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An Update on Ethanol Production and Utilization in Thailand- 2014

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Executive Summary

In spite of the recent political turmoil, Thailand has continued to develop its ethanol based alternative fuel supply and demand infrastructure. Its support of production and sales of ethanol contributed to more than doubling the production over the past five years alone. In April 2014, average consumption stood at 3.18 million liter per day- more than a third on its way to its domestic consumption goal of 9 million liters per day by 2021. Strong government incentives and the phasing out of non-blended gasoline contributed substantially. Concurrently, exports dropped significantly to their lowest level since 2011, increasing the pressure on Thai policy makers to balance energy independency goals with other priorities, such as Thailand's trade balance and environmental aspirations. Utilization of second generation biofuels might have the potential to further expand Thailand's growing ethanol market. Thailand has also dramatically increased its higher ethanol blend vehicle fleet, with all new vehicles sold in the Thai market now being E20 capable and the number of E85 vehicles increasing three fold in the last year from 100,000 in 2013 to 300,000 in 2014.

Introduction

Thailand's ambitious plans to grow its biofuel sector, reduce energy consumption, and reduce energy intensity and greenhouse gas emissions have not been affected by the recent political turmoil that culminated in the May 2014 military coup.[1] The country's caretaker government indicated that it will continue the policies outlined in the 2011 Alternative Energy Development Plan (AEDP), which outlines targets of increasing ethanol consumption to 9 million liters per day (ML/D) by 2021. Supported by several policies, such as the phasing out of regular RON 91 gasoline in 2013 and subsidies for ethanol sales, consumption of ethanol shot up to 2.6mL/d at the end of 2013, reflecting an increase of 85% compared to 2012 levels.[2]

Even though the political situation in Thailand has impacted the economy significantly, the ethanol sector escaped relatively unscathed. Thailand's economy barely expanded in the second quarter of 2014 with a rate of 0.4% year on year, thus narrowly escaping a recession after the first quarter's 0.1% contraction.[3] The biofuels sector, which increased more than ten-

[1] Agrochart 2014. Thailand. Biofuels Annual. Aug 2014. Available at: http://www.agrochart.com/en/news/news/290814/thailand-biofuels-annual-aug-2014/

[2] Nakornthap, Kurujit. 2014 The Promotion of Biofuels in Transportation Sector in Thailand. Presented at APEC'S 42nd EGNRET Meeting, Honolulu, Hawaii, USA.

[3] Economist. 2014. Thailand escapes recession. Accessed 9/20/2014 at http://country.eiu.com/article.aspx?articleid=782187662&Country=Thailand&topic=Economy&subtopic=Forecast&subsubtopic=Economic+growth&u=1&pid=1832219567&oid=1832219567&uid=1

fold between 2005 and 2010, continued its growth trajectory.[4] By April 2014, ethanol consumption averaged 3.18 mL/d, completing over a third of the journey towards the 2021 goals.[5]

This report gives an overview of Thailand's energy sector policies, examines the current state of ethanol production and consumption in Thailand, and showcases recent developments, including the sustainability of ethanol based fuel policy, the potential of second generation biofuels and foreign investments into Thailand's ethanol sector.

Thai energy sector and policy

While Thailand holds large proven reserves of natural gas, limited gas production and limited quantities of oil production and reserves make it dependent upon imports of fossil fuels.[6] Over the next seven years, fuel use is projected to increase from 35,990 to 41,409 million liters annually, potentially exacerbating import dependency.[7] This was one of the main reasons the Thai government enacted the 2011 AEDP, which set aggressive targets to increase alternative energy consumption by 25% of total energy consumption in 2021. This plan replaced the previous 15-Year Renewable Energy Development Plan, which targeted 20.3% of renewable energy consumption by 2022. The target for ethanol consumption under the AEDP is set at 9ML/D in 2021. In addition, the AEDP also sets a new aggressive goal of 3 mL/day for second generation biofuels by 2021.[8] The second generation fuels are meant to provide a replacement for diesel, and the feedstocks under discussion are bagasse, jatropha, and algae. Together, these support an overall 2021 ADEP renewable transport fuel target of 44%. Other goals of the AEDP are: strengthening of domestic energy security, promotion of integrated green energy utilization in communities, development of alternative energy industries, and increase competitiveness of Thai R&D in renewable energy technology for in the global market.[9]

Ethanol Production

Over the past five years, Thailand has more than doubled its production of ethanol. In 2013, the country's 21 refineries produced 1,048 million liters of ethanol or 2.87mL/d while their production capacity rose to 4.19 mL/d, an increase of 0.3 mL/d from 2012 levels (see Table 1

