioning system is over-designed. In such case, this measure may be effective.

iii) Operating chillers not based on the supply (outlet) temperature but on the return (inlet) temperature.

This is more effective than that based on the outlet temperature.

・Introducing desiccant dehumidifier system (–20%)

Air-conditioning system often is used not only for cooling but for dehumidifying which is super cool operation. Introducing desiccant dehumidifier system shall make more than 20% energy saving.

c) Sub countermeasures

・Variable speed control by inverter

Variable speed control by inverter should be introduced for chillers and water feed pumps.

・Introducing night purging (–5%)

Room temperature in night time is 1ºC to 4ºC higher than outside. In such case, intake-air from outside in a positive way in night time reduce air-conditioning load of this building of the next day.

・Infrared reflective coating on the roof (–20%)

With the application existence or non-existence of infrared reflective coating on the roof, 7ºC or more difference is sometimes born at the room temperature.

d) Potential of energy conservation (–15% (with desiccation system –27%))

・Rewiring distribution line in premises (Combined power factor improvement: –7%)

・Setting an operating standard based on consideration of energy saving and enforcement of energy management (–8%)

・Introduction of desiccation system (-20%)

0.07(rewiring)+0.08(standard, management)+0.6×0.2(desiccation)=0.27

(without desiccation system 0.15)

4) Remarks

2 on-site surveys were carried out for this building under the situation that the power distribution system on a premise hadn't been completed.

For the viewpoint to promote EE&C, proper temperature setting, and enhancement of the management of the air-conditioning system shall be prioritized, moreover the power distribution loss between the receiving transformer to the board of the air-conditioner system and the load unbalanced among three-phase are observable.

These matters are the issue of the electricity management, and not EE&C. It assumes that there is a lack of decrees, regulations or standards as Japanese electric facility technology standard for applications. The need for regulation as mentioned above shall be clarified soon.

2.8.11 On-site Survey Report (Building C)

1) Outline of building

(1) Name and type: Building C (hotel)

(2) Location: Ho Chi Minh City

(3) Outline of building

a) Completion: 1930 (block A: 4 floors with 27 rooms), expanded in 1945 (Block B: 13 floors with 80 rooms), an air-conditioner system was introduced in 1997, another expansion is scheduled in 2010 (block C: 26 floors with 165 rooms)

b) Gloss floor area: 9,946 m^2

c) Number of rooms: 107 rooms (272 rooms from 2010)

d) Annual electric power consumption: 1,948 MWh

e) Main equipment

Power receiving Transformer: 1,500 kVA (15 kV / 400 V)
Generator: 750 kVA × 1 unit
Air-conditioner: water-cooled type split air-conditioner (Block A)
cooling tower × 3 (quantity control)
split type air-conditioner × 110 (Block B)
Lighting fixture: FL or CFL (13 kW)
Elevator: 2 units (Block A), 3 units (Block B) with variable speed control
BAS: none

(4) Implemented Energy- Conservation measures

a) CFL and FL (every lighting)

b) Cooling tower × 3 (manual quantity control)

c) Elevator: 3 units (Block B) with variable speed control

d) Certification of ISO14001 in 2004

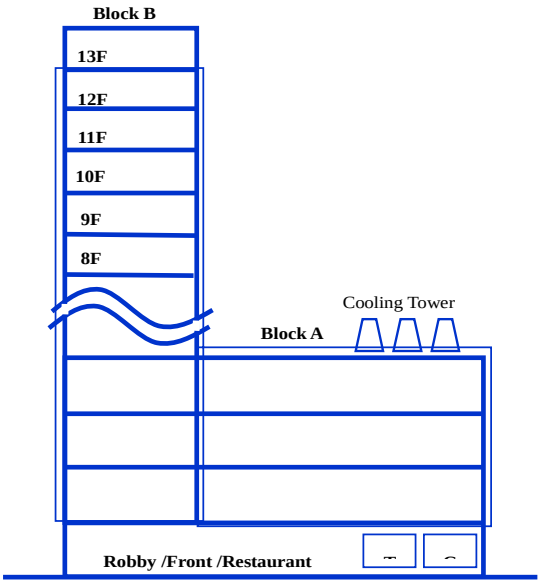


Figure 2.8.11-1 Outline of Building C

2) Outline of on-site survey

(1) Survey team member

JICA Study Team: Mr. Tsuyoshi Onoguchi, Mr. Yoichi Isobe
Institute of Energy: Mr. Song, Mr. Hau
ENERTEAM: Mr. Ving, Mr. Thuan

(2) Survey period: November 4, 6 and 7, 2008

(3) Object of survey: energy consumption status of the whole building

3) Results of energy on-site survey

(1) Status of energy management

a) Energy management system

The energy management organization has not been established. The targets of energy intensity and energy conservation activities have not been set up, either. However in order to meet the requirements of ISO14001, measurement of power consumption of cooling towers has been carried out since September 2008. Measurement and record of energy consumption by each main load (equipment) is essential for the energy conservation. Setting values of these equipment should be done by operators based on the measured data.

b) Implementation of measurement and record

As described above, measurement of power consumption has been carried out only for cooling towers. Measurement of power consumption by other main equipment should be carried out.

c) Maintenance of equipment

As a whole, maintenance of equipment has been carried on properly. However, a decade has passed since the air-conditioning system was installed; it is the time that the renewal of the facility should be considered. Some of the split air-conditioners in Block B had been already replaced.

d) Energy consumption management

The energy consumption management by measurement and record has not been done. The amount of electric power consumption is able go be known only by the electricity bills from the power company. This is not enough for functional energy conservation .

This building has two machine rooms because of the past expansion of Block B, it makes grasping electricity consumption more complicated.

e) Energy consumption intensity management

Since energy consumption management has not been carried out, energy consumption intensity management has not been carried out, either.

f) PDCA management cycle

The PDCA management cycle has not been carried out yet. The PDCA management cycle should be introduced for energy consumption management and equipment improvement.

(2) Potential of energy conservation (Refer Report for the customer)

a) Status of energy usage

・Annual electricity consumption based on bill of power company is 1,948 MWh and seasonal fluctuation is almost zero. The occupation of Block A is 68% and of Block B is 32% in electricity at 2 pm when the peak demand appears (Main load are caused by the air condition system).

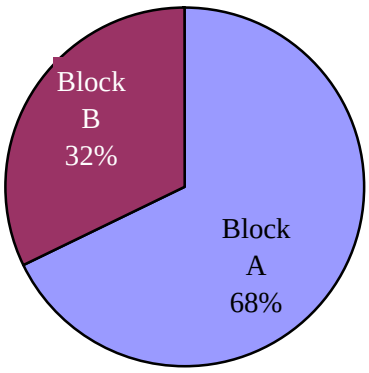


Figure 2.8.11-2 Occupation of Block A and Block B

・Daily load management including power factor

The descent of the line voltage is stable with about 5 V. But load unbalance among three-phases is seen in Block B. The reason of this unbalance is estimated to be caused by the split type air-conditioner in the Block B. And it is confirmed that there is a correlation between the allocation order of room at the checking in time and this unbalance. Although it is not big issue, re-wiring is recommended if there is an opportunity to modify air-conditioning system.

The power factor is fluctuating between 7 ~ 8%, center value is around 85% and declines relatively in nighttime.

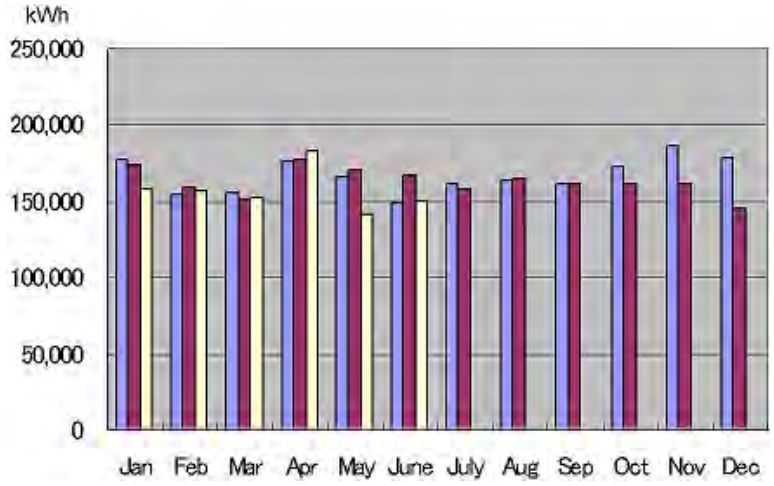


Figure 2.8.11-3 Monthly Eectricity Consumption

b) Main countermeasures

・Introducing energy-saving air conditioning system in Block B (–30%)

Since it has passed more than ten years after installation of these air conditioners, it is about the renewal time. In this decade, power consumption rates of split air-conditioners have been improved more than 30%, the renewal of air-conditioners should be planned.

