



**Asia-Pacific
Economic Cooperation**

**PEER REVIEW ON ENERGY EFFICIENCY IN
THAILAND**

Final Report

18 March 2010

Report for the APEC Energy Working Group

CONTENTS

PREFACE	iv
EXECUTIVE SUMMARY	v
RECOMMENDATIONS	vii
PART I: BACKGROUND INFORMATION	
1. STATISTICS, FORECASTS AND TRENDS IN ENERGY CONSUMPTION	1
1.1 THAILAND'S ENERGY SITUATION IN 2008	1
1.1.1 The consumption of primary commercial energy	1
1.1.2 The consumption of final commercial energy	2
1.1.3 The expenditure on final energy consumption	2
1.1.4 The value of Energy Import	2
1.1.5 The Electricity Sector	3
1.1.6 Energy in the Transport Sector	4
2. ENERGY EFFICIENCY POLICY AND INSTITUTIONS	6
2.1 ENERGY EFFICIENCY POLICY	6
2.1.1 Policy Directive	6
2.1.2 Strategy/Target/Implementation Methodology	6
2.2 THE ENERGY CONSERVATION PROMOTION ACT & ENERGY CONSERVATION PROMOTION FUND	9
2.3 ENERGY CONSERVATION PROGRAM	10
2.3.1 Energy Conservation Program, Phase 3 – revised (2008-2011)	11
2.3.2 Sectoral Energy Efficiency Improvement Goals	13
2.4 INSTITUTIONAL STRUCTURE	18
2.5 GOVERNMENT LAWS, DECREES, ACTS	19
2.5.1 The Energy Conservation Promotion Act, B.E. 2535 (1992), as amended up to No. 2, B.E. 2550 (2007)	19
2.5.2 Royal Decrees issued under the ENCON Act (1992)	19
PART II: REVIEW TEAM REPORT	
1. INSTITUTIONAL CONTEXT	22
1.1 Critique	22
1.2 Recommendations	23
2. ENERGY EFFICIENCY GOALS, TARGETS AND STRATEGY	23
2.1 Critique	23
2.2 Recommendations	25

3.	ENERGY DATA COLLECTION AND MONITORING	26
3.1	Critique	26
3.2	Recommendations	27
4.	POLICY MEASURES – SECTORAL ANALYSIS	28
4.1	Industrial Sector	28
4.1.1	Critique	28
4.1.2	Recommendations	30
4.2	Electricity Sector	30
4.2.1	Critique	30
4.2.2	Recommendations	32
4.3	Commercial and Residential Sector	33
4.3.1	Critique	33
4.3.2	Recommendations	41
4.4.	Transport Sector	42
4.4.1	Critique	42
4.4.2	Recommendations	44
5.	APPLIANCES AND EQUIPMENT	48
5.1	Critique	48
5.2	Recommendations	49
6.	ENERGY EFFICIENCY RELATED R&D	50
6.1	Critique	50
6.2	Recommendations	51
7.	CONCLUSION	51
	APPENDIX A: MEMBERS OF THE PEER REVIEW TEAM	52
	APPENDIX B: ORGANISATIONS AND OFFICIALS CONSULTED	53
	APPENDIX C: REFERENCES	54

LIST OF FIGURES

Figure 1: Thailand's Electricity Generation Fuel Mix and Installed Capacity	4
Figure 2: Schematic Diagram of the Energy Conservation Promotion Fund	10
Figure 3: The ENCON Program, Phase 3-revised (2008-2011)	11
Figure 4: Thailand's Share of Electricity Generation (GWh) by Fuel Types in 2008	31
Figure 5: EGAT's Peak Demand from 2002-2008	31
Figure 6: Thailand's Load Profile from 1982-2007	32
Figure 7: The trends of T&D losses on the National Grid and EGAT's system	32
Figure 8: Thailand's Final Energy Consumption by Sectors in 2008	34
Figure 9: Thailand's Electricity Consumption by Sectors in 2008	34
Figure 10: Thailand's Household Electricity Consumption	34
Figure 11: The category of labels under the Thailand Building Label Program	40
Figure 12: Annual cost of passenger vehicle ownership in APEC economies	44
Figure 13: Schematic Diagram on Ways to Improve Transport Energy Efficiency	45
Figure 14: The impact of appliances and equipment energy efficiency improvement on Thailand's electricity sector	49

LIST OF TABLES

Table 1: Thailand's consumption, production and import (net) of primary commercial energy (2005-2009)	1
Table 2: Thailand's primary commercial energy Consumption (2005-2009)	2
Table 3: Thailand's Consumption of and Expenditure on Final Energy	3
Table 4: Thailand's Value of Energy Import	3
Table 5: Thailand's Electricity Demand by Sectors	4
Table 6: Thailand's Energy in Transport Sector by modes (1999 -2006)	5
Table 7: Thailand's Transport Energy Consumption by Fuels	5
Table 8: Thailand's Sectoral Energy Efficiency Improvement Goals	13
Table 9: The subsidy rates of Thailand's Bidding Mechanism under the DSM	15
Table 10: Thailand's Industrial Sector Energy Saving Target in 2011	16
Table 11: Thailand's Transport Sector Energy Saving Target in 2011	17
Table 12: Thailand's Household/Business/Govt Sectors Energy Saving Target in 2011	18
Table 13: Thailand's Building Label Program Evaluation and Scoring Criteria	40

PREFACE

According to the guideline on APEC Peer Review on Energy Efficiency (PREE), the objectives of the APEC PREE, endorsed by APEC leaders at their 2007 meeting are to:

- share information on energy efficiency performances as well as on policies and measures for improving energy efficiency;
- provide opportunities for learning from other APEC member economies' experiences and for broadening the network among energy efficiency policy experts;
- explore how energy efficiency goals on an overall and/or sectoral basis and action plans could be effectively formulated in each APEC economy under review, taking into account the diversity of possible strategies that could be used, according to the circumstances of individual member economies;
- monitor progress toward attaining energy efficiency goals on an overall and/or sectoral basis and implementing action plans, if such goals and action plans have been already formulated at the time of the review;
- provide recommendations for voluntary implementation on how implementation of action plans could be improved with a view to achieving energy efficiency goals.

Two activities are undertaken as part of the PREE, namely:

- (a) **Peer Reviews** of volunteer member economies.
- (b) **Compendium** of energy efficiency policies of the APEC member economies based on either APEC voluntary PREE or Energy Efficiency aspects of the IEA Energy Policy Review.

This report presents the result of a peer review on energy efficiency in Thailand. Thailand volunteered to undertake a peer review and this was the fourth review of an APEC economy undertaken the PREE.

The primary accountability for each individual peer review is shared by the APEC economy being reviewed and the review Team. The peer review in Thailand was conducted by a review team of eight experts (see Appendix A, page 52) who visited Thailand from 9 to 14 November 2009.

During the visit, the Team attended comprehensive presentations and discussions on energy efficiency with Thai representatives and experts from various government sectors and private & state companies (see Appendix B, page 53).

The review Team wishes to thank all the people who made presentations and spent time for discussions with the Team members, especially the representatives of the government from Ministry of Energy who organized the efficient meetings and benefit visit.

EXECUTIVE SUMMARY

The PREE team was impressed by the efforts taken by the Thai Government on energy efficiency improvement and energy conservation. Energy efficiency improvement and conservation is the main focus of Thailand's energy policy. The backbone of Thailand's energy efficiency improvement and energy conservation policy is the Energy Conservation Promotion Act, B.E. 2535 (1992), which has been in effect since 3 April 1992. The Act empowers the Thai Government to implement various efforts to improve the use of energy. Under this Act, the Energy Conservation Promotion Fund (ENCON Fund) has been established to provide financial support to government agencies, state enterprises, non-government organizations, individuals, and businesses that wish to implement measures to increase efficiency in energy utilization.

The PREE team noticed that the energy efficiency improvement mechanism and energy conservation are very important energy policy instruments for the Thailand's economic development. Energy efficiency improvement and energy conservation reduces the economy's heavy dependent on imported energy supply as well as improves the security of supply by better final demand management. In this regard, most of the efforts on energy efficiency improvement taken by Thai Government especially in the industrial, commercial and residential sectors are serving well the need of the economy to reduce the final energy demand and to secure the energy supply.

However, Thailand is having difficulties in promoting energy efficiency in transportation sector. Likewise in many other economies especially in developing ones, the focus of the transport sector's authorities in the economy is mainly on its core function, to move passengers and freight smoothly and limited focus is given to improve the use of energy. Even though the existing traffic congestion easing program has produced some improvement on the energy use of the sector, the real energy saving potential has remained untapped. In this respect, the PREE team has considered carefully the current situation and has provided some suitable recommendations in accordance to the timeframe of implementation to improve the current situation.

The review team identified some lack of cohesiveness on the function of energy efficiency policy formulation and program implementation among the agencies under the Ministry of Energy. Even though the demarcation of functions among the agencies is well defined, some overlaps are still exist. The overlaps may result in redundancy in efforts and waste of allocated resources. The grey areas created by the overlaps need to be clarified by the agencies and their functions should progress in tandem to achieve the wider goal of energy efficiency improvement.

The PREE team also felt that it is important that the monitoring and evaluation of implementation of energy efficiency programs should be given more focus. The monitoring and evaluation will provide valuable information on the real progress and useful information that needed for better design of energy efficiency programs in the future. In doing so, monitoring and evaluation should be implemented as a part of any energy efficiency programs. Consequently, an energy database that supports comprehensive monitoring and evaluation works also should be developed.

The PREE team's overall impression was that Thailand's energy efficiency policy and programs regime is well functioning and in a good shape. The recommendations made by the PREE team are aimed to strengthen the weakest links in the existing policy and programs. The PREE team's other recommendations cover:

- Energy efficiency related to institution;
- Energy efficiency goals, target and strategy;
- Energy data collection and monitoring;
- Energy efficiency in the industry sector;
- Energy efficiency in the electricity sector;
- Energy efficiency in the residential and commercial sector;
- Energy efficiency in transport sector;
- Energy efficient appliances and equipment; and
- Energy efficiency related research and development.

RECOMMENDATIONS

INSTITUTIONAL CONTEXT

Recommendation 1 (page 23). *The Prime Minister and other Ministers who are responsible for energy conservation (EC) policies need to more closely cooperate on a regular basis to achieve the EE goals. It is critical to strengthen the policy coordination among relevant Ministries, especially between Ministry of Energy and Ministry of Transport for energy efficiency improvement in transport sector; and*

Recommendation 2 (page 23). *The role of Energy Policy and Planning Office (EPPO) should be further clarified and strengthened. It is important that it operates not as an implementing unit of energy conservation projects but as the unit for policy making and policy coordination with other Ministries.*

ENERGY EFFICIENCY GOALS, TARGETS AND STRATEGY

Recommendation 3 (page 25). *To assist in achieving these goals and accelerating the implementation of energy efficiency practices across all sectors, the Thai Government should*

- *Set “sub-sectoral” goals and formulate action plans for these sub-sectors to improve energy efficiency.*
- *Advance the effort in developing and implementing a package of policies and measures to promote energy efficiency, particularly in transport sector and industrial sector including small and medium enterprises (SMEs).*

Recommendation 4 (page 25). *To guarantee maximum compliance the Thai Government should*

- *Make certain that both voluntary and mandatory energy efficiency policies are effectively monitored, evaluated and/or enforced.*
- *Strengthen legal and institutional infrastructure for ensuring compliance with energy efficiency requirements; undertaking regular and public reporting of monitoring activities; and guaranteeing transparent and fair procedures for assessing compliance*

Recommendation 5 (page 26). *To further facilitate energy efficiency financing the Thai Government should*

- *Stimulate private sector’s involvement in energy efficiency investments by collaborating with the private financial sector to launch various public-private financial tools/packages to facilitate energy efficiency financing and also put in place regular co-operation and exchanges on energy efficiency issues between the public sector and financial institutions.*

Recommendation 6 (page 26). *The Thai Government should*

- *pursue more effective assistance and support in developing the energy management system and implementing energy management procedures and practices through various energy management tools i.e. capacity building and training, certification, quality assurance, awards, etc. as well as developing a formal energy management policy especially at company level; and*
- *Consequently, ensure that this energy management process is supported by good monitoring systems and adequate end-use data and information across all sectors and all energy types. This may require the Government to increase the resources allocated to the monitoring process and energy end-use data collection at individual company, sector and national level to help achieve the target.*

ENERGY DATA COLLECTION AND MONITORING

Recommendation 7 (page 27). *The Thai Government should comprehensively evaluate and monitor the energy efficiency policies and measures. The steps for this recommendation are:*

- *Comprehensive evaluation of sectoral & overall achievement of national energy target is necessary for better awareness of the people of Thailand and of related sectors to encourage united actions as a country;*
- *Monitoring of each program under the National Energy Intensity Target can be coordinated between responsible Ministries, for example at the National Committee;*
- *Energy data for actual status should be shown along with the achievement of each program and sectors as well as for macro level; and*
- *The result of the regular monitoring can be announced to the public with some linkage between macro energy intensity achievement and sector wise achievement shown.*

Recommendation 8 (page 28). *The Thai Government should disseminate information/ data for all the sectors in a complete and comprehensive manner. The steps for this recommendation are:*

- *An independent government office (e.g. Statistical Bureau) could produce consolidated energy data covering all energy sources including electricity and transport. This can be done either (1) by pooling data collected by each regulating Ministries or (2) by making the designated government office to collect data directly;*
- *Comprehensive information on the overall energy efficiency programs and Thailand's achievement since the establishment of energy conservation law in 1992 in a form of report may help promote people's awareness. If enough information is available, it can be published annually and on energy related topics including renewables, such as an Energy White Paper;*
- *Information displayed at the DEDE's demonstration/training centre, especially graphical presentations with numbers on the current energy usage share among different usages, etc. are good data for such report;*
- *End-use energy data estimation for key sectors such as transport sector (i.e. passenger / freight) will be beneficial for EE policy planning;*
- *The transport sector is one of the most important sectors to be given priority for energy saving and sound infrastructure planning including regional development and city planning in addition to a shift towards mass transport systems in Thailand;*
- *Data/information on energy consumption for passenger/freight sub sectors for each transport mode (road, rail, air, ship) is a good starting point; and*
- *The Ministry of Transport can initiate such data estimation process with transport census, etc.*

Recommendation 9 (page 28). *The Thai Government should:*

- *Edit and publish as a synthesized report the feedback report of energy management of the designated industries. Such report will appeal to the top management and industrial associations on the overall achievement of the Energy Management Scheme so that they have a full understanding of where they stand and what they can promote more in energy efficiency; and*
- *Design Best practice seminar or award contest for provinces and regions. For example, mobile DEDE training centre or best practice workshops held by designated industries/buildings may be ideal.*

INDUSTRY SECTOR

Recommendation 10 (page 30). *It is recommended that DEDE should implement a mandatory target for percentage reduction, in energy consumption or energy intensity. Another possible method may be to make it mandatory to implement recommended measures with a payback period of less than a certain period, for example 3 years.*

Recommendation 11 (page 30). *It is recommended that the Thai Government should continue as far as possible the revolving fund for industrial EE&C efforts until they reach more sustainable levels.*

Recommendation 12 (page 30). *It is recommended that DEDE should design and implement a strategy to provide information and technical support for the local manufacture of energy efficient equipment. This will enable such equipment or appliances being made available locally, possibly at a cheaper cost. Such assistance may be of advantageous to spur such local manufacture.*

Recommendation 13 (page 30). *It is recommended that the Thai Government extend tax benefits to companies implementing EE&C measures in their own installations/premises to encourage more companies to undertake EE&C measures*

ELECTRICITY SECTOR

Recommendation 14 (page 32). *It is recommended that EGAT should intensify its efforts on DSM. The focus of DSM strategy on residential users is appropriate owing to the element that demand from residential users is most difficult to manage. The proposed residential technologies according to load shape objectives are:*

- *Peak Clipping: Solar Water Heating, Water Heating Cycling control, Air Conditioner Cycling Control, Load Management Thermostats.*
- *Load Shifting: Water Heating Cycling control, Air Conditioner Cycling Control, Load Management Thermostats.*
- *Conservation: Building insulation (especially roof insulation) and high energy efficient appliances and equipment (especially air-conditioners, refrigerators, cooking appliances, cloth washers and lighting).*

