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### **Report Highlights:**

The current 20-year AEDP 2018 (2018 – 2037) revised down the biofuel consumption target, together with a gradual reduction in biofuel price subsidy between 2020 and 2022. The COVID-19 outbreak is expected to cause a 5 percent reduction in gasoline and ethanol consumption, as well as diesel consumption to a lesser degree. However, demand for biodiesel is expected to increase 10 percent in 2020, driven by the additional mandatory use of B10 and a government incentive price subsidy.

Thailand continues to exclude imports from playing any role in meeting biofuel consumption targets with the program's primary goal to support farm income.

## **I. Executive Summary**

The biofuel consumption target for 2037 has been officially revised down to 2.7 billion liters for ethanol and 2.9 billion liters for biodiesel under the current 20-year Alternative Energy Development Plan (AEDP) 2018 (2018 – 2037) that was approved in 2019. This compares to the initial targets of 4.1 billion liters for ethanol and 5.1 billion liters for biodiesel by 2036 set in the AEDP 2015. The downward revision is based on the fact that imports remain prohibited and domestic supplies of feedstock are insufficient to meet the former targets. The primary goal of the government's biofuel development plan is to support increased farm income through higher feedstock demand for molasses, cassava, and palm oil. As part of the AEDP 2018, the government will also phase out ethanol and biodiesel price subsidies between 2020 and 2022. The State Oil Fund Act B.E. 2562 (2019) of September 24, 2019, was amended to control the financial liability of the State Oil Fund and limit government price subsidies to only fossil fuel, since the government already provides subsidies for feedstocks of ethanol and biodiesel via government domestic support programs.

Total gasoline consumption in 2020 is expected to decline to 11.2 billion liters, down 5 percent from 2019, due to reduced mobility from the lock-down orders and reduced economic activity that has lowered household income due to the COVID-19 outbreak. With no year-to-year change in blending, fuel ethanol use is also expected to decline 5 percent. The government's plan to boost ethanol consumption through E20 by terminating the sale of octane 91 E10 has been delayed from the third quarter of 2020 to the first quarter of 2021 due to concerns about a shortage of ethanol for hand sanitizer. Meanwhile, total diesel consumption (on and off-road plus power for industry) is expected to decline to a lesser degree by 3-4 percent to 23.7 billion liters as cargo transportation was active while the government enforced the lockdown, particularly in the second quarter of 2020.

Molasses used in fuel ethanol production is expected to fall sharply in 2020 given tighter feedstock supply and a 5 percent drop in ethanol production. An increased use of cassava has helped offset the shortage of molasses feedstock. Despite an expected 3-4 percent reduction in diesel consumption caused by the outbreak of COVID-19, biodiesel production is forecast to increase 7 percent to a record 1.98 billion liters in 2020, driven by the new mandatory selling of B10, announced May 28, 2020. On October 1, 2020, gas stations will be required to sell B10 and have the option to sell B20 and B7. The government will provide price subsidy incentives to encourage the purchase of B10 while lowering price subsidy incentives for B20 and B7.

## **II. Policy and Programs**

Thailand committed to reduce greenhouse gas (GHG) emissions by 110-140 million tons of carbon dioxide (CO<sub>2</sub>) (20-25 percent of 2015 emissions) by 2030 at the 2015 Paris Climate Conference. The 2016 Nationally Determined Contribution (NDC) roadmap plans to reduce CO<sub>2</sub> emissions by 113 million tons by 2030 in the energy and transport sectors. The NDC's roadmap to achieve this goal includes increasing renewable energy use in households, industry, and power generation; promoting biofuels; and increasing efficiency in power generation, transport, buildings, and industry.

The NDC was incorporated into Thailand's National Energy Plan (2015 – 2036) (also known as Thailand Integrated Energy Blueprint (TIEB 2015)), which was endorsed in October 2015 and aligned with Thailand's 11th National Economic and Social Development Plan. The current national energy

plan includes five master plans: the Alternative Energy Development Plan (AEDP), the Power Development Plan (PDP), the Energy Efficiency Development Plan (EEDP), the Oil Development Plan (ODP), and the Gas Development Plan (GDP).

