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Thailand

Biofuels Annual

2011

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Report Highlights:
The Thai Government has initiated a 15-year plan to increase the use/production of ethanol and biodiesel from 2008-2022, however, growing actual production should not meet the government's targets in 2011 and 2012.

Post:
Bangkok

Executive Summary:
Since petroleum oil prices began to sharply escalate in 2004, the Thai government has continuously created and modified policies and programs which have led to significant increases in production and consumption of biofuels. The current 15-year ethanol and biodiesel plans are based on the Alternative Energy Plan 2008-2022. According to the plan, the government set targets of ethanol production of 3.0 million liters/day from 2008-2011, 6.2 million liters/day in the medium-term from 2012-2016, and 9.0 million liters/day in the long term from 2017-2022. The targets of biodiesel production (B100 biodiesel) are set at 1.35 million liters from 2008-2010, 3.02 million liters/day in 2011, 3.64 million liters/day in 2016, and 4.50 million liters/day in 2022.

An increase in actual gasohol and biodiesel production to meet these targets has proven challenging. Gasohol production, despite increasing from 0.92 million liters/day in 2008 to 1.17 million liters in 2010, has been far below the 3.0 million liter target, as consumers have expressed preference for gasoline and NGV, over biofuels. In the former case, the price differential between gasohol and gasoline has not encouraged consumers to flock to gasohol and for the latter consumers have substituted both gasoline and gasohol consumption for the highly-subsidized LPG and NGV. As for biodiesel, although its use is compulsory, it's facing feedstock challenges to meet government targets due to under-targeted planting of palm oil tree and unpredictable weather patterns. As such, the government has been modifying its biodiesel policy to meet the feedstock supply and avoid shortages of domestic palm oil supplies for cooking–oil demand as happened earlier this year. Under the plan, in 2011 B100 production should be 3.02 million liters/day but due to feedstock shortages it is estimated at 2.22 million liters/day. Therefore, the government is no longer demanding compulsory B5 production but has been switching to compulsory use of B2, B3 and B4 as feedstock supplies increase.

Ethanol production in Thailand is produced from feedstock of sugar molasses and tapioca products, while B100 biodiesel from palm oil products only. Ethanol production is estimated at 528 million liters in 2011 while consumption should be limited at 439 million liters. Thailand's ethanol exports accordingly are estimated to increase from 49 million liters in 2010 to 70 million liters in 2011. The outlook for ethanol production is on an upward trend in 2012 another 5 new ethanol plants with a capacity of 1.8-1.9 million liters/day in total will be added to the 19 existing plants.

B100 biodiesel production in 2011 is estimated to grow by 3 percent or 680 million liters, the lowest in the past few years which grew 8 percent in 2010 and 36 percent in 2009. B100 production is totally absorbed by domestic consumption and as a result Thailand does not export or import biodiesel. Although it is too early to estimate B100 production due to yield vulnerability on the fresh palm harvest which will be determined by the weather conditions up to early 2012, Post believes that B100 production should further increase to 800-820 million liters in 2012.

Thailand also promotes 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). 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.

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 and modified policies and programs which have led to significant increases in production and consumption of biofuels.

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, which feature production mandates (especially biodiesel), tax privileges from the Board of Investment (BOI), tax and retail price incentives, R&D support, and public awareness programs. The following are details on policy and programs for ethanol and biodiesel.

1.1 Ethanol

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	2.9	N.A.	N.A.
Actual Production	0.92	1.10	1.16	1.42[1/]	N.A.	N.A.

