Thailand's Biomass Energy

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ABSTRACT

Four major agro industries that have been commonly utilized biomass as fuel for cogeneration in Thailand are sugar, rice, palm oil and wood industries. Despite the current use of biomass as fuel in cogeneration, there is still much to be harnessed in the agro industries giving a clear picture of potential of biomass for cogeneration . Total installed capacity of cogeneration in these agro industries is over 700 MW. The estimated surplus power generation capacity generated from biomass in sugar, rice, palm oil mill and wood mill are 240, 486, 115 and 118 MW respectively.

In 1992 Electric Generating Authority of Thailand (EGAT) has announced the buy back electricity from small power Producer (SPP).

In 1998, thirty four SPPs firmed contract with 4000 MW of installed capacity had proposed to EGAT. Only 2200 MW capacity were selected. Some of these SPP generate power from biomass.

As of August 20th, 2003. fifty – nine SPPs with 2068.9 MW had synchronized the power to the grid.

Introduction

Biomass is one of the most important sources of Renewable Energy in Thailand. Energy from biomass is the traditional way and still practice in the rural area at present. Direct combustion has been the most important process in converting biomass to other useful form of energy. Biomass is also widely used in industry. Industries that rely on biomass as energy source are brick production, tobacco, lime production smoking of rubber sheet and fish mill production.

During 1997 – 1998 the energy demand was slowly down due to country 's economy crisis after the recovery in 1999 – 2000 the Thailand 's growth of final energy consumption were increased at the rates of 4.4 % and 1.3 % respectively. In 2001, the total final energy demand in Thailand was 49,542 ktoe (kilo-ton-oil-equivalent) with the rate of increasing 3.6 % from the previous year.

Table 1 : Final Energy Consumption in Thailand, 1992-2001

Type of Energy	Energy consumption (ktoe)									
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Renewable	9,818 28%	8,692 23%	8,430 21%	8,771 19%	8,861 18%	8,499 17%	7,885 17%	8,322 18%	8,599 18%	8,443 17%
Commercial	25,416 72%	28,926 77%	32,372 79%	36,958 81%	40,389 82%	40,956 83%	37,217 83%	38,807 82%	39,207 82%	41,099 83%
Total	35,234 100%	37,618 100%	40,802 100%	45,729 100%	49,250 100%	49,455 100%	45,102 100%	47,129 100%	47,806 100%	49,542 100%

The important elements of energy policy and strategy for Thailand are the development of renewable energy sources and the promotion of energy efficiency.

Renewable Energy will play an important role in security supply, reducing the dependence on oil import and the environment friendly.

Potential of Biomass Energy Resources

Agriculture sector is the base of Thailand's economy and accounts for about 60% of the labor forces. So biomass has high potential to utililze as renewable energy. The main agriculture residues consist of rice husk, straw, bagasse, palm oil waste, wood waste etc. According to the residue potential in 2001 from 10 main agriculture products assessment, 22 million tons out of 66 million tons were used as fuel and small amount for other purposes. Whereas about 44 million tons of agriculture residues were unused and equivalent to 612.89 PJ (Pica joule) of energy as shown in Table 2.