As a result of the TIEB 2015, the AEDP 2012 (2012-2021) was replaced by a new AEDP 2015 (2015-2036). Both the AEDP 2012 and the AEDP 2015 targeted national energy security and domestic economic development. AEDP 2015 extended the planned coverage from 10 years to 20 years and integrated all sectoral energy plans (i.e., AEDP, PDP, EEDP, ODP, GDP) with the national economic and social development plan. The AEDP 2015 had an overall goal that 30 percent of total energy consumption will come from renewable energy by 2036, up from the 25 percent target set in AEDP 2012. The AEDP 2015 aims to increase biofuel consumption from 7 percent of total fuel energy use in 2015 to 25 percent in 2036. In order to accomplish this energy goal, the Thai government set the ethanol consumption target of 4.1 billion liters by 2036, up from 1.18 billion liters actual consumption in 2015 and the biodiesel consumption target at 5.1 billion liters by 2036, up from 1.24 billion liters actual consumption in 2015.

The government promotes the use of gasohol (gasoline containing ethanol) through price incentives at the gas pump and by an excise tax reduction for cars compatible with E20 and E85 gasohol. To increase biodiesel consumption, the government imposes a mandatory biofuel blending requirement for diesel used primarily for on-road use. The government does not enforce a mandatory blending requirement for diesel used in industry and agriculture. Industry primarily uses based diesel in power generators.

The government set the target for sugarcane acreage in the AEDP 2015 at 16 million rai (2.6 million hectares) by 2026, up from 10 million rai (1.6 million hectares) in 2015 to meet the ethanol consumption target. The government set the average yield target for cassava at 7 metric tons per rai (44 metric tons/hectare) by 2026, up from 3.5 metric tons per rai (22 metric tons/hectare) in 2015 given existing acreage of 8.5 million rai (1.4 million hectares). The government did not set any acreage targets for cassava in the AEDP 2015. The government raised the palm oil acreage target to 10.20 million rai (1.63 million hectares) by 2036 from 4.4 million rai (0.70 million hectares) in 2015 to meet domestic demand. Domestic palm oil will be the primary feedstock used in biodiesel production and other feedstocks, like animal fats and used cooking oil (UCO), will play an insignificant role in production. So far, crop yields and acreages remain far below those required to meet the demands of the 20-year plan. The sugarcane acreage is at 11 million rai (1.7 million hectares) with average yield of 11-12 metric tons per rai (69-75 MT/hectare) compared to the target acreage of 16 million rai (2.6 million hectares). In addition, the average yield of cassava remains around 3.5 metric tons per rai (22 MT/hectare) compared to the target of 7 metric tons per rai (44 metric tons/hectare). A general weakness in the overall reliance on domestic palm oil and its products, crude palm oil (CPO) production, the main feedstock for biodiesel production, is that supply fluctuates significantly due to weather conditions.

The current 20-year AEDP 2018 (2018 – 2037) was approved by the Cabinet on April 30, 2019. The AEDP 2018 ethanol and biodiesel consumption targets, however, were temporary targets until being finalized on March 21, 2020. The official ethanol and biodiesel consumption targets were revised down to 2.7 and 2.9 billion liters, respectively, in 2037, compared to actual consumption of 1.6 and 1.8 billion liters in 2019. The new target is lower than the initial target of 4.1 and 5.1 billion liters set in the old AEDP in 2015 due to uncertainty in having adequate supplies of molasses and cassava for ethanol production and palm oil for biodiesel production. The government also restructured the administration

of the State Oil Fund through the new State Oil Fund Act B.E. 2562 (2019), enacted on September 24, 2019. The new State Oil Fund Act aims to control the financial liability of the State Oil Fund and limit government price subsidies to only fossil fuel, since the government already provides subsidies for feedstocks of biofuels via government domestic support programs. Under the new State Oil Fund Act, the government will gradually reduce the current price subsidy on gasohol and biodiesel between 2020 and 2022.