Note: [1/] Average capacity utilization during Jan. - Feb. 2011

Source: Ministry of Energy

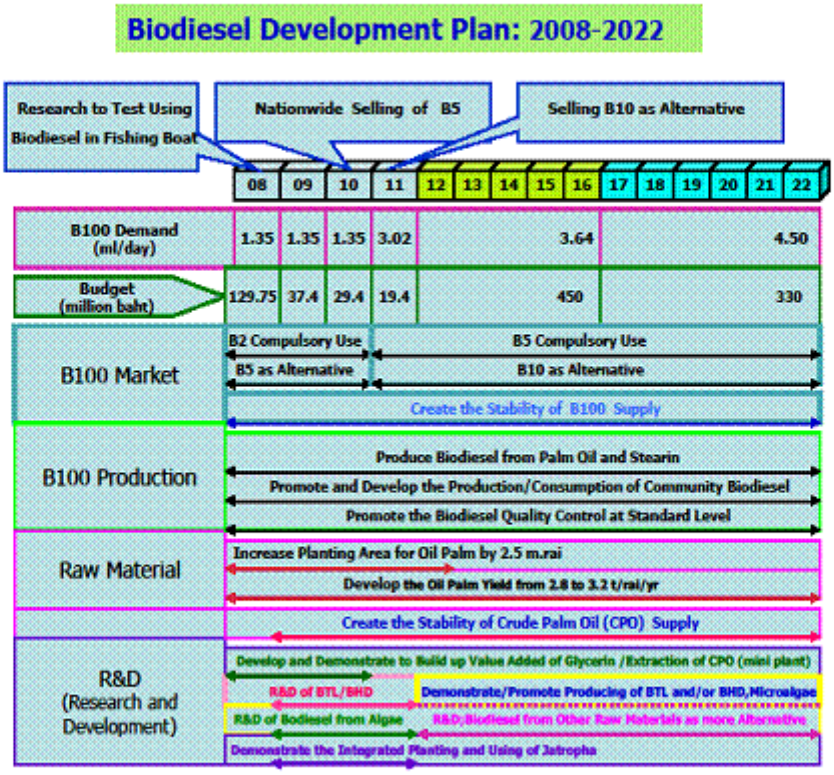
Thailand has implemented a 15-year ethanol plan (2008 – 2022) (Table 1.1). Under this plan, the Government has set targets of ethanol production and consumption of 3.0 million liters/day thorough 2011, 6.2 million liters/day in the medium-term (2012 – 2016) and 9.0 million liters/day in the long term (2017 – 2022). Nevertheless the plan's goals have fallen short of achieving the current target of 3 million liters/day as current consumption is 1.45 million liters/day.

In its efforts to make the plan operational, the Government provides a mix of tax incentives and subsidies to ethanol producers, gasohol refineries, and automobile manufacturers. For ethanol producers, these receive an excise tax exemption on ethanol of 7.0 baht/liter (US 80 cents/gallon) when selling ethanol for gasohol production in the domestic market., as compared to 2.0 percent for industrial use, 0.1 percent for medical use, and 10.0 percent for other uses like beverage Meanwhile gasohol refineries receive a subsidy of 13.5 baht/liters for E85 gasohol production (a mixture of 85 percent

ethanol and 15 percent gasoline) from the State Oil Fund applied at gasohol sales at the pump (see Table 2.4) in order to encourage gasohol consumption over gasoline. This enables refineries to set retail prices of E85 gasohol 53.0 percent lower than premium gasoline. As for automobile manufacturers, effective January 2011, those manufacturers who produce vehicles compatible with E85 will be able to import parts and components duty free during 2011 – 2013. Moreover, the Government extended a reduction on import duties for flex fuel vehicles (FFV) from 80 to 60 percent by end of 2011.

1.2 Biodiesel

Figure 1.1 Biodiesel Development Plan for 2008-2022



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 fifteen-year policy, called Biodiesel Development Plan for 2008-2022, requiring compulsory production of B2 biodiesel (B2) (high-speed diesel with the two percent of B100 biodiesel (B100) content by weight) while B5 biodiesel (B5) production would be available for voluntary use in 2008. The plan (figure 1.1) indicates that compulsory B5 production would have been scheduled to begin in 2011 and B10 biodiesel (B10) production would also be available for use on a voluntary basis, however feedstock production has fallen short in meeting the Government's goals.

Although current feedstock production does not meet current policy demand, the government has spearheaded efforts to stimulate domestic fresh oil palm production in order to align it with the policy's demand for B100 production. In 2008, the Ministry of Agriculture and Cooperatives and the Ministry of Energy initiated "Committee on Biofuel Development and Promotion" (CBDP) and developed a plan to expand 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 achieve the plan, the RTG provided low-interest loans to participating oil palm farmers.

