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Thailand

Biofuels Annual

Annual 2010

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Report Highlights:
The report discusses the effects of Thailand's biofuel policy on production, supply and demand.

Post:
Bangkok

Executive Summary:

Thailand's biofuel work plan and development had not materialized until petroleum oil prices began to sharply escalate in 2004. In an effort to deal with spiraling oil prices, the Thai government has continuously created policies and programs which have resulted in the desired effects of significant increases in production and consumption of biofuels.

In 2009, ethanol production totaled 400.7 million liters or 1.1 million liters/day, up 19 percent from the previous year due to an increase in new ethanol plants, particularly tapioca-based plants that became operational in the second half of the year. However, ethanol production remained lower than the government's target of 3.0 million liters/day. In 2010 and 2011, ethanol production should continue to grow sharply by 20-22 percent in line with domestic consumption driven by the government's price-incentive policy. On the export side, after a declining in 2009, ethanol exports should increase significantly due to large excess supplies of ethanol. Most ethanol exports went to Asian countries, particularly Japan and Singapore.

Biodiesel production increased significantly within two years from 68 million liters in 2007 to 448 million liters in 2008 and 610 liters in 2009 due to a compulsory B2 production policy. It is anticipated that production will grow an additional 10 percent in 2010 and 42 percent in 2011, as B3 production mandate comes into effect in mid 2010 and will be replaced by B5 production mandates in 2011.

Thailand began its first foray into second generation biofuels using sugar cane bagasse, it's still at an experimental level but is expected to be commercially viable in the short term. Thailand has also promoted biogas and biomass energy for heat and power generation in recent years through the licensing of approved establishments that are able to sell their electricity to the Electricity Generating Authority of Thailand (EGAT) under the Small Producer Program (SPP) and Very Small Producer Program (VSPP).

1. Policy and Programs

Thailand is a pioneer among Asian countries in establishing policies to promote biofuel production and use in an attempt to reduce its dependency on oil imports and to capitalize on its supplies of feedstock from its vast agricultural production. However, Thailand's biofuel work plan and development had not materialized until petroleum oil prices began to sharply escalate in 2004. In an effort to deal with spirally rising oil prices, the Thai government has continuously created several policies and programs which led to significant increases in production and consumption of biofuels during this decade.

All the policy and program thus far were built on the first National Alternative Energy Development Plan 2004-2011 and the second Alternative Energy Development Plan 2008-2022, featuring on production mandate (especially biodiesel), tax privilege from Board of Investment (BOI), tax and retail retail price incentive, R&D support, public awareness promotion, etc. The following are details on policy and programs for gasohol and biodiesel.

1.1 Ethanol

Thailand has implemented a 15-year ethanol plan (2008 – 2022) (Table 1.1); under this plan the Government has set targets of ethanol production and consumption of 3.0 million liters/day thorough 2011, 6.2 million liters/day in the medium-term (2012 – 2016) and 9.0 million liters/day in the long term (2017 – 2022). To carry out this plan, the Government provides tax incentives to ethanol producers, gasohol refineries, and automobile manufacturers. Ethanol producers who sell ethanol in the domestic market for gasohol production get an excise tax exemption on ethanol of 7.0 baht/liter (US 80 cents/gallon). Meanwhile, gasohol refineries are able to lower retail prices of gasohol as the Government provides a price subsidy using the State Oil Fund applied at gasohol sales at the pump (see Table 2.3) in order to encourage gasohol consumption over gasoline which is still being consumed at a rate of 8.0 million liters/day. Also, retail prices of E85 gasohol (a mixture of 85 percent ethanol and 15 percent gasoline) are set more than 30 percent lower than E 10 (a mixture of 10 percent ethanol and 90 percent gasoline)which is 22-26 percent lower than premium gasoline. On April 19, 2010 the cabinet approved to reduce excise taxes to 22-32 percent for automobile manufacturers who produce vehicles compatible with E85 of, as compared to E20 vehicles that pay 25-35 percent, and regular vehicles that pay 30-50 percent. In addition, the Government also extended a reduction on the import duties for flex fuel vehicles (FFV) from 80 percent to 60 percent by 2010.

Table 1.1: 15-year Ethanol Production Plan (2008 - 2022)

unit: million liters/day

	Short Term				Medium Term	Long Term
	2008	2009	2010	2011	2012 - 2016	2017 - 2022
Target	3.0	3.0	3.0	3.0	6.2	9.0
On-line Plants' Capacity	1.6	1.7	2.9	N.A.	N.A.	N.A.
Actual Production	0.9	1.1	2.5[1/]	N.A.	N.A.	N.A.

Note: [1/] Average production capacity during Jan. - Apr. 2010

Source: Ministry of Energy

The Government has implemented medium and long term programs to improve yields of biofuel crops used for feedstock in ethanol production. Thailand's ethanol production is based on molasses (a by-product of cane sugar production) and tapioca. The government seeks to increase sugarcane production to 95 million tons by 2011 by raising average yields to 15 tons/rai (94 tons/hectare), as compared to current average yields of 10.5 tons/rai (65.7 tons/hectare). Meanwhile, tapioca production is set at 30 million tons in 2011 with an increase in average yield to 5.0 tons/rai (31 tons/hectare) over the medium and long term by supporting yield improvement through the development new varieties.

