



The Role of Thai Energy Policy and Strategies in Sustainable Development

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Abstract

Thailand's energy demand is increasing each year. Measures to reduce dependency on imported energy are implemented to reduce the trade deficit. Therefore, establishing proper energy policy and strategies, together with efficient energy management, is crucial to ensure energy supply security for sustainable growth of the country. Energy diversification is an important means to enhance security of energy supply. Thailand has indigenous natural gas reserves and abundant renewable energy sources; therefore, efforts will be made to maximize the use of our own energy resources. Moreover, natural gas and renewable energy are cleaner energy that will help to reduce adverse environmental impact of energy supply.

More importantly, to promote greater use of alternative and renewable energy as well as R&D on technology and utilization of such energy, of which the costs are still high, financial incentives from the government are available, mainly through the Energy Conservation Promotion Fund. This aims to create a greater market for alternative and renewable energy and to make it competitive with conventional fuels in the long run.

Key words : biofuels, energy, environmental impact, policy and strategies, sustainable development

1. Overview on Thailand's Energy Sector Management

In the past, energy management was handled by various departments under different ministries. However, the overall management of the energy sector was under the National Energy Policy Council (NEPC), established under the National Energy Policy Council Act, B.E. 2535 (1992) and

chaired by the Prime Minister.

To enhance efficient management, the Energy Policy Committee (EPC) was established to assist with the work of the NEPC, chaired by the Minister to the Prime Minister's Office responsible for energy.

Additionally, the NEPC is responsible for the promotion of energy conservation and the management of

the Energy Conservation Promotion Fund (ENCON Fund) according to the Energy Conservation Promotion Act, B.E. 2535 (1992). The Energy Conservation Promotion Fund Committee has been established to assist the NEPC with the ENCON Fund management and to ensure that allocations from the ENCON Fund are made in compliance with the regula-

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Figure 1 Thai Oil Rig in Kamphaeng Phet Province

tions stipulated in the Act.

The Energy Policy and Planning Office (EPPO), formerly known as the National Energy Policy Office under the Office of the Prime Minister, served as the Secretariat to the NEPC, EPC and the ENCON Fund Committee.

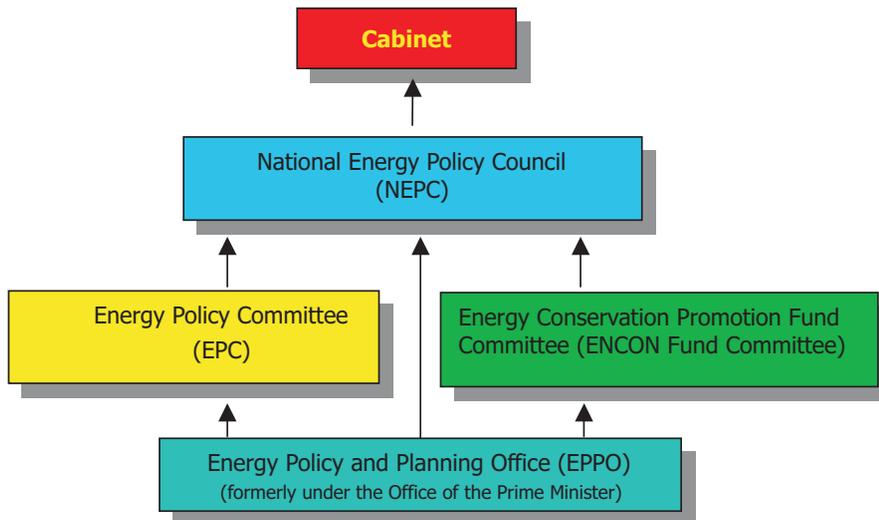
In October 2002, after the bureaucratic reform of the Thai government, the Ministry of Energy was established. Various energy-related agencies that used to be scattered under different ministries have been transferred to be under the Ministry of Energy so that the energy sector

management and the planning and development of national energy programs, including regulation, would be more streamlined.

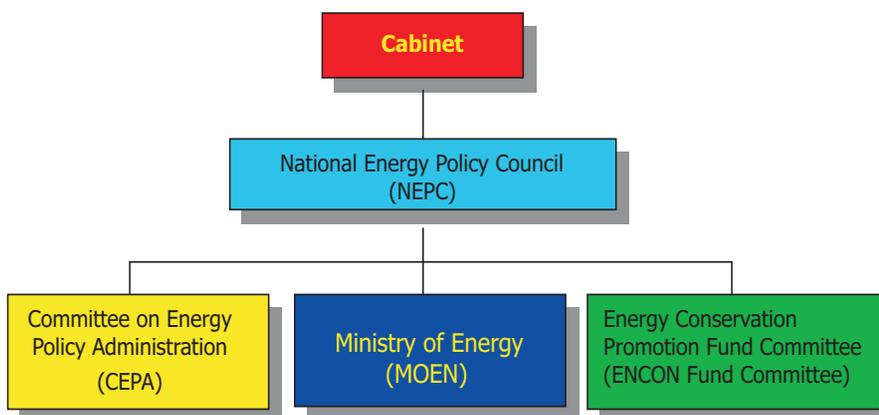
The Energy Policy Committee (EPC) was renamed as the Committee on Energy Policy Administration (CEPA), chaired by the Minister of Energy.