However, increasing palm plantings and productivity to meet demand has been challenging. An attempt to expand palm growing area is limited by competitive rubber plantations and a lack of suitable land for palm plantation. As a result, the actual increase in oil palm harvested areas is far below the planned 80,000 hectares per annum in recent years. In addition, irregular climatic patterns tend to be more severe as of late which have adversely affected palm yields.

These two factors, the under-targeted planting and unpredictable weather patterns, have hindered the accomplishment of the biodiesel development plan goals. For example, dry conditions in early 2010 led fresh oil palm production to drop by 30-40 percent during its second peak harvest from September-December 2010, resulting in shortages of domestic palm oil supplies for meeting cooking-oil demand and record prices in early 2011.

To ease the shortage problem, the government allowed imports of semi-refined palm oil and ordered the Ministry of Energy to reverse its B3 biodiesel (B3) compulsory policy (which had been in effect since June 2010) to B2 (TH0079). The B2 compulsory policy was valid from March-April 2011. In April 2011, the Ministry of Energy announced it would restart compulsory B3 production on May 1, 2011 and removed all price/tax subsidies for B5 production to ease the pressure on the limited supplies. As a result, B5 bio-diesel has not been on sale since May 1, 2011. On June 20, 2011, the Ministry announced to replace compulsory production of B3 with B4, but only for 3 months from July-September 2011 as the peak harvest season comes into play.

In order to avoid repeating the shortage mishaps, the Ministry of Energy has stated that they are closely monitoring the palm oil supply situation in the next few months in order to decide whether the introduction of compulsory B5 production is possible, which by plan should have been in place since January 1, 2011.

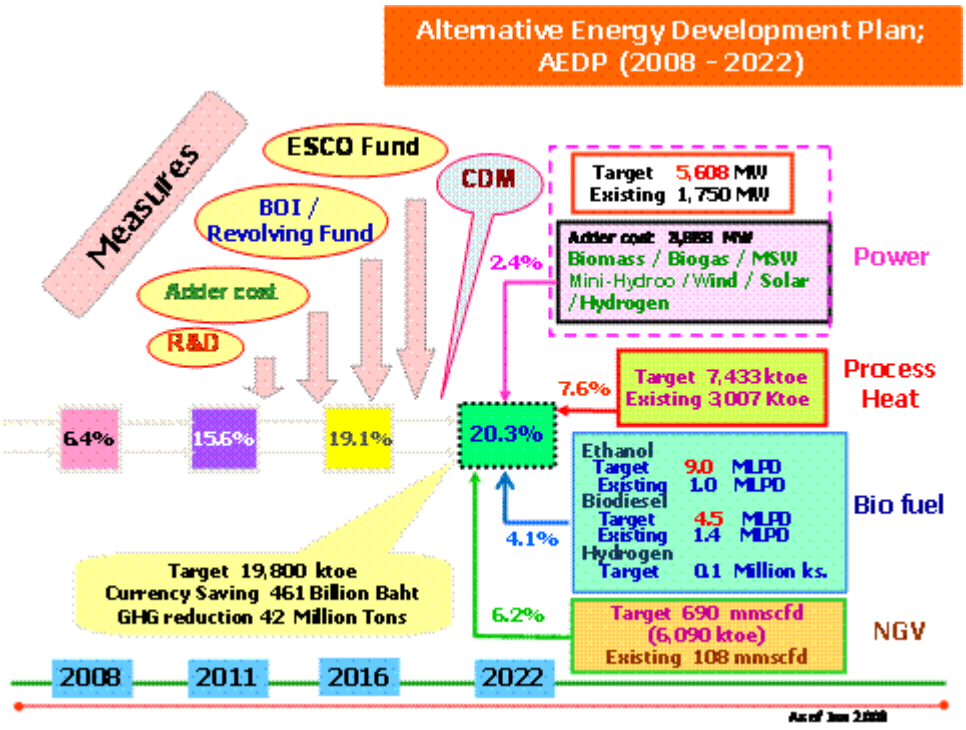
1.3 Alternative Energy Development Plan 2008-2022

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; 3) to promote an integrated green energy utilization in communities; 4) to enhance the development of alternative energy industry; and 5) to research, and develop efficient technologies for alternative energy sources.

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 diesel (BHD), extend green city models throughout the country and ASEAN countries.