・Introducing BEMS or enforcement of energy management(–5%)

After the expansion of Block C, the scale of this hotel will be 2.5 times of the present, and power consumption status will also increase and the power system will become complicated. Optimal control and high-level management of equipment become possible by introducing BEMS and imputing data such as environmental management standards, standard control ranges, limit values, external conditions, etc.

・Power receiving system

Introduction of an electric power monitoring system, which includes the power (including power factor) measuring and recording on the main branch and some sub-main feeders, is recommended. It can be used to investigate how to reduce electric power consumption and how to improve the power factor by capacitors as below. If BEMS is introduced, this function shall be achieved.

c) Sub countermeasures

・Variable speed control by an inverter air-conditioning system

At present, the air-conditioning system is composed of water-cooled type split air-conditioners (Block A) and air-cooled type split air-conditioners (Block B). The cooling towers for the former are operated in manual quantity control according to the outside air temperature. Variable speed control by an inverter should be introduced for the water feed pump or cooling towers fans.

・Block-off or make use of wind

This building lets a lot of air pass through and its air-conditioning load is relatively small. On the other hand, the strong wind from the lobby, 2nd and 3rd floors blow through the restaurant and kitchen and the cooled air goes away to the outside. Installation of air-curtains and a total heat exchange system are worth of consideration.

・Installation of capacitor for improvement of power factor

It is estimated that the occupation of air-conditioners of guestrooms in the electric power consumption of this hotel rise in night time.

After the expansion of Block C, the power factor will be worse because of increase of air-conditioners. Installation of the capacitor and its effectual operation will improve the power factor and reduce the risk of additional payment for low power factor.

d) Potential of energy conservation (–10.8%)

・0.32 × 0.6×0.3 (AC) + 0.05 (BEMS or EM) = 0.1076

4) Remarks

It is the historic colonial hotel which was built in 1930 and under control of the Ho Chi Minh City Sightseeing Bureau. Basically they are interested in the energy saving in view of the management. And they were certified ISO14001 in 2004.

In addition, It plans the expansion of Block C (26 floors with 165 rooms) in 2010. After that, this hotel will be 2.5 times bigger than the present, and power consumption will also be huge. In this sense, they are interested in energy management system.

Not only introducing of EE&C equipments and know-how, but also supporting the systematic renewal planning for EE&C is required strongly.

2.8.12 On-site Survey Report (Building D)

1) Outline of building

(1) Name and type: Building C (shopping center)

(2) Location: Ho Chi Minh City

(3) Outline of building

a) Completion: 1880, expanded in 1942 (the 4th floor), it became a department store with 200 emporiums in 1981. Large-scale repair was carried out in 1997 with installation of escalators, elevators, an air-conditioner system.

b) Gloss floor area: 15,000m^2 (the biggest shop in Vietnam, at that time).

c) Number of the emporiums: 200 emporiums

d) Annual electric power consumption: (8,452,357 kWh)

e) Main equipments

Power receiving Transformer: (2000 kVA, 630 kVA, 400 kVA)

Generator: 1500 kVA × 2

Air-conditioner: central air-conditioner (1st, 2nd and 3rd floors), water-cooled water chiller × 2 (automatic quantity control),
AHU: 3 units in the 1st floor, 2 units in the 2nd floor, 2 units in the 3rd floor
Split type air-conditioner × 15 units in the 4th floor
Duct type package air conditioner × 4 units in the 4th floor

Lighting fixture: FL or CFL (more than 4,000)

Elevator: 3 units

Escalator: 6 units

BAS: none

(4) Implemented Energy-Conservation measures

a) CFL and FL (every lighting)

b) Elevator: 3 units (variable speed control)

c) Capacitor for power factor

d) Sprinkler for metal roof

e) Automatic central air-conditioning system

f) Air curtain

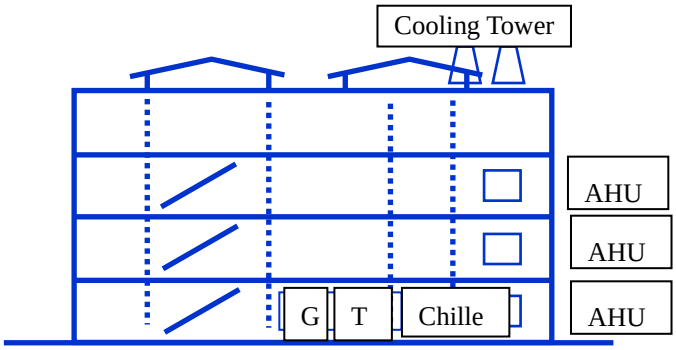


Figure 2.8.12-1 Outline of Building D

2) Outline of on-site survey

(1) Survey team member

JICA Study Team: Mr. Tsuyoshi Onoguchi, Mr. Yoichi Isobe

Institute of Energy: Mr. Song, Mr. Hau

(2) Survey period: November 10 and 11, 2008

(3) Objective of survey: energy consumption status of the whole building

3) Results of energy on-site survey

(1) Status of energy management

a) Energy management system

The energy management organization has not been established. The targets of energy intensity and energy conservation activities have not been set up, either. The central air-conditioning system which was installed in 1997 has the automatic control system. However the operation indicator values of equipment has been set at the manufacturer's default values. These values should be re-set by the building operators themselves.

b) Implementation of measurement and record

Electric power panels which have volt-ampere meters, power factor meters of main and sub-main feeder lines. But neither the measurement nor the record for energy conservation is done.

c) Maintenance of equipment

The air-conditioning system for the 1st, 2nd and 3rd floors has been properly maintained because it has the centralized monitoring function. On the 4th floor, duct-type air conditioners which were installed in the early stage is still working, but their performance has been worsened because of insufficient cleaning and maintenance. There are a lot of dust, dirt and clogging on grilles of duct and out-door units, etc.

d) Energy consumption management

The energy consumption management by measurement and record has not been carried out. The amount of electric power consumption, which is the dominant energy use in this building, is able go be known only by electricity bills from the power company. This is not enough for functional energy conservation.

e) Energy consumption intensity management

Since energy consumption management has not been carried out, energy consumption intensity management has not been carried out, either.

f) PDCA management cycle

The PDCA management cycle has not been carried out yet. The PDCA management cycle should be introduced for energy consumption management and equipment improvement.

(2) Potential of energy conservation (Refer Report for the customer)

a) Status of energy usage

・Annual energy consumption

Annual Electricity consumption based on bill of power company is 8,452,357 kWh and monthly average is 704,363 kWh. Receiving system in this building consist of three transformers ,2000 kVA which is main transformer and provides power to air conditioning system and lighting fixture etc., 630 kVA which provides power to restaurant in 4th floors and escalator etc. and 400 kVA for others. Annual electricity consumption of 2,000 kV transformer which was seen from the results in 2008 is 7,358,638 kWh monthly average is 613,220 kWh. The electric power consumption ratio of each transformer is 87.1% of 2,000 kVA, 12.8% of 630 kVA, 0.1% of 400 kVA. And seasonal fluctuation is almost zero except February when it is Viet Nam's new year holidays.