1.2 Biodiesel

In 2005, Thailand began a campaign to promote biodiesel production and consumption to ease its reliance on fossil fuels. Initial production of biodiesel was insignificant until February 1, 2008, when the Government adopted a policy requiring compulsory production of B2 biodiesel (high-speed diesel with the two percent of B100 content by weight).

As of June 1, 2010, the government replaced the compulsory production of B2 with B3 as the

government foresees sufficient crude palm oil (CPO) production to implement this policy. According to an official in the Ministry of Energy, the government is on target to implement its plan to move towards compulsory requirement to B5 production by January 2011.

In order to attract B5 biodiesel utilization, the government has maneuvered tax incentives to favor B5 production by making it cheaper than B2 and B3 biodiesel. Table 1 illustrates how through the use of taxes and fees prices for B5 become attractive than B2 although ex-refinery prices are higher for B5:

Table 1.2 : A Breakdown of Retail Prices for B2 and B5 Biodiesel As of May 10, 2010

	B2 Biodiesel (Baht/liter)	B5 Biodiesel (Baht/liter)
Ex-Refinery Prices	19.77	20.08
Excise Tax	5.31	5.04
Municipal Tax	0.53	0.50
Oil Fund Fee	0.85	-0.80
Conservation Fund Fee	0.05	0.25
Wholesale Prices	26.51	25.07
Value Added Tax	1.86	1.76
Wholesale Prices + VAT	28.37	26.83
Marketing Margin	1.42	1.74
Value Added Tax	0.10	0.12
Retail Prices	**29.89**	**28.69**

Source: Ministry of Energy

Note: Conservation fund fee is not consistent. Upon a cross-check, the Thai official was unable to explain this inconsistency.

In 2005, the Office of the Board of Investment (BOI) of the Ministry of Industry developed a framework in which tax incentives for B100 biodiesel processors were provided. These incentives waive import duties on machinery and accessories, and freezes corporate income tax for eight years.

In 2005, the Cabinet approved a budget of 1,300 million baht (approx. USD 34 million) to promote palm production by providing low-interest loans tied in with a sectorial development plan. This plan was set by a joint working group from the Ministry of Agriculture and Cooperatives and the Ministry of Energy, "Committee on Biofuel Development and Promotion" (CBDP), which aimed at expanding the palm growing area by 400,000 hectares from 2008 to 2012 or 80,000 hectares annually. Additionally, the committee set goals of increasing palm productivity from 19 tons/hectare to 22 tons/hectare, and the crushing rate of crude palm oil from 17 percent to 18.5 percent by 2012. To 2012. To achieve the plan, the RTG provided low-interest loans to participating oil palm farmers.

However, increasing palm plantings to meet demand has been challenging. Harvested palm area reported by Office of Agricultural Economics (OAE) increased by 33,600 hectares in 2008, 48,700 hectares in 2009, and an estimated 45,000 hectares in 2010, compared to the annual target of 80,000 hectares. The slow growth in fresh palm production led to concerns that supplies of crude palm oil (CPO) may not be sufficient to meet biodiesel consumption in the near future. An analysis of the

outlook for biodiesel industry from 2009-2015 was reported in a recent GAIN report Biodiesel Demand and Supply Outlook.

1.3 Alternative Energy Development Plan 2008-2022

In 2008, The Ministry of Energy rolled-out its Alternative Energy Development Plan 2008-2022. Its goal is "to increase the share of alternative energy mixed to be 20% of the country's total energy demand by 2022." The plan contains the following objectives: 1) to utilize alternative energy as a major energy substitute for imported oil; 2) to increase energy security of the country; 3) to promote an an integrated green energy utilization in communities; 4) to enhance the development of alternative energy industry; and 5) to research, and develop efficient technology for alternative energy.

The Plan is divided into 3 stages:

- Short term (2008-2011): Focus on promotion of commercial alternative energy technology from high potential energy sources including biofuels, biomass, and biogas.
- Medium term (2012-2016): Focus on development of alternative energy technology industry, encourage new alternative energy R&D of economically viable technological methods and sources, and introduce a model for the concept of "Green City" to help communities move toward energy self-sufficiency through sustainable development.
- Long term (2017-2022): Enhance utilization of new available alternative energy technology, i.e. hydrogen, bio hydrogenated (BHD), extend green city models throughout the country and ASEAN countries.

Note: alternative energy is defined as energy used for substituting fuel sources with the undesired consequences of the replaced fuels and are divided in 2 categories: 1) alternative energy derived from depleted resources such as coal, natural gas, nuclear, peat and oil sand etc., and 2) alternative energy which is derived from non-depleted resources such as biofuels, biomass, solar, wind, hydro and hydrogen.