Former Organizational Structure of Thailand's Energy Sector Management



Current Organizational Structure of Thailand's Energy Sector Management



* EPPO, now under the MOEN, still serves as Secretariat to the NEPC, CEPA and ENCON Fund Committee.

2. Thailand's Energy Situation

Thailand is the biggest consumer of energy in the Southeast Asian region. Since energy is a major driving force for the economic growth, it is essential that the Ministry of Energy ensure energy supply security to fuel the country's growth and development.

In 2004, the demand for primary commercial energy increased by 7.6% compared with that in 2003. The demand for refined oil products increased by 10.5% and natural gas and lignite by 3.6% and 18.7% respectively. The demand for imported coal increased by 6.2% and imported electricity/hydropower decreased by 11.8%. The demand for electric power in 2004 increased by 7.4% compared with the previous year.

On the supply side, the production of primary commercial energy in 2004 increased by 1.0% from the previous year. Crude oil production decreased by 11% due to the maintenance shutdown of Benjamas oil field of Chevron for two weeks in January and the three-week shutdown in April of the Big Oil Project for new pipeline connection for new tankers. Lignite production increased by 6.8% while the hydropower decreased by 18.2% due to long drought.



Figure 2 Biodiesel Station

The total installed generating capacity of Thailand as at the end of 2004 is 26,056 MW, 59% of which belongs to the EGAT Public Company Limited (Formerly Electricity Generating Authority of Thailand, or EGAT, which has been corporatized since 24 June 2005). The remainder is constituted by Independent Power Producers (IPPs), Small Power Producers (SPPs) and exchange/import from neighboring countries, account-

ing for 31%, 8% and 2% respectively.

The ratio of commercial primary energy import to the total demand in 2004 was 68%, increasing from 64% in 2003. The total value of Thailand's energy import in 2004 was 536 billion Baht (or almost 13.4 billion US\$). Of this amount, 89% was spent on the import of crude oil and refined oil products. The total expenditure on energy of the country in 2004 amounted to 15.4% of the GDP.

Demand, Production, (Net) Import of Primary Commercial Energy ^(a)

Unit : ktoe

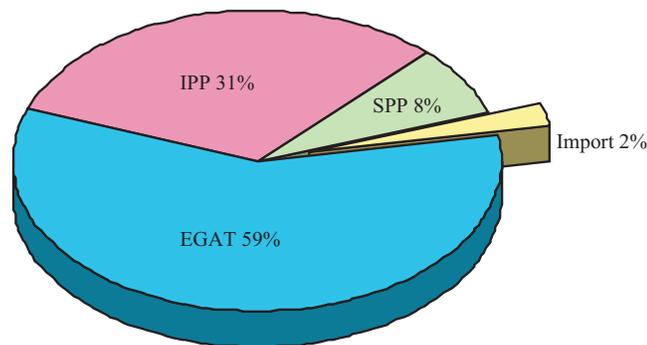
	2003	2004	Change (%)
Demand ^(b)	67,219	72,292	7.6
Production	33,382	33,695	1.0
(Net) Import	43,368	49,460	14.0
Import/total demand (%)	64.0	68.0	
Economic Growth Rate (%) [*]	6.9	6.1	
(*Source : NESDB)			

(a) Commercial primary energy comprises crude oil, natural gas, condensate, petroleum products, hydro-electricity and coal/lignite

(b) Exclusive of stock change and non-energy use, i.e. use of asphalt, NGL, condensate, LPG and naphtha as feedstock in the petrochemical industry.



**Total Installed Generating Capacity
(as of December 2004 : 26,056 MW)**



Thailand had a trade surplus during 2001 to 2004. However during January to April of 2005, Thailand experienced a trade deficit of approximately 185 billion baht. One of the main reasons of the trade

deficit was oil and other fuel import. The ratio of oil and other fuel import value to the total import value increased from 11.6% in 2001 to 14.0% and 15.3% in 2004 and 2005 (January to April) respectively. The

growth of oil and other fuel import, compared with the same period in the past, increased from 15.7% in 2001 to 44.1% and 60.8% in 2004 and 2005 (January to April) respectively.

