

# THAILAND ALTERNATIVE ENERGY INDUSTRY

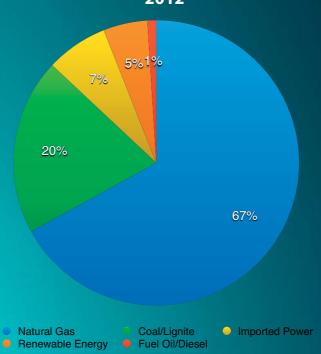
# ALTERNATIVE ENERGY IN THAILAND

In order to stay competitive in a rapidly globalizing economy, Thailand has emerged as one of the first countries in Asia to encourage alternative energy investment. In an effort to maintain the sustainability and security of energy in Thailand, the Government of Thailand developed the 10-Year Alternative Energy and Development Plan-AEDP (2012-

2021), with the target of increasing alternative energy consumption from 7,413 ktoe (kilo tonnes of oil equivalent) in 2012 to 25,000 ktoe in 2021.

With solid governmental commitment to develop a clean energy society, the Department of Alternative Energy **Development and Efficiency** (DEDE) was established under the Ministry of Energy, to support, promote, and develop clean energy production and consumption costeffectively and sustainably. In addition, they aim to develop the country as an energy knowledge base society, as Thailand recently established the School of Renewable Energy Technology – an institute of Naresuan University - to train students and scholars in this field.

Thailand's commercial energy consumption in 2012 was 1.97 million barrels of oil equivalent per day. The country is highly dependent on imported energy; in 2012, over 67% of energy was imported. Total energy expenditure in 2012 was US\$71 billion, 10% higher than in 2011. The manufacturing and transportation sectors were the largest energy consumers in 2012: consuming 37% and 36%, respectively.



### Power Generation by Energy Sources, 2012

Source: Energy Policy and Planning Office, Ministry of Energy

Natural gas fuels the majority of Thailand's power generation, 67% in 2012. In the same year, renewable energy sources accounted for only 5%, although this figure will increase as Thailand continues to implement its Alternative Energy Development Plan (AEDP).

### ENERGY SAVINGS AND TARGETS – THE RENEWABLE AND ALTERNATIVE ENERGY DEVELOPMENT PLAN (AEDP), 2012-2021

Energy consumption in Thailand is continually increasing. In 2012, the previously noted commercial energy consumption of 1.97 million barrels of oil equivalent per day represents a 6% increase from the previous year. The Ministry of Energy forecasts the demand in 2021 to be 99,838 ktoe, a 40% increase from the present level.

The energy sector in Thailand has relied primarily on imports. In 2012, energy supplied by imports accounted for over 55% of the primary commercial energy demand. Thailand's oil sector was even more reliant on imports, reaching 80% of total domestic oil consumption. To reduce dependency and imports of oil and other unsustainable energy resources, the government assigned the Ministry of Energy to establish the Renewable and Alternative Energy Development Plan for 10 years (AEDP 2012-2021) to identify the framework and direction of Thailand's renewable energy development strategy. The AEDP 2012-2021 has goals to transform the country into a low-carbon society and a target to increase the use of renewable energy to 25% of total energy consumption by 2021. A significant portion of this target is to seek substitutes for natural gas power generation, with emphasis on wind energy (wind turbine farms), hydro power, biomass, biogas and waste & garbage.

Thailand has high potential to source renewable energy resources due in part to the abundance of agricultural products. These would be used as feedstock for biogas, bio-diesel and ethanol. The waste and residue of the food industry could contribute to energy production from garbage and Municipal Solid Waste (MSW). Moreover, with its tropical climate, Thailand has strong potential for solar energy. Thus, Thailand's renewable energy potential is high and there are significant opportunities to develop energy sources and create a positive energy development outlook.

New energy

resources

3 MW

**Geothermal** 

1 MW

Tidal

wave

2 MW

**Budget to support** 

Research&Developn

The Ministry of Energy established a roadmap as strategy to promote the use of renewable and alternative energy to 25% of total energy consumption in 10 years (AEDP: 2012-2021) through the following six strategic initiatives:

- Promoting community collaboration in the 1. broadening of production and consumption of renewable energy.
- 2. Adjusting the incentive measures to promote stronger investment from the private sector.
- Amending the laws and regulations that do not 3. benefit renewable energy development.
- Improving the infrastructure system of 4. transmission lines, power distribution lines, and including the development of a Smart Grid System.
- 5. Improving public relations and building up comprehensive public knowledge.
- 6. Promoting research as a mechanism for the development of an integrated renewable energy industry.