Recommendation 15 (page 33). *It is recommended that EGAT should continue to improve the T&D network system to reduce the losses up to 3% - 5% to match the international standards as well as power quality improvement by 2011, through:*

- *Adding proper size transformers, panel boards, circuit breakers and wiring as well as running 200% neutral conductors to increase the available capacity.*
- *Using Zig-Zag or K-rated transformers.*
- *Implementing smart grid – automation for transmission and distribution system*

COMMERCIAL AND RESIDENTIAL SECTOR

Recommendation 16 (page 41). *It is recommended that the Thai Government should:*

- *Expand many of its existing energy efficiency programs for the residential sector to achieve higher energy savings so that it can better influence people's knowledge and choices*

- *Develop an “Eco-Cities” program to enhance both residential and commercial energy efficiency among other sustainability and environmental goals*

Recommendation 17 (page 42). *It is recommended that the Thai Government should:*

- *Increase the existing commercial building energy codes every 3 years so that the code process becomes dynamic and more energy efficiency is required for commercial buildings on a regular basis, and*
 - *the energy code should stress a performance path as well as a prescriptive path*
 - *a strict Compliance enforcement program should be developed which focuses on verifying if the code was in fact followed during, and after, the building completion. In instances where codes are, or were, not followed, stiff penalties should be applied*
- *Develop an building energy code for residential buildings for new construction, and*
 - *include application of the new residential codes to major renovations when they occur*
 - *include “passive” design features in the new residential energy codes*
 - *add “Cool Roofs” as a component of the new residential energy codes*

Recommendation 18 (page 42). *It is recommended that the Thai Government should:*

- *Enact regulations to make Building Labels mandatory for new construction for both commercial and residential buildings*
- *Initiate a pilot program to make Building Labels mandatory for existing buildings at time of major renovation or sale*

Recommendation 19 (page 42). *It is recommended that the Thai Government should:*

- *Increase tax incentives for commercial buildings that exceed building energy codes by 30% or more*
- *Include building envelope improvements in bank “household” financing mechanisms*
- *Develop other incentive programs for commercial and residential building envelope improvements, such as coupons or rebates on building envelope materials*

Recommendation 20 (page 42). *It is recommended that the Thai Government should:*

- *“Lead by Example” by having*
 - *DEDE demonstrate “Net-Zero Energy” buildings in key regions of Thailand*
 - *DEDE challenge other national, regional and local government agencies to match or exceed the best energy efficient buildings it has developed and offer awards to those units of government that do so.*

TRANSPORT SECTOR

Recommendation 21 (page 45). *It is recommended that the Ministry of Energy, the Ministry of Industry and the Ministry of Transport should work together to set fuel economy programmes. These should cover both the supply and demand sides, including*

- *corporate average fuel economy target to vehicle original equipment manufacturers (OEMs); and*
- *fuel economy information to consumers.*

Recommendation 22 (page 45). *It is recommended that the Thai Government should develop a comprehensive transport development plan that covers all modes (roads, car, motorcycle, truck, bus, rail, etc.) for passenger and freight transport. In this plan, it should*

- *set major policy directions (e.g. rail-based development) that will address the long-term trend of increasing transport energy consumption; and*
- *link energy efficiency sub-targets with transport measures.*

Recommendation 23 (page 45). *It is recommended that the Thai Government should study and introduce many demand management measures to meet the needs of different types of commuters in order for them not to drive.*

Recommendation 24 (page 46). *It is recommended that the Thai Government and the Bangkok Metropolitan Administration should work together to*

- *Develop the Bangkok MRT system as planned. At the same time, the transport system should be well integrated, for example, between MRT lines, with SkyTrain, buses, taxi, cars and two- or three-wheelers; and*
- *Develop bus priority schemes, including Bus Rapid Transit (BRT).*

Recommendation 25 (page 46). *It is recommended that the Thai Government and the Bangkok Metropolitan Administration should work together to*

- *Increase car driving cost in comparison with the public transit fare*

Recommendation 26 (page 47). *It is recommended that the Thai Government should*

- *Develop rail (MRT & railways) as backbone of national transport system. Rail is the most efficient transport mode for passenger and freight transport. For Bangkok, commuter rail at suburb areas should be developed which are less costly to build and operate; and*
- *Adopt the rail-based development strategy to maximise transit usage and to finance infrastructure. Rail systems, including MRT, suburb commuter rail and inter-city railways, require large capital to build the infrastructure. Rail-based development has been successful in Japan, followed by Hong Kong. Many other countries encouraged development around rail stations and captured the value through tax, transport development charge, selling state land at a premium, etc.*

APPLIANCES AND EQUIPMENT

Recommendation 27 (page 49). *It is recommended that DEDE should expedite the implementation rate of MEPS to meet the targeted schedule, by 2011 for 50 products. The implication of MEPS on the market transformation is very crucial, to phase –out inefficient appliances and equipment as soon as possible from the market. For efficient and effective implementation, the MEPS should be open-ended, i.e. regularly revised and upgraded. Revisions and upgrades could be carried out periodically every 3 to 5 years.*

Recommendation 28 (page 49). *It is recommended that DEDE should monitor continuously the progress of market transformation through market research and sales data analysis and evaluation. In this exercise the sales data should be provided by appliance and equipment manufacturers and importers.*

Recommendation 29 (page 50). *It is recommended that DEDE together with EGAT should design and implement programs such as a trade-in to accelerate the withdrawal of inefficient appliances and equipment, especially for high energy consuming residential appliances such as air-conditioners and refrigerators.*

Recommendation 30 (page 50). *It is recommended that DEDE should promote the market penetration of high efficient appliances and equipment by mandatory energy performance labeling (MEPL) along with MEPS.*

MEPS will improve the energy efficiency of appliances and equipment but as soon as the market stabilizes there is no incentive for manufacturers to improve the minimum standard. As such MEPL acts as an incentive for manufacturers to differentiate themselves from their competitors and stimulates the introduction of new, more efficient models. The MEPL also influences strongly users' purchasing-decision.

Recommendation 31 (page 50). *It is recommended that the Thai Government monitor and evaluate continuously the implementation of residential appliances programs such as the Residential Energy Credit and the 555 Project. These programs have high potential for market creation for high energy-efficient appliances and better penetration of high energy-efficient appliances in the market.*

ENERGY EFFICIENCY RELATED R&D

Recommendation 32 (page 51). *It is recommended that the Thai Government should establish an energy efficiency R&D roadmap under the current energy efficiency improvement programs with the focus on the key energy efficiency technologies that will provide the highest potential of energy efficiency improvement.*

Recommendation 33 (page 51). *It is recommended that DEDE should assess and coordinate the needs for energy efficiency R&D funding in government agencies, state enterprises, educational institution and private organizations in line with the provision under the Energy Conservation Promotion Act (1992).*

Recommendation 34 (page 51). *It is recommended that the Thai Government should promote greater private sector involvement in energy efficiency R&D efforts through tie-ups such as industry-academia, industry-state enterprises and etc as well as suitable funding mechanisms.*

PART 1: BACKGROUND INFORMATION

This part of the report was contributed by Thailand and includes basic information on energy consumption and the main institution associated with energy efficiency in the economy. The main purpose of this part is to provide the reader with the context within which the PREE Team based its recommendations.

The first section in this part shows the aspect of energy consumption. The second section includes a description of the energy efficiency institution, their current policies and objectives as well as energy efficiency programs.

1. Statistics, Forecasts and Trends in Energy Consumption

1.1 Thailand's Energy Situation in 2008

Energy situation in Thailand in 2008 was highly volatile. The oil price crisis in the first half of the year had caused oil consumption to decrease. However, due to the overall strong global economy and Thailand's economy, the GDP growth rate during January-June 2008 was at 5.6 %, resulting in the growth of primary energy demand of the economy at 3.6 %. In the third quarter, oil prices in the world market began to decrease concurrently with the advent of the financial crisis in the USA and eventually worldwide in the last quarter of 2008. In Thailand, the economic condition was aggravated by internal political conflicts, especially the halt in operation of Suvannabhum International Airport in late November 2008, causing an economic slowdown and hence a decrease in energy demand in the second half of the year.

1.1.1 The consumption of primary commercial energy

In 2008, the consumption of primary commercial energy was 80,749 thousand tons of crude oil equivalent (ktoe), an increase of 0.9 % from 2007. The oil share in the consumption of primary commercial energy decreased by 5.0 % from that of 2007 level because of high prices, but the natural gas share increased by 5.4 % from 2007 as the demand in the power generation and the industrial and the transport (NGV) sectors increased. Similarly, the use of imported coal increased by 10.6 %, resulting from greater use of coal instead of lignite. However, the share of hydropower dropped significantly by 17.4 % from 2007 because of the weather condition. As of the share of fuel, for the first time natural gas accounted for the largest share, i.e. 40 %; while oil's share dropped to the second rank, holding a share of 39 %. Others, which comprise lignite/imported coal and hydropower/imported electricity, accounted for 19 % and 2 % respectively.

Consumption, Production and Import (net) of Primary Commercial Energy

	2005	2006	2007	2008	2009 Jan-Jul
Consumption	75,864	77,093	80,044	80,749	47,608
Production	36,810	38,184	39,612	42,429	25,825
Import (net)	48,904	48,815	49,789	46,992	26,249
Import/Consumption (%)	64	63	62	58	55
Growth (%)					
Consumption	4.8	1.6	3.8	0.9	-1.3
Production	9.1	3.7	3.7	7.1	4.1
Import (net)	-0.9	-0.2	2.0	-5.6	-11.4
GDP (%)	4.5	5.0	4.8	2.6	-6.0*

* Jan-Jun

Table 1: Thailand's consumption, production and import (net) of primary commercial energy (2005-2009)

	2005	2006	2007	2008	2009 Jan-Jul
Consumption	75,864	77,093	80,044	80,749	47,608
Petroleum	34,406	33,626	33,276	31,627	18,680
Natural Gas	28,240	28,896	30,676	32,337	19,185
Coal	5,347	7,000	8,996	9,946	5,760
Lignite	6,239	5,365	4,946	5,063	2,943
Hydro/Imported Electricity	1,630	2,204	2,148	1,774	1,038
Growth (%)					
Consumption	4.8	1.6	3.8	0.9	-1.3
Petroleum	0.4	-2.3	-1.0	-5.0	-1.8
Natural Gas	9.2	2.3	6.2	5.4	1.2
Coal	13.8	30.9	28.5	10.6	-4.9
Lignite	4.2	-14.0	-7.8	2.4	-2.4
Hydro/Imported Electricity	2.4	35.2	-2.5	-17.4	-11.8

Table 2: Thailand's Primary Commercial Energy Consumption (2005-2009)

1.1.2 The consumption of final commercial energy

In 2008, Thailand consumed 55,503 ktoe of final commercial energy. The consumption of final commercial energy grew at 1.8 % from the 2007 level. In the first half of 2008, the consumption of final commercial energy increased by 4.2 % compared with the same period in 2007, but in the second half of the year, the consumption rate slowed at 0.1 %. This trend had resulted in an average growth rate of 1.8 % from the 2007 level. By source, oil demand decreased by 3.3 % from 2007, but natural gas demand increased considerably by 18.4 % because of the greater demand in the industrial and the transport sectors. The imported coal demand also increased significantly by 21.8 % but the domestically produced lignite demand decreased by 1.7 %. The electricity consumption increased by 1.6 % from 2007. As for the share of final commercial energy consumption in 2008, oil accounted for the largest share, i.e. 57 %; next to it were electricity, coal/lignite and natural gas, holding a share of 21%, 14 % and 8 % respectively

1.1.3 The expenditure on final energy consumption –

Although the volume of oil consumption decreased, the expenditure on petroleum products still increased by 14.1 % because of the price hikes early in the year. The expenditure, on the whole, increased by 11 % compared with that of 2007.

1.1.4 The value of Energy Import

Thailand imports about 60 % of its total energy demand. The total value of Thailand's energy import in 2008 was THB 1.16 trillion, or about US\$ 34 billion (at 34 THB/US\$). Of this, the value of crude oil import was THB 1 trillion (US\$ 29.5 billion), or 87 % of the total value of energy import, an increase of 40 % from 2007. The value of natural gas import accounted for the second largest share of 8 %, but the growth rate was at 12 %; while that of imported coal held a share of 3 %, but its growth rate was almost 23 %. The overall value of imported energy was considerable, accounting for 19.5 % of the total import of the economy, and 13 % of the GDP.

Final Commercial Energy Consumption					Unit: ktoe				
	2005	2006	2007	2008	2009 (Jan-Jul)	Growth Rate (%)			2009 (Jan-Jul)
						2006	2007	2008	
Consumption	52,237	52,215	54,501	55,503	32,742	0.0	4.4	1.8	-1.1
Oil	32,621	31,823	32,534	31,471	18,661	-2.5	2.2	-3.3	-0.7
Natural Gas	2,763	2,959	3,683	4,361	2,909	7.1	24.5	18.4	15.9
Coal	4,054	4,839	5,605	6,825	3,832	19.4	15.8	21.8	-6.4
Lignite	2,135	1,449	1,030	1,013	600	-32.1	-28.9	-1.7	-9.4
Electricity	10,664	11,145	11,649	11,833	6,740	4.5	4.5	1.6	-4.2
GDP (%)	4.5	5.0	4.8	2.6	-6.0 (Jan-Jun)				

Expenditure on Final Energy Consumption					Unit: Billion Baht				
Energy Type	2006	2007	2008	Jan-Jul		Growth Rate (%)			
				2008	2009	2007	2008	2009 Jan-Jul	
Petroleum Products	915.5	955.4	1,089.7	695.7	523.1	4.4	14.1	-24.8	
Electricity	385.1	390.7	394.5	232.8	244.9	1.5	1.0	5.2	
Natural Gas	28.9	35.1	53.9	29.4	25.1	21.6	53.4	-14.6	
Lignite/Coal	19.0	23.8	30.9	17.3	16.8	24.9	30.2	-3.0	
Renewable Energy	97.1	102.1	104.0	61.4	60.0	5.1	1.9	-2.2	
Total	1,445.6	1,507.1	1,673.1	1,036.6	869.8	4.3	11.0	-16.1	

Table 3: Thailand's Consumption of and Expenditure on Final Energy

Value of Energy Import					Unit: Billion Baht				
Energy Type	2005	2006	2007	2008	Jan-Jul		Growth Rate (%)		
					2008	2009	2007	2008	2009 Jan-Jul
Crude Oil	644.9	753.8	715.8	1,002.7	645.5	322.4	-5.0	40.1	-50.1
Petroleum Products	55.7	62.4	48.3	26.7	22.4	9.9	-22.5	-44.6	-55.8
Natural Gas	62.8	77.8	78.9	88.4	45.7	50.2	1.4	12.1	9.9
Coal	15.4	18.9	29.7	36.5	20.5	21.0	56.9	22.9	2.6
Electricity	7.1	8.3	7.4	4.5	2.6	1.8	-10.6	-38.8	-30.5
Total	786.0	921.2	880.1	1,158.8	736.7	405.4	-4.5	31.7	-45.0

In 2008:
 Value of imported energy : total import = 19.5%
 Value of imported energy : GDP = 13%
 Import/Consumption = 58%

Table 4: Thailand's Value of Energy Import

1.1.5 The Electricity Sector

In 2008, Thailand's total installed electricity generation capacity was 29,892 MW, comprising the generation by EGAT, 15,021 MW (50 %); IPP, 12,151 MW (41 %); SPP, 2,079 MW (7 %); and import from Lao PDR or exchange with Malaysia, 640 MW (2 %). By source, natural gas remained the major fuel used in power generation, accounting for a share of 70 %; followed by lignite & coal, at a share of 21 %; hydropower, 5 %; import & others, 3 %; and fuel oil, 1 %. In 2008, Thailand's peak demand was 22,568 MW, while the average load factor was 74.8 % and the minimum reserved margin was 29.8 %.

The total electricity demand of the economy in 2008 was 134,412 GWh, an average increase of 1.5 % from 2007, which is considered rather low when compared with the growth rate of 4 to 5 %, under normal economic conditions, in the recent years. By sector, the industry is the largest electricity user in the economy with the share 45 % of total electricity demand. In the second half of the year, due to the economic slump, power demand in the industrial sector slightly increased by 1.4 %, while the demand in other sectors decreased, except for the household sector of which the demand still increased as people still need electricity in daily life. On average in 2008, electricity demand by the industrial sector increased by 1.0 % from the previous year. The demand in the household, commercial, agricultural and other sectors increased by 2.6 %, 0.9

%, 7.4 % and 13.0 % respectively. The overall demand increased by 1.5 %, compared with that in 2007.

