

CHAPTER 1

INTRODUCTION

1.1 Rationale

Energy is an important factor for existence, people's quality of life, and economic development of a country. Thailand is a developing country where the demand for energy increases continuously. However, Thailand has limited energy resources and half of its energy is imported from other countries.

In 2010, total electricity generation was 165,457 GWh, increasing 11.5% from 2009. For the fuel used for power generation, more than 70% were from natural gas and the remaining were from fuel oil, coal, diesel, hydro, and other renewable energy sources. The generating capacity is comprised of domestic electricity production and power buy from Lao PDR and Malaysia.

The current electricity supply in Thailand comes mainly from the Electricity Generating Authority of Thailand (EGAT), and from the private sector i.e. Independent Power Producers (IPPs), Small Power Producers (SPPs), and Very Small Power Producers (VSPPs). After 2011, power purchase will be required from new IPPs and neighboring economies, because of the current Power Development Plan 2004-2015, four combined power plants of EGAT, with the installed capacity of about 700 MW each, will be on stream during 2008-2010. Another three IPPs, with the installed capacity of 1,400 MW each, will be fully on stream by the middle of 2008.

In Thailand, residential and small commercial sectors contribute about 30% of total electrical energy consumption of the country. In tropical regions such as Thailand, comfort air conditioning has been increasingly used corresponding to the increase in disposable income. Air conditioning has penetrated significantly over 50% of urban households. Air conditioning load accounts for over 70% of total electricity load in a small household. This problem is addressed specifically in the Demand Side Management Plan (DSM) of the electrical utilities.

The Cabinet agreed that the Thai Industrial Standards Institute (TISI) had to set energy efficiency standards of electrical appliances according to the proposal of the National Commission on Energy Policy for use as a criterion requires that the manufacturers, the importer as well as those who related to use as guidelines for effective control of the minimum energy, electrical appliances, TISI has been assigned to set the Minimum Energy Performance Standard (MEPs) of 6 products which were air conditioners, refrigerators, motors, ballasts, compact fluorescent tubes and fluorescent tubes.

Thai Industrial Standards Institute and the Department of Alternative Energy Development and Efficiency (DEDE) have signed a memorandum of understanding on cooperation in standardization since 2007. They jointly determined the energy efficiency standards of electrical equipment and materials for energy conservation.

Thailand's energy policy has the main focus on energy efficiency improvement and conservation. Since 1992, Thailand's energy efficiency improvement and energy

conservation policy under the Energy Conservation Promotion Act, B.E. 2535 (1992) which the Energy Conservation Promotion Fund (ENCON Fund) has established to provide financial support for energy conservation implementation to government agencies, state enterprises, non-government organizations, individuals, and businesses. The role of the government is to encourage and promote energy conservation implementation by consumers, including development and the use of renewable energy which is friendly to environment. The monitoring and evaluation of energy efficiency programs should be given more focus that will provide valuable information on real progress which will be needed for better program design in the future (APERC, 2010).

The Ministerial act had set the equipment with the energy efficiency not less than the value specified in the ministerial regulations was the high efficiency equipment in order to conserve energy. The manufacturers and distributors have the right to receive the promotion and assistance from the fund to promote energy conservation. And for consumers they can choose make high performance devices and reduce pollution. In the year 2009, Ministerial act was set that air conditioners, refrigerators, desktop type wall type and floor type electric fans, water coolers for air conditioning, glass for energy conservation, electric water heater, electric rice cooker power and electric kettle were the high-performance devices.

The Ministry of Energy had authorized EGAT to promote the use of household electrical appliances with high-performance and have the electricity saving Labels 5 such as air-conditioners, rice cookers, refrigerators etc., and assigned to the Department of Alternative Energy Development and Efficiency (DEDE) for setting high-efficiency labels for machinery and equipment which use other kinds of energy such as LPG stove, variable speed motor, glass and fiber glass insulation. The both types of labels were responsible to make consumers confident. If devices got high-performance labels or electricity saving Labels 5, it would reduce energy cost down. The current label is recognizable and according to DEDE management, it has caused the Thai consumer to buy only those appliances/equipments with the Labels 5 (see Figure 1.1). This label appears to have transformed the Thai market for labelled products.