The Plan is presented in a diagram and table below:

Diagram 1: Alternative Energy Development Plan: Target and Timeline

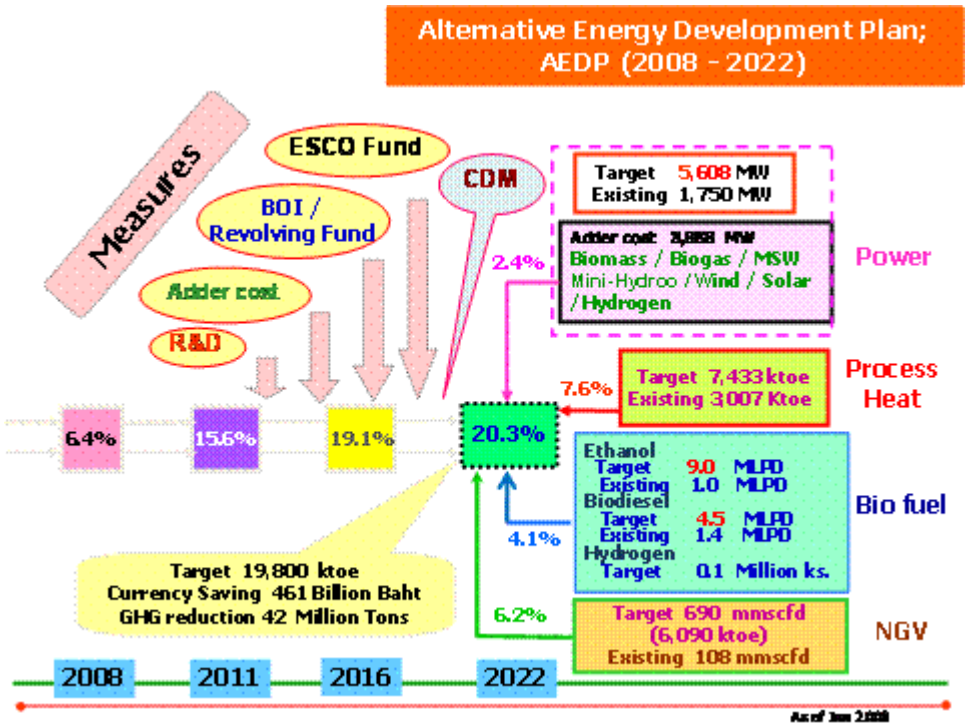

Table 1.3: Alternative Energy Potential and Target

Type of Energy	Potential	existing	2008 - 2011		2012 - 2016		2017 - 2022	
Electricity	MW	MW	MW	ktoe	MW	ktoe	MW	ktoe
Solar	50,000	32	55	6	95	11	500	56
Wind Energy	1,600	1	115	13	376	42	800	88
Hydro Power	700	55	165	48	281	73	324	85
Biomass	4,400	1,610	2,800	1,468	3,220	1,682	3,700	1,938
Biogas	190	45	60	27	90	40	120	54
Municipal Solid Waste	400	5	78	35	120	58	160	72
Hydrogen			0	0	0	0	0.5	1
Total		1,750	3,273	1,597	4,191	1,947	5,608	2,290
Thermal	ktoe	ktoe		ktoe		ktoe		ktoe
Solar Thermal	154	1		5		17.5		35
Biomass	7,400	2,781		3,660		5,000		6,760
Biogas	600	224		470		540		600
Municipal Solid Waste		1		15		24		35
Total		3,007		4,150		5,582		7,433
Biofuel	m lt/d	m lt/d	m lt/d	ktoe	m lt/d	ktoe	m lt/d	ktoe
Ethanol	3.00	1.24	3.00	805	6.20	1,686	9.00	2,447
Biodiesel	4.20	1.86	3.00	950	3.64	1,145	4.50	1,415
Hydrogen			0	0	0	0	0.1 mill kg	124
Total			6.00	1,755	9.84	2,831	13.50	3,986
Total Energy Consumption		66,248		70,300		81,500		97,300
Total Energy from R E (ktoe)		4,237		7,492		10,319		13,709
Renewable Energy Ratio		6.4%		10.6%		12.7%		14.1%
NGV (mmscfd - ktoe)		108.1	393.0	3,469	596	5,260	690	6,090
Total Energy from RE + NGV (ktoe)				10,961		15,579		19,799
Alternative Energy Ratio				15.6%		19.1%		20.3%

Source: Department of Alternative Energy, Ministry of Energy

2. Ethanol

2.1 Production

In 2009, ethanol production totaled 400.7 million liters or 1.1 million liters/day, up 19 percent from the previous year due to an increase in new ethanol plants, particularly for tapioca-based plants that became operational in the second half of the year. However, ethanol production remained lower than the government target of 3.0 million liters/day due to lower-than-expected gasohol consumption as the Government does not have compulsory mandates on the use of gasohol. In addition, the price differential between E10 gasohol and regular gasoline remains unattractive at 10-15 percent, as many consumers perceive that this difference doesn't compensate for the switch to gasohol use.