By solely relying on domestic sugarcane, cassava, and palm oil resources and excluding imports from any role in meeting past, current, and future biofuel consumption targets, Thailand risks 1) being forced to temporarily lower biofuel use targets or suffer price surges when weather-related feedstock shortages occur, a reoccurring problem for the palm oil industry; 2) not meeting long-term biofuel use goals, setting permanently lower goals (as it has just done) below levels the vehicle fleet can absorb and which some other countries are reaching, and falling short of its COP21 commitments; 3) higher GHG emissions from biofuels tied to direct land use change to support certain feedstocks, and 4) higher consumer prices for gasohol. Permitting some role for imports unlocks the full positive potential contribution biofuels can make to 1) lowering health costs tied to toxic air pollution from fossil fuels, 2) lowering costs future generations will bear from escalating carbon emissions, and 3) meet Thailand's GHG reduction targets.

Thailand does not currently have any environmental sustainability requirements established for transport biofuels. Thailand does, however, restrict land use change to avoid negative impacts on food crops; biodiversity; and air, water, and soil quality. For example, Thailand has increased the planted area for sugarcane and cassava (a source of feedstock for ethanol production), and for palm oil (a source of feedstock for biodiesel production) by transitioning existing farmland for other crops, such as rubber, rice, corn, and other field crops, into farmland for biofuel crops.

### Ethanol

The government lowered the ethanol consumption target in the current AEDP 2018 (2018 – 2037) to 2.7 billion liters in 2037, down 34 percent from the initial target of 4.1 billion in the AEDP 2015. The lowered targets are in anticipation of limited supplies of molasses and cassava, the primary feedstocks for ethanol production. Additionally, long-term demand growth for gasoline and gasohol is expected to slow down in the long run due to the increased availability of passenger and commercial electrical vehicles and the operation of double-track railways, which are under construction.

There is no ethanol blend mandate for the entire fuel pool. The average blend rate calculated in the ethanol balance table is derived and the result of 1) the established blend rates (E10, E20, and E85) of different gasohol (ethanol blended gasoline) pools, and 2) the size of these various pools, which is impacted by pricing policy designed to account for lower energy density of ethanol vs gasoline and incentivize ethanol use. The size of these pools is also determined by the existing vehicle fleet, which is evolving incentivized by VAT rates for different vehicle classes. The government aimed to phase out the production of octane 91 E10 between 2018 and 2022, followed by octane 95 E10 and E85 between 2023 and 2027, with the intention of making E20 the primary gasohol. All passenger cars manufactured in Thailand since 2008 are compatible with E20. The government aims to have only premium gasoline and E20 available in the market by the end of AEDP 2018.

The government remains uncertain if current domestic supplies of molasses and cassava will be sufficient to meet ethanol demand if octane 91 E10 sales are eliminated. The MOE expects the cessation of octane 91 E10 sales will increase ethanol demand by doubling sales of E20. The uncertainty over sufficient feedstock availability (and price effects) has caused the government to delay elimination of octane 91 E10 several times. The initial plan was to eliminate the sale of octane 91 E10 on January 1, 2018. The revised target is the second quarter of 2021 due to concerns over shortages of ethanol for sanitizer products during the COVID-19 outbreak in 2020.

The current price subsidies for gasohol make gasohol 25 – 40 percent cheaper than premium gasoline. All price subsidies on gasohol, however, will be terminated by 2022 under the new State Oil Fund Act, particularly for E20 and E85, which are currently subsidized by the State Oil Fund at 2.28 baht/liter (27 U.S. cent/gallon) and 7.13 baht/liter (86 U.S. cent/gallon), respectively (Table 4.2). The price subsidies on E85 will be reduced by half in 2020 and reduced by 25 percent in 2021 and 2022. Meanwhile, the price subsidy on E20 will decline by 25% in 2020 and 25% in 2021 until no subsidy remains in 2022. The government expects that E20 will be the primary gasohol by 2022, as the retail prices of E20 will be cheaper than E10 (octane 91 and octane 95) and E85 by 7-8 percent and 4-5 percent, respectively.

The government supports the manufacturing of vehicles that are compatible with E20 and E85 gasohol. Improvements in the fuel efficiency of vehicles is promoted by setting the excise tax rate for Eco-cars (less than 1,300 cc engines with fuel consumption rate of no more than 5 liters per 100 kilometers) at 17 percent compared to 30 percent for E10 vehicles. Moreover, the government provides an additional 3 percent reduction in the excise tax rate for the manufacturing of Eco-cars that can use E85 gasohol.