[4] S. Kumar, P. Abdul Salam, Pujan Shrestha, E Kofi Ackom. 2013. "An Assessment of Thailand's Biofuel Development." *Sustainability* 2013, 5, 1577-1597; doi:10.3390/su5041577
[5] Preechajarn, S., Ponnarong, P. 2013. Thailand Biofuels Annual. USDA, F. A. S., Ed. Bangkok, 2014
[6] EIA. 2014. Thailand- Analysis. Accessed 9/18/2014 at: http://www.eia.gov/countries/cab.cfm?fips=th
[7] Preechajarn, S., Ponnarong, P. 2014. Thailand Biofuels Annual. USDA, F. A. S., Ed. Bangkok, 2014
[8] Nakornthap, Kurujit. 2014 The Promotion of Biofuels in Transportation Sector in Thailand. Presented at APEC'S 42nd EGNRET Meeting, Honolulu, Hawaii, USA.
[9] Department of Alternative Energy Development and Efficiency. 2011. The Renewable and Alternative Energy Development Plan for 25 Percent in 10 Years (AEDP 2012-2021). Available at: http://www.dede.go.th/dede/images/stories/dede_aedp_2012_2021.pdf

and Table 2).[10] Eleven of the refineries produced ethanol from sugarcane derived molasses, the largest feedstock, while six were cassava fed and four were hybrids, including Thailand's sole sugarcane based refinery. The only sugarcane ethanol plant used 748,353 metric tons of sugarcane to produce approximately 56 million liters of ethanol, which accounted for 6 percent of total ethanol production in market year 2012/13.[11] The reason for cassava not playing any larger role in Thailand resides in molasses still providing the highest yield to farmers (about 85% compared to 60-62% from cassava).[12]

Table 1 Thailand's Ethanol Refineries, Capacity and Use

	2006	2007	2008	2009	2010	2011	2012	2013	2014*
Number of Refineries	5	7	11	11	19	19	19	21	22
Nameplate Capacity	0.78	0.96	1.6	1.7	2.9	2.9	3.2	3.9	5.2
Capacity Use (%)	58%	64%	66%	78%	49%	58%	67%	74%	59%

*Estimated. Source: USDA
http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Bangkok_Thailand_6-27-2014.pdf

Table 2 Ethanol Production, Exports and Consumption during 2009-2014

	Production (million liters)	Export (million liters)	Average Production per Day (million liters/day)	Average Consumption (million liters/day)
2009	482	16	1.32	1.25
2010	521	48	1.42	1.24
2011	613	139	1.68	1.23
2012	790	304	2.16	1.39
2013	1,048	64	2.87	2.6
2014	1,115*	10*	3.05*	2.92

*Estimate. *Source*: USDA
http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Bangkok_Thailand_6-27-2014.pdf

[10] Nakornthap, Kurujit. 2014 The Promotion of Biofuels in Transportation Sector in Thailand. Presented at APEC'S 42nd EGNRET Meeting, Honolulu, Hawaii, USA.
[11] Agrochart. 2014. Thailand. Sugar Annual. Apr 2014. Available at: http://www.agrochart.com/en/news/news/020514/thailand-sugar-annual-apr-2014/
[12] Ng, Esther. 2013. Asian Ethanol Mandates: Shifting Goalposts. Platts Insight. Singapore. Available at: https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsight-oct13-goalposts.pdf

Another feedstock currently investigated is rice, of which the government purchased 18 million tons from farmers at higher-than-market rates between October 2011 and February 2014. Yet while the government is estimated to have spent as much as 400 billion Thai Baht ($12.4m) for purchasing and storing the rice, the cost of turning it into ethanol would be about twice the price of ethanol made from molasses.[13]

The government and private sector are investigating alternatives to currently used feed stocks. A joint pilot program on second generation biofuels by the Thai Roong Ruang Group, one of the largest sugar mills in Thailand, and the Japanese and Thai governments started an additional production line using cane bagasse. However, due to high production costs, the production capacity is currently limited to 10,000 liters/day.[14]

Consumption of ethanol reached a record of 969 million liters in 2013, breaking down to 2.6mL/d (see Table 2). Several reasons have contributed to the growth, including the phase out of ULGRON 91, but also the generous government subsidies for E20 and E85 gasohol, which the current military caretaker government is still promoting. These subsidies, which are paid for by the State Oil Fund, make ethanol blends 12 to 40 percent cheaper than E10 Octane 95 gasoline. Further subsidies include marketing subsidies for gasoline stations totaling 1-2 Thai Baht/liter and 5-6 Thai Baht/liter to entice them to expand sales of E20 and E85 gasohol. [15]

Exports and Trade

Exports of ethanol used to be a driver that supported the continuous expansion of the ethanol production and distribution system. This was true especially between 2009 and 2012, when domestic demand was stagnant (see Figure 1). The Philippines' ethanol blend mandate – one of the tools several ASEAN countries used to react to the peaking oil prices of $145 per barrel in 2008 – contributed to the continuous expansion of ethanol refineries from 11 to 19 between 2009 and 2012 (see Table 1). The external market pull readied the industry for the increase in domestic demand, which kicked in to high gear after 2012. Consequently, exports significantly declined between 2012 and 2013 (see Table 3). Peaking at just less than 304 million liters in 2012, exports declined to 63.8 million liters in 2013, reflecting a decline of 79% back to pre-2011 levels. The Philippines saw its imports from Thailand reduced by 67% in light of these developments.