Balance of Trade

UNIT : Billion Baht

<u>Value</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005 (JAN-APR)</u>
Export	2,887	2,924	3,326	3,922	1,287
Import	<u>2,752</u>	<u>2,775</u>	<u>3,138</u>	<u>3,840</u>	<u>1,472</u>
Balance of Trade	<u>135</u>	<u>149</u>	<u>188</u>	<u>82</u>	<u>-185</u>

Source : Customs Department

The Component of Oil and Other Fuel Import

UNIT : Billion Baht

<u>Value</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005 (JAN-APR)</u>
Oil and other fuels	318	320	372	536	225
Others	<u>2,434</u>	<u>2,455</u>	<u>2,766</u>	<u>3,304</u>	<u>1,247</u>
Total import	2,752	2,775	3,138	3,840	1,472
Ratio of oil and other fuels (%)	11.6	11.5	11.9	14.0	15.3
Growth of oil and other fuels (%)	<u>15.7</u>	<u>0.7</u>	<u>16.1</u>	<u>44.1</u>	<u>60.8</u>

Source : Customs Department



3. Thailand's Energy Policy Framework

With a view to reducing dependency on imported energy and strengthening energy supply security in order to achieve sustainable development, the Thai government has emphasized secure, adequate energy supply and sustainable energy use while mitigating the impact of energy development and utilization on the environment through the following energy policy framework:

- to promote energy supply diversities, emphasizing the use of indigenous energy resources, such as natural gas;
- to promote efficient procurement and use of alternative energy sources; and
- to emphasize energy management to increase competitiveness of Thailand's production sector and to enhance stability of energy prices.

4. Thailand's Energy Strategies

The cabinet passed a resolution at its meeting on 2 September 2003 approving the targets and strategies for the national energy development, as presented by the Ministry of Energy. The objectives are to enhance energy supply security, to increase energy efficiency of the country, to enhance Thailand to be the "Regional Energy Center" and to provide access to energy with fair prices so as to improve the quality of life of people nationwide. In this regard, the Ministry of Energy has proposed the targets, among others, to reduce the national energy elasticity, or the

ratio of energy consumption growth rate to the Gross Domestic Product (GDP) growth, from 1.4:1 to 1:1 by the year 2007 and to increase the share of renewable energy in the national energy mix from 0.5% to 8% by 2011.

In this connection, four major strategic plans in the energy sector have been formulated as follows :

- a) Strategic Plan for Energy Efficiency
- b) Strategic Plan for New & Renewable Energy Development
- c) Strategic Plan for Energy Security Enhancement
- d) Strategic Plan for Thailand to Be the "Regional Energy Center."

a) Strategic Plan for Energy Efficiency

An important strategy to help decrease the growth rate of the national commercial energy demand is to increase energy efficiency and economic value of energy consumption. The proactive national energy policy matrix is, therefore, aimed at reducing the national energy elasticity from 1.4:1 to 1:1 by the year 2007.

The implementation under this strategy involves the study, R&D and support to bring about efficient use of energy in the transportation, industrial and household sectors. Importance is attached to the two major energy intensive sectors, that is, transportation and industrial sectors which accounted for about 38% and 36% of the total energy demand respectively in 2004. The implementation is expected to help save 20-

25% of energy consumption by the year 2009, equivalent to 169 billion baht, which means a substantial reduction of dependency on imported energy.

• Energy Efficiency Improvement in the Transportation Sector

In the transportation sector, in order to increase energy efficiency, emphasis is placed on the improvement of efficient multi-mode transportation infrastructure. Thailand's mass transport networks will undergo a massive 900 billion Baht (or 22 billion US\$) expansion to improve access and reduce oil consumption.

Investment by both the public and private sectors will be encouraged in the multi-modal transport system, coastal navigation and logistic networks related to transportation. Focus will be on the improvement and promotion of greater use of the energy-efficient rail mode for both freight and passenger transport, instead of using cars and light/heavy trucks. Also, oil transportation via pipeline networks will be promoted.

The mass transport infrastructure in Bangkok and suburbs will be integrated and expanded. It is expected that the implementation of this mega-project will be completed within 5 years.

• Energy Efficiency Improvement in the Industrial Sector

For the industrial sector, emphasis is placed on the improvement of the industrial structure to increase competitive potential and review of



the investment promotion direction to shift high-energy intensive to low-energy intensive manufacturing, paying greater importance to the economic value. Major measures include tax incentive to boost energy efficiency improvement in factories and goods transportation and tax exemption for auditable energy saving for industrial and commercial firms. Besides, implementation of the following will be speeded up--energy efficiency labeling for electrical appliances and cars, establishment of energy conservation certification for factories, and promotion of co-generation and district cooling/heating systems.

Mandatory preliminary energy audits, development of the energy conservation target and plan of each designated factory/building, and energy conservation investment according to the plan are still going on under the Energy Efficiency Improvement Program of the national Energy Conservation Plan, with financial assistance from the ENCON Fund.

To stimulate serious energy efficiency implementation in designated facilities, review is being carried out on the introduction of punitive measures, that is, the surcharge rates for designated facilities, pursuant to Article 43 of the Energy Conservation Promotion Act (1992), for violation or failure to comply with relevant laws and regulations on energy efficiency in designated facilities.