According to the Thai Department of Customs, fuel ethanol is a controlled import/export product (HS22072011 and HS22072019). Traders must apply for import/export permits, which are considered by the Ministry of Energy (MOE). The Thai government also imposed a 2.5 baht/liter duty on ethanol imports (30 U.S. cent/gallon), based on 31.5 baht/U.S. \$1.00, as of August 28, 2020).

### Biodiesel

The government lowered the biodiesel consumption target to 2.9 billion liters in 2037 under the current AEDP 2018 (2018 – 2037), down 43 percent from the initial target of 5.1 billion in the ADEP 2015. The revised consumption target is in anticipation of limited supplies of palm oil, the primary feedstock for biodiesel production in Thailand. The government continues to impose the mandatory blending of biodiesel in diesel for certain sectors, mainly for on-road use. In 2020, the government increased the mandatory blend rate to B10 and kept B7 and B20 as voluntary blend rates to help absorb excess supplies of oil palm. All gas stations will be required to sell B10 by October 1, 2020. While the government has subsidized the use of B20 in large trucks on a voluntary basis since 2016, the government provided more price subsidy incentives on B10 in 2020 in order to make B10 the primary diesel fuel after introducing it in 2019. The government increased palm oil target acreage to 10.2 million rai (1.63 million hectares) by 2037. Production of palm fresh fruit bunch (FFB) is expected to reach 29.46 million metric tons (MMT) in 2036, with 4.24 MMT of FFB expected to be processed as biodiesel in 2036.

The Thai Government restricts the import of biodiesel to protect domestic palm growers by requiring importers to obtain import permits from the MOE. The MOE issues import permits based on the

necessity of the imports. The import tariff for petroleum oil containing up to and including 30 percent biodiesel by volume (HTS 2710.20) is 0.01 baht/liter (28 cents per 1,000 liters). There is no import tariff for biodiesel greater than B30 and up to and including B100 (pure biodiesel) (HTS 3826.00).

### III. Gasoline and Diesel

Under the Energy Efficiency Development Plan (EEDP) (2018-2037), seven core measures are laid out to increase the country's energy efficiency, aiming at reducing final energy consumption (FEC) in 2037 to 30 percent of the 2010 baseline. The core measures include energy efficiency improvements in industrial facilities, energy-saving housing promotions, efficiency promotions for electric appliances and eco-stickers, mandatory application of the Energy Efficiency Resource Standard, soft loan provisions for energy efficiency improvements, promoting LED use, and energy efficiency promotions in the transportation sector.

**Table 3.1: Thailand Fuel Use (2010-2020)**

Fuel Use (Million Liters)										
Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020 <sup>f</sup>
<b>Gasoline Total</b>	7,331	7,705	8,233	8,567	9,714	10,680	11,030	11,373	11,791	11,200
<b>Diesel Total</b>	18,484	20,529	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,690
On-road	12,708	13,699	12,301	11,133	11,937	13,225	15,682	16,084	17,015	16,400
Agriculture	4,186	4,296	4,439	4,518	4,457	3,390	3,048	3,300	3,400	3,280
Construction & Mining	136	142	150	139	147	140	136	114	129	120
Shipping & Rail	261	266	270	244	261	270	301	315	300	290
Industry	1,193	2,126	3,672	5,044	5,100	5,600	4,056	3,774	3,735	3,600
Heating	0	0	0	0	0	0	0	0	0	0
<b>Jet Fuel Total</b>	5,077	5,091	5,562	5,513	6,034	6,468	6,743	7,096	7,153	6,100
<b>Total Fuel Markets</b>	30,892	33,325	34,627	35,158	37,650	39,773	40,996	42,056	43,523	40,990

f = forecast All fuel pool categories above contain biofuels where used.

Source: Department of Energy Business, Ministry of Energy

Diesel blending mandates, originally set in 2007 at B2 with the current level set at B10 have been effective in increasing biodiesel consumption. The mandates are strictly controlled and monitored and must be used in all diesel fuels. In general, the main markets for diesel use in Thailand are on-road transportation, accounting for about 70 percent of total diesel consumption, followed by industry at 15 percent and agriculture at 14 percent. The remaining 1 percent of use comes from construction and mining, trains, and inland shipping. The government does not set a mandatory blend rate for ethanol in gasohol. The government promotes the use of gasohol through price incentives that makes gasohol 20-40 percent cheaper than gasoline by using the State Oil Fund to subsidize gasohol prices. The voluntary blend rate of ethanol in gasohol was originally set at 10 percent in 2004.

