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Thailand: A Role Model for Biofuel "Dreamers"

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Abstract

This paper describes Thailand's experience in the design and implementation of government policies on ethanol and biodiesel. Where there is a widely accepted view regarding biofuels which emphasizes the negative consequences of their use (i.e. food price inflation, crop substitution, and vehicle engine damage), this paper offers a positive, alternative vision regarding their utilization rooted in concrete data and measurable outcomes. Our findings pinpoint the factors which have contributed to the success of Thailand's biofuel industry, while also identifying the challenges the future holds. In addition, we aim to provide substantive learning material for those interested or working in the biofuels industry. The methodology of this paper is based on a bibliography which is entirely available online, and on several interviews with one of the most respected experts on the biofuel industry in Thailand.

Keywords: Biofuels; Ethanol; Energy; Policy; Thailand; Transportation; Renewables

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1. Background

1.1. Thailand: Key Country Statistics

Thailand is located in Southeast Asia and borders a total of four countries. With a population of about 69 million inhabitants, Thailand is in the midst of transforming from a predominantly rural country to an increasingly urban one. In only 10 years, the country´s urban population has increased from 38.8% (2006) to 51.54% (2016), which means that half of the population now lives in cities and urban areas. Thailand's capital, Bangkok, has the highest population figures, with approximately 5.69 million people.

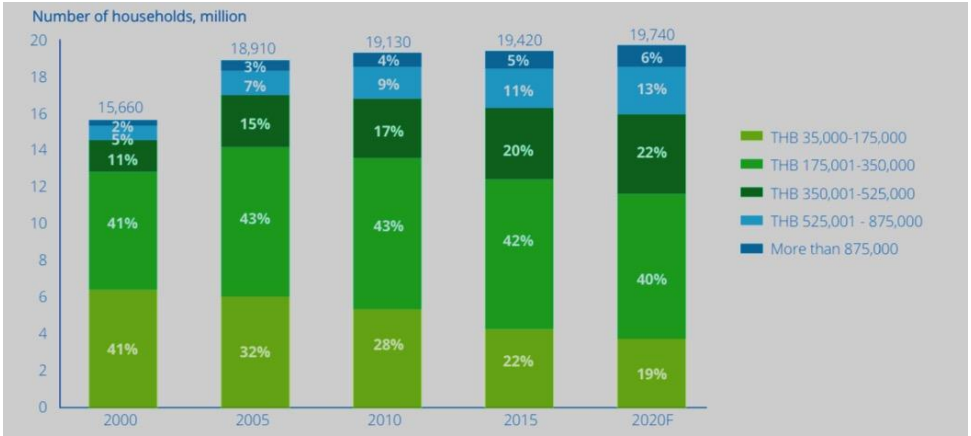
GDP per capita in 2015 was US$5,799.19 (IMF), placing the country in the 92nd position out of 236 countries. In 2016, agriculture represented 8.34% of GDP, industry 35.82% and services 55.84% (WB). In the distribution of employment by economic sector, agriculture employs 32.28% of the workforce, industry 23.68%, and services 43.87%. International trade plays an important role in the development of Thailand's economy. Thus, when it comes to trade, exports account for nearly 70% of the state GDP. The United States is Thailand's most important export partner, with a share of 11.4% of all exports. China is the most important import partner, accounting for 21.6% of all imports.

1.2. Household Income Levels

According to the World Bank, "over the last decades, Thailand has made remarkable progress in social and economic development, and in 2011 it moved from a low-income country to an upper-income country. Poverty has declined substantially over the last 30 years, from 67% in 1986 to 7.2% in 2015, driven by periods of high growth and rising agricultural prices" (WB; 2018).

In 2000, middle-income households (defined as having annual household incomes of between THB[1] 175,000 and THB 875,000) accounted for 57% of total households. By 2015, this number had grown to 73% (see Figure 1.1).

Figure 1.1
Annual Household Income Level by Segments of the Population (2000-2020)

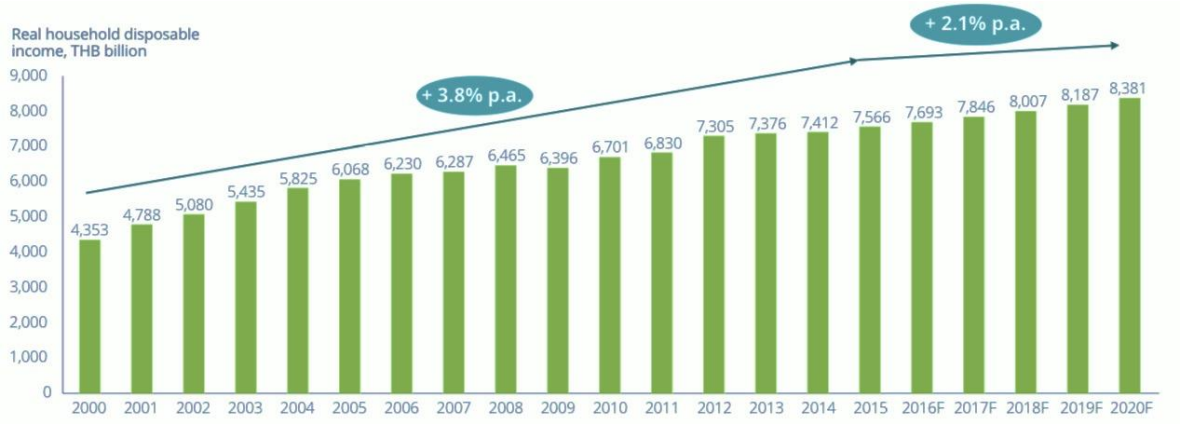


Source: The Economist Intelligence Unit (2016), https://www2.deloitte.com/content/dam/Deloitte/jp/Documents/consumer-business/cp/jp-cp-ci2016tl-eng.pdf. Last accessed March 2018.

