Thailand
20-Year Energy Efficiency Development Plan
(2011 - 2030)

กระทรวงพลังงาน
MINISTRY OF ENERGY

Summary
of the 20-Year Energy Efficiency Development Plan
(2011-2030)

EEDP Highlights

- This 20-year Energy Efficiency Development Plan (EEDP) is formulated with a target to reduce energy intensity by 25% in 2030, compared with that in 2005, or equivalent to reduction of final energy consumption by 20% in 2030, or about 30,000 thousand tons of crude oil equivalent (ktoe).

- The economic sectors with priority for undertaking energy conservation are the transportation sector (13,400 ktoe in 2030) and the industrial sector (11,300 ktoe in 2030).

- The EEDP is aimed at reducing energy elasticity (the percentage change in energy consumption to achieve 1% change in national GDP) from an average of 0.98 in the past 20 years to 0.7 in the next 20 years.

- Implementation in pursuance of the EEDP will result in cumulative energy savings at an average of 14,500 ktoe/year, which is worth 272 billion baht/year, and cumulative CO_2 emission reductions at an average of 49 million tons/year.

- Both mandatory measures, via rules and regulations, and supportive/promotional measures will be introduced. Major mandatory measures include the enforcement of the Energy Conservation Promotion Act, B.E. 2535 (1992), as amended up to No. 2, B.E. 2550 (2007), the establishment of Minimum Energy Performance Standards (MEPS), and energy efficiency labeling. As for supportive and promotional measures, a major one will be the Standard Offer Program (SOP), or funding for the amount of energy saving achieved, which can be proven or assessed.

- Emphasis will be placed on measures which will bring about market transformation and energy consumers' behavioral change, by enforcing energy efficiency labeling for equipment/appliances, buildings and vehicles so as to provide options for consumers.

- Large-scale energy businesses, e.g. those in the electricity, oil and natural gas industry, will be required to implement energy conservation promotion measures to encourage their customers to reduce energy use by a specified minimum standard (Energy Efficiency Resource Standards: EERS), instead of allowing such measures to be voluntarily undertaken as previously practiced.

- Assistance measures, both financial and technical, will be provided for small operators, e.g. SMEs, particularly the provision of funding via the Standard Offer Program (SOP) and technical assistance via the Energy Efficiency Resource Standards (EERS).

- As the use of motor vehicles is projected to continuously increase in the future, this EEDP includes measures promoting the use of highly energy-efficient vehicles, e.g. mandatory energy labeling, enforcement of MEPS and tax measures.

- Responsibilities for energy conservation promotion will be distributed to all spheres in society. The private sector will become an important partner and greater roles will be entrusted to local administration organizations. In addition, government agencies must set a good example of energy conservation practices.

1. Background and Objectives

"Energy Conservation" in this Energy Efficiency Development Plan has two meanings: (1) economical use or reduced expendable use of energy, and (2) energy efficiency improvement, i.e. doing the same activities with less energy, involving, among others, lighting, hot water production, cooling systems, transportation or running machines in the manufacturing process. Energy conservation plays an important role in strengthening energy security, alleviating household expenditure, reducing production and services costs, reducing trade deficit and increasing the competitive edge, including reduction of pollution and greenhouse gases (GHG) which cause global warming and climate change. Therefore, energy conservation has been an important policy of the government, particularly since the enforcement of the Energy Conservation Promotion Act, B.E. 2535 (1992). Five-year plans to allocate funding support from the Energy Conservation Promotion Fund for energy conservation activities have been consecutively developed, now being in Phase 3. Nevertheless, the government has foreseen that problems with energy prices, international competition for energy resources, environmental impact and climate change resulting from energy production and utilization will be exacerbated in the future, which will inevitably affect people's well-being and the national economic competitive edge. In addition, at the Asia-Pacific Economic Cooperation (APEC) Summit in 2007, government leaders ratified the collaboration in energy conservation promotion to meet the agreed target in 2030. In response to this, the Ministry of Energy has developed this 20-year Energy Efficiency Development Plan (2011-2030) to provide the national policy framework and guidelines on energy conservation implementation in the long term, with the following two main objectives:

(1) To set the energy conservation targets in the short term (five years) and in the long term (20 years), both at the national level and by energy-intensive economic sectors, i.e. transportation, industry, commercial and residential sectors;

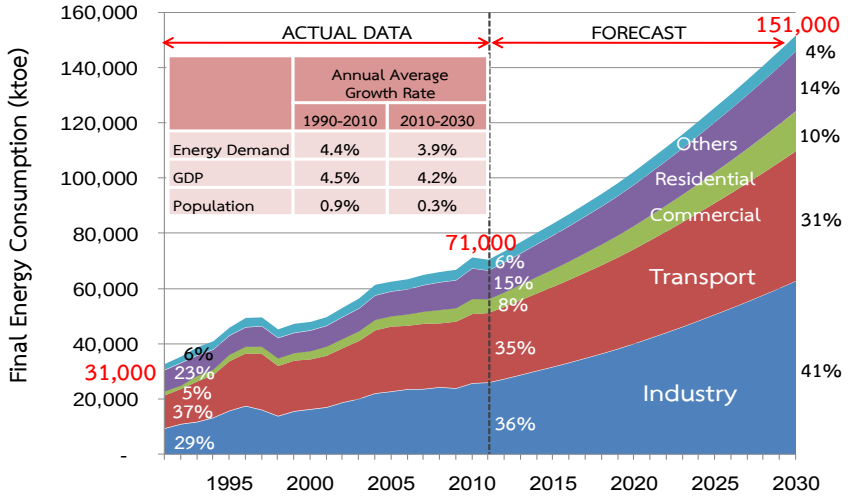
(2) To lay down strategies and guidelines promoting energy conservation to achieve the targets specified under (1) above, and to lay down measures and work plans to serve as the framework for concerned agencies in formulating their respective action plans for energy conservation promotion.

2. Energy Conservation Targets and Potential

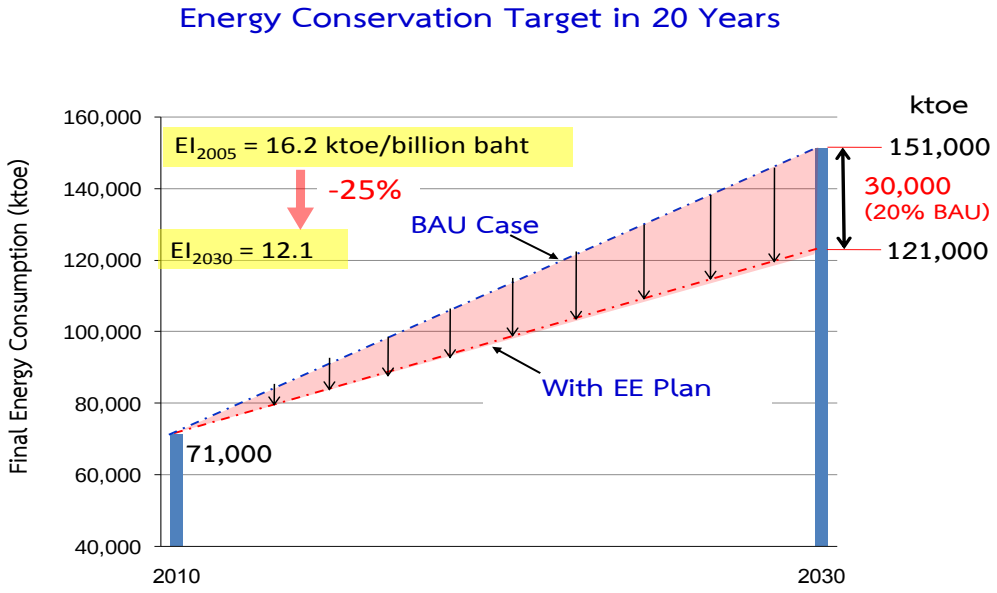
In the past 20 years (1990-2010), energy consumption in Thailand continuously increased at an annual average rate of 4.4%. At present, energy consumption is 2.3 times the amount it was in 1990; the growth rate has been in line with the economic growth rate, of which the annual average rate is 4.5%. In particular, energy consumption growth rates in the manufacturing industry and commercial building sectors are much higher than the GDP growth rate, i.e. 3.0 and 3.7 times respectively, compared with consumption in 1990.

In the next 20 years, if there is no energy conservation or energy efficiency improvement measures or no significant reform of the industrial structure and transportation system, energy demand under the business-as-usual (BAU) scenario will increase from 71,000 ktoe/year at present, to 151,000 ktoe, or about 2.1 times the present amount, accounting for an annual average growth rate of 3.9%, under the assumption that the GDP will grow at an annual average rate of 4.2%. The demand in the industrial and commercial sectors will still increase at a higher rate than other sectors. Hence, greenhouse gas emission from the energy sector will tend to increase accordingly.

Energy Consumption in the Past and Future Demand Trend under the BAU Case



According to the agreement reached by APEC Leaders in 2007 in Sydney, Australia, an energy conservation target has been set with a view to strengthening regional energy security and addressing climate change problems, by reducing "energy intensity," or the amount of energy used per unit of GDP, by 25% in the year 2030 compared with the 2005 base year. Since Thailand's energy intensity in 2005 was 16.2 ktoe per billion baht GDP (at 1988 constant value), if Thailand is determined to implement energy conservation measures pursuant to the mentioned agreement, the overall energy intensity of the country in 2030 must not exceed 12.1 ktoe per billion baht GDP, or the final energy consumption in that year must not exceed 121,000 ktoe (under the assumption that the annual economic growth rate will be at 4.2% in average). That is, energy demand must be 30,000 ktoe lower than that in the BAU case, or 20% lower than the demand in the BAU case.



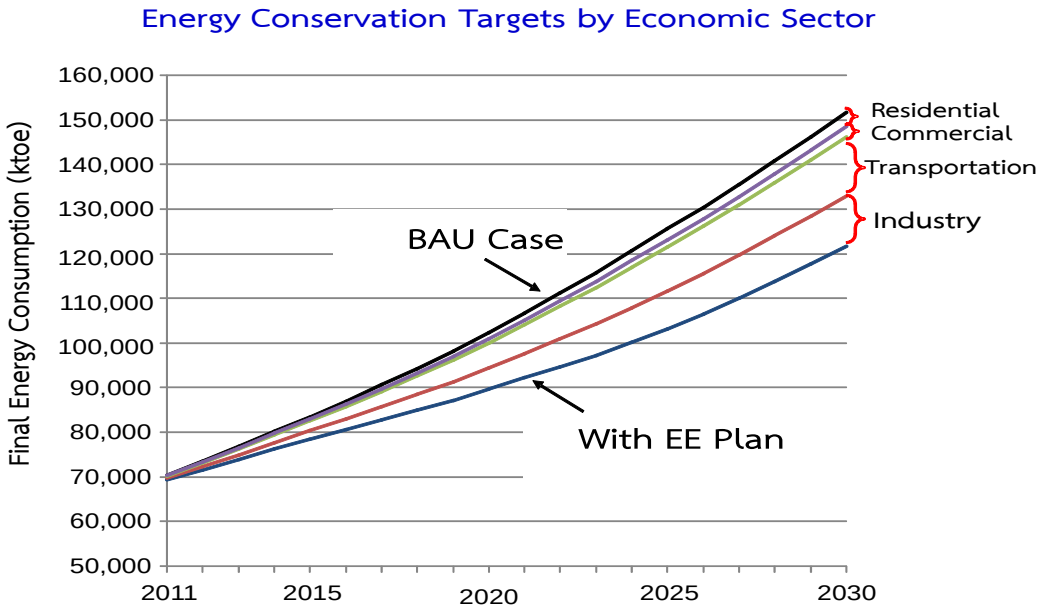
However, the outcome of potential assessment, in technical terms, reveals that the implementation of energy conservation measures, via demand side management and application of more advanced energy efficiency technology, in terms of equipment/appliances, machinery and manufacturing process, vehicles and buildings, including the change in energy consumption behavior, will have energy-saving potential in the three major economic sectors of approximately 36,450 ktoe in 2030, which is 22% higher than the specified target. Therefore, the specified energy conservation target can be achievable, but vigorous measures in all economic sectors would be required because the gap between the target and the potential is not too wide to bridge. In this connection, it is forecasted that the share of energy saving by sector in 2030 will be as shown in Table 1, with the transportation and industrial sectors together holding the highest energy saving share, i.e. over 80% in terms of final energy, or 69% in terms of primary energy, because the commercial building sector will account for a huge volume of power consumption.

Table 1: Share of Energy Saving by Economic Sector in 2030

Economic Sector	Technical Potential			Specified Target (ktoe)	Share (%)
	Heat (ktoe)	Electricity (GWh)	Total (ktoe)		
Transportation	16,250	-	16,250	13,400	44.7
Industry	10,950	33,500	13,790	11,300	37.7
Commercial Building & Residential					
- Large Commercial Building	410	27,420	2,740	2,300	7.6
- Small Commercial Building & Residential	1,690	23,220	3,670	3,000	10.0
Total	**29,300**	**84,140**	**36,450**	**30,000**	**100.0**

In case energy conservation measures can be successfully implemented until the target specified under this plan is achieved, energy consumption up to 2030 will increase at an annual average rate of 3.0% only, or an increase of only 1.7 times the current demand. The increase will be at a lower rate than that of the economic growth, accounting for

average energy elasticity at 0.71 over the next 20 years, compared with the average of 0.98 over the past 20 years.



3. Strategies and Measures

In previous Energy Conservation Programs, both mandatory and supportive strategic approaches and measures were introduced, i.e. via rules/regulations and provision of financial incentives, technical assistance and knowledge, including various forms of public awareness campaigns to create energy conservation awareness of the general public. Under this EEDP, it is recommended that the existing strategic approaches and measures be maintained, with further implementation and expansion of measures which have proven to be effective. Concurrently, new measures that have proven to be successful in other countries will be applied to Thailand. Following intensive consultations with and hearings from business, the general public, academic and government sectors, it is proposed that in strategically forging ahead with energy conservation policy and overall implementation according to this EEDP, importance should be given to the following matters:

- The application of combined measures, i.e. mandatory measures via rules, regulations and standards; and promotional and supportive measures via incentive provision.

- The introduction of measures which will bring about a wide impact in terms of awareness raising and change in energy consumption behavior of energy consumers, including decision-making behavior of business operators, as well as market transformation, by incorporating innovations into awareness raising campaigns and public relations activities, for example, the interrelationship between energy conservation and environmental protection as well as global warming alleviation.

- Potential and important role of the private sector in the public-private partnership to promote and implement energy conservation measures.

- Dissemination of energy conservation promotion to public and private agencies/organizations which are readily equipped with resources and expertise, such as power utilities and industrial associations, with backup support from the Ministry of Energy.

- The use of professionals and Energy Services Companies (ESCO) as an important tool to provide consultancy and to implement energy conservation measures in which the use of more advanced technology is involved.

- Increase in self-reliance in indigenously developed technology to reduce technological costs and to increase access to energy-efficiency technology, including promotion of highly energy-efficient product manufacturing processes.

To implement the plan, five strategic approaches, which are further divided into 16 specific measures, will be introduced or applied. These measures are of high priority as they require low investment capital while yielding high energy saving. The strategic approaches and measures are as follows:

(1) **Mandatory Requirements via Rules, Regulations and Standards,** comprising four measures as follows:

(1.1) Enforcement of the Energy Conservation Promotion Act, [as amended up to] B.E. 2550 (2007), so that the energy management system through energy consumption reporting and verification imposed on designated buildings and factories would materialize.

(1.2) Mandatory energy efficiency labeling to provide options for consumers to buy or use highly energy-efficient equipment/appliances, vehicles and buildings.

(1.3) Enforcement of the Minimum Energy Performance Standards (MEPS) for equipment/appliances, buildings and vehicles to prevent the distribution and use of low energy-efficient products. In this regard, the government will consult with product manufacturers and retailers to determine an appropriate lead time prior to the enforcement of MEPS for each product.

(1.4) Determination of the Energy Efficiency Resource Standards (EERS), or the minimum standards for large energy businesses to implement energy conservation measures encouraging their customers to use energy efficiently (with a penalty clause for those whose implementation outcome is lower than the specified standards and rewards for those whose achievement is greater than the specified standards in each year), which will be an important mechanism to provide both technical and financial assistance to small and medium enterprises (SMEs).

(2) **Energy Conservation Promotion and Support,** comprising five measures as follows:

(2.1) Execution of a “voluntary agreement” to save energy between the public and commercial/industrial sectors, especially various business associations and large-scale businesses.

(2.2) Support and incentive provision to encourage voluntary energy-efficiency labeling for highly energy-efficient equipment/appliances, buildings and vehicles.

(2.3) Promoting traveling by mass transit systems and goods transportation via highly energy-efficient logistics systems.

(2.4) Subsidization for investment in the implementation of energy conservation measures by (a) providing subsidies for the amount of energy saved which can be verified, as per the project proposals approved under the DSM Bidding scheme for large-scale businesses, and (b) providing subsidies for the amount of energy saved and/or reduction of peak load that can be verified or accurately assessed for SMEs, as per the project proposals submitted under the Standard Offer Program (SOP) scheme, which requires no bidding.

(2.5) Support for the operation of ESCO companies, (e.g. the use of funding from the Energy Conservation Promotion Fund to increase credit lines given by the ESCO Fund), to alleviate technical and financial risks of entrepreneurs wishing to implement energy conservation measures.

(3) **Public Awareness (PA) Creation and Behavioral Change,** comprising three measures as follows:

(3.1) Public relations and provision of knowledge about energy conservation to the general public, via the teaching/learning process in educational institutions, fostering youth awareness, and other PA activities, such as eco-driving.

(3.2) Putting forth the concept and promoting activities related to the development of a low carbon society and low carbon economy, which will bring about cooperation between local administration organizations and the business sector in the planning and implementation of activities that will lead to reduction of GHG emissions and efficient use of energy.

(3.3) Determination of energy prices to reflect the actual costs and application of tax measures as an important tool to promote energy conservation with a view to fostering public awareness and changing their energy consumption behavior.

(4) **Promotion of Technology Development and Innovation,** comprising two measures as follows:

(4.1) Promotion of research and development to improve energy efficiency and reduce technological costs, particularly those related to equipment/ appliances with large markets and having their manufacturing bases in Thailand, including the production process, materials as well as buildings and housing that are energy efficient.

(4.2) Promotion of demonstrations of energy-efficiency technologies that have been technically proven but have not been commercialized in the domestic market, including support for necessary preparation to implement wide commercial deployment of such technologies.

(5) **Human Resources and Institutional Capability Development,** comprising two measures as follows:

(5.1) Support for the development of professionals in the energy conservation field to be responsible persons for energy management and operation, verification and monitoring, consultancy and engineering services provision and the planning, supervision and promotion of the implementation of energy conservation measures.

(5.2) Support for the development of institutional capability of agencies/ organizations in both public and private sectors, responsible for the planning, supervision and promotion of the implementation of energy conservation measures.