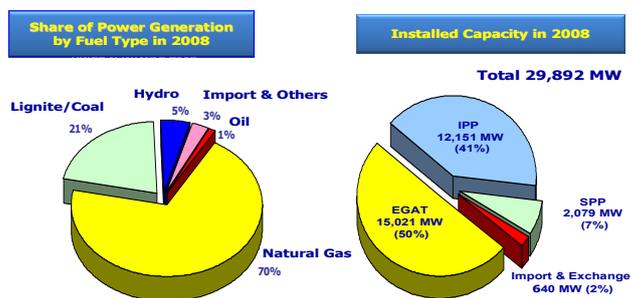


Figure 1: Thailand's Electricity Generation Fuel Mix and Installed Capacity

Sector	2006	2007	2008	Growth Rate (%)	
				2007	2008
Household	26,915	27,960	28,692	3.9	2.6
Commerce	31,702	32,839	33,116	3.6	0.9
Industry	56,995	59,436	60,057	4.3	1.0
Agriculture	240	268	288	11.5	7.4
Others	11,385	11,989	12,259	5.3	13.0
Total	127,237	132,492	134,412	4.1	1.5

Table 5: Thailand's Electricity Demand by Sectors

1.1.6 Energy in the Transport Sector

Thailand's transport heavily depends on road-based modes. As a result, the majority of total transport energy consumption (of which liquid fuels account for 99 %), about 76 % is in road transport. If international air and international water transport were excluded from the total, the share for road transport would reach 98 %. In 2008, energy consumption in this sector (excluding jet and fuel oil) was 17,996 ktoe, a decrease by 0.7 % from 2007 because of high oil prices, while the use of alternative transport energy, i.e. LPG and CNG (or natural gas for vehicles: NGV) increased. By fuel, diesel held the largest share accounted for 62 % in 2008, followed by gasoline at 29 %, LPG at 5 % and NGV at 4 %. In comparison, the consumption of diesel and gasoline decreased by 5.7 % and 2.9 % respectively in 2008. However, the LPG consumption increased by 35.7 % from 667 ktoe to 905 ktoe, and NGV increased significantly by 222.7 %, from 212 ktoe to 684 ktoe.

Transport Mode	1999		2006	
	KTOE	% of Alternatives	KTOE	%
Road Transport	14,588	79.7	17,499	76.1
Rail Transport	103	0.6	103	0.4
Domestic Transport Water	65	0.4	63	0.3
International Transport Water	845	4.6	1,626	7.1
Domestic Air Transport	288	1.6	249	1.1
International Transport Air	2,408	13.2	3,445	15.0
Total	18,297	100	22,985	100

Table 6: Thailand's Energy in Transport Sector by Modes (1999 -2006)

Energy Consumption in the Transport Sector in 2008

Unit: ktoe

Energy Type	2006	2007	2008	Growth Rate (%)	
				2007	2008
Gasoline	5,376	5,466	5,305	1.7	-2.9
Diesel	11,795	11,769	11,102	-0.2	-5.7
LPG	535	667	905	24.7	35.7
NGV	97	212	684	118.6	222.7
Total	17,803	18,114	17,996	1.7	-0.7

Table 7: Thailand's Transport Energy Consumption by Fuels

2. Energy Efficiency Policy and Institutions

Thailand has created the energy saving discipline as a national culture and encouraged energy conservation in all sectors -- household, industrial, services & commerce and transportation -- through campaigns aiming to build up energy-saving conscience. The economy also keeps promoting efficient use of energy by providing incentives to attract the private sector to opt for energy-saving appliances. Incentive measures have also been set to reduce electricity use during the peak period. Four major energy saving initiatives have been launched to stimulate decision-making of entrepreneurs to implement energy efficiency improvement, i.e. Revolving Fund for both energy efficiency (EE) & renewable energy (RE) projects, ESCO venture capital fund, Tax Incentives for energy saving and DSM Bidding. Furthermore, we research, develop and set standards for electrical appliances and energy conservation buildings and encourage the development of mass public transportation and railway systems to promote efficient energy use which will reduce the economy's investment in energy procurement.

2.1 Energy Efficiency Policy

2.1.1 Policy Directive

The present government, under PM Abhisit Vejjajiva's administration, has set a policy on energy efficiency by **“encouraging energy conservation and efficiency in the household, industrial, service and transportation sectors** through campaigns fostering energy-saving discipline and conscience and promoting effective energy use; providing incentives to induce private sector investment in opting for energy-saving appliances; setting incentive measures for the household sector to reduce electricity consumption during the peak period; supporting research and development and standard setting for electrical appliances and energy-saving buildings; and supporting the development of mass public transportation and railway system to improve energy efficiency which will help defer the economy's investment in energy procurement.”

2.1.2 Strategy/Target/Implementation Methodology

In pursuance of the mentioned policy directive, the Ministry of Energy has developed an energy conservation and efficiency strategy together with targets and implementation methodology as follows:

1. National energy development and energy conservation.

- To increase the energy conservation target stipulated in the Energy Conservation Program to 20 %, focusing on increasing energy-saving achievement in the industrial and transportation sectors.

- *Prepare the drafting of Energy Conservation Program, Phase 4 (2012-2016) to be intensive to be able to address future crises caused by oil price volatility, climate change and world food crisis, underlying participation of people and concerned parties at all levels.*

2. Organize campaigns to create energy-saving conscience and provide knowledge about energy conservation.

- To forge ahead with the implementation of “11 Energy-Saving Measures for the People” to rapidly attain practical achievement and set an energy-saving target at THB 100 billion (US\$ 2.94 billion)/year.
- To enhance Local Administration Organizations (LAOs) to be focal agencies in creating and disseminating “energy-saving culture” via such target groups as children and juveniles, housewives and senior citizens under the “Community Energy Volunteers” mechanism.
- To attain participation of 100,000 households in the “Household Energy Credit” project, which will contribute to energy-saving at a minimum of 1,000 million Baht/year.
- A target of energy credit provision is set to reach THB 60 billion (US\$ 1.76 billion)/year, contributing to energy-saving at a minimum of THB 40 billion (US\$ 1.18 billion)/year.
 - *Improve the implementation approach of the “11 Energy-Saving Measures” by placing emphasis on pilot provinces at three scales (SML), and by pushing forwards energy-saving measures emphasizing a participation process, mainly through the “Community Energy Volunteers” mechanism, prior to expansion to other provinces in 2011.*
 - *Enforce measures on mandatory energy performance labeling within 2009, starting with refrigerators and air-conditioners by upgrading/increasing efficiency of No. 5 refrigerators and air-conditioners by at least 10%.*
 - *Expedite coordination with the Office of the Consumer Protection Board (OCPB) and concerned agencies to enable issuance of the mandatory measure on “Standby Power 1-Watt” within early-2010 for pilot appliances such as televisions and air-conditioners, and set a target of electricity saving worth THB 4 billion (US\$ 117.65 million)/year.*
 - *Accelerate the replacement of light bulbs by energy-saving lights (No. 5 and T5 fluorescent tubes) in 100 sample temples/mosques within 2009, and complete such replacement in 500 facilities by 2011, to achieve a change to the use of energy-saving light tubes totaling 1,000,000 units, including creation of a sensitizing presenter in each facility.*
 - *Speed up the issuance of relevant ministerial orders and announcements pursuant to the Building Energy Code within 2009, together with organizing training/conferences for*

architects, engineers and concerned institutions so as to attain at least 10% energy-saving in new buildings, accounting for electricity saving at 2,365 GWh/year.

- *Speed up the enforcement of laws and announcements related to the regulation of energy conservation in factories (ISO – Energy) within 2009, aiming to attain energy saving worth THB 90 billion (US\$ 2.65 billion) by 2011.*
- *Assign the Energy Mobile Units, via the Regional Energy Coordination Offices of all 12 Provincial Energy Offices, to carry out their field work in at least 576 sub-districts nationwide.*
- *Review the projects on “Clean Air-conditioners Increase Money for Households” and “Engine Tune-up to Reduce Oil Consumption” to be implemented continuously on an annual basis, especially in summer.*

3. Devise incentives and provide privileges to induce investment in energy saving.

- To set a target to reduce “Energy Intensity,” or energy consumption per production unit, in the industrial sector by 20% compared with the base year (2006).
 - *Promotion via 4 major measures, i.e.*
 - *Energy Credit and Revolving Fund to promote energy efficiency and alternative energy;*
 - *Tax measures and privileges on both cost-based and performance-based basis;*
 - *Joint ventures via the use of ESCO Fund;*
 - *DSM Bidding.*

4. R&D on energy-saving systems and technologies.

- To have in place an Integrated Resources Planning with regard to energy conservation R&D.
 - *Gather information about energy-saving innovations in each locality and encourage further development.*
 - *Consider clearer determination of the ratio of state budget and budget from the Energy Conservation Promotion Fund to be used for R&D promotion.*

5. Set standards, rules and regulations for energy-saving equipment, materials as well as energy management.

- To announce the Minimum Energy Performance Standards (MEPS) of 15 electrical appliances by 2009.
- Expedite the issuance of Ministerial Orders, particularly on the Building Energy Code and ISO - Energy.
 - *Expedite the issuance of Ministerial Orders with immediate effect.*

6. Promote the creation of prototype networking, e.g. SMEs with distinguishing features or with interest in energy-saving.

- To make “Thailand Energy Awards” recognized by general target groups.
 - *Intensify the implementation via the “Thailand Energy Awards” project.*

2.2 The Energy Conservation Promotion Act & Energy Conservation Promotion Fund

The Energy Conservation Promotion Act, B.E. 2535 (1992) has been in effect since 3 April 1992, with the objective to promote the energy conservation discipline and energy conservation investment in factories and buildings. Under this Act, the Energy Conservation Promotion Fund (ENCON Fund) has been established to provide financial support to government agencies, state enterprises, non-government organizations, individuals, and businesses that wish to implement measures to increase efficiency in energy utilization. At the same time, a punishment clause is stipulated in the Act for owners of any designated factory or building who fails to comply with the standards, criteria and procedures as provided by related ministerial regulations issued under the Act. The role of the public sector is to establish and utilize government mechanisms to encourage and promote energy conservation implementation by consumers, including development and utilization of renewable energy which is environmentally friendly.

The Ministry of Energy has established two funds, i.e. ESCO Fund and EE Revolving Fund, to promote private investments in RE/EE projects, with initial capitals from the ENCON Fund. The structures of the two funds are shown in the Figure 2 below:

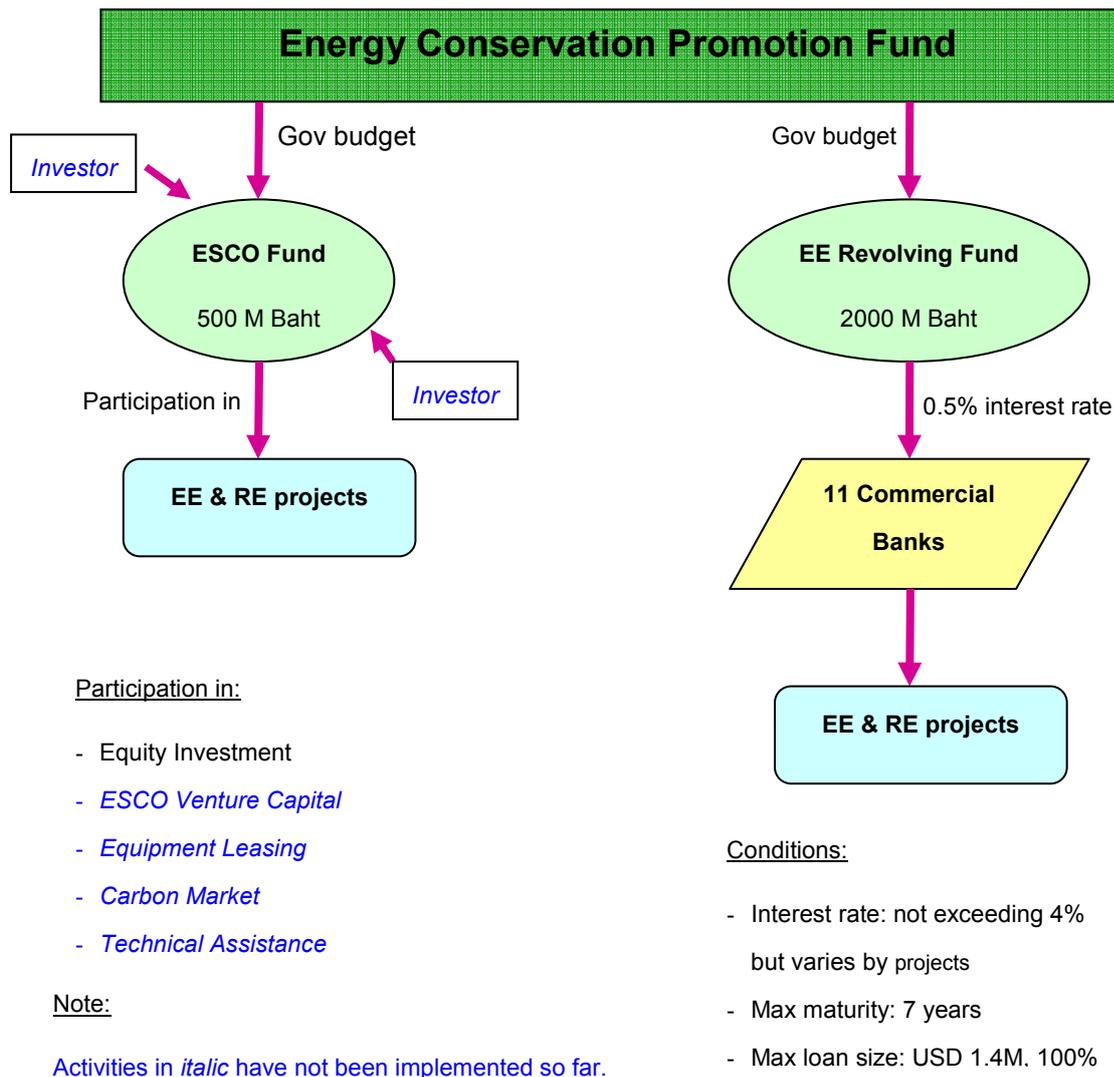


Figure 2: Schematic Diagram of the Energy Conservation Promotion Fund

2.3 Energy Conservation Program

Financial assistance from the ENCON Fund to materialize the above-mentioned objectives is monitored under the framework of the Energy Conservation Program. The first two phases of the ENCON Program covered the periods 1995-1999 and 2000-2004 respectively. Presently, the implementation is under Phase 3 (2005-2011). With the characteristic of a “rolling plan,” the programs/projects under the Energy Conservation Program and the expenditure estimation will be reviewed and adjusted each year because changes in influential factors may occur, for example, new policies/strategies determined by the government, economic and social conditions and the implementation outcome. The Energy Conservation Program, Phase 3, was revised in 2008 to correspond with the changing situations.

2.3.1 Energy Conservation Program, Phase 3 – revised (2008-2011)

The Energy Conservation Program, Phase 3 (2008-2011) aims to increase energy efficiency by reducing commercial energy use in the year 2011 from 80,331 thousand tons of crude oil equivalent (ktoe) to 72,511 ktoe, i.e. to reduce non-productive energy use by 10.8% or 7,820 ktoe.¹ Concurrently, alternative/renewable energy development will be encouraged, with a target to increase its share to 15.6% of the total final energy consumption, being able to replace about 10,961 ktoe of commercial energy demand.