[1] 1,000 Thai Baht is equal to 29.44 U.S. dollars and 26.36 euros (as of June 2017).
Source: https://www.statista.com/statistics/716001/share-of-household-income-levels-in-thailand-forecast/.

The real household disposable income increased by an average of 3.8% per year from 2000 to 2015, and it is expected to keep increasing at a slower pace (2.1% per year) from 2015 to 2020 (Figure 1.2).

Figure 1.2
Real Household Disposable Income, 2015 Constant THB Prices (2000-2020)



Source: The Economist Intelligence Unit (2016), https://www2.deloitte.com/content/dam/Deloitte/jp/Documents/consumer-business/cp/jp-cp-ci2016tl-eng.pdf. Last accessed March 2018.

The World Bank points out that "poverty and regional inequality continue to pose significant challenges. Many people are vulnerable due to faltering economic growth, falling agricultural prices and ongoing droughts. In 2014, over 80% of the people in poverty (7.1 million) lived in rural areas. The government has launched a program to create jobs and generate sustainable income for farmers and low-income households" (WB; 2018).

1.3. Thailand: a Logistics Hub in Southeast Asia

Thailand is located in Southeast Asia. It is bounded on the East by Cambodia and Laos, on the West by Myanmar and the Andaman Sea, and on the South by the Gulf of Thailand and Malaysia. Thailand is a logistics hub in the Southeast Asia region. Trade is one of the most important economic activities due to the geostrategic position of the country: Thailand leads the development of the ASEAN Free Trade Area as one of the founding ASEAN member countries (Deloitte; 2018).

1.4. Automotive Industry in Thailand

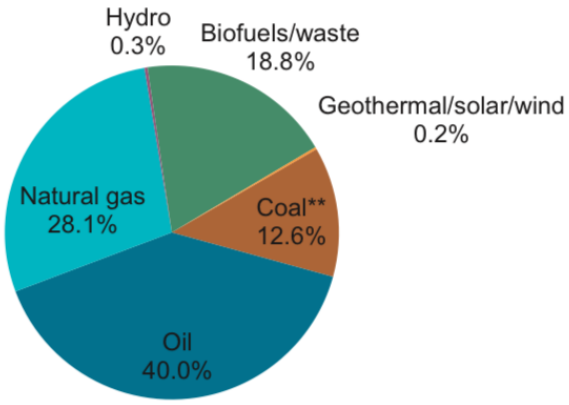
The automobile industry is a vital sector for the country's economy, as it contributes greatly to exports and trade flows. It is the second largest export industry in Thailand, after parts and computer components. The main factors that attract investors to enter the Thai automotive market are the large pool of skilled labor at an affordable cost and the abundant supply of rubber. The country ranks as the world's 12th-largest car producer. The automobile industry accounts for around 10% of the country's GDP (US Department of Energy; 2017).

The country is moving towards the production and adoption of green automobiles: "In a bid to promote new industries as part of Thailand's 4.0 modernization program, the Thai government has identified 10 potentially high-growth industries, including electric and other modern vehicles. Next-generation vehicles in Thailand will be motor-driven vehicles including hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), battery electric vehicles (BEV) and full cell vehicles (FCV)" (US Department of Energy; 2017). Although registration of electric vehicles (EVs) in 2016 grew significantly (approximately 32%), when compared with internal combustion engine vehicles (ICE), EVs represent a very small proportion (132 EVs compared to 16,159,528 ICEs), according to the data collected by Thailand´s Department of Land Transport (Krungsri; 2017).

1.5. Dependence on Crude Imports and Increasing Prices

Figure 1.3 presents the share of oil in the total primary energy supply for 2015, which provides a rough estimate of the degree of reliance or dependency on oil products.