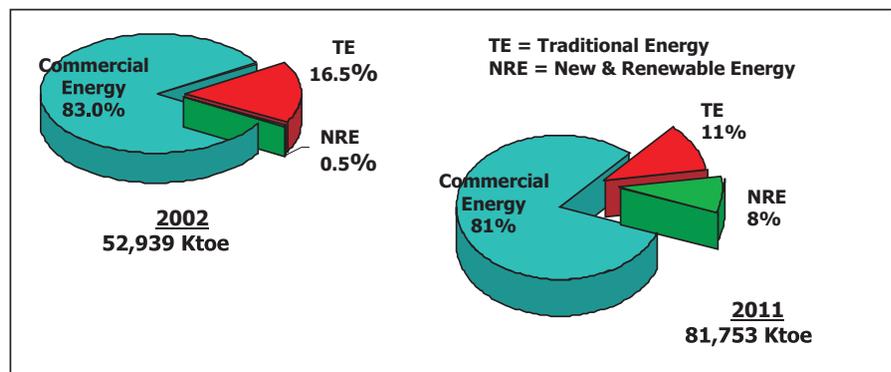
b) Strategic Plan for New & Renewable Energy Development

The Thai government fully recognizes the importance of renewable energy with a view to achieving sustainable development, diversification of energy supply, and protection of the environment.

However, from the projects on renewable energy applications funded by the government, it has shown that capital cost is the most important factor affecting competitiveness and hence the viability of renewable energy technologies. Our

challenge is to lower the cost while increasing efficiency of these technologies. This is to create sufficient market demand, which will in turn create the “economy of scale” that will further pull the prices down.

Therefore, the government has set the national goal to increase the share of renewable energy in the total energy mix from 0.5% in 2002 to 8% by the year 2011. Several supportive measures have been devised to establish market-driven mechanisms.



Share of Thailand's Final Fuel Mix in 2002 and Target in 2011

Some major measures are :

- 1) To promote the use of bio-fuels via provision of tax incentive and eventually introduction of mandatory measures;
- 2) To encourage renewable energy utilization for power generation via the regulations for power purchase from Small Power Producers (SPPs) using renewable energy as

fuel in accordance with the policy on Renewable Portfolio Standard (RPS)¹ and via fiscal and financial incentives, for example, tax credit and subsidies, including supportive measures on externality (social and environmental) costs and on carbon tax, including improvement of the power purchase regulations;

¹ The regulatory requirement for new power plants that 5% of their energy generation must be generated by renewable energy.



Figure 3 Solar for Roof Top for Department Store

3) To promote the use of renewable energy for heat generation via the establishment of minimum efficiency of the Combined Heat and Power (CHP) system, measures on biomass management in industrial factories, tax incentive for industries using biomass fuel, and legislative measures on wastewater treatment and waste disposal;

4) To support policy study and R&D on renewable energy of which Thailand has high potential, such as solar, micro-hydropower and biomass energy; and

5) To continue carrying out public relations work to create positive attitude and correct understanding of renewable energy use.

• Promotion of Biofuels

In order to cope with the un-

stable supply of world crude oil and oil price fluctuation, many countries are trying to search for alternative fuels to reduce the heavy reliance on petroleum fuels, partially or entirely.

Under the strategic plan for new&renewable energy development, measures have been initiated to promote the biofuel development, particularly ethanol and biodiesel. By the year 2011, a target has been set to make use of oil plants, alcohol or used cooking oil, via an appropriate production process, to produce an oil additive or to replace diesel and gasoline consumption.

• Gasohol

For gasohol, the strategic plan aims to utilize 4.0 million litres of gasohol per day, or a half of gasoline 95 consumption to blend with gaso-

line at 10% ratio in 2005. In Addition, gasohol 95 stations will be expanded from 800 to 4,000 stations by the end of the same year. Importantly, as from 1 January 2007, gasohol 95 will be distributed nationwide and gasoline 95 will be removed from the market. A pilot product, gasohol 95 (or the so-called "E-10"), which is the mixture of gasohol and Octane 91 gasoline at a ratio of 1 to 9, has been introduced into the Thai market. In order to promote greater production and use of gasohol, the government has exempted the excise tax imposed on the 10% ethanol mixed with gasoline. This makes the price of gasohol cheaper than the price of Octane 95 gasoline (currently it is 1.50 baht lower per litre), which will induce consumers to use gasohol instead of gasoline.

Other major supportive measures include:

- to reduce/exempt the contribution rates to the Oil Fund and the Energy Conservation Promotion Fund;
- to establish the gasohol specifications;
- to support R&D related to ethanol production and utilization;
- to phase out the use of MTBE in octane 95 gasoline by 2006; and
- to encourage the government vehicle fleets to use gasohol as the priority fuel option.

• Biodiesel

For biodiesel, the target is to replace 10% of diesel consumption



in the year 2012 by biodiesel, accounting for biodiesel utilization of about 8.5 million litres per day or 3,100 million litres/year, by blending biodiesel with diesel at 10% ratio. Also, the blending of biodiesel at various ratios will be encouraged for other specific purposes, for example, to fuel agricultural machines in rural communities and to use in combination with natural gas for buses of the Bangkok Mass Transit Authority (BMTA). Raw materials suitable for biodiesel production are raw palm oil and used cooking oil.