[13] Phoonphongphiph, Apornrath. 2014. Thailand looking to produce ethanol from rotten rice stocks – officials. Reuters UK. Accessed 9/20/2014 at: http://uk.reuters.com/article/2014/08/13/uk-thailand-rice-ethanol-idUKKBN0GD0KT20140813

[14] Agrochart. 2014. Thailand. Sugar Annual. Apr 2014. Available at: http://www.agrochart.com/en/news/news/020514/thailand-sugar-annual-apr-2014

[15] Preechajarn, S., Ponnarong, P. 2013. Thailand Biofuels Annual. USDA, F. A. S., Ed. Bangkok, 2014

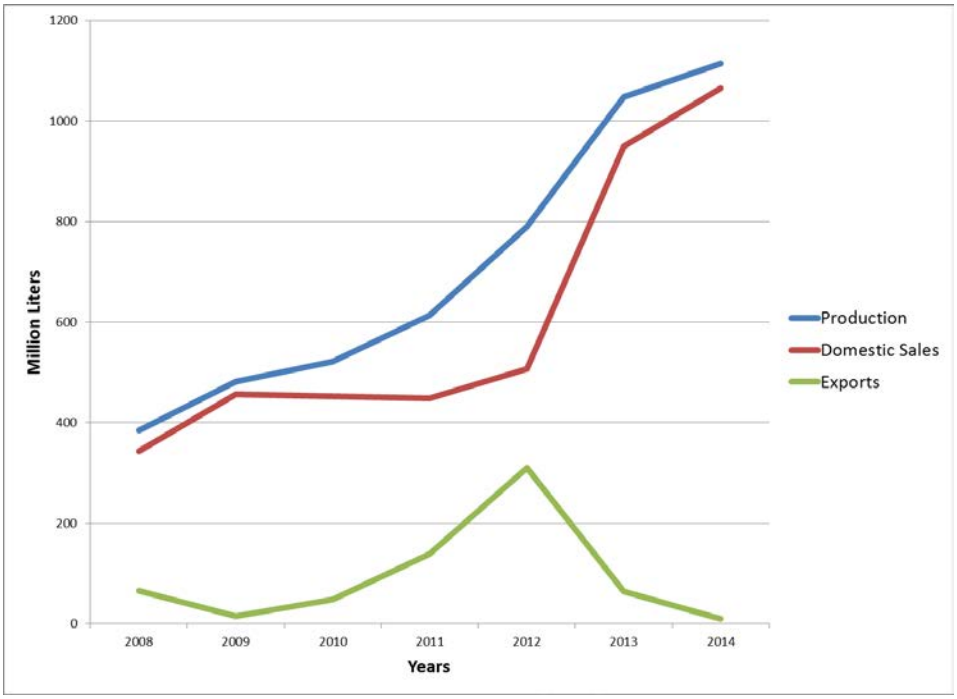

Figure 1 Thailand's Ethanol Production, Domestic Sales and Exports 2008-2014
Source:
http://www.dede.go.th/dede/fileadmin/usr/bers/gasohol_documents/gasohol_2010/september/160953_exportethanol.pdf; http://webkc.dede.go.th/testmax/node/159;

In 2010, the Association of South East Asian Nations (ASEAN) implemented the ASEAN Trade in Goods Agreement (ATIGA) that aims at establishing the region as a single market by 2015.[16] One of the commodities included was sugar, whose tariff rates will be reduced to 0-10 percent (compared to 5 – 40 percent) under the 2015 scheme. The ATIGA will leave sugar import tariff free in most countries, with the notable exception of the Philippines, Indonesia and Myanmar, where a lower tariff of 5%, 5-10%, and 0-5% will go into effect come 2015.[17] While the impact on the Thai sugar price or ethanol producers is not certain, an increase in sugar prices could lead local ethanol producers to switch to producing sugar instead.[18]

A potential free trade regime including ethanol might lead to significant growth in Thailand's ethanol industry. A 2006 study examining the impact of free trade of ethanol between the U.S. and Brazil found that the removal of trade barriers would lead to a 23.9 percent increase in the

[16] ASEAN. 2013. ASEAN TRADE IN GOODS AGREEMENT. Available at http://www.asean.org/communities/asean-economic-community/category/asean-trade-in-goods-agreement
[17] Prasertsri, P. 2014. Thailand Sugar Annual. USDA, F. A. S., Ed. Bangkok, 2014. Available at: http://www.thefarmsite.com/reports/contents/ThailandSugar22April2014.pdf
[18] Ng, Esther. 2013. Asian Ethanol Mandates: Shifting Goalposts. Platts Insight. Singapore. Available at: https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsight-oct13-goalposts.pdf

average price of world ethanol (between 2006 and 2015).[19] Furthermore, the U.S. domestic ethanol price would decrease by 13.6 percent, while Brazil, the country with the comparatively lower ethanol production costs, would increase production by 9.1 percent and exports of ethanol 64 percent. Thailand, the regions second largest producer of ethanol after China, might experience a similar boost in its production and exports of ethanol with a more liberalized ethanol trade regime.[20] Concurrently, increased exports could dampen the availability of ethanol for domestic consumption, thus limiting Thailand's AEDP.