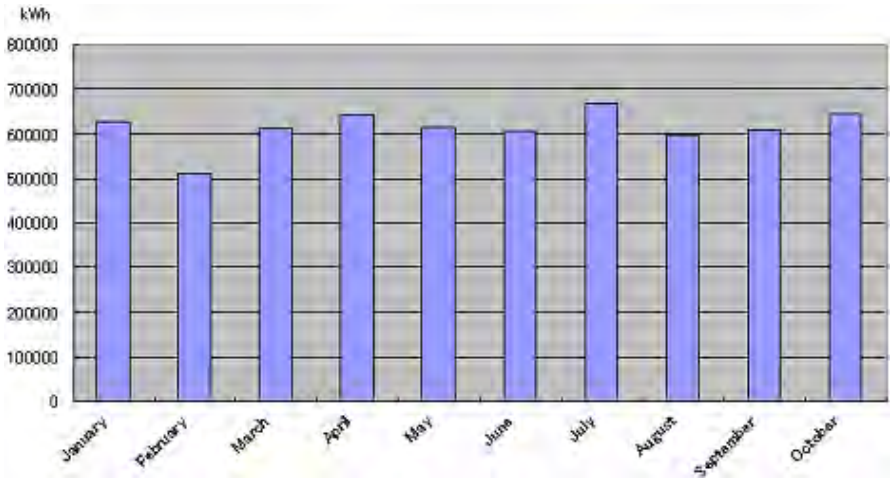


Figure 2.8.12-2 Monthly Electricity Consumption

Electric power consumption of two chillers of central air conditioning system, AHU and

the pump and so on is about 600 kW in amount. If running time per day is 14 hours, the energy consumption is 600kW × 14hr × 30day = 252,000kWh/month and it occupies 54.4% of the whole. Also, the approximate electric power consumption of four duct type package air conditioning systems is estimated as 42, 000 kWh , 9.1% in whole.

If it is estimated the hat electric power consumption of the individual split-type air conditioners which are installed in the 4th floor 150 kW, the total is estimated as 63,000kWh and accounts for 13.6%. And 77.3% of it is estimated to be an electric power consumption of the whole air-conditioner related electricity consumption.

Next main consumption is caused by lighting fixture in this building. And CFL has been already drastically introduced. If the average rate of lamp is assumed to be 18 W/piece and the number of it to be 5,000 pieces, then the total energy consumption comes to 90kW. Besides the energy consumption of the other fluorescent lamps is around 60kW, based on 600 pieces of 100 W. The total energy consumption of lighting fixtures in this building is estimated around 150 kW. Monthly electricity consumption of lighting fixture is estimated to be 63,000 kWh, 13.6%. of all. It was an instantaneous value (elevator and so on are contained is obscure) on the investigation day, but as for the 2,000 kVA transformer, 1,237 kW is the secondary electric power consumption and 82% is for air conditioning system 14% for lighting fixture.

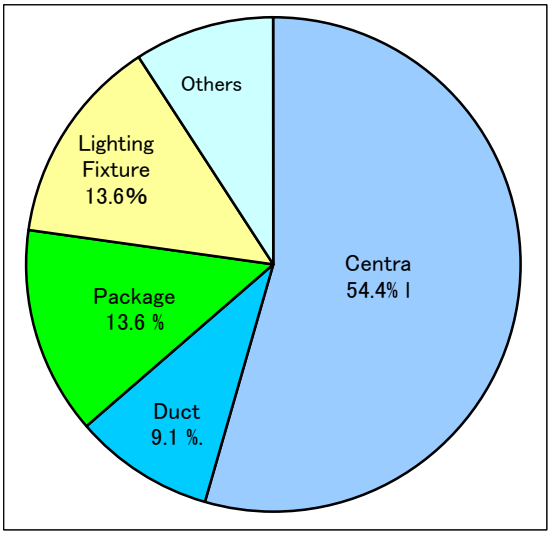


Figure 2.8.12-3 Load Balance

・Daily load and management of power factor

Daily load pattern is categorized into two, business hours and after the closing, but a fluctuation can't be seen in both patterns. The power factors of this building are 0.89 to 0.94, These values come from the appropriate set capacitors. The operating demand fluctuates significantly between the daytime and the nighttime, in such a case, it is worth considering reducing no-load loss in the transformers .

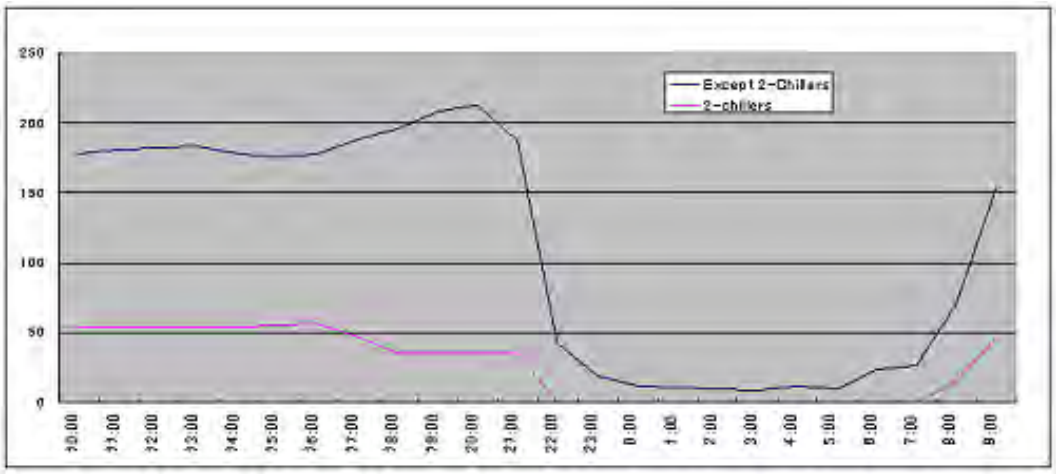


Figure 2.8.12-4 Daily Load Fluctuation

b) Main countermeasures

・Stop and remove duct type package air conditioners, improvement of operation(–100%)

In addition to the central air-conditioning system, various split type air-conditioners were installed in this building. The room temperature of the 1st to 3rd floor which is covered by central air-conditioning system, is going down at once after the air-conditioning starts and there is no big difference among the floors. On the other hand, the air-conditioner system for the 4th floor seems not to work effectively. For example the room temperatures goes up with the outdoor temperature rise .It can be estimated that the central air-conditioner system has enough capacity for three floors and split-type and duct type package air conditioners in the 4th floor have only small power for the limited area.

Also it assumes that these air-conditioners start to work all together at business hour start and continue to work at full capacities because that the daily load curve of the electric power consumption is stable.

First of all, understanding of the present operation condition, analysis, cleaning and maintenance should be carried out for all air-conditioners in the 4th floor. And especially, as for duct type package air conditioner, because the cool air does not come from blower, it shall be done to turn off or remove them.

Although there is a control system for central air-conditioner, to re-adjust opening and shutting of AHU and some ducts to meet actually condition will make exiting air-conditioner more comfortable and effective.

Figure 2.8.12-5 Room Temperature and Outside Temperature

・Adjustment the water temperature setting of chiller (–5%)

Re-adjustment in central air conditioning , even if there is a central controller to operate AHU and ducts to meet actually condition which can make much more comfortable circumstance.

On the survey day, the setting temperature of chiller is 6ºC for outlet and 11ºC for inlet. But actual temperature of inlet is 9ºC.

In this case, the central air-conditioning system which was installed in this building have the bigger capacity which can cover the whole of this building including the 4th floor. The detail investigation of air conditioning system or re-designing of total air-conditioning system of this building shall be recommended.

・Introducing electronic ballast (–8%)

The introduction of already thoroughgoing CFL has been done and then the energy saving of the fluorescent lamp except CFL shall be required. Changing the existing ballasts to electronic ballasts is effective.

c) Sub countermeasures

・Infrared reflective coating on the roof (–20%)

With the application existence or non-existence of Infrared reflective coating on the roof, 7 ºC or more difference is sometimes born at the room temperature.

・Water spray for outdoor units of split type air-conditioner

・Reducing no-load loss of the transformer

Reducing no-load loss of the transformer by introducing of the amorphous transformer or Transformer Bank for example is recommended.

・Introducing BEMS (–5%)

After the expansion of Block C, the scale of this hotel will be 2.5 times of the present, and power consumption status will also increase and the power system will become complicated. An optimal control and high-level management of equipment becomes possible by introducing BEMS and imputing data such as environmental management standards, standard control ranges, limit values, external conditions, etc.