4. Expected Benefits

The investment in energy conservation in each year will result in energy saving and cumulative avoided carbon dioxide (CO_2) emission in following years throughout the 20-year period of this EEDP. The cumulative final energy saving up to 2030 will be about 289,000 ktoe, or an annual average of 14,500 ktoe, and avoided CO_2 emission at about 976 million tons, or an annual average of 49 million tons. In financial terms, the cumulative savings in energy expenditure will be approximately 5.4 trillion Baht, or an annual average of 272 billion Baht (see Table 2). Within the first five years, the annual energy saving achieved, compared with the BAU case, will be about 1,000 ktoe, 1,940 ktoe, 2,910 ktoe, 3,930 ktoe and5,040 ktoe respectively. The cumulative energy saving will total 14,830 ktoe (divided into fuel and electricity at 11,950 ktoe and 33,900 GWh respectively), accounting for an annual average of 2,960 ktoe, which is worth 278.54 billion Baht in total or an annual average of 55.7 billion Baht. About 50 million tons of avoided CO_2 emission, or an annual average of 10 million tons, can be achieved. Besides these direct benefits, other indirect benefits will also be obtained, such as the environmental quality improvement and a positive impact on the macroeconomic arena.

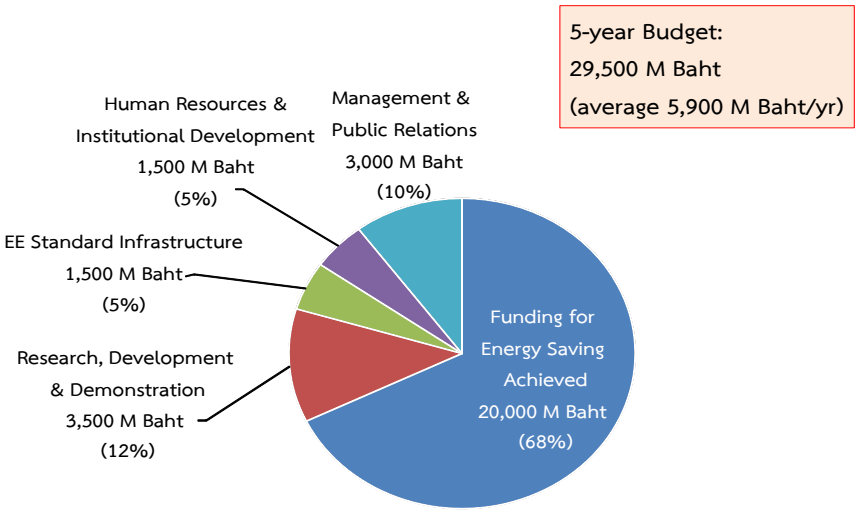
Table 2: Expected Benefits from the EEDP Implementation by Economic Sector

Economic Sector	Annual Average Energy Saving (ktoe)		Annual Average Avoided CO_2 Emission (Million Tons)		Annual Average Value of Energy Savings (Million Baht)	
	in 5 yrs	in 20 yrs	in 5 yrs	in 20 yrs	in 5 yrs	in 20 yrs
Transportation	1,300	6,400	4	20	28,700	141,000
Industry	1,120	5,500	4	17	17,900	87,000
Commercial Building & Residential						
- Large Commercial Building	220	1,100	1	6	3,800	20,000
- Small Commercial Building & Residential	320	1,500	1	6	5,300	24,000
Total	**2,960**	**14,500**	**10**	**49**	**55,700**	**272,000**

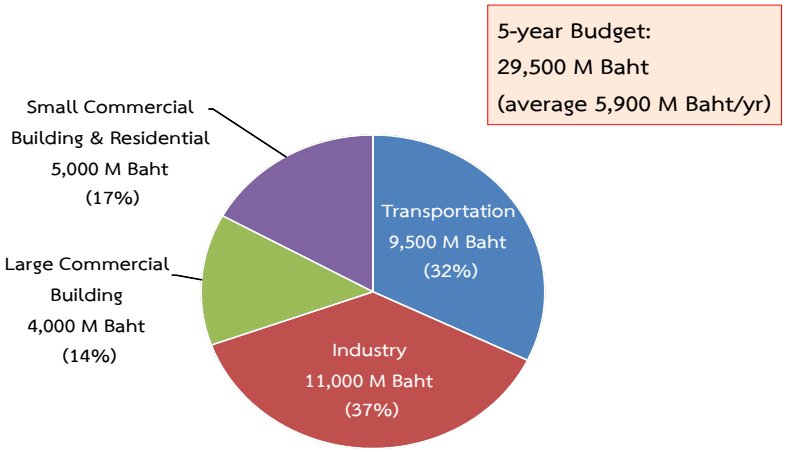
5. Implementation Budget for the First Five Years

In the first five years, this EEDP will receive funding from the government, especially from the Energy Conservation Promotion Fund, totaling 29.5 billion Baht, or an average of 5.9 billion Baht per year. This implementation budget can be classified by type of expenditure as follows: direct funding for energy saving achieved, 20 billion Baht (68%); management and public relations activities, 3 billion Baht (10%); infrastructure development to accommodate mandatory measures on standards and energy efficiency labeling, 1.5 billion Baht (5%); funding for research, development and demonstration work, 3.5 billion Baht (12%); and human resources and institutional capacity development, 1.5 billion Baht (5%). If the budget is allocated by economic sector (based on the indicated share of primary energy saving target), it will be as follows: the industrial sector, 11 billion Baht; the transportation sector, 9.5 billion Baht; and the commercial building and residential sector, divided into the large commercial building group, 4 billion Baht, and the small commercial building and residential group, 5 billion Baht. In this regard, the government's investment in energy conservation promotion is considered to be cost effective, with an average investment of 2,000-6,000 Baht per ton of crude oil equivalent (toe) that can be saved.

Budget Allocation by Type of Expenditure



Budget Allocation by Economic Sector



6. Energy Efficiency Development Plan Mobilization and Success Factors

The promotion and implementation of energy conservation measures in each economic sector usually involve various agencies. In particular, for the transportation and industrial sectors, of which energy conservation potential is high, concerned ministries with direct responsibilities are the Ministry of Transport and Ministry of Industry, while support is to be rendered by other ministries, especially the Ministry of Energy. In addition, the industrial sector and the commercial building sector will require a high level of involvement from private sector entrepreneurs. (Responsible agencies for each measure are shown in Chapter 6.)

To achieve the targets specified under this EEDP will, therefore, require cooperation and determination of various concerned agencies in both public and private sectors, particularly in the following actions which are key factors to success of this plan:

(1) The development of management systems as well as management tools, e.g. the development of an energy consumption database and the reporting, verification and assessment systems; the establishment of a dedicated independent body with flexibility to implement energy conservation promotion measures; and the development of a mechanism, at the policy level, to enhance cross-ministry energy conservation promotion and monitoring.

(2) Adequate and continuous budget allocation to support work plans and activities under the plans, e.g. it can be developed as a rolling plan every 3-5 years.

(3) The development of human resources and institutional capability of concerned organizations on a continuous basis to become professional, especially to build up personnel with understanding of the concept and business practices of the private sector.

(4) Public agencies should take a lead role and should set a good example by implementing programs such as the green procurement – to set a policy requiring procurement of goods/services which are energy efficient and environmentally friendly; the deployment of ESCO services and the implementation of energy-saving measures in government buildings.

(5) The determination of energy prices which reflect actual costs and the application of tax measures as a tool to promote energy conservation and to reduce GHG emissions via raising awareness and changes in energy consumption behavior.

(6) As the assessed energy-saving potential is only slightly higher than the specified energy-saving target and as the potential does not include the impact which may occur resulting from the industrial restructuring to be less energy-intensive or the transportation system restructuring to the rail and mass transit systems (apart from the measures stipulated herein), concerned agencies should, therefore, explicitly formulate policies and development plans in the long term, which will have positive impact on energy consumption.

20-Year Energy Efficiency Development Plan

(2011 - 2030)

Contents

Summary of the 20-Year Energy Efficiency Development Plan **1**

Contents i

Table Contents ii

Figure Contents iii

Chapter 1: Introduction **1-1**
1.1 Background and Objectives 1-1
1.2 Development of the 20-Year Energy Efficiency Development Plan (2011-2030) 1-2

Chapter 2: Energy Demand Situation and Trend **2-1**
2.1 Energy Demand Situation in Thailand 2-1
2.2 Trend of Future Energy Demand 2-2
2.3 Major Energy Challenges 2-4

Chapter 3: Energy Conservation Potential **3-1**
3.1 Potential Assessment Approach 3-2
3.2 Outcome of Energy Conservation Potential Assessment 3-8

Chapter 4: Framework of the 20-Year Energy Efficiency Development Plan (2011-2030) **4-1**
4.1 Energy Conservation Targets 4-1
4.2 Strategies to Achieve the Targets 4-2
4.3 Strategic Approaches, Measures and Work Plans 4-3
4.4 Expected Benefits 4-14

Chapter 5: Framework of the First 5-Year Work Plans **5-1**
5.1 Annual Energy Conservation Targets 5-1
5.2 Work Plans and Activities 5-1
5.3 Budget Framework 5-19
5.4 Expected Benefits 5-21

Chapter 6: EEDP Mobilization and Success Factors **6-1**
6.1 EEDP Mobilization 6-1
6.2 Success Factors 6-5

Appendix A: Name List of the Study Team **A-1**

Appendix B: Order of the Ministry of Energy on the Appointment of the Steering Committee on the 20-Year Energy Efficiency Plan Development **B-1**

Table Contents

Table 3.1: Final Energy Consumption by Economic Sector in 2009 3-2
Table 3.2: Energy Consumption by Industrial Cluster in 2009 3-3
Table 3.3: Electricity Consumption in 2007 in the Large Commercial Building Group by Building Type 3-4
Table 3.4: Net Energy Consumption Derived from Modeling Each Building Type under Each Level of Energy Saving Capability 3-5
Table 3.5: LPG Consumption in the Large Commercial Building Group in 2007 3-5
Table 3.6: Energy Saving Potential by Industrial Cluster 3-9
Table 3.7: Electricity Saving Potential in the Large Commercial Building Group 3-9
Table 3.8: Fuel Saving Potential in the Large Commercial Building Group 3-9
Table 3.9: Electricity Saving Potential in the Small Commercial Building & Residential Group 3-10
Table 3.10: Fuel Saving Potential in the Small Commercial Building & Residential Group 3-11
Table 3.11: Energy Conservation Potential in the Commercial Building & Residential Sector 3-11
Table 3.12: Energy Conservation Potential in the Transportation Sector 3-12
Table 3.13: Energy Conservation Potential as a Result of Energy Efficiency Improvement of New Vehicles 3-12
Table 3.14: Energy Conservation Potential as a Result of Efficient Use of On-road Vehicles 3-13
Table 3.15: Energy Conservation Potential as a Result of Goods Transport Mode Shift 3-13
Table 3.16: Energy Conservation Potential as a Result of TDM 3-14
Table 3.17: Summary of Energy Conservation Potential in 2030 3-14
Table 4.1: Share of Energy Saving by Economic Sector in 2030 4-1
Table 4.2: Framework of Cross-sector Measures and Work Plans 4-6
Table 4.3: Framework of Measures and Work Plans for the Industrial Sector 4-9
Table 4.4: Framework of Measures and Work Plans for the Large Commercial Building Group 4-10
Table 4.5: Framework of Measures and Work Plans for the Small Commercial Building & Residential Group 4-11
Table 4.6: Framework of Measures and Work Plans for the Transportation Sector 4-12
Table 4.7: Expected Benefits from the EEDP Implementation by Economic Sector in the 20-Year Period 4-14
Table 5.1: Annual Targets of Final Energy Saving 5-1
Table 5.2: Work Plans and Activities in the First 5-Year Period 5-2
Table 5.3: Expected Benefits from the First 5-Year EEDP Implementation in Each Economic Sector 5-21
Table 6.1: Agencies/Organizations Responsible for the Implementation of Strategic Approaches and Measures in Each Economic Sector under the 20-Year EEDP (2011-2030) 6-1

Figure Contents

Figure 2.1:	Energy Demand and GDP Growth from 1990 to 2010	2-1
Figure 2.2:	Thailand's Energy Intensity from 1986 to 2010	2-2
Figure 2.3:	Comparison of Thailand's Energy Intensity with Other Countries	2-2
Figure 2.4:	Trend of Future Energy Demand under the BAU case	2-3
Figure 2.5:	Energy Demand and GDP Growth from 2010 to 2030	2-3
Figure 3.1:	Greenhouse Gas Emission Reduction Technology	3-1
Figure 3.2:	Energy Saving Amount to Be Achieved by Thailand by 2030 in pursuance of the APEC Leaders' Declaration	3-2
Figure 4.1:	Energy Conservation Targets by Economic Sector	4-2
Figure 5.1:	Budget Allocation by Type of Expenditure	5-20
Figure 5.2:	Budget Allocation by Economic Sector	5-20

Chapter 1: Introduction

1.1 Background and Objectives

Energy is an important factor in our daily living, for improving the quality of life and for the economic development of the country. In particular, energy demand in Thailand, being a developing country, has been increasing continuously. Since indigenous energy resources are quite limited, more than half of the national energy demand has to depend on energy imports, and the share of energy import dependency tends to be increasing, which may affect energy security of the country in the future. In addition, it is projected that energy prices will be constantly on the rise, hence creating a greater burden on energy consumers and affecting Thailand's economic competitive edge, as well as international trade balance. Apart from energy problems, Thailand has to face a further challenge from the environmental impact caused by the use of energy, particularly the impact of climate change resulting from global warming. Relevant international agreements, coupled with the pressure from Thailand's trade dialogue partners that have stringent policies to reduce greenhouse gas (GHG) emissions, are major driving factors for Thailand to gear the national system towards a low-carbon energy system.

Currently, it is internationally accepted that energy conservation and energy efficiency improvement is an important approach to address the aforementioned challenges because relevant measures normally require low initial investment costs and most technologies are readily available, so some of these strategies may be implemented immediately. From past literature reviews, it is found that there is enormous potential for energy efficiency improvement and energy conservation in developing countries. In Thailand, the government has introduced various energy conservation measures since the enforcement of the Energy Conservation Promotion Act (ENCON Act), B.E. 2535 (1992). Importantly, funding has been allocated from the Energy Conservation Promotion Fund to support the implementation of a number of measures under its Energy Conservation Plan, which is a rolling plan, with each phase taking five years to complete and it is currently in its 3rd Phase. Some examples of major measures that have been implemented are the enforcement of the ENCON Act to promote energy management in designated factories and buildings, promotion of energy efficiency labeling for electrical equipment/appliances, incentive provision via tax measures and soft loans, energy services companies (ESCO), business development and awareness raising campaigns on energy saving. A review of the outcomes of energy conservation measures implemented has indicated that some measures have resulted in satisfactory energy saving, while others have faced with some obstacles during implementation, especially in the cross-agency implementation, as well as the issues of continuity of policy and budget allocation.

Additionally, the previous Energy Conservation Plans were formulated to serve the objectives under the Energy Conservation Promotion Fund only, that is, there has been no formulation of an integrated national plan, especially in terms of targets and long-term work plans, which will bring together the implementation of all related activities of all sectors. The government has also foreseen that problems concerning

energy prices, international competition for energy resources, environmental impact and climate change will be exacerbated in the future, which will inevitably affect people's well-being and the national economic competitive edge. Consequently, the government has developed this 20-year Energy Efficiency Development Plan (2011-2030), which is in line with the declaration of the Asia-Pacific Economic Cooperation (APEC) Leaders in 2007 to collaborate in energy conservation promotion in order to achieve the agreed target in 2030. This 20-year EEDP has the following two main objectives:

(1) To set the energy conservation targets for the short term (five years) and for the long term (20 years), both at the national level and by the energy-intensive economic sectors, i.e. transportation, industry, commercial and residential sectors;

(2) To lay down strategies and guidelines promoting energy conservation to achieve the specified targets, and to lay down measures and work plans to serve as the framework for concerned agencies in formulating their respective action plans for energy conservation promotion.

1.2 Development of the 20-Year Energy Efficiency Development Plan (2011-2030)

On 17 June 2010, the Ministry of Energy, via the Energy Policy and Planning Office (EPPO), granted funding to the Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi (KMUTT), for undertaking a study to develop an energy efficiency development plan (the Study Team is shown in Appendix A). Concurrently, a Committee on the 20-Year Energy Efficiency Plan Development has been appointed, chaired by the Permanent Secretary of Energy, with the Deputy Permanent Secretary of Energy being Vice Chair and representatives from concerned agencies, both within the Ministry of Energy and others, including qualified persons from both public and private sectors, being Committee Members. (The order on the appointment of the Committee is shown in Appendix B).

The Study Team has assessed energy conservation potential, in technical terms, of three major economic sectors, i.e. transportation, industry, commercial building and residential sectors, so as to develop the energy conservation targets in the next 20 years, and has analyzed the application of various energy conservation promotion measures, both domestic and overseas, and then presented the strategies, strategic approaches and measures leading to the achievement of the specified energy conservation targets. In this connection, the frameworks of short, medium and long-term implementation are put forth herein, including the budget framework necessary for the implementation of activities pursuant to the first 5-year period of the implementation framework. Additionally, assessment has been made of the benefits to be obtained from the implementation according to the work plans.

In the development process of this 20-Year EEDP, the Study Team closely consulted with concerned agencies, particularly the Energy Policy and Planning Office (EPPO) and the Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry

of Energy, as well as the Office of Transport and Traffic Policy and Planning (OTP) under the Ministry of Transport. Hearings were organized to obtain opinions from both public and private sectors. When the development of the Draft 20-Year EEDP was completed by the Study Team, it was reported to the Committee on the 20-Year Energy Efficiency Plan Development for comment and review. After a preliminary approval had been granted by the Committee, five public consultations were organized by the Study Team to obtain views from all stakeholders and the general public, covering all regions, i.e. the north (Chiang Mai), the south (Songkhla), the northeast (Nakorn Ratchasima), the east (Pattaya) and in Bangkok, with a total of 767 participants. After revision had been made by the Study Team, taking into consideration comments and recommendations obtained, the Final Draft 20-Year EEDP was approved by the Committee at its meeting on 18 April 2011.

Chapter 2: Energy Demand Situation and Trend

2.1 Energy Demand Situation in Thailand

In the past two decades, from 1990 to 2010, energy demand in Thailand increased continuously at an annual average rate of 4.4%. In 2010, final energy consumption was 2.3 times the amount it was in 1990, or about 71,000 thousand tons of crude oil equivalent (ktoe). The growth rate corresponded with the economic growth rate, of which the annual average rate was 4.5%, accounting for the "energy elasticity"[1] at 0.98, which is considered quite high when compared with developed countries where energy consumption efficiency is higher. The economic sectors for which the energy consumption growth rates were much higher than the GDP growth rate were the commercial building and industrial sectors, with energy consumption in 2010 being 3.71 and 3.0 times the amount in 1990 respectively, when compared with the GDP growth rate which was 2.36 times only (Figure 2.1).

