



# Thailand's Energy Conservation Program and the Role of New & Renewable Energy in Energy Conservation

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## Abstract

At present, the private sector has realized the benefits from energy efficiency improvement and the use of new and renewable energy. To facilitate energy efficiency improvement, the Thai government has promoted the ESCO Company services especially in large factories and buildings. Moreover, several financial measures have been devised to boost investment in energy efficiency improvement. For new and renewable energy project development, the private sector has taken part in the implementation of a number of projects, such as the implementation of biogas technology for power generation in livestock farms and for wastewater treatment in agro-industry factories. With the government policy determined to reduce energy demand and dependency on energy imports through various strategies and measures, it is hoped that the national energy security will be strengthened, and hence sustainable development of the country and the well-being of the people.

*Key words:* energy conservation, new and renewable energy, sustainable development

## 1. Background and Rationale

Recognizing that energy is an important factor to the economic and social development of the country and given the high volatility of world oil prices together with the unpredictable political tension in major oil exporting countries, especially Iran and Nigeria, the Thai government has attached importance to the national energy supply security.

In order to strengthen energy security of the country, the Ministry of Energy has initiated many

strategies and measures so as to reduce dependency on oil imports while enhancing utilization of domestic energy resources. Some major measures are promotion of energy efficiency, new & renewable energy development and fuel diversification.

**The Energy Conservation Promotion Fund (ENCON Fund) - the government tool to promote energy conservation, energy efficiency and renewable energy development**

Due to continuous high growth rates of domestic energy demand, the Energy Conservation Promotion Act, B.E. 2535 (1992), has been put into force to be the government tool in determining regulatory measures and promoting efficient use of energy. Under the Act, the Energy Conservation Promotion Fund (ENCON Fund) was established as a working capital to provide financial grants or support to energy conservation-related activities. The ENCON Fund revenues are derived mainly

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from the contributions collected from domestically sold petroleum products, i.e. gasoline, diesel, kerosene and fuel oil. Since October 1998, the contribution has been at a rate of 0.04 Baht/litre.

**2. Thailand’s Energy Conservation Program**

Thailand’s Energy Conservation Program (ENCON Program) has been developed to ensure that the management and allocation of the ENCON Fund is in line with the objectives stipulated in the 1992 Act and to serve as the framework for concerned parties in carrying out their activities that will contribute to efficient use of energy, which will help reduce energy import from foreign sources.

The implementation under the ENCON Program, Phase 1 (1995-1999) and Phase 2 (2000-2004) has been completed. From the overall implementation, the expected energy conservation poten-

tial includes the reduction of energy demand by 883 MW, replacing electric power at 5,447 GWh and fuel use at 430 million litres of crude oil per year, accounting for a saving of 20.89 billion baht (about US\$ 522 million<sup>1</sup>) per year.

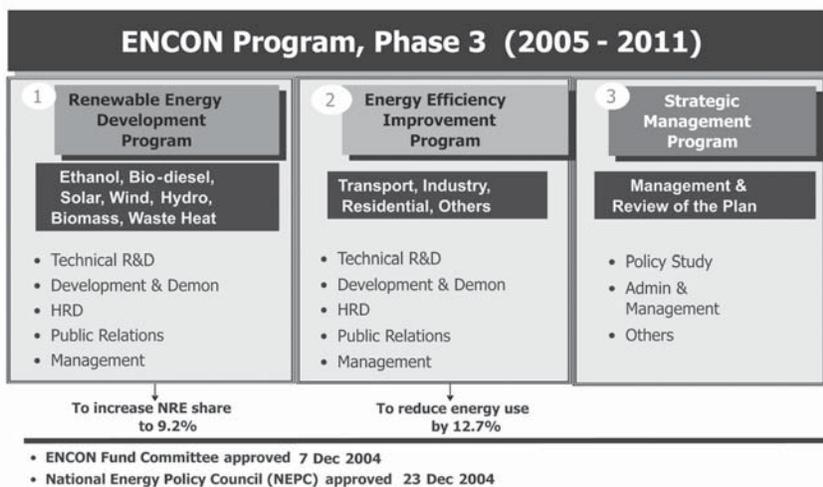
The ENCON Program, Phase 3 (2005-2011), is now being implemented, with a target to increase energy efficiency by reducing the national energy elasticity from 1.4:1 to 1:1 by the year 2007 and to increase the share of renewable energy in the total energy mix from 0.5% in 2002 to 8% by 2011. The expected out come at the end of this phase is to reduce commercial energy use by 12.7% or 10,354 thousand tons of crude oil equivalent (ktoe) and to increase the share of alternative/renewable energy to 9.2% of the total final energy consumption, replacing about 7,530 ktoe of commercial energy demand.