・Introducing night purging

Room temperature in night time is 1ºC higher than outside. In such case, intake-air from outside in a positive way in night time reduce air-conditioning load of this building of the next day.

d) Potential of energy conservation (–11.6%)

・Stop and removal duct type package air conditioners based on the energy management and analysis (–100%)

・Adjustment of chiller temperature setting based on the energy management and analysis(–5%)

・Introducing electronic ballast (–8%)

・0.091 × 1(duct) + 0.545 × 0.05 (temperature setting)+ 0.136 × 0.4 × 0.08(electronic ballast) = 0.116

4) Remarks

This shopping center is one of the most famous ones in Vietnam. This building was built more than 100 years as an office building, and then large-scale expansion and repair such as installation of vaulted ceiling, elevators and escalators were implemented. Therefore, it has some problems mainly in the air-conditioning system. In Vietnam, many old buildings are used after renovation like this building, and since the design of air-conditioning system in some of them seems not adequate, there exists some common problems in the air-conditioning systems.

As for “water spray” on the steel roof of 4th floor which was implemented at this building, an effect like “Uchi-mizu” in Japan was expected. But essentially, this is an option which was applied after the installation of inadequacy designed air-conditioning system .

When the air-conditioning system is renewed in the near future, re-design should be done considering the balance of air-conditioning in the whole building.

2.9 Progress Situation of Other Projects in "National Strategic Program on EE&C"

The "National Strategic Program on EE&C" is composed of 11 programs which are implemented by 6 groups. Table 2.9-1 shows progress situation and major implemented items in each project.

Table 2.9-1 Overview of National Strategic Program on EE&C

Group	Program	Progress situation	Major implemented items
Group 1 **Intensification of management function**	Program 1	Good	**Intensification of the state administration on energy saving and effective use, organizing controlling system on energy saving (MOIT)** - Drafting Energy conservation law (Ver.13) - Creation of energy performance standard, selection of labeled equipments - Capacity building for existing energy conservation centers, establishment of new centers
Group 2 **Awareness raising**	Program 2	Good	**Awareness raising of energy saving and effective use (MOIT)** - Awareness raising through mass media (TV, radio, web) - Energy conservation exhibition, contest - Energy conservation training
	Program 3	Medium	**Incorporation of energy conservation education into the national education system (MOET)** - Establishment of expertise committee
	Program 4	Medium	**Pilot campaign of "energy saving in household" (MOIT)** - Model project of solar water heater and bio gas
Group 3 **Promotion of high efficient equipments**	Program 5	Good	**Development of energy performance standards and commencement of energy-saving labeling scheme (MOST)** - MEPS for 11 items and labeling for 3 items - Establishment of CFL sales network by EVN, solar water heater pilot projects
	Program 6	Medium	**Technical assistant to domestic energy efficiency product manufacturers (MOST)** - CFL production increase in domestic lamp manufacturers
Group 4 **Energy efficiency in manufacturer**	Program 7	Medium	**Establishment of controlling model of energy saving and effective use in enterprises (MOIT)** - Energy conservation surveys/projects in energy intensive manufactures - Identification of energy conservation scale - Energy audit
	Program 8	Medium	**Assistance for manufacturers to improve energy efficiency in production line (MOIT)** - Financial assistance for energy conservation model project
Group 5 **Energy efficiency in Building**	Program 9	Slow	**Capacity building for energy efficiency-design and management in buildings (MOC)** - Training on Building Code - Green Building activity
	Program 10	Slow	**Creation and promotion of energy efficiency building model (MOC)** - Energy conservation pilot project
Group 6 **Energy efficiency in transport**	Program 11	Slow	**Maximum utilization of transportation capacity, minimizing fuel consumption and decrease of emission (MOT)** - Small scale energy conservation project

The "National Strategic Program on EE&C" is categorized into 6 groups; Group1 (Intensification of management function), Group2 (Awareness raising), Group3 (Promotion of high efficient equipments), Group4 (Energy efficiency in manufacturer), Group5 (Energy efficiency in Building) and Group6 (Energy efficiency in transport).

Group1 (Intensification of management function) and Group3 (Promotion of high efficient equipments) have made relatively greater progress than the other groups. Regarding formulation of Energy Conservation law, one of the major activities in Group1, the bill is planed to be submitted to the congress within 2009, though the initial time table was 2008. Group3 (Promotion of high efficient equipments) has developed energy performance standards for 11 equipments/appliances and initiated labeling program for 3 equipments/appliances. In addition, technical assistance to the domestic lamp manufacturers has led large increase in production of CFL. It is desirable for the both groups that the institution should be rapidly built and its coverage should be expanded.

In Group2 (Awareness raising) and Group4 (Energy efficiency in manufacturer), it is highly evaluated that quick-impact and tangible (energy conservation effect is quantifiable) projects are being implemented, like residential solar water heater introduction and energy efficiency projects in the energy intensive industry. However, verification and enlargement of these projects are required hereafter.

Regarding Group5 (Energy efficiency in Building) and Group6 (Energy efficiency in transport), almost no concrete measures have not so far been taken. In Group5, further implementation of model projects in building sector is needed. In Group6, energy efficiency-oriented urban and transport planning is essential, though this requires long-term vision.

The completed programs in 2007 ~ 2008 and the planned programs in 2009 are presented in detail in 2.9.1.

2.9.1 Progress Situation of Each Project

1) Group 1 (Intensification of management function)

- Although formulation of the EC Law has been prepared since 2007, it is highly likely that submission to the congress would be postponed to the middle of 2009 from within 2008, initial time table. Collaboration with related ministries should be strengthened rapidly and effectively.
- The current capacity building for local energy conservation center should be further strengthened.
- Selection of targeted items to be labeled is smoothly progressed.

Program 1	**Intensification of the state administration on energy saving and effective use, organizing controlling system on energy saving (MOIT)**
Items	- Issuance of documents guiding existing laws and decrees related to activities of energy saving and effective use. - Establishment of energy mechanism, policy and tariff in accordance with trend of energy policy of regional countries and other countries in the world - Establishment and issuance of Vietnamese construction standards on "Energy saving and effective use Constructions". - Selection of 10 items (equipments) for labeling scheme and development of energy performance standards - Drafting and submitting the EC Law in the period of 2008 - 2010 to National Assembly for his approval. - Development of management system on energy saving and effective use in provinces, cities directly under Central government (including organization and consolidation of activities of 8 energy conservation centers established in 3 regions)
Achievement 2007	- Basic survey for development of the EC Law (Energy conservation center in HCMC, DOIs). - Establishment of energy consumption database (IT center, IE)
Achievement 2008	- Survey on energy management situation in foreign countries, Draft of the EC Law - Development and publication of energy performance standard for CFL, electric ballast, electric rice cooker. Draft of energy management standard. 3 companies (Electrical Devices Joint Stock Company No.1, Hanoi Lighting & Urban Equipment Ltd. Company, Philips Vietnam) started labeling for electric ballast, T8 fluorescent lamp and street lamp. - Capacity building for the existing ECCs (Hanoi, HCMC, Tien Giang). Establishment of new centers (Hai Phong, Phu Tho, Phu Yen, Lam Dong)
Plan 2009	- Submission of the draft of the EC Law to the congress (second congress) - Strengthening and continuation of cooperation with local DOIs for energy conservation promotion - Support for building capacity in consultation of ECCs. Nationwide networking of energy saving service.

2) Group 2 (Awareness raising)

- Awareness raising campaign by means of mass media currently steadily progressed should be continued.
- Although, ECC Hanoi and ECC HCMC are promoting energy efficiency activities in educational institutes, energy conservation education has merely experienced establishment of expertise committee and campaign. Additional cooperation with MOET is required.
- Although introduction of solar water heater and biogas kitchen to households was realized through cooperation with local communities, this stays in small-scale. Project implementation should be accelerated.

