JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DEPARTMENT OF ELECTRICITY AND GAS SUPPLY, MALAYSIA (JBE&G)
MINISTRY OF ENERGY, COMMUNICATIONS AND MULTIMEDIA
MALAYSIA

STUDY
ON PROMOTION OF ENERGY EFFICIENCY
IN MALAYSIA

FINAL REPORT
(SUMMARY)

March 1999

TECHNO CONSULTANTS, INC.

MITSUBISHI CHEMICAL ENGINEERING CORPORATION

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LIST OF ABBREVIATIONS

A	Ampere
ABF	ASEAN Bintulu Fertilizer
AC	Alternating Current
ACEE	AC Feedback Control System
AHU	Air Handling Unit
API	American Petroleum Institute
APMC	Associated Pan Malaysia Cement Sdn. Bhd.
AS	Air Slide
ASEAN	Association of Southeast Asian Nations
ASM	Amsteel Mills Sdn. Bhd.
B.F	Bag Filter
Bar	Bar Thermometer
BE	Bucket Elevator
BFW	Boiler Feed Water
BTU/hr	British Thermal Unit per Hour
C/S mill	Coal Shale Grinding Mill
CCM	Continuous Casting Machine
CEB	Central Electricity Board
CEC/EV	Coefficient of Energy Consumption of Elevator
CEC/HW	Coefficient of Energy Consumption of Hot Water
CEC/L	Coefficient of Energy Consumption of Lighting
CEL/AC	Coefficient of Energy Consumption for Air-conditioning
CEO	Chief Executive Officer
CFG	Control Flow Gate
CFM	Cubic Feet per Minute
CHN	Carbon, Hydrogen, Nitrogen
CO(%)	Carbon Oxide (percent)
$CO_2(\%)$	Carbon Dioxide (percent)
CSR	Central Sugars Refinery Sdn. Bhd.
CW Pump	Chilled Water Pump
DB	Distribution Board
DB	Data Base
DC	Direct Current
DTA/TG	Differential Thermal Analysis / Thermal Gravimetric Analysis
EAF	Electric Arc Furnace
EBT	Eccentric Bottom Tapping
EP	Electrostatic Precipitator
EPU	Economic Planning Unit
ESCO	Energy Services Company
F	Frequency
F CaO, f cao	Free CaO
F.F	Flush Furnace
F.K pump	Fuller Kinyon pump
FCU	Fan Coil Unit
FIRROI	Financial Internal Rate of Return on Investment
G cal/h	Giga Calorie per Hour
GBF	Gravel Bed Filter
GCT	Gas Conditioning Tower

GDP	Gross Domestic Product
GPP	Gas Processing Plant
HM	Hydraulic Modulus
HP	High Pressure
HP	Horse Power
HRS	High Cycle Regenerative Combustion System
HSZ	Horizontal Single Zone
Humid.	Humidity
HV	High Voltage
Hz	Hertz
I	Electrical Current
IDF	Induced Draft Fan
IEA	International Energy Agency
IM	Iron Modulus
in w.g	Inch Water Column Gage
IPP	Independent Power Producer
IRR	Internal Rate of Return
JBE&G	Jabatan Bekalan Elektrik dan Gas Malaysia (Department of Electricity & Gas Supply, Malaysia)
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standard
JY	Japanese Yen
kl	kilo litter
kRM	Thousand Ringgit Malaysia
kTOE	kilo Ton Oil Equivalent
kTon	kilo Ton
kV	kilo Volt
kVA	kilo Volt Ampere
kW	kilo Watt
kWh	kilo Watt Hour
kWh/d	kilo Watt Hour per Day
kWh/h	kilo Watt Hour per Hour
kWh/t	kilo Watt Hour per Ton
L.O.I	Loss of Ignition
L/S mill	Limestone Grinding Mill
LF	Ladle Furnace
LFO	Light Fuel Oil
LHV	Low Heating Value
LNG	Liquefied Natural Gas
LP	Low Pressure
LPG	Liquefied Petroleum Gas
LV	Low Voltage
Lx	Lux
m/s	Meter per Second
MECM	Ministry of Energy, Communications and Multimedia
MITI	Ministry of International Trade and Industry
MTBE	Methyl Tertiary Butyl Ether
MVA	Mega Volt Ampere
MW	Mega Watt
MWh/d	Mega Watt Hour per Day

N.A	Not Available
NEB	National Electricity Board
NSF	New Suspension Preheater with Flush Furnace
NSP	New Suspension Preheater
O_2(%)	Oxygen Content (percent)
OECD	Organization for Economic Cooperation and Development
OJT	On-the-job Training
P	Effective Power
PAL	Perimeter Annual Load
PCD	Pitch Circle Diameter
PDA	Petroleum Development Act
PE	Professional Engineer
PETRONAS	Petroleum Nasional Berhad
PF	Power Factor
PGU	Peninsular Gas Utilization
PH	Preheater
pH	Symbol of acidity and alkalinity
PS	Production Sharing
PSC	Production Sharing Contract
psi	Pound per Square Inch
PTM	Pusat Tenaga Malaysia (Malaysian Energy Center)
Q	Reactive Power
R&D	Reseatrch and Development
R.F	Rotary Feeder
RH	Relative Humidity
RM	Ringgit Malaysia
RMP	Rolling Mill Plant
RPM, rpm	Revolution Per Minute
S	Apparent Power
S/W	Scope of Work
SEB	Sabah Electricity Board
SESCO	Sarawak Electricity Supply Corporation
SF	Suspension Preheater with Flush Furnace
SIRIM	SIRIM Berhad
SM	Silica Modulus
SMP	Steel Making Plant
Sp. Gr., S.G.	Specific Gravity
STL	Stockage par Chaleur Latente (Storage of Latent Heat)
Surface T.	Surface Thermometer
T.G.	Temperature Gauge
Temp.	Temperature
TFC	Total Final Consumption of Energy
TNB	Tenaga Nasional Berhad
TOE	Ton Oil Equivalent
TPES	Total Primary Energy Supply
UK	United Kingdom of Great Britain and Northern Ireland
UNDP	United Nations Development Program
US GPM	United State Gallon per Minute
US$	United State Dollar
USA	United States of America
USRT	United State Refrigerating Ton

V	Voltage
VAV	Variable Air Volume
VSD	Variable Speed Design
VSZ	Vertical Single Zone
VVGD	Ward-Leonard System
VVVF	Variable Voltage Variable Frequency
VWV	Variable Water Volume
W	Watt
Wh	Watt Hour
WHO	World Health Organization
WTP	Water Treatment Plant
μ s/cm	Micro Second per Centimeter
ϕ	Phase

Chapter 1 Introduction

This is the summary report of the Final Report for the Study on Promotion of Energy Efficiency in Malaysia. Consigned by Japan International Cooperation Agency (JICA), this study was conducted by a consortium of Techno Consultants, Inc. (TCI) and Mitsubishi Chemical Engineering Corporation (MEC), an international consulting company and an international engineering company both based in Japan, who have prepared this Final Report for the Department of Electricity and Gas Supply (JBE&G), Ministry of Energy, Communications and Multimedia, Malaysia.

The study aims to present legal and administrative forms that would permit the government to promote effective use of energy in the commercial and industrial sectors; to diagnose selected institutions and factories; and to present recommendations for improving their energy use. Accordingly, the study may be broken down into two aspects: policy study and technical study; the former analyzes the administrative operation and legal structure of Malaysia and presents recommendations and plans deemed effective in the promotion of energy efficiency in commercial institutions and industrial factories. The latter presents energy audits of the three selected institutions and three factories, and makes recommendations for achieving more efficient use of energy.

The study took 15 months from January 1998 to March 1999, during which time three field surveys and one Draft Final Report presentation were conducted in Malaysia. Two seminars for the promotion of energy efficiency are included in the study, one of which was held successfully for the commercial sector during third field survey; the other for policy matters and the industrial sector was conducted during the period of the Draft Final Report presentation. The first, second, third field surveys, and presentation of the Draft Final Report and seminars have already been carried out according to the schedule shown below.

Survey	Schedule
1. The first field survey:	February to March 1998
2. The second field survey:	May to July 1998
3. The third field survey and seminar:	September to October 1998
4.The fourth field survey: (Draft Final Report presentation and seminar)	February 1999

Throughout the entire course of this study, the study team presented to JBE&G the following reports:

Report	Submission	Content of Report
Inception Report	February 1998	Plan for the study execution
Progress Report	May 1998	Results of the first field survey
Detailed Energy Audit Plan	June 1998	Plan for energy audit
Interim Report	September 1998	Interim results
Draft Final Report	January 1999	Explanation of the Draft Final Report
Final Report (Main and Summary Reports)	March 1999	Results of the entire study

This report contains outcomes of the investigation, which are the energy situation, policies and plans for the promotion of energy efficiency, as well as energy audits of the three selected institutions belonging to the commercial sector, which are a hotel, a shopping complex and a hospital, and three factories of the industrial sector, which are cement, food processing, and iron and steel factories.

The experts engaged in this study are shown below.

Name	Organization	Assignment
Akinori HASHIMOTO	Techno Consultants, Inc.	Team Leader, Energy Policy and Institution
Kazumitsu MITANI	Mitsubishi Chemical Engineering Corporation	Plan for Energy Efficiency Promotion
Hiroshi OMORI	Dia Research Martech Inc.	Energy Management (Heat)
Yasuo ISHIBASHI	Kokan Keisoku K.K.	Energy Management (Electricity)
Muneteru YOSHIZAWA	Techno Consultants, Inc.	Energy Audit (Heat)
Shunichi IIZUKA	Mitsubishi Chemical Engineering Corporation	Energy Audit (Electricity)
Kiyoshi KAMIYA	Mitsubishi Electric Building Techno-Service Co., Ltd.	Sector Technology (Commercial)
Yoshihiko UEDA	Onoda Engineering Co., Ltd.	Sector Technology (Industry)
Shinya KINOSITA	Kokan Keisoku K.K.	Process Technology (Iron & Steel)
Minoru NAGAI	Techno Consultants, Inc.	Economic and Financial Evaluation
Toshio SASAKI	Techno Consultants, Inc.	Coordinator

The counter parts engaged in this study are shown below.

Name	Position
Datuk Ir. Mohd. Annas Bin Haji Nohd. Nor	Director General, JBE&G
Ir. Chong Cheong Yin	Director of Electricity Regulation, JBE&G
Ir. Chah Ain Chuan	Principal Assistant Director, JBE&G
Ir. Francis Xavier Jacob	Principal Assistant Director, JBE&G
Ms Teratai @ Zainab Leman	Assistant Director, JBE&G
Mr. Mohd. Elmi Anas	Assistant Director, JBE&G
Mr. Mohd. Asri Sharani	Assistant Director, JBE&G

Chapter 2 Background and Objectives of Study

This chapter describes the background, objectives and procedure of the study.

2-1 Background of Study

The average GDP growth rate in Malaysia was recorded at 8.7% p.a. from 1991 to 1995. In the scenario of "Vision 2020", the Malaysian Government assumes that the same level of growth will continue in future, though the growth has decreased recently. In line with the high economic growth rate, energy consumption in Malaysia has also shown rapid growth of 9 to 13% p.a. Although Malaysia is an oil and natural gas producing country, it is predicted that supply and demand will become unbalanced in future. As a national policy for energy supply, the preservation of oil resources is planned, and a diversification policy of four types of energy (oil, gas, coal, and electricity) is now being promoted. Energy consumption in Malaysia per unit GDP is two to four times higher than in industrialized countries. In addition, energy consumption per unit GDP accelerated during 1980 - 1990's. With the rapid growth of total energy, the decline of energy consumption efficiency is regarded as a problem.