Table 2.1: Ethanol Plants in Thailand

Ethanol Plants by Feed Stocks	Registered Plants		Under-Construction Plants[1/]		On-line Plants[2/]	
	Number of Plants	Capacity (Million Liters/Day)	Number of Plants	Capacity (Million Liters/Day)	Number of Plants	Capacity (Million Liters/Day)
1. Sugarcane (S)	1	0.20	-	-	1	0.20
2. Molasses (M)	15	2.69	-	-	6	0.87
3. Tapioca (T)	24	8.39	4	1.62	4	0.63
4. (M)/(S)/(T)	8	1.23	-	-	8	1.23
Total	**48**	12.51	**4**	**1.62**	**19**	**2.93**

Note: 1/ As of May 2010
2/ As of March 2010
Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy

In 2010, 19 ethanol plants are operating with a total production capacity of 2.9 million liters/day (Table 2), of which nearly half are flexible feedstock based ethanol plants. Presently, molasses-based ethanol dominates ethanol production, accounting for 60-70 percent of total ethanol production, as 70 percent of ethanol plants have sugar mills as their core business. However, tapioca-based ethanol production increased significantly to account for 20-30 percent of total ethanol production due to the operation of new tapioca-based plants with production capacity of 0.6 million liters/day. During January – April 2010, average ethanol production totaled 1.25 million liters/day, up 14 percent from 1.1 million liters/day in 2009. However, average capacity utilization dropped significantly to 25-30 percent in June 2010 due to large carry-over stock since the beginning of the year as consumption of both gasoline and gasohol decreased due to political unrest. Nevertheless, total ethanol production by the end of 2010 is expected to increase to 490 million liters, or 1.3 – 1.4 million liters/day in anticipation of a recovery in gasohol consumption in the second half of the year as the political situation stabilizes. Meanwhile, co-products of ethanol production are distillery slop from molasses-based ethanol used for bio-fertilizer production and distillery slop from tapioca-based ethanol used to produce biogas generation amounting to approximately 5 MW/year.

In 2011 ethanol production will likely trend upward in anticipation of an increase in gasohol consumption. Ethanol plants are expected to increase to 23 plants with a total production capacity of 4.6 million liters/day, up from 2.9 million liters/day. However, they will likely operate at 1.6 million liters/day, far below their full capacity, as ethanol demand for gasohol production is limited by the existing consumption of regular gasoline which will account for approximately 40 percent of total fuel consumption. In addition, the Government did not support the plan to regulate compulsory use of gasohol.

Of the 23 plants, eight will be tapioca-based ethanol plants with a total operating capacity of 2.1

million liters/day, accounting for approximately half of total ethanol production capacity. To supply these needs, tapioca feedstock for ethanol production will need to increase significantly to 1.8 million tons, up from 0.7 million tons in 2010 and accounting for approximately 6.0 percent of total tapioca production,. Meanwhile, only one sugarcane based ethanol plant will operate in 2010 - 2011 at 30-40 percent capacity or 60,000-80,000 liters/day using approximately 0.2 – 0.3 million tons of sugarcane cultivated from contract farming of 27,000 rai (4,320 hectares). This production accounts for less than one percent of total sugarcane production.

2.2 Consumption

In 2009 ethanol consumption increased significantly by 48.3 percent to 367 million liters or 1.0 million liters/day in line with a surge in sales of gasohol. The increase reflected the government policy to promote gasohol consumption through price incentives instead of compulsory phasing out of premium gasoline sales. The most common gasohol is E10 gasohol. Sales of E10 gasohol accounted for 98.0 percent of total gasohol sales of 11-12 million liters/day which accounted for nearly 60 percent of total gasoline consumption, up significantly from 48 percent in the previous year. However, gasohol consumption remained lower than expected as the Government does not regulate compulsory use or sale of gasohol and the price different between E10 gasohol and regular gasoline remain unattractive at only 10-15 percent, as compared to 22-26 percent between E10 gasohol and premium gasoline.

Table2.2: Thailand's Gasoline Consumption (Unit: Million Liters)

Type of Gasoline	2006	2007	2008	2009	% change 2009/2008	Jan - Apr		% change 2010/2009
						2009	2010	
Regular (octane 91)	4,464	4,467	3,388	2,877	-15.1	983.6	961.9	-2.2
Premium (octane 95)	1,471	1,106	341	177	-48.1	65.6	41.5	-36.7
Gasohol	**1,279**	**1,763**	**3,392**	**4,490**	**31.8**	**1,501**	**1,422**	**-5.3**
- Gasohol E10 Octane 91	94	244	924	1,415	53.2	458.5	483.0	5.3
- Gasohol E10 Octane 95	1,185	1,519	2,439	2,972	21.8	1022.8	899.3	-12.1
- Gasohol E20	-	-	29	83	185.9	19.7	39.0	98.2
- Gasohol E85	-	-	0.02	0.25	1090.5	0.031	0.421	1258.1
Total	7,214	7,336	7,120	7,524	5.7	2,550	2,425	-4.9

Source: Energy Policy and Planning Office, Ministry of Energy

Table 2.3: Price Structure of Petroleum Product in Bangkok (as of June 17, 2010)
Unit: Baht/Liter