Program 2	**Awareness raising of energy saving and effective use (MOIT)**
Items	- Producing broadcast and television programs on energy saving and effective use - Establishment of website on energy saving and exhibition of energy efficiency technology & equipment (6 sites). - Organizing training courses on energy saving for managers, engineers, public relations, etc. (6 courses) - Organizing competitions on energy efficiency technology in 2008 and 2013. - Publishing leaflets, posters and brochures on successful model of energy saving and effective use in local government, enterprises or buildings.
Achievement 2007	- Formulation of energy conservation communication program (Asian Communication technology JSC) - Awareness raising through TV (Vietnam TV, Industrial TV) - Awareness rising through radio (Voice of Vietnam) - Creation of leaflet (Ministry of Culture and Communication) - Creation of Web site for VNEEP (IT center)
Achievement 2008	- Development 500 energy conservation radio programs jointly with Voice of Vietnam, Vietnam Television, EVN and the others (energy conservation contest, periodicals, entertainment program) - Establishment of 16 classes in which 450 trainees are trained for energy conservation advertisement. - Organizing 2nd contest of energy conservation building, participating in ASEAN energy conservation contest (Majestic Hotel, Six Senses Hideaway Resort and Ninh Van Bay were awarded). - Organizing energy efficiency equipment trade fare (50 companies joined, 117 booths, 10,000 visitors in 3 days) - Organizing energy conservation equipment exhibition in HCMC (Ecoshopping), mainly targeted home appliances (microwave oven, inverter air conditioner, refrigerator, cloth washer, electric rice cooker, fan) - Training for managers in DOI, DOE, energy conservation centers, designated facilities
Plan 2009	- Production of energy conservation program in TV and radio (Vietnam Television, Voice of Vietnam) cooperating with MOIC (Ministry of Information and Communication).

Program 3	**Incorporation of energy conservation education into the national education system (MOET)**
Items	- Compiling text books, teaching methods for energy saving and effective use (elementary school - high school). - Establishing syllabus, compiling textbooks for vocational schools. - Establishing syllabus, compiling textbooks for universities and colleges.
Achievement 2007	(None)
Achievement 2008	- Establishment of expertise committee for energy conservation education program and compilation of text books - Energy conservation campaign in schools
Plan 2009	- Formulation of program and compilation of text books. Energy conservation education instruction for teachers.

Program 4	**Pilot campaign of "energy conservation in household" (MOIT)**
Items	- Energy conservation in project in households (100 households in 6 sites). - Training for staffs participating in the projects. - Evaluation on existing energy consumption equipments and proposal. - Offer of energy efficient equipments at preferential price - Project evaluation and proposal of popularization.
Achievement 2007	- Promotion of biogas cooker (3 provinces, IE) - Energy conservation campaign by Vietnam Women Union (6 provinces) - Pilot project of solar water heater (Hanoi Institute of Technology) - FS for biogas utilization
Achievement 2008	- Widening energy conservation campaign (Vietnam Women Union, Vietnam Farmers Union, local Women Unions). 4 sites in 2007 and 8 sites (Dien Bien, Hai Phong, Ha Tinh, DakLak, An Giang, Ninh Binh, Thanh Hoa, Binh Dinh) were added in 2008. - During 2007 ~ 2008, 3000households experienced energy conservation project, and 560 biogas tanks (6～30m3) were installed (Hanoi, Ninh Binh, Thai Binh, Thanh Hoa, Nghe An, Quang Ngai, Binh Dinh, Dong Nai). - Solar water heaters were installed in 70 households (Hanoi, Son La, Dong Nai). Industrial biogas tank (250m3: power generation, anaerobic biogas: 1,000m3, 5,000m3) demonstration project was also carried out.
Plan 2009	- Continuation of local community level energy conservation activities cooperating with Vietnam Women Union, Vietnam Farmers Union, etc.

3) Group 3 (Promotion of high efficient equipments)

This group aims at development of standards and initiation of labeling scheme, as well as elimination of low efficient appliance from the market.

- Development of standards is smoothly progressing. Enlargement of coverage and periodic revision of the standards would be the next issues. Additionally, expansion and strengthening of the labeling scheme should be examined ("voluntary or mandatory" and "endorsement or comparative").
- It is highly admired that financial support is provided to the domestic CFL manufacturers.

Program 5	**Development of energy performance standards and commencement of energy-saving labeling scheme (MOST)**
Items	- Investigation on energy consumption situation of energy-consumed appliances (penetration rate of each appliance, listing energy-intensive appliances and classifying by efficiency level) - Compilation and publication of MEPS for t targeted products (fluorescent lamp, ballast for fluorescent lamp, electric fan, electric motor, air conditioner and refrigerator) in period of 2006 - 2010 and 5 standards for 5 appliances to be selected in the period of 2011 - 2013. - Development of program and testing system of energy efficiency, creation of website of activities of labeling energy-saving products.
Achievement 2007	- Development of standards for air conditioner, electric fan and refrigerator (Vietnam Standard Center) - Energy performance standard for OA equipments (Vietnam computer Company) - Advertisement of energy efficiency lamp and motor (Dein Quang, JSC)
Achievement 2008	- Pilot project of residential solar water heater (EVN collaborating with Energy Conservation Center of Hanoi and HCMC, 3000 households in 3 sites) - Establishment of CFL sales network collaborating with EVN. CFL price is 10% lower than market price (2,948 distributors; 1742 EVN-affiliate and 1206 others as of Nov/2008). 1.2 million CFLs were sold. - Financial support to testing organization for air conditioner and refrigerator regarding creation of energy performance standard (6.9 billion VND).
Plan 2009	- Completion of financial support to testing organization for air conditioner and refrigerator regarding creation of energy performance standard - Pilot program for labeling scheme for air conditioner, refrigerator, electric fan and CFL - Continuation of creation of energy performance standards for the other appliances. Market survey necessary for standard setting will be carried out. - Financial support to testing organization for air conditioner and refrigerator regarding creation of energy performance standard (3.1 billion VND to Institute of Energetical and Mining Machines)

Program 6	**Technical assistant to domestic energy efficiency product manufacturers (MOST)**
Items	- Organizing workshops, forums to discuss with domestic manufacturers on energy-saving appliances; identifying the necessary requirements for applying in design of product and technology with the aim at producing higher efficiency products, meeting the market demand; updating the latest national standards on energy efficiency. - Providing training courses to improve capability of economic analysis of projects for some enterprises - Encouragement of collaboration among companies on energy efficiency improvement. - Assistance for manufactures to make action plans to manufacture energy efficient appliances which meet the standards.
Achievement 2007	- Technical assistance for labeling on CFL and T8 fluorescent lamp (Rang Dong Bulb & Thrmos JSC) - Strengthening of testing facility for lamps (Dien Quang Bulb JSC)
Achievement 2008	- Amount of production of CFL by Dien Quang Lamp Joint Stock Company has increased to 6 million.
Plan 2009	- Financial support to Vietnam Electronics and Informatics Joint Stock Company (Industrial and commercial LED manufacturer): 5 billion VND

voluntary←|→mandatory

	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
T8 fluorescent lamp	F																			
	F																			
CFL						F														
Street lamp						F														
						F														
Electric ballast						F														
Magnetic ballast	F																			
	F																			
Air conditioner			F																	
Electric fan			F																	
Refrigerator			F																	
Electric water heater						F														
Solar water heater						F														
3-phase motor	F																			
Washing machine																				
Electric rice cooker																				
Other home appliances (*)																				
Equipments for commercial use(*)																				
Equipments for industrial use(*)																				
Materials(*)																				
Renewable enegies(*)																				

Standard
Labeling

Note: "F" means enforcement.
*: See the table below

Other home appliance	micro wave oven, cleaner, air purification system, drying machine
Equipments for commercial use	hard disk of PC, screen of PC, printer, copy machine, facsimile machine, commercial refrigerator
Equipments for industrial use	industrial fan, boiler, 3-phase electric transformer, energy efficiency glass, insulation material, solar water heater and photovoltaics
Materials	energy efficiency glass, insulation material, solar water heater and photovoltaics
Renewable energies	solar water heater, photovoltaics

Endorsement Label

Shift from endorsement to comparative for some items

Comparative Label

Figure 2.9.1-1 Situation of Energy Performance Standard and Labeling Scheme

Figure 2.9.1-1 shows progress situation and future planning of energy performance standards and labeling scheme. As of March 2009, development of standards are completed for 11 items; T8 tube fluorescent lamp, CFL, street lamp, electric ballast, magnetic ballast, air conditioner, electric fan, refrigerator, electric water heater, solar water heater and 3-phase motor. The labeling scheme has started for T8 tube fluorescent lamp, street lamp and electric ballast and will start for 3-phase motor within 2009.