In developing the framework for the ENCON Program, Phase 3, the overall potential workload in the next 3-7 years has been projected. With the characteristic of a “rolling plan,” the programs/projects under the ENCON Program will be reviewed and adjusted each year in order to correspond with changing influential factors, such as new energy policies/strategies determined by the government, and changing domestic and global energy situations.

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

**1) Renewable Energy Development Program**, targeting to increase the use of renewable energy and alternative energy by 9.2% by 2011. Emphasis is placed on biofuel development, especially gasohol and biodiesel to be alternative fuels in the transportation sector; promotion of renewable energy utilization for power generation; policy study and R&D on renewable energy of which Thailand has high potential, such as solar, micro-hydropower and biomass energy; and human resources development in the field of renewable energy.

**2) Energy Efficiency Improvement Program**, aiming to improve and promote energy efficiency in the transportation, industrial and residential sectors. By 2011, it is expected that non-



<sup>1</sup> 1 US\$ = ~40 baht



productive energy use can be reduced by 12.7%, or 10,354 ktoe.

**3) Strategic Management Program**, involving the work on policy research & study, e.g. the study on fuel options and energy market restructuring, aiming to provide recommendations or situation overviews, for the review and improvement of the first two Programs to correspond with the changing situations. This Program also involves the monitoring and management of the ENCON Program implementation to ensure that the respective targets can be effectively achieved.

### 3. Implementation of Energy Conservation Measures in Thailand

**3.1 The Past Achievements of Energy Conservation Measures during the Fiscal Period 2003-2005** can be summarized as follows:

**1) In the transportation sector**, energy consumption was reduced by 6%, or 8.5 million barrels of oil equivalent, accounting for a saving of 17 billion baht. Key factors were:

- Continuous energy saving campaigns, amidst the oil price hikes, resulting in oil consumption reduction by about 6 million litres/day.

- The use of two new public transport systems, i.e. sky-trains and subways, accounting for the transportation of 600,000 passengers/day.

**2) In the industrial sector**, energy consumption was reduced by 4%, or 5 million barrels of oil equivalent, accounting for a saving of 13 billion baht. Key factors were:

- The private sector participation in energy conservation.

- Provision of government revolving funds and soft loans.

- Tax incentives.

**3) In the government/residential sectors**, electricity consumption was reduced by 3.5%, or 2.3 million barrels of oil equivalent, accounting for a saving of 4.6 billion baht. Key factors were:

- Continuous energy saving campaigns, particularly on electricity saving in the households & offices and on the encouragement of community energy management.

**4) Increased use of new & renewable energy**, accounting for a saving of 14.1 million barrels of oil equivalent, worth 28.2 billion baht. Key factors included:

- The use of renewable energy, especially biomass, reducing 3% of fuel oil and electricity consumption.

- The use of natural gas for vehicles (NGV) and gasohol, replacing 0.7% of oil consumption.

### 3.2 Acceleration of Energy Conservation Measures to Respond to the Oil Price Hikes

Since the crude oil prices in the world market had continuously increased and in order to reduce the country's dependency on oil imports, on 17 May 2005 the government approved the strategies to solve energy problems of the country, setting higher targets of the overall energy demand reduction. And recently, on 25 April 2006, the government reiterated the necessity to intensify energy conservation measures as crude oil prices had sharply increased by about US\$ 10/barrel, and exrefinery diesel price had reached US\$ 88/barrel, which was then a record high. The implementation can be divided into the following economic sectors:

1) The Transportation Sector: to reduce oil consumption by 25% by 2009.

2) The Industrial Sector: to reduce energy consumption by 20% by 2008.

3) The Household Sector: to reduce energy consumption by 10%, with the Kick-Off of continuous energy saving campaigns nationwide on 1 June 2005.