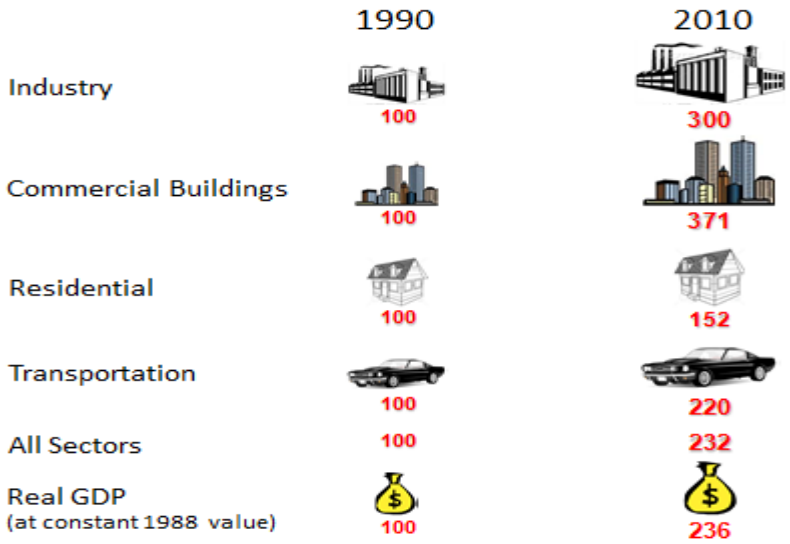


Figure 2.1: Energy Demand and GDP Growth from 1990 to 2010

In addition to energy elasticity, another index that indicates the efficiency of overall energy use of the country is the "energy intensity," or a ratio of the amount of energy used to a unit of GDP, which was on the rise over the past 20 years, except for the period 2005-2008 during which oil prices were considerably high (Figure 2.2). This index was a bit higher than the world average, but much higher than that of developed countries, like Japan and the EU (Figure 2.3). Although the energy intensity indexes of large developing countries are higher than that of Thailand, they tend to rapidly decrease, and this may affect the economic competitive edge of Thailand in the future.

[1] Energy elasticity is the ratio of energy consumption growth rate to the national GDP growth rate.

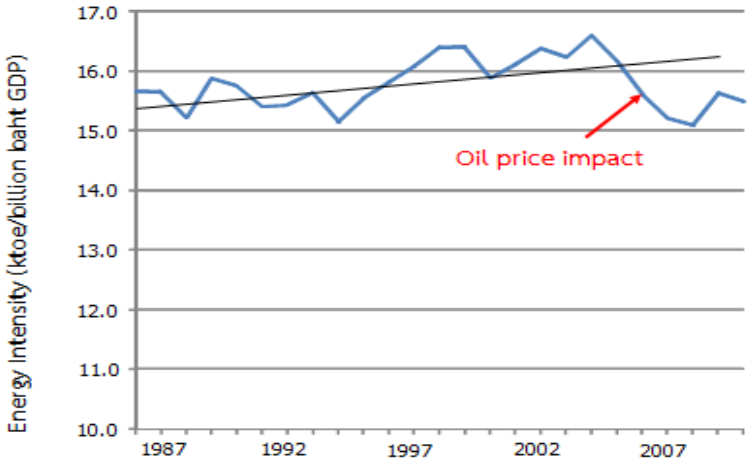


Figure 2.2: Thailand's Energy Intensity from 1986 to 2010

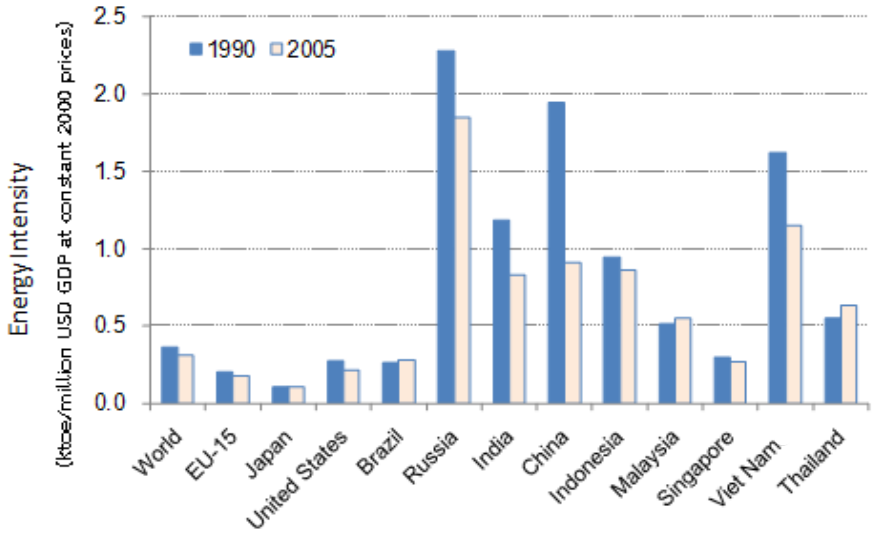


Figure 2.3: Comparison of Thailand's Energy Intensity with Other Countries
(Source: Calculated from the data on energy consumption and GDP of World Resources Institute)

2.2 Trend of Future Energy Demand

In the next 20 years, under the assumption that the economic growth will be at a base case, i.e. the GDP (at 1988 constant value) will grow at an annual average rate of 4.2% and that the population will grow at an annual average rate of 0.3%, without any significant change in the energy consumption structure, such as industrial restructuring, and without any special energy conservation measures introduced (the business-as-usual or BAU case), energy demand tends to continuously increase to 151,000 ktoe, or about 2.1 times the present amount, accounting for an annual average growth rate of 3.9% (Figure 2.4), with the average energy elasticity at 0.93. Energy demand in the commercial and industrial sectors will still increase at a higher rate than other sectors and higher than

the GDP growth rate (Figure 2.4). The forecast energy demand growth in each economic sector is illustrated in Figure 2.5.

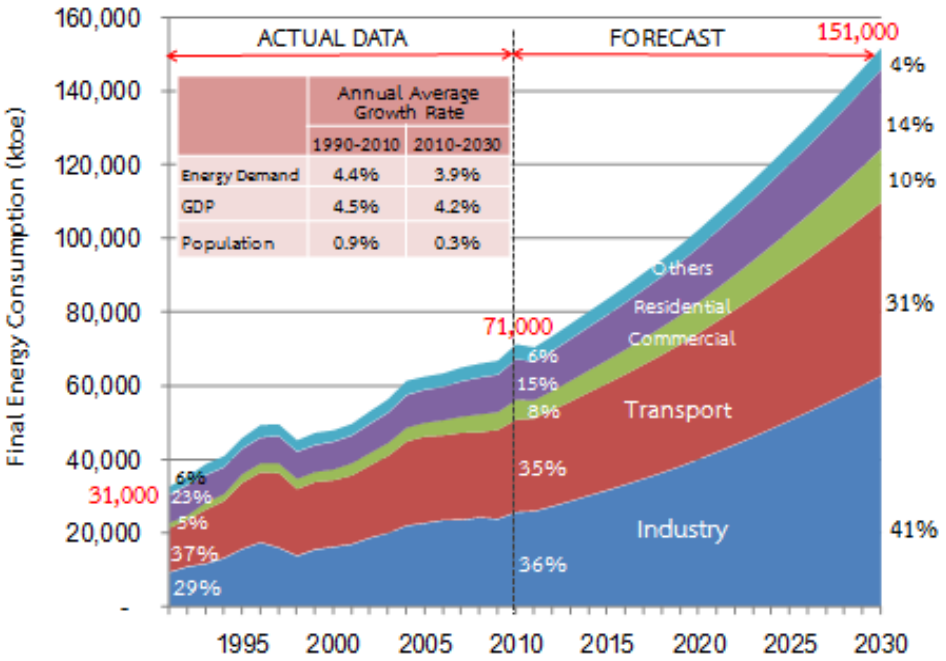


Figure 2.4: Trend of Future Energy Demand under the BAU case

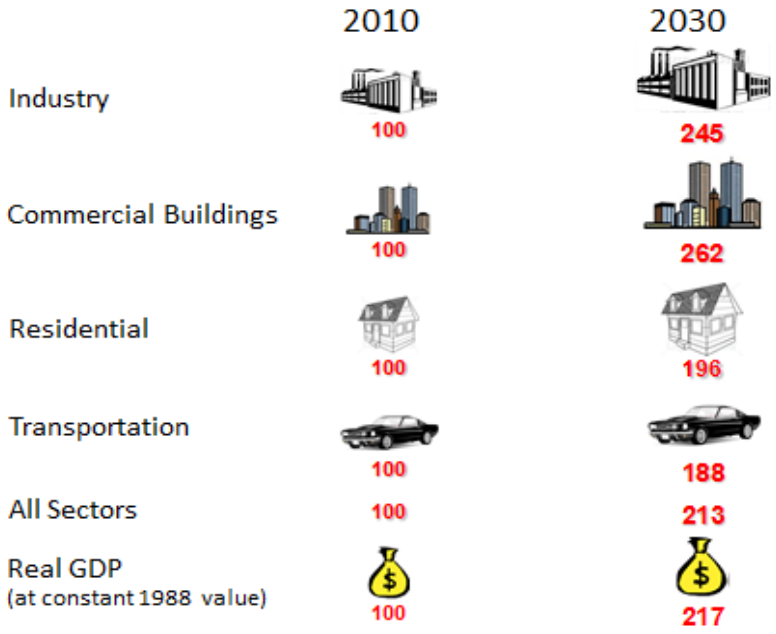


Figure 2.5: Energy Demand and GDP Growth from 2010 to 2030

2.3 Major Energy Challenges

Given the aforementioned present energy demand situation and the continuously increasing trend of energy demand, it is predicted that Thailand may have to face the following major challenges in the future:

(1) **Energy supply security** since there will be vigorous international competition for natural energy resources, especially with the larger developing countries for which the demand growth rate is considerably high.

(2) **Continuously increasing energy cost** due to the rapidly increasing demand as mentioned in (1) and greater difficulty of energy production since natural reserve amounts are being depleted, coupled with increasing environmental cost in the production process as well as the geo-political problems of major oil producing countries in the Middle East and North Africa.

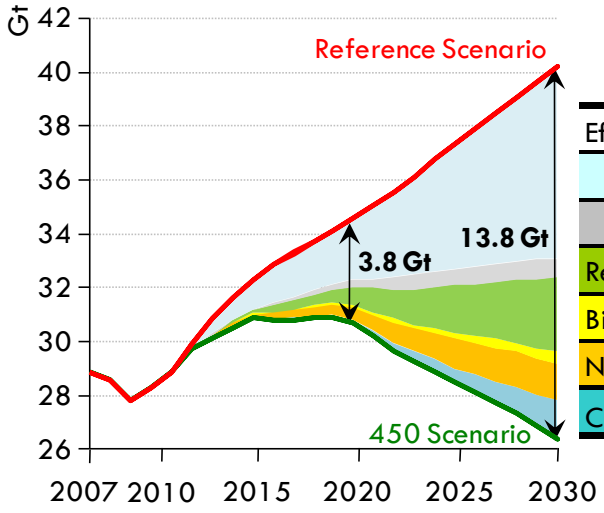
(3) **Greater dependency on energy imports** because domestic energy resources are being depleted, particularly natural gas in the Gulf of Thailand. This will increase the burden in terms of trade balance, which will lead to problems of national security and economic competitiveness.

(4) **Increasing pollution emissions** resulting from the use of fossil fuels for heat and electricity generation and for transportation, which will entail an increasing cost to maintain the environmental quality, especially in industrial estates, in case there is no application of cleaner fuels or no improvement of energy efficiency.

(5) **Increasing volume of carbon dioxide (CO_2) emission** since the percentage of fossil fuel dependency is still high – at present, the use of fossil fuels is more than 80% of the total energy demand and accounts for 90% of the energy used for power generation – hence, CO_2 emission from the energy sector accounts for 70% of the total emissions. In order to alleviate the climate change problem, Thailand, particularly Thai businesses, may have to contend with the pressure to limit CO_2 emission due to international agreements or bilateral agreements, i.e. the requirement from goods importing countries, or due to the measures introduced in many countries to provide options for consumers to choose goods or services with a low carbon footprint, including the demand of domestic consumers.

Chapter 3: Energy Conservation Potential

There may be a variety of measures to address the major five energy challenges, as mentioned in Chapter 2, for example, promotion of renewable energy utilization. However, the option which requires low investment cost and for which relevant technologies are more readily in place than other options is "Energy Conservation" which, in the context of this 20-Year Energy Efficiency Plan means (1) economical use or reduced expendable use of energy, and (2) energy efficiency improvement, i.e. doing the same activities with less energy use, involving, among others, lighting, hot water production, cooling systems, transportation or machine operation in the manufacturing process. Although the government has so far implemented a number of energy conservation promotion measures, there remains great potential to save more energy, according to the outcome of potential assessments which will be discussed in detail later. Energy conservation is, therefore, an important option of almost all countries, including developed countries where energy efficiency is already high. In addition, energy efficiency improvement is an important means to reduce greenhouse gas (GHG) emissions. It is reported by the International Energy Agency (IEA) that energy efficiency is crucial to prevent global warming and will significantly contribute to GHG emission reduction by more than 50% by the year 2030 (Figure 3.1).



Share of abatement %	2020	2030
Efficiency	65	57
End-use	*59*	*52*
Power plants	*6*	*5*
Renewables	18	20
Biofuels	1	3
Nuclear	13	10
CCS	3	10

Figure 3.1: Greenhouse Gas Emission Reduction Technology [1]

In addition, at the Asia-Pacific Economic Cooperation (APEC) Summit in 2007 in Sydney, APEC Leaders jointly issued the Sydney Declaration stipulating, among others, the target for energy conservation with a view to strengthening regional energy security and addressing climate change problems, by reducing "energy intensity," or the amount of energy used per unit of GDP, by 25% by the year 2030, compared with the 2005 base year. Thailand also ratified the declaration.

Since Thailand's energy intensity in 2005 was 16.2 ktoe (thousand tons of crude oil equivalent) per billion baht GDP (at 1988 constant value), if Thailand is determined to implement energy conservation measures pursuant to this declaration, the overall energy

intensity of the country in 2030 must not exceed 12.1 ktoe per billion baht GDP, or the final energy consumption in that year must not exceed 121,000 ktoe (under the assumption that the annual economic growth rate will be at 4.2% on average). That is, energy demand must be about 30,000 ktoe lower than that in the business-as-usual (BAU) case, or 20% lower than the demand in the BAU case (Figure 3.2).

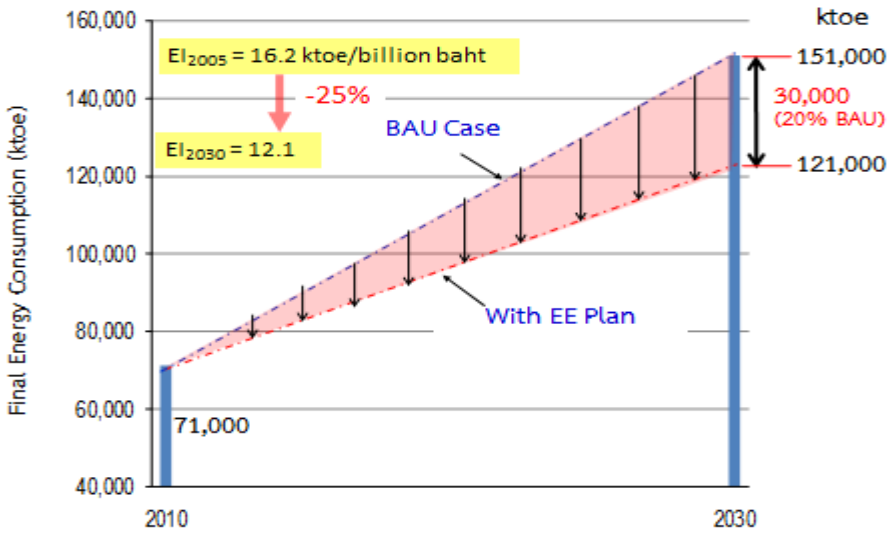


Figure 3.2: Energy Saving Amount to Be Achieved by Thailand by 2030 in pursuance of the APEC Leaders' Declaration
(EI = Energy Intensity)

Consequently, in order to ensure that Thailand will have the potential to achieve the energy conservation target as stipulated in the declaration, it is necessary to assess energy conservation potential both at the national level, as a whole, and at the individual economic sector level.

3.1 Potential Assessment Approach

In 2009, major economic sectors comprised industrial, commercial and residential building and transportation sectors, altogether accounting for over 94% of the total final energy consumption of the country, as shown in Table 3.1.

Table 3.1: Final Energy Consumption by Economic Sector in 2009[2]

Economic Sector	Final Energy Consumption (ktoe)	Share (%)
Transportation	24,132	36
Industry	23,798	36
Commercial Building & Residential	15,029	22
Others	3,739	6
Total	**66,339**	**100**

As a result, the assessment of energy conservation potential of the country will focus on these three main economic sectors.

3.1.1 Industrial Sector

The assessment of energy conservation potential in the industrial sector is divided into five main clusters, i.e. non-metal, food & beverage, basic metal, chemical, and paper. These clusters account for the largest share of energy consumption, i.e. over 84% of the total energy consumption in the industrial sector in 2009, as shown in Table 3.2.

Table 3.2: Energy Consumption by Industrial Cluster in 2009 [2]

Industrial Cluster	Energy Consumption (ktoe)	Share (%)
Non-metal	7,406	31
Food and beverage	7,282	31
Chemical	2,439	10
Paper	1,836	8
Basic metal	1,030	4
Others	3,202	16
Total	**23,195**	**100**

The energy conservation potential, in technical terms, of each industrial cluster is roughly assessed by comparing Thailand's current average specific energy consumption (SEC), or the amount of energy used per unit of products in each cluster, with the best SEC or best practice in foreign countries or with the best practice in Thailand (in case no comparable foreign best practice is available). The best SEC derived will be set as the target for energy efficiency improvement in respective industrial clusters in the next 20 years. When considered jointly with the forecast product outputs up to 2030, the assessment of overall energy conservation potential in each year up to 2030 can be made.

3.1.2 Commercial Building and Residential Sector

The assessment of energy conservation potential in the commercial building and residential sector is divided into two groups, i.e. (1) the large commercial building group and (2) the small commercial building and residential group, due to their different energy consumption characteristics.

Large Commercial Building Group

For the assessment of energy conservation potential in the large commercial building group, the energy consumed is divided into electricity and fuel. Electricity consumption in 2007 by eight major building types is shown in Table 3.3.

Table 3.3: Electricity Consumption in 2007 in the Large Commercial Building Group by Building Type [3, 4]

Building Type	Electricity Consumption (GWh)	Share (%)
Office building	7,139	37
Department store	2,351	12
Retail & wholesale business facility	2,351	12
Hotel	2,339	12
Condominium	1,303	7
Medical center	1,172	6
Educational institution	1,102	6
Other general buildings	1,365	8
Total	**19,125**	**100**

The assessment of electricity saving potential is based on the comparison between the average energy consumption rate/space unit/year of individual building types at present, called the "Reference Case," and such a rate in the case where the minimum energy consumption efficiency standard of buildings, or "Building Energy Code (BEC)," is enforced, including the case where a higher standard in the future is enforced. The average energy consumption rate under the Reference Case is derived from the energy consumption modeling representing each building type, based on the official data from energy consumption inspection. Energy efficiency standards which are higher than the BEC comprise the following three levels:

(1) HEPS (High Energy Performance Standard) – the high energy efficiency standard of various systems which can be achievable by using current technologies;

(2) Econ (Economic building) – the target in the near future when the technologies of equipment and various systems are developed to be more energy efficient, but are still cost-effective; and

(3) ZEB (Zero Energy Building) – the long-term target when the need for external energy supply to the buildings is near zero because the energy demand of such buildings is very low and there is also on-site energy generation from renewable energy.