Under these circumstances, in order to improve energy efficiency in the commercial and industrial sectors, the Malaysian Government issued a formal request to the Japanese Government regarding the execution of a study on the promotion of energy efficiency. This is to establish a "Master Plan" for the promotion of energy efficiency in the commercial and industrial sectors, that is consistent with energy-saving guidelines. Japan International Cooperation Agency signed the Scope of Work in February 1997, after confirmation of request details and discussion regarding the specifics of the study.

2-2 Objectives of Study

The objectives of the study are, as defined by the Scope of Work, to promote the energy efficiency in the country; specifically, the study aims at:

1. Recommending ways in which energy efficiency can be increased in the selected institutions and factories,
2. Outlining implementation plans including consolidation of the laws and regulations,

establishment of standard certifications and the engineer's training program, as well as of the institutions and organizations, and

3. Proposing necessary resources to be input into the Energy Efficiency Promotion Division of the Malaysian Energy Center (PTM).

The study includes:

1. Government policy, laws and regulations to help achieve the above objectives,
2. Organizations to promote energy efficiency,
3. Activities to promote the same,
4. Energy audits to promote energy efficiency in the selected industrial sub-sectors, which are cement, food processing and steel & iron, and commercial sub-sectors, which are hotel, hospital and shopping complex,
5. Measures to address the problems of inefficient energy use, and evaluation of the expected effects after implementation of the master plan, and
6. Preparation of reference materials to be used as guidelines for the promotion of energy efficiency.

2-3 Procedure of Study

The Study Team programmed the Study so that it would be conducted systematically based on the plan described below.

Phase 1 (Preparatory Work in Japan) was the preparatory work performed in Japan, prior to the commencement of the First Field Survey in Malaysia. The work consisted of the preparation of this Inception Report; collection and analysis of data and information; grasping processes and equipment and facilities generally used in factories and institutions that might be selected for energy audits; and preparation of preliminary inspection forms and explanatory materials both for energy audits as well as preparation of technology transfer and field survey plans.

Phase 2 (First Field Survey in Malaysia) was conducted for twenty days from February 16 to March 7, 1998. Works performed during this period were: presentation and discussion of the Inception Report; selection of model factories and institutions for the energy audits; preliminary inspection, and preparations for energy audits; and collection of data on financial status for the selected model factories and institutions. Basic data and information of Malaysia were also

gathered and investigated during this period.

Phase 3 (First Home-office Work in Japan) covered mainly the review and analysis of results of the First Field Survey. In addition, the framework of the energy audit plan and the plan for the Second Field Survey were prepared during this period. A Progress Report was prepared as well.

Phase 4 (Second Field Survey in Malaysia) covered explanation of the Progress Report and the energy audits for the commercial sector. This survey was conducted from May 31 to July14, 1998.

Phases 5 (Second Home-office Work in Japan) covered the review and analysis of results of the Second Field Survey in Malaysia and preparation of the Interim Report.

Phase 6 (Third Field Survey in Malaysia) covered presentation and discussion of the Interim Report, and the first seminar; the energy audits for the industrial sector; and development of a work plan for the Energy Efficiency Division of the Malaysian Energy Center. This survey was carried out from September 6 to October 21, 1998.

Phase 7 (Third Home-office Work in Japan) covered the following works: review and analysis of the results of the Third Field Survey in Malaysia; preparation of guidelines for the promotion of energy efficiency, policy for the promotion of energy efficiency and a master plan; preparation and submission of the Draft Final Report; and preparations for the second seminar.

Phase 8 (Fourth Field Survey in Malaysia) covered presentation and discussion of the Draft Final Report and presentation of the second seminar in Malaysia. This survey was carried out from February 1 to 7, 1999.

Phase 9 (Fourth Home-office Work in Japan) covered preparation of the Final Report.

Chapter 3 Overall Conclusions and Recommendations of Study

This chapter summarizes conclusions and recommendations on policies, institutions and activities to be taken by the Government in order to promote energy efficiency. In addition, measures for improving energy efficiency are proposed for the six selected entities for which energy audits were carried out.

3-1 Recommendations of Policies and Institutions

3-1-1 Creation of Coordination Board for Promotion of Energy Efficiency

(1) Current State and Problems

There are many public organizations, universities and private entities participating in plans and activities for the promotion of energy efficiency. There should be effective coordination of the promotion of energy efficiency activities.

(2) Recommendations

It is recommended that an energy efficiency coordination board headed by organizations such as the Economic Planning Unit (EPU), and participated by the Ministry of Energy, Communications and Multimedia (MECM) as a key member be created to coordinate the energy efficiency activities of ministries, agencies and entities; to formulate plans; to undertake various studies; to create awareness; and to prepare reports. The board is advised to work on a basis with legal mandate.

3-1-2 Enactment and Enforcement of Regulations for Promotion of Energy Efficiency

(1) Current State and Problems

No laws or regulations for the promotion of energy efficiency have been enacted yet in Malaysia. To ensure that activities for energy efficiency can be carried out more effectively, the Department of Electricity and Gas Supply (JBE&G) formulated a draft of regulations for the promotion of energy efficiency and submitted it to MECM for approval in 1997.

(2) Recommendations

1) Early enforcement of laws and regulations

It is necessary for the government, governmental agencies, energy equipment manufacturers

and importers, and consumers to collaborate in promoting energy efficiency from their respective standpoints. In order to ensure that the activities for energy efficiency can be carried out more effectively, early enactment of the regulations is expected.

2) Expansion of scope of prepared regulations

The prepared regulations by JBE&G mainly concerns electricity. It is recommended that the scope of the regulations be expanded to cover not only electricity, but also fuel and other sectors such as residential and machinery when revision for the purpose of further energy saving is necessitated.

3-1-3 Preparation of Standards and Guidelines for Commercial and Industrial Sectors

(1) Current State and Problems

1) Standards:

There is no concrete form of energy standards that could serve as a basis for entities in the industrial and commercial sectors to judge the degree to which efficient energy use is promoted. The standards may help entity staff implement appropriate measures for efficient energy use and may help operators make positive efforts for streamlining energy use in their entities, by choosing better solutions suited to the given conditions.

2) Guidelines:

It is required that entities endeavor to improve the efficiency of their energy-consuming equipment. For this purpose, guidelines are necessary for each entity to apply standards.

(2) Recommendations

Standards for judgement are essential. MECM and JBE&G are strongly advised to take the initiative in preparing these standards in collaboration with the Malaysian Energy Center (PTM) and other organizations concerned with promotion of energy efficiency. The standards and guidelines of energy efficiency developed by the study team are described in Chapter 7 of the main report. For reference, the items of standards described in the main report are shown below:

1) Commercial Sector

Commercial sector (Preceding 4 years) :

-Lighting intensity

-Room environment

-Electricity standard

Commercial sector (Latter 6 years) :

-Prevention of heat loss through external walls, windows and others

-Effective utilization of energy in relation to air-conditioning equipment

-Effective utilization of energy in relation to lighting apparatuses

-Effective utilization of energy in relation to hot water supply systems

-Effective utilization of energy in relation to elevators

2) Industrial Sector

Industrial Sector (Preceding 4 years)

-Rationalization of fuel combustion system

-Rationalization of heating, cooling and heat transfer system

-Prevention of heat loss due to radiation and transmission

-Recovery and utilization of waste heat

-Rationalization of systems to convert heat into motive power

-Prevention of electric power loss due to resistance and other factors

-Rationalization of systems to convert electricity into motive power, heat, etc.

Industrial Sector (Latter 6 years)

-Combustion facility

-Rationalization of heating, cooling and heat transfer systems

-Recovery and utilization of waste heat

-Co-generation facilities

-Power-consuming facility

3-1-4 Energy-Managed Entities and Energy Manager System

(1) Current State and Problems

A system of energy-managed entities is one effective measure to promote rational use of energy, but is not yet established in Malaysia. Consequently, the energy manager system does not exist in Malaysia. According to the draft regulations prepared by JBE&G, entities that consume a large volume of electricity annually, for example consuming 360,000 kWh per month or more, are designated as energy-managed entities.

(2) Recommendations

1) Establishment of energy-managed entity system

For the promotion of energy efficiency, the early establishment of an energy-managed entity designation system is recommended. The designated entities are urged to effectively report

and carry out energy efficiency programs, and furthermore are responsible for reporting their energy supply and consumption every year. This will help the designated entities to recognize their energy consumption; to analyze their energy consumption; and to understand the causes of fluctuations in energy consumption.

2) Energy manager system

It is important to establish this system as soon as possible, and also important for the designated entity to have an energy manager and to enable these managers to play a key role in promoting energy efficiency.

3-1-5 Qualification System of Energy Manager

(1) Current State and Problems

An energy manager qualification system is not established in Malaysia. By the draft regulations prepared by JBE&G, the qualification criteria for energy managers are defined.

(2) Recommendations

Energy-managed entities will be obliged to appoint an energy manager when the systems for energy-managed entities and energy managers are introduced in Malaysia. The introduction of a state-approved qualification system and a system for certificate issuance to energy managers is needed. In order to maintain and improve the quality of energy managers, it is necessary to organize and register them; provide them with technical information on energy efficiency and conservation; and train them.

3-1-6 Award System for Promotion of Energy Efficiency

(1) Current State and Problems

To increase business interest in energy efficiency, awards should be given to individual engineers or groups of employees or factories, which have achieved excellent results in promoting energy efficiency.

(2) Recommendations

It is considered necessary for state organizations to publicly commend factories that have achieved excellent results in energy efficiency and that have made constant efforts in energy management, as well as manufacturers who have developed highly effective energy efficiency equipment during the year. This system will lead to the boosted morale of people engaged in

energy efficiency.

3-1-7 Incentives

(1) Current State and Problems

The most popular legal incentives are tax credits and tax exemptions. Administrative incentives include soft loans, etc. Tax incentives and soft loans are not available for investment in facilities and equipment of the promotion of energy efficiency in Malaysia.

(2) Recommendations

The formulation of a tax and loan incentive system is recommended.

To increase the effectiveness of incentives for the promotion of energy efficiency, such as tax reduction and exemption, and loan incentives, it would be useful to formulate an incentive package that includes tax credits and exemption, and soft loans, etc.

3-2 Activities for Promotion of Energy Efficiency

3-2-1 Activities for Promotion of Energy Efficiency by JBE&G and PTM

(1) Current State and Problems

A number of activities were carried out by JBE&G recently. Many of them concern electricity and consist of holding seminars, workshops, and exhibitions; conducting energy audits; preparing materials for the promotion of energy efficiency; and approving co-generation projects.

PTM was newly established in 1998 as a technical arm of MECM and has just started its activities for the promotion for energy efficiency. According to PTM, the following organizational demarcation of activities regarding promotion of energy efficiency is clarified at present.

(a) Scope of Activities for PTM:
The scope of Activities for PTM are Campaign, seminars, research and energy audits for the promotion of energy efficiency

(b) Scope of Activities for Others (JBE&G, Universities and Others):
1. Education and training programs on energy efficiency
2. Energy manager's qualification
3. Energy management lessons for university students

The study team recognizes the following items still remain as important issues:

1. Decentralization of activities for energy efficiency will result in poor performance in the future.
2. Though energy management should be on the basis of thermal and electrical energy, the current activity is too concentrated on electricity in Malaysia.

(2) Recommendations

In order to promote energy efficiency smoothly, it is necessary for JBE&G and PTM jointly or separately to carry out the following activities.