4) The Government Sector: to reduce energy consumption by 10-15%, with immediate effect.

### 4. Energy Conservation Measures : Government Sector

According to the past records, electricity consumption of the government sector is about 5.4 GW/year, or about 0.2% of the



total consumption of commercial primary energy of the country. Oil consumption of this sector is about 700 million litres/year, or about 3.5% of the total oil demand of the country. These shares are very small when compared with the consumption in the industrial or transportation sectors. Therefore, one may question why the government sector has to reduce energy consumption.

The underlying reason is that the government agencies, dealing closely with the people, have to be good examples for the general public. Besides, millions of the government personnel are already acting as leaders, both in their families and in their offices; therefore, what they do will be watched with interest by the public. Particularly, given the oil price crises in the country, the government agencies should take the lead role in reducing energy consumption, both electricity and oil.

#### **“10-15% Target” - Energy Saving Requirement**

Since May 2005, the government has set a target for government agencies and state enterprises to reduce energy consumption by 10-15% from the base year 2003. In addition, the energy saving implementation will be considered as a Key Performance Index (KPI) of each agency, starting in the fiscal year 2006.

In order to enhance effective

energy-saving implementation to reach the target set, the Ministry of Energy, via the Energy Policy and Planning Office (EPPO), has introduced the following measures:

1) Disseminate the stated energy-saving policy to the executives of all government agencies nationwide to ensure correct and common understanding of the government objective.

2) Build up capacity of the personnel in individual agencies to enable efficient implementation of energy-saving measures, by organizing workshops and training by energy experts so that participants could learn and exchange energy saving methods that could be applied to their respective offices.

3) Develop the e-report via the internet to manage energy consumption data in the government sector. Each agency has a password and can send in the energy-saving report via the internet. The information of successful cases can be shared with other agencies to stimulate their active implementation on energy saving.

#### **5. Energy Conservation Measures: Private Sector**

Energy conservation measures in the private sector are focused on three key economic sectors, i.e. transportation, industrial and residential sectors, which account for a share of 37%, 36% and 21% of energy consumption of the country respectively.

#### **5.1 Energy Conservation Measures in the Transportation Sector**

In the transportation sector, the target is to reduce 25% of oil consumption by 2009. Major implementation measures include the following :

1) **Promotion of new/ alternative transport fuels**, to reduce oil consumption by 15% by 2008. The use of gasohol, biodiesel and natural gas for vehicles (NGV) will be promoted, with the following targets:

- Gasohol: to increase the use of gasohol to 8 million litres/day within 2006 and to replace octane 95 gasoline with gasohol 95 nationwide as from 1 January 2007.

- Biodiesel: to increase the use of biodiesel to 5.2 million litres/day in 2006 and to 8.5 million litres/day by 2012.

- NGV: to speed up the expansion of NGV stations from 60 now to 180 stations in 2006 and to replace 10% of gasoline and diesel consumption by NGV by December 2008, and to increase the number of NGV-fueled vehicles to 500,000 by 2010 together with the expansion of NGV service stations to 740 stations.

2) **Improvement of the Transport System Efficiency**, to reduce oil consumption by 10%, via:

- Promotion of the use of rail and waterway transport modes instead of the transporta-



tion of goods and commodities by land transport.

- Promotion of the use of public transport systems instead of private vehicles.

- Improvement of the traffic management system by, for example, the installation of speed cameras/red light cameras to control violation of traffic rules, and the use of Intelligent Traffic System (ITS) to manage & control the traffic flows.

- Promotion of oil transportation via pipelines to reduce the number of oil-tank trucks.

- The use of town planning to enhance transportation system efficiency.

- Promotion of energy saving vehicles, via the introduction of energy-saving car labeling.

- Application of tax measures, i.e. increasing taxes for annual car ownership registration based on car ages and engine sizes while reducing taxes for energy saving and low emission cars.

## 5.2 Energy Conservation Measures in the Industrial Sector

In the industrial sector, the target is to reduce energy consumption by 20% by the year 2008. Major implementation approaches include the following:

**1) Promotion of the use of natural gas** to replace 5% of fuel oil consumption in large industrial factories.

- Promotion of the Combined Heat & Power (CHP) system (or Cogeneration) in large industries/buildings and industrial estates, including the Gas District Cooling, such as the implementation at the New Bangkok International Airport, or Suvarnabhumi Airport.