The parameters that are modified or changed to achieve greater energy efficiency are the heat transmission via building envelope, air-conditioning efficiency, lighting and electrical equipment/appliance efficiency, and air ventilation.

Based on the modeling, the adjustment of the mentioned parameters under each level of energy saving capability will result in the net energy consumption of each building type, as shown in Table 3.4. It can be noticed that the level of energy consumption under the ZEB Case is only 1/4 - 1/3 of energy consumption under the Reference Case. This reflects the energy conservation opportunity of each building type.

Table 3.4: Net Energy Consumption Derived from Modeling Each Building Type under Each Level of Energy Saving Capability.

Building Type	Energy Consumption under Each Level of Energy Saving Capability (kWh/m^2/y)				
	Reference	BEC	HEPS	Econ	ZEB
Office building	219	171	141	82	57
Department store	308	231	194	146	112
Retail & wholesale business facility	370	298	266	161	126
Hotel	271	199	160	116	97
Condominium	256	211	198	132	95
Medical center	244	195	168	115	81
Educational institution	102	85	72	58	39
Other general buildings	182	134	110	66	53

With regard to the energy conservation potential assessment in terms of fuel, only liquefied petroleum gas (LPG) is taken into consideration as the use of liquid fuel, such as fuel oil and diesel, is quite insignificant. LPG consumption by each commercial building type in 2007 is shown in Table 3.5.

Table 3.5: LPG Consumption in the Large Commercial Building Group in 2007 [5]

Building Type	Volume of LPG Consumption (ktoe)	Share (%)
Office building	31	12
Department store	72	28
Retail & wholesale business facility	91	36
Hotel	32	13
Condominium	10	4
Medical center	8	3
Educational institution	6	3
Other general buildings	3	1
Total	**254**	**100**

The assessment of fuel saving potential is based on the comparison between the average efficiency of various types of equipment using LPG, which are available in the market and are currently in use, and the possible highest efficiency of such equipment which can be achieved by using currently available technologies or those to be developed in the future.

Small Commercial Building and Residential Group

Since the government has not yet determined the energy performance standard of the small commercial building and residential group, the assessment of energy conservation potential of this group is based mainly on the forecast utilization of

higher energy-efficient equipment/appliances, for which energy utilization is divided into five categories as follows:

1) **Lighting** -- fluorescent tubes and incandescent bulbs;

2) **News & Entertainment** -- color televisions, VDO/VCD/DVD players, stereos, radios and computers;

3) **Cooking** – rice cookers, electric stoves, electric pans, microwave ovens, electric ovens, electric kettles, blenders and toasters. Fuels used under this category comprise cooking gas (LPG), charcoal and firewood, including the use of electric power;

4) **Comfort** – electric fans, air-conditioners, vacuum cleaners, washing machines, water heaters, water pumps, electric irons and refrigerators;

5) **Others.**

The above data will help indicate the dispersion of energy efficiency of equipment/appliances available now in the market and those being in use at present; and from the data, the mean (average) of energy efficiency of the present equipment/appliances can be deduced. The difference between the possible highest efficiency of such equipment using currently available or future technologies and the current efficiency of the equipment in use, coupled with the forecast volume of the equipment to be in use up to 2030, will reflect the energy conservation potential under this group.

3.1.3 Transportation Sector

Energy conservation in the transportation sector can be divided into three major approaches, i.e. (1) improvement of energy efficiency of motor vehicles, (2) energy efficiency improvement by shifting the modes of travel or goods transport, and (3) energy efficiency improvement by travel demand management (TDM). Energy saving potential of each approach can be analyzed as follows.

Improvement of Energy Efficiency of Motor Vehicles

In assessing energy conservation potential by improving energy efficiency of motor vehicles, the vehicles to be considered are divided into: (1) new vehicles and (2) existing vehicles in the transport system (or “on-road” vehicles). The assessment is based on the difference between the fuel consumption rate of vehicles under present conditions and the reduced fuel consumption rate as a result of improved energy efficiency, and on the estimated increasing number of vehicles up to 2030.

With regard to new vehicles, major assumptions include: (1) the types of vehicles to be assessed will be based on those in use at present, comprising private cars, private trucks, fixed-route buses, non fixed-route buses and trucks; and (2) the present fuel economy (kilometre/litre) of current vehicles and improved vehicles in the future, with reference to Japan’s fuel economy improvement direction, which is expected to increase by 20% by 2030.

Additionally, in assessing the energy efficiency improvement potential of motorcycles, the share of electric motorcycles has been increased, replacing part of the ordinary internal combustion engine motorcycles. Key assumptions applied here are that more than 70% of energy saving can be achieved by an electric motorcycle, compared with an ordinary one, according to the study outcome in foreign countries, and that the share of electric motorcycles sold in 2030 will be 70% of new motorcycles. As a result, in 2030 the cumulative number of electric motorcycles will account for about 60% of the total number of motorcycles, which is equal to the share of electric motorcycles in China at present.[6]

With regard to the potential assessment of on-road vehicles, consideration is focused on the change in driving behavior to "eco-driving," involving gentle speed acceleration and slowdown, driving at an appropriate and constant speed, switching off the engine while the vehicle is stationary (idling stop), and engine & vehicle maintenance to keep the vehicle in a good working condition, including the use of auxiliary equipment contributing to eco-driving. The types of vehicles considered in this potential assessment comprise five types, the same as those of new vehicles. A major assumption applied here is that the eco-driving promotion will result in an increase of vehicle energy efficiency by about 10%. (According to an IEA study, such an increase is in a range of 5-10%.) [7]

Energy Efficiency Improvement by Shifting the Modes of Travel and Goods Transport

Among various transport modes, land transport is the mode in which the rate of energy consumption per transport volume is the highest. Within land transport, traveling by private cars is the form of transport that has the highest rate of energy consumption per transport volume, compared with other forms of passenger transport by land. When compared with the travel by public transport systems, such as buses and rail systems, the rate of energy consumption of private cars is 2.8 and 5.5 times that of buses and public rail systems respectively. The rate of energy consumption for goods transport by trucks is 3.1 times higher than that by waterway and about 10 times higher than that by rail.[8]

The assessment of energy saving potential as a result of a travel and goods transport mode shift is divided into two scenarios, i.e. urban zone and intercity zone. For the urban zones, the assessment is made with reference to the outcomes of relevant studies commissioned by the Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport, i.e. the Mass Rapid Transit Master Plan in Bangkok Metropolitan Region: M-MaP,[9] the Report on Integrated Plan of Bus Rapid Transit (BRT) System Routing Network in Bangkok Metropolitan Region,[10] and the Project on Master Plan and Preliminary Design of Mass Transit System for Chiang Mai City,[11] in which comparisons of travel modes are made under the Base Case.

Energy Efficiency Improvement by Travel Demand Management

Travel demand management (TDM) generally means a measure or a set of measures introduced to change travel behavior and travel demand of a person to be in such a way that it contributes to higher efficiency in the transport system as a whole.[12] TDM measures can be divided into three groups: (1) measures supporting travel modes with a high transport rate per vehicle (Vehicle Occupancy); (2) measures creating

incentives or difficulties to reduce travel demand; and (3) measures promoting alternative activities instead of traveling.

Examples of measures in the first group, supporting travel modes which will contribute to traveling with high vehicle occupancy or require low energy consumption per travel, are: the provision of "Park-and-Ride" areas in the suburbs, increase in convenience to connect mass transit systems with other transport systems, and discounts on public transport system fees during off-peak hours.

Examples of measures in the second group, creating incentives or difficulties to reduce travel demand, are: the collection of charges for the use of roads ("road pricing") in heavily congested areas, limitation of car-parking areas or collection of high parking fees in city central areas, annual license plate taxation according to the distance travelled per year, and prohibition of driving into inner-city areas on odd/even dates based on car plate numbers. As for the third group, promoting alternative activities instead of traveling, some examples are: promotion of the use of information technology (IT) to support the work instead of traveling, and promotion of working from home.

In this connection, the introduction of TDM measures will be effective and acceptable to users of private vehicles only if and when the services of public transport systems (especially rail systems) can be widely accessible and are rapid and convenient.

3.2 Outcome of Energy Conservation Potential Assessment

3.2.1 Industrial Sector

The outcome of the assessment of energy conservation potential in the industrial sector is shown, by industrial cluster, in Table 3.6. Overall, the potential in this sector is about 13,790 ktoe, accounting for 22% of the forecast energy demand in 2030 under the BAU case. The food and beverage cluster has the highest saving potential, i.e. 5,370 ktoe, or 28% of the forecast demand. Next to it are the non-metal, paper and chemical clusters, with energy saving potential of 2,500 ktoe, 2,110 ktoe and 1,370 ktoe respectively. The basic metal cluster has the least potential, i.e. 300 ktoe. With regard to energy saving potential in other industrial clusters, of which the energy demand share altogether is about 15% of the total energy demand in this sector and which involve a variety of small industries, if it is deduced that energy saving potential is equal to that of the other five major clusters, i.e. 22%, the potential of this cluster will be 2,140 ktoe.

Table 3.6: Energy Saving Potential by Industrial Cluster

Industrial Cluster	Energy Demand in 2030 under BAU Case (ktoe)[1]	Energy Saving Potential in 2030 (ktoe)	Potential Share Compared with the BAU Case (%)
Non-metal	19,510	2,500	13
Food and Beverage	19,260	5,370	28
Paper	4,830	2,110	44
Chemical	6,460	1,370	21
Basic metal	2,700	300	11
Others[2]	9,940	2,140	22
Total	**62,700**	**13,790**	**22**

Remarks: [1] Assuming there is no change in the industrial structure and energy demand shares are constant.
[2] Estimated by using the average percentage of the overall industrial cluster potential.

3.2.2 Commercial Building & Residential Sector

Large Commercial Building Group

The outcome of the electricity saving potential assessment in the large commercial building group is shown in Table 3.7. It indicates that office buildings, educational institutions, department stores and hotels have higher potential than other building types. As for the assessment of fuel saving potential, the outcome is shown in Table 3.8. It is found that the use of LPG burners has a high saving potential, i.e. 354 ktoe.

Table 3.7: Electricity Saving Potential in the Large Commercial Building Group

Building Type	Demand in 2030 BAU Case (GWh)	Demand in 2030 BEC Case (GWh)	Saving Potential in 2030 (GWh)	Share (%)
Office building	11,211	4,178	7,033	26
Department store	8,466	4,372	4,094	15
Retail & wholesale business facility	3,265	1,401	1,864	7
Hotel	7,366	3,197	4,169	15
Condominium	1,931	907	1,024	4
Medical center	2,163	1,228	935	3
Educational institution	12,947	6,150	6,797	25
Other general buildings	2,356	857	1,499	5
Total	**49,705**	**22,289**	**27,416**	**100**

Table 3.8: Fuel Saving Potential in the Large Commercial Building Group

Equipment	Demand in 2030 BAU Case (ktoe)	Demand HEPS Case (ktoe)	Saving Potential in 2030 (ktoe)	Share (%)
LPG burner	831	477	354	87
Liquid fuel burner	118	67	51	13
Total	**949**	**544**	**405**	**100**

Small Commercial Building and Residential Group

The outcomes of electricity and fuel saving potential assessment in the small commercial building and residential group are shown in Tables 3.9 and 3.10 respectively. Electricity saving potential in this group is derived from the use of fluorescent tubes, electronic ballasts, compact fluorescent lamps, air-conditioners and water heaters, of which energy efficiency is higher, with the following assumptions:

(1) Fluorescent tubes – the change from former 36-watt tubes to energy-saving 30-watt tubes, using the same magnetic ballast, can save energy at about 30%.

(2) Electronic ballasts – replacing 10-watt magnetic ballasts with 1-watt electronic ballasts can save energy at about 90%.

(3) Compact fluorescent lamps, replacing incandescent lamps, contribute to energy saving at about 80%.

(4) Air-conditioners – the change from existing units with EER 8 to those with EER 13 will contribute to about 33% energy saving. For new air-conditioners distributed in the market, the change from former EER 11 to EER 13 will contribute to about 15% energy saving. In addition, consideration is also given to the supplementary application of air-conditioning by solar energy ("Solar Cooling"), which will help achieve energy saving, in total, at about 50% of the energy amount required for this equipment.

(5) Water heaters – the shift to use heat-pump water heaters will result in 100% energy saving.

In this regard, the use of high energy-efficiency air-conditioners and water heaters will have the highest energy saving potential.

Table 3.9: Electricity Saving Potential in the Small Commercial Building & Residential Group

Equipment	Demand in 2030 BAU Case (GWh)	Percentage of Energy Saving (%)	Electricity Saving Potential in 2030 (GWh)	Electricity Saving Potential in 2030 (ktoe)
Lighting Category				
Fluorescent tube	5,222	30	1,573	134
Electronic ballast	1,596	90	1,450	124
Compact fluorescent bulb	320	80	257	22
Comfort Category				
Air-conditioner	25,901	50	13,325	1,135
Water heater	6,614	100	6,614	564
Total			**23,219**	**1,978**

Remarks: 1 GWh = 0.08521 ktoe

With regard to fuel saving potential assessment, the assumptions used are that the heat demand is constant; the efficiency of LPG stoves will be increased from the current 49% to 65% by 2030; the use of firewood in 2030 is expected to be totally replaced by charcoal as the latter is more convenient for use, and hence a higher demand for charcoal in 2030, while the efficiency of charcoal stoves is expected to increase from currently 25% to 30% in 2030. The derived outcome of this potential assessment is shown in Table 3.10.

Table 3.10: Fuel Saving Potential in the Small Commercial Building & Residential Group

Fuel (Measurement Unit)	Demand in 2030 BAU Case	Current Efficiency of Equipment	Maximum Efficiency of Equipment	Saving Potential in 2030	Saving Potential (ktoe)
Cooking gas (10^6 kg LPG)	3,538	49%	65%	829	967
Charcoal (10^6 kg)	8,173	25%	30%	1,061	725
Total					**1,693**

Remarks: 1) 10^6 kg LPG = 1.1669 ktoe; 10^6 kg charcoal = 0.68364 ktoe
2) Charcoal demand in 2030 includes demand for heat energy from firewood

The overall energy conservation potential in the commercial building and residential sector in 2030 can be summarized in Table 3.11. It will be noticed that both large commercial building and small commercial building and residential groups have a high electricity saving potential. The total potential in this sector is about 6,410 ktoe.

Table 3.11: Energy Conservation Potential in the Commercial Building & Residential Sector

Building Group	Energy Type	Energy Conservation Potential in 2030 (ktoe)	Share (%)
Large Commercial Building	Electricity	2,335	37
	Fuel	405	6
Small Commercial Building and Residential	Electricity	1,978	31
	Fuel	1,693	26
Total		**6,411**	**100**

3.2.3 Transportation Sector

In the transportation sector, the total energy saving potential, in technical terms, is 16,250 ktoe, or about 35% of the forecast energy demand in 2030. The potential is derived from the following: 12,470 ktoe, or 77% of the total potential, from the use of higher energy-efficient vehicles and efficient use of vehicles; 2,770 ktoe, or 17%, from the travel and goods transport mode shift; and 1,010 ktoe, or 6%, from the application of Travel Demand Management (TDM) measures, as shown in Table 3.12.

Table 3.12: Energy Conservation Potential in the Transportation Sector

Approach to Energy Efficiency Improvement	Energy Conservation Potential in 2030 (ktoe)	Share (%)
Use of higher energy-efficient vehicles and efficient use of vehicles	12,470	77
Travel and goods transport mode shift	2,770	17
Application of Travel Demand Management (TDM)	1,010	6
Total	**16,250**	**100**

Use of Higher Energy-Efficient Vehicles and Efficient Use of Vehicles

Using higher energy-efficient vehicles, in the case of new vehicles, will result in an enormous energy conservation potential of 8,413 ktoe. Most of the potential will be derived from the use of private cars, vans and pick-ups, trucks and motorcycles, as illustrated in Table 3.13. Measures contributing to the shift to use higher energy-efficient vehicles may include the mandatory energy efficiency labeling, the enforcement of Minimum Energy Performance Standards (MEPS) and the application of CO_2 emission tax measures in order to boost the production and distribution of higher energy-efficient vehicles. Regarding the use of old vehicles, or "on-road vehicles," the energy saving potential is also quite high, i.e. 4,053 ktoe, as shown in Table 3.14. The potential is mainly derived from eco-driving, e.g. gentle speed acceleration and slowdown, driving at an appropriate and constant speed, switching off the engine while the vehicle is stationary (idling stop), etc.

Table 3.13: Energy Conservation Potential as a Result of Energy Efficiency Improvement of New Vehicles

Type of Vehicle	Fuel Economy Current [13] (km/litre)	Fuel Economy Potential (km/litre)	Energy Conservation Potential in 2030 (ktoe)
Private car	11.4	14.3	1,357
Van & Pick-up	10.9	13.6	2,399
Fixed-Route Bus	3.2	4.0	99
Non Fixed-Route Bus	3.6	4.5	46
Truck	3.8	4.8	1,722
Motorcycle	28.7	95.8	2,791
Total			**8,413**

Table 3.14: Energy Conservation Potential as a Result of Efficient Use of On-road Vehicles

Type of Vehicle	Fuel Economy Current[1] (km/litre)	Fuel Economy Potential (km/litre)	Energy Conservation Potential in 2030 (ktoe)
Private car	11.52	12.80	1,229
Van & Pick-up	11.06	12.29	1,603
Fixed-Route Bus	3.52	3.91	104
Non Fixed-Route Bus	4.28	4.75	28
Truck	3.80	4.22	1,089
Total			**4,053**

Remarks: [1] Calculated from the model developed by the Study Team

Travel and Goods Transport Mode Shift

The total energy saving potential derived from the travel and goods transport mode shift is 2,770 ktoe, divided into the potential as a result of the travel mode shift, from the use of private vehicles to the use of public transport systems owing to infrastructure development (348 ktoe), and the goods transport mode shift, from land transport to rail and waterway transport (2,422 ktoe), as shown in Table 3.15.

Table 3.15: Energy Conservation Potential as a Result of Goods Transport Mode Shift

Transport Mode	Energy per Transport Unit [8] (MJ/ton-km)	Share of Transport Mode Current[14,15]	Share of Transport Mode In 2030* (Base Case)	Share of Transport Mode In 2030** (Target)	Energy Saving Potential (ktoe)
Land	2.5	87.5%	85.0%	73.2%	2,422
Rail	0.75	2.6%	5.2%	17.0%	
Waterway	0.25	9.8%	9.8%	9.8%	

Remarks: * Calculated from the model developed by the Study Team
** Adjusted from [14, 15]

Potential from the Application of Travel Demand Management (TDM)

Travel demand management will bring about energy saving, resulting from reduced travel demand and travel mode shift (other than travel mode shift caused by the construction of public transport systems), at a total potential of 1,010 ktoe, comprising the potential from the shift from the use of private cars and private motorcycles to the use of public transport systems, both land and rail. Rail transport will have the highest saving potential. (Table 3.16)

Table 3.16: Energy Conservation Potential as a Result of TDM

Travel Mode	Energy per Travel Unit [8] (MJ/man-km)	Share of Travel Mode Current [9]	Share of Travel Mode In 2030 [9] (Base Case)	Share of Travel Mode In 2030 (Target)	Energy Saving Potential (ktoe)
Private car	2.2	39.6%	48.0%	35.3%	1,010
Private motorcycle	0.9*	15.0%	12.8%	9.7%	
Public transport systems - Land	0.8	41.6%	32.9%	28.2%	
Public transport systems - Rail	0.25	3.7%	6.2%	26.8%	

Remarks: *Estimated by the Study Team

3.2.4 Summary

In summation, the total energy saving potential in 2030 in the three major economic sectors will be 36,450 ktoe, comprising: the transportation sector, 16,250 ktoe; the industrial sector, 13,790 ktoe; and the commercial building and residential sector, 6,410 ktoe (divided into the large commercial building group, 2,740 ktoe, and the small commercial building & residential group, 3,670 ktoe) (Table 3.17).