Table 3 Thailand's Exports of Ethanol

	2009	2010	2011	2012	2013
Philippines	-	5.5	61.3	142.3	45.9
Singapore	3.1	19.3	68.5	76.8	-
Japan	7.4	20.0	16.5	24.9	8.8
Australia	-	-	2.1	-	-
Taiwan	3.1	1.2	3.2	1.5	-
Indonesia	-	-	-	1.5	-
Europe	-	-	-	9.3	9.1
South Korea	-	2.1	12.8	45.5	-
Other	2.0	-	2.6	2.1	-
Total	15.6	48.2	167	303.9	63.8

Millions of Liters

Source: USDA

http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Bangkok_Thailand_6-27-2014.pdf

Gasohol Consumption

The ethanol fuels available in the Thai market are E10, E20 and E85. E10 (10% ethanol with 90% gasoline) is blended in Octane 91 and Octane 95 and are sold as Gasohol 91 and Gasohol 95, respectively. E20 (20% ethanol with 80% gasoline) and E85 (85% ethanol with 15% gasoline) are both blended only in Octane 95 and are sold as Gasohol E20 and Gasohol E85, respectively.

Sales of gasohol in Thailand had been increasing continually since it was commercially available in the market. Sales of gasohol 95 slipped in 2010 and 2011 due to the economic downturn. Consumption of gasohol dropped further in 2011 because of the government policy to terminate the levy on gasoline to lower gasoline prices resulting in a jump of gasoline consumption and a decline of gasohol consumption. However, sales picked up dramatically in

[19] Elobeid, Amani, S Tokgoz. 2006. Removal of U.S. Ethanol Domestic and Trade Distortions: Impact on U.S. and Brazilian Ethanol Markets. Working Paper 06-WP 427 Center for Agricultural and Rural Development Iowa State University Ames, Iowa

[20] Ng, Esther. 2013. Asian Ethanol Mandates: Shifting Goalposts. Platts Insight. Singapore. Available at: https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsight-oct13-goalposts.pdf

2012 and 2013, mainly due to the phasing out of RON 91 and the continued subsidies for gasohol products. Average sales of gasohol per day from January to July 2013 are 10.5 mL/day as compared to 10.02 mL/d during the same months in 2012, an increase of 4.6% (see Table 4). In early 2014, gasohol had a market share of 91.9%. [21]

Table 4 Gasohol Sales in Thailand (E10, E20, and E85 combined)

	Million Liter	Million Liter/Day	% Change of Sales Per Day
2006	1279	3.50411	-
2007	1763	4.830137	27.4
2008	3392	9.293205	48.0
2009	4470	12.24726	24.1
2010	4383	12.00852	-2.0
2011	4213	11.54274	-4.0
2012	4455	12.20548	5.4
2013	7471	20.46849	40.4
Total Jan-July 2013	3658	10.02192	
Total Jan-July 2014	3834	10.50411	4.6

Source: Department of Energy Business
http://www.doeb.go.th/info/data/datadistribution/y_sale.xls

The gasoline market in Thailand has seen dramatic changes over the past two years. Until 2012, (ULG 91RON was the dominating fuel. However, the phase out of ULG 91RON led to the precipitous drop of sales from 3,208 million liters in 2012 to 147 million liters a mere year later. (See Figure 2)

At the same time, all ethanol blended fuels (Gasohol 91, Gasohol 95, Gasohol E20 and Gasohol E85) saw significant upticks in 2013 sales, with Gasohol 95 sales increasing from 1,931 million Liters to 3,030 and Gasohol 91 growing from 2,121 million liters to 3,337 in 2013. This 57% year on year increase for both Gasohol 91 and Gasohol 95 is a clear reversal of the previously ongoing decline in sales of Gasohol 95, whose sales had dropped 9% between 2011 and 2012.

In contrast, sales of Gasohol E20 and Gasohol E85 have steadily risen due to strong support of the government in reducing excise tax rates for E20-compatible cars and for FFVs and in keeping prices of Gasohol E20 and Gasohol E85 competitive with prices of gasoline. Sales of Gasohol E20 almost tripled from 367 million liters in 2012 to 963 million liters in 2013- an

[21] Nakornthap, Kurujit. 2014 The Promotion of Biofuels in Transportation Sector in Thailand. Presented at APEC'S 42nd EGNRET Meeting, Honolulu, Hawaii, USA.

increase of 262%. Over the first six months of 2014, about 629 million liters of Gasohol E20 have been sold, compared to 426 million liters during the same period in 2013.[22]

The sales of Gasohol E85 have also increased substantially since it was available in 2008. The total amounts of Gasohol E85 sold in 2008 were just 0.021 million liters, while 2013 sales totaled 141 million liters. With 138 million liters already sold in the first six months of 2014, E85 is poised to set another sales record in 2014.[23]