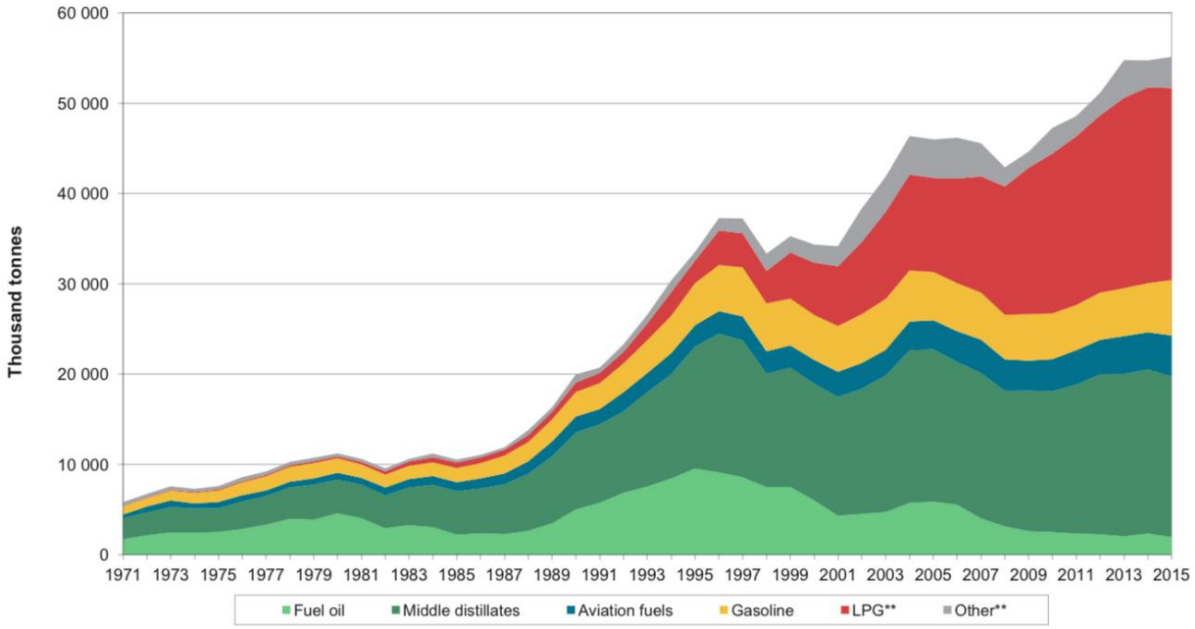
Figure 1.3
Share of Energy Sources in the Total Primary Energy Supply (2015)



Source: IEA, https://www.iea.org/stats/WebGraphs/THAILAND4.pdf. Last accessed March 2018.

Figure 1.4 provides a disaggregation of oil consumption by fuel type. We observe a predominance of middle distillates (mostly diesel) and LPG (which includes NGL, ethane and naphtha as well). In "Other" the IEA includes direct use of crude oil and other hydrocarbons.

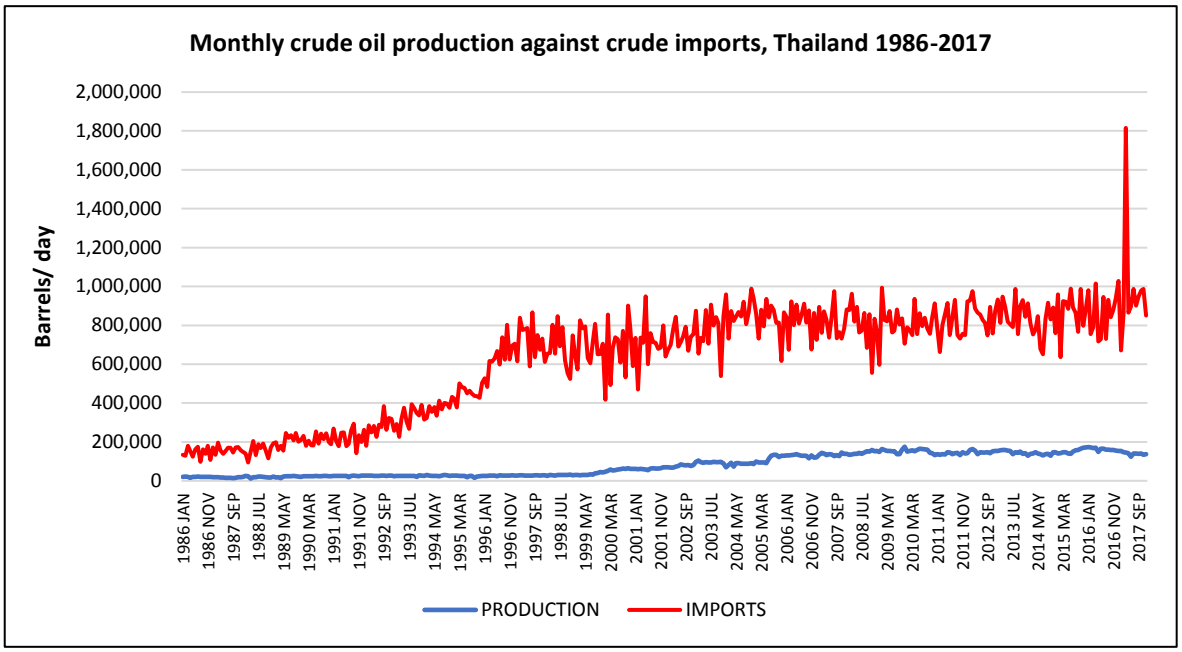
Figure 1.4
Consumption of Oil Products in Thailand (1971-2015)



Source: IEA, https://www.iea.org/stats/WebGraphs/THAILAND1.pdf. Last accessed March 2018.

There has been a long trend in Thailand (and in Southeast Asia as a whole) of meeting the country's fast-increasing energy demand and economic growth through oil imports (IEA; 2017). Declining oil production in the region and rising demand heightens policy-makers' concerns regarding the challenges associated with increasing import dependency (Figure 1.5).