Note: alternative energy is defined as energy used for substituting fuel sources without 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.



Type of Energy	Potential	existing	2008 - 2011		2012 - 2016		2017 - 2022	
Electricity	MW	MW	MW	ktoe	MW	ktoe	MW	ktoe
Solar	50,000	82	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	46	60	27	90	40	120	54
Municipal Solid Waste	400	5	78	35	120	58	160	72
Hydrogen			0	0	0	0	2.5	1
Total		1,750	3,273	1,387	4,191	1,987	5,608	2,290
Thermal	ktoe	ktoe		ktoe		ktoe		ktoe
Solar Thermal	154	1		5		17.5		28
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		7,423
Biofuel	m lt/d	m lt/d	m lt/d	ktoe	m lt/d	ktoe	m lt/d	ktoe
Ethanol	3.00	1.24	2.00	805	6.20	1,686	9.00	2,447
Biodiesel	4.20	1.86	2.00	950	3.64	1,145	4.50	1,415
Hydrogen			0	0	0	0	01 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%

2. Ethanol

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	5	1.82	4	0.63
4. (M)(S)(T)	8	1.23	-	-	8	1.23
Total	**48**	12.51	5	**1.82**	**19**	**2.93**

Note: 1/ As of April 2011

2/ As of April 2011

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

Table 2.2: Ethanol - Conventional and Advanced Fuels (Million Liters)							
Calendar Year	2006	2007	2008	2009	2010	2011 (Forecast)	2012 (Forecast)
Production, Total	135	192	336	401	426	528	580
Advanced Only	0	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0
Exports	0	14.9	65.8	15.6	48.5	70.0	95.0
Consumption	116	159	309	410	386	439	483
Ending Stocks	67.8	85.9	47.6	22.4	13.3	32.9	34.4
Production Capacity (Conventional Fuel)							
No. of Biorefineries	5	7	11	11	19	19	24
Capacity (Million liters/day)	0.78	0.96	1.6	1.7	2.9	2.9	4.8
Capacity Use (%)	48	54	58	65	40	50	42
Production Capacity (Advanced Fuel)							
No. of Biorefineries	-	-	-	1	1	1	1
Capacity (Million liters/day)	-	-	-	0.01	0.01	0.01	0.01
Co-product Production (1,000 MT)	-	-	-	-	-	-	-
Feed Stock Use - Conventional (1,000 MT)							
Sugarcane	25	57	60	160	200	380	400
Molasses	441	614	1,216	1,163	1,255	1,664	1,788
Tapioca	164	240	197	691	687	600	735

2.1 Production

In 2011, five new tapioca-based ethanol plants are due for completion with total production capacity of 1.8 million liters/day (Table 2.1). However, their operation is expected to be delayed until high tapioca prices ease at a level where it is economically feasible to operate the plants. In addition, there are 19 existing ethanol plants operating with total production capacity of 2.9 million liters/day, of which nearly half are flexible feedstock based ethanol plants. They are currently operating at approximately 1.45 million liter/day, up 25 percent from an average production of 1.16 million liters/day in the previous year, due to an increase in gasohol consumption, particularly for E10 Octane 91 gasohol driven by bigger price difference with premium gasoline.

Molasses-based ethanol dominates ethanol production, operating at 1.17 million liters/day, up 54.5 percent from the previous year's average production of 0.76 million liters/day. It accounts for 80 percent of total ethanol production, as 70 percent of ethanol plants have sugar mills as their core business. In addition, the downward trend in molasses prices due to a bumper sugarcane crop in MY2010/11 (TH1051, Sugar Annual 2011) of 4.2 million tons, or up 42 percent from the previous year, made it more attractive to use. Meanwhile, tapioca-based ethanol production, is at 0.28 million liters/day, is down 12.8 percent from the average of 0.33 million liters/day from the previous year due to record tapioca prices. Due to this price divergence, tapioca-based ethanol production cost is 17 percent higher than molasses-base ethanol as tapioca prices increased 23.1 percent from the previous year's average prices of 2.25 baht/kg. By the end of this year, ethanol production is expected to increase to 1.5 million liters/day in anticipation of an increase in gasohol consumption. In 2012, 24 ethanol plants with