To increase energy efficiency in transportation, the government plans to: 1) phase out the subsidy for gasoline and diesel so that prices reflect actual production costs; 2) promote the acquisition of eco-vehicle fleets through tax incentives; 3) increase eco-tire use; 4) support mass transit rail infrastructure; 5) construct double-tracked railways and high-speed train development; 6) fund electric vehicle (EV) research and development; and 7) support fuel pipeline construction. The total government budget to increase energy efficiency is 1,484 billion baht (U.S. \$43 billion) from 2015-2036, with the goal to reduce fuel consumption in transportation by 30 percent by 2036. Some projects such as double-tracked

railways, high-speed trains, and purchasing incentives for EVs have already started. The MOE expects that the number of EVs on the road will gradually increase from 2,854 cars in 2019 to reach the target of 1.2 million EV cars by 2036. In addition, the first double-tracked railways and high-speed trains are scheduled to be operational by 2023.

The Thai government also initiated a campaign to promote Eco passenger cars, which are fuel efficient and environmentally friendly vehicles, in 2007 through excise tax incentives and Board of Investment (BOI)'s privileges on corporate income tax-free and import duty-free on machinery. Sales of Eco passenger cars started in 2010 and grew significantly to 179,000 new cars sold in 2013. Due to unfavorable economic conditions, sales were stagnant during 2014-2017. However, in 2018, new Eco passenger car sales increased to 209,522 cars, up 34 percent increase from 2017. The number of new Eco passenger cars sold continued to increase in 2019, totaling 220,744 cars, up 3 percent from 2018. According to industry sources, Thai consumers purchased 3,339,744 Eco passenger cars from 2008 to 2019.

The Thai government has pushed the production of EcoEV vehicles, which includes Hybrid Electric Vehicles (HEV), Plug in Hybrid Vehicles (PHEV), Battery Electric Vehicles (BEV) and Fuel Cell Electric Vehicles (FCEV), since 2019 by curbing half of the levied excise tax. However, the automotive industry did not agree with the government's approach to promote investment in EcoEVs. Industry argued that there is already an existing import duty exemption provided for the importation of key parts of HEV and that HEVs with CO2 emission ratios not over 100 grams/kilometer already receive a reduced excise tax of 10 percent compared to 14 percent for Eco passenger cars. The small demand for PHEV and BEV and lack of electric charging stations are also unfavorable factors that make this government incentive program ineffective. However, on February 7, 2020, the government established the National EV Policy Committee chaired by the Deputy Prime Minister to promote the EV industry. The target of the committee is to achieve 60,000 – 110,000 EV on the road between 2020 – 2022 and up to 250,000 EV in the medium term between 2021 - 2025. In the longer run, the target increases to 750,000 EV. Presently, EV accounts for around 1 percent of total passenger cars.

The COVID-19 outbreak caused an economic recession in Thailand during the first half of 2020 when China banned outbound travel at the beginning of 2020 that led the dramatic reduction in the number of foreign tourists in Thailand. The impact of COVID-19 on fuel use and household incomes intensified in March 2020 when the Thai government began to enforce a lockdown until June 2020 to control the spread of COVID-19. The service sector, which accounts for 27 percent of the Thai economy, has been the most severely impacted, particularly hotels and restaurants, and transportation services, mainly due to a 36% reduction in the number of foreign tourist arrivals in the first quarter of 2020. The government's one trillion-baht (U.S. \$32 billion) relief measure and the Bank of Thailand's financial assistance of 500 billion baht (U.S. \$16 billion) to support vulnerable households and businesses will not offset the contraction of aggregate demand in 2020. The Thai economy is expected to experience a record economic decline of 8.1 percent in 2020. In comparison, the Asian financial crisis over two decades ago caused the economy to contract by 7.6 percent in 1998. However, the government expects the economy will slowly recover in 2021 by 5 percent assuming the spread of COVID-19 is under control in the second half of 2020. According to the Ministry of Energy's estimate in June 2020, total gasoline consumption in 2020 is expected to decline to 11.2 billion liters, down 5 percent from 2019 as household income has been adversely affected by COVID-19 outbreak. Meanwhile, diesel consumption is likely to decline to a lesser degree by 3-4 percent to 23.7 billion liters as some necessary economic

activities, including logistics, were still active during the government enforced lockdown, particularly in the second quarter of 2020.