• Promotion of Renewable Energy Utilization in Power Generation

This will help not only diversify fuel sources for power generation and reduce energy import but also develop alternative energy op-

tions to enhance the power system stability through the use of clean and environmentally friendly energy.

Focus is made on four renewable energy sources of which the domestic potential is high, namely: solar, wind, biomass/biogas and mini-hydro.

• Solar Energy

With regard to the PV technology for power generation, about 6 MW of PV applications has been reported so far. Most of them are in remote areas and are off-grid, such as solar cell battery charging stations, PV pumping for village water supply and integrated systems of PV/wind turbine/diesel engine for power generation in national parks and wildlife sanctuaries. One major grid-connected project is EGAT's 500-

kW Pha Bong Solar Cell Power Plant operated by EGAT in mountainous Mae Hong Sorn province in northern Thailand. The opening ceremony of this largest solar cell power plant in Indochina, worth 187.11 million baht, was launched on 23 July 2004. It is expected to help reduce diesel consumption by 215,385 litres/year.

In addition, the government has a policy to speed up electrification nationwide. Pursuant to this, the Provincial Electricity Authority (PEA) is carrying out a project on "solar home system" to electrify about 250 thousand households in remote rural areas, which will be more cost-efficient than the conventional grid-connected extension. The project is to be accomplished by 2007, accounting for a total capacity of 24 MW.

By 2011, it is targeted that 250 MW of the PV system will be installed. Of this, 140 MW will be boosted via the RPS to be imposed on new power plants. The remaining 86 MW will be promoted by incentive measures to cover stand-alone systems in remote areas and PV rooftop for factories, buildings, private homes and government buildings mainly for on-site consumption.

Promotion has also been made on the use of solar thermal energy in the form of solar water heaters for use in households and new buildings, solar herbicide extracting system units, and solar dryers in the industries that require the drying process, such as vegetable and fruit drying. Financial support from the ENCON Fund is provided to help reduce the system installation costs.



Figure 4 Biodiesel Van



• Wind Energy

There are currently two main types of windmills used in Thailand, according to their applications--one is for agricultural water pumping and the other is for electricity generation. So far, a 192-kW generation system from windmills has been installed in Phuket province in the south of Thailand. Besides, wind turbines have been installed as part of the hybrid systems (PV/wind turbine/diesel engine) at Tarutao and Phu Kradueng National Parks with a capacity of 10 kW and 2.5 kW respectively.

Given the government policy to promote renewable energy utilization in power generation, it is projected that by the year 2011, 100 MW of capacity can be generated by wind energy. However, due to expected associated high investment costs, support from the government in the form of subsidy, for example, may be necessary.

Moreover, power generation of no greater than 150 kW using wind turbines will be promoted. R&D will be supported on the production of wind turbines for power generation of no greater than 150 kW, based on the wind energy potential in Thailand. In addition, demonstration and promotion of domestically produced wind turbine installation for power generation will be carried out, totaling 100 systems with a total generating capacity of 15 MW.

• Biomass Energy

In the power generation sector, power producers, in the form of

“Small Power Producers (or SPPs)” using renewable energy as fuel instead of fossil fuel, have continuously been supported by the government, which can be summarized into four phases up to now.

Phase I: Started in 1992, with a view to encouraging the private sector participation in power generation of the country, promotion has been made on power purchase from SPPs by the Electricity Generating Authority of Thailand (EGAT). The result has been satisfactory. Various SPPs, using either fossil fuel such as coal and natural gas or renewable energy such as bagasse, rice husk, wood chips and palm shells, have proposed sale of capacity to the grid system.

Phase II: In May 2001, the government initiated the pricing subsidy from the ENCON Fund in the form of energy payment adder for the capacity generated by renewable energy at a maximum rate of 0.36 baht/kWh, for a five-year period. To date, 19 SPPs using renewable energy are in the pipeline under this program, accounting for a total proposed sale of 235 MW of electricity to the grid. The program has resulted in fuel diversification used for power generation, including hydropower.

Phase III: In May 2002, to further promote the use of renewable energy for power generation by small-scale (less than 1 MW) generators, the Thai government approved the Regulations for the Purchase of Power from

Very Small Renewable Energy Power Producers (VSPPs).

Phase IV: Currently, given the requirement on the Renewable Portfolio Standard (RPS) that 5% of energy to be dispatched into the grid system by new power plants must be generated by renewable energy, a total capacity of about 100 MW generated by biomass is expected through this RPS measure.

By the year 2011, a target has been set to make use of wood-chips, firewood or agricultural wastes to generate about 955 MW of electricity, which can replace the use of about 3,441 ktoe of commercial energy.

Biomass Technology

In addition to the use of biomass residues for power generation, wastewater containing organic matters from livestock farms and industries has increasingly been used as a potential source of biogas energy. Biogas systems using anaerobic digestion techniques such as Upflow Anaerobic Sludge Blanket (UASB) and Fixed Film technology have increasingly been established nationwide especially for pig farms and food processing industries. In general, the biogas systems can be locally produced and installed.