Table 3.17: Summary of Energy Conservation Potential in 2030

Economic Sector	Potential (ktoe)	Share (%)
Transportation	16,250	44
Industry	13,790	38
Commercial Building & Residential	6,410	18
Total	**36,450**	**100**

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[1] IEA (International Energy Agency) (2009), World Energy Outlook 2009, DECD/IEA, Paris.

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[3] Provincial Electricity Authority (2010), PEA's Energy Sales Statistics during 2002-2007.

[4] Metropolitan Electricity Authority (2010), MEA's Energy Sales Statistics during 2002-2009.

[5] Department of Alternative Energy Development and Efficiency (2007), Thailand Energy Situation (2007).

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[7] IEA (International Energy Agency) (2010), Transport Energy Efficiency, pp. 37.

[8] IEA (International Energy Agency), Energy Technology Perspectives 2006.

[9] Office of Transport and Traffic Policy and Planning (2010), Mass Rapid Transit Master Plan in Bangkok Metropolitan Region: M-MaP, Final Report.

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[14] Office of Transport and Traffic Policy and Planning (2006), Development of Multimodal Transport and Logistics Supply Chain Management for Implementation of Action Plan, Final Report.

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Chapter 4: Framework for the 20-Year Energy Efficiency Development Plan (2011-2030)

4.1 Energy Conservation Targets

In determining the targets for energy conservation in this 20-Year Energy Efficiency Development Plan (EEDP), the following two major factors have been taken into consideration:

(1) The international agreement on energy conservation targets, i.e. the Joint Declaration of the Asia-Pacific Economic Cooperation (APEC) Leaders, agreeing to reduce energy intensity (EI), or the amount of energy used per unit of GDP, by 25% in the year 2030 compared with that in 2005. If Thailand is determined to achieve the mentioned energy conservation target, Thailand's final energy consumption in 2030 must be reduced by 20%, compared with the demand under the BAU case, or about 30,000 ktoe.

(2) According to the outcome of energy conservation potential assessment, in technical terms, in the three major economic sectors, it is found that energy demand can be reduced, in total, by 36,450 ktoe, which is 22.5% higher than the target specified in (1).

From the above-mentioned two factors, it can be deduced that Thailand has energy conservation potential to achieve the mutually agreed target of APEC. Hence, if the target is distributed among those major economic sectors, based on the assessed potential shares, the target of each economic sector will be as shown in Table 4.1.

Table 4.1: Share of Energy Saving by Economic Sector in 2030.

Economic Sector	Technical Potential			Specified Target (ktoe)	Share (%)
	Heat (ktoe)	Electricity (GWh)	Total (ktoe)		
Transportation	16,250	-	16,250	13,400	44.7
Industry	10,950	33,500	13,790	11,300	37.7
Commercial Building & Residential					
- Large Commercial Building	410	27,420	2,740	2,300	7.6
- Small Commercial Building & Residential	1,690	23,220	3,670	3,000	10.0
Total	**29,300**	**84,140**	**36,450**	**30,000**	**100.0**

In the case where energy conservation measures can be successfully implemented up until the target specified under this plan is achieved, energy consumption up to 2030 will increase at only an annual average rate of 3.0%, or an increase of only 1.7 times the current demand (Figure 4.1). The growth rate will be lower than the GDP growth rate, accounting for the average energy elasticity at 0.71 over the next 20 years, compared with the average of 0.98 over the past 20 years.

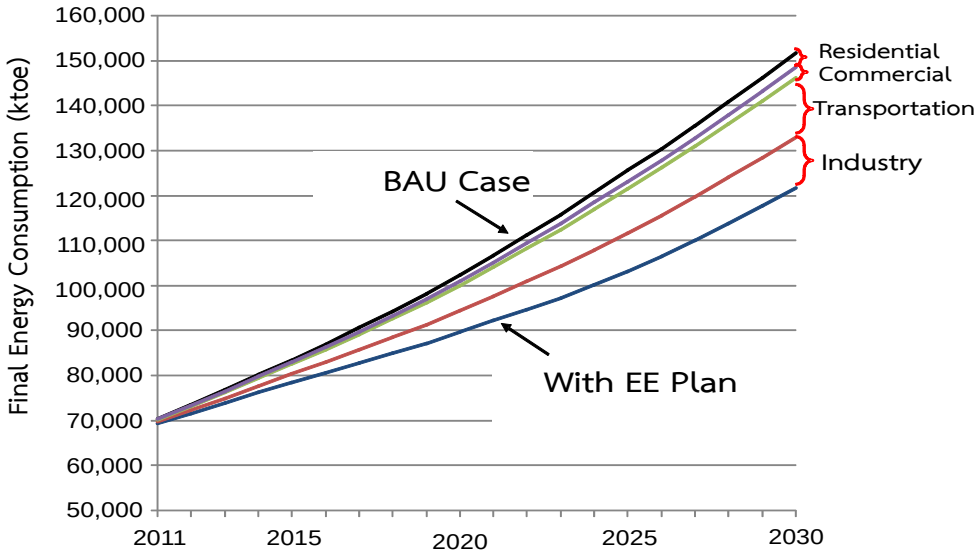


Figure 4.1: Energy Conservation Targets by Economic Sector.

4.2 Strategies to Achieve the Targets

Following intensive consultations with and hearings from business, the general public, academic and government sectors, it is suggested that in strategically forging ahead with energy conservation policy and overall implementation according to this EEDP, importance should be given to the following matters:

Strategy 1: The application of combined measures, i.e. mandatory measures via rules, regulations and standards; and promotional and supportive measures via incentive provision.

Strategy 2: The introduction of measures which will bring about a wide impact in terms of awareness raising and change in energy consumption behavior of energy consumers, including decision-making behavior of business operators, as well as market transformation, by incorporating innovations into awareness raising campaigns and public relations activities, for example, the interrelationship between energy conservation and environmental protection as well as global warming alleviation.

Strategy 3: Potential and important role of the private sector in the public-private partnership to promote and implement energy conservation measures.

Strategy 4: Distribution of energy conservation promotion work to public and private agencies/organizations which are readily equipped with resources and expertise, such as power utilities and industrial associations, with backup support from the Ministry of Energy.

Strategy 5: The use of professionals and Energy Services Companies (ESCO) as an important tool to provide consultancy and to implement energy conservation measures in which the use of more advanced technology is involved.

Strategy 6: Increase in self-reliance on indigenously developed technology to reduce technological costs and to increase access to energy-efficiency technology, including promotion of highly energy-efficient product manufacturing businesses.

4.3 Strategic Approaches, Measures and Work Plans

4.3.1 Strategic Approaches and Measures to Achieve the Targets

In previous Energy Conservation Programs, both mandatory and supportive strategic approaches and measures were introduced, i.e. rules/regulations and provision of financial incentives, technical assistance and knowledge, including various forms of public awareness campaigns to create energy conservation awareness of the general public. Under this 20-Year EEDP, it is recommended that the existing strategic approaches and measures be maintained, with further implementation and expansion of measures which have proven to be effective. Concurrently, new measures that have proven to be successful in other countries should be considered for application to Thailand.

To implement the plan, five strategic approaches, which are further divided into 16 specific measures, will be applied. These measures are of high priority as they require low investment capital while yielding high energy saving. The strategic approaches and measures are as follows:

Strategic Approach 1: Mandatory Requirements via Rules, Regulations and Standards

Strategic Approach 2: Energy Conservation Promotion and Support

Strategic Approach 3: Public Awareness (PA) Creation and Behavioral Change

Strategic Approach 4: Promotion of Technology Development and Innovations

Strategic Approach 5: Human Resources and Institutional Capability Development

(1) Mandatory Requirements via Rules, Regulations and Standards, comprising four measures as follows:

(1.1) Enforcement of the Energy Conservation Promotion Act, [as amended up to] B.E. 2550 (2007), so that the energy management system through energy consumption reporting and verification imposed on designated buildings and factories would materialize.

(1.2) Mandatory energy efficiency labeling to provide options for consumers to buy or use highly energy-efficient equipment/appliances, vehicles and buildings.

(1.3) Enforcement of the Minimum Energy Performance Standards (MEPS) for equipment/appliances, buildings and vehicles to prevent the distribution and use of low energy-efficient products. In this regard, the government will consult with product manufacturers and sellers to determine an appropriate lead time prior to the enforcement of MEPS for each product.

(1.4) Determination of the Energy Efficiency Resource Standards (EERS), or the minimum standards for large energy businesses to implement energy conservation measures encouraging their customers to use energy efficiently (with a penalty clause for those whose implementation outcome is lower than the specified standards and rewards for those whose achievement is greater than the specified standards in each year), which will be an important mechanism to provide both technical and financial assistance to small and medium enterprises (SMEs).

(2) Energy Conservation Promotion and Support, comprising five measures as follows:

(2.1) Execution of a "voluntary agreement" to save energy between the public and commercial/industrial sectors, especially various business associations and large-scale businesses.

(2.2) Support and incentive provision to encourage voluntary energy-efficiency labeling for highly energy-efficient equipment/appliances, buildings and vehicles.

(2.3) Promoting traveling by mass transit systems and goods transportation via highly energy-efficient logistics systems.

(2.4) Subsidization for investment in the implementation of energy conservation measures by (a) providing subsidies for the amount of energy saved which can be verified, as per the project proposals approved under the DSM Bidding scheme for large-scale businesses, and (b) providing subsidies for the amount of energy saved and/or reduction of peak load that can be verified or accurately assessed for SMEs, as per the project proposals submitted under the Standard Offer Program (SOP) scheme, which requires no bidding.

(2.5) Support for the operation of ESCO companies, (e.g. the use of funds from the Energy Conservation Promotion Fund to increase credit lines given by the ESCO Fund), to alleviate technical and financial risks of entrepreneurs wishing to implement energy conservation measures.

(3) Public Awareness (PA) Creation and Behavioral Change**,** comprising three measures as follows:

(3.1) Public relations and provision of knowledge about energy conservation to the general public, via the teaching/learning process in educational

institutions, fostering youth awareness, and other PA activities, such as eco-driving.

(3.2) Putting forth the concept and promoting activities related to the development of low carbon society and low carbon economy, which will bring about cooperation between local administration organizations and the business sector in the planning and implementation of activities that will lead to reduction of GHG emissions and efficient use of energy.

(3.3) Determination of energy prices to reflect the actual costs and application of tax measures as an important tool to promote energy conservation with a view to fostering public awareness and changing their energy consumption behavior.

(4) Promotion of Technology Development and Innovations**,** comprising two measures as follows:

(4.1) Promotion of research and development to improve energy efficiency and reduce technological costs, particularly those related to equipment/ appliances with large markets and having their manufacturing bases in Thailand, including the production process, materials as well as buildings and housing that are energy efficient.

(4.2) Promotion of demonstrations of energy-efficiency technology that has been technically proven but has not been commercialized in the domestic market, including support for necessary preparation to materialize wide commercial deployment of such technology.

(5) Human Resources and Institutional Capability Development**,** comprising two measures as follows:

(5.1) Support for the development of professionals in the energy conservation field to be persons responsible for energy management and operation, verification and monitoring, consultancy and engineering services provision, and the planning, supervision and promotion of the implementation of energy conservation measures.

(5.2) Support for the development of institutional capability of agencies/ organizations in both public and private sectors, responsible for the planning, supervision and promotion of the implementation of energy conservation measures.

4.3.2 Framework of Energy Conservation Measures and Work Plans by Economic Sector

The framework of measures and work plans under this 20-Year Energy Efficiency Development Plan are divided into three phases – short term (2011-2015), medium term (2016-2020) and long term (2021-2030), with specified activities under each phase of each work plan for individual economic sectors so as to steer the implementation pursuant to the strategic approaches towards the achievement of targets specified under each phase of the EEDP, as shown in Tables 4.2-4.6.

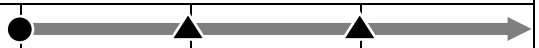
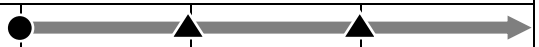
Table 4.2: Framework of Cross-sector Measures and Work Plans

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
1.1 Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards			
1.1 Measure: Enforcement of the Energy Conservation Promotion Act (ENCON Act)			
• Enforce the ENCON Act, as amended up to B.E. 2550 (2007)	●	▲	▲
• Amend the 2007 ENCON Act (e.g. expansion of the scope to cover small-scale buildings/factories and business facilities other than buildings/factories)	▽	●	▲
1.2 Measure: Mandatory labeling			
• Enforce energy efficiency labeling for equipment/appliances	●	▲	▲
• Develop standard testing laboratories	▽	●	▲
1.3 Measure: Enforcement of the Minimum Energy Performance Standards (MEPS)			
• Enforce MEPS for equipment/appliances	▽	●	▲
1.4 Measure: Enforcement of the Energy Efficiency Resource Standards (EERS) for large energy businesses			
• Enforce EERS for the electricity supply industry	▽	●	▲
• Enforce EERS for the natural gas and oil industry		▽	●
2.1 Strategic Approach: Energy Conservation Promotion and Support			
2.1 Measure: Execution of voluntary energy-saving agreements			
• Engage in voluntary energy-saving agreements with commercial/industrial clusters and business associations	●	▲	▲
2.2 Measure: Support and incentive provision to encourage voluntary energy-efficiency labeling			
• Make agreements with manufacturers to produce equipment/appliances with high energy performance standard (HEPS)	●	▲	▲
• Support the use of HEPS, low carbon footprint equipment/appliances, or ISO 50001 products	●	▲	▲
2.3 Measure: Financial support to subsidize energy saving achieved			
• Provide subsidies for energy saving achieved, which can be verified as per the project proposals approved under the DSM Bidding scheme for large-scale businesses	●	▲	▲

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

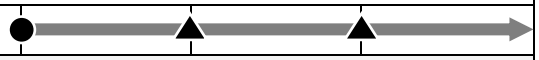
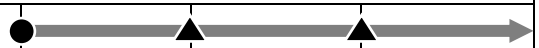
Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
• Provide subsidies for energy saving achieved and/or peak load cut that can be verified for retail consumers and small businesses/industries under the Standard Offer Program (SOP) scheme	●	▲	▲
2.4 Measure: Support the operation of energy services companies (ESCO)			
• Use money from the Energy Conservation Promotion Fund to increase credit lines given by the ESCO Fund	●	▲	▲
3.1 Strategic Approach: Public Awareness (PA) Creation and Behavioral Change			
3.1 Measure: Public relations and provision of knowledge about energy conservation			
• Launch PR on energy efficiency measures and technology (HEPS, eco-points, ISO 50001)	●	▲	▲
• Organize contests and confer awards (energy management, innovative campaign slogans, etc.)	●	▲	▲
• Draw up syllabuses and activities related to energy conservation in schools and other educational institutions	●	▲	▲
3.2 Measure: Putting forth the concept and promoting activities related to the development of low carbon society and low carbon economy as well as environmental protection			
• Encourage local administration organizations and the business sector to undertake activities related to low carbon society and economy development	●	▲	▲
3.3 **Measure: Pricing and taxation to push consumers towards behavioral change, create energy conservation awareness and reduce GHG**			
• Determine energy prices to reflect the actual costs	▽	●	▲
• Undertake tax restructuring to encourage energy conservation and GHG reduction	▽	●	▲
4.1 Strategic Approach: Promotion of Technology Development and Innovations			
4.1 Measure: Promotion of research and development			
• Develop an energy efficiency technology roadmap	●	▲	▲
• Promote R&D on equipment/appliances with large markets	●	▲	▲
4.2 Measure: Promotion of high energy-efficiency technology demonstration			
• Demonstrate energy efficiency technology contributing to high saving impact	●	▲	▲

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
• Create cooperation between the public and private sectors, including educational/research institutions			
5.1 Strategic Approach: Human Resources and Institutional Capability Development			
5.1 Measure: Support for the development of professionals in the field of energy efficiency			
• Build up professionals to serve business operation facilities			
• Develop experts to serve consultancy agencies/companies and ESCO			
• Build up human resources via educational curriculums			
5.2 **Measure: Support for the development of institutional capability of agencies/organizations in both public and private sectors**			
• Enhance institutional capability of agencies/organizations responsible for the planning, supervision and promotion of the implementation of energy efficiency measures			

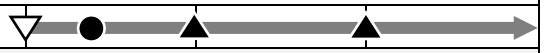
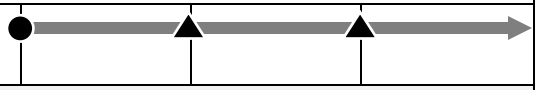
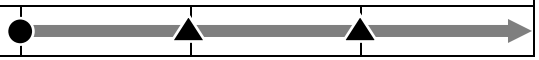
Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Table 4.3: Framework of Measures and Work Plans for the Industrial Sector

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards			
1.1 Measure: Enforcement of MEPS for the production process			
• Enforce the specific energy consumption (SEC) standards for the production process			
(2) Strategic Approach: Energy Conservation Promotion and Support			
2.1 Measure: Benchmarking the amount of energy used per unit of products (SEC)			
• Develop the SEC database and benchmark both domestic and overseas SEC			
(3) Strategic Approach: Promotion of Technology Development and Innovations			
3.1 Measure: Promotion of R&D to improve energy efficiency of the production process			
• Promote R&D on high energy-efficiency equipment/appliances with large markets and manufacturing bases in Thailand			

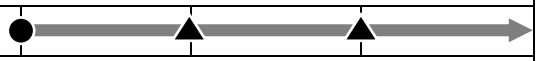
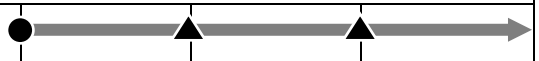
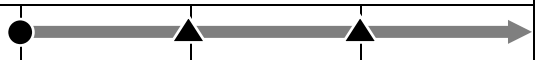
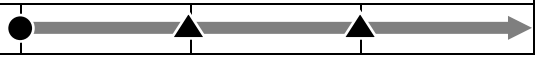
Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Table 4.4: Framework of Measures and Work Plans for the Large Commercial Building Group

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards			
1.1 Measure: Enforcement of energy performance standards of buildings			
• Enforce the Ministerial Regulation on Building Design for Energy Conservation, B.E. 2552 (2009)			
1.2 Measure: Mandatory building energy efficiency labeling			
• Enforce energy efficiency labeling for new government buildings			
(2) Strategic Approach: Energy Conservation Promotion and Support			
2.1 Measure: Support for voluntary building energy-efficiency labeling			
• Encourage building energy efficiency labeling			
(3) Strategic Approach: Promotion of Technology Development and Innovations			
3.1 Measure: Support for the development of energy-saving building prototypes			
• Support the construction of demonstration buildings to be energy-saving building prototypes (e.g. government buildings)			
(4) Strategic Approach: Human Resources and Institutional Capability Development			
4.1 Measure: Promotion of the development of professionals in building energy efficiency			
• Build up professionals in building design inspection			