Table 2 : Estimation of Agricultural residues Potential, Year 2001

Type	Production	Residues	RPR	Residue generated	Energy Use factor	Amount of Residue used for energy	Surplus Availa bility factor	Amount of surplus residue	Calorific value	Energy
	(10^6 kg)			(10^6 kg)		(10^6 kg)		(10^6 kg)	(MJ/kg)	(TJ)
Sugar cane	49,070	Bagasse	0.291	14,279	0.793	11,324	0.207	2,956	14.40	42,564
		Top & Trashier	0.302	14,819	0.000	0	0.986	14,612	17.39	254,097
Paddy	25,608	Husk	0.230	5,890	0.507	2,986	0.493	2,904	14.27	41,436
		Straw (top)	0.447	11,447	0.000	0	0.684	7,830	10.24	80,175
Oil palm	4,089	Empty Bunches	0.428	1,750	0.030	53	0.584	1,022	17.86	18,254
		Fiber	0.147	601	0.858	516	0.134	81	17.62	1,419
		Shell	0.049	200	0.588	118	0.037	7	18.46	137
		Frond	2.604	10,648	0.000	0	1.000	10,648	9.83	104,667
		Male bunches	0.233	953	0.000	0	1.000	953	16.33	15,558
Coconut	1,396	Husk	0.362	505	0.289	146	0.595	301	16.23	4,880
		Shell	0.160	223	0.413	92	0.378	84	17.93	1,514
		Empty Bunches	0.049	68	0.144	10	0.843	58	15.40	888
		Frond	0.225	314	0.159	50	0.809	254	16.00	4,066
Cassava	17,330	Stalk	0.088	1,525	0.000	0	0.407	621	18.42	11,433
Maize	4,397	Corn cob	0.273	1,200	0.193	2,320	0.670	804	18.04	14,509
Ground nut	135	Shell	0.323	44	0.000	0	1.000	44	12.66	552
Cotton	36	Stalk	3.232	116	0.000	0	1.000	116	14.49	1,686
Soybean	324	Stalk, Leaves, Shell	2.663	863	0.007	6	0.760	656	19.44	12,748
Sorghum	148	Leaves & stem	1.252	185	0.118	22	0.648	120	19.23	2,309
TOTAL	102.533			65,630		17,643		17,643		612,891

Some parts of these waste are currently used as fuel such as paddy husk, which is burned to produce steam for rotating turbines in rice mills, fiber and shell, empty fruit bunches in palm oil mills, bagasse in sugar mills are burned to produce steam used in turbines and exhaust steam to use in process and parawood wastes are burned to produce hot water boiler or steam to heat exchange for drying the wood in the kiln.

The availability of biomass potential for power generation as shown in Table 3.

Table 3 : Power Generation from surplus biomass potential in 2001

Biomass	Biomass Generated (1,000 tons)	Surplus Availability factor	Surplus biomass (1,000 tons)	Power generation potential (MW)[5/]
Bagasse	14,279	0.207	2,956	246
Paddy husk	5,890	0.493	2,904	486
Oil palm bunch	1,750	0.584	1,022	115
Oil palm fiber	601	0.134	81	
Oil palm shell	200	0.037	7	
Wood chip	5,800	0.310	1,800	118
Total	29,790		8,843	965

During the crop year 1995/1996, forty-six sugar mills in the country had a combined milling capacity of about 58 million tons of sugar cane. About 16.8 million tons of bagasse were used to cogenerate power and heat for sugar processing. A total electricity generating capacity of 430 MW had been installed in sugar mills, including 64.5 MW of SPPs. A mechanical power capacity of about 200 MW had also been installed for cane cutting and shredding.

Among eighty large – rice mills with the milling capacities over 100 tons of paddy per day. Most of them used rice husk as fuel to generate power about 50 MW for milling. As of June 1, 1998 there were several large rice mills exporting power to the grid about 36 MW (Over 5 MW Power Plant, rice husk, wood waste and imported coal were used as mixture fuel).

Over 30 palm oil mills in the country produced 400,000 tons of palm oil from aggregate capacity 2,255,000 tons of FFB (fresh fruit bunche) (FFB) per year. Sixteen Large palm oil mills with the average milling capacity of about 10 tons of FFB per hours used fiber and shells to cogenerate heat and power for internal consumption. The average power generating capacity of the large palm oil mills is about 530 kW.

Small Power Producer (SPP)

In 1992 the Government announced the policy of state enterprise privatization and encouraging more private sectors participation in power development in the forms of Independent Power Producer (IPP). And the National Energy Policy Council (NEPC) had drown up the regulations for the purchase of electricity from Small Power Producer (SPP).