Moreover, a variety of items are selected for candidate, like micro wave oven, cleaner, air purification system, drying machine, hard disk of PC, screen of PC, printer, copy machine, facsimile machine, commercial refrigerator, industrial fan, boiler, 3-phase electric transformer, energy efficiency glass, insulation material, solar water heater and photovoltaics.

< Voluntary or mandatory >

The labeling scheme currently under implementation and examination is voluntary. However, it is planed to shift to the mandatory scheme for all items during 2012~2014.

< Endorsement or comparative>

The label type currently under implementation and examination is endorsement type. The comparative type label would be applied to the items whose energy efficiency varies widely by products.

4) Group 4 (Energy efficiency in manufacturer)

The energy efficiency model projects for energy intensive industry and street lighting are being implemented. Energy conservation effect is quantified in these projects.

The detailed information on the model projects should be provided publicly, such as scale and budget of energy efficiency measures, energy conservation effect of each energy resource and each type of use, etc. It is, therefore, required to increase model projects and create database for success case studies.

Program 7	**Establishment of controlling model of energy saving and effective use in enterprises (MOIT)**
Items	- Documentation of case study of energy efficiency models in abroad - Organizing training courses on energy management for heads of departments of enterprises - Creation of sample models on energy management for 6 targeted industries. - Investigation and evaluation on capability of energy consulting agencies. Establishment of energy service organizations and improvement in the capability
Achievement 2007	- Energy consumption survey in industrial sector (200 surveys by IE) - Energy efficiency success case study (Hanoi Institute of Technology)
Achievement 2008	- Implementation of energy efficiency project and energy managers training in the energy intensive industry (Vietnam Coal–Minerals Group, Vietnam Electricity Group, Vinashin Group (Vietnam Shipbuilding Industry Group), Vietnam Steel Corporation, Vietnam National Cement Corporation, Vietnam National Chemical Corporation, some Beer-Beverage enterprises) EVN: realized 669.2 million kWh saving in office, street lamp, manufactures, etc. in urban area in 2007 (exceeded the target by 15%). In 2008 realized 1.0035 billion kWh saving through collaboration with local people's committee. Vietnam Coal – Minerals Group: carried out energy consumption survey in coal industry, energy audit at 3 sites and energy efficiency projects (increase in voltage, inverter, improvement in power factor). Vinashin Group: carried out energy consumption survey in ship industry, followed by energy efficiency proposal to 2 manufactures and also implementatin of energy efficiency pilot projects in Pha Rung Shipbuilding Corporation Vietnam National Cement Corporation: implemented kiln waste heat recovery power generation in 6 cement factories in 2007 and 2008 in the framework of CDM (e.g., 4.5MW power plant in Hoang Mai Cement Company planned to be in oepration from 2010). In addition, inverters were also introduced. Vietnam Steel Corporation: carried out energy consumption survey in steel industry and pilot energy audit, as well as proposed energy efficiency measures. - Energy consumption survey in 500 designated facilities, which revealed energy saving potential; 3~5% in textile, garment and chemistry, 10% in cement and 15% in paper pulp. - Energy audit in more than 200 companies
Plan 2009	- Training course for managers and engineers in DOI, DOE, energy conservation center and designated facilities - Continuation of financial support to designated facilites to implement enegy efficiency measures

Program 8	**Assistance for manufacturers to improve energy efficiency in production line (MOIT)**
Items	- Establishment of mechanism, plan, and mode of assisting manufacturers to improve, upgrade and rationalize technology of energy consumption. - Assistance to enterprises to carry out energy audit and to implement energy efficiency projects - Implementation of some specific technological projects (waste heat recovery, co-generation, efficient motor, air conditioner and ventilator
Achievement 2007	- Energy efficiency support for production line (10 companies; IE, HUT) - Ventilation and electric equipment survey in coal mine (Mine research center) - Energy efficiency support for paper and pulp, food processing and dyeing industry (Vietnam heat association) - Energy efficiency support to water treatment plant (Energy Science Institute) - Energy efficiency support to companies in southern regions (HCMECC) - Energy efficiency support to plastic and rubber industry (Industrial technology and safety inspection center No.2) - Energy efficiency support to lighting in factories (Urban Lamp Association) - Development of standard for public lighting and energy efficiency promotion in Hanoi (Urban Lighting Equipment Company)
Achievement 2008	- Support to Rang Dong Plastic Joint Stock Company (20% electricity saving achieved by 3.3 billion VND support) - Support to Phu Yen Beer and Beverage Joint Stock Company (24.67% unit electricity consumption (kWh/unit product) saved (equivalent to 1.5 million kWh saving) by 1.3 billion VND support); renewal of compressor, introduction of inverter, etc. In addition, 10% coal was saved. - Support to introduction of high efficient street lighting in HCMC (Project of Energy-Saving Lighting in Small Alleys). 72.6% saving was realized (8.4 million kWh) by replacing 23,157 lamps in six districts (Phu Nhuan, Binh Thanh, Go Vap, Tan Binh, Binh Tan, No.6) by 2.5 billion VND support.
Plan 2009	- Energy efficiency support to Ben Tren Sugar Joint Stock Company (2 billion VND) - Energy efficiency support to Hanoi 19/5 Textile Limited Company (2.5 billion VND) - Energy efficiency support to apartment houses in Viet Hung CT-9 district (Housing and Urban Development and Investment Corporation) (1 billion VND) - Energy efficient lamp support to school in Hai Phong (DOET/Hai Phong) (1.4 billion VND)

5) Group 5 (Energy efficiency in building)

- Building Code has been in effect since 2006. The standards and guideline were created to enforce the Building Code. However, the code currently governs only the central government jurisdiction. Enforcement in the local governments' jurisdiction will be a crucial issue.
- The limited budget (3~4 billion VND) prevents from enforcement and enlargement of the other programs, which remains small-scale.

Program 9	**Capacity building for energy efficiency-design and management in buildings (MOC)**
Items	- Organizing courses and diffusing information on Vietnamese Construction Regulations and Standards on "Energy-saving and effective use constructions", raising awareness of counterparts who involve in construction in Vietnam on energy saving in construction. - Providing training courses on solutions for energy saving and effective use in construction works, with contents on methods for consulting, supervision, appraisal and license grant, to staffs in local construction departments. - Publishing and disseminating leaflets on energy saving energy on communication, diffusing to units and labors in construction industry.
Achievement 2007	(None)
Achievement 2008	- Development of energy efficiency building standards and guideline. Training course in 64 regions - Proposal of urbanism and architectural design for energy conservation (central air conditioning, water supply system, building material, interior-exterior design) - Campaign of "Green Building" (design competition of students) - Establishment of energy consulting center in Architecture university (Hanoi and HCMC) - Implementation of energy audit in building with support from MOTIVA in Finland (2004 ~ present)
Plan 2009	- Strengthening of compliance with Building Code at local level (DOC) - Development of energy efficiency building standards and guideline, reinforcement of training course.