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Table 4.5: Framework of Measures and Work Plans for the Small Commercial Building & Residential Group

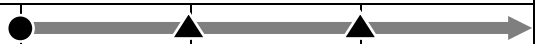
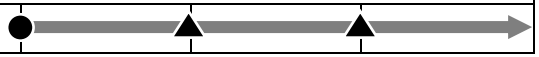
Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
(1) Strategic Approach: Energy Conservation Promotion and Support			
1.1 Measure: Promotion of home energy efficiency labeling			
• Encourage home energy efficiency labeling, particularly in the housing estate business			
1.2 Measure: Promotion of high energy-efficiency equipment/appliance utilization			
• Encourage the use of high energy-efficiency equipment/appliance, e.g. CFL tubes, high efficiency LPG stoves, etc.			
(2) Strategic Approach: Promotion of Technology Development and Innovations			
2.1 Measure: Promotion of R&D on high energy-efficiency equipment/appliances			
• Promote R&D on high energy-efficiency equipment/appliances, e.g. LED light bulbs, heat-pump water heaters, etc.			
2.2 Measure: Support for the development of energy-saving home prototypes			
• Support the design and construction of demonstration energy-saving homes			

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Table 4.6: Framework of Measures and Work Plans for the Transportation Sector

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards			
1.1 Measure: Mandatory energy efficiency labeling for vehicles			
• Enforce energy efficiency labeling for new vehicles	▽ ● ▲	▲	▲
1.2 Measure: Enforcement of the Minimum Energy Performance Standards (MEPS) for vehicles			
• Enforce the minumum fuel economy standard for vehicles	▽	● ▲	▲
(2) Strategic Approach: Energy Conservation Promotion and Support			
2.1 Measure: Encouraging high energy efficiency labeling for vehicles			
• Encourage high energy efficiency labeling for vehicles	●	▲	▲
2.2 Measure: Support for traveling via mass transit systems and goods transport via highly energy-efficient logistics systems			
• Support the development of infrastructure contributing to traveling and goods transportation with high energy efficiency transport systems, e.g. construction of the bus rapid transit (BRT) system, double-track railway, etc.	●	▲	▲
• Exercise Travel Demand Managment (TDM) concurrently with promotion of the use of public transport system to reduce travel demand and traveling by private vehicles, e.g. road-pricing	▽	● ▲	▲
(3) Strategic Approach: Public Awareness (PA) Creation and Behavioral Change			
3.1 Measure: Public relations and creation of eco-driving knowledge			
• Carry out PR and campaigns to create awareness and provide training on/information about engine maintenance and eco-driving to enhance safety while reducing pollution	●	▲	▲
3.2 Measure: Application of tax measures to pave the way for market transformation			
• Introduce tax measures to promote utilization of high energy efficiency and environmentally friendly vehicles, e.g. eco-cars and electric motorcycles	▽ ● ▲	▲	▲
3.3 Measure: Forging ahead with concept and promotion of sustainable transport systems and improvement of air quality in urban areas			
• Designate special zones to prohibit the use of private vehicles causing pollution, e.g.	▽	● ▲	▲

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

Measure/Work Plan	Implementation in Each Phase		
	2011-2015	2016-2020	2021-2030
designation of walking streets, etc.			
• Planning and improvement of land use in support of traveling via public transport systems and non-motorized transport (NMT)			
(4) Strategic Approach: Promotion of Technology Development and Innovations			
4.1 Measure: Promotion of Research and Development			
• Promote R&D on highly energy-efficient equipment technology and change in traveling behavior			
4.2 Measure: Promotion of energy-saving equipment demonstration			
• Promote energy-saving equipment demonstration to enhance wide commercial deployment			

Remarks: ▽ Preparation/Study (if necessary) ● Start operation/expansion ▲ Evaluation/review (on a continuous basis)

4.4 Expected Benefits

The investment in energy conservation in each year will result in energy saving and cumulative avoided carbon dioxide (CO_2) emission in following years throughout the 20-year period of this EEDP. The cumulative final energy saving up to 2030 will be about 289,000 ktoe, or an annual average of 14,500 ktoe, and avoided CO_2 emission at about 976 million tons, or an annual average of 49 million tons. In financial terms, the cumulative savings of energy expenditures will be approximately 5.4 trillion baht, or an annual average of 272 billion baht (Table 4.7). In addition to these direct benefits, other indirect benefits will also be obtained, such as the environmental quality improvement and positive impact on the macroeconomics.

Table 4.7: Expected Benefits from the EEDP Implementation by Economic Sector in the 20-Year Period.

Economic Sector	Annual Average Energy Saving (ktoe)	Annual Average Avoided CO_2 Emission (Million Tons)	Annual Average Value of Energy Savings (Million Baht)
Transportation	6,400	20	141,000
Industry	5,500	17	87,000
Commercial Building & Residential			
- Large Commercial Building	1,100	6	20,000
- Small Commercial Building & Residential	1,500	6	24,000
Total	**14,500**	**49**	**272,000**

Chapter 5: Framework for the First 5-Year Work Plans (2011-2015)

In order that explicit guidelines are in place for the implementation during the first 5-year period (2011-2015) of this 20-Year Energy Efficiency Development Plan (EEDP), annual energy conservation targets have been established, including the development of details of individual work plans. Also presented is the budget framework for the implementation during the first 5-year period, together with the benefits to be derived, if the stipulated measures can be implemented until the specified targets under this phase are successfully achieved.

5.1 Annual Energy Conservation Targets

In the first five years, the achievement of final energy saving as a result of the implementation pursuant to the EEDP in each year should be no less than 1,000 ktoe (thousand tons of crude oil equivalent). The transportation and industrial sectors together must account for the highest share of energy saving, or over 80% of the overall target in each year (Table 5.1).

Table 5.1: Annual Targets of Final Energy Saving.

Economic Sector	Energy Type	Annual Target				
		2011	2012	2013	2014	2015
Industry	Electricity (GWh)	915	1,777	2,670	3,597	4,612
	Heat (ktoe)	299	580	872	1,175	1,506
	Total (ktoe)	**377**	**731**	**1,100**	**1,482**	**1,899**
Commercial Building & Residential						
- **Large Commercial Building**	Electricity (GWh)	734	1,424	2,140	2,884	3,697
	Heat (ktoe)	11	21	32	43	55
	Total (ktoe)	**74**	**142**	**214**	**289**	**370**
- **Small Commercial Building & Residential**	Electricity (GWh)	637	1,237	1,859	2,505	3,212
	Heat (ktoe)	52	102	153	206	264
	Total (ktoe)	**106**	**207**	**311**	**419**	**538**
Transportation	Electricity (GWh)	-	-	-	-	-
	Heat (ktoe)	443	861	1,293	1,743	2,235
	Total (ktoe)	**443**	**861**	**1,293**	**1,743**	**2,235**
Grand Total (ktoe)		**1,000**	**1,942**	**2,913**	**3,932**	**5,041**

5.2 Work Plans and Activities

The framework for the first 5-year work plans provide details of the following: objectives of individual work plans and major activities to be undertaken, in the case of both cross-sector work plans and those by economic sector, as illustrated in Table 5.2.

Table 5.2: Work Plans and Activities in the First 5-Year Period.

CROSS-SECTOR	
Measure: Enforcement of the Energy Conservation Promotion Act (ENCON Act)	
Work Plan: Enforce the ENCON Act, as amended up to B.E. 2550 (2007)	
Objective	To use the legislative tool to compel designated factories/buildings to appoint persons responsible for energy (PRE) to set up energy management systems and report the outcome of energy management, so that concerned authorities could efficiently monitor and verify energy consumption of the facilities.
Major Activities	• Speed up the announcement of the Ministerial Regulation on the qualifications of PRE. • Strictly enforce the legislation on designated buildings and factories, especially the penalty on those who violate the law by not reporting and not setting up energy management systems, including government agencies. • Create a mechanism, involving professionals in the energy conservation field, to respond to the ENCON Act enforcement so that the energy management reports could lead to practically achieved energy saving, by analyzing the reports in depth and recommending guidelines on energy saving implementation to the operators.
Work Plan: Amend the 2007 ENCON Act	
Objective	To enhance energy efficiency of energy-intensive businesses, which have not been considered designated factories or buildings, and business facilities other than factories/buildings.
Major Activities	• Study on the expansion of the 2007 ENCON Act scope to cover small-scale buildings/factories. • Study on the amendment to the 2007 ENCON Act to cover energy consumption of energy-intensive businesses other than factories or buildings, e.g. transport services business, etc.
Measure: Mandatory energy efficiency labeling	
Work Plan: Mandatory labeling for equipment/appliances	
Objective	To compel manufacturers and distributors to put energy efficiency labels on their products to provide options for consumers to choose higher energy efficiency products.
Major Activities	• Compile a list of energy-consuming equipment/appliances that have a wide market base and enforce mandatory labeling. • Lay down rules/criteria for enforcement and penalties with regard to energy efficiency labeling. • Coordinate with the Office of the Consumer Protection Board to issue rules/regulations requiring energy efficiency labeling.

Work Plan: Develop standard testing laboratories	
Objective	To develop testing standards and support the establishment of energy efficiency testing laboratories for testing energy efficiency of machinery/equipment and appliances/vehicles, including energy-saving materials.
Major Activities	• Compile energy efficiency testing standards, both domestic and overseas, of machinery/equipment and appliances/vehicles. • Develop Thailand's testing standards and put the standards into effect. • Encourage the establishment of testing laboratories pursuant to the established standards.
Measure: Enforcement of the Minimum Energy Performance Standards (MEPS)	
Work Plan: Enforce MEPS for equipment/appliances	
Objective	To impose the ENCON Act and relevant Ministerial Regulations on manufacturers and distributors to produce and distribute only products with energy efficiency no less than the officially established standards.
Major Activities	• Speed up the process of MEPS enforcement for equipment/products of which the standards are already in place. • Add product items to which MEPS will be applied, including upgrading MEPS of previously specified products. • Determine the cycle of MEPS enforcement so that manufacturers and distributors would know in advance of the time frame and standard levels to be enforced for individual products, thus allowing them an adequate lead time to meet the new standards.
Measure: Enforcement of the Energy Efficiency Resource Standards (EERS) for large energy businesses	
Work Plan: Enforce the minimum EERS for the electricity supply industry	
Objective	To impose the Energy Industry Act, B.E. 2550 (2007), on the operators of large-scale public electricity industries to help power consumers realize energy saving at no less than the minimum amount specified by the government.
Major Activities	• Appoint a working group, comprising representatives from energy-related government agencies and the private sector, and qualified persons, to determine the criteria of EERS application to the state-owned electricity enterprises. • The working group is to jointly determine the minimum energy saving to be achieved (e.g. in a certain percentage of the average of the total generation or sales during the previous 3-year period), together with the approach for energy saving verification, as well as the rate of penalties for failure to meet the specified EERS and the incentive rate for achievement greater than the specified EERS.

Measure: Execution of voluntary energy-saving agreements	
Work Plan: Engage in voluntary energy-saving agreements with commercial/industrial clusters and business associations	
Objective	To induce business/industrial clusters to engage in energy-saving agreements, via setting energy-saving targets for individual clusters, on a voluntary basis.
Major Activities	• Government agencies should negotiate and execute agreements, on a voluntary basis, with business/industrial clusters of which energy consumption is high, e.g. the Federation of Thai Industries, Board of Trade of Thailand, Thai Bankers' Association, Thai Hotels Association, Transportation and Logistics Association, etc., with clearly specified energy saving targets and approaches to achieve the targets. • The government should provide financial support for campaign expenditure and/or funding for energy-saving activities, under existing schemes, e.g. DSM Bidding and Standard Offer Program (SOP). • Responsible government agencies should monitor and evaluate the implementation outcome in order to develop similar agreements in the future.
Measure: Support and incentive provision to encourage voluntary energy-efficiency labeling	
Work Plan: Make agreements with manufacturers to produce equipment/appliances with high energy performance standard (HEPS)	
Objective	To make agreements with manufacturers of high energy efficiency equipment/appliances and to induce voluntary energy efficiency labeling for such products so that consumers could be informed and could opt to buy products with HEPS.
Major Activities	• Negotiate and make agreements with manufacturers of high energy efficiency equipment/appliances, with government support for campaigns and PR activities aiming to change consumer behavior and to transform the market to the production and consumption of equipment/appliances with HEPS. • Persuade manufacturers and distributors of energy-intensive equipment/appliances and/or products with high total sales to participate in the project.
Work Plan: Support the use of HEPS, low carbon footprint equipment/appliances, or ISO 50001 products	
Objective	To encourage consumers to buy and use equipment/appliances with HEPS, low carbon footprint, or products manufactured by producers with certified Energy Management System (ISO50001).
Major Activities	• Organize PR to provide knowledge of HEPS, carbon footprint or the Energy Management System (ISO50001). • Encourage the purchase of high energy efficiency equipment/appliances by using financial and tax measures, e.g. provision of benefits in terms of pricing, tax deduction or rebate, etc.

Measure: Financial support to subsidize energy saving achieved	
Work Plan: Provide subsidies for energy saving achieved, which can be verified as per the project proposals approved under the DSM Bidding scheme for large-scale business	
Objective	To persuade large business operators to invest in energy conservation activities; the government should consider proposed subsidy rates for achieved energy saving, giving priority to the minimum rate submitted, and the energy saving outcome will be verified and proven at each stage.
Major Activities	• Increase the budget used for supporting the existing projects. • Publicize the projects and disseminate the implementation outcome of measures undertaken by participating business facilities. • Select energy conservation techniques, experiences or measures of which the implementation has proven successful to be standard techniques/measures in order to facilitate and speed up the implementation of measures under the Standard Offer Program (SOP).
Work Plan: Provide subsidies for energy saving achieved and/or peak load reduction that can be verified for retail consumers and small business/industries under the Standard Offer Program (SOP)	
Objective	To encourage all sectors, particularly small energy consumers, e.g. SMEs, to implement energy conservation measures, by providing subsidies for the amount of energy that can be saved and/or reduced peak load, which can be verified and which do not have to undergo the bidding process.
Major Activities	• Appoint a working group to determine the procedures for project participation in order to have the energy saving outcome measured and verified, together with the procedures for subsidy payment. • Prepare a list of proven energy-saving equipment/appliances and techniques to be announced as standard items. • Establish a system where SOP business operators, like ESCO, and energy business operators, like power utilities and gas distributors, can undertake energy conservation activities for energy consumers, and then obtain subsidies under the SOP scheme.
Measure: Support the operation of energy services companies (ESCO)	
Work Plan: Use money from the Energy Conservation Promotion Fund to increase credit lines given by the ESCO Fund	
Objective	To strengthen ESCO and support greater expansion of ESCO business.
Major Activities	• Double the credit line of the ESCO joint venture fund (current support is given via two sources of funds, with a budget of 500 million baht each), using money from the ENCON Fund. • Mobilize capital from financial institutions to increase the ESCO Fund.

Measure: Public relations and provision of knowledge about energy conservation	
Work Plan: Launch PR campaign on energy efficiency measures and technology (HEPS, eco-points, ISO 50001)	
Objective	To publicize and provide knowledge of energy conservation and energy efficiency measures and technology, and to encourage the use of high energy efficient or environmentally friendly equipment/appliances.
Major Activities	• Launch campaigns via various media channels so that consumers and energy users could be informed of products with HEPS, products with carbon footprint labeling and products manufactured by producers with certified Energy Management System (ISO50001). • Cooperate with product manufacturers and distributors in developing a point accumulation system when consumers buy environmentally friendly products (eco-points) so that consumers could collect points to exchange for gifts or cash vouchers, etc.
Work Plan: Organize contests and confer awards (energy management, innovative campaign slogans, etc.)	
Objective	To increase innovations and intensify PR activities to create wide awareness among consumers and energy users of the importance of energy conservation.
Major Activities	• Organize contests and confer complimentary awards to continuously enhance consumer and energy user awareness of the importance of energy conservation. • Add innovations to campaign and PR messages to create awareness leading to a wide impact on behavioral change in energy consumption and utilization.
Work Plan: Draw up syllabuses and activities related to energy conservation in schools and other educational institutions	
Objective	To foster consciousness and create recognition of energy saving among the young.
Major Activities	• Develop energy conservation syllabuses and activities to include energy-saving messages for the young in schools and other levels of educational institutions. • Create networks of the young, e.g. the eco-youth, to carry out activities related to energy conservation on a continuous basis and expand the networks by increasing the network members via disseminating energy conservation concepts and fostering awareness of its importance to include the entire family.
Measure: Putting forth the concept and promoting activities related to the development of a low carbon society and low carbon economy as well as environmental protection	
Work Plan: Encourage local administration organizations (LAOs) and the business sector to undertake activities related to low carbon society and low carbon economy development	

Objective	To forge ahead with the concept and promote activities contributing to the development of low carbon society/economy among LAOs.
Major Activities	• Disseminate the concept of low carbon society/economy development at the community level via agencies under the LAOs. • Support activities contributing to low carbon society/economy development and publicize the implementation outcome, including providing awards for activities with excellent achievements to be examples for future activities.
Measure: Pricing and taxation to push consumers towards behavioral change, create energy conservation awareness and reduce GHG	
Work Plan: Determine energy prices to reflect the actual costs	
Objective	To use pricing measures as a tool to achieve behavioral change and create energy conservation awareness.
Major Activities	• Study the impact of increasing energy prices on energy consumers at all levels and gradually adjust the prices of all energy types to reflect the actual costs, and then allow the market mechanism to determine the prices so that all social spheres would recognize the importance of energy conservation and efficient use of energy. • Explore appropriate assistance measures for small business operators/the underprivileged affected by increasing energy prices, e.g. price subsidies for energy-saving equipment and high energy efficiency machinery, provision of technical assistance to improve energy efficiency, etc.
Work Plan: Undertake tax restructuring to encourage energy conservation and GHG reduction	
Objective	To use tax measures as a tool to stimulate recognition of the necessity to save energy and reduce GHG emissions.
Major Activity	• Study the appropriateness and determine tax structures, e.g. petroleum tax, carbon tax, vehicle tax, annual car plate tax, etc., which will contribute to behavioral change to use energy economically, and also to market transformation so that buyers could opt for products with HEPS and/or low GHG emission.
Measure: Promotion of research and development	
Work Plan: Develop an energy efficiency technology roadmap	
Objective	To determine a plan for energy efficiency technology R&D in the fields that are of high priority.
Major Activities	• Appoint a working group, comprising representatives of government, researchers (universities/research institutes) and industry, to jointly develop an energy efficiency technology R&D roadmap for technologies with high priority, i.e. – Plan to upgrade energy efficiency of common and widely used (cross-cutting) industrial equipment, e.g. electric motors and boilers. – Plan to upgrade energy efficiency of common equipment/appliances used in buildings and homes, e.g. air-conditioners, refrigerators, electric fans, etc.