Figure 1.5
Monthly Crude Oil Production Against Crude Oil Imports in Thailand (1986-2017)



Source: Prepared by authors based on data from Thailand´s Department of Mineral Fuels (DMF), Ministry of Energy, http://www.dmf.go.th/index.php?act=about&ln=en, accessed on March 2018.

2. Biofuels Program

2.1. Overview

Thailand was the first country in Asia to announce national biofuels policies. In September 2000 and in July 2001 the Thai government committed to promote both bioethanol and biodiesel (US Department of Energy; 2017). The phase-in strategy started effectively in 2004 with the introduction of Gasohol E10, a blend of 90% gasoline and 10% ethanol, and it continued in 2008 for biodiesel, with the introduction of B2, a blend of 98% diesel and 2% biodiesel. In the following decade, the government introduced products with a higher volume content of biofuels in the blend such as E20, E85, B3, B5 and B7. Moreover, the policy shifted from optional blending (when these products competed with the regular gasoline and diesel) to mandatory blending, where there was no longer "pure" diesel on the market, and regular Gasoline 91 was phased out (Gasoline 95 remained).

In Thailand, ethanol is produced from molasses (a byproduct of cane sugar that results from the refining process), sugarcane juice and cassava. Biodiesel is produced from palm oil-derived feedstock such as crude palm oil (CPO), refined bleached deodorized palm oil (RBDPO), palm stearin and free fatty acids (FFA) from palm oil (GAIN Report; 2017).

The biofuel policy is part of the Alternative Energy Development Plan (AEDP), which in turn is under the Thailand Integrated Energy Blueprint (TIEB), developed by the Ministry of Energy. AEDP focuses on:

- Energy security in its three dimensions: (i) guaranteeing that the supply can respond to the growing demand; (ii) reducing dependency on imported fuels; (iii) and diversifying the sources of energy.
- Cost-efficiency: energy costs should be reasonable and cost reflective in order to sustain economic and social development. This should be pursued through the establishment of a sustainable whole-chain energy business that promotes long-term country development.
- Environmental friendliness: to reduce negative externalities affecting the environment.

These three pillars – and the biofuel policy implemented under them – seem to have been designed to respond to the main energy challenges that the country was facing then: excessive reliance on fossil fuels, high dependence on oil imports, fast-increasing energy demand and air pollution.

Furthermore, experts highlight another important political motivation for creating a biofuel industry in the country: improving the conditions of the agriculture sector that provides feedstock for biofuels, allowing farmers to increase their incomes, and creating more job opportunities for the young rural population, thus narrowing the socio-economic gap between rural and urban areas.

The US Department of Energy outlines a set of "measures [that] have been implemented to promote the production and consumption of biofuel in the country including investment promotion, biofuel standardization, price incentives, vehicle specifications, tax incentives and R&D programs" (US Department of Energy; 2017). As a result, Thailand has made impressive progress in the introduction of alternative fuels into the domestic market. In 2015:

- 3.5 million liters per day of ethanol were produced, accounting for 13% of the total gasoline-based demand. There were 22 plants producing ethanol in different regions in the country, with a total capacity of 4.9 million liters of ethanol per day.
- 2.5 million liters per day of biodiesel were produced, accounting for 4% of the total diesel-based demand. There were 11 plants producing biodiesel in different regions in the country, with a total capacity of 4.9 million liters of biodiesel.

However, as the GAIN report on biofuels in Thailand points out: "AEDP 2015 is being revised taking into consideration that the low global price of petroleum may continue in the long run and that domestic feed stock supplies for ethanol and biodiesel production may not be able to meet the current biofuel consumption goals for 2036" (GAIN report; 2017).

2.2. Keys for Success in the Ethanol Program Implementation

The consumption of ethanol and biodiesel fuel in Thailand has been growing rapidly due to the government's implementation of comprehensive policies to promote consumption and production, aligned with external factors such as the previous period of spiking oil prices.

a) Production-promoting policies

Scaling up the amount of ethanol in the blend

The government started the program focusing on blends with lower levels of biofuels (B2 and E-10) and subsequently moved toward higher contents. On January 1, 2008, E20 was introduced, and in the third quarter of 2008, E85 was introduced. This phase-in strategy helped to prepare the industry and customers gradually.

In 2013, the gasohol consumption increased significantly because the government banned sales of unleaded 91 octane gasoline, which accounted for 40% of the total gasoline consumption at the time, and replaced it with gasohol 91 blended at the E10 level. The ban consequently raised ethanol usage from 1.3 million liters/day in 2012 to 2 million liters/day in 2013.

The government has also announced plans to further boost ethanol demand by phasing out gasohol 91 at the E10 level by 2018, and gasohol 95 at the E10 level by 2027, which will result in higher quantities of E20 and E85 blends in the market (Asia-Pacific Economic Cooperation; 2017).

Leveraging indigenous raw materials and adjusting blending rates to feedstock availability

According to the Food and Agriculture Organization (FAO), Thailand's main agricultural products are: rice, sugarcane, cassava, maize, natural rubber, pineapples and bananas.