Program 10	**Creation and promotion of energy efficiency building model (MOC)**
Items	- Building 5 models of energy management and put them into operation regularly for 5 targeted buildings. - Improving capability of some energy services to be selected in 3 regions. - Providing pilot rehabilitation on some high rise buildings, assisting to apply energy-saving measures to the new buildings. - Organizing and implementing campaigns on "Green works" ("Công trình xanh") of saving energy in offices and enterprises. - Evaluating and awarding and granting national certifications on "Green works" for the ones that satisfy stipulated requirements and criteria. Combining with activities on awarding for energy-saving buildings of ASEAN. - Organizing competitions of sample designs and thoughts of making models of energy-saving building, ecological architectural village. Selecting suitable design and having supporting methods for pilot implementation.
Achievement 2007	(None)
Achievement 2008	- Energy efficiency pilot projects in operation (office building, hospital, hotel, apartment)
Plan 2009	(None)

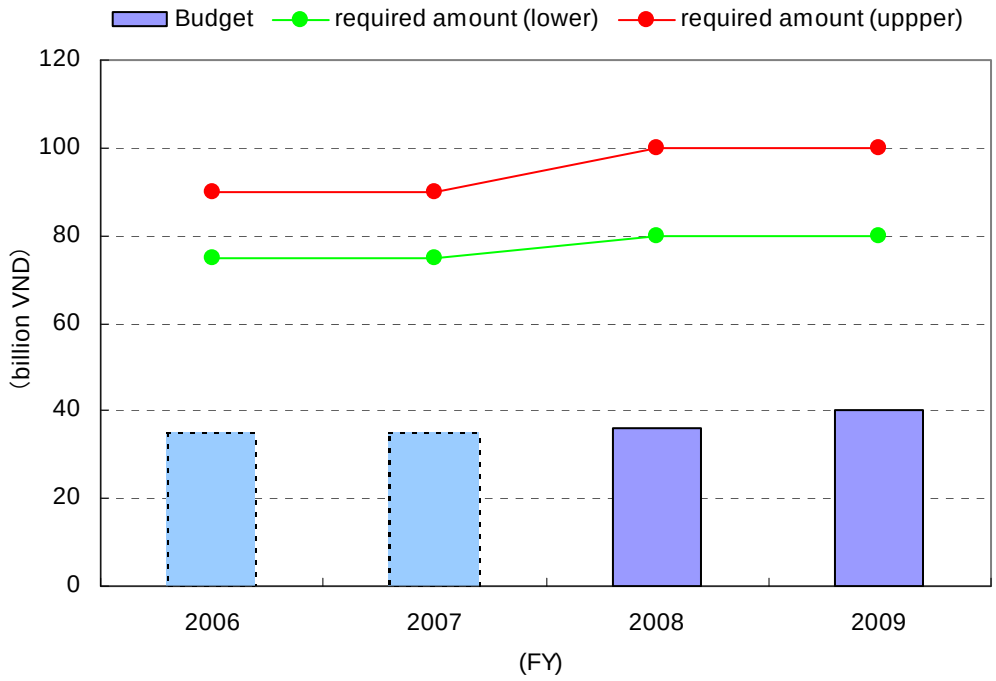
6) Group 6 (Energy efficiency in transport)

A few projects under implementation are small-scale and sporadic. Promotion of public transport utilization (modal shift) is the most important measures that should be taken hereafter.

Program 11	**Maximum utilization of transportation capacity, minimizing fuel consumption and decrease of emission (MOT)**
Items	- Development of specific programs and plans on energy saving through exploiting at maximum transportation network including road, waterway, railway, airway, seaway; rationalizing means of transport; developing high-capacity transportation with large volume of freight and passenger. - Applying solutions of saving energy and effective use to means of transport through technical controlling and new technological application; establishing and adjusting rationally eco-technical norms in manufacturing and maintenance of means of transport. - Implementing trial on using bio-fuel as alternative one for some means of transport.
Achievement 2007	(None)
Achievement 2008	- Promotion of public transport utilization (some programs were tried in Vietnam Railway) - Introduction of driving simulator in car license school - Introduction of waste heat recovery boiler for ship
Plan 2009	- Continuation of program. Proposal for improvement and evaluation for promoting energy efficiency.

2.9.2 Budget Scale for the Program

As presented above, though a variety of projects has been and are being implemented with a view to achieving the target, significant intensification is strongly required. The present government budget scale is too small (no more than 40 billion VND: Figure 2.9.2-1) to promote the programs. It is estimated that double to triple government budget is needed.



Note-1: Necessary budget scale is estimated, based on the interview to MOIT EEC Office in "Viet Nam News" (19/02/2009).
Note-2: Budget scale in 2006 and 2007 is assumption.

Figure 2.9.2-1 Government Budget for National Strategic Program on EC& EU

2.10 Constraints and Issues for Promoting EE&C

2.10.1 Results of Problem Structure Analysis

The previous sections covered on legal and institutional aspects of promoting EE&C, as well as the current EE&C practices observed during Study Team's auditing. The Study will cover the analytical results derived from the two aspects and cross-sectional views. Figure 2.10.1-1 shows the result of Problem Structure Analysis on constraints for promoting EE&C in Vietnam.

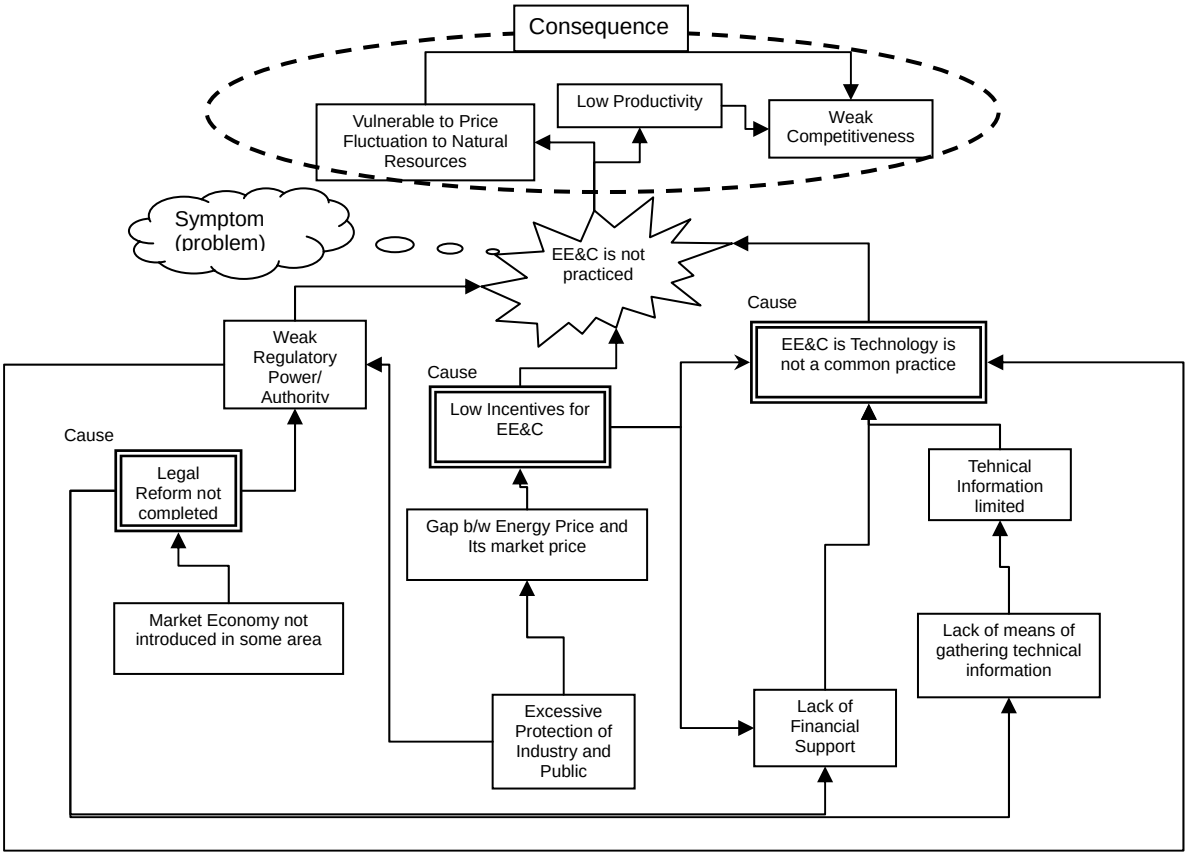


Figure 2.10.1-1 Problem Structure Analysis on Promoting EE&C in Vietnam [1)]

1) Problem Structure Analysis is a tool to analyze a root cause of the problem. The direction of the allows shows causal relationship. A box with many allows, particularly with the same direction has a significant meaning within the structure.

2.10.2 Constraints and Issues

The analysis placed "EE&C Technology is not a common practice" as the core problem. There are three causes, they are "Legal and Regulatory Reform not Completed," "Low EE&C Incentives," and "EE&C Technology is not a common practice." The three causes links to root causes. Consequence of the core problem were identified as "Low Competitiveness," "Low Productivity," and "Vulnerable to Price Fluctuation to Natural Resources." The following is a brief explanation of the analysis.

