

NON-FOSSIL-FUEL OPTIONS IN THAILAND AND RELATED NEIGHBOURING COUNTRIES

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Abstract

The total primary energy supply for Thailand increases at a rate of about 6 % per annum. Fossil fuels including fuel oils, natural gas, coal and lignite provide about 82 % of energy of the total energy supply.. The fossil fuels have limitations, however, such as long-term availability in the country, air pollution and green-house gas emission. One of the energy policies of Thailand is to increase the supply of renewable energy sources to about 25 % of the total supply within the year 2014.

Gasohol and bio-diesel have been promoted as alternative fuels for transportation in Thailand. To avoid competition between food and energy, gasohol E20 and bio-diesel B5 should be the upper limits of the two bio-fuels in Thailand. In the near future, plug-in hybrid and electric cars will be better alternatives as passenger cars.

Natural gas which has to be shared between power generation and transportation will still be the main source of energy for power generation until at least 2021. However, recent feasibility studies indicate that more than 3,000 MW can be generated by small hydro-power plants in the country. A very large potential for hydro-power generation still exists in neighbouring countries. Hydro-power development in the region must be based upon acceptable environmental impact and mutual benefits.

Wastes from manufacturing industries and agro-industries such as sugar mills, rice mills, saw mills have already generated more than 1,500 MW. Pilot projects confirm that fast-growing trees such as eucalyptus, acasia have potential to economically generate electricity for rural areas. Thailand can economically obtain an additional power generating capacity over 2,000 MW from biomass and biogas.

The average wind velocity in the country at 10 m high which is about 2 m/s is suitable for water pumping but too low for economical electricity generation. However, recent studies suggest that large wind turbines at heights above 50 m in the country may economically generate more than 1,500 MW for the national electrical grid and remote areas.

With increasing environmental impact from global warming, renewable sources of energy such as biomass, hydro-energy and wind should provide better options during the next two decades. Nuclear power and photovoltaics may eventually become final options.

Keywords: bio-fuels, electricity generation, biomass, hydro-power, nuclear power, wind.

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MAIN PROBLEMS OF FOSSIL-FUELS:

- Large foreign exchange required for imported oils and gases
- Less energy security, especially on crude oil
- Environmental impact in the air, water and on land
- GHG emissions

GREEN HOUSE GASES

Status:

- 280 ppm, before the industrial revolution , 1750
- 380 ppm, at present,
- > 550 ppm in 2050, if business as usual,
- worst impacts and point of no return for global warming
- **combustion of all fossil fuels emits CO₂, about 70% of all GHG**
- **current emission index: emission per capita**

Kyoto Protocol, 1994:

- GHG covered: CO₂, CH₄, N₂O, ...
- Reduction of CO₂ : 8 % by EU, 6 % by Japan,.
- **USA, the largest emitter, refuses to ratify.**
- **USA, etc., proposed emission per GDP instead of emission per capita..**
- Thailand ratified the Protocol in 1997
- **Thai emission per capita & per GDP will exceed the global average value in about five years, if BAU.**

TRANSPORT SECTOR

- Natural gas is at present the main alternative fuel.
- Joint development of natural gas with neighbouring countries

Bio- Fuels:

- Thailand has sufficient raw materials to produce gasohol E10 and bio-diesel B3 for the whole country.
- **To avoid competition between food and energy, gasohol E20 and bio-diesel, B5 should be the upper limits.**
- **Bio-diesel is more cost-effective and therefore preferable to gasohol.**
- Bio-fuels are supplementary alternative fuels.
- **Plug-in hybrid and electric cars will be better alternatives.**

ELECTRICITY GENERATION

Current Status:

Economic Sector	Demand, %
Commercial	31.2
Industry	46.9
Residential	21.1
Agriculture & Others	0.8
Total	100.0
Total Installed Power Generating Capacity	33,348 MW
National grid	27,107 MW
Reserve capacity in the national grid	22.1 %
Installed generating capacity per capita	0.54 kW

Energy Sources for Electricity Generation, including off-grid

Energy Source	%
Coal & lignite	15.8
Diesel & fuel oils	5.4
Natural gas	64.8
Hydro-energy	8.6
Biomass & others	5.4
Total Electricity Production	152,572 GWh

**Additional Power Generating Capacity for National Grid, 2011-2021:
(PDP 2007)**

Energy Sources, in	MW	Remark
Coal	2,800	CO2
Natural gas	18,200	transport?
Nuclear power	4,000	timing?
Small power producers	1,700	too small
Imported power, mainly hydro-power	5,090	revision
Total additional power generating capacity	31,790	revision ?
Total generating capacity in the grid	59,251	revision ?

Small Power Production by Renewable Sources, 2007-2014:

Renewable Sources	MW	Remark
Biomass	2,800	
Biogas from industries, pig farms, etc.		
Fast-growing trees, e.g. eucalyptus, acasia, etc.		
Municipal wastes	100	too small
Hydro-power	400 +	3,000 +
Solar power	45	too large
Wind power	400 +	1,500 +
Total power generating capacity	3,705 +	too small

**Hydro-Power Generation from Neighbouring Countries, in MW,
after 2021**

Status in	Burma	China	Laos
Installed	-	-	360
Under construction	-	-	2,117
MoU signed	1,500	3,000	990
Under negotiation or feasibility studies	8,900 ?	?	3,910
Total power generating capacity	10,400 ?	3,000	7,377

Conclusions & Recommendations

- Dependency on natural gas for electricity generation is too excessive, especially a large fraction has to be diverted to transport sector.
- Imported high-quality coal which has low sulphur & moisture contents, is preferable to lignite in the region.
- To avoid competition between food and energy, gasohol E20 and bio-diesel B5 should be the upper limits of bio-fuels for transport sector.
- Small power production, mainly from renewable sources, is still too small by the year 2014.
- With a wind-power potential more than 1,500 MWe in the country, installation of large wind turbines should be accelerated, especially along coastal areas.
- Large hydro-power potential over 10,000 MWe is still available in Thailand, and should be better utilized.
- Hydro-power potential on the Maekhong River, especially between Laos and Thailand should be further assessed and harnessed with consents from downstream countries i.e. Cambodia and Vietnam.
- Hydro-power potentials in Laos and Cambodia should be better utilized with mutual benefits.
- Large hydro-power projects in Thailand and neighbouring countries with unsolved political issues must be avoided.
- Dependency on hydro-power generation in neighbouring countries is too excessive.
- Nuclear power generation which is a proven technology has to be kept as the last option for controlling CO₂ emission from power generation after 2025.
- Externalities have not been fully taken into account, especially the cost of CO₂ emission.

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