Iternative Energy Development Plan (AEDP), 2012 – 2021

NE Development of low-carbon society

nent

Alternative Energy Development Plan (AEDP: 2012-2021)

Support the investment of Private sector and community

### Target on using Renewable Energy at 25% of Total Energy Consumption by 2012

Solar	Wind	Hydro power plant				Bio-energy		Biofuels			
2,000 MW		Mini	Micro	Pumped- Storage		Biomass	Bio-gas	MSW	Ethanol	Bio-diesel	2 <sup>nd</sup> -Gen. Biofuels
100 ktoe	1,200 MW	324	мw	1.284 MW		3,630 MW	600 MW	160 MW	9	5.97	25
TOO KIDE		524	4 10100	1,204 1/100		8,200 ktoe	1,000 ktoe	35 ktoe	ML/day	ML/day	ML/day
3,200 MW, 100 ktoe		1,608 MW		-	4,390 MW, 9,235 ktoe		44% Replacing Oil				

Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy

<b>The AEDP Renewable</b>	<b>Energy Consumption Target</b>
in	10 years

		iii iu years			
	Type of Energy	Unit	Target 2021	As of 2012	California a management
	Electricity	MW	9,201	2,786	
		ktoe		1,138	
	Solar	MW	2,000	376.72	
	Wind	MW	1,200	111.73	
	Small Hydro Power	MW	1,608	101.75	Con the
1 . L	Biomass	MW	3,630	1,959.95	an the state
R	Biogas	MW	600	193.40	1. 1955
なと見た	MSW	MW	160	42.72	
	New Energy	MW	3	-	N New Mark
1	Heat	ktoe	9,335	4,886	- inte
1	Solar	ktoe	100	4	
	Biomass	ktoe	8,200	4,346	
10-10	Biogas	ktoe	1,000	458	GY_
	MSW	ktoe	35	78	
	Biofuels	million litres/day	39.97	3.5	
		ktoe		1,270	
A	Ethanol	million litres/day	9	1.4	
	Biodiesel	million litres/day	5.97	2.7	
「「「「「「」」」	New Energy Replacing Diesel	million litres/day	25	-	
a line	%Alternative Energy		25%	<b>9.9</b> %	
N.	Source: Department of Alterna	tive Energy Development	and Efficiency Mini	stry of Energy	

Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy

BIOMASS

Biomass is organic and renewable material originated primarily from agricultural waste or byproduct, including rice husks, sugarcane wastes, oil palm wastes, cassava wastes, rubber, wood wastes, corncobs, distillery slop, coconut fibers and shells. Biomass is one of the most important sources of renewable energy in Thailand. Thailand, with a developed agricultural sector employing more than half of the population, produces 66 million tons of agricultural waste annually, 22 million tons were used as fuel for generating power and about 44 million tons of agriculture residues were unused. The most promising residues are rice husks, bagasse, oil palm residue and rubber wood residue. Thus, Thailand has high potential to utilize the unused agricultural waste as alternative energy. In 2012, Thailand produced 2,000 megawatts from biomass. According to the AEDP 2012-2021, Thailand aims to produce 3,630 megawatts from biomass by 2021.

# BIOGAS

Biogas is a mixed gas, mainly composed of methane and inert carbonic gas produced from anaerobically digested organic matter. The main raw materials in the production of biogas are industrial waste, farm waste, waste water, and Municipal Solid Waste (MSW). Biogas power has high potential in Thailand due to the abundant availability of industrial waste and livestock manure. The installed capacity of Thai biogas power plants was 193 megawatts in 2012. AEDP aims for 600 megawatts of biogas utilization by 2021. To further stimulate biogas power, the government has introduced in February 2013 a feedin tariff subsidy program that contributes US\$0.15 (THB4.50) per kilowatt-hour for a period of 20 years to power plants that use Napier grass supplied by local green energy community projects to produce the compressed-biogas (CBG) that is used as feedstock.

And this

# MUNICIPAL SOLID WASTE (MSW)

In 2012, Thailand generated approximately 14.5 million tons of MSW composed of food waste, paper and plastic. This waste could be used to produce electricity from the heat generated by incineration. Thailand is developing the potential to produce electricity from MSW. In 2012, Thailand produced 43 megawatts of power through MSW. Thailand's AEDP aims to produce 160 megawatts from MSW by 2021.