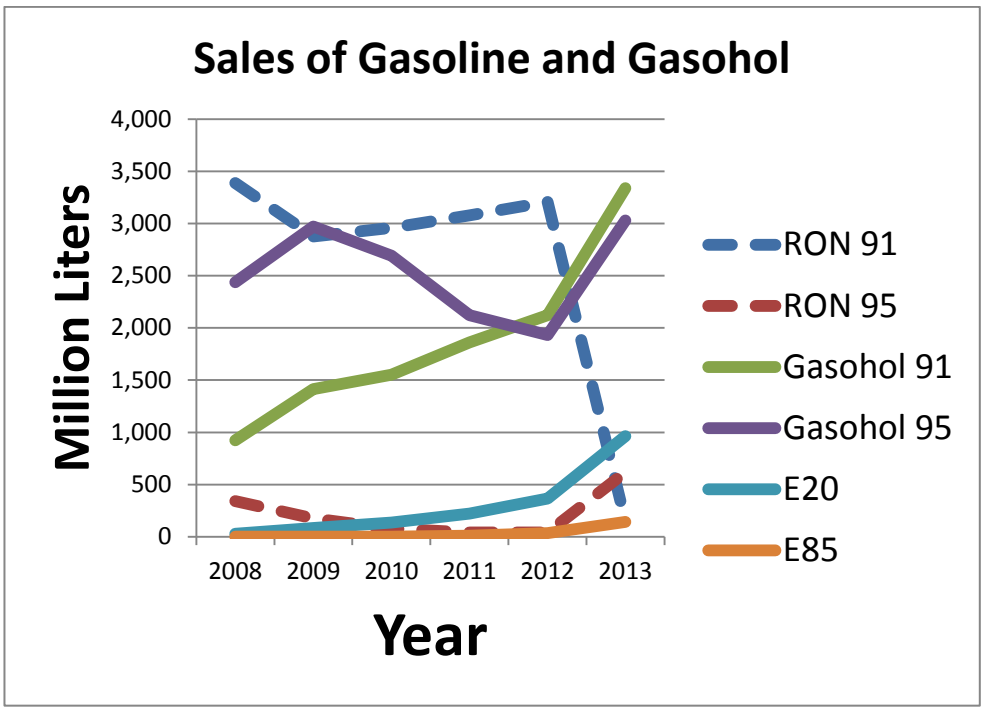

Figure 2 Sales of Gasoline and Gasohol 2008-2013
Source: Department of Energy Business.
http://www.doeb.go.th/info/data/datadistribution/y_sale.xls

Number of Stations

As the government has pushed to increase the demand for high-content ethanol fuels, demand for Gasohol E20 and Gasohol E85 has risen, and consequently the numbers of pumps. Between July 2013 and July 2014, there were 757 more Gasohol E20 pumps in Thailand making it a total of 2,461 pumps that are selling Gasohol E20. As a comparison, just a year earlier, the number of pumps stood just at 968. Table 5 shows the number of gas stations selling E20 and E85

[22] Department of Energy Business. http://www.doeb.go.th/info/data/datadistribution/y_sale.xls
[23] Department of Energy Business. http://www.doeb.go.th/info/data/datadistribution/y_sale.xls

Table 5 Number of gas stations selling E20 and E85.

	July 2013 E20	July 2013 E85	July 2014 E20	July 2014 E85
PTT	902	33	991	214
Bangchak	654	74	677	126
Shell	35		253	-
Esso	-	-	237	-
PTT Administrative	111	-	144	-
Chevron	-	-	144	-
Siam Chemical	-	9	-	10
TGF-P	2	-	13	-
Rayong Purifier	-	39	1	48
Susco	-	-	1	29
Total	**1,704**	**155**	**2,461**	**427**

Source: Department of Energy Business http://www.doeb.go.th/info/data/dataoil/gasohol/57/july57/summary-station_E20-E85__jul57.xls

Pumps for Gasohol E85 also increased, from 155 pumps in July 2013 to 427 pumps as of July 2014. Again, this reflects a dramatic rise given that in July 2012 there were only 49 pumps in Thailand selling E85.

One gas station will normally sell several fuel types. Each fuel type has a distinctive hose nozzle. Figure 3 shows a PTT gas station selling Gasohol E85 (first pump), diesel (middle pump) and Gasohol 95 (third pump). Until 2013, only gas stations owned by PTT and Bangchak sold Gasohol E20 and Gasohol E85. In 2014, gas stations owned by Susco and Rayong Purifier started offering both grades.

Figure 3 E85, Diesel, and Gasohol 95 (E10) pumps

The retail prices of E10, E20 and E85 as compared to prices of gasoline and diesel sold in Bangkok and vicinity areas are shown in Table 6.