The Energy Conservation Program, Phase 3, comprises the following three main sub-programs:

- (1) Renewable Energy Development Program
- (2) Energy Efficiency Improvement Program
- (3) Strategic Management Program

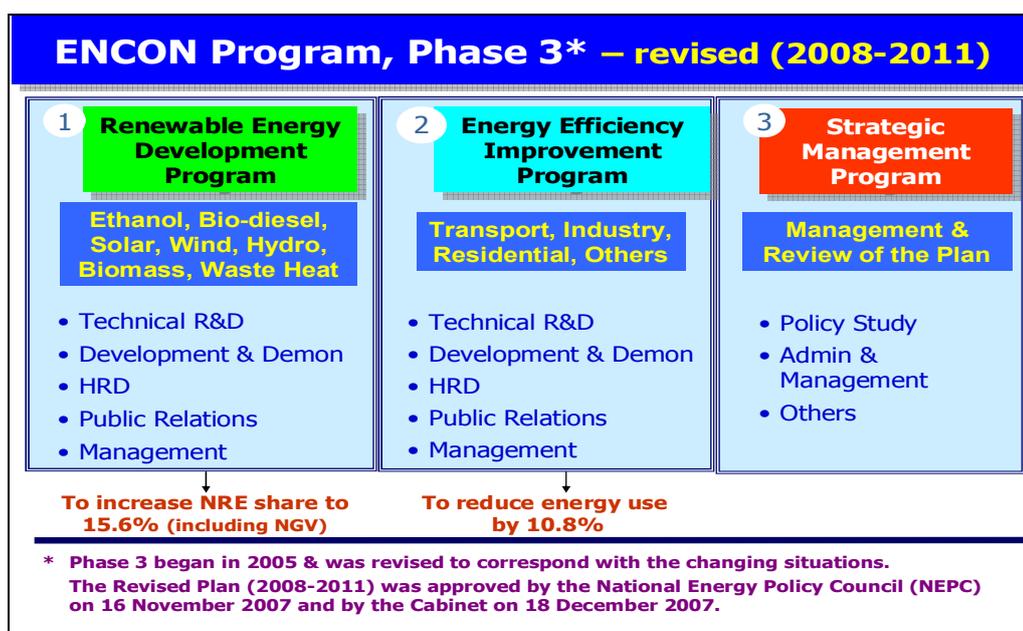


Figure 3: The ENCON Program, Phase 3-revised (2008-2011)

(1) Renewable Energy Development Program

The objective is to increase the use of renewable energy and other alternative energy. It is expected that in the year 2011 the share of renewable/alternative energy utilization will increase to 15.6% of the final energy demand, accounting for the replacement of commercial energy use of about 10,961 ktoe. The implementation will be focused in five areas, namely:

¹ The target of energy saving has been adjusted from 10.8% to 20% under the present government.

- a) Promotion of biofuels (gasohol and biodiesel).
- b) Promotion of renewable energy utilization for power generation.
- c) Promotion of renewable energy for heat generation.
- d) Policy study and technology research.
- e) Public relations work to create positive attitude and correct understanding of renewable energy use

(2) Energy Efficiency Improvement Program

The program involves the study, R&D and support to bring about efficient use of energy in the industrial, transportation and household sectors. The target is to increase energy efficiency and hence reduce commercial energy consumption. The program implementation is expected to help save 10.8% of energy consumption by the year 2011, equivalent to 7,820 ktoe

The implementation will include:

- Study, R&D and promotional activities to enhance efficient use of energy in the transportation, industrial and household sectors.
- Capacity building and development of the personnel dealing with energy efficiency improvement projects/activities via, among others, organizing academic conferences, seminars, training, technical visits, including scholarship granting to pursue further study at the bachelor's degree, master's degree and Ph.D. levels.
- Creation of knowledge and understanding of the importance of energy conservation and efficient use of energy.

(3) Strategic Management Program

The implementation will include:

- Policy research and study to provide recommendations, options or situation overviews, comprising several dimensions, from the energy supply/demand to the economic, social and environmental impacts, to be an element for decision-making pertaining to the improvement of the Renewable Energy Development Program or the Energy Efficiency Improvement Program so that the programs would be appropriate and correspond with the changing situations. The study outcomes could serve as a guiding tool for setting the work priorities and budget allocation.
- Monitoring and management to ensure efficient and effective implementation of the Energy Conservation Program.
- Special tasks to support and enhance the implementation that is of particular importance or urgency.

2.3.2 Sectoral Energy Efficiency Improvement Goals

The target of the Energy Efficiency Improvement Program at the end of ENCON Program, Phase 3, is to reduce energy demand of the economy by 10.8% in 2011, focusing on three energy-intensive sectors with an individual goal for each sector. The sectors and goals are as in the Table 8.

ENCON Program, Phase 3 (2008-2011)	Projected Energy Demand in 2011 (ktoe)		Saving Target	
	Business As Usual Case	With ENCON Plan	ktoe	%
Energy Efficiency Improvement Program	80,331	72,511	7,820	10.8
(1) Industrial Sector	31,847	28,658	3,190	4.4
(2) Transportation Sector	28,781	25,367	3,413	4.7
(3) DSM – Household/ Business/ Government Sectors	19,704	18,486	1,217	1.7

Table 8: Thailand’s Sectoral Energy Efficiency Improvement Goals

The measures for energy efficiency improvement on the industrial, transportation and household/business/government sectors are as follows:

(1) Industrial Sector

Various measures have been introduced, e.g. revolving funds (soft loans), tax incentives, and investment promotion, via the Board of Investment (BOI), to encourage energy efficiency improvement in the industrial sector. The details of the measures are:

- a) Revolving Funds or Soft loans (monitored by DEDE) are provided to stimulate and expedite energy efficiency investment in large-scale buildings and factories.
 - Launched in January 2003, with an initial budget of THB 2 billion (about US\$ 58.8 million) allocated from the ENCON Fund. At first, 6 financial institutes participated;
 - Provide zero-interest loans and 7-years final maturity to local commercial banks as an incentive to encourage the banks to lend to RE/EE projects, including ESCO companies at a maximum interest rate of 4%;
 - The maximum loan size is THB 50 million (US\$ 1.5 million);

- The banks will manage all aspects of loans and report the project status to DEDE. DEDE will 1) ensure that the projects are genuinely energy-saving projects, not simply equipment replacement; 2) monitor the performance of the banks to ensure that they meet their targets in terms of projects, lending and repayment; and 3) evaluate the program to measure energy savings;
- Currently, 11 public and commercial banks are participating and extended some US\$ 500 million loans via the banks in support of approximately 250 projects with about US\$ 180 aggregated project costs; and
- The Fund has been successful in familiarizing the participating banks with RE/EE business.

b) ESCO Venture Capital (monitored by DEDE) – a new initiative in 2008.

The ESCO Fund has been established as a source of venture capital for ESCOs to jointly invest with private operators in energy efficiency and renewable energy projects, through various channels – venture capital, equity investment, equipment leasing, carbon market, technical assistance and credit guarantee facility.

The Fund was launched in October 2008, with an initial capital of THB 500 million (about US\$ 14.7 million) targeted for SMEs; and as a pilot venture capital initiative to address the issue of lack of equity capital for small developers. The Fund provides equity capital up to 50% of total equity; and in the case of very small projects, provides its support through equipment leasing. The Fund has outsourced the identification and appraisal of projects to two entities (THB 250 million each for ECFT and E for E²). The Fund has so far approved \$US 8.3 million for supporting investment in 17 EE and RE projects, including a solar firm, biomass power plants, gasification projects and lighting devices.

c) Tax incentives (monitored by DEDE)

- Cost-based: Allow 1.25 times of actual investment capital for tax calculation, which will lessen the tax burden by phasing the tax deduction in over a period of 5 years. So far 94 facilities have received the tax benefits. The government lost US\$ 4.1 million of tax revenue but saved energy expenses around US\$ 11 million;
- Performance-based: Return 30% of saving value to the project owners through income tax reduction, but not exceeding THB 2 million. After two years of implementation, 174 facilities have joined the program by investing over US\$ 38.9 million in EE projects, reducing energy consumption of US\$ 25.1 million; and

² Energy Conservation Foundation of Thailand and Energy for Environment Foundation.

- BOI: Waive income tax for 8 years and also waive the import tax for ESCO or renewable energy projects. As of October 2009, there are 37 projects receiving BOI privilege, for the total investment of US\$ 235 million with the potential energy savings of US\$ 72.3 million.

d) DSM by Bidding Mechanism (monitored by EPPO) – a new initiative in 2008.

- Provide financial support to encourage business operators to invest in higher energy efficiency machines/equipment;
- Subsidy is granted based on actual energy saving achieved in a year resulting from such investment (subsidy = annual energy saving x subsidy rate [as bid by each company]); and
- Maximum subsidy rate set for each energy type as shown in the Table 9.

Energy Type	Maximum Subsidy Rate
<i>Electricity</i>	1 Baht/kWh
<i>Heat from liquid and gas fuels</i> e.g. fuel oil, LPG, natural gas, etc.	75 Baht/MMBtu
<i>Heat from solid fuels</i> e.g. coal, wood, rice husks, sawdust, bagasses and other agricultural waste	15 Baht/MMBtu

Table 9: The subsidy rates of Thailand’s Bidding Mechanism under the DSM

- With bidding mechanism, proposals with lower weighted subsidy rate will be subsidized first; and
- This scheme is expected to reduce energy consumption by 149 ktoe in 2011.

e) Other Supportive Measures for SMEs (monitored by various organizations)

Provision of grants for SMEs for the replacement of existing production processes and technologies by proven high-efficiency ones. Examples are energy efficiency improvement of tobacco curing process, ceramic shuttle kilns, and Chinese sausage dryers.

Energy Saving Target in the Industrial Sector in 2011: 3,190 ktoe				
	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
1. Implementation pursuant to the Act	25	50	100	211
2. Tax incentives	232	341	454	570
3. Soft loans	300	400	500	600
4. Promotion & development of ESCO business	97	153	224	300
5. Partnership in ENCON	200	300	400	551
6. Advance technology demonstration	25	50	100	200
7. DSM Bidding + hotels	149	149	149	149
8. Policy promoting CoGen	358	406	500	608
Energy Saving Target (ktoe)	1,387	1,849	2,427	3,190
Saving Achieved @ end-2008	1,345			

Table 10: Thailand's Industrial Sector Energy Saving Target in 2011

(2) Transport Sector

- a) More "Park & Ride" areas have been established, with support from the Government's ENCON Fund, in order to facilitate people travelling inbound to park their cars and use sky trains/underground trains instead.
- b) Transportation Incentive Program (implemented by the Federation of Thai Industries) – a new initiative in 2009

Project activities are divided into three main parts, i.e.

i. Feasibility Study on Oil Consumption Reduction in the Goods Transport Business

This is designed for operators who have not seriously implemented energy efficiency improvement in their business but who are interested in reducing energy consumption.

Experts will visit their facilities to help analyze and determine suitable improvement methods, based on the following aspects:

- Engineering and Technology
- Management
- Driving
- Task Force

ii. Promotion and Demonstration of Energy Efficiency Improvement in the Transport Sector

This is designed for operators who have analyzed and planned for energy efficiency improvement in their business but implementation has not been made. Financial support from the ENCON Fund will be divided into two categories:

- People Transport: support = 30% of the investment cost, but not exceeding 500,000 Baht/operator
- Goods Transport: support = 30% of the investment cost, but not exceeding 2,000,000 Baht/operator

iii. Promotion of Smart Driving for Energy Saving in the Transport Sector

This part of activities will foster energy conservation conscience of the personnel and their participation in energy saving of the organization. Training will be organized in all 5 regions of the economy.

Energy Saving Target in the Transport Sector in 2011: 3,413 ktoe				
	2008	2009	2010	2011
1. Promotion of public transport utilization	144	153	1,441	1,554
2. Traffic management system improvement	45	60	80	106
3. Promotion of logistic depot and ICD businesses	450	800	1,150	1,450
4. Create efficient transport system network	180	180	180	180
5. Policy on ECO CAR	0	26	66	123
Energy Saving Target (ktoe)	819	1,219	2,917	3,413
Saving Achieved @ end-2008	445			

Table 11: Thailand's Transport Sector Energy Saving Target in 2011

(3) Demand Side Management (Household/Business/Government Sectors)

- a) Promotion of high-efficiency equipment:
- Minimum Energy Performance Standards (MEPS): air-conditioners, refrigerators, ballast, fluorescent lamps and compact fluorescent lamps;
 - Energy efficiency labelling;
 - Establishment of the standards of LPG-fired cooking stoves;
 - Promotion of high-efficiency charcoal cooking stoves;
 - Establishment of building codes & building material standards;
 - Promotion of high efficiency CFL (under responsibility of EGAT): In 2007-2008, sales of high efficiency CFLs no. 5 increased by 11.9 million units, compared with the sale in 2006 (= a saving of 403 GWh/year);and
 - Promotion of high efficiency T5 fluorescent lamps (under responsibility of EGAT): To encourage replacement of T8 (36W) fluorescent lamps with T5 (28W) fluorescent lamps, targeting a savings of 408 ktoe in 2011.
- b) Public awareness campaigns such as TV spots, booklets, youth activities, etc.

Energy Saving Target in the Household/ Business/ Government Sectors in 2011: 1,217 ktoe				
	2008	2009	2010	2011
1. Electrical appliance standards:				
- Min. Energy Performance Standards (MEPS)	63	93	134	179
- Energy Efficiency Labeling	81	100	120	158
2. Heating equipment standards				
- High efficiency standards of LPG stoves	6	8	11	14
3. Automobile standards	8	40	100	140
4. Building codes	0	1	1	1
5. Promotion of energy efficiency products:				
- Promotion of high-efficiency charcoal stoves	17	28	46	68
- Promotion of CFL	17	31	46	46
- Promotion of T5	56	148	260	408
6. Public awareness campaign/ government sector	112	150	191	204
Energy Saving Target (ktoe)	360	599	908	1,217
Saving Achieved @ end-2008	223			

Table 12: Thailand's Household/Business/Government Sectors Energy Saving Target in 2011

2.4 Institutional Structure

The Ministry of Energy:

Energy Policy and Planning Office (EPPO): Policy maker -- recommend national energy conservation policies, management and development plans; establish energy conservation measures and the framework of energy conservation promotion budget allocation; and coordinate, follow up and evaluate the implementation outcome of the policies, management and development plans.

Department of Alternative Energy Development and Efficiency (DEDE): Regulator/implementer -- promote, support and monitor energy conservation activities; undertake R&D on energy efficiency improvement; establish regulations, standards and disseminate technologies related to production, processing, transportation, and energy utilization efficiency; and follow up/evaluate the implementation on energy efficiency improvement.

Electricity Generating Authority of Thailand (EGAT) -- owns and operates various types of power generating plants located in 38 sites, together with transmission and main distribution systems nationwide. EGAT has a unit called DSM Office to promote energy conservation, especially in electrical appliances through standard and labelling scheme. At the same time, EGAT also playing a significant role in encouraging energy efficiency in major industries, via ESCO programs.

PTT Public Company Limited (PTT) – an integrated energy and petrochemical company, conducting its business as the national energy company and is listed on the Thai stock market.

PTT also put its emphasis on energy conservation and alternative fuels by conducting research and development together with supporting energy efficiency and alternative energy policies from the government.

The present government requires the Local Administration Organizations (LAO) to act as focal points in creating and disseminating "energy-saving culture" via such target groups as children & juveniles, women/housewives, and the aged, under the "Community Energy Volunteers" mechanism.

2.5 Government Laws, Decrees, Acts

2.5.1 The Energy Conservation Promotion Act, B.E. 2535 (1992), as amended up to No. 2, B.E. 2550 (2007)

The Energy Conservation Promotion Fund (ENCON Fund) has been established to enforce energy conservation, particularly in designated factories and buildings under the Energy Conservation Promotion Act. The ENCON Fund provides working capital, grants or subsidies for investment in energy conservation programs in both public and private sectors, including energy efficiency improvement, renewable & alternative energy development, R&D projects, human resources development, public education and campaigns on energy conservation, and for the expenses for management and monitoring of the Energy Conservation Program.

2.5.2 Royal Decrees issued under the ENCON Act (1992)

Under the ENCON Act (1992), the following decrees have been enacted:

1) *Royal Decree on Designated Buildings, B.E. 2538 (1995), effective since 12 December 1995*, to stipulate the characteristics of "designated" buildings (energy consumption $\geq 1,000$ kW or ≥ 20 million megajoules of electrical energy equivalent, or those authorized to install one or more transformers with a total capacity of 1,175 kVA. Under this Royal Decree, three Ministerial Regulations on designated buildings have been issued, effective 12 December 1995, prescribing a) the standards, criteria, and procedures for energy conservation in designated buildings; b) the forms and schedule for submission of information on energy consumption and conservation; c) the criteria, procedures and schedule for owners of designated buildings to establish and submit energy conservation targets and plans, respectively.