# BIODIESEL AND ETHANOL

The Government of Thailand has undertaken serious efforts to decrease dependence on imported fuel oil, as well as to promote green technologies by promoting the use and production of alternative energy such as biodiesel and ethanol. To support the use of alternative energy, most vehicles in the public transportation network in Bangkok are flexfuel, allowing them to burn biofuels. Biofuels are lessexpensive than pure fossil oil. Additionally, biofuels are available for purchase throughout the country and less harmful to the environment.

Biodiesel is a diesel fuel produced from plant oil, which is abundant in Thailand. In 2012, 13 biodiesel manufacturers obtained the quality standards set by the Department of Energy Business, with a total capacity of 5.21 million liters per day. The goal of AEDP is to increase the consumption to 5.97 million liters per day by 2021.

Ethanol is an alcohol made by fermenting plant materials such as sugar cane or molasses, tapioca, paddy straw, cassava and corn, all of which are widely available in Thailand. In 2012, Thailand was the world's largest exporter of cassava and the second largest exporter of sugar. Both of these raw materials are interchangeable in ethanol production.

Thailand's AEDP forecasts sharp increases in the proportion of cassava and molasses that will be used for energy such as ethanol. The plan forecasts cassava and sugarcane production will reach 35 and 105 million tons per-year, respectively, by 2021.

The consumption of ethanol was 1.4 million liters per day in 2012 and is estimated to reach the target of 9 million liters per day by 2021. In 2012, there were 21 factories producing ethanol in Thailand with a total capacity of 3.89 million liters per day. "Over 20 years of experience working in the solar energy sector makes me see the potential of the intensity of sunlight, which Thailand possesses more than many other countries."

- Wandee Khunchornyakong, Chairman & CEO, SPCG Public Company Limited.

# SOLAR ENERGY

Located in the tropics, Thailand has high potential for solar energy. The annual average of total daily solar radiation in Thailand is 5.06 kWh/m2.day (18.2 MJ/ m2.day). Most of the country receives the maximum solar radiation during April & May, ranging from 5.56– 6.67 kWh/m2.day. Thailand has several areas with great solar power potential including Northeastern region and certain area in the central region.

Solar is one of clean natural energy sources that can be transformed into heated and electricity. There are two main methods for generating electricity from solar energy. One is photovoltaic (PV) cells, which generate power by converting solar radiation into direct current (DC) electricity using semiconductors. The other method is a concentration system, using lenses or mirrors to focus sun radiation. The concentrated sunlight heats water or other fluids to generate steam for use in steam turbines to generate electricity.

In 2012, Thailand had solar power production capacity of 377 megawatts. Thailand's AEDP targets a solar energy capacity of 2,000 megawatts in 2021. In July 2013, the National Energy Policy Committee has approved a Feed-in Tariff (FIT) for rooftop solar power with a target of 100 megawatts for household and 100 megawatts for Small and Medium Enterprise (SME) and factories.

# WIND POWER

There is potential for utilization of wind turbines for power generation throughout Thailand, particularly along the sea shores and on islands either in the Thai Gulf or Andaman Sea. Low-speed wind turbines can start rotating at wind speeds of 2.5 meters persecond and generate a full load of electricity at 9 meters per-second. Wind speed in Thailand is mainly influenced by the northeast monsoon, the southwest monsoon and local topography. Thailand has an annual average wind speed of 4-5 meters per-second at an elevation of 90 meters above sea level. Higher wind speeds of 6-7 meters per second can be found in mountain ranges in the south and the northeast during the period of the monsoons.

The Thai government supports investors with special incentives for investing in wind energy. The investors receive US\$0.12-0.15 (THB3.5-4.5) per kilowatt hour when investing in wind power generation. All private investments can sell electricity to state-owned companies for prices above market rates. Moreover, the Department of Alternative Energy Development and Efficiency (DEDE) has initiated the Demonstration Project on (Micro) Wind Power Generation at a Community Level, since 2007, by supporting the installation of micro wind turbine sets for one kilowatt power generation. The targeted areas are 60 communities nationwide. This effort is intended to promote production of wind turbines and increased use of wind energy in the future.

Wind Energy Holding Co., Ltd, a wind project developer, has already finished installing of wind farm projects called "West Huay Bong 3" and "West Huay Bong 2". Both wind farm projects, located in Nakhon Ratchasima, have capacity of 103.5 megawatts each and started commercial operation since November 2012 and February 2013, respectively. Additionally, the company has a long-term investment plan for wind farms with a total installed capacity of 1,000 megawatts by 2017.

By 2012, Thailand had commercial wind power capacity of 112 megawatts and aims to reach 1,200 megawatts by 2021.