Petroleum Product	Ex-Refinery Factory Price	Excise Tax	Municipal Tax	State Oil Fund	Conservation Fund	Wholesale Price (WS)	Value Added Tax (VAT)	WS+VAT	Marketing Margin	VAT	Retail Price
Premium gasoline	17.1	7.0000	0.7000	7.5000	0.2500	33.1	3.3	35.43	4.32	0.30	40.04
Regular gasoline	17.53	7.0000	0.7000	1.7000	0.2500	31.4	3.1	34.51	0.87	0.06	35.04
Gasohol											
regular E10	18.4	5.3000	0.5300	3.8000	0.2500	28.3	1.98	30.27	0.80	0.05	31.34
premium E10	18.5	5.3000	0.5300	1.9000	0.2500	31.7	1.87	33.54	1.03	0.07	35.74
premium E20	15.0	5.3000	0.5300	-0.4000	0.2500	25.0	1.75	26.75	1.97	0.13	28.84
premium E85	22.4	1.0500	0.1050	-11.0000	0.2500	12.8	0.89	13.70	3.14	0.22	19.43
High speed diesel	18.3	5.31	0.531	0.35	0.2500	24.8	1.74	26.54	0.58	0.04	27.19
Biodiesel (B5)	18.5	5.04	0.504	-0.3000	0.2500	23.8	1.67	25.53	1.51	0.10	31.79

Note:
Exchange rate = 33.31 baht/$
Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy

Presently, ethanol utilization for gasohol production is at 1.1 million liters/day as gasohol prices remained cheaper than regular and premium gasoline. Prices of E10 gasohol are 22-26 percent lower than premium gasoline. In addition, the Government provided a price subsidy for E20 gasohol and

E85 gasohol derived from State Oil Fund, which caused E20 and E85 cheaper than premium gasoline by 28 percent and 52 percent, respectively (Table 2.4). The number E20 vehicles and gasoline stations that accommodate E20 gasohol also doubled from the previous year, which will likely result in a significant increase in sales of E20 in 2010. Also, E85 gasohol sales increased significantly twelve-fold but the expansion is limited by its availability in gasoline stations. So far, there are six gasoline station supplying E85 gasohol nationwide, five in Bangkok and one in upcountry (Nakhonratchsrima). Despite a reduction in total gasohol consumption of 5 percent during January – April 2010, gasohol consumption will likely increase moderately by 5-7 percent in 2010 domestic consumption recovers for the rest of the year as the political situation stabilizes.

In 2011, ethanol consumption will continue the upward trend driven by growing gasohol E20 consumption as availability of E20 vehicles and E20 gasohol stations increase. In addition, more E85 vehicles are likely be on sale in 2011 due top the favorable tax incentives that these automobiles enjoy of an excise tax reduction of 3 percent from the current excise tax on E20 automobiles of 25 – 35 percent.

2.3 Trade

In 2009, ethanol exports (HS2207.10.00) declined significantly by 76 percent to 15.6 million liters from the previous year as domestic consumption increased ethanol demand and as most ethanol plants preferred selling ethanol in the domestic market as their production facilities are not cost effective for export sales. There is only one ethanol plan established for export sales which is molasses-based ethanol with production capacity of 200,000 liters/day which is running at 60-70 percent capacity. In addition, the Government discourages ethanol exports in order to guarantee sufficient domestic supplies for gasohol production by collecting an excise tax of 80 percent on ethanol production for exports. Meanwhile, there have been no imports of ethanol for gasohol consumption due to sufficient domestic supplies since 2005. The Government imposes a tariff rate of 2.5 baht/liter (roughly 27 US cents/gallon) on imported ethanol, which is mainly used for liquor production.

In 2010 ethanol exports are expected to increase significantly due to large excess supplies of ethanol production caused by a reduction in domestic consumption. In the first four months of the year, ethanol exports totaled 24.8 million liters, up significantly by 250 percent year to date from the same period last year. Most ethanol exports are going to Asian countries, particularly Japan and Singapore.

Table 2.4: Thailand's Exports of Ethanol [1/]

Unit: Million Liters

	2007	2008	2009	2010[2/]
Philippines	3.7	1.5	-	-
Singapore	9.2	12.3	3.1	7.9
Japan	0.9	10.4	7.4	13.7
Australia	1.1	2.5	-	-
Taiwan	0.0	3.2	3.1	1.1
Indonesia	-	2.0	-	-
Europe	-	25.8	0.0	-
South Korea	-	-	-	2.1
Other	-	8.1	2.0	0.0
Total	**14.9**	**65.8**	**15.6**	**24.8**

Note: 1/ Based on 19 on-line ethanol plants exporting 95% purity ethanol
2/ Jan. - Apr.

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

In 2011, ethanol exports are forecast to decline in anticipation of growing domestic gasohol consumption driven by the economic recovery. In addition, an anticipated increase in consumption of gasohol E 20 and E85 will drive ethanol demand for gasohol production.