Table 6 Gasohol Retail Prices (Thai Baht/L) in Bangkok & Vicinities

	PTT	BCP	Shell	Esso	Chevron	IRPC	PTG	Susco	Pure	SUSCO
Gasohol 95-E10	37.80	37.80	37.80	37.80	37.80	37.80	37.80	37.80	37.80	37.80
Gasohol 95-E20	33.98	33.98	33.98	33.98	33.98	-	33.98	33.98	33.98	-
Gasohol 95-E85	24.28	24.28	-	-	-	-	-	24.28	24.28	-
Gasohol 91-E10	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78
ULG 95 RON	44.86	-	-	44.86	44.86	-	44.86	44.86	44.86	44.86
Diesel HSD, 0.005%S	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99
Premium Diesel	32.99	-	33.28	32.99	33.28	-	-	-	-	-

Source: Thailand Energy Policy and Planning Office. http://www.eppo.go.th/retail_prices.html, Accessed 9/16/2014

Update E10

E10 is sold as Gasohol 91 (10% ethanol with 90% gasoline in octane 91) and Gasohol 95 (10% ethanol with 90% gasoline in octane 95). Until 2012, the main gasohol product in the market was Gasohol 95 with higher sales and more pumps than other gasohol products. With the phasing out of ULGRON 91, the sales of Gasohol 95 picked up after declining in 2010 and 2011. The sales of Gasohol 91 have continued to increase, reaching 3,030 million liters in 2013, an increase of 57% from 2012.

Sales of Gasohol 91 in 2013 were 3,337 million liters, an increase of 57% from those in 2012. As of July 2014, there are approximately 23,000 E10 pumps in Thailand.[24]

Update E20

Sales of E20 (known as Gasohol E20) have continued to rise since its introduction to the Thai market on January 1, 2008. About 29.03 million liters of E20 were sold in 2008 and 963 million liters in 2013. The Department of Energy Business reported the sales of E20 in 2013 from January to July at a total of 629 million liters, or about 3.45 million liters per day, as compared to 0.61 million liters per day in 2011.

[24] Department of Energy Business. http://www.doeb.go.th/info/data/dataoil/amount1_57.xls

At present all new cars in Thailand are E20-compatible cars. The Department of Alternative Energy Development and Efficiency, Ministry of Energy, in cooperation with the Department of Mechanical Engineering, King Mongkut's Institute of Technology Ladkrabang, conducted a laboratory test, a road test and a material compatibility test on conventional cars and motorcycles using E20 to see changes in engine performance, emissions, and impacts on all the components contacted with E20 fuel.[25] The result showed that cars using E20 had approximately the same engine performance and emissions as cars using gasoline. The fuel consumption was about 5% higher in cars using E20 as compared to cars using gasoline. The effects on the components which contacted with the E20 fuel were low. For motorcycles, the change in power was about 10% in average with E20, but fuel consumption was less than 5% with E20 as compared to with gasoline.

E85

E85 was introduced to Thailand in 2008. In 2012, PTT and Bangchak where the only E85 distributors. Since then, Susco, Rayong Purifier and Siam Chemical have added the fuel to their distribution network. As of July 2014, there are total of 427 gas stations selling E85—an almost tenfold increase since July 2012, when only 49 stations were available.

Flex Fuel Vehicles

While ethanol production and use have remained on their growth trajectory during the recent political turmoil in Thailand, the car market itself has been in upheaval. According to the Federation of Thai Industries' Automotive Industry Club, April 2014 production totaled 126,730 vehicles, down 25.6% from a year earlier. Sales were off 33% over the year-earlier level to 73,242 vehicles.[26]

The government is stimulating the sale of flex fuel vehicles by offering a series of incentives and tax rebates to manufacturers, who benefit from reduced excise tax rates. E85 cars or flex-fuel vehicles get an excise tax cut of Thai Baht 50,000 for flex fuel cars and Thai Baht 30,000 for eco-cars, which emit no or very limited amounts of CO_2.[27] The result of these policies is that approximately half of Thailand's new vehicle sales in 2013 were reportedly compatible with E20 and E85 gasohol.[28]

[25] Study of Using 20 Percent Ethanol Blended Gasohol in Conventional Cars and Motorcycles, by Associate Professor Dr. Chinda Charoenphonphanich, King Mongkut's Institute of Technology Ladkabang, September 2008.
[26] Chaichalearmmongkol, Nopparat. 2014. Thai Auto Sales Plunged in April Industry's- Continuing Grim Situation Starts to Cause Job Losses. *Wall Street Journal*. Accessed 9/15/2014 at http://online.wsj.com/news/articles/SB10001424052702303749904579577120575374750
[27] Ng, Esther. 2013. Asian Ethanol Mandates: Shifting Goalposts. Platts Insight. Singapore. Available at: https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsight-oct13-goalposts.pdf
[28] Preechajarn, S., Ponnarong, P. 2013. Thailand Biofuels Annual. USDA, F. A. S., Ed. Bangkok, 2014