The biogas technology has been rapidly and widely accepted in both large and small-sized livestock farms chiefly because the production of biogas helps reduce not only the pollution problems but also the energy cost by substituting the on-site use



of fuel oil, LPG or electricity from the grid. It is expected that about 50 MW of electricity will be generated by biogas in 2011.



Figure 5 Biogas Engine

• **Hydropower Energy**

The installed capacity of hydropower in Thailand as at the end of 2004 is 3,424 MW. As of December 2004, EGAT produced 5,896 GWh of hydropower, which accounted for 5% of the total EGAT power generation by fuel type. However, hydropower resources are difficult to exploit due to the environmental impact on the resource areas that a large-scale power project would entail.

Therefore, future development of hydropower resources will likely be in the form of small or mini/micro-hydropower projects which are considered most economical and environmentally friendly. In addition, there are possibilities to utilize the existing irrigation dams for small to mini/micro hydropower generators. For example, of the 19 SPP projects under the subsidized SPP program, three are small hydropower projects,

with an installed capacity of 8 MW, 10 MW and 14 MW, utilizing water resources from three irrigation dams.

Small hydropower potential is estimated at 350 MW. Expansion of generator installation at other potential dams is being explored.

• **Investment for the Future**

It is expected that the approach taken by the government in using market-based mechanisms to stimulate demand and in supporting research and innovation will greatly speed up the development and application of new and renewable energy technologies in Thailand. What we are doing now is an investment for the future, aiming at the following goals :

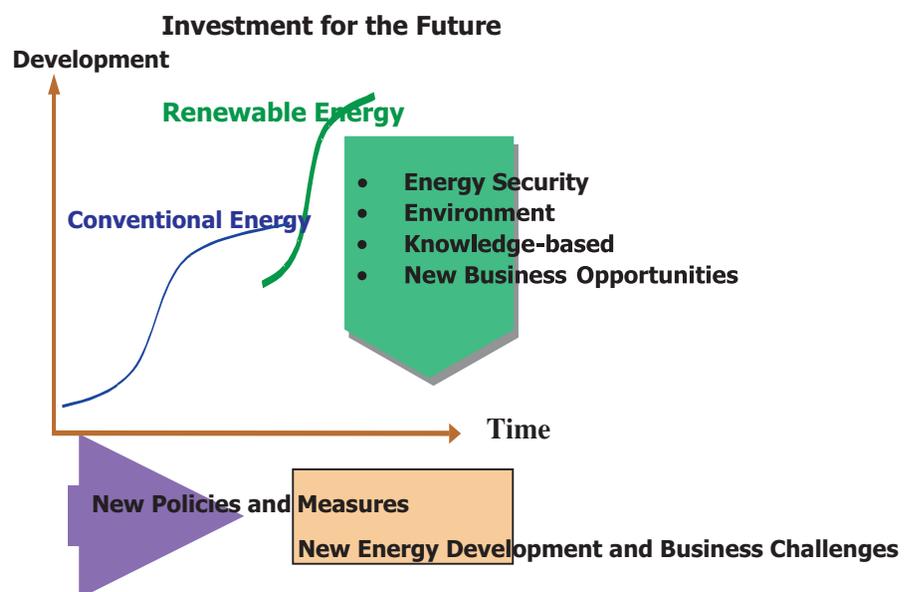
- To enhance energy supply security of the country in the long run

- if the share of renewable energy in the fuel mix increase as targeted, the country's dependency on imported energy can be considerably reduced;

- To protect and solve environmental problems – as renewable energy is considered clean energy;

- To establish the knowledge-based economy – the know-how in renewable technologies will help increase the product value. In the past, new technologies were developed to enhance wider use of conventional energy. Now, a *new S curve of renewable energy technology and business* is enhanced by the government. Research and development work on renewable energy technologies will be strongly supported; and

- To open up many new business opportunities.





c) Strategic Plan for Energy Security Enhancement

This strategic plan aims to enhance security of energy resources, which the country depends upon, involving electrical energy and fossil fuel energy resources, such as oil, natural gas and coal, with a view to optimizing their utilization and extending the energy reserve availability.

• Electric Energy

To strengthen the power supply security, the targets under this Strategic Plan include:

- The power supply must be in balance with the demand to prevent an electrical outage or a voltage drop or an excessive reserve margin. In this regard, it has been determined that the appropriate level of the annual minimum reserve margin should be 15%.

- The power tariff structure must be reasonable and fair, with due consideration on fuel options to keep the generation costs at low levels and on fuel diversification to reduce supply risks while increasing the bargaining power.

- Due consideration must be given to the quality of life of the communities and localities as well as the environmental impact.

In this regard, the EGAT Plc. is responsible for the generation and transmission systems of the country.