	– Plan to develop and apply energy consumption control systems in buildings and industrial manufacturing processes. – Plan to develop the combined heat and power (CHP) system (study the economic feasibility and suitable systems for application to different cases). – Plan to develop technology to increase energy efficiency of industry-specific production systems/processes, focusing on the reduction of specific energy consumption (SEC), particularly for SMEs. – Plan to develop vehicle technology, emphasizing engine development to efficiently run on alternative fuels and the development of electric motorcycles. – Plan to develop energy-saving buildings for tropical climate, focusing on the designing of building envelopes and air-conditioning systems which are highly energy efficient.
Work Plan: Promote R&D on equipment/appliances with large markets	
Objective	To promote and provide funding for R&D on energy efficiency improvement technology to enable local design, manufacture and installation, involving equipment/appliances for vehicles and transportation, buildings, building systems, as well as production process technology of industries with large markets.
Major Activities	• Provide funding for R&D work, by encouraging the establishment of cluster networks, comprising representatives of government, researchers (universities/research institutes) and industry, to jointly determine the direction and topics of R&D so that the R&D outcome would meet the needs of end users. • Support the establishment of centers of excellence in specific fields in educational and research institutions.
Measure: Promotion of high energy-efficiency technology demonstration	
Work Plan: Demonstrate energy efficiency technology contributing to high saving impact	
Objective	To promote and provide funding for the development of demonstration projects on technology or equipment with high energy saving potential, as well as market potential, so as to create confidence by investors and financiers in technology applications.
Major Activities	• Establish an agency to be responsible for undertaking study, research, demonstration and dissemination of information about new technology. • Support demonstration projects undertaken by the operators interested to participate in this demonstration scheme. • Disseminate knowledge and provide consultancy, e.g. organizing seminars to publicize the demonstration implementation undertaken in business facilities or developing energy conservation projects with participation of members and general interested operators.

Work Plan: Create cooperation between the public and private sectors, including educational/research institutions	
Objective	To create cooperative networks between the public and private sectors, including educational/research institutions, for demonstration of high energy efficiency technology.
Major Activities	• Establish cluster networks, comprising representatives of government, researchers (universities/research institutes) and interested industry to participate in the demonstration of highly energy-efficient technology. • Support, by government agencies, the demonstration of energy efficiency technology which corresponds with the needs of the networks.
Measure: Support for the development of professionals in the field of energy efficiency	
Work Plan: Build up professionals to serve business operation facilities	
Objective	To provide training courses for professionals in the field of energy efficiency, e.g. energy inspectors, auditors, energy efficiency consultants, building design inspectors in compliance with the building energy code (BEC), etc.
Major Activities	• Support the development and organization of short-term training courses, by providing government funding for the training costs for business personnel, as deemed appropriate. • Organize knowledge tests of persons responsible for energy (PRE) and building design inspectors, on a regular basis, and confer certificates on those who successfully complete the training courses.
Work Plan: Develop experts to serve consultancy agencies/companies and ESCO	
Objective	To enhance human resources of agencies dealing with energy efficiency to become experts, being able to undertake energy analysis and management at a higher level.
Major Activities	• Organize training courses for experts in the field of energy efficiency. • Promote the enhancement of professionalism to increase credibility of ESCOs by assigning a credit rating for them, taking into consideration their past achievements and financial status. • Support the exchange of experiences with overseas ESCOs.
Work Plan: Build up human resources via educational curriculums	
Objective	To increase the number of personnel in the fields of energy efficiency technology, energy management, and energy policy and planning.
Major Activities	• Increase educational funding for persons interested to pursue relevant courses, in the form of both scholarships and research funds for thesis development. • Prepare a summary report on the funding for publication and encourage further application of the outcomes of funded research work.

Measure: Support for the development of institutional capability of agencies/organizations in both public and private sectors	
Work Plan: Enhance institutional capability of agencies/organizations responsible for the planning, supervision and promotion of the implementation of energy efficiency measures	
Objective	To increase the capability of concerned agencies/organizations to be up-to-date so as to be prepared for undertaking their respective functions involving energy efficiency technology and policy innovations.
Major Activities	• Organize training courses and testing of knowledge for responsible personnel to assess the capability of concerned agencies, on a regular and continuous basis. • Organize study visits for decision-making authorities to learn about successful energy efficiency policies in foreign countries.
INDUSTRIAL SECTOR	
Measure: Benchmarking the amount of energy used per unit of product (Specific Energy Consumption: SEC)	
Work Plan: Develop the SEC database and benchmark both domestic and overseas SEC	
Objective	To develop the database and benchmark SEC for the industrial clusters.
Major Activities	• Select industrial clusters and invite them to jointly discuss and determine the benchmarking approach and standards. • Analyze the dispersion, and the mean (average), minimum and maximum values of SEC. • Determine the target of average SEC reduction, on a voluntary basis, and provide technical assistance to the operators whose SEC values are still high. • Follow up and evaluate the outcome achieved by the industrial clusters that have been assisted. • Undertake benchmarking to cover all industrial clusters.
Measure: Promotion of R&D to improve energy efficiency of the production process	
Work Plan: Promote R&D on high energy-efficiency equipment/appliances with large markets and manufacturing bases in Thailand	
Objective	To promote R&D on high energy-efficiency equipment/appliances that are widely used and have manufacturing bases in Thailand with a view to reducing technological costs while increasing the opportunity for technology access.
Major Activities	• Examine and select suitable equipment/appliances that are widely in use and have domestic manufacturing bases for further research and development to have higher energy efficiency. • Cooperate and make agreements with the private sector/industry interested to provide the information/data of R&D that meets the needs and can be practically applied.

COMMERCIAL BUILDING & RESIDENTIAL SECTOR -- COMMERCIAL BUILDING GROUP	
Measure: Enforcement of energy performance standards of buildings	
Work Plan: Enforce the Ministerial Regulation on Building Design for Energy Conservation, B.E. 2552 (2009)	
Objective	To speed up actual enforcement of the Ministerial Regulation on Building Design for Energy Conservation, B.E. 2552 (2009).
Major Activities	• Appoint a working group, comprising concerned agencies, e.g. the Ministry of Energy and the Ministry of Interior, to reach an agreement regarding building design inspection. • Prepare for the readiness of building design inspectors and organize training and tests of knowledge and capability on a regular basis. • Undertake a study to upgrade the standard level every three years.
Measure: Mandatory building energy efficiency labeling	
Work Plan: Enforce energy efficiency labeling for new government buildings	
Objective	To showcase highly energy-efficient new government buildings; this will be an energy efficient exemplar for the private sector.
Major Activities	• Study the issuance of rules, regulations and requirements to have energy efficiency labeling applied to government buildings to be newly constructed. • Evaluate and confer complimentary awards on buildings with high energy efficiency.
Measure: Support for voluntary building energy-efficiency labeling	
Work Plan: Encourage building energy efficiency labeling	
Objective	To encourage the assessment of energy consumption of buildings and voluntary application of building energy efficiency labeling.
Major Activities	• Encourage the measurement and assessment of energy consumption of buildings and building energy efficiency labeling. • Organize contests and give awards to buildings with high energy efficiency. • Add equipment/materials onto the list of items that require assessment for energy efficiency labeling, and continuously upgrade the high energy performance standard (HEPS) for buildings.

Measure: Support for the development of energy-saving building prototypes	
Work Plan: Support the construction of demonstration buildings to be energy-saving building prototypes (e.g. government buildings)	
Objective	To promote building construction/retrofitting to be highly energy efficient so as to be energy-saving building prototypes.
Major Activities	• Select government building construction and/or retrofitting projects to be developed as prototypes of energy-saving buildings. • Carry out public relations and dissemination of methods used to save energy and improve energy efficiency in buildings. • Arrange for publication of compiled information of demonstration energy-saving buildings in foreign countries as well as demonstration buildings in Thailand.
Measure: Promotion of the development of professionals in building energy efficiency	
Work Plan: Build up professionals in building design inspection	
Objective	To enhance the capacity of personnel to act as building design inspectors pursuant to the law on building design for energy conservation, issued in 2009.
Major Activities	• Organize building design inspection training courses and tests to create certified building design inspectors, with 3-year valid certificates. • Set up a committee to examine, monitor and evaluate the training and the duty execution of building inspectors.
COMMERCIAL BUILDING & RESIDENTIAL SECTOR -- RESIDENTIAL GROUP	
Measure: Promotion of home energy efficiency labeling	
Work Plan: Encourage home energy efficiency labeling, particularly in the housing estate business	
Objective	To encourage the assessment of energy consumption and energy efficiency labeling of homes, especially housing estates, aiming to foster awareness to opt for purchasing energy-saving homes.
Major Activities	• Study/collect information and draw up the assessment criteria for home energy efficiency labeling. • Publicize the information about home energy efficiency labeling to make it known to concerned sectors. • Inspect and assess energy consumption in homes/housing and grant energy efficiency labels for those which successfully meet the criteria. • Follow up and evaluate the energy-saving outcome of labeled homes/housing.

Measure: Promotion of high energy-efficiency equipment/appliance utilization	
Work Plan: Encourage the use of equipment/appliances, using new technology and having high energy efficiency	
Objective	To encourage the use of highly energy-efficient equipment/appliances, e.g. the switch to use CFL tubes, LED light bulbs, heat-pump water heaters, etc.
Major Activities	• Undertake a study to determine an appropriate price subsidy rate for the purchase of high energy efficiency equipment/appliances. • Cooperate with the private sector and local organizations to publicize and provide support for the switch to use high energy efficiency equipment/appliances.
Measure: Support for the development of energy-saving home prototypes	
Work Plan: Support the design and construction of demonstration energy-saving houses	
Objective	To support the design and construction of demonstration homes to be examples of energy-saving houses.
Major Activities	• Carry out a publicity campaign to identify persons interested in constructing demonstration homes to serve as examples of energy-saving houses and provide them with technical assistance in construction. • Publicize and disseminate energy-saving home blueprints, by cooperating with local administration organizations for their support for the construction of demonstration homes to be examples of energy-saving houses in provincial areas.

TRANSPORTATION SECTOR	
Measure: Mandatory energy efficiency labeling for vehicles	
Work Plan: Enforce energy efficiency labeling for vehicles	
Objective	To compel vehicle manufacturers and distributors to label vehicle energy efficiency to provide information to consumers so that the latter could opt to buy vehicles with higher energy efficiency.
Major Activities	• Appoint a working group, comprising public agencies, the private sector and qualified academics, to jointly specify the details and format of the vehicle energy efficiency information to be applied. • Develop an inventory of vehicle types and set up a vehicle energy efficiency database. • Determine standard criteria for vehicle energy efficiency testing and carry out the testing in compliance with the stipulated items under the criteria. • Enforce mandatory energy efficiency labeling – to be implemented by the Ministry of Energy or via the Office of the Consumer Protection Board (OCPB). • Benchmark vehicle energy efficiency and publicize the information pertaining to vehicle energy efficiency labels via the automobile-related media mechanism or NGOs.
Measure: Enforcement of the Minimum Energy Performance Standards (MEPS) for vehicles	
Work Plan: Enforce the minumum fuel economy standard for vehicles	
Objective	To exert the ENCON Act and relevant Ministerial Regulations on vehicle manufacturers and distributors to manufacture and distribute only vehicles with energy efficiency not less than the officially specified standard.
Major Activities	• Collect and develop a database on vehicle energy efficiency; analyze and categorize vehicles based on weight and types of application to come up with a statistical range to determine the ranking of vehicle energy efficiency in each category; and study the developing trend of the mean of vehicle energy efficiency of each category. • Lay down guidelines on upgrading the level of MEPS, e.g. to set the current mean of vehicle energy efficiency of each category as the MEPS of vehicles in the future, for instance, in the next 5-7 years; and set forth the cycle of MEPS enforcement so that the manufacturers/distributors would be aware of the timeframe and the standard level to be enforced for each vehicle category and hence could be well prepared to respond to the new standard criteria.

Measure: Encouraging high energy efficiency labeling for vehicles	
Work Plan: Encourage high energy efficiency labeling for vehicles	
Objective	To induce vehicle manufacturers/distributors to display high energy performance standard (HEPS) labels to encourage market transformation, which will help advance the manufacturing and distribution of vehicles with HEPS in the market.
Major Activities	• Discuss with vehicle manufacturers/distributors and encourage the implementation of HEPS labeling with government support in terms of PR campaigns and testing standards. • Launch PR campaigns via mass media to inform the general public about vehicles with HEPS labeling, and consider the use of pricing measures or tax privileges for consumers who buy vehicles with HEPS labeling. • Upgrade the criteria of HEPS by setting forth the cycle of standard review, concurrently with the enforcement of MEPS.
Measure: Support for traveling via mass transit systems and goods transport via highly energy-efficient logistics systems	
Work Plan: Support the development of infrastructure contributing to traveling and goods transportation with high energy efficiency transport systems	
Objective	To support the development of infrastructure systems which will contribute to traveling and goods transportation with high energy efficiency transport systems, e.g. the construction of the bus rapid transit (BRT) system and double-track railway system, etc.
Major Activities	• Continuously allocate budget for the development and improvement of infrastructure inducing traveling via public transport systems, especially mass transit systems which can be constructed in a short time with low costs, e.g. the BRT system. • Improve and encourage efficient utilization of existing rail networks, and develop an extensive double-track railway system with connecting systems to passenger and goods terminals.

Work Plan: Exercise Travel Demand Managment (TDM) concurrently with promotion of the use of public transport systems to reduce travel demand and traveling by private vehicles, e.g. road-pricing	
Objective	To implement TDM measures aimed at reducing travel demand and the use of private vehicles, and to encourage travel mode shift to utilization of public transport systems.
Major Activities	• Explore various forms of TDM measures, e.g. designation of certain inner-city areas as special areas subject to road pricing or prohibition of driving into such areas on odd/even dates based on car plate numbers, taking into consideration the availability of alternative public transport systems if such TDM measures are implemented. • Launch PR campaigns/disseminate information about TDM measures so that car users/the general public would have accurate knowledge and understanding of why the measures are introduced to be well prepared before the measures are actually implemented.
Measure: Public relations and creation of eco-driving knowledge	
Work Plan: Carry out PR and campaigns to create awareness and provide training on/information about engine maintenance and eco-driving to enhance safety while reducing pollution	
Objective	To publicize and disseminate knowledge/techniques of engine maintenance and application of oil-saving auxiliary equipment, including organizing campaigns to build up awareness of energy-saving driving (eco-driving), which will enhance safety and reduce pollution emissions.
Major Activities	• Organize training/PR activities to provide the general public and logistics operators with knowledge about engine maintenance, the application of techniques/auxiliary equipment that help reduce oil consumption, and eco-driving. • Cooperate with local educational institutions to provide knowledge of and support for engine checks and modifications to save energy.
Measure: Application of tax measures to pave the way for market transformation	
Work Plan: Introduce tax measures to promote utilization of high energy efficiency and environmentally friendly vehicles, e.g. eco-cars and electric motorcycles	
Objective	To promote greater use of high energy efficiency vehicles and gear the market direction towards environmentally friendly vehicles.
Major Activities	• Explore appropriate tax measures to support the use of high energy efficiency vehicles, e.g. import tax reduction, tax credits. • Publicize the supportive measures for the use of high energy efficiency vehicles to create general public awareness and to encourage them to opt for high energy efficiency vehicles.

Measure: Forging ahead with concept and promotion of sustainable transport systems and improvement of air quality in urban areas	
Work Plan: Designate special zones to prohibit the use of private vehicles causing pollution, e.g. designation of walking streets	
Objective	To reduce the use of private vehicles and pollution emissions in inner-city areas and to promote the use of public transport systems, e.g. designation of certain streets as walking streets, etc.
Major Activities	• Select suitable areas (e.g. areas where public transport systems can be easily accessed). • Appoint a working group, comprising local authorities, business operators and people residing in concerned areas, to jointly determine the implementation format so that the area management would be suitable and accepted by the general public. • Launch PR campaigns to make the project widely known and evaluate the project achievement. • Prepare PR publications to disseminate the concept and showcase examples of project achievements so that implementation could be replicated in other areas.
Work Plan: Planning and improvement of land use in support of traveling via public transport systems and non-motorized transport (NMT)	
Objective	To support the concept of land use planning and improvement in support of traveling via public transport systems and NMT, e.g. walking, riding bicycles, etc.
Major Activities	• Develop a handbook on land use planning and improvement to facilitate traveling via public transport systems and to shorten the travel distance. • Deliver training courses on land use management to concerned personnel of local administration organizations. • Organize study visits, both domestic and overseas, for town and country planning personnel to learn about land use management that successfully supports traveling via public transport systems.
Measure: Promotion of Research and Development	
Work Plan: Promote R&D on highly energy-efficient equipment technology and change in traveling behavior	
Objective	To promote R&D on highly energy-efficient equipment technology as well as research study to induce change in traveling behavior.
Major Activities	• Establish network groups to determine the topics for technology research related to high energy efficiency equipment for vehicles, and support R&D on energy-saving equipment technology and high efficiency vehicle components, e.g. battery development for electric motorcycles and development of auxiliary equipment that helps reduce oil consumption, etc. • Support research study on vehicle purchasing behavior and traveling behavior to be used in determining measures to promote and support the purchase of highly energy-efficient vehicles and traveling via public transport systems.

Measure: Promotion of energy-saving equipment demonstration	
Work Plan: Promote energy-saving equipment demonstration to enhance wide commercial deployment	
Objective	To support demonstration of the use of energy-saving equipment that has been technically proven to enhance commercial deployment.
Major Activities	• Support demonstration of the application of energy-saving equipment technology that has been developed and is in use in foreign countries to logistics operators in Thailand. • Study the cost effectiveness of commercial application of demonstrated energy-saving equipment technology and promote greater deployment via various supportive measures.

5.3 Budget Framework

In the first five years, this EEDP will receive funding from the government, especially from the Energy Conservation Promotion Fund, totaling 29.5 billion baht, or an average of 5.9 billion baht per year. This implementation budget can be classified by type of expenditure as follows: direct funding for energy saving achieved, 20 billion baht (68%); management and public relations activities, 3 billion baht (10%); infrastructure development to accommodate mandatory measures on standards and energy efficiency labeling, 1.5 billion baht (5%); funding for research, development and demonstration work, 3.5 billion baht (12%); and human resources and institutional capacity development, 1.5 billion baht (5%), (Figure 5.1). If the budget is allocated by economic sector (based on the indicated share of primary energy saving target), it will be as follows: the industrial sector, 11 billion baht; the transportation sector, 9.5 billion baht; and the commercial building & residential sector, divided into the large commercial building group, 4 billion baht, and the small commercial building and residential group, 5 billion baht, (Figure 5.2). In this regard, government investment in energy conservation promotion is considered to be cost effective, with an average investment of 2,000-6,000 baht per ton of crude oil equivalent (toe) that can be saved.