- Promotion of power and cool-water generation using the Distributed Generation (DG) system in large-scale department stores, situated along the natural gas pipeline routes.

**2) Energy efficiency improvement**, to save 15% of energy consumption via:

- Speed-up of energy efficiency improvement in small and medium-sized enterprises (SMEs), via several supportive measures, such as provision of the revolving funds and tax incentives to encourage investment in the replacement of the existing low efficiency equipment by high efficiency one, and energy efficiency investment promotion measures, via the Board of Investment (BOI) of Thailand.

- Promotion of the Energy Services Company (ESCO) business.

- Restructuring of the industrial sector – to promote the industries that are non-energy intensive but yield a high economic value and to improve energy consumption efficiency at a level suitable for each industrial sub-sector.

## 5.3 Energy Conservation Measures in the Household Sector

The target is to reduce commercial energy consumption in the household sector by 10%, with the Kick-Off of continuous energy saving campaigns nationwide on 1 June 2005. The implementation includes, among others:

- Promotion of high-efficiency equipment utilization, via such measures as follows:

- Establishment of the Minimum Energy Performance Standards (MEPS) of electrical equipment.

- Application of energy efficiency labeling.

- Establishment of the standards of LPG-fired cookers.

- Promotion of high-efficiency cooking stoves.

- Establishment of the building code and building material standards.

- Public awareness campaigns, by:

- Dissemination of energy conservation knowledge and energy saving methods, especially oil and electricity saving tips that people can use in their daily activities, through various media and campaign activities.

- Dissemination of household management methods to save energy, such as the use of natural daylight instead of electrical light, and the use of trees for shading or blinds to reduce heat transfer into the house.



## 6. The Role of NRE in the Country's Energy Conservation Program

As mentioned earlier, renewable energy development is one of the three main subprograms of the Energy Conservation Program of Thailand. It is a key implementation approach to achieve the government's target to increase the share of renewable energy in the total national fuel mix from 0.5% in 2002 to 8% by 2011.

**The Renewable Energy Development Program** focuses on the following five areas:

1) Promotion of the use of biofuels, especially gasohol and biodiesel, to be alternative fuels in the transportation sector;

2) Promotion of renewable energy utilization for power generation;

3) Promotion of renewable energy utilization for heat generation in industrial factories;

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

5) Human resources development in the field of renewable energy, and public awareness campaigns to create knowledge and understanding about renewable energy among the general public.

### 6.1 Promotion of Biofuels and Alternative Transport Fuels

#### \* Gasohol

A biofuel product, i.e. **gasohol 95** or the so-called "E-10," which is the mixture of ethanol and octane 91 gasoline at a ratio of 1 to 9, has been introduced to the market. This means 10% of gasoline consumption can be reduced. Now, the Gasohol Roadmap has been developed, targeting to distribute gasohol 95 nationwide, starting on 1 January 2007 and then remove octane 95 gasoline from the market. From 2008 onwards, promotion of gasohol 91 will be made nationwide.

The price of gasohol 95 is now set to be cheaper than octane 95 gasoline (currently at 3.75 US cents/litre) to promote utilization of gasohol 95. Also, the guidelines on government support include, for example, investment promotion through the Board of Investment for fuel-ethanol production plants, reduction of import and excise taxes for flexible-fuel vehicles (FFV), and provision of soft loans to support domestic manufacturing of FFV engines.

The market response to the gasohol promotion has been very satisfactory. The total sale of gasohol in March 2006 was 4 times more than the sale in the same month last year, i.e. from 0.816 million litres/day to 3.433 million

litres/day<sup>2</sup>. As of March 2006, the number of gasohol service stations is 3,030 stations throughout the country.

#### \* Biodiesel

Thailand has been pursuing the Biodiesel Roadmap, targeting to replace 10% of diesel consumption by 2012 by biodiesel and to produce 8.5 million litres per day of biodiesel.

Demonstration projects of biofuel production at the community level, with the trial blending ratio of biodiesel at 2%, or known as "B2," have proved to be very successful as the product has been widely accepted by consumers and it causes no problem to the engines. According to the Biodiesel Roadmap, the blending ratio of biodiesel at 5% (**B5**) will be promoted nationwide by 2011 and at 10% (**B10**) by 2012.