1. Energy Audits (JBE&G, PTM)
2. Seminars for Energy Efficiency (JBE&G, PTM)
3. Energy Data Base (PTM)
4. Research on Promotion of Energy Efficiency (PTM)
5. Promotion of Energy Efficiency Campaign (JBE&G, PTM)
6. Publication (PTM)
7. Education and Training on Energy Efficiency (JBE&G, PTM)

It is recommended that the Energy Efficiency Promotion Division of PTM be reinforced in order to centralize the activities mentioned above in the long-range plan.

3-2-2 Organization and Role of Energy Efficiency Promotion Division of PTM

(1) Current State and Problems

The Energy Efficiency Promotion Division of PTM is newly organized and does not have much experience in the promotion of energy efficiency activities. There is an insufficient number of staff for the promotion of energy efficiency. There are no plans for developing the capability of engineers of private entities by means of opening training courses.

(2) Recommendations

1) Decentralization of activities for energy efficiency among various organizations, universities and entities will be inefficient in the future. Centralization of activities to PTM is recommended.

2) It is hoped that the promotion of energy efficiency activities, namely education and consulting, can be further developed and enhanced using international collaboration schemes.

3) The activities of PTM should not be limited but diversified. As a centralized organization for the promotion of energy efficiency in Malaysia, it is recommended to expand and enhance PTM's organization in order to establish sections such for public relations and publication, research, technical and training.

3-2-3 Others

Recommendation:
It would be advisable for MECM to coordinate and arrange a study to enhance ESCOs, which are private entities. The further activation of ESCOs is one option to promote developments in the efficient use of energy. The function of an ESCO would be to carry out energy audits, assist arrangement of finance and modification of facilities and to operate for the benefit of various entities. These activities would be carried out through the allocation of profits obtained by the promotion of energy efficiency between entities and ESCOs.

3-3 Recommendations to Model Entities

Energy audits were conducted for three model entities in the commercial sector as well as for another three in the industrial sector. Based on the energy audits and subsequent studies for the six model entities, the following measures are recommended for improving their energy efficiency.

3-3-1 Hotel (Mingcourt Vista Hotel)

(1) VAV System in Air-conditioning

It is recommended that a Variable Air Volume (VAV) system be installed in the hotel's air-conditioning. It can be said that this measure is financially feasible from the results of the financial evaluation.

(2) VVVF System in Lifts

This measure is at a marginal level of financial feasibility, assuming an inverter system (VVVF) is installed together with lift replacement. Investigation of this measure is recommended at the time of lift replacement.

(3) Ice Storage System

Installation of an ice storage system in the hotel's chiller system has the potential for financial feasibility, provided that the price of electricity increases to the current level in Japan. It is recommended that this measure be investigated in the event that the electricity tariff increases in future.

(4) Increase in Room Temperature

It is recommended that the hotel investigate increasing the temperature of its building area. The expected benefit from increasing the temperature by 2℃ is an RM 140 thousand annual saving in the electricity bill.

(5) Other Recommendations

In addition to the above, several recommendations are made for hotel's energy facilities in terms of operation management as well as maintenance management and are summarized in Chapter 7.

3-3-2 Shopping Complex (Bandar Utama Shopping Center)

(1) Decreasing Illumination Intensity

The following are recommended: decrease the illumination intensity by installing an automatic on-off system activated by lighting intensity; replace incandescent bulbs with fluorescent lights; and extinguish unnecessary lights. This investment measure can be regarded as financially feasible based on the financial evaluation.

(2) Prevention of Heat Loss from Entrances

It is recommended that heat loss from entrances be prevented by installation of rotating doors and air curtains. The investment for this measure appears to be financially feasible.

(3) Utilization of Off-peak Electricity

It is recommend that off-peak electricity be utilized by expanding the ice storage system. The investment can be said to be financially feasible as well.

(4) Stoppage of Incoming Transformer

Stoppage of the incoming transformer, T-11-1, is recommended. This measure will enable an RM37,000 annual saving in the electricity bill without any investment.

(5) Increasing Temperature of Building Area

It is recommended that the temperature of building areas be increased by 2℃. By this measure, a RM 2.2 million annual saving in the electricity bill is expected.

(6) Other Recommendations

In addition to the above, several recommendations are made for the shopping center's energy facilities in terms of operation management as well as maintenance management and are summarized in Chapter 8.

3-3-3 Hospital (Hospital Seremban)

(1) Introduction of Latent Heat Storage System

For space cooling, Hospital Seremban currently uses a combination of natural ventilation, mechanical ventilation and centralized air-conditioning and local air-conditioning systems. In the near future, expansion of air-conditioning will become inevitable instead of natural ventilation and mechanical ventilation. In the event of such air-conditioning system expansion, it is recommended that the introduction of latent heat storage be investigated. This technology will enable effective peak load saving and reduction in maximum demand by shifting peak demand into off-peak demand.

(2) Solution to Frequent Over-current Trip Problem

The chiller system often stops because of the over-current trip problem. According to the investigation by the study team during the energy audit, this system has two problems: extraordinarily low power factor and high current quite close to the trip set value of 300 amperes. The following measures should be investigated: "Clarifying the cause of low power factor"; "Increasing the fuse from 300 ampere to 350 ampere"; "Installation of capacitor"; and "Replacing distribution line cable with a larger size".

(3) Improvement of TNB Power Receiving System

Negative power factor values were observed at the power receiving system from Tenaga Nasional Berhad (TNB) during the energy audit by the study team. It is recommended that the automatic control system of the capacitor bank be adjusted.

(4) Improvement of Boiler Combustion Conditions

The air ratio of Boiler exhaust gas exceeds the Japanese guideline. Improvement is desired by reinforcement of operation management from an energy efficiency point of view, although the

current air ratio may be affected by the on-off operation of boilers.

3-3-4 Cement (APMC Rawang Works)

(1) Waste Heat Boiler/Generation System

This measure enables the recovery of sensible heat of preheater exhaust gas and cooler exhaust gas. This system is composed of (1) a boiler to recover sensible heat of preheater exhaust gas, (2) a boiler to recover sensible heat of cooler exhaust gas, and (3) a power generator system consisting of a turbine, a generator and a condenser. It could be said that this measure is at a marginal level of financial feasibility under the conditions set for the study. It is recommended that a detailed investigation be conducted for this measure.

(2) Construction of Coal Drying/Grinding Mill

Expensive fuel oil is used in the F.F furnace together with coal, owing to the limited capacity of the existing coal mill. The recommended measure is to construct a coal drying/grinding mill that is composed of (1) a vertical roller mill for drying and grinding the coal, (2) a bag filter, and (3) a set of pulverized coal weighers. By this measure, all the fuel oil used in the factory will be replaced with coal, resulting in fuel cost saving. In addition, combustion efficiency will be improved by combustion of fine coal powder. It could be said that this measure is financially feasible.

(3) Adoption of Lifter Brick

The energy audit revealed that a lot of unburned carbon is returned to the kiln because of poor fuel combustion in the preheater F.F furnace. It is recommended that the inner wall of the kiln be lined with lifter brick so that heat consumption can be reduced by maintaining efficient combustion of unburned carbon from the preheater F.F furnace. This measure is especially recommended, as it is excellent in terms of financial feasibility.

(4) Prevention of Air-leakage

During the energy audit, air-leakage was observed from various locations in the plant. Total air-leakage volume is estimated at around 39.5% of the total exhaust gas volume. A 3.8 kWh per ton-clinker power saving is anticipated by reducing this air-leakage. It is recommended that this measure be investigated.

(5) Rationalization of Transportation System

Currently, coal shale and cement are transported by pneumatic transportation facilities such as an

FK pump and compressor. By modifying this transportation system into a mechanical bucket elevator and air slide system, about a 5.3 kWh per ton-clinker power saving is expected. Further investigation is recommended for this measure.

(6) Change of Feeding Point and Feeding System of Coal Shale

From the results of differential thermal analysis (DTA) and thermogravimetric analysis (TG) of coal shale, it is deemed necessary to investigate changing the feeding point from direct feeding into the F.F furnace to the C4 cyclone inlet, in consideration of coal shale burning conditions. In addition to this, it is recommended that the feeding system of coal shale be changed from a pneumatic to a mechanical system. A 1,258 ton-coal per year heat saving is expected by this measure.

(7) Improvement of C5 Cyclone Collecting Efficiency

It was observed that the collecting efficiency of the C5 (bottom) cyclone was poor. Consequently, exhaust gas temperature of the C1 (top) cyclone increased. By improving the collecting efficiency, an 8,510 ton-coal per year heat saving is expected through exhaust gas temperature reduction. This measure is recommended.

(8) Replacement of Cooler GBF

It is suggested that investigation be made into the replacement of the existing Gravel Bed Filter (GBF) with an Electrostatic Precipitator (EP) for cooler exhaust gas. By this measure, the following benefits are expected: "heat saving by stable combustion in the kiln and F.F. furnace", " electricity saving by preventing air-leakage from the cooler exhaust line and kiln hood", and "clinker recovery by improving collecting efficiency". It is recommended that this measure be investigated further.

(9) Grinding Aids

It is recommended that investigation be made into the use of grinding aids, although the economics of the measure depends on its price in Malaysia. A 7,500,000 kWh per year power saving is expected at the grinding mill, assuming a 0.02% addition of grinding aids.

3-3-5 Food Processing (Central Sugars Refinery (CSR))

(1) Improvement of Heat Energy Conservation in Steam and Steam Condensate System

The energy audit revealed a rather high temperature of boiler flue gas and a low recovery rate of steam condensate. It is recommended that the heat of boiler flue gas be recovered to increase

the boiler feed water (BFW) temperature. As for a measure to increase the recovery rate of steam condensate, the installation is recommended of a steam condensate recovery system, consisting of a condensate tank, a condensate recovery pump, and related piping. This measure is considered financially feasible.

(2) Improvement of Steam Trap System

It was observed that thirty-one steam traps among the sixty-four installed in the steam-utilizing facilities were malfunctional due to blowing, leaking or blocking. It is recommended that blowing or leaking steam traps be replaced with new steam traps. As for the blocked or low-temperature steam traps, scheduled maintenance is recommended. This measure is considered financially feasible.

(3) Decreasing Heat Loss by Thermal Insulation

During the energy audit, it was observed that some portions of straight lines, valves and flanges were not insulated. It is recommended that these parts be insulated to prevent heat loss.

(4) Power Generation to Recover Energy Loss from Steam Control Valve

Of the 50 ton per hour of steam generated by boilers, 20 ton per hour was depressurized by the steam control valve to low-pressure steam at 0.5 bar for heating purposes. According to a rough estimation by the study team, 750 kW of power could be generated by recovering the energy loss due to this depressurization. It is recommended that a supplementary turbine be installed to recover this energy loss, provided that the present tariff system is amended to allow CSR to supply excess electricity to outside users through TNB.

3-3-6 Iron and Steel (Amsteel Mills (ASM))

(1) Reduction in Air/Fuel Ratio of Reheating Furnace in Rod Rolling Mill

During the energy audit, an air/fuel ratio of 1.25 was observed for the reheating furnace. It is recommended that the ratio be reduced to 1.15 of the optimum attainable value. Reduction in air/fuel ratio results in a decrease in exhaust gas volume, which contributes toward saving energy for the reheating furnace. For this measure, an investment is required for installation of an oxygen content meter at the reheating furnace tail, replacing the broken one. This investment is financially feasible under the conditions of the study.

(2) Reduction of Heat Loss from Reheating Furnace Wall in Rod Rolling Mill

A reheating furnace wall temperature of over 130℃ was observed during the energy audit,

although it is generally around 100℃ for ordinary furnaces. It is recommended that insulation be improved for reducing heat loss from the wall. The most convenient way of improving insulation is a veneering method, which involves overlaying a ceramic fiber blanket on the inside of the pre-build wall. This measure is regarded as financially feasible.