In 2014, the production of ethanol from molasses accounted for 66% of the total, 6% of ethanol was produced from sugarcane juice and 28% from cassava (Thailand's Ministry of Energy; 2015). Regarding biodiesel, it is estimated that about 70% of biodiesel is derived from RBDPO or CPO, 22% from palm stearin and 8% from FFA (Preechajan and Prasertsri; 2017).

Because cassava is an important food resource in the country, only 6% of domestic cassava production is converted into ethanol (Table 2.1). Even so, availability of cassava may be affected by shortages, due to competition among several food and beverage industry.

In the case of biodiesel, the crude palm oil used should not affect the share used for domestic consumption. For this reason – and to help palm farmers – the biodiesel production is driven by government mandates. The government regularly adjusts the blending rate (the percentage of biodiesel to mix with the petroleum diesel) depending on the quantity of palm oil available after accounting for the needs of domestic consumption. Moreover, the government does not allow imports of palm oil to produce biodiesel. For example, even though there is a B7 blend mandate since 2014 (with plans to scale up to B10), due to a drought that affected palm oil production the government reduced the mandatory biodiesel blending rates from B7 to B5 in July 2017 and to B3 in August 2017 (Preechajan and Prasertsri; 2017).

Table 2.1
Feedstock Used to Produce Ethanol and Biodiesel (2014)

	Ethanol feedstock				Biodiesel feedstock	
	Sugarcane	Molasses	Sugarcane juice	Cassava	Crude Palm Oil	Note
Total area harvested (hectares)	1,353,600	-	-	1,392,000	752,000	(1) (2)
Yield (tons/hect/year)	76.9	-	-	22.5		
Total output (m. tons)	104	4.7	?	31	2.24	
Output used to produce biofuel (m. tons)	-	2.9	0.9	1.9	0.83	
Output used to produce biofuel (% of total output)	-	62%	?	6%	37%	
Biofuel produced (m. liters)	-	694	66	298	1,054	(3)

Notes:
(1) 1 Hectare = 6.25 Rai.
(2) The harvested area in the "crude palm oil" category represents the oil palm plantation area.
(3) The total amount of biodiesel produced from all palm-oil-derived feedstock.

Source: Prepared by the authors based on data from *Biofuels Status and Policy*, September 18, 2015, Department of Alternative Energy Development and Efficiency Ministry of Energy, https://www.mtec.or.th/files/chanpen/1_DEDE.pdf. Last accessed March 2018.

License-based distribution model: securing domestic supply

The distribution of ethanol within Thailand is restricted by the government to oil traders (as defined by the Fuel Trade Act). Moreover, biofuels are controlled products and traders must have a special permit from the Director General of the Excise Department to either import or export the product. The Thai government restricts the import of biofuels to protect sugar cane and palm growers, and it restricts exports to ensure that there are sufficient supplies for the domestic market. As a consequence, Thailand's biodiesel imports and exports are minimal. In the case of ethanol, the government suspended exports and, as result, there have been no exports of ethanol since May 2003.

Box 2.1
Biofuel Producers in Thailand

Who are the biofuel producers?

In Thailand, a special license is necessary to set up a biofuel production plant. The production of ethanol and biodiesel was a good opportunity for players with access to the necessary feedstock.

In molasses-to-ethanol and sugarcane juice-to-ethanol production, most producers are large-scale players who came from the sugar milling business. For cassava-to-ethanol, several producers are from the cassava processing industry. For palm oil-to-ethanol, most of the produces are also from the edible palm oil refinery business. In addition to having easier access to a supply of raw materials and lower logistic costs than an "out-of-the-industry" producer, these companies have the advantage of being able to control the production output depending on the situation of the two markets they attend (biofuel and food), optimizing their benefits.

In 2015, there were 22 plants producing ethanol and 11 plants producing biodiesel in different regions in the country.

Expanding the number of biofuel stations

To incentivize the sales of gasohol E85, gas stations receive a significantly higher margin for each liter of E85 sold: 5.05 bahts/liter, whereas for gasoline and other gasohol the margin is around 2.98 bahts/liter. As of April 2017, there are a total of 3,396 gasohol stations for E20 and 1,000 for E85 – a 10% and 20% increase from the previous year, respectively (Preechajan and Prasertsri; 2017), which seems to demonstrate that the incentive produced a response. On the other hand, the government adjusts these margins frequently, which could drive gas stations to adapt their marketing and product mix strategies in the short term.

b) Consumption-promoting policies

Creating a portfolio of fuels to adapt to different cars and give customers a choice

Currently, there is a significant portfolio of blended fuels available to customers. Ethanol blended fuels are sold in Thailand as Gasohol 91-E10 (10% ethanol blended with 90% gasoline, octane 91); Gasohol 95-E10 (10% ethanol blended with 90% gasoline, octane 95); Gasohol 95-E20 (20% ethanol blended with 80% gasoline, octane 95) and Gasohol 95-E85 (85% ethanol blended with 15% gasoline, octane 95).

According to the Department of Alternative Energy Development and Efficiency, E10 is suitable for most cars manufactured from 1995, E20 for cars manufactured from 2008 and E85 for flex fuel cars.