Five flexible fuel vehicles (FFVs) models are available in Thailand at present—Volvo C 30 1.8F, Volvo S80 2.5 FT, Volvo S80 Business Line, Mitsubishi Lancer EX and the Chevrolet Captiva. The Volvo C30 1.8 F is an imported model available in the Thai market since the beginning of 2008 at the price tag of 1.89 million Thai Baht. The Volvo S80 2.5 FT model has being manufactured in Thailand since November 2008. The Lancer EX model is a mass production FFV model in Thailand by Mitsubishi which was launched in October 2009. The Lancer EX is powered by two engines 1.8 and 2.0 liter, and cost from 831,000 Thai Baht to 1.034 million Thai Baht. In the last quarter of 2010 the Volvo company added another model of Volvo—Volvo S80 Business Line. Chevrolet Captiva has been in the market since July 2011 with the price ranging between 1.2 - 1.7 million Thai Baht. The number of FFV's operating in Thailand has continued to increase at a rapid rate. While there were approximately 6,544 in 2011, there were around 100,000 in 2013 and an estimated 300,000 as of August 2014.[29]

Other fuels

Biodiesel

Biodiesel is another alternative fuel the Thai government is supporting. The AEDP increased the biodiesel consumption target to 5.97 mL/d by 2021. A mandate on B5 biodiesel blend was installed in 2012, and a B7 mandate installed in early 2014.[30] Analysts expect biodiesel intake to increase in the next few years, but caution that the government's prioritization of palm oil- the dominant feedstock- for food over fuel use could jeopardize these targets.[31]

One of the measures the government is taking to increase production of palm oil is to pay farmers to cut down rubber trees and replace them with palm oil trees. Given the recent 20% slip in global rubber prices, the government is incentivizing the removal of 350,000 rubber trees per year, while expanding oil palm acreage by 25%.[32] These measures may be well needed, given that the recent B7 mandate has been delayed because of a decrease in oil palm output from the usual 1 million tons to 800,000-900,000 tons a month.[33] Instead, B4 diesel will be used for the time being.

[29] Ng, Esther. 2014. Thai consumption of E20, E85 increases with more E85 cars, gas stations. Accessed 9/21/2014 at: Platts http://www.platts.com/latest-news/agriculture/singapore/thai-consumption-of-e20-e85-increases-with-more-27560168

[30] Department of Alternative Energy Development and Efficiency. 2011. The Renewable and Alternative Energy Development Plan for 25 Percent in 10 Years (AEDP 2012-2021). Available at: http://www.dede.go.th/dede/images/stories/dede_aedp_2012_2021.pdf

[31] EIA. 2014. Thailand- Analysis.Accessed 9/18/2014 at: http://www.eia.gov/countries/cab.cfm?fips=th

[32] Phoonphongphiphat, Apornrath. 2014. UPDATE 1-Thai govt to aim for rubber supply cut to support prices. Reuters. Accessed 9/21/2014 at: http://in.reuters.com/article/2014/08/05/thailand-rubber-idINL4N0QB24C20140805

[33] Oiltrends. 2014. Lower palm output causes hiccup in B7 production in Thailand. Accessed 9/21/2014 at: http://fuelsandlubes.com/oiltrends/lower-palm-output-causes-hiccup-in-b7-production/

On a brighter note, the Alternative Energy Development and Efficiency Department successfully completed two years of laboratory and field trials of B20 to examine the potential of providing the elevated diesel blend for large trucks, which account for 60% of Thailand's national diesel consumption.[34] The results showed no negative impact on driving experience, while lowering emissions.

Electric Vehicles

One of the car companies betting on the fledgling electric vehicle (EV) market is Mitsubishi. It has been working with several government agencies on expanding charging infrastructure while planning to introduce an EV model based on the Mirage platform. Mitsubishi seems to be hoping to gain from a first mover advantage, as Thailand's EV market is still in a very early stage compared to Japan or South Korea.[35]

CNG and LNG

Another potential competition to ethanol comes from natural gas fueled vehicles (NGV). In 2013, sales of NGVs topped 112,000, while the fuel infrastructure of CNG stations increased to 488, with 59 additional stations slated to open in 2014.[36] The network of LPG stations stood at 1,500 in 2013.

Discussion

The AEDP has been scrutinized by Thai policy makers, as well as researchers examining global ethanol strategies. A recent study completing a general equilibrium economic analysis of Thailand's ethanol policies found that while in the short-run, the policy had an adverse impact on real output (resulting from a shortage of biofuel feedstock, leading to a decline in aggregate employment), in the long run, the adverse impact on real GDP would be reversed via an increase in aggregate investment resulting from an increase in foreign investment, and a general increase in sectoral output.[37] However, the same study also noted that the Thai government would face a significant decrease in fuel tax revenue given that fuel tax on gasoline currently is the major source of the total tax revenue.