a total capacity of 4.8 million liters/day will exist in Thailand, as compared to 19 plants with capacity of 2.9 million liters/day in 2011. Although, the new ethanol plants will be tapioca-based plants, molasses based ethanol will continue to dominate ethanol production, accounting for 60-70 percent of total ethanol production, as the downward price trend is expected to continue due to the bumper MY2011/12 sugarcane crop (TH1051). The sole sugarcane based ethanol plant will operate at 40-50 percent capacity at 80,000 – 100,000 liters/day using approximately 0.4 million tons of sugarcane a year, producing 28 million liters/year or 5.0 percent of total ethanol production. The sugarcane used in this plant is cultivated in an area of 50,000 rai (8,000 hectares), which is unsuitable to the production of edible crop due to the hazardous nature of the land.

Nevertheless, the plants will continue to face challenges as they will be operating at less than half of their full capacity, as demand for gasohol production is limited by the existing consumption of regular gasoline, accounting for around 40 percent of total consumption, as many consumers are inclined to pay the premium on gasoline.

2.2 Consumption

In 2011, ethanol consumption is expected to increase to 1.2 million liters/day, up 14.0 percent from 2010, in anticipation of an increase in E20 gasohol consumption (a blend of 20% ethanol and 80% gasoline) driven by more production of E20 vehicles which has increased to 700,000 units, so far. In addition, sales of flex-fuel vehicles (FFV) which are compatible with E85 gasohol (a blend of 85% ethanol and 15% gasoline) have increased to 4,520 units in April 2011, as compared to 3,489 units in the end of 2010. Moreover E85 gasohol stations have increased to 21 stations, up from 10 stations in the end of 2010.

In the first four months of the year, E20 gasohol consumption increased to 0.6 million liters/day, up 50 percent from an average 0.3 million liters/day in the previous year (Table 2.3). Also, E85 consumption nearly doubled from the previous year to 0.02 million liters/day. The increase reflects the government price subsidy for E20 and E85 gasohol from the State Oil Fund, causing E20 and E85 to be cheaper than premium gasoline by 28 and 53 percent, respectively (Table 2.4).

In 2012, ethanol consumption will continue its upward trend to 1.3 million liters/day in anticipation of growing E20 and E85 consumption due to the increase in the number of E20 and flex-fuel vehicles, and E20 and E85 gasohol stations. However, this anticipated increase in ethanol consumption of 1.3 million liter/day is still far below the government's medium-term goal of 6.2 million liters/day in 2012 - 2016. This discrepancy can be attributed to an inconsistent government policy by reversing its decision to mandate compulsory use of gasohol when it first enacted its gasohol plan. Moreover, consumption of LPG (Liquid Petroleum Gas) and NGV (Natural Gas Vehicles) has trended upward at the expense of gasohol as they are 60-70 percent cheaper than gasohol. Presently, NGV consumption increased to 6.1 million kilogram/day, up 22 percent from 2010.

The paucity in ethanol consumption is putting many ethanol plants under financial duress as these are operating way below capacity. Stakeholders have different views of how to make-up for this shortfall in consumption some want more direct government intervention such as mandating ethanol use. Others favor a less drastic approach such as eliminating subsidies on LPG and NGV and increasing the price differential between gasohol and gasoline. Regardless of the policies, the industry is aware that if

consumption does not increase significantly many plants will have to cease operations.

Table 2.3: Thailand's Gasoline Consumption (Unit: Million Liters)

Type of Gasoline	2006	2007	2008	2009	2010	% change 2010/2009	Jan.-Apr. 2010	Jan.-Apr. 2011	% change 2011/2010
Regular (octane 91)	4,464	4,467	3,388	2,877	2,958	2.8	962.0	939.0	-2.4
Premium (octane 95)	1,471	1,106	341	177	77	-56.5	42.0	13.0	-69.0
Gasohol	1,279	1,763	3,392	4,470	4,383	-1.9	1,421	1,508	6.1
- Gasohol E10 Octane 91	94	244	924	1,415	1,552	9.7	483.0	610.0	26.3
- Gasohol E10 Octane 95	1,185	1,519	2,439	2,972	2,692	-9.4	899.0	828.0	-7.9
- Gasohol E20	-	-	29	83	137	65.1	39.0	68.0	74.4
- Gasohol E85	-	-	0.02	0.25	2.11	744.0	0.4	1.9	375.0
Total	7,214	7,336	7,120	7,524	7,418	-1.4	2,425	2,460	1.4