Price structure and subsidies to make biofuels competitive with traditional fuels

Although the ethanol "ex-refinery" prices are higher than gasoline, the government maintains retail prices of gasohol at a lower level than retail prices of gasoline, and gasohol with a higher ethanol content is less expensive than gasohol with a lower ethanol content.

As seen in Table 2.2, while the "ex-refinery" price of one liter of gasohol is from 7% to 44% higher than that of regular gasoline, depending on the blending rate, the retail prices of gasohol are 20% to 40% lower than those of regular gasoline. This is mainly due to the cross subsidy provided by the "State Oil Fund" fee, which has been heavily charged to regular gasoline but discounted from the price of gasohol E20 and E85. Furthermore, lower municipal and excise taxes have been applied to gasohol.

Table 2.2

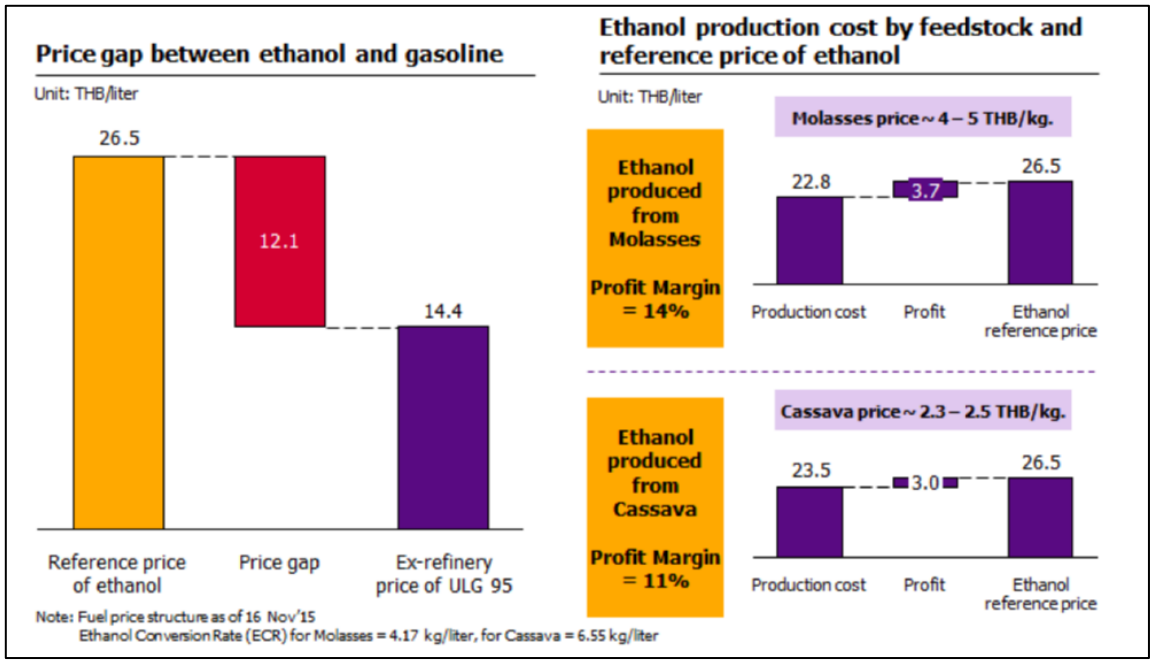
Price Structure of Gasoline and Gasohol in Bangkok (June 9, 2016)

	Premium gasoline (Octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Price	14.28	15.25	15.01	16.20	20.66
Excise Tax	6.00	5.40	5.40	4.80	0.90
Municipal Tax	0.60	0.54	0.54	0.48	0.09
State Oil Fund	6.31	0.25	0.21	-2.75	-9.30
Conservation Fund	0.25	0.25	0.25	0.25	0.25
Wholesale Price (WS)	27.44	21.69	21.41	18.98	12.60
Value-added Tax (VAT)	1.92	1.52	1.50	1.33	0.88
WS+VAT	29.36	23.21	22.90	20.31	13.48
Marketing Margin	2.99	2.23	2.13	2.55	5.05
VAT	0.21	0.16	0.15	0.18	0.35
Retail Price	32.56	25.60	25.18	23.04	18.89
Note: Exchange rate =35.5 baht/$					

Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy, https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Bangkok_Thailand_6-23-2017.pdf. Last accessed March 2018.

Figure 2.1

Gap Between the Reference Prices of Ethanol and 95-octane Gasoline



Source: SCB, Economic Intelligence Center analysis based on data from the Energy Policy and Planning Office (EPPO), the Thai Tapioca Starch Association and the Ministry of Commerce. Available from: https://www.scbeic.com/en/detail/product/1781. Last accessed March 2018.

Box 2.2

Production Costs of Ethanol by Different Type of Feedstock

Production costs

In the production of ethanol from molasses, approximately 60%-70% of all costs are for raw materials, 25%-35% corresponds to operating costs and 5% to fixed costs (Narin Tunpaiboon; 2017).

In the production of ethanol from cassava, approximately 55%-60% of costs are for raw materials, operating costs account for 35%-40% and 5% are fixed costs. The operating costs for cassava-to-ethanol are higher than those for molasses-to-ethanol (Narin Tunpaiboon; 2017).