2.4 Ending Stocks

Current stocks of ethanol increased significantly to 80-90 million liters from 20-30 million liter at the beginning of the year, including ethanol plant stocks of 52 million liters and petroleum refinery stock of 30-40 million liters, due to lower-than-expected petroleum consumption. Ethanol consumption totaled 1.1 million liters/day, up slightly from the previous year, as compared to a significant increase in production capacity of 2.9 million liters/day driven by the new ethanol plants. By the end of 2010 through 2011, ethanol stocks will likely be at optimal level of 45-50 million liters as recovery of domestic demand resumes.

3. Biodiesel

3.1 Production

B100 biodiesel in Thailand is currently produced from feedstock from the palm oil industry- i.e. crude palm oil (CPO), refined bleached deodorized (RBD) palm oil, and palm stearin. B100 production is solely determined by domestic demand for blended biodiesel, i.e. B2, B3 and B5. Thailand does not import and export B100.

Despite irregular growth in total diesel sales, a compulsory B2 production policy has led B100 biodiesel production to increase ten-fold within two years from 68 million liters in 2007 to 448 million liters in 2008 and 610 million liters in 2009. Meanwhile, diesel sales dropped from 18,652 million

liters in 2007 to 17,593 million liters in 2008 and rebounded to 18,360 liters in 2009. B100 biodiesel production is forecast to grow sharply in 2010 (10 percent) in 2011 (42 percent), reflecting the changes in policy mandates for B3 in mid 2009 and B5 in 2010.

Due to the response to government's incentives through the Board of Investment (BOI)'s provisions, 14 biodiesel processing plants were established from 2005-2009. The industry's rapid expansion created production capacities that far exceed actual B100 demand. Details on individual plant capacity and actual production as of November 2009 reported by Department of Energy Business (DEB) are provided in Table 4, indicating 25 percent capacity utilization.

Table 3.1: A List of Biodiesel Plants in Thailand and Their Capacities

Processing Plant	Location	Production Capacity (Liters/day)	Average Actual Production (Liters/day) in Nov 2009
1. Bangchak Petroleum	Bangkok	50,000	2,967
2. Bioenergy Plus	Ayudhaya	100,000	0
3. Absolute Energy	Prachinburi	800,000	188,724
4. Patum Vegetable Oil	Patumthani	1,400,000	576,989
5. Bangkok Alternative Energy	Chachoengsao	200,000	41,667
6. Green Power Corporation	Chumporn	200,000	90,203
7. A.I. Energy	Samutsakorn	250,000	41,173
8. Weerasuwan	Samutsakorn	200,000	11,185
9. Thai Oleo Chemical	Rayong	685,800	307,000
10. New Biodiesel	Suratthani	220,000	93,162
11. Pure Biodiesel	Rayong	300,000	111,787
12. Siam gulf Petrochemical 1/	Petchaburi	1,200,000	0
13. E-Ether	Chiang Rai	50,000	1,300
14. Bangchak Biofuel 2/	Ayudhaya	300,000	0
TOTAL		5,955,800	1,466,157

Note: Plants no. 1, 9 and 14 belong to two major petroleum oil refineries, i.e. PTT and Bangchak
1/ Stop operation in Feb 2009
2/ Began operating in Dec 2009

Source: Department of Alternative Energy, Ministry of Energy

Industry sources reported that nearly all B100 producers have suffered continued losses since 2008. At least 4 plants are currently suspending their operations. The losses are attributed to high production costs as capacity is way under-utilized and an oligopolistic market structure that favors B100 buyers which consist of 7 petroleum oil refineries.

Although production of B100 is closely adjusted to actual demand, which currently stands at 1.7-1.8 million liters per day, B100 producers are at disadvantage as the few petroleum refineries seem able to influence market prices. Trade sources cited that actual prices paid to CPO B100 producers are 2-3 baht/liter and 3-4 baht for stearin B100 below reference prices1/. Prices for stearin B100 are sold at 1-2 baht/liter below CPO B100 due to a presence of "cloud point" appearance in stearin-derived B100. Due to this situation, producers sold their products below production cost for most of 2009.

Some B100 producers who own feedstock processing plants (i.e., CPO crushing plants or cooking oil refineries) enjoy lower production costs than processors without feedstock processing. The latter

group attempted to reduce their production costs by switching from CPO raw material to cheaper stearin in 2008. Nevertheless, this switch pushed stearin prices higher resulting in the disappearance of the price differential over CPO as prices increased from 14-15 baht/kg in late 2008 to 27-28 in mid 2009.

The table below illustrates cost difference for B100 derived from CPO and stearin, and the average Government reference prices.