Thailand has been purchasing power from two projects in Lao PDR, i.e. Houay Ho and Theun-Hin Boun, accounting for a capacity of about

300 MW. A power purchase agreement (PPA) has been signed for another project, Nam Theun 2, with a supply capacity of 920 MW by 2009. There are five more projects proposed by Lao PDR, with a total sale capacity of 1,760 MW, and negotiations on the purchasing rates with the project developers are in progress. With Myanmar, a Memorandum of Understanding on hydropower development cooperation was signed on 30 May 2005. Feasibility studies will be carried out on four power projects, with a total capacity of 5,300 MW. As for the power development cooperation with Cambodia, a feasibility study is being carried out on the Stung Mnam hydropower project, from which a capacity of 140 MW is expected.

These potential hydropower projects will be able to accommodate Thailand's increasing power demand in the future, and the future power tariffs are expected to be cheaper than the avoided cost of domestic power plants owing to these hydropower sources.

• Fossil Fuel Energy

Thailand has limited reserves of natural gas, crude oil and lignite/coal, accounting for a supply availability of 30, 20 and 60 years respectively. Each year Thailand has to import a considerable amount of fossil fuel energy and hence has to face the risk of price volatility.

Therefore, the target is set to expand the availability of energy reserves in order to adequately meet the

domestic demand. To meet this target, the government will:

- Promote domestic energy exploration and production;
- Speed up negotiations and agreements with neighboring countries on energy development in joint development areas;
- Cooperate in energy development with other countries in the region;
- Support the Trans-ASEAN Gas Pipeline Project; and
- Encourage PTT Public Company Limited (PTT), PTT Exploration and Production (PTTEP), and potential Thai private companies to invest in overseas energy projects.



Figure 6 Thai Oil Rig in the Gulf of Thailand

d) Strategic Plan for Thailand to Be the "Regional Energy Center"

This Strategic Plan is a significant move to maximize the geographical advantage of Thailand. Being located in the central of the Indochina, Thailand can link energy supply sources, mainly countries in



the Middle East, and consumer markets, like China, Japan, Korea and Taiwan, and at the same time serving as a gateway to Indochina and Southern China.

• **Key Measures**--This Strategic Plan consists of key measures as follows :

- Review the taxation system and structure to eliminate duplication of tax collection and barriers to oil trading, and establish the Customs Free Zones to further facilitate overseas oil trading in line with international standards.

- Develop the power transmission network, the natural gas pipeline network, and the networks of other energy sources. This requires international cooperation between the public and private sectors, and government to government collaboration for efficient development of natural resources and optimum use of energy infrastructure.

- Connect the north and north-east oil pipeline transmission systems and support intra-regional connection of various transport modes from east to west and south to north of the country, linking Thailand to Burma, Indochina and the southern part of China to expand the energy market.

- Encourage integration, synergies, and merger or acquisition among domestic producers to create a world-scale petrochemical business.

• **Si Racha Trading Hub**

To pave the way for Thailand to become the “Regional Energy

Center”, efforts have been made to utilize the existing but underutilized energy infrastructure, along with the potential for further expansion in Si Racha. On 29 January 2004, there was an inauguration of “Si Racha Trading Hub” in Chon Buri province --about one and a half (1.5) hour drive east of Bangkok. Si Racha Trading Hub will serve as a gateway for petroleum and petrochemical trading to cater the demand of Indochina and the Far East. This involves the establishment of *the Tax Free Zones* on Si Chang Island and at Si Racha, both of which are already equipped with energy infrastructure, able to accommodate 350,000 dead-weight-ton tankers.

To fully operate as a Tax Free Zone, the taxation system and structure has been made more favorable for oil trading and export. The corporate income tax payable on oil trading profits has been reduced from 30% to 10%. There is a possibility for this rate to fall to 5% if the trading volumes are high. Laws and regulations relevant to the storage and transportation of energy have also been amended to facilitate the trade in petroleum products. A One-Stop Service has been established to facilitate all transactions concerning the Tax Free Zones.

Si Racha and the surrounding areas already have extensive oil storage as well as refinery facilities, which means that Thailand can immediately take on the role of energy trader. With surging demand from China and Japan, the Asian region is

faced with tight supply. Therefore, Thailand can come in and offer an alternative market aiming to complement the existing regional trading activities for the benefit of the whole.

5. Environmental Impact of Energy Supply

Thailand’s rapid economic growth and hence increased consumption of energy, particularly in the industrial and transportation sectors, have brought about adverse impact on the environment. The most visible environmental effect is the growing problem of air pollution in major urban cities where traffic congestion has been a difficult problem to tackle. The Thai government has introduced various measures to address urban air pollution problems. One prominent measure is the phasing out of leaded gasoline, which was absolutely abolished from the market as from 1 January 1996 and which has much improved air quality in major cities, particularly Bangkok.

With a view to reducing the carbon intensity level resulting from energy development and utilization, Thailand has diversified the types of fuel supply, emphasizing cleaner energy, like natural gas, and more renewable energy sources. Also intensified is the energy efficiency improvement and biofuel promotion, such as fuel ethanol and biodiesel, to reduce fossil fuel consumption. Besides, environmental impact assessments (EIAs) are required for major energy projects, and more public participation in the development



of energy infrastructure projects are encouraged.