2) *Royal Decree on Designated Factories, B.E. 2540 (1997), effective since 17 July 1997*, to stipulate the characteristics of "designated" factories (those with one or more transformers installed, with a total capacity of $\geq 1,000$ kW or $\geq 1,175$ kVA, or those consuming ≥ 200 million mega joules of electrical energy equivalent. Under this Royal Decree, two Ministerial Regulations on designated factories have been issued, effective 17 July 1997, prescribing a) the forms and schedule for submission of information on energy production,

consumption and conservation, including the criteria on and methods of recording information on energy consumption and installation or modification of machinery or equipment that affects the level of energy consumption and conservation; b) the criteria, procedures and schedule for owners of designated factories to establish and submit energy conservation targets and plans, respectively.

PART II: REVIEW TEAM REPORT

This part of the report was written by the PREE Team and presents the Team's conclusions and recommendation about energy efficiency policies and programs in Thailand.

1. Institutional Context

1.1 Critique

Well-organised institutional structures are crucial to the successful development and implementation of energy efficiency policies. To achieve effective cross-sector improvement in energy efficiency requires very close coordination among relevant government agencies at various levels on regular basis.

In Thailand the energy sector was managed by various departments under different ministries in the past. Since 1992 the overall management has been under the National Energy Policy Council (NEPC) chaired by the Prime Minister. The NEPC is responsible for the promotion of energy conservation and management of Energy Conservation Promotion Fund (ENCON Fund). The members of the NEPC include the Deputy Prime Minister (Vice Chair) and Ministers of Finance, Energy, Transport, Commerce, Industry, Agriculture, Science & Technology among others. The PREE team found that the NEPC has not frequently been held in recent years. It is recommended that the NEPC should meet on regular basis so that the Prime Minister and other Ministers can strengthen energy efficiency policies in a coordinated manner, considering regularly updated information and data.

The Energy Conservation Promotion Committee chaired by the Deputy Prime Minister is responsible for allocating appropriations from the ENCON Fund in accordance with the objectives. The PREE team found that the members of Energy Conservation Promotion Committee do not include Director- Generals of some Ministries such as the Ministry of Transport and Ministry of Science & Technology. It is recommended that the government officials in various Ministries such as Ministries of Energy, Transport and Science & Technology should more closely communicate and cooperate at the working level.

International experience tells us that it is very important that the government's institutional arrangements relating to energy efficiency clearly identify objectives and provide a mandate to act. The PREE team was informed that EPPO is expected to be the "Policy maker" as the Secretariat to the NEPC, the Secretariat to the ENCON Fund Committee and the Secretariat to the ENCON Fund Sub-Committee. The PREE team was also informed that EPPO has an additional role as an implementing unit of energy conservation projects. At the same time, the PREE team was informed that the DEDE is expected to be the "Regulator/implementer" for promoting, supporting and monitoring energy conservation activities. The PREE team found that the more clearly defined role of EPPO and the more clearly defined role of DEDE would lead to more effective and efficient policy making and implementation.

1.2 Recommendations

Recommendations 1. *The Prime Minister and other Ministers who are responsible for energy conservation (EC) policies need to more closely cooperate on regular basis to achieve the EE goals. It is critical to strengthen the policy coordination among relevant Ministries, especially between Ministry of Energy and Ministry of Transport for energy efficiency improvement in transport sector; and*

Recommendations 2. *The role of Energy Policy and Planning Office (EPPO) should be further clarified and strengthened. It is important that it operates not as an implementing unit of energy conservation projects but as the unit for policy making and policy coordination with other Ministries.*

2. Energy Efficiency Goals, Targets and Strategy

2.1 Critique

Thailand recognizes the importance of her energy policies to enhance national energy security, particularly on the promotion of energy efficiency improvement that has been pursued very seriously as a key measure to help reduce energy consumption and thereby reduce dependency on energy import of the economy. As a national agenda, the Thai Government has set a policy on energy efficiency with an aim to create the energy saving discipline as a national culture by encouraging energy conservation and efficiency in the household, industrial, service & commerce and transportation sectors through campaigns fostering energy-saving discipline and conscience and promoting effective energy use; providing incentives to induce private sector investment in opting for energy-saving appliances; setting incentive measures for the household sector to reduce electricity consumption during the peak period; supporting research and development and standard setting for electrical appliances and energy-saving buildings; and supporting the development of mass public transportation and railway system to improve energy efficiency which will help defer the economy's investment in energy procurement.

In response to the above directive, the Thai Government through the Ministry of Energy has launched an ambitious program to increase investments and has also set in motion the plans to speed up the implementation pursuant to the Energy Conservation Program, Phase 3 (2005-2011), under which the target of energy saving has been adjusted from 10.8% to 20.0% by focusing mainly on energy saving promotion in the industrial and transportation sectors. The Minister of Energy of Thailand has announced several strategies to reach this challenging target. Four Main energy saving initiatives have been launched to raise awareness i.e. Revolving Fund for EE/RE, ESCO venture capital funds, Tax incentives for energy saving and DSM Bidding.

These policies will promote energy security of the kingdom by reducing its energy imports and increasing energy resources, building competitive energy market for sustainable economic growth, and help reducing the emission of greenhouse gases in the long run.

The PREE team acknowledges Thailand's effort through the Ministry of Energy in developing various energy conservation and efficiency strategies together with targets and implementation methodologies with support from the **Energy Conservation Promotion Fund** under the Energy Conservation Promotion Act, B.E. 2535 (1992). This Fund collects a small levy (0.07 baht per liter) from the sale of gasoline, diesel, fuel oil, and kerosene with annual revenue around 2 – 2.5 billion baht. Having supervised by the Energy Conservation Promotion Fund Committee – chaired by the Deputy Prime Minister, this Fund is used for energy conservation promotion including research, study, development, demonstration, incentives (grants/soft loan), capacity building, and policy study.

As recently developed, the National Energy Development and Energy Conservation Program was established to increase the energy conservation target as stipulated in the Energy Conservation Program to 20%, focusing on increasing energy-saving achievement in the industrial and transportation sectors. The *Energy Conservation Program, Phase 4 (2012-2016)* is in a drafting process taking into account oil price volatility, climate change and world food crisis, underlying participation of people and concerned parties at all levels. The Review Team also recognises the aggressive plan in the organized *national campaigns* to create energy-saving conscience and provide knowledge about energy conservation. Examples include: the implementation of “11 Energy-Saving Measures for the People” and set an energy-saving target at THB 100 billion (US\$ 2.94 billion)/year; the enhancement of Local Administration Organizations (LAOs) to be focal agencies in creating and disseminating “energy-saving culture” via such target groups as children and juveniles, housewives and senior citizens under the “Community Energy Volunteers” mechanism; the participation of 100,000 households in the “Household Energy Credit” project, which will contribute to energy-saving at a minimum of 1,000 million Baht/year; and a campaign to introduce a target of energy credit provision that is set to reach THB 60 billion (US\$ 1.76 billion)/year, contributing to energy-saving at a minimum of THB 40 billion (US\$ 1.18 billion)/year.

The PREE team praises the remarkable progress in the implementation of the *EE Financial Support Program* that devises incentives and provides privileges to induce investment in energy saving. To set a target to reduce energy intensity in the industrial sector by 20% compared with the base year 2006 through promotions via 4 major measures such as 1) Energy Credit and Revolving Fund to promote energy efficiency and alternative energy; 2) Tax measures and privileges on both *cost-based* and *performance-based* basis; 3) Joint ventures via the use of ESCO Fund; and 4) DSM Bidding. The review Team also learned that up to 2008 this program supports over 250 EE/RE projects with total investment around 500 million USD – of 150 million USD of Government's Revolving Fund and achieves energy savings of 120 million USD per year. On setting *standards, rules and regulations* for energy-saving equipment, materials as well as energy management, the review Team lauds the attempt taken by the Government to announce the Minimum Energy Performance Standards (MEPS) of 15 electrical appliances by 2009 as well as to expedite the issuance of Ministerial Orders, particularly on the Building Energy Code and ISO - Energy.

Up to 2008, the PREE team recognises the achievement of the cooperative efforts for energy conservation whereby the 2,777 facilities have been implemented including 1250 designated factories (metallic, food, chemical, textile), 570 designated buildings (hospitals, hotels), over 1000 SMEs, and energy savings of 76 million USD/ year (housekeeping, low cost measures).

The PREE team agrees that Thailand's energy efficiency target for the new period seems even more ambitious. By 2008, Thailand's ratio of energy demand growth and economic growth will be 1 to 1 (reduced from 1.2 to 1) and will be reduced to 0.8 to 1 in 2020.

The PREE team fully acknowledges Thailand's strong intention to create the energy saving discipline as a national culture and encourage energy conservation in all sectors -- household, industrial, services & commerce and transportation -- through campaigns aiming to build up energy-saving conscience. The Thai Government has made a significant effort in pursuing policies and practical energy technologies to enhance energy security in the National Energy Conservation Program, Phase 3 (2005-2011) with a variety of key energy saving initiatives. The PREE team also found that the strategies as stipulated in the current Phase 3 is well oriented toward the aspirational energy efficiency goals. Furthermore, the PREE team notes that some barriers still exist to the deployment of many energy efficient technologies.

The PREE team encourages the Thai Government to adopt implementation strategies that can accelerate the implementation of energy efficiency practices across all sectors. These effective strategies should involve the establishment of specific, measurable and achievable energy efficiency objectives. The PREE team learned that many policies and measures now exist for improving energy efficiency, both of a voluntary and mandatory nature. The PREE team also believes that alongside the continued evolution of energy efficiency policy measures there may be a common emergence of a gap – *at the point of implementation* – between expectations of what a policy measure will achieve and its actual and measured impacts. Therefore, when such a gap emerges, anticipated energy savings may not be easily achieved within the timeframe. However, overcoming the barriers to bridge the *gap* may require a further concerted effort and integrated policy framework.

2.2 Recommendations

Recommendation 3. *To assist in achieving these goals and accelerating the implementation of energy efficiency practices across all sectors the Thai Government should*

- *Set “sub-sectoral” goals and formulate action plans for these sub-sectors to improve energy efficiency.*
- *Advance the effort in developing and implementing a package of policies and measures to promote energy efficiency, particularly in transport sector and industrial sector including small and medium enterprises (SMEs).*

Recommendation 4. *To guarantee maximum compliance the Thai Government should*

- *Make certain that both voluntary and mandatory energy efficiency policies are effectively monitored, evaluated and/or enforced.*

- *Strengthen legal and institutional infrastructure for ensuring compliance with energy efficiency requirements; undertaking regular and public reporting of monitoring activities; and guaranteeing transparent and fair procedures for assessing compliance.*

Recommendation 5. *To further facilitate energy efficiency financing the Thai Government should*

- *Stimulate private sector's involvement in energy efficiency investments by collaborating with the private financial sector to launch various public-private financial tools/packages to facilitate energy efficiency financing and also put in place regular co-operation and exchanges on energy efficiency issues between the public sector and financial institutions.*

Recommendation 6. *The Thai Government should*

- *pursue more effective assistance and support in developing the energy management system and implementing energy management procedures and practices through various energy management tools i.e. capacity building and training, certification, quality assurance, awards, etc. as well as developing a formal energy management policy especially at company level; and*
- *Consequently, ensure that this energy management process is supported by good monitoring systems and adequate end-use data and information across all sectors and all energy types. This may require the Government to increase the resources allocated to the monitoring process and energy end-use data collection at individual company, sector and national level to help achieve the target.*

3. Energy Data Collection and Monitoring

3.1 Critique

The PREE team observed that basic energy data are available and published on regular basis including energy balance tables. An energy balance table is a powerful tool for energy efficiency policy design. For example, the table can provide useful information about balances among different energy sources in domestic production, power generation fuel and final energy consumption. From the data compiled in the “Thailand Energy Situation 2007”, the PREE team found that the transportation sector has the same amount of energy usage as the manufacturing sector. This draws the Team’s attention to the necessity to introduce more energy efficiency measures in the transport sector. Such an analysis can be done only when overall energy data is available and properly summarized in a form such as an energy balance table. The relevant time series energy data are maintained by DEDE and the data for the latest 5-10 years are published in statistical books including “Thailand Energy Situation”, “Oil and Thailand” and “Electric Power in Thailand”.

In addition to official statistics, some very illustrative data are displayed at DEDE training/display centre or shown in the EGAT presentation during the stay of PREE team. For example, end-use energy data are available on ad-hoc base, such as cooling/others for buildings (DANCED/DEDE, 2001) or electricity consumption by different household appliances (EGAT,

2001). This kind of data is very informative in promoting energy efficiency measures and worth considering for wider dissemination.

The monitoring of the National Energy Efficiency Goals and Energy Intensity Target are done by different departments for each related sectors and reported to DEDE for synthesized announcement. Because of the change in governments and timing of the PREE team visit, understanding the current status of achieving the goal/target was not very easy. In case of some measures, the achievement seems to have been measured by the coverage of the policies and measures done against the planned numbers of energy saving policies and measures and not the actual energy savings. In addition, energy intensity target and national macro level energy efficiency goal are not directly connected but it is not very easy to understand the difference. Therefore, there seems to be some room for improvement in terms of monitoring these goals and targets.

The Energy Management since 1992 has accumulated energy consumption data for designated industries. The PREE team discovered and was impressed that the average for each industry/building category is calculated and each designated factories/buildings are benchmarked for policy purpose and an Energy Management Feedback Reports are sent back to the designated industries. Such information can be further utilized by sending it directly to the management as the private sector is very cooperative on energy management and they can support the government initiatives for people's awareness and regional/local campaign. On the other hand, SMEs still seem to need better access to the information and finance, therefore examples from the Energy Management Feedback Reports could be useful. Collaboration between the government and larger industries along with local offices will help SMEs to have better access to such information.

3.2 Recommendations

The PREE team acknowledges that Thailand has sound basic statistics. However, there is some room for improvement in information sharing and monitoring including dissemination of statistical data. As such, recommendations in this area can be summarized in 3 categories:

Recommendation 7. *The Thai Government should comprehensively evaluate and monitor the energy efficiency policies and measures. The steps for this recommendation are:*

- *Comprehensive evaluation of sectoral & overall achievement of national energy target is necessary for better awareness of the people of Thailand and of related sectors to encourage united actions as a country;*
- *Monitoring of each program under the National Energy Intensity Target can be coordinated between responsible Ministries, for example at the National Committee;*
- *Energy data for actual status should be shown along with the achievement of each program and sectors as well as for macro level; and*
- *The result of the regular monitoring can be announced to the public with some linkage between macro energy intensity achievement and sector wise achievement shown.*

Recommendation 8. *The Thai Government should disseminate information/data for all the sectors in a complete and comprehensive manner. The steps for this recommendation are:*

- *An independent government office (e.g. Statistical Bureau) could produce consolidated energy data covering all energy sources including electricity and transport. This can be done either (1) by pooling data collected by each regulating Ministries or (2) by making the designated government office to collect data directly;*
- *Comprehensive information on the overall energy efficiency programs and Thailand's achievement since the establishment of energy conservation law in 1992 in a form of report may help promote people's awareness. If enough information is available, it can be published annually and on energy related topics including renewable, such as Energy White Paper;*
- *Information displayed at the DEDE's demonstration/training centre , especially graphical presentations with numbers on the current energy usage share among different usages, etc. are good data for such report;*
- *End-use energy data estimation for key sectors such as transport sector (i.e. passenger / freight) will be beneficial for EE policy planning;*
- *The transport sector is one of the most important sectors to be given priority for energy saving and sound infrastructure planning including regional development and city planning in addition to shift towards mass transport systems in Thailand;*
- *Data/information on energy consumption for passenger/freight sub sectors for each transport mode (road, rail, air, ship) is a good starting point; and*
- *The Ministry of Transport can initiate such data estimation process with transport census, etc.*

Recommendation 9. *The Thai Government should:*

- *Edit and publish as a synthesized report the feedback report of energy management of the designated industries. Such report will appeal to the top management and industrial associations on the overall achievement of the Energy Management Scheme so that they have a full understanding of where they stand and what they can promote more in energy efficiency; and*
- *Design Best practice seminar or award contest for provinces and regions. For example, mobile DEDE training center or best practice workshops held by designated industries/buildings may be ideal.*

4. Policy Measures – Sectoral Analysis

4.1 Industry Sector

4.1.1 Critique

In 2008, the industrial sector represented the biggest energy consuming sector in Thailand by using 37.4% of the total final energy consumption in the economy. In terms of electricity, the industrial sector uses an even larger proportion, 44.7% of the total electrical energy used in the economy. Thus efforts on energy efficiency and conservation in this sector can be expected to contribute significantly to the overall energy use.