Source: Energy Policy and Planning Office, Ministry of Energy

Table 2.4: Price Structure of Petroleum Product in Bangkok (as of June 15, 2011)

	Premium gasoline (octane 95)	Regular gasoline (Octane 91)	Gasohol			
			E10 Octane 91	E10 Octane 95	E20	E85
Ex-Refinery Factory Price	29.9199	29.4811	24.0015	24.2178	24.4969	25.0241
Excise Tax	7.0000	7.0000	6.9000	6.9000	5.6000	1.0500
Municipal Tax	0.7000	0.7000	0.6900	0.6900	0.5600	0.1050
State Oil Fund	7.5000	6.7000	0.1000	2.4000	-1.9000	-19.5000
Conservation Fund	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
Wholesale Price (WS)	99.9699	98.1911	91.2815	93.7978	29.5469	12.9291
Value Added Tax (VAT)	2.7595	2.6992	2.1897	2.9658	2.0683	0.9050
WS+VAT	42.1194	40.8008	93.4712	96.1636	31.6152	13.8341
Marketing Margin	5.8197	1.9997	1.9894	1.7536	2.8269	8.1176
VAT	0.4070	0.1400	0.1953	0.1228	0.1979	0.5882
Retail Price	48.34	42.94	95.54	98.04	34.64	22.52

Note: Exchange rate = 30.07 baht/$

Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy

2.3 Trade

In 2010 ethanol exports (HS2207.10.00) increased to 48.2 million liters, up 8.5 percent from the previous year, due to excess ethanol supply. Most exports were molasses-based ethanol for use in the beverage industries. Although a huge excess capacity of 40-50 million liters/month goes unused, only

three ethanol plants out of the existing 19 plants are capable to export, while other plants, especially the tapioca-based ethanol plants, are not cost effective for export sales as their production facilities are designed for domestic sales, therefore lacking the needed infrastructure for export capabilities, and located far from export facilities. Currently, only one molasses-based ethanol plant, initially established for export sales with a production capacity of 200,000 liters/day, is operating at full capacity.

Presently, ethanol exports during January – February 2011 increased significantly by 36 percent from the previous year. Ethanol exports will likely continue to increase to 70 million liters in 2011, most of which are beverage grade ethanol. Meanwhile, there will be no imports of ethanol for gasohol production in 2011 due to sufficient domestic supplies and the Government imposes a tariff rate of 2.5 baht/liter (roughly 27 US cents/gallon) on imported ethanol.

In 2012 ethanol exports are forecast to continue the upward trend due to large excess surplus of ethanol production and the operation of the new tapioca-based ethanol plants that will add1.8 million liters/day of capacity. However, the increase in exports falls way short of closing the gap between existing capacity and production.

Table 2.5: Thailand's Exports of Ethanol 1/

Unit: Million Liters

	2007	2008	2009	2010
Philippines	3.7	1.5	-	5.5
Singapore	9.2	12.3	3.1	19.3
Japan	0.9	10.4	7.4	20.0
Australia	1.1	2.5	-	-
Taiwan	0.0	3.2	3.1	1.2
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	48.2

Note: 1/ Based on 19 on-line ethanol plants exporting 99% purity ethanol

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

2.4 Ending Stocks

Presently, ethanol stocks of ethanol remain high at 43.7 million liters, as compared to 30.5 million liters at the beginning of 2011. Some ethanol plants suspend operations for 3-6 months to deplete their surplus, particularly for small tapioca-based ethanol plants who have limited storage facilities.. Ending stocks of ethanol in 2011 will likely be at an optimal level based on oil reserve requirement of 5% of sales which is around 20-30 million liters, in anticipation of an increase in export demand.