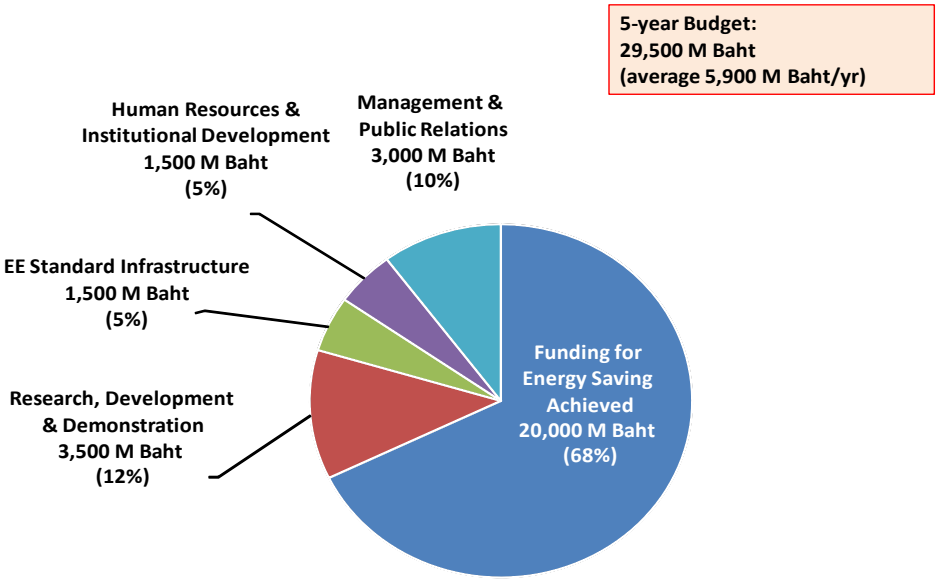


Figure 5.1: Budget Allocation by Type of Expenditure

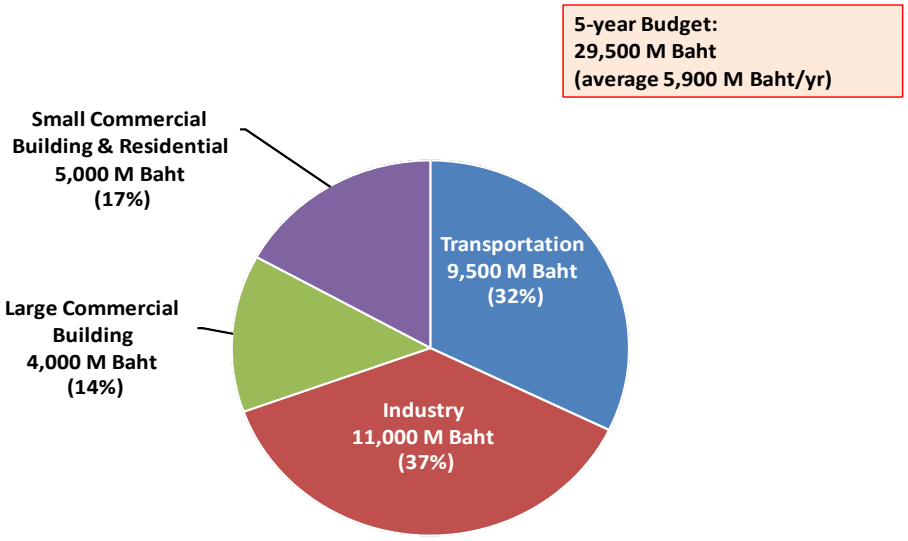


Figure 5.2: Budget Allocation by Economic Sector

5.4 Expected Benefits

If the measures specified in the first 5-years of this EEDP are successfully implemented, it will result in cumulative energy saving and avoided carbon dioxide (CO_2) emission in following years throughout the 5-year period. Given the framework of the short-term work plan, cumulative final energy saving up to 2015 will total 14,830 ktoe (divided into fuel at 11,950 ktoe and electricity at 33,900 GWh), accounting for an annual average saving of 2,960 ktoe. About 50 million tons of avoided CO_2 emission, or an annual average of 10 million tons, can also be achieved. In financial terms, the cumulative savings of energy expenditure will be approximately 278.54 billion baht, or an annual average of 55.7 billion baht (Table 5.3).

Table 5.3: Expected Benefits from the First 5-Year EEDP Implementation in Each Economic Sector

Economic Sector	Annual Average Energy Saving (ktoe)	Annual Average Avoided CO_2 Emission (M Tons)	Annual Average Value of Energy Saving Achieved (M Baht)
Transportation	1,300	4	28,700
Industry	1,120	4	17,900
Commercial Building & Residential			
- **Large Commercial Building**	220	1	3,800
- **Small Commercial Building & Residential**	320	1	5,300
Total	**2,960**	**10**	**55,700**

Chapter 6: EEDP Mobilization and Success Factors

6.1 EEDP Mobilization

In order to successfully implement the 20-Year Energy Efficiency Development Plan (2011-2030) to achieve the specified target by 2030, effective mechanisms for mobilization are required. As a result, agencies and organizations to be responsible for the implementation of the given strategic approaches and measures are clearly specified in this EEDP, as shown in Table 6.1.

Table 6.1: Agencies/Organizations Responsible for the Implementation of Strategic Approaches and Measures in Each Economic Sector under the 20-Year EEDP (2011-2030).

CROSS-SECTOR	
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards	
1.1 Enforcement of the Energy Conservation Promotion Act (ENCON Act)	**Ministry of Energy,** Ministry of Industry, Ministry of Interior, Ministry of Transport
1.2 Mandatory labeling	**Ministry of Energy, Office of the Prime Minister,** Ministry of Industry, Ministry of Commerce, Ministry of Interior, Ministry of Science and Technology, Ministry of Education
1.3 Enforcement of the Minimum Energy Performance Standards (MEPS)	**Ministry of Energy, Ministry of Industry** Ministry of Commerce, Ministry of Science and Technology, Ministry of Education
1.4 Enforcement of the Energy Efficiency Resource Standards (EERS) for large energy business	**Ministry of Energy, Energy Regulatory Commission,** Ministry of Finance, Ministry of Interior, Ministry of Transport, Ministry of Industry
(2) Strategic Approach: Energy Conservation Promotion and Support	
2.1 Execution of voluntary energy-saving agreements	**Ministry of Energy, Ministry of Industry Federation of Thai Industries,** Ministry of Interior, Ministry of Transport Business Associations/Clusters
2.2 Support and incentive provision to encourage voluntary energy-efficiency labeling	**Ministry of Energy, Ministry of Industry Federation of Thai Industries** Ministry of Science and Technology, Ministry of Education, Ministry of Finance
2.3 Financial support to subsidize energy saving achieved	**Ministry of Energy,** Ministry of Industry Ministry of Interior, Ministry of Transport, Ministry of Finance, Associations/Businesses, ESCO Companies
2.4 Support the operation of energy services companies (ESCO)	**Ministry of Energy,** Ministry of Industry, Ministry of Interior, Financial Institutions, ESCO Companies

(3) Strategic Approach: Public Awareness (PA) Creation and Behavioral Change	
3.1 Public relations and provision of knowledge about energy conservation	**Ministry of Energy, Ministry of Education, Ministry of Natural Resources and Environment, Office of the Prime Minister, Ministry of Interior, Ministry of Transport, Ministry of Industry**
3.2 Putting forth the concept and promoting activities related to the development of low carbon society and low carbon economy as well as environmental protection	**Ministry of Natural Resources and Environment, Thailand Greenhouse Gas Management Organization (Public Organization), Ministry of Industry, Ministry of Interior,** Ministry of Transport, Ministry of Energy, Ministry of Public Health, Ministry of Finance, Ministry of Commerce, Associations/Businesses
3.3 Pricing and taxation to push consumers towards behavioral change, create energy conservation awareness and reduce GHG	**Ministry of Energy, Ministry of Finance, Ministry of Natural Resources and Environment, Thailand Greenhouse Gas Management Organization (Public Organization),** Ministry of Industry, Ministry of Interior, Ministry of Transport, Ministry of Commerce, Ministry of Foreign Affairs
(4) Strategic Approach: Promotion of Technology Development and Innovations	
4.1 Promotion of research and development	**Ministry of Energy, Ministry of Science and Technology, Ministry of Industry,** Ministry of Transport, Ministry of Interior, Ministry of Education, Associations/Businesses
4.2 Promotion of high energy-efficiency technology demonstration	**Ministry of Energy, Ministry of Science and Technology,** Ministry of Industry, Ministry of Transport, Ministry of Interior, Associations/Private Sector
(5) Strategic Approach: Human Resources and Institutional Capability Development	
5.1 Support for the development of professionals in the field of energy efficiency	**Ministry of Energy, Ministry of Education, Ministry of Industry, Ministry of Interior,** Ministry of Science and Technology, Ministry of Natural Resources and Environment, Ministry of Labour, Ministry of Transport, Council of Engineers, Architects Council of Thailand
5.2 Support for the development of institutional capability of agencies/organizations in both public and private sectors	**Ministry of Energy, Ministry of Education, Ministry of Industry, Ministry of Interior,** Ministry of Science and Technology, Ministry of Natural Resources and Environment, Ministry of Labour, Ministry of Transport, Council of Engineers, Architects Council of Thailand

INDUSTRIAL SECTOR	
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards	
1.1 Enforcement of MEPS for the production process	**Ministry of Industry, Ministry of Energy, Federation of Thai Industries**, Industrial Associations/Clusters
(2) Strategic Approach: Energy Conservation Promotion and Support	
2.1 Benchmarking the amount of energy used per unit of products (SEC)	**Ministry of Industry, Ministry of Energy, Federation of Thai Industries**, Industrial Associations/Clusters
(3) Strategic Approach: Promotion of Technology Development and Innovations	
3.1 Promotion of R&D to improve energy efficiency of the production process	**Ministry of Industry, Ministry of Energy, Federation of Thai Industries**, Ministry of Science and Technology, Ministry of Education, Industrial Associations/Clusters
COMMERCIAL BUILDING & RESIDENTIAL SECTOR – COMMERCIAL BUILDING GROUP	
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards	
1.1 Enforcement of the building energy code (BEC)	**Ministry of Energy, Ministry of Interior,** Ministry of Science and Technology, Ministry of Education, Council of Engineers, Architects Council of Thailand
1.2 Mandatory building energy efficiency labeling	**Ministry of Interior, Ministry of Energy,** Ministry of Science and Technology, Ministry of Education, Council of Engineers, Architects Council of Thailand
(2) Strategic Approach: Energy Conservation Promotion and Support	
2.1 Support for voluntary building energy-efficiency labeling	**Ministry of Interior, Ministry of Energy,** Ministry of Science and Technology, Ministry of Education, Council of Engineers, Architects Council of Thailand
(3) Strategic Approach: Promotion of Technology Development and Innovations	
3.1 Support for the development of energy-saving building prototypes	**Ministry of Energy**, **Ministry of Interior,** Ministry of Science and Technology, Ministry of Education, Council of Engineers, Architects Council of Thailand
(4) Strategic Approach: Human Resources and Institutional Capability Development	
4.1 Promotion of the development of professionals in building energy efficiency	**Ministry of Energy, Ministry of Interior,** Ministry of Education, Council of Engineers, Architects Council of Thailand

COMMERCIAL BUILDING & RESIDENTIAL SECTOR – RESIDENTIAL GROUP	
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards	
1.1 Promotion of home energy efficiency labeling	**Ministry of Energy, Ministry of Interior**
1.2 Promotion of high energy-efficiency equipment/appliance utilization	**Ministry of Energy, Ministry of Interior,** Ministry of Finance
(2) Strategic Approach: Promotion of Technology Development and Innovations	
2.1 Promotion of R&D on high energy-efficiency equipment/appliances	**Ministry of Industry, Ministry of Science and Technology, Ministry of Energy, Ministry of Interior, Ministry of Education,** Private Sector/Business Clusters
2.2 Support for the development of energy-saving home prototypes	**Ministry of Interior, Ministry of Energy,** Council of Engineers, Architects Council of Thailand, Private Sector/Business Clusters
TRANSPORTATION SECTOR	
(1) Strategic Approach: Mandatory Requirements via Rules, Regulations and Standards	
1.1 Mandatory energy efficiency labeling for vehicles	**Office of the Prime Minister, Ministry of Energy,** Ministry of Industry, Ministry of Science and Technology, Ministry of Education, Ministry of Transport
1.2 Enforcement of the Minimum Energy Performance Standards (MEPS) for vehicles	**Ministry of Industry, Ministry of Natural Resources and Environment, Ministry of Energy,** Ministry of Science and Technology, Ministry of Education
(2) Strategic Approach: Energy Conservation Promotion and Support	
2.1 Encouraging high energy efficiency labeling for vehicles	**Ministry of Natural Resources and Environment, Ministry of Energy,** Ministry of Transport, Ministry of Science and Technology, Ministry of Education
2.2 Support for traveling via mass transit systems and goods transport via highly energy-efficient logistics systems	**Ministry of Transport, Bangkok Metropolitan Administration, Ministry of Interior, Office of the Prime Minister, Office of the National Economic and Social Development Board, Ministry of Commerce,** Ministry of Energy, Ministry of Finance, Ministry of Natural Resources and Environment, Ministry of Science and Technology, Ministry of Education
(3) Strategic Approach: Public Awareness (PA) Creation and Behavioral Change	
3.1 Public relations and creation of eco-driving knowledge	**Ministry of Energy, Ministry of Transport, Office of the Prime Minister, Ministry of Education, Ministry of Interior,** Ministry of Science and Technology, Ministry of Public Health, Private Sector

3.2 Application of tax measures to pave the way for market transformation	**Ministry of Finance, Ministry of Natural Resources and Environment, Ministry of Energy, Ministry of Transport,** Ministry of Education, Ministry of Science and Technology
3.3 Forging ahead with concept and promotion of sustainable transport systems and improvement of air quality in urban areas	**Ministry of Transport, Bangkok Metropolitan Administration, Ministry of Interior, Ministry of Natural Resources and Environment,** Ministry of Energy, Ministry of Public Health, Ministry of Science and Technology, Ministry of Education, Private Sector
(4) Strategic Approach: Promotion of Technology Development and Innovations	
4.1 Promotion of Research and Development	**Ministry of Science and Technology, Ministry of Energy, Ministry of Education, Ministry of Transport**
4.2 Promotion of energy-saving equipment demonstration	**Ministry of Science and Technology, Ministry of Energy, Ministry of Education, Ministry of Transport**

Remarks:

1) **Focal Agency** (in bold letters) means an agency with direct responsibility for the implementation pursuant to the strategic approaches and measures to achieve specified targets.
2) **Support Agency** (in regular letters) means an agency providing support to the Focal Agency in the implementation pursuant to the strategic approaches and measures to achieve specified targets.

6.2 Success Factors

To achieve the targets specified under this EEDP will need cooperation and determination of various concerned agencies in both public and private sectors, particularly in the following actions which are key factors to the success of this plan:

(1) The development of management systems as well as management tools, e.g. the development of an energy consumption database and the reporting, verification and assessment systems; the establishment of a dedicated independent body with flexibility to implement energy conservation promotion measures; and the development of a mechanism, at the policy level, to enhance cross-ministry energy conservation promotion and monitoring.

(2) Adequate and continuous budget allocation to support work plans and activities under the plans, e.g. it can be developed as a rolling plan every 3-5 years.

(3) The development of human resources and institutional capability of concerned organizations on a continuous basis to become professional, especially to build up personnel with understanding of the concept and business practices of the private sector.

(4) Public agencies should take a lead role and should set a good example in such implementation as the green procurement – to set a policy requiring procurement of goods/services which are energy efficient and environmentally friendly; the deployment of ESCO services and the implementation of energy-saving measures in government buildings.

(5) The determination of energy prices which reflect actual costs and the application of tax measures as a tool to promote energy conservation and to reduce GHG emissions.

(6) As the assessed energy-saving potential is only slightly higher than the specified energy-saving target and as the potential does not include the impact which may occur resulting from the industrial restructuring to be less energy-intensive or the transportation system restructuring to the rail and mass transit systems, concerned agencies should, therefore, explicitly formulate policies and development plans in the long term, with due consideration for the impact on energy consumption.

APPENDIX A

Name List of the Study Team

STUDY TEAM

Project Leader

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Principal Researchers

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Mr. Karun Pantong	Joint Graduate School of Energy and Environment
Ms. Autsadaporn Tungjai	Joint Graduate School of Energy and Environment
Ms. Jintaluk Kidhen	Joint Graduate School of Energy and Environment
Ms. Orathai Chaisinboon	Joint Graduate School of Energy and Environment

APPENDIX B

Order of the Ministry of Energy
on the
Appointment of the Steering Committee
on the 20-Year Energy Efficiency Plan Development

(Unofficial Translation)

Order of the Ministry of Energy
No. 9/2554

Subject: Appointment of the Steering Committee on the 20-Year Energy Efficiency Plan Development

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Whereas the Ministry of Energy has a policy to forge ahead with energy conservation materialization in all social spheres of the country, it is essential to develop an energy efficiency plan for 20-year implementation to address national energy crisis problems and to lay down guidelines on energy conservation development of the country in the future.

Consequently, in order to ensure smooth, comprehensive and efficient implementation of the foregoing to achieve the objective, in compliance with the energy policy of the government, the Ministry of Energy deems it appropriate to order the following:

1. The Order of the Ministry of Energy, No. 4/2553, on the Appointment of the Steering Committee on the 15-Year Energy Efficiency Plan Development, dated 29 March 2010, shall be annulled.
2. The Steering Committee on the 20-Year Energy Efficiency Plan Development is hereby appointed with members and authority and duties as follows:

Members:

1.	Permanent Secretary of Energy	Chairman
2.	Deputy Permanent Secretary of Energy (Mr. Kurujit Nakornthap)	Vice-Chairman
3.	Director General, Department of Alternative Energy Development and Efficiency	Member
4.	Director General, Department of Energy Business	Member
5.	Director, Policy and Strategy Coordination Office, Ministry of Energy	Member
6.	Representative of the Office of the National Economic and Social Development Board	Member
7.	Representative of the Department of Industrial Works, Ministry of Industry	Member
8.	Representative of the Thai Industrial Standards Institute, Ministry of Industry	Member
9.	Representative of the Office of Transport and Traffic Policy and Planning, Ministry of Transport	Member

10.	Representative of the Electricity Generating Authority of Thailand	Member
11.	Representative of the Federation of Thai Industries	Member
12.	Representative of the Thai Chamber of Commerce	Member
13.	Representative of the Sub-Committee on Energy Conservation Program Implementation Evaluation	Member
14.	Prof. Dr. Praipol Koomsup	Member
15.	Prof. Dr. Bundhit Eua-arporn	Member
16.	Assoc. Prof. Dr. Sorawit Narupiti	Member
17.	Dr. Tienchai Chongpeerapieng	Member
18.	Mr. Paitoon Pityachawan	Member
19.	Director General, Energy Policy and Planning Office	Member & Secretary
20.	Deputy Director General, Energy Policy and Planning Office, supervising the Energy Conservation and Renewable Energy Policy Bureau	Member & Assistant Secretary
21.	Director, Energy Conservation and Renewable Energy Policy Bureau	Member & Assistant Secretary

Authority and Duties:

1. Lay down policy and direction of the 20-Year Energy Efficiency Plan development;
2. Monitor, speed up and follow up the progress of the 20-Year Energy Efficiency Plan development;
3. Periodically report the progress of the 20-Year Energy Efficiency Plan development to the Minister of Energy;
4. Appoint working groups to support the implementation, as deemed appropriate; and
5. Perform any other task as assigned by the Ministry of Energy.

This order shall come into force with immediate effect.

Issued on 25 February 2011

-- Signature --

(Mr. Wannarat Channukul)
Minister of Energy