### HYDROPOWER

Thailand has several large hydropower projects throughout the country; however, small hydropower projects are considered more environmentally sound and have emerged as a compelling alternative. Hydropower is a renewable energy source with significant potential and relatively low cost of production. In Thailand, hydropower is available in any part of the country in which there is water flow. Thailand has abundant seasonal rainfall and reservoirs providing suitable locations to generate electricity by hydropower.

Moreover, micro-hydro technology is suitable for both on-grid and off-grid systems. Thus, the government supports micro hydropower projects in many villages across the country, especially in the remote areas that electricity from the Thailand Provincial Electricity Authority (PEA) cannot access. People in these villages can use their resources to generate their own electricity.

In 2012, Thailand's small hydropower energy production totaled 102 megawatts. Thailand's AEDP has a target to increase power generation from hydropower to 1,608 megawatts by 2021.

# NATURAL GAS VEHICLES

Natural gas is one of the cleanest-burning alternative transportation fuels. Natural Gas Vehicles are more efficient, produce fewer emissions and cost less when compared to oil. In 2012, Thailand consumed 278 million cubic feet per-day of NGV, a 21% increased from the previous year.

Global vehicle manufacturers have continued to increase the production of NGV cars. By the end of 2012, the number of NGV vehicles in Thailand increased to 374,857 units from 300,581 units in 2011. In the same year, Thailand had a network of 469 natural gas stations, 243 of which are located in Bangkok and 240 in other locations around the country.

# CLEAN DEVELOPMENT MECHANISM (CDM)

The Clean Development Mechanism is an arrangement under the Kyoto Protocol which aims to reduce carbon dioxide gas emissions. The CDM allows foreign firms to invest in less-expensive emission reductions in foreign markets, while collecting Certified Emission Reduction (CER) credits. Developing nations receive investments for the enhancement of their carbon dioxide reduction. These CERs can be traded, sold, and used by industrialized countries to a meet a part of their emission control. Thailand Greenhouse Gas Management Organization (TGO) has currently issued a Letter of Approval (LoA) for 211 CDM projects, with expected average annual CERs of 12.7 megaton carbon-equivalent.

Royal Decree No.514 provides an exemption of corporate income tax on net profit derived from the sale of carbon credit, either domestic or overseas, for three accounting periods starting from January 1st, 2011. Royal Decree No.514 covers the two following types of projects:

- CDM projects that sell carbon credits of CERs, as certified by the Committee for Clean Development of the United Nations and are certified prior to the end of 2013.
- CDM projects that see carbon credits of Voluntary Emission Reduction (VERs) as certified by the Thailand Greenhouse Gas Management Organization and are certified prior to the end of 2013.

### SUPPORT FOR INVESTORS

The Energy Policy & Planning Office resolution offers additional value to the normal purchasing rate from power plants using renewable energy through the Adder Program. Detailed rates for the Adder Program are shown in the table below.

### **Adder Program**

Types of renewable energy	Adder rate (Baht/kWh)	Special Adder for Diesel Replacment (Baht/kWh)	Special Adder for 3 Southernmost Provinces and 4 districts in Songkhla* (Baht/kWh)	Year supported		
1. Biomass						
- installed Capacity $\leq$ 1 MW	0.50	1.00	1.00	7		
- installed Capacity > 1 MW	0.30	1.00	1.00	7		
2. Biogas						
- installed Capacity $\leq$ 1 MW	0.50	1.00	1.00	7		
- installed Capacity > 1 MW	0.30	1.00	1.00	7		
3. Waste (MSW and Industrial	Waste, excluding Hazardous Waste and Organic Waste)					
- Landfill and Digestor	2.50	1.00	1.00	7		
- Thermal Process	3.50	1.00	1.00	7		
4. Wind						
- installed Capacity $\leq$ 50 kW	4.50	1.50	1.50	10		
- installed Capacity > 50 kW	3.50	1.50	1.50	10		
5. Small/Hydropower						
- 50 kW ≤ installed Capacity ≤ 200 kW	0.80	1.00	1.00	7		
- installed Capacity < 50 kW	1.50	1.00	1.00	7		
6. Solar	6.50	1.50	1.50	10		

4 districts in Songkhia province including Channa, Theoha, Saba voi and Na Thawi Source: Energy Policy and Planning Office, Ministry of Energy as of 2012

### Rooftop Solar Feed-in Tariff (FIT) Program

Classification	Scale Quota		FIT (Baht/kWh)	Year Supported	
Residential	0-10 kWp	100 MW	6.96	25	
Small Enterprise	>10-250 kWp	100 MW	6.55	25	
Medium and large Enterprise	>250-1,000 kWp		6.16	25	

Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy as of 2013

The Ministry of Energy (MOE) has planned to shift the Adder program to a Feed-in Tariff (FIT) arrangement. FIT offers a guaranteed purchase price for electricity generated from renewable energy sources for a specified period of time, typically based on the cost of generation of each technology. Recently, the MOE is studying FIT implementation measures for electricity generated from alternative energy in Thailand.