The PREE team found that Thailand's energy efficiency and conservation (EE&C) efforts appear to be well developed from the aspects of institutional development, the legislative framework and the funding mechanisms needed. The PREE team was made to understand that DEDE develops and implements as well as monitors EE&C measures for the industrial sector in the country. The funding for the programmes is mainly taken from the Energy Conservation Promotion Fund handled by EPPO which also appears to develop and implement EE&C measures for the sector. As mentioned earlier in this report, this arrangement can perhaps be improved upon.

Energy audits are almost always a prerequisite for EE&C projects to be implemented in a particular installation/premise. In many economies, persuading consumers to undertake audits appear to be a major concern and subsidised audits are a norm, at least in the initial stages. In Thailand, however, the concern appears to be more on getting consumers to implement the EE&C measures recommended by the energy audits. Making the implementation of the recommended measures mandatory by law, however, does not appear to be easily implementable since some of the measures can have huge cost implications and their payback period may not be attractive yet under present fuel prices.

The PREE team found that Thailand has created a good workable model to finance industrial energy efficiency improvement projects through the revolving funds. The funds make energy efficiency improvement projects in the industry sector financially viable and attract very active participation of industrial players to implement EE&C projects. However, the role of revolving fund in providing low-cost capital will be fading down and DEDE will be focusing on supporting technical and consultancy services to the financial sector. This would gradually withdraw the government intervention in EE lending market. One of major hindrances in promoting uptake of energy-efficient equipment is the high cost factor. Normally, in a developing economy like Thailand, the most energy-efficient model of equipment carries high price premiums because they are mainly imported. The Peer Review Team was told that DEDE encourages and stimulates the demand for such high energy-efficient equipments. However, it leaves it entirely to the private sector to undertake the local manufacture of them.

The PREE team was made to understand that while the profits made by Energy Service Companies (ESCOs) enjoy certain tax exemptions, the extra income obtained by the energy savings derived from the implementation of EE&C measures by the companies do not enjoy such benefits. However, the facilities implementing EE&C measures are eligible to receive a grant based on their actual energy savings, under the program called "performance based incentive", which is equivalent to the tax exemptions for their extra income resulted by the energy savings.

4.1.2 Recommendations

Recommendation 10. *It is recommended that DEDE should implement a mandatory target for percentage reduction, in energy consumption or energy intensity. Another possible method may be to make it mandatory to implement recommended measures with a payback period of less than a certain period, for example 3 years.*

Recommendation 11. *It is recommended that the Thai Government should continue as far as possible the revolving fund for industrial EE&C efforts until they reach more sustainable levels.*

Recommendation 12. *It is recommended that DEDE should design and implement a strategy to provide information and technical support for the local manufacture of energy efficient equipment. This will enable such equipment or appliances being made available locally, possibly at a cheaper cost. Such assistance may be advantageous to spur such local manufacture.*

Recommendation.13 *It is recommended that the Thai Government extend tax benefits to companies implementing EE&C measures in their own installations/premises to encourage more companies to undertake EE&C measures*

4.2 Electricity Sector

4.2.1 Critique

In 2008, electricity accounted for 21.3% of the total final energy consumption in Thailand. As a developing economy, Thailand's electricity demand growth is coupled with its GDP growth. This element is supported by the fact that the largest electricity user in the economy is the industrial sector with the share of 45% of the total electricity demand. In this regard, EGAT has a major role to provide a reliable and quality electricity supply in the economy. Thailand has a reliable national grid system to support its power transmission and distribution throughout the economy. On the generation aspect, Thailand has diversified its fuel mix to improve the supply security. Thailand power generation sector also has reduced its dependence on oil sources. In 2008, fuel oil contributed only 1.14% of the total fuel mix for electricity generation. Natural gas was the major energy sources for electricity generation with the share of 71.36%, followed by coal with the share of 21.23% (Figure 4)

Reducing electricity consumption by the use of energy-efficient devices and effective load management are two important elements in an electricity supply system. The former needs continuous technical efficiency improvement of energy-use devices and the latter depends on good management of electricity demand by affecting the amount and timing of electricity use. In this regard, the PREE team noticed that Thailand's power sector embarks on these two elements to save its electricity consumption and to reduce peak demand.

The PREE team applauds EGAT for its well structured efforts on Demand-Side Management (DSM) since 1993. The prioritisation of DSM activities of EGAT is based on cost comparison between the cost incurred for saving electricity and the cost of future power generation planting-

up. As of September 2009, 10,175 GWh of electricity was saved and 1,752 MW of peak demand capacity was reduced by EGAT's DSM Program.

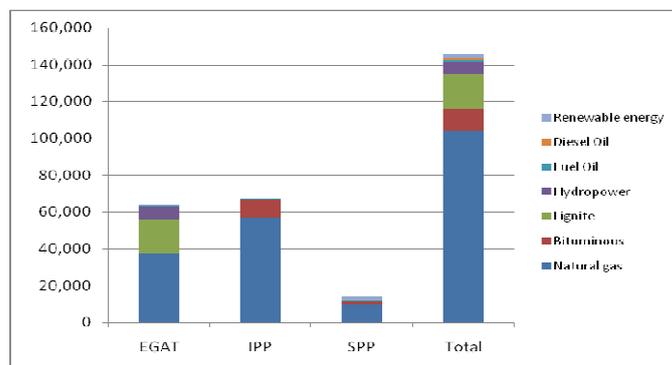


Figure 4: Thailand's Share of Electricity Generation (GWh) by Fuel Types in 2008

In 2002, Thailand's peak demand was 16,681 MW. This peak demand grew at an average rate of 6.2% to reach 22,586 MW by 2007. In 2008, EGAT's peak demand was 22,568 MW, a decrease of 0.1% from 2007. The reduction of peak demand in 2008 is attributed mainly to the high utilization of energy-efficient compact florescent lamps (CFLs) where in that year the labelling of CFLs was introduced. The comparison of EGAT's peak demand is depicted in the Figure 5.

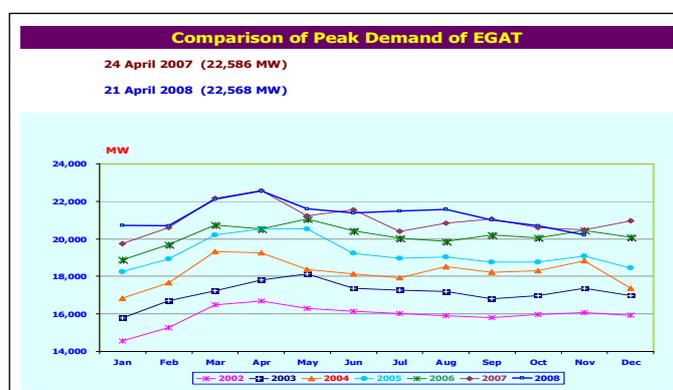


Figure 5: EGAT's Peak Demand from 2002-2008 (source EGAT)

The PREE team found that Thailand has substantial potential to improve further its electricity load profile. The load profile in Figure 6 shows that Thailand's daily load profiles were characterised by peaks and valleys. The kind of load profile could be improved further by load shifting, peak clipping and load shifting activities under the DSM program. The PREE team was informed by EGAT that their current DSM strategy is focused on the residential sector. Various market-orientated and persuasive programs for energy users in the residential sector are being implemented by EGAT. In this regard, the energy efficiency improvement efforts taken by the

Thai Government on buildings and appliances would provide good support and add value to the EGAT's DSM program.

On transmission and distribution losses (T&D), Figure 7 depicts the reduction on T&D losses on the National Grid and EGAT's system. The National grid losses reduced sharply from 8.1% in 2006 to 6.5% in 2007. On EGAT's system, the T&D losses was reduced much better from 7.6% in 2005 to 5.3% in 2007. The PREE found that there was no comprehensive data of T&D losses based on technical, commercial and non-technical losses.

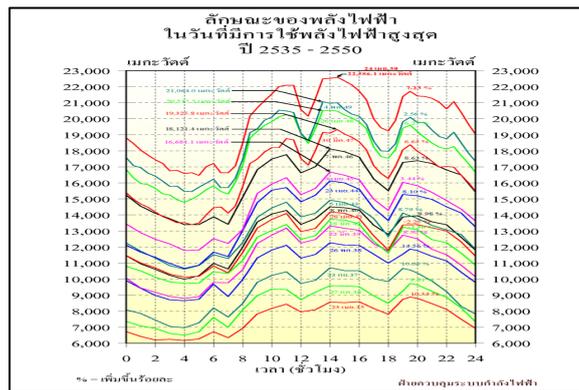


Figure 6: Thailand's Load Profile from 1982-2007 (source EGAT)

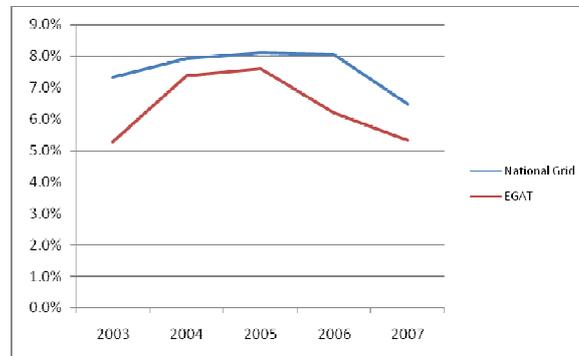


Figure 7: The trends of T&D losses on the National Grid and EGAT's system (Source EGAT)

4.2.2 Recommendations

Recommendation 14. It is recommended that EGAT should intensify its efforts on DSM. The focus of DSM strategy on residential users is timely and appropriate owing to the element that demand from residential users is most difficult to manage. The proposed residential technologies according to load shape objectives are:

- Peak Clipping: Solar Water Heating, Water Heating Cycling control, Air Conditioner Cycling Control, Load Management Thermostats.

- *Load Shifting: Water Heating Cycling control, Air Conditioner Cycling Control, Load Management Thermostats.*
- *Conservation: Building insulation (especially roof insulation) and high energy efficient appliances and equipment (especially air-conditioners, refrigerators, cooking appliances, cloth washers and lighting).*

Recommendation 15. *It is recommended that EGAT should continue to improve the T&D network system to reduce the losses to the 3% - 5% range to match the international standards as well as power quality improvement by 2011, through:*

- *Adding proper size transformers, panel boards, circuit breakers and wiring as well as running 200% neutral conductors to increase the available capacity.*
- *Using Zig-Zag or K-rated transformers.*
- *Implementing smart grid – automation for transmission and distribution system*

4.3 Commercial and Residential Sector

4.3.1 Critique

The commercial and residential sectors, though not the largest energy consumption sectors in Thailand, nevertheless account for 22.3 % of the country's total energy demand. These two sectors, nonetheless, hold great potential for improvements in energy efficiency, particularly as the occupants in both residential and commercial buildings continue to add plug loads (more electric appliances and equipment) in their current buildings. Overall, from 2004 through 2008, Thailand's energy consumption has been increasing at an average annual growth rate of 2%.

Electricity consumption in the residential sector constitutes 21% of total electrical energy use in 2008. This is an amount similar to the 25% total consumed by the commercial and public sector that year. In light of the world wide economic downturn, the demand for electric power overall decreased by 3.8% during January to July 2009 when compared to demand for the same period in 2008. However, while the demand in the commercial sector decreased 6.2 % during the first half of 2009, the demand for electricity in the residential sector increased by 4.2 %. The increase in residential electricity demand, even in the downturn, is clearly impacted by the ever increasing electric use of Thailand's population.

Air conditioning, lighting and refrigeration make up the bulk of residential energy use and as these appliances and equipment become more ubiquitous throughout the country, demand will continue to increase. As in other developed and developing economies, these appliances (and myriad others) become more common and pervasive over time and the energy needed to run them increases as well.

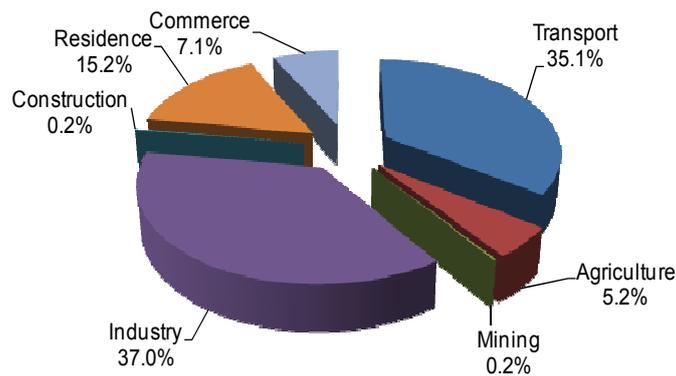


Figure 8: Thailand's Final Energy Consumption by Sectors in 2008 (Source: DEDE)

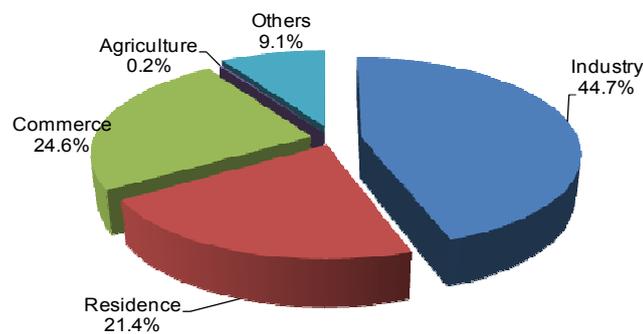


Figure 9: Thailand's Electricity Consumption by Sectors in 2008 (source: EGAT)

This potential for increased electric demand becomes one of the strongest drivers for Thailand to increase the efficiency of these appliances, dramatically and quickly, and accelerate their entry into the market.

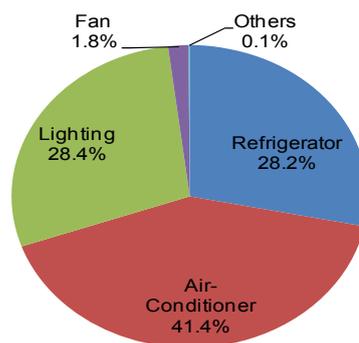


Figure 10: Thailand's Household Electricity Consumption (source: EGAT)

Consequently, Thailand has created the energy saving discipline as a national culture and encouraged energy conservation in all sectors – including the residential (household) and commercial sectors. Thailand's government leaders in the energy sector recognize that one important aspect to make energy efficiency the “norm” in the residential and commercial sector

is that some consumer behaviour requires change. Thailand has taken a significant policy and program approach to making these two sectors more energy efficient by:

- a) First, providing a strong foundation of broad policy and legislative actions to drive energy efficiency and investment into these sectors, such as;
 - improving the 1992 Energy Conservation Promotion (ECP) Act, B.E. 2535 (1992) through a variety of other decrees or revisions to the act, with the 2007 Revision of the Act focusing more on the management solution than the technical engineering solutions of the past – intending to drive the country along a sustainable energy conservation path,
 - focusing on an energy management standard and harmonizing it with an upcoming ISO standard on that subject, and
 - creating local (provincial or regional) energy offices to disseminate energy savings information to local citizens.
- b) And second, implementing specific policies and programs that would directly drive more energy efficiency and investment into these sectors, such as;
 - implementing an educational energy lab for school children,
 - developing energy building codes for the commercial sector,
 - improving the efficiency level and number of products covered under appliance standards,
 - building some very low energy using government facilities,
 - creating financing and incentive programs for energy efficiency,
 - developing mandatory labels for a variety of appliances and equipment,
 - initiating a voluntary building label program, and
 - creating programs to help reduce energy in households and commercial buildings.

A more in-depth look at some of the actions taken by Thailand in these sectors is illustrative of the pathway they have chartered. Building energy codes is a good example. In the commercial sector any buildings over 2,000 m² are categorized as “designated facilities” (DFs) and they must comply with mandatory building energy codes. So far more than 1,900 buildings and 3,500 factories have registered as DFs. The law initiated in the 2003 to 2006 period required each DF to appoint a “Person Responsible for Energy” (PRE) and a Target and Plan to reduce energy use reported on and updated every three years. The 2007 revision to the ECP Act also requires that each DF that uses more than 3000 kW of electricity to have two PREs in place, one being a Senior PRE (those DFs with usage less than 3000kW of electricity need only have one PRE). The 2007 revision requires further stringency in that an annual energy audit must take place and the results reported to the Department of Alternative Energy Development and Efficiency (DEDE).