(3) Reduction in Temperature Variation of Extracted Material in Rod Rolling Mill

It was observed that the extracted billet temperature varied from 1,030℃ to 1,097℃, and the rolling procedure was performed successfully, even at the lowest temperature in the variation. It is recommended that the range of extracted billet temperature be reduced by half and the mean temperature be reduced to 1,045℃ by improved estimation of heating pattern changes. About a RM 57,000 annual fuel oil cost saving is expected by this measure.

(4) Introduction of Hot Billet Charging in Rod Rolling Mill

Hot billet charging to the reheating furnace is a popular energy-saving measure adopted by many steel mills. ASM has very favorable conditions to introduce hot billet charging in terms of facilities and their layout. It is recommended that hot billet charging be introduced into ASM. It is expected that 342 ton of medium fuel oil or RM 111,000 of the fuel bill be saved annually by this measure, depending on the operation, especially the cooperation of the steel making shop and the rod rolling mill.

(5) Reduction in Electricity Consumption for New Shredder Plant

It was observed during the energy audit that electricity was consumed at a rate of around 35 kWh per hour in the new shredder plant even when the plant stopped. It is recommended that the cause of this loss be investigated and that the heat loss be prevented.

(6) Reduction in Electricity Consumption for Electric Arc Furnace (EAF)

The electricity consumption of ASM's EAF is somewhat higher than Japanese steel shops. ASM's data suggests that heat transfer in the EAF is rather poor. This problem would be solved by an active boiling reaction in the EAF, which would require additional carbon and would therefore increase heat generation. It is recommended that the oxygen lance position be well into the molten phase and also influence the metal phase, so that the boiling reaction is not localized only in the slag phase. About a 15 kWh per ton electricity saving in the EAF is anticipated by this measure.

Chapter 4 Energy Situation and Plans for Promotion of Energy Efficiency

In this chapter, the energy situation and the plans for the promotion of energy efficiency are described.

4-1 World Energy Situation

4-1-1 Energy Situation throughout the World

(1) Total Primary Energy Supply (TPES) in the World

According to the data based on IEA, the world primary energy supply was 4,860 million TOE in 1971 and 8,200 million TOE in 1995, as shown in Table 4-1. The primary energy supply increased at a rate of approximately 2.2 percent per annum during 1971and 1995, mainly as a result of the increase of energy consumption in developing countries. In the recent five year period between 1990 and 1995, the average rate of energy supply increase was approximately 1.1 percent per annum. By type of energy source, petroleum collectively accounted for 39 percent of the total supply in 1995. The rest came from solid fuel, natural gas, nuclear and hydro electricity.

Table 4-1 Total Primary Energy Supply in the World

	Primary Energy Consumption (Billion TOE)								Growth Rates (% p.a.)		Shares of Fuel (%)	
	1971	1973	1980	1985	1990	1993	1994	1995	1971 -1995	1990 -1995	1971	1995
TPES	**4.86**	**5.42**	**6.44**	**6.94**	**7.78**	**7.97**	**8.01**	**8.20**	**2.2**	**1.1**	**100**	**100**
Solid Fuels	1.43	1.49	1.74	2.02	2.16	2.13	2.15	2.20	1.8	0.4	29.5	26.8
Oil	2.33	2.70	2.99	2.80	3.07	3.14	3.14	3.19	1.3	0.8	47.8	38.9
Natural Gas	0.90	0.98	1.24	1.42	1.67	1.75	1.75	1.81	3.0	1.5	18.5	22.0
Nuclear	0.03	0.05	0.19	0.39	0.52	0.57	0.58	0.61	13.5	3.0	0.6	7.4
Hydro	0.10	0.11	0.15	0.17	0.19	0.20	0.20	0.21	3.1	2.8	2.1	2.6
Other fuels	0.07	0.08	0.14	0.14	0.16	0.18	0.18	0.18	4.0	2.4	1.5	2.3
TPES per Capita (TOE)	1.30	1.39	1.46	1.44	1.48	1.45	1.44	1.45	0.5	-0.4	-	-
TPES/GDP (TOE/Mill. US$ 1987 price)	463	461	443	425	408	404	396	396	-0.6	-0.6	-	-

Source: Based on Energy Balances of OECD Countries, Energy Statistics and Balances of Non-OECD Countries (IEA)

Notes: (1) TPES (Total Primary Energy Supply)
(2) Consumption is based on net heating value
(3) Other fuels are combustible renewables and waste, and solar energy etc.
However,combustible renewables and waste are not included for non-OECD countries

(2) Total Final Consumption of Energy (TFC) in the World

The global total final consumption of energy in 1971 was 3,770 million TOE; per capita consumption was 1.01 TOE. The world Total Final Consumption of Energy in 1995 was 5,790 million TOE, much larger than that in 1971; per capita consumption was 1.03 TOE, slightly larger than that in 1971. The difference between TPES and TFC consists of self-use and losses of energy in the energy transformation sector such as electricity plants, combined heat and power plants, heat plants, production of gas and gas works, and petroleum refineries. In the five years from 1990, energy consumption increased at a rate of approximately 0.9 percent per annum, as shown in Table 4-2. This is mainly as a result of the increase in consumption by transportation and other sectors including residential, commercial, agriculture, fisheries and public service, in contrast to a decrease in the industrial sector and non-energy use.[1]

Table 4-2 Total Final Energy Consumption in the World

	Final Energy Consumption (Billion TOE)								Growth Rates (% p.a.)		Shares (%)	
	1971	1973	1980	1985	1990	1993	1994	1995	1971 -1995	1990 -1995	1971	1995
TFC	3.77	4.17	4.81	5.03	5.53	5.65	5.63	5.79	1.8	0.9	100	100
Industry	1.63	1.81	2.04	2.04	2.19	2.12	2.10	2.17	1.2	-0.1	43.2	37.5
Transportation	0.85	0.96	1.14	1.22	1.42	1.47	1.49	1.54	2.5	1.6	22.7	26.6
Residential, Commercial & Agriculture	1.16	1.26	1.45	1.60	1.73	1.90	1.87	1.91	2.1	2.0	30.8	33.0
Non-Energy	0.13	0.14	0.18	0.17	0.19	0.17	0.18	0.17	1.3	-2.3	3.3	3.0
TFC per Capita (TOE)	1.01	1.07	1.09	1.05	1.05	1.03	1.01	1.03				
TFC/GDP (TOE/Mill. US$ 1987 price)	359	355	330	308	290	286	278	279				

Source: Based on Energy Balances of OECD Countries, Energy Statistics and Balances of Non-OECD Countries (IEA)

Notes: (1) TFC (Total Final Energy Consumption)
(2) Consumption is based on net heating value
(3) Other fuels are combustible renewables and waste, and solar energy etc.
However, combustible renewables and waste are not included for non-OECD countries

4-1-2 Energy Consumption in Selected Countries

The energy consumption of Malaysia, Japan, Germany, the United Kingdom, France, the United States, Singapore, Thailand, Indonesia and South Korea are described here.

[1] Non-energy use covers use of other petroleum products such as paraffin waxes, lubricants, bitumen and other products. Non-energy use of coal includes carbon black, graphite electrodes, etc. Please note that feedstock for the petrochemical industry is earmarked for the industrial sector.

(1) Trends in Energy Demand and GDP in Selected Countries

A fairly high increase rate of TPES has been observed together with GDP growth in ASEAN countries including Malaysia and NIES countries. The TPES growth rates for 1985-1995 in those countries were: 8.1 percent in Malaysia, 10.6 percent in Singapore, 12.8 percent in Thailand, 9.1 percent in Indonesia and 10.5 percent in South Korea. However, in OECD countries such as Japan, Germany, the United Kingdom, France and the United States for the period between 1985 and 1995, TPES increased at lower average annual rates between minus 0.6 percent and plus 3.1 percent, while GDP grew at rates from 2 to 3 percent per annum.

Table 4-3 TPES and GDP Growth Rate

	TPES (Million TOE)				GDP (Billion US$, 1990 Price)				TPES Growth		GDP Growth	
	1971	1985	1994	1995	1971	1985	1994	1995	1971 -1985	1985 -1995	1971 -1985	1985 -1995
Malaysia	5	15	33	33	12	31	59	65	8.3	8.1	7.1	7.7
Japan	270	367	483	497	1,358	2,369	3,144	3,191	2.2	3.1	4.1	3.0
Germany	308	361	337	339	1,041	1,421	1,750	1,781	1.1	-0.6	2.2	2.3
United Kingdom	211	204	221	224	632	828	1,013	1,040	-0.3	1.0	2.0	2.3
France	155	200	232	241	737	1,030	1,234	1,260	1.9	1.9	2.4	2.0
USA	1,593	1,782	2,058	2,088	3,348	4,846	6,005	6,147	0.8	1.6	2.7	2.4
Singapore	3	8	25	21	9	25	50	55	7.2	10.6	7.7	8.3
Thailand	7	16	44	52	22	52	118	128	6.4	12.8	6.4	9.4
Indonesia	9	36	75	86	32	81	154	166	10.6	9.1	6.9	7.4
South Korea	17	54	133	145	49	156	334	364	8.8	10.5	8.6	8.8

Source: Based on Energy Balances of OECD Countries, Energy Statistics and Balances of Non-OECD Countries (IEA)

(2) Trends in Energy Intensity (TPES/GDP)

Table 4-4 compares energy intensities using GDP estimates in selected countries. Energy intensity in Malaysia was 512 TOE/million US$, which was around the same level as Indonesia, but higher than that in Singapore, Thailand and South Korea. Energy intensity in Japan, Germany, the United Kingdom and France was considerably lower than that in Malaysia, reaching only 30 percent to 42 percent of Malaysia's.

Energy intensity has increased in Malaysia by 1.2 percent annually during 1971-1985, and 0.4 percent annually during 1985-1995. The energy intensity in OECD countries such as Japan, Germany, the United Kingdom, France and the United States has basically declined continuously in the same period.

Table 4-4 Energy Intensity

	TPES/GDP (TOE/Million US$, 1990 Price)				Increase Rate (% p.a.)	
	1971	1985	1994	1995	1971-1985	1985-1995
Malaysia	415	491	562	512	1.2	0.4
Japan	199	155	154	156	-1.8	0.1
Germany	296	254	192	190	-1.1	-2.9
United Kingdom	334	246	219	216	-2.2	-1.3
France	210	194	188	192	-0.5	-0.1
USA	476	368	343	340	-1.8	-0.8
Singapore	337	315	491	390	-0.5	2.1
Thailand	298	299	377	407	0.0	3.1
Indonesia	277	443	489	516	3.4	1.5
South Korea	335	343	397	399	0.2	1.5

Source: Based on Energy Balances of OECD Countries, Energy Statistics and Balances of Non-OECD Countries (IEA)

(3) Per Capita Energy Consumption

As outlined in Table 4-5, per capita TPES in Malaysia in 1995 was 1.65 TOE, which was considerably less than that in Japan, Germany, the United Kingdom, France, the United States and Singapore. It is clear that there is a relationship between per capita energy demand and per capita GDP.