According to the GAIN Report "the Energy Policy and Planning Office (EPPO) under Ministry of Energy calculates reference prices for biodiesel based on actual biodiesel production cost, and announces them on a weekly basis. The reference prices are used as a guideline for biodiesel transaction, however, most biodiesel producers usually receive 3-5 baht/liter (9-14 cents/liter) lower than these reference prices due to limited competition among diesel manufacturers. In 2016, actual biodiesel prices paid by petroleum (diesel) refineries reportedly ranged between 32.50-33.60 baht/liters (94-97 cents/liter)" (Preechajan and Prasertsri; 2017).

As a complement to the policies to incentivize customers to use gasohol and biodiesel, there are also excise tax reductions for cars that are compatible with higher blending rates, such as E20 and E85 gasohol and B10 biodiesel, and the government invests in campaigns to raise people's trust in biofuels.

We can also conclude that, in addition to the implementation of comprehensive and "aggressive policies on the supply and demand side, the cooperation and alignment among government agencies was fundamental. For example, when the government passed the cabinet resolution to promote the use of ethanol fuel, the Ministry of Energy approved funds from the Oil Fund to subsidize gasohol prices to make it attractive to consumers as compared to gasoline. The Department of Energy Business provided information to consumers on car models that can be fueled with E10. The Ministry of Finance reduced excise taxes for imported cars and domestically manufactured cars that run on ethanol-based fuel. The Board of Investment gave tax privileges to E20 and E85 car manufactures. The Ministry of Agriculture set implementation targets for planting areas of ethanol feedstocks and crop yields to promote ethanol production" (US Department of Energy; 2017).

c) The 2008 energy crisis

The consumption of bioethanol did not increase significantly until the energy crisis in 2008 when crude oil price rose above US$140/barrel. Consequently, the production of biofuel, both ethanol and biodiesel, increased to replace oil imports. The consumption of bioethanol rose from 0.71 million liters/day in 2007 to 1.29 million liters/day in 2008, and the use of biodiesel increased from 0.80 million liters/day to 1.40 million liters/day (Thailand's AEDP; 2015).

3. Results from the Ethanol Policy

With a comprehensive set of policies in place, sales of gasohol consistently increased between 2004 and 2016. The increase in gasohol consumption was driven by two main milestones: the spike in crude oil prices and the ban on 91-octane unleaded gasoline in 2013. Figure 3.1 suggests a kind of pure substitution effect between the demand for gasohol and for gasoline.

Figure 3.1
Comparison of Sales of Gasoline and Gasohol During 2004-2016

Source: Prepared by authors based on data from the Department of Energy Business, www.doeb.go.th/info/data/datadistribution/y_sale.xls. Last accessed March 2018.

In 2016, 10,118 million liters of gasohol were sold, 80% of which was E10 (Table 3.1). In the same year, only 561 million liters of regular gasoline were sold.

Table 3.1
Fuel Sales for Transportation

	Gasohol (million liters)					Gasoline (million liters)		
	E10-91	E10-95	E20-95	E85-95	Total	ULG91	ULG95	Total
2004	0.1	14	-	-	14.1	4,631	2,970	7,601
2005	29	646	-	-	675	4,333	2,240	6,573
2006	94	1,185	-	-	1,279	4,464	1,471	5,935
2007	244	1,519	-	-	1,763	4,467	1,107	5,574
2008	924	2,439	29	0.02	3,392.02	3,388	341	3,729
2009	1,415	2,972	83	0.3	4,470.3	2,877	177	3,054
2010	1,552	2,692	137	2.1	4,383.1	2,958	77	3,035
2011	1,860	2,122	222	9.1	4,213.1	3,077	42	3,119
2012	2,121	1,931	367	36	4,455	3,208	42	3,250
2013	3,337	3,030	963	141	7,471	147	616	763
2014	3,595	2,735	1,344	334	8,008	51	498	559
2015	4,019	3,283	1,511	317	9,130	81	502	583
2016	4,073	3,968	1,753	324	10,118	71	490	561
Jan-July 2017	2,284	2,483	1,087	220	6,074	35	265	300

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

As a result, the crude oil self-sufficiency ratio (percentage of domestically produced crude oil in the total amount of crude oil used) increased from 15.2% in 2004 to 23.2% in 2016 (EPPO; 2018).

Furthermore, the compound annual growth rate (CAGR) in CO2 emissions caused by oil consumption used in transportation decreased from 3.79% in the period between 1999 and 2004 to 1.43% in the period after the introduction of biofuels (2004-2017),[2] although this reduction could have been affected by other factors, such as more efficient cars and/or gasoline and diesel with lower emission rates.

4. Challenges and the Future of the Biofuel Program

4.1. A Program in Constant Evolution Looking Toward the Next 20 Years

Since the implementation of the biofuel policy, the government has reviewed the targets for renewable energy (including biofuels) several times. This ongoing mechanism of check and balance to adapt to a constantly changing and dynamic scenario has turned out to be key in the implementation of a program that fits the specific conditions of the market at any given point in time.