One major problem that prevents the immediate increase of biodiesel production is the raw materials. In Thailand, we can use raw palm oil, coconut oil and some other oil plants, including used-cooking oil, to produce biodiesel. However, exclusive of the use for producing cooking oil and export, the remaining production amount of palm oil, which is the main raw material used, i.e. 500,000 litres/day, is currently not enough for biodiesel production. To solve this problem, the government has

<sup>2</sup> Dept. of Energy Business, Ministry of Energy, Thailand, *Oil Situation-March 2006* [Online], April 2006. Available : [http://www.doeb.go.th/news/oil\\_april.htm](http://www.doeb.go.th/news/oil_april.htm) [Accessed 26 Apr. 2006].



planned to increase oil palm plantation by 5 million rai<sup>3</sup> by 2009.

Therefore, the current promotion of biodiesel utilization is focusing on small-scale or community-scale demonstration projects (100-200 litres/day), using oil palm, used-cooking oil and jatropha oil, to educate the public about the management and production process of biodiesel, which will create their confidence in biodiesel utilization. The implementation now includes 11 pilot communities and will expand to 60 potential communities in various provinces within 2006.

#### \* Natural Gas Vehicles (NGV)

To encourage the use of NGV, the retail price of NGV is initially set at 50% of the diesel retail price. However, the price adjustment may be required later to be 55% and 60% of gasoline 91 in the year 2007 and 2008 respectively. From 2009 onwards, the NGV price would be 65% of gasoline 91.

A total of 500,000 NGV-fueled vehicles is targeted by the year 2010, focusing on the public transport fleets, taxis and government car fleets. The development of NGV market requires simultaneous development of infrastructure, i.e. natural gas pipelines and natural gas service stations. The establishment of NGV stations will

be speeded up from the current 60 stations (as of April 2006) to 740 stations by 2010.

#### 6.2 The Use of New & Renewable Energy in the Industrial Sector

The use of renewable energy, especially biomass, is being promoted 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 incentives for industries using biomass fuel, and legislative measures on wastewater treatment and waste disposal.

Natural gas will be promoted to replace the use of oil in the industrial sector, aiming to save expenditures on oil import, worth about 34 billion baht in 2006 and 80 billion baht in 2010.

Expansion of the Gas District Cooling & Cogeneration to replace oil consumption in this sector will account for a saving of 3 billion baht in 2006 and 32 billion baht in 2010.

#### 6.3 The Use of Renewable Energy for Power Generation

Currently, natural gas is the major fuel used in power generation. As of December 2005, natural gas accounted for 72% of the fuel used in this sector. Next to it was lignite & coal, holding a

share of 15%. Others comprised fuel oil, hydro and imported electricity from Lao PDR & exchange with Malaysia, accounting for 6%, 4% and 3% respectively.

According to Thailand Power Development Plan 2004-2015 (PDP 2004) developed by EGAT, 76% of the total power generation in 2010 will be from natural gas. If new power plants after 2011 use natural gas, its share in the fuel mix for power generation will go up to 81% in 2015. If so, the power system security will be at risk.

The government recognizes the risk due to over-dependency on natural gas and, therefore, sees it necessary to diversify the fuel types used for power generation to ensure the power supply security.

The government will encourage the Electricity Generating Authority of Thailand (EGAT) and new Independent Power Producers (IPPs) to use imported coal for power generation to be supplied to the grid after 2011 with the use of clean coal technology (CCT) to enhance the operating efficiency while reducing the environmental impact.

Greater use of renewable energy for power generation will also be promoted. Focus is made on four domestic renewable energy sources, of which the potential is high, i.e., biomass/biogas and

<sup>3</sup> 1 rai = 0.16 hectare.



mini-hydro. In addition, Thailand is seeking cooperation on hydro-power development with neighboring countries, e.g. Laos, Myanmar, China and Cambodia.

To encourage renewable energy utilization as fuel for power generation, the Ministry of Energy has devised the following supportive measures:

- The Renewable Portfolio Standard (RPS)<sup>4</sup> measure through this measure, it is expected that 140 MW generated by renewable energy will be supplied into the grid by 2011. The contribution by different types of renewable energy comprises hydro 75 MW, biomass 25 MW, municipal solid waste 20 MW, wind 10 MW and solar energy 10 MW.