2.5 Market for Ethanol Used as Other Industrial Chemicals

Unlike fuel ethanol, production of non-fuel ethanol is controlled by the government. The Liquor

Distillery Organization (LDO) under the Excise Department of the Ministry of Finance monopolized industrial grade ethanol production in Thailand with production capacity of approximately 60,000 liters/day. Industrial grade ethanol accounts for around 30 percent of total non-fuel ethanol production. The balance is beverage grade which is produced by private distillers who receive concession from the government. In 2011-12 industrial grade ethanol production is forecast to increase to 17-18 million liters, up 6.0 percent annually. The LDO plans to invest in new facilities with triple capacity increase due to growing domestic demand for industrial grade ethanol, particularly for medical/pharmacy, paints, and cosmetic industries. Presently, domestic demand for industrial grade ethanol is approximately 50,000 liters/day.

There is only one fuel-ethanol plant that established for exports with production capacity of 200,000 tons which have facilities for beverage- and industrial-grade ethanol production. Most of its exports are beverage grade ethanol to Japan, Korea, and China.

Table 2.6 Estimated Ethanol Used as Other Industrial Chemicals (Million Liters)

	2006	2007	2008	2009	2010	2011	2012
Production	17.8	18.3	17.4	21.0	16.0	17.0	18.0
Imports	1.4	2.0	3.7	6.5	5.4	6.0	6.0
Exports	3.7	4.7	6.2	10.9	4.4	6.5	7.0
Consumption	15.0	16.3	14.6	15.4	16.5	17.3	18.2
Stocks	1.5	0.8	1.0	2.2	2.7	1.9	0.7
Production Capacity							
Capacity (liters/day)	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Capacity Use (%)	82	85	80	97	74	79	83

3. Biodiesel

Table 3.1: Biodiesel - Conventional and Advanced Fuel: (Million Liters)							
Calendar Year	2006	2007	2008	2009	2010	2011	2012
Production	2	68	448	610	660	680	810
Advanced Only	-	-	-	-	-	-	-
Imports	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0
Consumption	2	62	447	609	646	678	810
Ending Stocks	-	6	7	8	22	24	24
Production Capacity - Conventional							
No. of Biorefineries	3	5	9	14	13	13	13
Capacity (Million liters/day)	0.6	1.3	2.2	5.4	5.4	5.4	5.4
Capacity Use (%)	1	16	68	38	41	42	50
Production Capacity - Advanced							
No. of Biorefineries	-	-	-	-	-		-
Capacity (Million liters/day)	-	-	-	-	-		-
Feed Stock Use - Conventional (1,000 MT)							
Crude Palm Oil	2	72	475	575	618		882

3.1 Production

B100 in Thailand is currently produced from feedstock from the palm oil industry- i.e. crude palm oil (CPO), refined bleached deodorized (RBD) palm oil, palm stearin and free fatty acids of palm oil (FFA). B100 production is solely determined by domestic demand for blended biodiesel, currently compulsory at B3, and will shift to mandatory B4 production on July 1, 2011. Thailand does not import or export B100, it does however export CPO.

Although the government is likely to maintain its mandatory B4 policy for the rest of the year, B100 production in 2011 is estimated to grow by 3 percent or 680 million liters, the lowest in the past few years which grew 8 percent in 2010 and 36 percent in 2009, due to the Ministry of Energy's reversal of its mandatory B3 production to B2 to ease palm oil shortages. Based on a recent survey done by FAS, the production outlook for palm oil is favorable for 2011 as CPO palm oil production should top 1.55 million tons aided by improving yields and an expanding harvested area. This would represent a 20 percent increase from 2010 CPO production of 1.29 million tons, which was hampered by unfavorable weather conditions as production dropped from from1.37 million tons or 6 percent from 2009.

Production of B100 for 2012 is too early to estimate due to yield vulnerability on the fresh palm harvest which will be determined by the weather conditions up to early 2012. As such, the Ministry of Energy has become more cautious about the palm oil's vulnerability to erratic weather conditions which has lead them to delay introduction of compulsory B5 production..

In 2010, the latest B100 processing plant came into production with the along with the prevailing 14 plants, This plant, called Bangkok Produce, is considered a small plant with a capacity of 4,000 liters/day utilizing recycled cooking oil as feedstock. The total capacity of biodiesel processing plants altogether is currently 6 million liters/day. As compared to actual B100 production of 1.8-2.0 million

liters/day, the B100 industry is running far below its capacity at about 40 percent of total capacity. In addition, unfavorable prices paid to these B100 processors forced a few plants to halt their production temporarily in 2010 and 2011.