Table 4-5 Per Capita Energy Demand

	Per Capita Energy Demand (TOE)				Increase Rate (% p.a.)	
	1971	1985	1994	1995	1971-1985	1985-1995
Malaysia	0.45	0.97	1.69	1.65	5.7	5.5
Japan	2.57	3.04	3.86	3.96	1.2	2.7
Germany	3.93	4.65	4.14	4.15	1.2	-1.1
United Kingdom	3.77	3.59	3.79	3.83	-0.3	0.6
France	3.01	3.62	4.01	4.15	1.3	1.4
USA	7.67	7.47	7.90	7.94	-0.2	0.6
Singapore	1.55	3.15	8.44	7.15	5.2	8.5
Thailand	0.18	0.30	0.77	0.90	3.9	11.4
Indonesia	0.07	0.22	0.39	0.44	8.2	7.2
South Korea	0.51	1.31	2.98	3.23	7.0	9.4

Source: Based on Energy Balances of OECD Countries, Energy Statistics and Balances of Non-OECD Countries (IEA)

(4) Total Final Consumption of Energy by Sector in Selected Countries

The final energy consumption by sectors such as industry, transport, others (including household, commercial, agriculture, fishery and public services), and non-energy use are shown in Figure 4-1. In Malaysia, final energy consumption by sector was; 41 percent for the industrial sector, 35 percent for the transport sector, 15 percent for other sectors, and 9 percent for non-energy use in

1995. In comparison, between 1985 and 1995, though the industrial sector's share did not change, the transport sector's share decreased by 6 percent and the share of other sectors and non-energy use increased by 2 percent and 4 percent, respectively.

The industrial sector's contribution to growth in final energy demand slowed from 1985 to 1995 in Japan, Germany, the United Kingdom and the United States, reflecting structural shifts in the major economies toward services and less energy-intensive industries. In these countries, contributions of the transport sector and other sectors increased in place of the industrial sector's contribution.

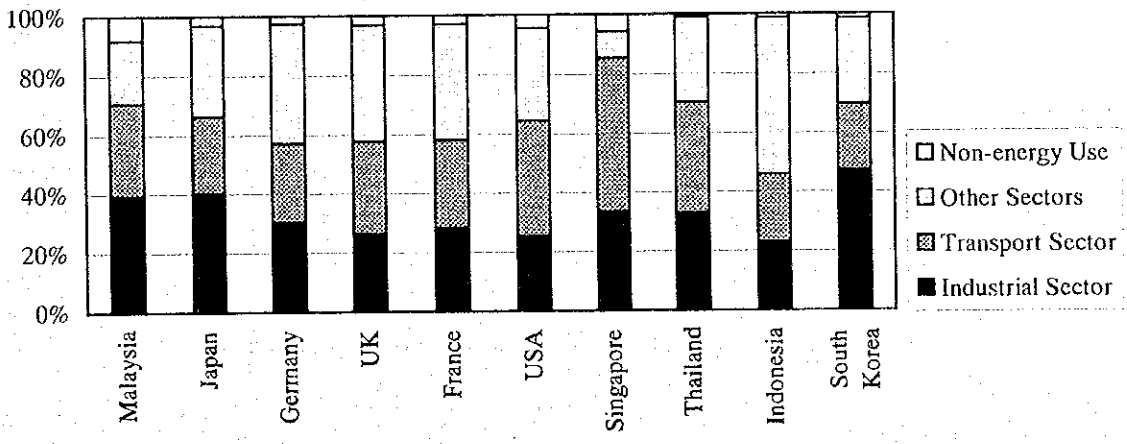

Figure 4-1 Final Energy Consumption by Sector

4-2 Energy Situation in Malaysia

(1) Commercial Energy Supply by Source

Table 4-6 shows the commercial energy supply by source during the period from 1980 to 1996. In term of natural gas supply, a deduction has been made for the quantity of gas flared, re-injected into gas fields and used for production purposes as well as use for LNG production. In 1996, commercial energy supply increased up to 35.6 million TOE, that is four times as much as the supply in 1980, 9.4 million TOE.

Crude oil continued to be the largest supply source and the amount of natural gas supply increased rapidly. Dependence on crude oil and petroleum products continued to decline, except for the period from 1995 to 1996. The share of crude oil and petroleum products in the total

supply decreased from 87.8 percent in 1980 to 57.2 percent in 1996, while that of natural gas increased from 7.4 percent to 34.6 percent during the same period. This change indicates the success of the four-fuel diversification policy.

Table 4-6 Commercial Energy Supply by Source

	1980		1985		1990		1995		1996	
	kTOE	%	kTOE	%	kTOE	%	kTOE	%	kTOE	%
Crude Oil	5,901	63.0	7,579	60.2	8,783	44.7	16,159	52.3	18,255	51.3
Petroleum Product	2,323	24.8	2,131	16.9	3,651	18.6	610	2.0	2,099	5.9
Natural Gas	697	7.4	1,487	11.8	4,991	25.4	10,974	35.5	12,289	34.6
Coal & Coke	53	0.6	362	2.9	1,326	6.7	1,612	5.2	1,677	4.7
Hydropower	383	4.1	1,019	8.1	915	4.7	1,540	5.0	1,243	3.5
Electricity	7	0.1	5	0.0	-5	0.0	-2	0.0	-1	0.0
Total	9,364	100.0	12,583	100.0	19,661	100.0	30,893	100.0	35,562	100.0

(2) Energy Demand

During the period from 1990 to 1996, the final consumption of commercial energy in Malaysia grew rapidly from 13.2 million TOE to 24.4 million TOE at an average annual rate of 10.6 percent, as shown in Table 4-7.

Table 4-7 Selected Economic and Energy Indicators (1990-1996)

	1990	1991	1992	1993	1994	1995	1996	Growth
GDP (Million RM 1978)	79	86	93	101	110	120	131	8.7%
Population (Million)	18	19	19	20	20	21	21	3.0%
Primary Energy (Mill. TOE)	20	21	23	26	28	31	36	10.4%
Final Energy (Mill. TOE)	13	15	16	17	19	22	24	10.6%
Electricity (Mill. TOE)	2	2	2	2	3	3	4	14.1%
Electricity (TWh)	20	22	26	28	34	39	44	14.1%
Average Annual Growth Rate (%)								
GDP		8.6%	7.8%	8.3%	9.2%	9.5%	8.6%	8.7%
Primary Energy		4.8%	11.9%	14.0%	7.4%	9.4%	15.3%	10.5%
Final Energy		10.2%	11.2%	7.9%	10.4%	14.9%	9.0%	10.6%
Electricity		12.2%	15.2%	10.5%	19.7%	15.1%	11.9%	14.1%
Per Capita								
GDP (RM 1978)	4,468	4,645	4,877	5,143	5,465	5,815	6,171	5.5%
Primary Energy (kTOE)	1,107	1,111	1,211	1,344	1,404	1,493	1,682	7.2%
Final Energy (kTOE)	744	785	850	893	959	1,071	1,142	7.4%
Electricity (kWh)	1,123	1,206	1,354	1,455	1,694	1,896	2,074	10.8%
Energy Intensity								
Primary Energy (TOE/1978 Mill. RM)	248	239	248	261	257	257	273	1.6%
Final Energy (TOE/1978 Mill. RM)	167	169	174	174	175	184	185	1.8%
Electricity (TOE/1978 Mill. RM)	22	22	24	24	27	28	29	5.0%
Electricity (MWh/1978 Mill. RM)	251	260	278	283	310	326	336	5.0%

Source: National Energy Balance Malaysia (1980-1996), Ministry of Energy, Telecommunications and Posts, Malaysia

This average annual growth rate is higher than that of GDP for the same period, i.e. 8.7 percent. Electricity consumption grew at a higher annual growth rate of 14.1 percent during the period. Consequently, energy intensity per GDP increased during the period at an average annual rate of 1.8 percent for final consumption of commercial energy and 5.0 percent for electricity consumption.

(3) Energy Prices

Electricity prices of Malaysia's three utilities are compared with those of foreign countries in Table 4-8. The electricity tariff of various countries may consist of a portion linked with the quantities delivered, portions dependent on diurnal patterns of use, power factor, etc., as well as a fixed charge component. Therefore, it is not practical to obtain an average unit price from the tariff systems. It has been obtained by the IEA either from utilities as the average revenue per unit delivered or from users as the average expenditure per unit purchased. In this report, average unit prices were obtained for Malaysia's three utilities by dividing their electricity sales revenue by their total units sold.

Among Malaysia's three utilities, TNB sold electricity to users at the lowest price and SESCO did so at the highest price. It is difficult to compare Malaysia's prices with foreign prices, because separate values for industry and household cannot be obtained for Malaysia. However, it is clear that electricity was been delivered to users at much lower prices in Malaysia than in Japan.

Table 4-8 Comparison of Electricity Prices

Unit: US cent/kWh

	1993	1994	1995	1996
Electricity Prices for All Users in Malaysia				
TNB	7.3	7.1	7.9	8.3
SEB	9.0	10.1	10.2	9.8
SESCO	8.1	10.8	11.2	11.6
Electricity Prices for Industry				
Japan	16.3	17.2	18.5	15.7
Germany	8.9	8.9	10	8.6
France	5.5	5.3	6	5.7
United States	4.9	4.7	4.7	4.6
United Kingdom	6.8	6.7	6.8	6.5
Electricity Prices for Households				
Japan	23.0	25.0	26.9	23.0
Germany	16.9	17.8	20.3	18.0
France	14.6	15	16.7	16.4
United States	8.3	8.4	8.4	8.4
United Kingdom	11.6	12.2	12.7	12.5

Source: Based on Statistics of Electricity Supply Industry in Malaysia, 1997 edition, Department of Electricity & Gas Supply Malaysia; IEA

4-3 Policy and Institutional Measures for Promotion of Energy Efficiency

Governmental measures for the promotion of energy efficiency are described in this section. It is not appropriate to use Japanese measures directly due to the differences in level of energy efficiency, economy and religion between Malaysia and Japan. Accordingly, in addition to Japan, the measures adopted in Thailand, which is the neighboring country of Malaysia, and Turkey, which is an Islamic country, are compared and referred to. The results of comparison are mentioned later in the tabular form.

4-3-1 Organizations for Promotion of Energy Efficiency

(1) Present State

There are many public organizations, universities and private entities participating in plans and activities for the promotion of energy efficiency.

(2) Problems

A centralized strong coordination organization based on legal mandate is necessary to coordinate among government and private organizations to promote energy efficiency. A coordination board is required to coordinate energy efficiency activities of the government, ministries, agencies, universities and private entities for the purpose of coordinating planning works for the promotion of energy efficiency; various studies for energy-saving policies and institutions; preparation of information network; research works for technical developments; and creating awareness .

(3) Notes

A study on energy efficiency in IEA member countries by the International Energy Agency concluded that strong political leadership and bureaucratic commitment are, however, the key to the success of government energy saving activities. In addition, there should be effective interdepartmental coordination in the government for the smooth promotion of energy efficiency activities. For this purpose, a strong political leadership with bureaucratic interest is expected to promote the promotion of energy efficiency.

(4) Recommendations

It is recommended that an energy efficiency coordination board headed by organizations such as the Economic Planning Unit (EPU) and participated in by the Ministry of Energy, Communications and Multimedia (MECM) as a key member is created. The board is

recommended to work on a basis with legal mandate.

4-3-2 Laws and Regulations for Promotion of Energy Efficiency

(1) Present State

Laws or regulations on which nationwide energy efficiency measures can be based are still needed in order to execute energy efficiency programs in an integrated manner. It is necessary for the government to express its commitment to energy efficiency, and to formulate laws or regulations on which various measures are to be based. No laws or regulations for the promotion of energy efficiency have been enacted yet in Malaysia. JBE&G formulated a draft of new energy efficiency regulations in 1997 and submitted them to MECM for approval to include them in the Electricity Supply Act.

(2) Problems

The draft of regulations prepared by JBE&G includes an energy-managed entity system, an energy manager system, provisions for the qualification of energy manager and standards for electrical appliances. The regulations do not include standards for judgement of energy use. The regulations cover mainly electricity. Accordingly, the scope of regulations should be expanded not only for electricity, but also other fuels in order to promote further energy efficiency. In addition, regulations should cover other sectors such as the residential sector, and specification of machinery when their revision is required.