The objectives in Purchasing Electricity from SPP were :

- to encourage participation by SPPs

- to promote the use of indigenous by product of energy sources and renewable energy
- to promote more efficient use of primary energy
- to reduce the financial burden of government investment

Characteristic of Qualifying Facilities

- Using non – conventional energy
- Using the following fuels (waste or residual from agriculture, garbage, dendro thermal sources)
- Co generation using anytype of fuel
  - the process involves the continuous use of energy Topping cycle or Bottoming Cycle
  - Steam production > 1O% of total energy production
  - Efficiency > 45%

Table 4 : Power Purchase Program from SPPs

Date	Cumulative Maximum Capacity (MW)
• EGAT Announcement Date	
1. March 1992	300
2. December 1995	1,444
3. September 1996*	3,200
• Cabinet Resolution Date	
4. August 1997**	No limit

Remark : * two announcements :
1) To increase the purchasing capacity from 1,444 to 3,200 for pending SPPs
2) To purchase power from projects using renewable energy only.

** Power purchase from Non-Firm Contract SPPs and / or SPPs using Renewable Energy.

Table 5 : Power Purchase Capacity from SPPs (Signed Contracts)

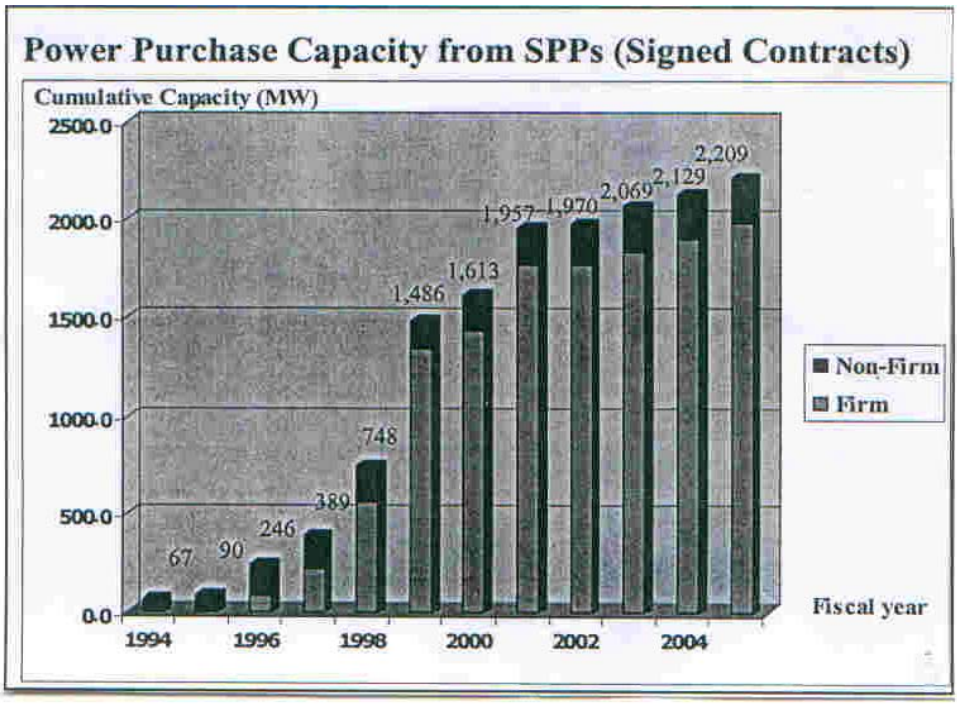


Table 6 : Current Status (as of August 20th, 2003)

SPPs	Firm		Non-Firm	Total
	Co-gen.	Renew		
No.of SPPs	26	14	40	80
Purchased Capacity (MW)	1,852.0	265.6	322.3	2,439.9
Signed Contracts				
No.of SPPs	26	5	34	65
Purchased Capacity (MW)	1,852.0	65.4	281.9	2,199.3
Achieved COD				
No.of SPPs	25	4	30	59
Purchased Capacity (MW)	1,792.0	45.2	231.7	2,068.9

Promotion of SPPs using Renewable Energy

In 1999 the Energy Conservation Promotion Fund Committee (ENCON Fund) (Comittee) authorized the National Energy Policy Office (NEPO) to Manage an amount of 2,060 million Baht to subsidize SPPs using renewable energy. Nepo announced the Request for Proposal in 16 July 2001. The Funding would be given by Bidding Producer which requested amount of funding not exceeding 0.36 Baht/kWh for 5 years. In June 2002,

the ENCON fund Committee approved 31 selected proposals totalling 511 MW with the Fund 2991 million Baht. These selected SPPs must submit public hearing plan and the result from public hearing.