As for the Building Energy Codes, the 2007 revision introduced the idea of designing new buildings with energy efficiency as a cornerstone of the construction. Required standards have been set in six areas:

Building Envelope	Lighting	Heating
Air Conditioning	Renewable Energy	Overall Performance

Approvals are made during the construction permitting process by the Central and Local administrative offices. DEDE provides supporting tools and training when needed. The Ministry of the Interior coordinates with DEDE for enforcing the code process. While Thailand has made significant progress in the Building Energy Code area, two critical items are missing from the overall program:

- a) A process for improving the codes on a regular basis, and
- b) Compliance enforcement to verify that the code was in fact followed during, and after, the building completion. In instances where codes are or were not followed, stiff penalties should be applied.

The government also promotes the efficient use of energy by providing financial incentives to attract the private sector to opt for energy-saving appliances, for example. Incentive measures have also been set to reduce electricity use during the peak period. Of the four major energy saving initiatives that have been launched to stimulate decision-making of entrepreneurs to implement energy efficiency improvements, the Revolving Fund for both energy efficiency (EE) & renewable energy (RE) projects and Tax Incentives for energy saving are the most important.

Applying the principles of energy efficiency first in government actions on public buildings is another good example of Thailand’s move to accelerate energy efficiency into their economy. The Energy Demonstration Centre (also known as the Energy Conservation Building in Honor of His Majesty the King) and the EGAT Headquarters Building are both state of the art energy efficient buildings.

DEDE has constructed the Energy Demonstration Centre as state of the art 14,000 m² energy efficient building that demonstrates both sustainability and eco-design. The building shows how an extremely low energy using building can be (i) smartly designed to take into account the natural surroundings that lower energy use and (ii) built with today’s best energy efficiency technologies for hot and humid climates. For example, this building significantly outperforms both the requirements in the ENCON Act and the average energy consumption of typical Thai buildings:



	Energy Consumption of the Building	Energy Consumption per ECP Act	Average Energy Use in Buildings
Overall Thermal Transfer Value	18 W/ m ²	45 W/ m ²	65 W/ m ²
Energy Consumption of Lighting System	8 W/ m ²	16 W/m ²	25 W/m ²

The building also serves as a major training centre and information dissemination centre displaying 54 technologies in industrial, residential and commercial settings and many of them set up in an interactive mode for the public to use and learn how they operate. The PREE team was informed that this Energy Demonstration Centre is the first international energy technology centre in Southeast Asia.



The Electricity Generating Authority of Thailand (EGAT), one of the three state owned enterprises under the overall direction of the Ministry of Energy (MOEN), has built and occupied a multi-story headquarters office building that also demonstrates many of today's energy efficiency and renewable energy technologies that significantly reduce its energy consumption.



The building contains 20 stories, is more than 40,000 m², and houses nearly 3,000 employees. As with the demonstration centre, the EGAT building has been designed to take advantage of

natural conditions to cool and light the building – the above right photo demonstrates how best to create an environment around the building for the benefit of cooling down the temperature by utilizing landscaping features such as large trees, bushes, the water feature and fountain to reduce the ambient temperature. In addition, the building was properly oriented in order to maximize natural daylight but minimize the heat gained by avoiding openings toward the south and west. Another sustainable design feature was that the non-air conditioned space (e.g. the circulation core, the main staircase, the toilets, and air handling units) operates as the buffer zone in the south-west direction.

The building was also designed to protect the office space from the sun's heat by using a high performance curtain wall system (using insulation for the solid panel and double glazing system in the open panel). Moreover, an aluminum fin shading device is employed to allow daylight to filter in but reduce the heat gained. Though not an efficiency measure, by deploying Building Integrated Photovoltaic (BIPV) as part of the curtain wall, electricity is generated from the solar panels and is expected to achieve more than 21,000 kWh per year.

The building's air-conditioning system uses a heat recovery method to re-circulate the cold waste air from the air-conditioned space to cool down the temperature and humidity of fresh outside air that is introduced into the building. This resulted in 20% energy savings for the air conditioning system. The chillers use a low-flow system to reduce the load on the chillers and this saves another 5% in energy consumption. Using a variable air volume (VAV) air flow system with a variable speed drive for the air handling units saves another 20% of energy consumption.

EGAT has determined that its electrical consumption for the headquarters office is 109 kWh/m²/year, approximately 45% less than the energy consumption of a standard office building. EGAT achieved this result from a combination of energy efficient lighting fixtures (and bulbs), day lighting techniques, efficient air conditioning and ventilating equipment and the use of photovoltaic panels.

The above described buildings show that government can have a decided influence on the energy efficiency of new building construction in the commercial sector, but more could be done from a government “leadership” context:

- a) DEDE could demonstrate “Net -Zero Energy” buildings; and
- b) DEDE could challenge other national, regional and local government agencies to match or exceed the best energy efficient buildings it has developed and offer awards to those units of government that do so.

Improving the energy efficiency of appliances and equipment has been another means by which energy consumption of buildings has been reduced in Thailand. DEDE has responsibility for setting high-efficiency labels for a variety of appliances and equipment. The current label is recognizable and according to DEDE management, it has caused the Thai consumer to purchase only those appliances/equipment with the highest “5” rating. This label appears to have transformed the Thai market for labelled products. In the next section of the report, a more detailed description of the labelling program is explored.



The building labels program in Thailand is currently a voluntary program. The building label program has been devised in a manner similar to the United States Green Building Council’s method of awarding a LEED rating³ for buildings that meet specific sustainability and energy criteria. The Thai building label system awards different point scores in a variety of categories for energy and environmental performance. For Non-Residential and Residential Buildings, note that there are three levels of labels; Bronze, Silver and Gold. For Residential buildings, Bronze must score between 40 and 54, Silver is 55 to 69 and Gold is greater than 70. For Non-Residential Buildings, the score for Bronze must be between 45 and 59, Silver 60 to 74 and Gold greater than 75. Table 13 shows the criteria and the scoring scheme of building labels program.

The labels however are only on a voluntary basis. Enhancements to this program would be to:

- a) Enact regulations to make Building Labels mandatory for new construction, and
- b) Initiate a pilot program to make Building Labels mandatory for existing buildings at time of a major renovation or sale.

Evaluation Criteria	Non-Residential Energy Points	Non-Residential Environmental Points	Residential Energy Points	Residential Environmental Points
Building Site	5	5	4	2
Landscape Architecture	6	6	8	8
Building Envelope	34	0	40	0
Air Conditioning System	15	8	10	2
Lighting System	15	1	12	1
Alternative Energy &	12	3	12	5

³ Leadership in Energy and Environmental Design rating highlighting the “greenness” of a building

Evaluation Criteria	Non-Residential Energy Points	Non-Residential Environmental Points	Residential Energy Points	Residential Environmental Points
Energy Management				
Sanitation System	5	7	4	5
Materials & Construction	0	7	0	5
Advanced Technology & Innovation	8	4	10	5

Table 13. Thailand's Building Label Program Evaluation and Scoring Criteria



Figure 11: The category of labels under the Thailand Building Label Program

Energy efficiency financing mechanisms is another keystone of Thailand's energy efficiency program. Under the ECP Act, three financing mechanisms were created;

- a) A revolving loan program for energy efficiency (and renewable energy) projects;
- b) An Energy Service Company fund; and
- c) Tax incentives for energy efficiency investments.

The revolving loan fund has been set up to stimulate and leverage commercial bank investment for energy efficiency improvements and also to familiarize banks with the loan opportunities in this market. Other economies have followed a similar route to get the banking community into energy efficiency lending. The program is now in the third phase and has approximately \$125 million (US\$) to lend for up to seven (7) years with a maximum loan of up to \$1.56 million (US\$) with a maximum interest charge to the customer of 4% and .5% from the banks⁴. Eleven (11)

commercial Thai banks are participating in the Program. There have been 239 projects funded so far, although only 43 have been in the buildings sector⁵.

The ESCO fund initial size is \$12.5 million (US\$) and comes from the Energy Conservation Promotion Fund. Funding can be up to \$1.25 million (US\$) per ESCO with repayment in five years. Through September 2009, 17 projects have been undertaken.

Tax incentives have also been provided. A 25% tax credit on corporate tax for investments in energy efficiency projects has been initiated. It applies to the first \$1.25 million (US\$) for equipment and installation costs and can be spread over 5 years. The incentive can either be cost based or performance based, each with its own criteria. The cost based incentive program has approved 110 applications so far; the performance based incentive has had 240 applications approved. There is also an incentive through the Board of Investment (BOI), in which import duties and corporate taxes are exempt if it is a new investment in an energy efficiency business (or a renewable energy production business) and the incentive has a life of 8 years. BOI has approved 37 projects under this incentive program. While the overall financial incentive program has been robust; additional enhancements could be initiated, such as:

- a) Increasing tax incentives for commercial buildings that exceed building energy codes by 30% or greater;
- b) Providing coupons/rebates for energy efficiency commercial or residential building products; and
- c) Including envelope improvements in bank “household” financing.

While Thailand has enacted numerous and successful energy efficiency programs, there is still room for improving and enhancing the economy’s energy efficiency. The recommendations in the section below highlight some of the major findings that the PREE team found and discussed during its review of Thailand’s energy efficiency programs.

4.3.2 Recommendations

Recommendation 16. *It is recommended that the Thai Government should:*

- *Expand many of its existing energy efficiency programs for the residential sector to achieve higher energy savings so that it can better influence people’s knowledge and choices*
- *Develop an “Eco-Cities” program to enhance both residential and commercial energy efficiency among other sustainability and environmental goals*

Recommendation 17. *It is recommended that the Thai Government should:*

⁴ From the Nov. 10, 2009 “Energy Efficiency Programs in Thailand” DEDE presentation

⁵ From the Nov. 10, 2009 “Thailand Financing Programs for EE and RE” DEDE presentation

- *Increase the existing commercial building energy codes every 3 years so that the code process becomes dynamic and more energy efficiency is required for commercial buildings on a regular basis, and*
 - *the energy code should stress a performance path as well as a prescriptive path*
 - *a strict Compliance enforcement program should be developed which focuses on verifying if the code was in fact followed during, and after, the building completion. In instances where codes are, or were, not followed, stiff penalties should be applied*
- *Develop an building energy code for residential buildings for new construction, and*
 - *include application of the new residential codes to major renovations when they occur*
 - *include “passive” design features in the new residential energy codes*
 - *add “Cool Roofs” as a component of the new residential energy codes*

Recommendation 18. *It is recommended that the Thai Government should:*

- *Enact regulations to make Building Labels mandatory for new construction for both commercial and residential buildings*
- *Initiate a pilot program to make Building Labels mandatory for existing buildings at time of major renovation or sale*

Recommendation 19. *It is recommended that the Thai Government should:*

- *Increase tax incentives for commercial buildings that exceed building energy codes by 30% or more*
- *Include building envelope improvements in bank “household” financing mechanisms*
- *Develop other incentive programs for commercial and residential building envelope improvements, such as coupons or rebates on building envelope materials*

Recommendation 20. *It is recommended that the Thai Government should:*

- *“Lead by Example” by having*
 - *DEDE demonstrate “Net-Zero Energy” buildings in key regions of Thailand*
 - *DEDE challenge other national, regional and local government agencies to match or exceed the best energy efficient buildings it has developed and offer awards to those units of government that do so.*

4.4 Transport Sector

4.4.1 Critique

Currently, Thailand has 25 million registered motor vehicles for its 65 million people. In Bangkok City alone, the 5.5 million population owns 5.6 million vehicles, among which 2.0 million are passenger cars⁶. At 36 per 1,000 people (approximately 2.0 : 5.5), Bangkok’s car ownership is higher than many developed metropolitan cities in the world (London 33, Tokyo 26, Seoul 21, New York 20, Singapore 11, Hong Kong 5)⁷.

⁶ ERIA Research Project Report 2008 No. 7: Sustainable Automobile Society in East Asia, March 2009

⁷ Compilation by APEC PREE team

The challenges facing the energy efficiency of the transport sector, therefore, are two fold: (1) In Bangkok, the dependence on motor vehicles, especially for passenger transport; (2) At the national level, the rapid increase in transport demand along with economic development, especially in the provinces surrounding Bangkok.

The situation is serious in Bangkok. Almost a quarter of national passenger-km takes place in the Bangkok Metropolitan Region (BMR). In 2003, approximately 46% of total daily person trips in the BMR were made by private modes; the second most important mode is public bus with a 37% share. Mass Rapid Transit (MRT) carried only 3% of total daily trips in 2003.

Many projects targeted at improving the passenger transport in the Bangkok region are underway and/or in the plan. These would concurrently improve the energy efficiency in the Transport Sector.

It is projected that the share of MRT in the Bangkok region is expected to grow to 15% by 2015 if the planned MRT network (approximately 200 km) is substantially completed and functioning well.

The Bangkok Metropolitan Administration (BMA) has recently promoted the development of several Bus Rapid Transit (BRT) routes with an initial route of 15km under construction. The BRT master plan covers 14 routes with the initial 6 routes (138km; US\$400 million) for the first phase.

DEDE's report "Energy Efficiency Improvement Program in Thailand" also emphasized that "integration of various modes, including the following, remains the key to the efficient urban transport development – improving reliability, reducing travel time, and better air quality. It is crucial to emphasize not only system integration among MRTs and with BRTs, but also coordination with existing bus systems".

The Policy and Strategy Co-ordination Office (PSCO) of the Ministry of Energy (MoEN) noted that one challenge to increase the modal share of public transit (rail and bus) is that the cost to travel by passenger cars is very low compared to the public transit fare and to other metropolitan cities

In addition, through the Energy Conservation Promotion Fund (ENCON), an Energy Efficiency Improvement Program, aims to reduce energy demand of the economy by 10.8% in 2011, among which the transport sector will achieve a 4.7% reduction from Business As Usual. These include a park & ride project in Bangkok to promote the use of MRT, a Transport Incentive Program to assist companies to improve transport energy efficiency, and a milk-run promotional effort by the Thai Truck Alliances.

However, we noted that in Thailand, there are no fuel economy programmes in place, either to the vehicle manufacturers, and to the consumers.

Because the Ministry of Transport was not present in PREE meetings, this review may not have all the complete information.

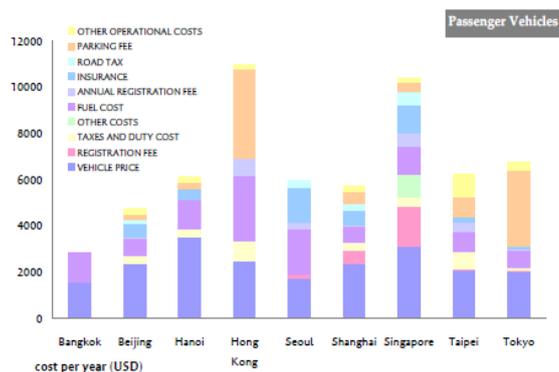


Figure 12: Annual cost of passenger vehicle ownership in APEC economies (source: APERC)

4.4.2 Recommendations

Generally, there are 3 ways to improve the transport energy efficiency. The first is to manage the demand in order to reduce the need for transport supply. We are pleased to note that the Energy Efficiency Improvement Program supported by the ENCON Fund, including the Transport Incentives Programmes, milk-run by the Thai Truck Alliances, Park & Ride, are all demand management measures.

The second way is to use transport modes with high energy efficiency, for example, MRT, railways, buses. The development of MRT in Bangkok is a very effective energy efficiency measure. SkyTrain and MRT in Bangkok have greatly relieved the traffic congestion, and they are very effective energy efficiency measures as well. On average, a rail-based system is 5 to 10 times more energy efficient than a road transport system.

The third way is to improve fuel economy of vehicles. Due to the high oil prices, many countries have introduced or refined fuel economy programmes. On the supply side, the American government mandate corporate average fuel economy of Original Equipment Manufacturers (OEMs), and the Japanese set the fuel economy of the most efficient model in the vehicle class, the top runner, as the benchmark for all other OEMs. On the demand side, comprehensive fuel economy information is displayed in showrooms and on website for consumers.