According to B100 producers, they claim that they are at disadvantage as the few petroleum refineries are able to influence market prices. Trade sources cited that actual prices paid to CPO B100 producers are about 10 percent or 2-3 baht/liter 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.

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. Until recently, the latter group attempted to reduce their production costs by switching from CPO raw material to cheaper stearin, however this sent the prices of stearin skyrocketing. These elevated prices have again caused this group to move towards using cheaper a source in the form of free fatty acids of palm oil (FFA) as feedstock. Typical prices for different types of feedstock are currently 36.00-37.00 baht/kg for CPO, 34.00-35.00 baht/kg for stearin, and 20.00-22.00 baht/kg for FFA.

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.

3.2 Consumption

B100 consumption, which is determined by the sale of the different blended ratios of biodiesel, increased from 609 million liters in 2009 to 646 million liters in 2010. B100 consumption is anticipated to further grow to 678 million liters in 2011.

Petroleum refineries suspended their B5 production in May 2011. Only B3 production is on sale at the moment. As of July 1, 2011, B4 production will be on sale by mandate. The government has thus far eased its different tax burdens on biodiesel in order to stabilize transportation and electricity costs as a measure to help curb inflation. Price structure of diesel (B3) is presented below.

Table 3.2: A Breakdown of Retail Prices for B3 Biodiesel As of June 28, 2011

	B3 Biodiesel (Baht/liter)
Ex-Refinery Prices	23.7177
Excise Tax	0.0050
Municipal Tax	0.0005
Oil Fund Fee	2.4000
Conservation Fund Fee	0.2500
Wholesale Prices	26.3732
Value Added Tax	1.8461
Wholesale Prices + VAT	28.2193
Marketing Margin	1.6549
Value Added Tax	0.1158
Retail Prices	29.9900

Source: Ministry of Energy

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

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

Month	B100 Consumption	High Speed Diesel (B2/B3)	B5 Sales	Total Sales
2007	62.116	1,537.050	627.486	2,164.536
2008	446.384	12,925.912	3,757.314	16,683.226
2009	609.330	10,045.590	8,168.389	18,213.979
2010	645.783	11,043.224	7,052.600	18,095.824
Janaury	50.796	856.7	673.0	1,529.7
February	49.154	888.6	624.6	1,513.2
March	52.741	975.3	669.3	1,644.6
April	49.073	916.1	598.2	1,514.3
May	49.328	947.6	608.4	1,556.0
June	56.937	907.2	575.8	1,483.0
July	57.562	909.9	566.5	1,476.4
August	53.347	865.0	536.5	1,401.5
September	52.624	840.2	531.2	1,371.4
October	53.615	859.8	541.6	1,401.4
November	58.788	993.6	564.2	1,557.8
December	61.818	1,083.2	563.3	1,646.5
2011				
Janaury	59.246	1,076.5	511.5	1,588.0
February	46.838	1,285.5	170.9	1,456.4
March	51.113	1,669.6	6.1	1,675.7

3.3 Trade

Thailand has not imported or exported any B100 products thus far since the government practically

restricts trade by not issuing import/export permits for B100. This is done to protect domestic palm growers.

3.4 Ending Stocks

B100 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 low at 15-20 million liters or about ten days of utilization.

The stock availability of CPO, a main feedstock for B100 production, will be the main factor determining how far the government will mandate production of B4. Based on Post's calculation, Thailand may encounter low stocks of CPO in early 2012 if actual CPO production in 2011 turns out to less than 1.6 million tons. If that is the case, the government may need to reverse its B4 mandate to B3 or B2 as it did in early 2011.

4. Advance Biofuels

A molasses-based ethanol plant using second-generation biofuels in the form of cane bagasse is currently operational. This pilot project has been established between 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 the 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, one for molasses and one for bagasse.

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, as of December 31, 2009, 101 small producers (SP) were approved to sell 5,828.523 MW of electricity to EGAT, of which 60 producers were able to supply 2,358.52 MW in total in 2009. It also reported that 1,155 very-small producers (VSP) were approved to sell 5492.81 MW of electricity in 2009, of which 148 producers supplied 340.72 MW.

End of report