Only 15 SPPs totally 214.1 MW were approved for the Fund of 1235 million Baht from the ENCON Fund Committee after they had assessed the result of public hearing.

Firm Contract

Capacity Payment (CP_o) - Baht/kW/month	
EGAT 's Announcement	1 August 2001
Term of Contract (year)	Renewable Energy
> 5 - 10	217
> 10 - 15	276
> 15 - 20	301
> 20 - 25	400
Energy Payment (EPO)	1.49 Baht/kWh

Non Firm Contract

The Announcement of SPP purchase price dated 1 August 2001
Energy Payment (EPO) 1.59 Baht/kWh
Purchase Price will be changed when the price of Natural gas (NG) the PTT sold to SPPs change from the base price 151.4548 Baht/million BTU more or less than 1 Baht/million BTU

Table 7 : Existing Installed Generating Capacity in Thailand
(As of March 2003)

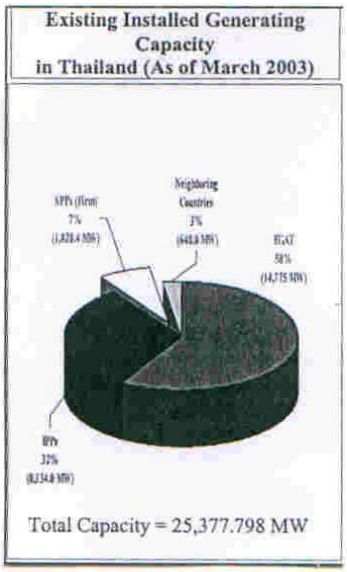
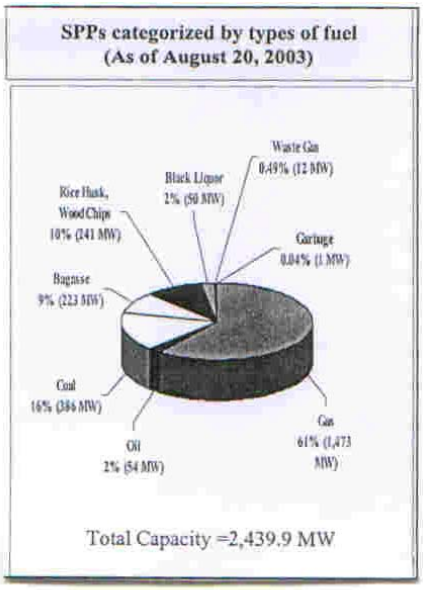


Table 8 : Categorized by types of fuel
(As of August 20, 2003)



Biomass for Cogeneration

Positive Factors :

1. Thailand is agriculture country. There is abundance of biomass production. The price of Biomass is still low.
2. The exchange rate since 1997 have effected to the price of imported energy.
3. Biomass is an environment friendly fuel.
4. There are many support programmes from government and others international funds. (UNDP, GEF, EC etc.,)
5. Difficult access to financing

Negative Factors :

1. High investment cost for modern biomass technologies.
2. People don' t want any new power plant in their area.
3. Lack of research personnel in the area of thermal conversion.
4. The conversion efficiency in utilizing biomass as an energy source is generally low.
5. Difficult assess to financing.

Conclusion

The strategic plan for renewable energy development have set ambitions target for renewable energy in next 10 years :

To increase the renewable energy ratio from 0.5% to 8% and new power plant must generate power from renewable energy 3 - 5% of total capacity. This should lead to expand opportunities and markets for biomass power production in Thailand.

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