[34] Praiwan, Yuthana. 2014. B20 'commercially viable' after testing. Bangkok Post. Accessed 9/21/2014 at: .http://www.bangkokpost.com/most-recent/421829/b20-commercially-viable-after-testing

[35] Thailand Autos Industry Update Quarter 2 2014, March 2014 Business Monitor International

[36] Zloty, Piotr. 2014. Thailand - LPG and CNG potentate. Gazeo. Accessed 9/21/2014 at: http://gazeo.eu/up-to-date/news/2014/Thailand-LPG-and-CNG-potentate,news,7659.html

[37] S. Wianwiwat, J. Asafu-Adjaye / Energy Policy 55 (2013) 543–555

Furthermore, recent developments of Thailand's decrease of ethanol exports contributed to the country posting a negative current account, consisting of a deficit of US$2.7 billion in 2013 - nearly double the 2012 deficit of US$1.4 billion.[38]

Another study examining the potential of using sustainably-derived crop residues for ethanol production concluded that about 10.4×10^6 bone dry tons of feedstock per year could be produced, which could result in between 1.14–3.12 billion liters per year.[39] This would translate into between 3.1 and 8.5 mL/d, thus potentially coming close to fulfilling the AEDP targets-using second generation feedstock alone.

As this report outlines, the turbulent political situation in Thailand has not greatly affected the biofuels industry. In contrast, the industry is expanding both domestically and internationally. Foreign companies, such as Japan's Sumitomo Corporation and Nissin Sugar Co., Ltd. are investing in Thai sugarcane producers.[40] Thai companies, such as Sahacogen (Chonburi), are meanwhile expanding into neighboring countries, such as Myanmar, were the producer and distributer of electricity and steam in Thailand plans to build a 600,000L/day biofuel facility, taking advantage of the favorable wage and investment climate.[41]

New ethanol production facilities are also coming online in 2014, while existing plants are being modified to increase output. Thailand's Khonburi Sugar announced plans to invest US$37.1 million to build a 200,000L/day ethanol facility, slated to be online at the end of 2015, while Mitr Phol Sugar and energy maker PTT set up a joint venture to build a 500,000L/day ethanol facility in 2014.[42]

Conclusion

Thailand has made great strides towards the realization of its alternative fuel targets, more than doubling its production of ethanol over the past five years alone. In early 2014, the country's 21 refineries' capacity rose to 4.19 mL/d and 2014 promises to see more refineries coming online.

[38] Economist. 2014. Thailand escapes recession. Accessed 9/20/2014 at http://country.eiu.com/article.aspx?articleid=782187662&Country=Thailand&topic=Economy&subtopic=Forecast&subsubtopic=Economic+growth&u=1&pid=1832219567&oid=1832219567&uid=1

[39] S. Kumar, P. Abdul Salam, Pujan Shrestha, E Kofi Ackom. 2013. "An Assessment of Thailand's Biofuel Development." Sustainability 2013, 5, 1577-1597; doi:10.3390/su5041577

[40] Sumitomo Corporation.2014. Sumitomo Corporation to Invest in a Thai Leading Sugar Manufacturer. Available at: http://www.sumitomocorp.co.jp/english/news/detail/id=27126

[41] Sapp, Meghan. 2014. Thai company to build biofuel plant in Myanmar. *Biofuels Digest*. Accessed 9/21/2014 at: http://www.biofuelsdigest.com/bdigest/2014/06/30/thai-company-to-build-biofuel-plant-in-myanmar/

[42] Praiwan, Yuthana. 2014. PTT, Mitr Phol ink fuel deal. Bangkok Post. Accessed 9/21/2014 at: http://www.bangkokpost.com/print/403793/

Another positive development was the increase of consumption, which set a record of 2.6 million liters per day in 2013, or 969 million liters annually. The continuous support for ethanol development and use by the current government, including generous government subsidies for E20 and E85 gasohol which make ethanol blends 12 to 40 percent cheaper than E10 Octane 95 gasoline, are driving these developments. The phasing out of ULG RON91 most likely also contributed substantially.

These developments have led to dramatic changes in the Thai gasoline market, which as recently as 2012 was dominated by the now phased out ULG 91RON. At the same time, all ethanol blended fuels saw significant upticks in 2013 sales, with Gasohol 95 sales increasing 57% year on year and sales of Gasohol E20 increasing 262% since 2012.

The strong domestic demand for ethanol did, however, contribute to a drastic reduction in Thailand's exports, which declined to 63.8 million liters in 2013, the lowest level since 2011. Thai policy makers need to carefully evaluate the best path forward for their country, balancing environmental goals with other priorities, such as Thailand's trade balance and energy dependency. This is true especially in light of a prospective free trade regime covering ethanol, which could greatly boost ethanol production in Thailand, while potentially reducing fuel available for domestic consumption, and thus alter the consumption targets outlined in the AEDP.

Currently, ethanol is poised to be the leader of alternative fuels in Thailand. Biodiesel, while also supported by the Thai government, has not been able to reach production goals- mainly due to palm oil being used for food production as well. This led to the B7 mandate being downsized to B4 in early 2014. CNG and LNG also have potential in the market, but given Thailand's currently low domestic production of natural gas, NGV's would also contribute to exacerbating its energy dependence. Lastly, EVs are in their very infancy, with only one manufacturer exploring the market.

The potential of expanding feedstock utilization and adding new, second generation biofuels sourced from agricultural scrap showcase the countries potential to further expand its growing market.