In addition, the government has promoted and supported other non-conventional, alternative energy production. For example, owners of pig farms and food processing factories are encouraged to install biogas systems to better handle their wastewater management and to make use of biogas in power generation. With the installment of such a system, they can make a saving from electricity generated from biogas and gain extra revenues from by-products of the waste treatment process (such as organic fertilizer), while the environmental problems on their farms would also be solved.

In the case of a micro-hydroelectricity project, communities that benefit from the electricity generated will also have a motive to preserve the watershed so as to ensure healthy flow of water for electricity generation. Electricity generated from renewable sources, e.g. solar, wind, biomass/biogas and hydro energy, can replace electricity generated from more polluting fossil fuels and thus help reduce the environmental impacts resulting from electricity generation in the country as a whole.

6. Conclusion

Thailand's energy demand is increasing each year. Measures to reduce dependency on imported energy are implemented to reduce the trade deficit. Therefore, establishing proper energy policy and strategies, together with efficient energy ma-

agement, is crucial to ensure energy supply security for sustainable growth of the country. Energy diversification is an important means to enhance security of energy supply. Thailand has indigenous natural gas reserves and abundant renewable energy sources; therefore, efforts will be made to maximize the use of our own energy resources. Moreover, natural gas and renewable energy are cleaner energy that will help to reduce adverse environmental impact of energy supply.

More importantly, to promote greater use of alternative and renewable energy as well as R&D on technology and utilization of such energy, of which the costs are still high, financial incentives from the government are available, mainly through the Energy Conservation Promotion Fund. This aims to create a greater market for alternative and renewable energy and to make it competitive with conventional fuels in the long run.

In addition, energy conservation campaigns have been launched and measures introduced on a continuous basis, aiming to change energy consumption behavior of the people to be more economical and efficient and to raise their energy conservation consciousness. International cooperation in energy development will continue to be a significant strategy of Thailand so as to enhance national energy development.

It is hoped that the aforementioned energy policy framework and implementation strategies will even-

tually lead to sustainable development of the energy sector and hence contribute to sustainable economic growth of the country.

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**บทคัดย่อ**

บทบาทของนโยบายและยุทธศาสตร์พลังงานไทยในการพัฒนาแบบยั่งยืน

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สำนักงานนโยบายและแผนพลังงาน กระทรวงพลังงาน

ความต้องการพลังงานของไทยในแต่ละปีกำลังเพิ่มขึ้น มาตรการเพื่อลดการพึ่งพิงการนำเข้าพลังงานเป็นสิ่งที่ควรดำเนินการเพื่อลดปัญหาการขาดดุลการค้า ดังนั้น การจัดทำนโยบายพลังงานและยุทธศาสตร์ที่เหมาะสมควบคู่กันไปกับการจัดการพลังงานอย่างมีประสิทธิภาพเป็นสิ่งสำคัญที่ให้หลักประกันด้านการสร้างความมั่นคงในการจัดหาพลังงานเพื่อการเจริญเติบโตอย่างยั่งยืนของประเทศ การกระจายแหล่งพลังงานจะเป็นแนวทางสำคัญ เพื่อให้บรรลุถึงความมั่นคงในการจัดหาพลังงาน ไทยมีแหล่งแก๊สธรรมชาติสำรองในประเทศและมีแหล่งพลังงานทดแทนอย่างมากมาย ดังนั้น จะต้องใช้ความพยายามอย่างเต็มที่เพื่อใช้ประโยชน์สูงสุดจากแหล่งพลังงานของเราเอง แก๊สธรรมชาติและพลังงานทดแทนเหล่านี้เป็นพลังงานที่สะอาดและช่วยลดผลกระทบต่อสิ่งแวดล้อมของอุปทานพลังงาน ประการสำคัญเพื่อส่งเสริมการใช้พลังงานทางเลือกและพลังงานทดแทนให้กว้างขวางยิ่งขึ้น เช่นเดียวกันกับการสนับสนุนการค้นคว้าวิจัยด้านเทคโนโลยีของพลังงานเหล่านี้ซึ่งต้นทุนการผลิตยังคงค่อนข้างสูง การให้สิ่งจูงใจทางการเงินจากรัฐบาลเป็นสิ่งต้องจัดทำให้แก่ผู้ลงทุน โดยเฉพาะการให้เงินช่วยเหลือหรือสนับสนุนจากกองทุนเพื่อส่งเสริมการอนุรักษ์พลังงาน จุดมุ่งหมายของการดำเนินการนี้เพื่อขยายตลาดพลังงานทางเลือกและพลังงานทดแทนให้กว้างขวางยิ่งขึ้นและสามารถแข่งขันได้กับเชื้อเพลิงประเภทฟอสซิลในระยะยาว

คำสำคัญ : การพัฒนาอย่างยั่งยืน, เชื้อเพลิงชีวภาพ, นโยบายและยุทธศาสตร์, ผลกระทบด้านสิ่งแวดล้อม, พลังงาน