(3) Notes

It takes a lot of time to prepare laws and regulations for the promotion of energy efficiency like those enacted in Japan. This is because with Japan's stage of development, the laws and regulations are more stringent. The early enforcement of laws or regulations of countries such as Thailand, which has similar economic characteristics to Malaysia, and Turkey, which is an Islamic country, are expected. In order to ensure that energy-saving activities can be carried out more effectively, revision of regulations is also expected in the future.

(4) Recommendations

1. Early enactment of laws and regulations

   It is recommended that the government express its commitment to the promotion of energy efficiency, and for it to formulate regulations on which its various measures are to be based. A draft of regulations has been prepared by JBE&G, and is expected to be enacted in 1999 or 2000. Early revision of the Electricity Supply Act with

regulations for the promotion of energy efficiency is recommended.

2. Preparation of standards and guidelines for promotion of energy efficiency

   It is strongly recommended that standards and guidelines be prepared, and these are described in the respective sections.

3. Expansion of scope of prepared regulations

   The prepared regulations by JBE&G are mainly for electricity. It is recommended to expand the scope of the regulations not only for electricity, but also other fuels when revision is required for the purpose of further energy-saving. It is also recommended that other sectors such as residential and machinery such as electrical appliances, vehicles and office equipment be covered.

4-3-3 For Industrial Sector

(1) Energy Managed-Entity System

1) Present State

An energy-managed entity system is not yet effective in Malaysia. This system consists of appointing a company as an energy-managed entity with the aim of controlling the rational use of energy for the promotion of energy efficiency. As described before, the draft of regulations prepared by JBE&G stipulates the entities consuming large volume of electricity. The entities consuming 3600,00kWh or more energy per month, or exceeding maximum demand of 1 MW, are obligated to appoint an energy manager officer in order to promote rational use of energy.

2) Problems

It is a good system to appoint a company as an energy-managed entity that consumes a large volume of electricity to promote energy efficiency. Judging from the efficiency of this system in Thailand, Turkey and Japan, entities that are large energy consumers should be stipulated by this system in order to control 60% or 70% of total consumption of energy in Malaysia. As detailed energy statistics are not available in Malaysia, it is difficult to identify the entities that consume more than 360,000kWh of electricity per month or 1 MW. Large-scale manufacturing industries are mostly large energy consumers. Some of them use a large volume of fuel, not only electricity, but also petroleum products natural gas, etc. This system should be applied not only to consumption of electricity but also to fuels especially for the industrial sector.

3) Notes

The energy-managed entity system should not be applied to the small and medium scale entities, as it would force them to bear cost and technical burdens.

4) Recommendations

1. Early enactment of energy-managed entity system

   For the promotion of energy efficiency, the early establishment of an energy-managed factory designation system is recommended. Entities that consume a large volume of energy are designated as energy-managed factories and are urged to effectively carry out energy efficiency programs, and furthermore are held responsible for reporting their energy supply and consumption every year. This will help the designated factories to recognize their energy consumption; to analyze their energy consumption process-by-process; and to understand the causes of fluctuations in energy consumption. As a result, this will lead them to take effective measures to conserve energy. At the same time, MECM and JBE&G will be able to analyze the energy data thus made available to them, and to use these data in formulating their policies for the industrial sector. This system should not include small and medium scale entities in view of efficiency.

2. Expanding scope of regulations

   It is recommended to revise the applicable scope of the regulations, expanding it not only to consumption of electricity, but also to fuels (petroleum products and natural gas) especially for the industrial sector.

(2) Energy Manager System

1) Present State

An energy-managed entity system is not yet enacted in Malaysia. As a result, an energy manager system is not established as yet.

2) Problems

At present, not all entities that consume more than 360,000 kWh of electricity or have more than 1 MW of electricity demand employ enough qualified energy managers. It is necessary to train engineers and improve their technical skills for enforcement of this system.

3) Notes

It is a good system for a designated entity to have energy managers and to enable these managers to play a key role in promoting energy efficiency.

4) Recommendation

It is recommended that this system be established as soon as possible, since the system of energy managers will greatly contribute to nationwide energy efficiency measures for the industrial sector.

(3) Qualification System of Energy Manager

1) Present State

An energy manager qualification system is not established in Malaysia, but the draft of regulations prepared by JBE&G includes the criteria to qualify as an energy manager.

2) Problems

An energy-managed entity will be obligated to appoint an energy manager. The Malaysia of nowadays, experienced energy engineers are not sufficient enough.

3) Notes

The qualification system for an energy manager should be a socially authoritative one.

(a) Energy manager certificate

The Government is advised to establish short-term courses to provide training on energy management subjects to the personnel to be assigned by the plants, and/or shall issue authorization to the training organizations to arrange these courses. MECM or JBE&G is responsible to issue certificates after the examinations at the end of the said courses.

(b) Energy efficiency classes in universities

When engineers who have received a semester of energy efficiency education during their education at a university apply to JBE&G with the necessary documents, they may be issued with the certificate of Energy Manager.

4) Recommendations

1. State-approved qualification system

To expedite deployment of energy managers as soon as possible, it is advisable to introduce a state-approved qualification system for energy managers, for example by issuing certificates to graduates of technology courses and to engineers with years of experience in the promotion of energy efficiency.

2. Training

Arrangement of training courses for the promotion of energy efficiency is recommended to provide certification.

3. Registration of energy managers

A registration system for qualified energy managers is recommended. After the qualified engineers are posted to energy-managed factories, JBE&G would provide them with updated information obtained by surveys and foreign information on the promotion of energy efficiency, as well as communicating government measures and providing specialized technical education. In order to maintain and improve the quality of energy managers, it is necessary to organize and register them with technical information on energy efficiency and conservation, and to train them.

(4) Award for Energy Efficiency

1) Present State

To increase business interest in energy efficiency, awards should be given to individual engineers or groups of employees or entities, which have achieved excellent results in promoting energy efficiency, but an award system is not established yet in Malaysia.

2) Problems

The key factor is for this system to be recognized by engineers and managers.

3) Notes

As this system will lead to the boosted morale of people engaged in energy efficiency, it is important that it be carried out periodically. In addition, nationwide recognition of this system is a key factor.

4) Recommendations

It is considered necessary for a state organization to publicly commend factories that have achieved excellent results in energy efficiency and that have made constant efforts in energy management, as well as manufacturers who have developed highly effective energy efficiency equipment during the year.

(5) Standards for Energy Use

1) Present State

In Malaysia, there are no concrete forms of energy standards that could serve as the base for industrial sectors to judge the degree to which energy efficiency is promoted.

2) Problems

The preparation of various non-compulsory standards for the promotion of energy efficiency,

which show quantitative targets, is essential for the promotion of energy efficiency. The draft of regulations is without standards for energy use.

3) Notes

The necessity and technological level of energy efficiency in the industrial sector seem more advanced compared to the commercial sector. And the promotion of energy efficiency in soft aspects such as management, operation and maintenance is an important management target. However, there are still old types of energy-consuming facilities whose energy efficiency is markedly different from new ones. In terms of also strengthening the international competitiveness of Malaysian products, the application of Japanese standards is considered to be highly significant.

4) Recommendations

Standards for judgement are desperately needed. MECM and JBE&G are strongly advised to take the initiative in preparing these standards in collaboration with PTM and other organizations concerned with promoting energy efficiency. In the case of the industrial sector, it is recommended that the standard portion of Japanese criteria be adopted in the preceding four years and the targeted portion in the latter six years. The standards of energy efficiency developed by the study team are described in Chapter 7 of the main report. For reference, the items of standards for the industrial sector described in the main report are shown below:

Rationalization of fuel combustion system
Rationalization of heating, cooling and heat transfer system
Prevention of heat loss due to radiation and transmission
Recovery and utilization of waste heat
Rationalization of systems to convert heat into motive power
Prevention of electric power loss due to resistance and other factors
Rationalization of systems to convert electricity into motive power, heat, etc.

(6) Preparation of Guidelines

1) Present State

As there are no energy standards, there are also no guidelines for the promotion of energy efficiency in Malaysia. It is essential that an energy-managed factory endeavors to improve the efficiency of its energy-consuming equipment. For the above purpose, it is necessary to guide each entity on ways to improve itself to pass the above- mentioned standards.

2) Problems

The draft prepared by JBE&G does not include guidelines for the promotion of energy efficiency that may help entities to save energy.

3) Notes

The guidelines may help entity staff to conduct energy efficiency promotion measures and may help business operators to manage positive efforts for the streamlining of energy use in each factory, for example by enabling them to select sounder solutions adapted to the given conditions. To attain the above standards, it is effective to apply guidelines developed by advanced countries in the area of energy efficiency.

4) Recommendations

Various guidelines with quantitative targets for the promotion of energy efficiency should be prepared, which show realistic methods to improve energy efficiency. MECM and JBE&G are strongly urged to take the initiative in preparing guidelines. The guidelines on energy efficiency developed by the study team are described in Chapter 7 of the main report. For reference, the items of standards described in the main report are shown below:

Fuel combustion system
Heating, cooling and heat transfer
Radiation and transmission
Recovery and utilization of waste heat
Converting heat into motive power
Electric power loss
Converting electricity into motive power

4-3-4 For Commercial Sector

The draft of regulations for the promotion of energy efficiency includes an energy-managed entity system, an energy manager system for the commercial as well as the industrial sectors. The draft, which covers the industrial and commercial sectors, is good for the promotion of energy efficiency. Recommendations for the commercial sector are described below excluding the recommendations mentioned above for the industrial sector, which are applicable to the commercial sector.

Measures such as the insulation of buildings are highly effective for the promotion of energy efficiency. Thus, the formulation of regulations is recommended that stipulates the following

rules for the promotion of energy efficiency in buildings.

(1) Standards for Energy Use

1) Present state

In Malaysia, there is no concrete form of energy standards that could serve as a base for the commercial sector to judge the degree to which energy efficiency is promoted.

2) Problems

In order to ensure appropriate and effective implementation, the ministry concerned shall stipulate and announce items to which building owners should refer as standards in making decisions concerning which specific measures to take. However, after the study team conducted energy audits in the commercial and industrial sectors of Malaysia, it is evident that the application of current Japanese standards to the commercial sector would be rather difficult compared to the industrial sector.

3) Note

Though Japanese standards were established on the basis of technical and economic appropriateness and are supported by every commercial sector in Japan, they could be applied as a basis for setting long-term standards for Malaysia, by making adjustments for climate and other environmental differences. Accordingly, it seems realistic to apply Japanese standards to Malaysia in a step-by-step manner.

4) Recommendations

MECM and JBE&G are strongly urged to take the initiative in preparing these standards in collaboration with PTM and other organizations concerned with promoting energy efficiency. The standards of energy efficiency developed by the study team are described in Chapter 7 of the main report. For reference, the items of standards described in the main report are shown below:

1. Target : To attain the current level of energy efficiency in Japan within ten years
2. Periods and duration : Preceding term of 4 years and latter term of 6 years
3. Preceding four years : Soft approach (management, operation and maintenance)
4. Latter six years :
   - Application of current Japanese standards to new facilities
   - Application of energy efficiency standards to existing facilities requiring relatively small investment
   - In the case of equipment renovation, standards equivalent to those for new equipment

could be applied.

(2) Guidelines for Promotion of Energy Efficiency

1) Present state

It is essential that an energy-managed entity endeavors to improve the efficiency of its energy-consuming equipment. For the above purpose, it is necessary to guide each entity on ways to improve itself to pass the above-mentioned standard. However, there is no form of guidelines for the promotion of energy efficiency.

2) Problems

Various non-compulsory guidelines should be prepared for the commercial sector to promote energy efficiency, which show realistic methods to improve energy efficiency.