(a) for electrical appliances



(b) for machinery and equipment which use other kinds of energy

Figure 1.1: High-efficiency labels in Thailand

Due to the expansion of society and the growth of Thai economy, it increased the country's demand for electricity. EGAT needed to expand to meet the demand. In addition to providing resources to produce and not only require high investment in the construction of power plants but also use much more fuel to generate electricity. And there was continuously fluctuating that affected to the economic stability of the country.

DSM is the mission of the Council of Ministers who approved the EGAT campaign to encourage people to use electricity economically and efficiently was officially launched in the year 1993 under the name "Together Conservation". And the power saving Label 5 Project has been operating since then.

EGAT still operates the power saving Label 5 Project to conform with the policy of the Ministry of Energy and be a working group on energy-efficiency standards for overseeing the power saving Label 5 which had the standard brand of the Ministry of Energy appear in the look of the label.

Operations in this residential sector are targeted at encouraging each household to switch to high performance appliances. EGAT received cooperation from the manufacturer/importer by producing and importing the high-capacity electrical power savings. In addition, it would push to develop other types of electrical equipments to be high efficiency appliances and get inefficient appliances such as fat lamps out of the Thai market as well.

Electrical appliances which already have Label 5, such as refrigerators, air conditioners, compact fluorescent lamps, electronic ballasts, electric fans, electric rice cookers, high efficiency lamps, electronic ballasts of T5 oscillating around fans, thin tubes and standby power 1 watt (television/computer screens).

In addition, EGAT also made an advertising campaign and supported activities through person and public to strengthen public participation by creating a network of users to drill to get closely the target of electric appliance users. Build confidence and positive attitude towards the product number 5 as well.

The Department of Alternative Energy Development and Efficiency (DEDE) has instituted the Criteria for Evaluating Residential for assessing energy efficiency of buildings and homes and for recommending to the owners of buildings and homes about the improving higher efficiency energy consumption. Building owners who can be passed the score of the assessment would be appreciated.

The project began operations in energy conservation through labeling in 2007 to focus on awareness of energy conservation to the public to understand how to conserve energy in both theory and practice. The owners of residential building project include house allocation, row house (townhouse) were eligible to participate this project, which would get technical assistance about energy saving building design, construction and consulting team, free of charge. When the buildings had been certified they would get the save energy label and would be announced to the public via newspapers and radio as well. The building owners who would have been certified from criteria for evaluating residential (see Table 1.1), they would have to passed environmental responsibility standards such as: no substance CFC as a refrigerant in the air conditioners; the criteria of the minimum

illumination and threshold values of electric lighting inside are up to 25 watts per square meter; wastewater treatment ponds, waste ponds and trap fat ponds; a plan to prevent pollution and noise from construction; and choice of colors and / or coatings adversely affecting the environment less.

Table 1.1: Thailand's Residential Building Label Program Evaluation and Scoring Criteria

Evaluation Criteria	Energy Points	Environmental Points
Section 1: Building Site	4	2
Section 2: Landscape Architecture	8	8
Section 3: Building Envelope	40	0
Section 4: Air Conditioning System	10	2
Section 5: Lighting System	12	1
Section 6: Alternative Energy & Energy Management	12	5
Section 7: Sanitation System	4	5
Section 8: Materials & Construction	0	5
Section 9: Advanced Technology & Innovation	10	5
Total	100	33

The level of energy conservation, Bronze must score between 40 and 54, Silver is 55 to 69 and Gold is greater than 70. Figure 1.2 shows the sign of home energy conservation.