- The improvement of the power purchase regulations and the introduction of "Feed-in Tariff" - attractive power purchasing prices will be established to encourage investment in renewable energy-fuel generation, for example, the rate of invested capital (ROIC) of no less than 11% and the payback period within 10 years; and

The fiscal and financial incentives, for example, tax privileges, soft loans, investment pro-

motion through the BOI channel, measures on externality (social and environmental) costs and on carbon tax.

## 7. Conclusion

At present, the private sector has realized the benefits from energy efficiency improvement and the use of new & renewable energy. Especially, the financial assistance provided by the government ENCON Fund has induced more private investment in these fields.

To facilitate energy efficiency improvement, the Thai government has promoted the ESCO company services especially in large factories and buildings where energy efficiency improvement is mandated by law. Several financial measures have been devised to boost investment in energy efficiency improvement. Major measures are: the provision of soft loans, which has brought about greater participation of bankers/financiers in the implementation; tax incentives; and energy efficiency investment promotion measures via the Board of Investment (BOI). Several manufacturers of electrical equipment/appliances have given good cooperation in terms of improving their pro-

ducts to be more energy efficient.

For new & renewable energy project development, the private sector has taken part in the implementation of a number of projects, such as the implementation of biogas technology for power generation in livestock farms and for wastewater treatment in agro-industry factories, which has gained wide acceptance nationwide. Academics and industries have taken part in terms of, among others, research and development of new & renewable energy technologies, such as solar cells that are appropriate for the tropical climate, fuel cell development and wind resource assessment in Thailand.

With the government policy determining to reduce energy demand and dependency on energy imports through various strategies and measures, together with the cooperation of the private sector and the growing energy-saving consciousness of the general public, it is hoped that the national energy security will be strengthened and hence sustainable development of the country and the well-being of the people.

<sup>4</sup> The mandatory requirement for new power plants that 5% of their energy generation must be generated by renewable energy.



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**บทคัดย่อ** นโยบายการอนุรักษ์พลังงานและบทบาทพลังงานทดแทนของไทย  
ชวลิต พิชาลัย  
ผู้อำนวยการสำนักวิเคราะห์แผนพลังงาน สำนักงานนโยบายและแผนพลังงาน

ในปัจจุบัน ภาคเอกชนไทยได้ตระหนักถึงผลประโยชน์จากการปรับปรุงการใช้พลังงานอย่างมีประสิทธิภาพและการส่งเสริมการใช้พลังงานทดแทน และเพื่ออำนวยความสะดวกในการปรับปรุงดังกล่าว รัฐบาลได้ส่งเสริมให้บริษัทจัดการพลังงาน (ESCO) ได้เข้ามามีบทบาทมากขึ้นในการจัดการพลังงานในภาคธุรกิจและอุตสาหกรรมโดยเฉพาะในอาคารและโรงงานขนาดใหญ่ นอกจากนี้ มาตรการการจูงใจทางการเงินหลายประการได้ถูกนำมาใช้ในการกระตุ้นการลงทุนเพื่อปรับปรุงการใช้พลังงานอย่างมีประสิทธิภาพ สำหรับการพัฒนาโครงการด้านพลังงานทดแทน ภาคเอกชนได้เข้ามามีบทบาทในการจัดทำโครงการหลายโครงการ อาทิเช่น โครงการผลิตแก๊สชีวภาพจากฟาร์มเลี้ยงสัตว์ และนำเสียจากโรงงานแปรรูปสินค้าเกษตรกรรมสำหรับการผลิตไฟฟ้า และด้วยนโยบายของรัฐในการลดความต้องการการใช้พลังงานและลดการพึ่งพาพลังงานนำเข้าเหล่านี้จึงเป็นที่หวังได้ว่า นโยบายด้านพลังงานของประเทศจะมีความมั่นคง และนำไปสู่การพัฒนาที่ยั่งยืนและความอยู่ดีกินดีของประชาชน

**คำสำคัญ** : การอนุรักษ์พลังงาน, พลังงานทดแทน, การพัฒนาแบบยั่งยืน