3) Notes

It seems realistic to develop guidelines in a step-by-step manner.

4) Recommendations

MECM and JBE&G are strongly urged to take the initiative in preparing these guidelines in collaboration with PTM and other organizations concerned with promoting energy efficiency. The guidelines of energy efficiency developed by the study team are described in Chapter 7 of the main report.

(3) Others

Besides standards and guidelines, it is recommended that the following items are incorporated into the regulations.

1) Obligations of Building Owners

Any person who intends to construct a building must take appropriate measures for prevention of heat loss and for efficient utilization of energy for building facilities.

2) Guidance and Advice

The ministry concerned may give insulation and other construction material manufacturers necessary guidance and advice for improving the insulation properties of their construction materials in order to ensure the improved quality of insulation materials, which constitute a basic element in improving the total insulation capability of buildings.

3) Instructions for Specific Buildings

Furthermore, if the concerned ministry deems that any building (not for dwelling) of for example, 360,000kWh per month or more is notably lacking in measures undertaken for efficient use of energy in terms of the standards to be referred to, the concerned ministry can give necessary instructions to the building owner on matters concerning design and construction work, and if the building owner does not comply, the ministry shall make an announcement to that effect.

4-3-5 Incentives for Promotion of Energy Efficiency

(1) Present State

The most popular legal incentives are tax credits and tax exemptions. The administrative incentives are soft loans. Tax incentives and soft loans for investment in energy saving are not available in Malaysia.

(2) Problems

There are many entities that are suffering from a shortage of funds for investment in energy-efficient equipment. Government assistance programs are needed.

(3) Notes

The establishment of legal incentives requires a partial amendment of the concerned act, and the preparation of administrative incentives needs a large amount of budget and governmental support.

(4) Recommendations

In order to promote energy-saving smoothly on a nationwide scale, establishment of the following incentives is advisable in parallel with the enactment of regulations.

1. The implementation of customs duty exemption, investment allowance, and tax incentives, etc.
2. Low interest finance and a system of endorsement for debt
3. An incentive package scheme using incentives such as incentives of taxes and loans mentioned above.

To increase the effectiveness of incentives for energy efficiency promotion such as tax credits and exemption, and loan incentives, it would be useful to formulate an integrated incentive package, or incentive schemes consisting of tax credits and exemptions, soft loans.

4-3-6 Others

It would be advisable for MECM to coordinate and arrange a study to enhance ESCOs, which are private entities. The further activation of ESCOs is one option to promote developments in the efficient use of energy. The function of an ESCO would be to carry out energy audits, assist arrangement of finance and modification of facilities and to operate for the benefit of various entities. These activities would be carried out through the allocation of profits obtained by the promotion of energy efficiency between entities and ESCOs.

4-4 Measures for Energy Manager Training and Energy Efficiency Promotion Division of PTM

4-4-1 Training for Energy Managers

(1) Present State

The system of training energy managers for the promotion of energy efficiency is served by private entities but is still recognized to be underway.

(2) Problems and Notes

In order to facilitate energy efficiency promotion, the cultivation of talented individuals to engage in the promotion of energy efficiency becomes necessary so that such individuals do indeed engage in the promotion of energy efficiency; the training is also necessary of energy managers for each entity, and of talented individuals to train those managers.

(3) Recommendations

The objective of training is to foster talented individuals who possess the planning sense, knowledge and experience necessary to promote energy efficiency. In order to achieve this objective, it is recommended that the following be carried out.

1. Preparation of a system
2. Preparation of a training organ
3. Establishment of a training plan
4. Preparation of a qualification system
5. Creation of a schedule

4-4-2 Activities for Promotion of Energy Efficiency by JBE&G and PTM

(1) Present State

A number of activities were carried out by the JBE&G recently. Many of them are for electricity and include holding seminars, workshops, and exhibitions, to conduct energy audits; preparing materials for the promotion of energy efficiency; and approving co-generation projects.

PTM was newly established in 1998 as a technical arm of MECM and has just commenced its activities for the promotion for energy efficiency.

(2) Problems and Notes

Activities for the promotion of energy efficiency will be carried out by JBE&G and PTM.

(3) Recommendation

In order to promote energy efficiency smoothly, it is necessary for JBE&G and PTM jointly or separately to carry out the following activities.

1. Energy Audits (JBE&G, PTM)
2. Seminars for Energy Efficiency (JBE&G, PTM)
3. Energy Data Base (PTM)
4. Research on Promotion of Energy Efficiency (PTM)
5. Promotion of Energy Efficiency Campaign (JBE&G, PTM)
6. Publication (PTM)
7. Education and Training on Energy Efficiency (JBE&G, PTM)

Strengthening the Energy Efficiency Promotion Division of PTM is recommended in order to centralize the above activities in the long-range plan.

4-4-3 Energy Efficiency Promotion Division of PTM

(1) Organization and Role of Energy Efficiency Promotion Division of PTM

1) Present State

PTM is newly established and the group for the promotion of energy efficiency of PTM is just starting its activities to promote energy efficiency. The following organizational demarcation of activities regarding promotion of energy efficiency is clarified at present.

Scope of Implementation for PTM:

1. Promotion of energy efficiency campaign

2. Research activities
3. Energy data base
4. Seminars on energy efficiency
5. Technical development
6. Energy audits
7. Publication

Scope of Implementation for Others (JBE&G, Universities and others):

1. Education and training programs on energy efficiency
2. Energy manager's qualification
3. Energy management lessons for university students

2) Problems and Notes

PTM is newly organized and does not have much experience in the promotion of energy efficiency activities. There is an insufficient number of staff for the promotion of energy efficiency. There are no plans for developing the capability of engineers of private entities by means of opening training courses.

3) Recommendations

The study team recognizes that following items still remain as important issues:

1. Decentralization of activities for energy efficiency among various organizations, universities and entities will be inefficient in the future. Centralization of activities to PTM is recommended.
2. It is hoped that the promotion of energy efficiency activities, namely education and consulting, can be further developed and enhanced using international collaboration schemes.
3. The activities of PTM should not be limited but diversified to include education and training.
4. As a centralized organization for the promotion of energy efficiency in Malaysia, it is recommended to expand and enhance PTM's organization in order to establish sections such for public relations and publication, research, technical and training.

(2) Activities of PTM

1) Energy Audits

(a) Present State

PTM plans to carry out energy audits using Malaysian institutes, universities and

private entities. PTM is also expected to assist energy managers to carry out energy audits at their institutions or plants.

(b) Problems and notes

Analytic technology, engineers and equipment are not sufficient even in large-scale manufacturing industries as well as PTM. Entities of the commercial sector are in an even poorer state. In addition, the Government should allocate a larger budget to implement the energy audits.

(c) Recommendations

Followings are recommendations for PTM to conduct energy audit smoothly and fruitfully.

1. To thoroughly utilize the equipment provided by JICA for conducting energy audits.
2. To use human resources available inside and outside to cope with the increasing need for audits after the enactment of regulations.
3. To conduct simpler energy audits mainly at entities in the commercial sector, medium and small-scale factories, in order to make these entities interested in the promotion of energy efficiency.
4. To study energy bus program in order to execute simplified audits.
5. Introduction of paid energy audits

   Paid energy audits should also be studied, since many human resources and costly experts from outside including overseas are needed for carrying out precise, high level diagnosis and guidance services.

2) Dissemination of Technical Information on the Promotion of Energy Efficiency

(a) Present state

There is no organization with aggressive activities to disseminate technical information for the promotion of energy efficiency.

(b) Problems and notes

At present, sufficient information on the promotion of energy efficiency is probably not being provided to managers and engineers of entities. Provision of the latest technical information would serve to upgrade the technical levels of factories and institutions, and to stimulate them in the promotion of energy efficiency activities.

(c) Recommendations

1. PTM is planning various activities for enhancement of awareness for the promotion of energy efficiency such as:
   - seminars technology for rational use of energy

- publication of technical information such as magazines and papers
- holding of exhibitions devoted to the promotion of energy efficiency

It will be necessary to obtain technical collaborations from experienced organizations or entities to facilitate the activities mentioned above.

2. As an essential activity of publication activities, it is recommended that a pocket-sized book be issued entitled, 'The Promotion of Energy Efficiency Reference Book', illustrating related regulations, statistics, standards and technical data on heat management and electricity management, in order to enable staff to easily access the needed information while they are conducting promotion of energy efficiency activities.

3) Establishment of Energy Data Base System
(Energy statistics and Technical information)

(a) Present State

PTM has a plan to develop an energy database by gathering, and sorting out information and publications concerned with the promotion of energy efficiency data and technology.

(b) Problems and notes

To establish an energy data system, the following are required:
Highly educated man-power, a sophisticated computer system, a large amount of budget, long range period, large volume of information and data, and coordination and assistance from various organizations, agencies and universities and private entities. It is also necessary to establish proper and wide channels of information gathering, and increase public trust therein as a reliable source of information to people and enterprises.

(c) Recommendations

1. It is recommended that information service outlets be established in order to effectively provide entities with statistical and technical information on the promotion of energy efficiency; it is necessary to establish a system by which the present situation and future trends in energy statistics and technology in various areas can be accurately grasped, and with which such information can be used effectively.
2. It is recommended that the information gathering system be consolidated, and that PTM channels be broadened for the acquisition of international technical information on the promotion of energy efficiency, by promoting cooperative relations with overseas organizations, and that the information is then released to the public.
3. It is recommended that an on-line information provision and retrieval system be installed.

4) The promotion of energy efficiency Seminars

(a) Present State

JBE&G and private entities with foreign collaborations hold seminars for energy-saving, but are not sufficient in terms of advertisement and extension of energy-saving.

(b) Problems and notes

There is a shortage of engineers and technology at entities of the commercial sector and medium and small-scale factories. Managers and staff are not sufficiently aware of the need for the promotion of energy efficiency, because they are concerned more about production and cost.

(c) Recommendations

It is recommended that seminars be held concerning successful examples of the promotion of energy efficiency in entities and to give education in the promotion of energy efficiency to management and engineers of entities. Advertisement of successful examples of the promotion of energy efficiency will be effective in leading those engineers to recognize the importance of the promotion of energy efficiency. In this regard, the collaboration of related organizations such as universities or private consultants is recommended in holding joint seminars on the promotion of energy efficiency in order to improve awareness of energy-saving among management and engineers.

4-5 International Comparison of Measures for Promotion of Energy Efficiency

In order to evaluate the effectiveness of Government measures for the promotion of energy efficiency in Malaysia, the cases for other countries as such Thailand, Turkey, and Japan are studied. Table 4-9 is the comparison table, in which the Malaysian situation is also listed for reference.

Energy promotion activities are considered to be normal practice in Japan, while such activities are now progressing with special emphasis in Thailand and Turkey. Hence energy promotion activities should be emphasized and continuously carried out in Malaysia.

The Malaysian regulations for promotion of energy efficiency (draft) resemble similar laws in Thailand, and reaches the same level as the ministry ordinance of Turkey. Hence it is recommended to first enforce the regulations (for promotion of energy efficiency in Malaysia),

then try to fulfill the content and gradually complete the regulations.

(1) Energy Efficiency Promotion Board

In Turkey, the Electric Power Agency under the Ministry of Energy has organized a board for the promotion of energy efficiency, and engaged in relevant coordination work.