"Thailand has a very attractive and modern scenario for investment. The Board of Investment's incentives on renewable energy are many and generous. Thailand is a regional leader in many sectors, thanks largely to BOI promotion."

- Martin Klose, Director, Roedl & Partner, Ltd.-

# SUPPORTING AGENCIES ENCOURAGING ALTERNATIVE ENERGY USE

### Ministry of Energy (MOE):

The Energy Policy and Planning Office (EPPO) is the main authority in the formulation and administration of energy policies and planning for national sustainability.

The Department of Alternative Energy Development and Efficiency (DEDE) has a mission to support and promote clean energy production and consumption that is consistent with the situation of each area, and is cost-effective and sustainable.

Ministry of Natural Resources and Environment of Thailand (MNRE) is in charge of the protection of Thailand's mineral, marine, water and coastal resources and administers environmental protection through laws governing these jurisdictions.

Ministry of Science and Technology (MOST): Formerly the "Ministry of Science, Technology and Energy". The office exists among others to exploit technology and innovation as well environmental protection.

### ATTRACTIVE INVESTMENT INCENTIVES

The Thailand Board of Investment (BOI) offers an attractive range of fiscal and non-tax incentives for investments. Tax-based incentives include exemption or reduction of import duties on machinery and raw materials, and corporate income tax exemptions and reductions. Non-tax incentives include permission to bring in foreign workers, own land, and take or remit foreign currency abroad. Additionally, projects in manufacturing and many service sectors are entitled to majority or total foreign ownership.

Recognizing the importance of Alternative Energy to the country, the BOI has designated alternative energy as a target. Under the BOI's Investment Promotion for Sustainable Development, which is designed to enhance domestic industrial growth and upgrade to a more knowledge-based industry that uses higher technology, the following activities have been classified as Priority Activities:

- Manufacture of alcohol or fuel from agricultural products, including scrap, garbage and/or waste;
- Manufacture of energy-conserving machinery or equipment or machinery that uses alternative energy;
- Manufacture of fuel cells;
- Production of electricity or steam power using alternative energy such as energy from agricultural materials, biogas and wind energy.



Projects in these activities that are submitted prior to the end of 2013 for all locations except Bangkok receive maximum incentives, including import duty exemption on machinery; an 8-year-corporate income tax exemption without being subject to a corporate income tax exemption cap; a further 50% reduction of CIT on the net profit generated from investment for 5 years after the exemption period; double deductions for transportation, electricity and water costs for 10 years from the date of first income derivation from promoted activity; and, deduction of infrastructure installation or construction costs from net profit in addition to normal depreciation of not more than 25% of the project.

Other Thai government agencies that encourage alternative energy include the Energy Policy and Planning Office under the Ministry of Energy, the Department of Alternative Energy Development and Efficiency under the Ministry of Energy; the Ministry of Natural Resources and Environment; and the Ministry of Science and Technology.



# FOR FURTHER INFORMATION:

Thailand Board of Investment (BOI): http://www.boi.go.th

The Department of Alternative Energy Development and Efficiency (DEDE): http://www.dede.go.th

The Energy Policy and Planning Office (EPPO): http://www.eppo.go.th/

Ministry of Energy of Thailand (MOE): http://www.energy.go.th/

Ministry of Natural Resources and Environment of Thailand (MNRE): http://www.mnre.go.th/

Ministry of Science and Technology of Thailand (MOST): http://www.most.go.th

Thailand Greenhouse Gas Management Organization (TGO): http://www.tgo.or.th/

Electricity Generating Authority of Thailand (EGAT): http://www.egat.or.th

Provincial Electricity Authority (PEA): http://www.pea.or.th

Metropolitan Electricity Authority (MEA): http://www.mea.or.th

Department of Industrial Work (DIW): http://www.diw.go.th

Office of the Energy Regulatory Commission of Thailand (OERC): http://www.oerc.go.th

Office of Natural Resources and Environmental Policy & Planning (ONEP): http://www.onep.go.th

Department of Business Development (DBD): http://www.dbd.go.th

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