Table 3.2 B100 Production Cost and Margin

Month	Reference Price for B100 announced by the Committee [1]	Average Cost for B100 derived from CPO (baht/liter) [2]	Margin b/w Reference Price and Cost (baht/liter) [3] = [1]-[2]	Average Cost for B100 derived from stearin (baht/liter) [4]	Margin b/w Reference Price and Cost (baht/liter) [5] = [1]-[4]
2009					
January	24.82	25.01	-0.18	17.37	7.45
February	24.88	27.46	-2.57	19.48	5.40
March	26.56	23.39	3.58	20.06	6.50
April	24.56	25.62	-1.06	23.58	0.98
May	29.73	29.78	-0.05	27.57	1.16
June	31.00	27.82	3.18	28.84	2.16
July	27.88	24.25	3.64	26.98	0.91
August	27.31	26.00	1.31	25.59	1.74
September	27.88	24.20	3.68	25.22	2.66
October	25.45	23.12	2.33	22.88	2.57
November	26.87	25.46	1.41	25.76	1.11
December	29.11	28.19	1.58	27.35	2.42
Average	27.29	25.86	1.44	24.29	3.02
2010					
January	31.45	27.70	3.75	27.62	3.83
February	29.53	27.10	2.43	27.13	2.40
March	30.53	27.29	3.26	27.86	2.67

Note: Average cost for B100 = feedstock price X 3.0091.06

3.2 Consumption

B100 biodiesel consumption, which is determined by the sale of the different blended ratios of biodiesel, increased from 62 million liters in 2007 to 446 million liters in 2008 and 609 million liters in 2009. B100 consumption is anticipated to further grow to 655 million liters in 2010 and 935 million liters in 2011.

In addition to a sharp growth in B100 demand, there have been changes in the demand for the different different blended biodiesel, as B2/B5 sales ratio rose from 2.45 in 2007 to 3.44 in 2008 due to the B2 production mandate in February 2008. However, the ratio dropped sharply to 1.23 in 2009 as the government eased the tax burdens and fees on B5 prices, making it 1.40-3.00 baht/liter (4-9 cents/liter) cheaper than B2 prices, as compared to a price gap of 0.50-1.50 baht/liter (1-4 cents/liter) in 2008. The B2/B5 sale ratio is likely to rebound in 2010 when the government has recently increased Oil Fund fee on B2 to lower a retail price gap following the possible negative impact of dry conditions on oil palm productivity.

B100 monthly consumption and sales of B2 and B5 biodiesel are presented in a table below:

Table 3.3 : Monthly B100 Consumption and Sales of B2 and B5 Biodiesel (Unit: Million Liters)

Month	B100 Consumption	B2 Sales	B5 Sales	Total Sales	B2/B5 Sale Ratio
2007	62.116	1,537.050	627.486	2,164.536	2.450
January	0.728	0.000	14.552	14.552	0.000
February	0.937	0.000	18.746	18.746	0.000
March	1.377	0.000	27.544	27.544	0.000
April	1.608	0.000	32.169	32.169	0.000
May	1.991	0.000	39.823	39.823	0.000
June	2.290	1.600	45.163	46.763	0.035
July	5.092	125.400	51.673	177.073	2.427
August	6.282	175.050	55.614	230.664	3.148
September	6.688	189.350	58.020	247.370	3.264
October	7.374	205.850	65.133	270.983	3.160
November	12.793	405.250	93.753	499.003	4.323
December	14.956	434.550	125.296	559.846	3.468
2008	446.384	12,925.912	3,757.314	16,683.226	3.440
January	21.618	699.899	152.398	852.297	4.593
February	35.005	1,368.823	152.562	1,521.385	8.972
March	40.106	1,422.730	233.019	1,655.749	6.106
April	39.740	1,354.896	252.845	1,607.741	5.359
May	39.334	1,225.748	296.383	1,522.131	4.136
June	36.653	1,037.518	318.059	1,355.577	3.262
July	34.188	948.622	304.286	1,252.908	3.118
August	35.672	997.552	314.430	1,311.982	3.173
September	35.849	898.455	357.606	1,256.061	2.512
October	39.881	960.430	413.449	1,373.879	2.323
November	40.139	930.799	430.462	1,361.261	2.162
December	48.199	1,080.440	531.815	1,612.255	2.032
2009	609.330	10,045.590	8,168.389	18,213.979	1.230
January	50.957	1,108.021	575.931	1,683.952	1.924
February	45.257	864.793	559.227	1,424.020	1.546
March	52.402	923.549	678.628	1,602.177	1.361
April	52.645	862.879	707.749	1,570.628	1.219
May	57.020	853.268	799.107	1,652.375	1.068
June	51.256	713.953	739.545	1,453.498	0.965
July	50.904	719.842	730.140	1,449.982	0.986
August	49.060	725.394	691.046	1,416.440	1.050
September	47.238	744.731	646.872	1,391.603	1.151
October	48.786	793.583	658.280	1,451.863	1.206
November	47.890	794.166	640.124	1,434.290	1.241
December	55.915	941.411	741.740	1,683.151	1.269
2010					
January	50.796	856.724	673.232	1,529.956	1.273
February	49.154	890.376	626.924	1,517.300	1.420
March	52.761	974.146	665.164	1,639.310	1.465
April	49.080	932.019	608.651	1,540.670	1.531

3.3 Trade

Thailand has not imported or exported any B100 biodiesel products thus far since the government practically restricts trade by not issuing import/export permits for these products. This is done to protect domestic palm growers.