The current Alternative Energy Development Plan (AEDP 2015-2036) – a guideline for the country's energy future focused on promoting energy production within the full potential of domestic renewable energy resources, for implementation during the period 2015-2036 – set a target of 30% renewables as a percentage of the total energy consumption by 2036, 20%-25% of which is meant to come from ethanol fuel and biodiesel. To accomplish this goal, the Thai government set the following targets (see Table 4.1 for ethanol and Table 4.2 for biodiesel).

Table 4.1
Cassava and Molasses Potential for Ethanol Production (2015-2026)

Potential	2015	2017	2019	2026
Casava				
Target Planting Area (Million rai)	8.50	8.50	8.50	8.50
Casava Yield (Million tons/year)	30.60	36.00	42.50	59.50
Used as Food Consumption (Million tons/year)	8.05	8.91	9.77	11.57
Remain cassava for Ethanol Production (Million tons/year)	2.00	2.42	2.93	5.71
Ethanol Production (Million l/d)	0.87	1.06	1.28	2.50
Molasses				
Target Planting Area (Million rai)	10			16
Sugar Cane Yield (Million tons/year)	112.00	135.00	152.00	182.00
Used as Food Consumption (Million tons/year)	1.01	1.02	1.05	1.13
Remain Sugar Cane for Ethanol Production (Million tons/year)	4.03	5.00	5.79	7.43
Ethanol Production (Million l/d)	2.65	3.29	3.81	4.88
Total Ethanol Production (Million l/d)	3.52	4.35	5.09	7.38

Source: AEDP 2015, http://www.eppo.go.th/images/POLICY/ENG/AEDP2015ENG.pdf. Last accessed March 2018.

[2] Calculations based on information for CO2 emissions from Energy Policy and Planning Office (EPPO) statistics, accessed online at http://www.eppo.go.th/index.php/en/en-energystatistics/indicators in March 2018.

The plan indicates that expanding the harvested area can be a major constraint to increasing production. The use of land with potential for cassava has achieved its full capacity, and to guarantee adequate availability of cassava for ethanol, cassava producers will have to double productivity from 2015 to 2026. Furthermore, from 2026 the share of cassava used to produce ethanol is expected to increase by 10% annually through 2036, which could compromise food security in the long term. The sugarcane planting area is expected to increase by 60% in the same period, reaching full capacity by 2026.

Table 4.2
Palm Oil Potential for Biodiesel Production (2015-2026)

Palm Oil Potential	2015[1]	2017[1]	2019[1]	2026[1]	2036[2]
Target of Palm Planting Area (Million Rai)	4.50	5.00	5.50	7.50	10.20
Palm Feedstock (Million tons/year)	14.34	15.40	16.66	21.40	29.46
Crude Palm Oil (Million tons/year)	2.58	2.93	3.17	4.28	5.89
Remained Crude Palm Oil (Million tons/year)[3]	1.56	1.85	2.03	2.93	4.24
Maximum Production of Bio-diesel (Million L/d)[4]	5.60	6.50	7.10	10.00	14.00

Notes:
(1) 1 Hectare = 6.25 Rai.

Source: AEDP 2015, http://www.eppo.go.th/images/POLICY/ENG/AEDP2015ENG.pdf. Last accessed March 2018.

The palm oil harvested area should increase from 0.70 million hectares in 2015 to 1.63 million hectares in 2036 to meet the expected target.

Aware of the limitations that are expected in the use of the current feedstock for the production of biofuels when it comes to meeting the growing demand for transportation fuel, the AEDP 2015 also aims to introduce other alternative transportation fuels into the mix, such as compressed bio-methane gas (CBG) and pyrolysis oil. Moreover, the country's aim to lead the next clean energy revolution has materialized in investment in research and development regarding potential feedstock to produce fuels that are not yet cost competitive, such as biomass (second-generation biofuels), bio-oil, algae (third-generation biofuels), or hydrogen. While pyrolysis oil, second- and third-generation biofuels will remain at marginal levels, CBG is expected to account for 23% of alternative fuels for transportation. Ethanol and biodiesel will account for the rest (77%).

4.2. Remaining Challenges

The current low-oil scenario presents an important challenge to the sustainability of the biofuel industry in the country. The reference prices of ethanol are still 12 baht (approximately 45%) higher than "ex-refinery" prices for high-octane gasoline, such as ULG 95 gasoline.

On the other hand, there are serious questions regarding the ability of the agro industry to expand cassava, sugarcane and palm oil yield and harvested area, posing significant challenges to the feasibility of the scale-up policy for ethanol pursued by the AEDP 2015 plan. The palm oil production is also under constraints, due to unfavorable weather conditions in recent years.

With these challenges in mind, the AEDP 2015 (implementation period 2015-2016) is under review, and the progressive scale-up in the volume of biofuels in the blend scheduled for 2036 could be reduced significantly some time soon.

Will biofuel producers and farmers producing cassava, sugarcane and palm oil fruit be able to achieve the required productivity levels? The Thai government has manifested a strong commitment and serious will to continue supporting the consumption of gasohol and biodiesel, especially through price incentives to consumers and subsidies at the pump, in order to maintain gasohol at a cheaper price than gasoline and make it more attractive to consumers.

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