Table 4-9 International Comparison of Measures for Promotion of Energy Efficiency

	Malaysia	Thailand	Turkey	Japan
Energy Efficiency Coordination Board	×	×.	○	×
Central Body for Energy Saving	×	○	○	○
Law and Regulations	Draft	○	○	○
・Energy Managed Entities System	Draft	Factory & Buildings	Factory	Factory & Buildings Vehicles
・Energy Manager System	Draft	○	○	○
・Energy Manager Qualification	Draft	○	○	○
・Standards	×	n.a.	×	○
・Guidelines	×	n.a.	×	○
Incentives	×	○	×	○
Penalties	Draft	○	×	○
Training (Energy Manager)	○	○	○	○
Energy Manager Certification by Examination	×	×	×	○
Energy Audit				
・Free of Charge	–	–	○	○
・Paid	○	○	○	○
・Energy Bus Programme	×	×	○	×
Data Base	Planning	n.a.	(On-going)	○
・Energy Statistics			(On-going)	○
・Technical Information			(On-going)	○
Technical Documents	○	○	○	○
Publications	×	○	○	○
Media Campaigns				
・TV and Radio Broadcasting	–	○	×	○
・Video Cassette Recording	○	○	×	○
・Seminars	○	○	○	○
・Exhibitions	○	○	○	○
Energy Saving Campaign Weeks	×	×	○	○

(2) Centralization of Promotion of Energy Efficiency

Japan and Turkey are trying to concentrate activities for the promotion of energy efficiency, by establishing organizations such as the Energy Conservation Center. In Thailand also, the Department of Energy Development and Promotion of the Ministry of Science, Technology and Environment is about promotion of energy efficiency and has been continuing related activities

up to the present day.

(3) Energy Efficiency Promotion Laws and Regulations

At present, regulations are still in the draft stage in Malaysia. In Thailand, energy conservation laws were put into force in 1992, aiming to promote energy efficiency for factories and commercial buildings. The law stipulates those factories requiring guidance that consume electricity and/or other energy according to the consumption level (electricity consumption: more than 1MW, and/or energy consumption: more than 20 million MJ). In Turkey, energy conservation laws were put into force in 1997 to improve the energy efficiency of industrial factories (energy consumption: more than 2,000TOE). In Japan, energy conservation laws were enacted in 1977. The laws cover such facilities as factories, commercial buildings, private housing and machinery.

Energy conservation laws include systems for the energy-managed entities in Thailand, Turkey, and Japan. The big difference in the Japanese law is that it contains standards of judgement criteria for energy saving that is necessary for individual enterprises.

(4) Incentives

Apart from Turkey, energy conservation laws stipulate incentives for energy saving. In the case of Thailand, the preferential treatment consists of a subsidy to be provided for a simplified energy audit, for the fees to establish an energy conservation program, and for the interest incurred from the loans used for the procurement of energy conservation equipment. In case of Japan, the incentives are applicable to the investment for the promotion of energy efficiency based on a law, which supports the law for rational use of energy. The incentives consist of tax exemptions or granting loans at a very low interest rate.

(5) Penalties

There is no stipulation of penalties under Turkish law. In Thailand, violation of this law is punished with surcharges levied on the electricity cost. In Japan, the names of companies that violate the laws are announced and made known to the general public.

(6) Energy Efficiency Activities

Energy conservation activities are vigorous throughout Thailand, Turkey and Japan. From the table, it is recommended to further develop energy conservation activities especially in Malaysia, by offering gratis energy audits, by database build-up, by issuing printed materials regarding energy saving, and by promoting awareness activities for energy efficiency campaign weeks. It

would be helpful to load measuring equipment on the bus and utilize such equipment when executing gratis energy audits.

4-6 Plans for Promotion of Energy Efficiency

4-6-1 Plans and Priority of Measures for Promotion of Energy Efficiency

A plan for the promotion of energy efficiency based on the study for energy efficiency promotion measures described in Sections 4-3 and 4-4 is shown in Table 4-10. In addition, the measures are evaluated by rating based on criteria of urgency, basic concept, existence, ease of execution and importance and summarized in Table 4-11. It is concluded that the following measures be important and executed in a step-by-step manner.

Plan for the promotion of energy efficiency on yearly basis are summarized in Figure 4-2.

(1) Short Range Plan (measures to be enacted at an early date)

1. Establishment of Energy Efficiency Promotion Board
2. Enactment of Energy Efficiency Promotion Regulations
   The regulations should include the following systems.
   (a) Energy managed entity system
   (b) Energy manager system
   (c) Qualification system for energy managers
   (d) Reporting duty regarding data and information for the promotion of energy efficiency
3. Preparation of standards for promotion of energy efficiency
4. Preparation of guidelines for promotion of energy efficiency
5. Training for trainer and energy managers
6. Enhancement of activities for promotion of energy efficiency such as energy audits and awareness
7. Establishment of data base for the promotion of energy efficiency
8. Expansion and enhancement of the group for the promotion of energy efficiency of PTM

(2) Middle Range Plan

1. Establishment of tax incentives

(3) **Long Range Plan**

1. Revision of energy efficiency promotion regulations
2. Revision of standards
3. Revision of guidelines
4. Arrangement of incentive loans

Table 4-10 Plan for Promotion of Energy Efficiency

Organization			Phase 1 (1 -4 Years)	Phase 2 (5-7 Years)	Phase 3 (8-10 Years)
Laws and Regulations	EPU	Overall Coordination	Energy Efficiency Promotion Coordination Board		
	MECM · JBE&G	Energy Efficiency Law Kind of Energy Reporting Duty Recommendation	Energy Efficiency Law Electricity Annual Plan of Energy Efficiency	Unit Consumption of Energy (Efficiency)	Revised Energy Efficiency Law Heat, Gas, Coal etc. Confirmation of Energy Efficiency
		Energy Managed Factory Energy Officer (Qualification) Award	Regulation of Energy Managed Factory Energy Officer Method of Application and Approval	Regulation of Energy Managed Buildings Energy Officer Method of Application and Approval	Revised Energy Managed Factory Revised Energy Officer Application, Examination and Approval Award of Excellent Managed Factory
		Energy Standards Industrial Sector Commercial Sector	Basic Energy Standards for Factory	Basic Energy Standards for Building Soft Aspects (Management, Operation, Maintenance)	Targeted Energy Standards for Factory Revised Energy Standards for Building Building Architecture
		Guidelines Industrial Sector Commercial Sector	Basic Energy Guidelines for Factory	Basic Energy Guidelines for Building	Revised Energy Guidelines for Factory Revised Energy Guidelines for Building
		Incentives Taxes Low Interest Loan		Investment for Energy Efficiency Tax Exemption and Reduction Approval of Special Depreciation	Investment for Energy Efficiency Low interest Loan Debt Guarantee
Human Resources	JBE&G · PTM	Trainer Education Training Qualifying Examination	Education in Universities, Energy Institutions or Private Sector Education and Training	Qualifying Examination	
Extension		Energy Audit Measuring Instruments Energy Bus	Continuation and Propagation of Energy Audit utilizing Instruments provided by JICA	Energy Audit by authorized Institution	Propagation of Activity following the establishment of various resources
		Data Base Center Energy Statistics Technical Information	Structural Data Base Domestic and International Technology	Energy Efficiency Data Base Leading to Energy Policy	
		Propagating Activity Campaign Seminar Exhibition	Soft Aspects (Management, Operation, Maintenance)	Utilization of Data Base of PTM	New and Advanced Technology and Information required for Energetically Advanced Country
ESCO			Study on ESCO	Activation of ESCO	

Table 4-11 Priority of Measures for Promotion of Energy Efficiency (1)

Category	Recommendation Item	Urgency	Basic Concept	Existing or Not*	Easiness	Import-ance	Total Point	Priority Ranking
Overall Coordination	Energy Efficiency Promotion Coordination Board	5	5	5	3	5	23	A
Energy Efficiency Promotion Regulations	Energy Efficiency Promotion Law (Electricity)	5	5	5	3	5	23	A
	Revised Energy Efficiency Promotion Law (Heat, Gas, Coal, etc.)	1	5	5	1	5	17	B
Reporting Duty	Annual Plan of Energy Efficiency Promotion	5	5	5	4	4	23	A
	Unit Consumption of Energy Efficiency	5	5	5	3	5	23	A
	Confirmation of Energy Efficiency Production	1	4	5	5	3	18	B
Energy-Managed Factory and Building	System of Energy-Managed Factories	5	5	5	3	5	23	A
	System of Energy-Managed Buildings	5	5	5	3	5	23	A
	Revised Energy-Managed Factory System	1	5	5	3	5	19	B
Energy Officer	Energy Officer System (Factory)	5	5	5	3	5	23	A
	Energy Officer System (Building)	5	5	5	3	5	23	A
	Revised Energy Officer System (Factory)	1	5	5	3	5	19	B
Qualification	Method of Application and Approval (Factor)	5	5	5	4	5	24	A
	Method of Application and Approval (Building)	5	5	5	4	5	24	A
	Application, Examination and Approval (Factory)	2	5	5	3	3	18	B
Award	Award of Well-Managed Factory	2	3	5	4	2	16	B
Energy Standard								
Industrial Sector	Basic Energy Standards for Factories	5	5	5	1	5	21	A
	Targeted Energy Standards for Factories	2	5	5	1	5	18	B
Commercial Sector	Basic Energy Standards for Buildings Soft Aspects (Management, Operation and Maintenance)	4	5	5	2	5	21	A
	Targeted Energy Standard for Buildings Building Architecture	2	5	5	1	5	18	B
Guideline								
Industrial Sector	Basic Energy Guidelines for Factories	5	5	5	1	5	21	A
	Revised Energy Guidelines for Factories	2	5	5	1	5	18	B
Commercial Sector	Basic Energy Guidelines for Buildings	4	5	5	1	5	20	A
	Revised Energy Guidelines for Factories	2	5	5	1	5	18	B

Note *: Non-existing measures are counted as 5 points

Table 4-11 Priority of Measures for Promotion of Energy Efficiency (2)

Category	Recommendation Item	Urgency	Basic Concept	Existing or Not*	Easiness	Importance	Total Point	Priority Ranking
Incentives	(Investment for Energy Efficiency Promotion)							
Taxes	Tax Exemption and Reduction	3	5	5	2	5	20	A
Low Interest Loan	Low Interest Loan	2	5	5	1	5	18	B
Other Incentives	Approval of Special Depreciation	3	5	5	3	5	21	A
	Debt guarantee	2	5	5	3	3	18	B
Trainer Education	Education in Universities, Energy Institution or Private Sector	5	5	3	3	5	21	A
Training	Education and Training	5	5	3	4	5	22	A
Qualifying Examination	Qualifying Examination	3	4	4	4	4	19	B
Energy Audit								
Measuring Instruments	Continuation and Promotion of Energy Audit Utilizing Equipment Provided by JICA	5	5	3	4	5	22	A
	Energy Audit by Experienced Institution	3	5	3	4	4	19	B
Energy Bus	Expansion of Activity attendant to the enrichment of Various Resources	2	5	1	4	4	16	B
Data Base Center								
Energy Statistics	Data Bases (Energy Statistics)	5	5	4	3	5	22	A
	Energy Data Base Leading to Energy Policy	3	5	5	3	3	19	B
Technical Information	Domestic and International Technology	5	4	3	3	4	19	B
Popularization Activities	Soft Aspects (Management, Operation and Maintenance)	5	5	3	5	4	22	A
Campaign	Publicizing Effect of Energy Efficiency Promotion							
Seminar	Campaign, Seminar, Exhibition and Publication	4	5	3	5	4	21	A
Exhibition	Utilization of Data of PTM	3	5	5	3	3	19	B
Publication	Publication and Advertisement of Collected Information							
	Development to Advanced Energy-Efficient Country	1	4	5	1	3	14	C
	New and Advanced Technology							
ESCO	Study of ESCO	3	4	3	5	4	19	B
	Activity of ESCO	3	5	3	2	4	17	B

Note* : Non-existing measures are counted as 5 points

Figure 4-2 Plan for Promotion of Energy Efficiency