1) Legal and Regulatory Reform not Completed

(1) Lack of (quantitative) evidence-based management

Study Team found that day-to-day production and various decisions associated with operations lack periodical measuring of the parameters that may support effective operation of the factories and buildings the team visited. Accurate data collected regularly is generally not available because many factories do not utilize the data for operations. Many factories are not equipped with basic measuring devices for collecting necessary data. These factories lack quantitative operation and management based on monitoring data that may be used objectively. (In many countries, energy use is mandatory by laws or voluntary rules, etc.)

2) Low EE&C Incentives

(1) Apathy and lack of interest in EE&C

Effective EE&C promotion requires especially strong will on the part of the top management in implementing it at both individual and organizational levels. Many companies acknowledge the importance of EE&C, but they lack knowledge, experience, and will in practicing it. There are many who stress the importance of EE&C, but only few have ideas of how to implement it on the ground. Realizing the importance of EE&C does not necessarily lead to actual EE&C practice.

In addition, most managers do not recognize long-term positive effects to the bottom line by adopting EE&C measures. Operational effects in economy and social aspects are rarely recognized by most managers.

(2) Gap between energy price and its market price

Development of the market in Vietnam is still premature because of transitional economy. Official energy price is significantly discounted by subsidies (e.g.; politically discounted fuel price for electricity company) and is cheaper than that of international market. Such price structure makes it difficult to ensure a price incentive for promoting EE&C in Vietnam.

(3) Lack of regulatory control over energy usage

No legislative framework at this point regulates inefficient energy usage in Vietnam. Strict control over energy use with mandatory energy usage reporting, etc which are adopted by many industrialized countries has not been introduced in Vietnam. Nonexistence of these strict requirements does work an incentive to monitor daily usage of energy.

3) EE&C Technology is not a Common Practice

(1) Lack of access to technical information on EE&C

Availability of new and effective EE&C technology and good practice is limited in the Vietnamese language. Access to these important information is difficult. No one is collecting, accumulating and publishing these information in the country. Therefore usability for applying such technology in actual production line is low.

(2) Insufficient standards in operations and procedures

Organizational arrangements and operational procedures are arbitrary in many factories. Though regular procedures and operations are well established, documentation and standardization have not yet been established. In combination to the item (1) above, only individuals, not the organization, have knowledge about regular operational procedures. Such knowledge is not transferable and available to others. In addition, procedures to meet with irregularities are not prepared.

(3) Improper maintenance

Many factories still use production lines and machinery as they were built originally. The old machinery has been used without major modifications and renovation. The level and frequency of maintenance is only the bare minimum to operate and survive. Such maintenance is not intended to prevent failure. It was very common to encounter production lines fully equipped with second-hand machinery imported from Japan. They are usually assembled with a variety of used parts and modules. It is very difficult to ensure maximum production.

(4) Insufficient understanding of production processes and facilities

The factories have a long history of retrofitting whenever they have a problem in the production line. Much of the machinery and equipment used has become quite different from what was installed when it was built. Many factories no longer have any documents and plans of the production lines in use. As such, even the managers responsible for energy management do not have sufficient knowledge and understanding about their production lines.

(5) Improper facility design and equipment

The team has found many factories and buildings are not designed to operate efficiently because of their facilities and equipment [2)].

2.10.3 Basic Strategy for Promoting EE&C in Vietnam

It was found that the three basic strategies are required to mitigate the constraints identified in the energy audit by the Study Team. .

1) Goal for EE&C Policy

The ultimate goal for EE&C policy and its road map is “Realization of comprehensive policy for achieving self-reliant EE&C”.

2) Basic Strategy

To achieve the policy goal, three basic strategies of “ Enhance awareness and consciousness”, “Strengthen support from the government”, and “Enforce rules and regulations” as shown in the figure 2.10.3-1.

The first strategy, “Enhance awareness and consciousness” is the basis for promoting EE&C policy. It includes measures such as (1) expansion of education and training toward all stakeholders, (2) introduction of high efficiency electric appliances, and (3) creation of award program to excellence in EE&C activities.

2) For example, many commercial buildings are not equipped with a block-wise control system for air-conditioning and lighting, and hence cannot control temperature and lighting regardless of the occupancy of the floor. When a portion of the floor is used, the entire floor is lit and air-conditioned because of inflexible system design. Another example the team has observed is unnecessary energy loss resulting from improper utility design in a factory. In designing dual pump systems, the first pump was decided based on a single demand side requiring with high water pressure with low volume, where its system control is based on pressure. The second pump in the same system incurs energy loss as much as 15 idling stop every 10 minutes.

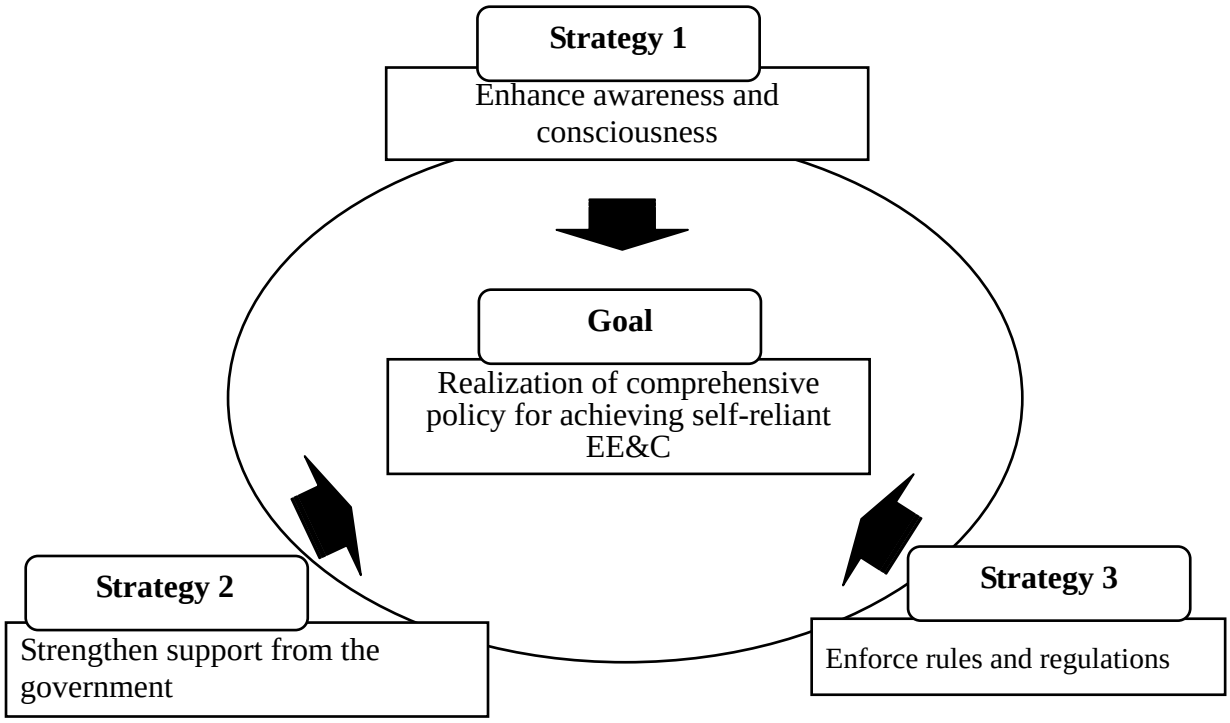


Figure 2.10.3-1 Basic Strategy for Promoting EE&C in Vietnam

The second strategy, “strengthening support from the government” is to lead incentives for EE&C. Specific measures may include: (i) capacity development for energy audit by diverse measures, (ii) introduction of high efficient machinery and equipment, (iii) introduction of electricity demand side management (DSM), etc.

The third strategy ,“enforcing rules and regulations”. may include (1) introduction of target setting agreement program for designated factories, (2) introduction of certified energy manger program, (3) establishment of new building code for EE&C, (4) EE&C standards and EE&C labeling program, (5) furnishing the legal framework ensuring the implementation of effective EE&C policies and programs, and (6) introduction of a appropriate electricity tariff mechanism.