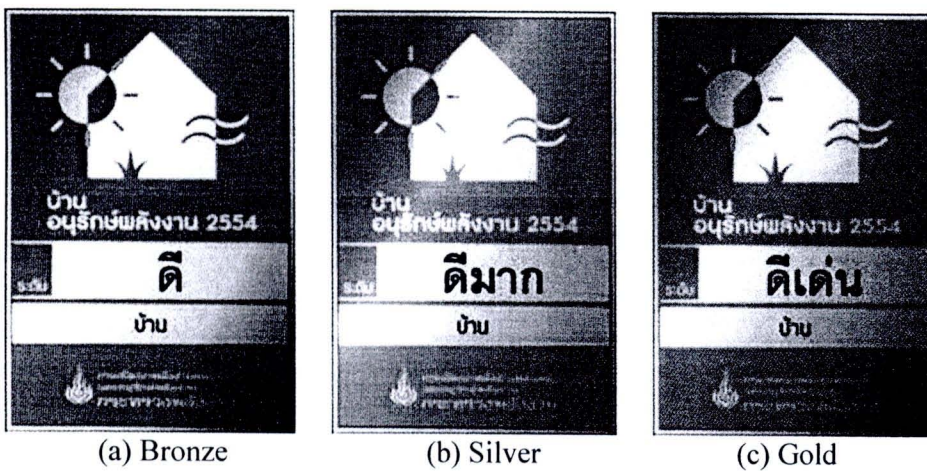


Figure 1.2: The category of labels under the Thailand Building Label Program

The energy consumption trend in residential sector report (KMUTT, 2003) was the main document to provide information about the number of appliances and about energy use in each household of the residential and small commercial buildings. The data was separated from the area, within and outside the municipality. However, the number and size of households have changed when the time passed by. The trend of residential buildings in the municipality would increase and the number of members per household would decrease in the future. In order to reflect a change in nature of population

settlement, this report built on the report of the Department of Provincial Administration (DOPA, 2008), and another.

Two reference or 'Business-As-Usual, BAU' scenarios are adopted. The first BAU scenario assumes that energy consumption of each category of end-use activities increase proportionately with the increase in future energy demand forecasted by the Electric Load Forecast Sub-Committee under the Committee for Administration of Energy Policy. The second BAU scenario assumes that intensities of most end-use activities of each household reach saturation and hence the corresponding energy requirements also reach saturation from 2011. When electricity for growing use of air-conditioning and hot water heating is accounted, total energy demand in the second BAU scenario matches up with that of the first BAU scenario in 2030. The study also examines three scenarios of energy use for food preparation. All electrical or all LPG food preparation scenarios threaten sustainability and both must be avoided. The viable scenario allows charcoal to replace fuel wood for food preparation.

The desirable future scenario is the energy efficient programs (EEP). Even accepting that air-conditioning and hot water demands increase steadily up to the year 2030, the EEP features a reduction of energy demand from that required under the BAU scenario by up to 23%. The study examines an energy conservation plan that could be implemented to realize the EEP. The plan include rigorous electric lighting program to eliminate incandescent lamps and to steadily increase electric lighting efficiency to its technical potential. The plan also includes application of mandatory minimum efficiency requirements on air-conditioning, hot water generation, and other energy intensive end-uses. It also calls for simultaneous application of energy labelling and higher energy performance standards with implantation of mandatory measures. Innovative programs include development and promotion of solar cooling and heating for air-conditioning and hot water generation. The plan includes program of replacement of every low energy efficient appliances with high energy efficient one when its life expires.

1.2 Objective

The main objective of this study is to develop a twenty-year strategic plan for energy conservation in residential and small commercial sectors in Thailand.

In order to achieve the main objective, specific objectives are summarized as follows:

- to investigate the extent of past and present energy consumption of residential and small commercial buildings from relevant researches and reports,
- to project the likely consumption of residential and small commercial buildings in future, and
- to develop programs to increase energy efficiency and to reduce energy use in residential and small commercial buildings. The programs must be designed to maximize savings, present reasonable costs, and are practicable.

1.3 Scope and Limitations

- The residential model is not divided into categories such as house, town house or other, which is a customer of EGAT receiving electricity through one meter as well as small commercial buildings. Small commercial buildings receive electricity through its meter not more than 30 kW.
- The models of energy consumptions of residential and small commercial buildings used in this study are adopted from those in reference (KMUTT, 2003). The models were proposed 10 years ago in a national research report of the energy consumptions of residential and small commercial sectors submitted to the department of alternative energy development and energy efficiency (DEDE).
- The models are accepted to apply for the whole country, regardless of different cultures and life styles in different regions.
- The consumption is presented in the form of end-use energy comprising electricity, LPG, charcoal and fuel wood.

1.4 Organization of the Thesis Report

This thesis is organized into five Chapters. Chapter 1 gives an overview of the energy situation of the residential sector in Thailand. Past activities implemented to improve energy efficiency of the sector are described. The objective, scope and limitations of the study are also given. Chapter 2 summarizes a review of the energy conservation plans of residential sectors implemented in some selected countries. Available measures and programs leading to the improvement of energy efficiency of residential sector in Thailand are presented as well. Chapter 3 describes step-by-step the method employed in the study. Chapter 4 presents the results and discussions obtained from the study. Conclusions and recommendations are made in Chapter 5.