Recommendations are based on findings and experiences from others. The recommendations are grouped into short-term (implementable in 1-2 years), medium-term (implementable in 3-5 years), and long-term where the impact will be seen only after 5 years.

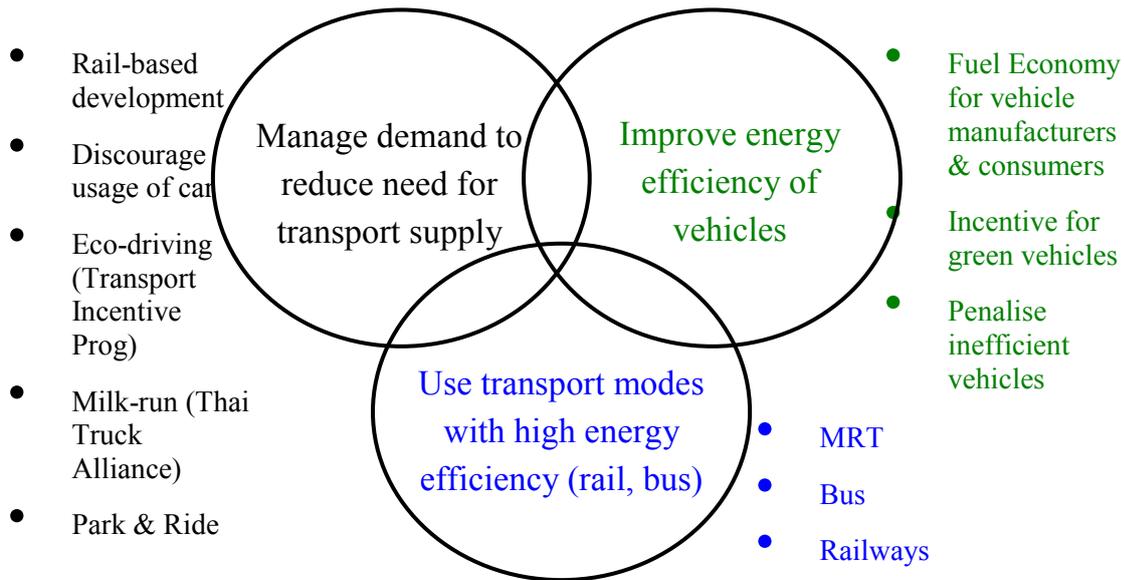


Figure 13: Schematic Diagram on Ways to Improve Transport Energy Efficiency

4.4.2.1 Short-term (1-2 years)

Recommendation 21. *It is recommended that the Ministry of Energy, the Ministry of Industry and the Ministry of Transport should work together to set fuel economy programmes. These should cover both the supply and demand sides, including*

- *corporate average fuel economy target to vehicle original equipment manufacturers (OEMs); and*
- *fuel economy information to consumers.*

Recommendation 22. *It is recommended that the Thai Government should develop a comprehensive transport development plan that covers all modes (roads, car, motorcycle, truck, bus, rail, etc.) for passenger and freight transport. In this plan, it should*

- *set major policy directions (e.g. rail-based development) that will address the long-term trend of increasing transport energy consumption; and*
- *link energy efficiency sub-targets with transport measures.*

Recommendation 23. *It is recommended that the Thai Government should study and introduce many demand management measures to meet the needs of different types of commuters in order for them not to drive.*

Due to a lack of information, the PREE team does not recommend a specific demand management measure. Some measures may appear to be easily implementable (such as Limiting odd-even plate number) and can be very effective (e.g. Electronic Road Pricing (ERP)). Detailed studies are required before implementation, and the key success factors for a demand management measure are that driving trips are reduced, alternative transport is viable, and the public is well communicated.

Take the High-Occupancy-Lane (HOL) as an example. Before implementation, it must ensure that most of the new passenger-occupants are existing drivers and not transit users, effective enforcement of “illegal” drivers, handling other drivers’ unhappiness over the “low utilisation” of HOL or being penalised for entering the lane.

Section 4.4.2.4 lists many demand management measures that have been successfully implemented in other cities and countries.

4.4.2.2 Medium-term (3-5 years)

Recommendation 24. *It is recommended that the Thai Government and the Bangkok Metropolitan Administration should work together to*

- *Develop the Bangkok MRT system as planned. At the same time, the transport system should be well integrated, for example, between MRT lines, with SkyTrain, buses, taxi, cars and two- or three-wheelers ; and*
- *Develop bus priority schemes, including Bus Rapid Transit (BRT).*

Worldwide experiences show that bus ridership continues declining when economy develops. Given the direction to reduce car dependency, bus will have to remain a main transport mode. To ensure that bus passengers are not pushed to drive, it is important to develop the bus system. Bus Rapid Transit (BRT) is recommended because there are many successful implementations worldwide including Jakarta. At the same time, priority schemes must be planned for other public buses, otherwise the young bus commuters will soon become drivers once they can afford.

Recommendation 25. *It is recommended that the Thai Government and the Bangkok Metropolitan Administration should work together to*

- *Increase car driving cost in comparison with the public transit fare*

Demand management schemes cannot sustain if the pricing signal is not correct. If the driving cost in Bangkok remains low compared to the MRT fare, schemes like park and ride, HOL, are destined to fail in the long run. Driving cost can be increased in many ways, from the indirect control of parking supply or parking tax to the direct Electronic Road Pricing (ERP) and fuel tax (see Section 4.4.2.4 for list of demand management measures). However, most demand management measures come at a political price, because a measure would be effective only when some drivers are pushed to switch transport mode. Detailed studies are required before implementation to ensure that driving trips are reduced, alternative is viable, public is well communicated.

4.4.2.3 Long-term (beyond 5 years)

Recommendation 26. *It is recommended that the Thai Government should*

- *Develop rail (MRT & railways) as the backbone of a national transport system. Rail is the most efficient transport mode for passenger and freight transport. For Bangkok, commuter rail at suburb areas should be developed which are less costly to build and operate; and*
- *Adopt the rail-based development strategy to maximise transit usage and to finance infrastructure. Rail systems, including MRT, suburb commuter rail and inter-city railways, require large capital to build the infrastructure. Rail-based development has been successful in Japan, followed by Hong Kong. Many other countries encouraged development around rail stations and captured the value through tax, transport development charge, selling state land at a premium, etc.*

4.4.2.4 List of demand management measures

Short-term (1-2 years)

- Special bus for working professionals (red minibus in Hong Kong, premium bus in Singapore)
- High-Occupancy-Lane (HOL) (USA)
- Promoting Carpool (USA)
- Limiting odd-even plate number to enter city centre (Manila, Beijing)
- Off-peak car scheme (Singapore)
- Weekly no driving day (Seoul)
- Tax on parking spaces (New York city, San Francisco)

Medium-term (3-5 years)

- Electronic Road Pricing (Singapore, London)
- Increase fuel tax, possibly in the form of BRT or rail-infrastructure fund
- Limiting new car registration (COE bidding in Singapore, auction of new car plate number in Shanghai)
- Energy efficiency or CO₂-based tax (United Kingdom)

Long-term (beyond 5 years)

- Reduce provision of parking in new buildings through building regulatory measures (Hong Kong, London)

5. Appliances and Equipment

5.1 Critique

The improvement of energy efficiency of energy-using appliances and equipment is one of the main components in the Thailand's energy efficiency improvement program. The Energy Conservation Promotion Act (1992), under the Section 23, empowers the Thai Government with the regulatory authority to improve the energy efficiency of appliances and equipment. The Act also, under the Section 40, provides incentives and surcharges exemption for the promotion of energy- efficient appliances and equipment under the Section 23 of the Act.

Institutionally, EPPO is responsible for macro policy and promotion of energy efficiency programs for appliances and equipment. DEDE is responsible for setting high-efficiency levels for energy-using equipment (High Energy Performance Standard, HEPS) and for establishing Minimum Energy Performance Standard (MEPS); and the Thailand Industrial Standards Institute (TISI) is responsible for energy performance test protocols and for publishing the MEPS. On electrical energy, EGAT has been promoting the use of energy-efficient appliances and equipment including energy-efficient lights under its Demand-Side Management (DSM) program.

Thailand started an appliances and equipment energy efficiency improvement through a voluntary market intervention tool, i.e. the High Energy Performance Standard and Labeling Program (HEPS). In this respect, EGAT has been running a voluntary energy labeling program covering several types of household appliances and equipment since 1994. The voluntary measure has boosted the market transformation of appliances and equipment market into high energy-efficient. To further improve and enhance the energy efficiency improvement of appliances and equipment, the Thai Government decides to use a mandatory intervention tool, i.e. MEPS.

Currently, DEDE is targeting MEPS for 50 appliances and equipment and HEPS for 54 appliances and equipment by 2011. Since 2008, DEDE has drafted and submitted to TISI 11 drafts of MEPS and 8 HEPS have been issued effectively. The appliances and equipment under HEPS will carry energy- performance label. In line with the program, the promotion efforts are carried by the government through financial incentives such as interest-free loans and rebates for residential users and low-interest loan for industry and commercial sectors.

The PREE team acknowledges the efforts taken by the Thai government on the energy efficiency improvement of appliances and equipment. The fruits of energy efficiency improvement of appliances and equipment are enjoyed by the economy through energy saving

and peak demand saving as well as greenhouse gases reduction. For an example, the labeling and voluntary standards program by EGAT has contributed 10,175 GWh of energy saving, 1,725 MW of peak demand capacity saving and 6.6 million tonnes of CO₂ reduction as of September 2009. The Figure 14 below depicts the quantity of electrical energy saving and peak demand reduction achieved by EGAT since 1995 through standards and labeling efforts.

The PREE team believes that MEPS would continue further the energy efficiency improvement by strengthening the appliances and equipment market transformation. In this regard, the PREE encourages the Thai Government to closely monitor and survey the progress of market transformation induced by MEPS. The information on market transformation is very important to the Thai Government to introduce follow-up schemes and to further improve the standards.

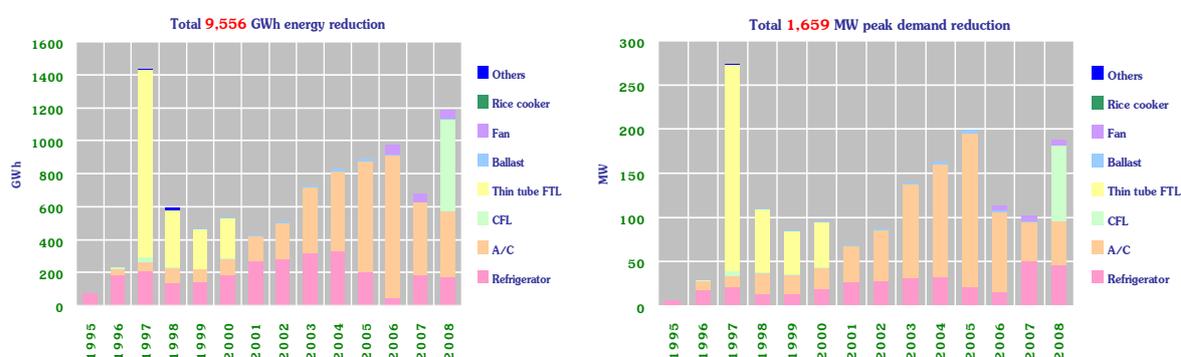


Figure 14: The impact of appliances and equipment energy efficiency improvement on Thailand’s electricity sector (source: EGAT)

On the efforts to promote the uptake of high energy-efficient appliances and equipment through financial measures for household users, the PREE team found that the success rates were not very encouraging. The PREE team believes that there are some stumbling blocks in the implementation of the programs that hampered the success rate of the programs. The stumbling blocks should be indentified and more ‘pulling factor’ should be added on the programs to improve the uptake rates.

5.2 Recommendations

Recommendation 27. *It is recommended that DEDE should expedite the implementation rate of MEPS to meet the targeted schedule, by 2011 for 50 products. The implication of MEPS on the market transformation is very crucial, to phase –out inefficient appliances and equipment as soon as possible from the market. For efficient and effective implementation, the MEPS should be open-ended, i.e. regularly revised and upgraded. The standard revise and upgrade could be carried out periodically for every 3 to 5 years.*

Recommendation 28. *It is recommended that DEDE should monitor continuously the progress of market transformation through market research and sales data analysis and evaluation. In this exercise the sales data should be provided by appliances and equipment manufacturers and importers.*

Recommendation 30. *It is recommended that DEDE together with EGAT should design and implement programs such as a trade-in to accelerate the withdrawal of inefficient appliances and equipment especially for high energy consuming residential appliances such as air-conditioners and refrigerators.*

Recommendation 31. *It is recommended that DEDE should promote the market penetration of high efficient appliances and equipment by mandatory energy performance labeling (MEPL) along with MEPS. MEPS will improve energy efficiency of appliances and equipment but as soon as the market stabilizes there is no incentive for manufacturers to improve the minimum standard. As such MEPL acts as an incentive for manufacturers to differentiate themselves from their competitors and stimulates the introduction of new, more efficient models. The MEPL also influences strongly users' purchasing-decision.*

Recommendation 31. *It is recommended that the Thai Government monitor and evaluate continuously the implementation of residential appliances programs such as the Residential Energy Credit and the 555 Project. These programs have high potential for market creation for high energy-efficient appliances and better penetration of high energy-efficient appliances in the market.*

6. Energy Efficiency related R&D

6.1 Critique

Research and development (R&D) is one of the main tools for continuous improvement of energy efficiency, mainly on products and processes, by helping to bring forward innovative technologies. In the effort of technical energy efficiency improvement, the role of R&D in the innovation chain is as a 'push' factor where the R&D supports the basic research done by academia, research centres and private entities. Under this chain, market 'pull' is created by demonstration, deployment and commercialisation of energy-efficient technology.

In Thailand, the energy efficiency improvement policy framework acknowledges the role of R&D. In this regard, the Energy Conservation Promotion Act (1992), under the Section 24, has stipulated that grants and subsidies from the Energy Conservation Promotion Fund (ENCON Fund) should be provided to government agencies, state enterprises, educational institution or private organizations for energy efficiency R&D.

However, the PREE team found that, currently, energy efficiency R&D efforts are not in the mainstream of the energy efficiency improvement strategies those being implemented by the government. The PREE team was informed that energy efficiency R&D efforts in Thailand are mainly done by academia.

The PREE team observed that Thailand's focus on energy efficiency improvement is targeted on process improvement. Currently, the process energy efficiency improvement is progressing well and expected to reach saturation level in the near future. As such, Thailand needs to move

further to the high tech energy efficiency improvement tier. The new tier needs a strong support from R&D to progress.

Thailand, currently, is a taker of energy efficiency technology. However, Thailand has the financial and institutional capacity to move its status from taker to provider. In doing so, the Thai Government should enhance the effort to cultivate energy efficiency improvement through innovative culture in the society. In the long run the innovative culture through R&D efforts would continue to enhance and strengthen the energy efficiency improvement efforts.

6.2 Recommendations

Recommendation 32. *It is recommended that the Thai Government should establish an energy efficiency R&D roadmap under the current energy efficiency improvement programs with the focus on the key energy efficiency technologies that will provide the highest potential of energy efficiency improvement.*

Recommendation 33. *It is recommended that DEDE should assess and coordinate the needs for energy efficiency R&D funding in government agencies, state enterprises, educational institution and private organizations in line with the provision under the Energy Conservation Promotion Act (1992).*

Recommendation 33. *It is recommended that the Thai Government should promote greater private sector involvement in energy efficiency R&D efforts through tie-ups such as industry-academia, industry-state enterprises and etc as well as suitable funding mechanisms.*

7. Conclusion

The PREE team's overall impression was that Thailand's energy efficiency policy and programs regime is well functioning and in a good shape. The review is a good avenue for the Thai Government to evaluate their energy efficiency improvement and energy conservation policy and programs. The recommendations made by the PREE team are aimed to strengthen the weakest links in the existing policy and programs.

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Representatives from the Federation of Thai Industry (FTI)

Representatives from the Institute of Industrial Energy (IIE)

Representatives from the Thai Chamber of Commerce,

Mr. Chirawut, CIMB, Thai Bank Public Company Limited

Mr. Ruamlarp Anantasanta, Excellent Energy International Co., Ltd.

Mr. Somnuk Ovuthithum, Managing Director, Lee KijchareonSeang Co., Ltd.

APPENDIX C: REFERENCES

Policy and Program

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