3.4 Ending Stocks

B100 biodiesel production is supplied to domestic petroleum oil refineries on a contract basis; B100 producers try to keep their production limited to cover the contract amounts. As a result, the country's stocks, held by either B100 producers or petroleum oil refineries, are very low, currently at 10-15 million liters or about ten days of utilization.

4. Advanced Biofuels:

A molasses-based ethanol plant using second generation technology biofuels in the form of cane bagasse is currently operational. This plant is a model project of Thai Roong Ruang Group, one of the largest sugar mills in Thailand, in cooperation with the Japanese government (under the supervision of

the New Energy and Industrial Technology Development Organization (NEDO), Ministry of Economy, Trade and Industry (METI)), and the Thai government (under the supervision of the Office of Cane and Sugar Board (OCSB), Ministry of Industry). The operation remains in an experimental stage with a production of 10,000 liters/day. The full capacity will be 120,000 liters/day once it is fully developed. This plant has two production lines, including molasses and bagasse. Presently, it is operating its molasses-based ethanol production at commercial scale with production capacity of 110,000 liters/day, and a pilot project using bagasse-based ethanol at 10,000 liters/day.

5. Biomass for Heat and Power:

In Thailand, biogas derived from animal manure for power generation and cooking is done at the farm level usually for own household needs. Larger developments have been undertaken on power generation from landfill biogas. The Energy Conservation Promotion Fund (ENCON), a government agency, has supported several projects in forms of soft loan, monetary subsidy, R&D, and assistance on feasibility study.

Thailand has also promoted biomass energy for heat and power generation in recent years through the granting of licenses to approved private companies in order to sell electricity to the Electricity Generating Authority of Thailand (EGAT) under the Small Producer Program (SPP) and Very Small Producer Program (VSPP). SPP is applied for a facility which could supply not more than 10 MW of electricity while VSPP is not more than 1 MW. The government also provided incentives to these small power producers through "adder cost" which is added on the top of selling prices for 7-10 years and a soft loan program. As a result, a large number of small renewable energy projects have emerged in many areas of Thailand. Feedstock used for these projects is mainly agricultural wastes including bagasse from sugar mills, paddy husk from rice mills, woodchips from paper factories, and empty palm bunches from palm oil crushing mills.

The Energy Policy and Planning Office (EPPO) reported that 90 small producers (SP) were approved to sell 4,203.02 MW of electricity to EGAT in 2008, of which 60 producers were able to supply 2,285.52 MW in total. It also reported that 546 very-small producers (VSP) were approved to sell 2,010.59 MW of electricity in 2008, of which 117 producers supplied 244.89 MW.

6. Notes on Statistical Data:

Statistic Data

Table 6.1: Conventional and Advanced Bioethanol (Million Liters)

CY	2006	2007	2008	2009	2010	2011
Production	**135.4**	**191.8**	**336.2**	**400.7**	**490**	**590**
Imports	0	0	0	0	0	0
Exports	0	14.9	65.8	15.62	30.0	20
Consumption	116	159	309	410	470	542
Ending Stocks	67.8	85.9	47.6	22.4	11.6	39.9
Production Capacity (Conventional Fuel)						
No. of Biorefineries	5	7	11	11	19	23
Capacity (Million liters/day)	0.78	0.96	1.6	1.7	2.9	4.6
Production Capacity (Advanced Fuel)						
No. of Biorefineries	-	-	-	1	1	1
Capacity (Million liters/day)	-	-	-	0.01	0.01	0.01
Co-product Production (1,000 MT)	-	-	-	-	-	-
Feed Stock Use (1,000 MT)						
Sugarcane	25	57	60	160	200	300
Molasses	441	614	1,216	1,163	1,485	1,246
Tapioca	164	240	197	691	731	1,802

Table 6.2: Conventional & Advanced Biodiesel (Million Liters)

CY	2006	2007	2008	2009	2010	2011
Production	2	68	448	610	660	940
Imports	0	0	0	0	0	0
Exports	0	0	0	0	0	0
Consumption	2	62	446	609	655	935
Ending Stocks	0	6	7	8	13	18
Production Capacity (Conventional Fuel)						
No. of Biorefineries	3	5	9	14	13	13
Capacity (million liters/day)	0.6	1.3	2.2	6.0	4.8	4.8
Production Capacity (Advanced Fuel)						
No. of Biorefineries	0	0	0	0	0	0
Capacity	0	0	0	0	0	0
Feedstock Use (1,000 MT)						
Crude Palm Oil/RBD/Stearin	2	72	475	575	618	882

Note: 1/ Production capacity represented in this table does not cover biodiesel production derived from used cooking oil which has been promoted for community/farm use
2/ production capacity per year can be derived from average daily capacity X300 days

Note

1/ Reference prices are calculated and announced on a weekly basis by Energy Policy and Planning Office (EPPO), Ministry of Energy, to reflect B100 production coat at a certain period. The government uses these reference prices to calculate an Oil Fund fee. However, both B100 producers and buyers use the reference prices as a basis for negotiating actual prices for their trade.

End of report.