#### **IV. Ethanol**

##### Consumption

Ethanol consumption increased by 8 percent in 2019, which was a slower growth rate compared to the 12 percent year-to-year increase achieved in 2017. The government postponed its plan to promote E20 consumption by prohibiting the sale of octane 91 E10 due to uncertainty in having adequate supplies of molasses and cassava for ethanol production. According to the Ministry of Energy's research, the elimination of octane 91 E10 sales will cause 50 percent of octane 91 E10 consumption to shift to E20 consumption, followed by octane 95 E10 (45%) and E85 consumption (5%).

Ethanol consumption is expected to decline to 1.5 billion liters in 2020, down approximately 5 percent from 2019 due to the outbreak of COVID-19 (Table 4.3). Gasohol consumption decreased by 7 percent in the first half of 2020, leading to a 14 percent reduction in ethanol consumption (Table 4.1). The outbreak of COVID-19 also caused the government to postpone the prohibition on the sale of octane 91 E10 again until the second quarter of 2021 due to concerns about a shortage of domestic ethanol for sanitizer products.

Consumption of gasohol still accounted for 97 percent of total gasoline consumption driven by the government's price subsidies on gasohol via the State Oil Fund, particularly for E20 gasohol. The government maintains E20 and E85 retail prices approximately 30 and 40 percent cheaper than premium gasoline to promote the use of E20 and E85 (Table 4.2). Similarly, E10 retail prices were 26 percent cheaper than premium gasoline to promote the use of E10. Octane 91 E10 consumption continued to decline to 28 percent of total gasohol consumption in the first half of 2020, compared to an average of 30 percent in 2019. This shift is mainly due to government tax changes implemented since 2017, which lowered the price difference between octane 91 E10 and octane 95 E10 to encourage consumers to shift to octane 95 E10 under the government's plan to terminate the sales of octane 91 E10. This effectively set the price difference between octane 91 E10 and octane 95 E10 at 0.27 baht per liter (3 U.S. cent/gallon).



**Table 4.1: Thailand's Gasoline and Gasohol Consumption (Unit: Million Liters)**

Type of Gasoline	2015	2016	2017	2018	2019	January - June		
						2018	2019	% Change
<b>Gasoline</b>	<b>583</b>	<b>561</b>	<b>508</b>	<b>437</b>	<b>388</b>	<b>197</b>	<b>187</b>	<b>-5.1</b>
Regular (octane 91)	81	71	57	39	41	17	44	158.8
Premium (octane 95)	502	490	451	398	347	180	143	-20.6
<b>Gasohol</b>	<b>9,130</b>	<b>10,119</b>	<b>10,521</b>	<b>10,936</b>	<b>11,403</b>	<b>5,631</b>	<b>5,255</b>	<b>-6.7</b>
- Gasohol E10 Octane 91	4,019	4,073	3,885	3,638	3,485	1,745	1,460	-16.3
- Gasohol E10 Octane 95	3,283	3,968	4,350	4,739	5,068	2,487	2,530	1.7
- Gasohol E20	1,511	1,753	1,903	2,122	2,379	1,164	1,099	-5.6
- Gasohol E85	318	325	383	437	471	235	166	-29.4
<b>Total</b>	<b>9,714</b>	<b>10,680</b>	<b>11,029</b>	<b>11,373</b>	<b>11,791</b>	<b>5,828</b>	<b>5,442</b>	<b>-6.6</b>

Note: Regular and premium gasoline uses Ethyl Tertiary Butyl Ether (ETBE) as an oxygenate since 2008 when Methyl Tertiary Butyl Ether (MTBE) was banned.

Source: Department of Energy Business, Ministry of Energy

**Table 4.2: Price Structure of Gasoline and Gasohol in Bangkok (as of June 12, 2020)**

	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
<b>Ex-Refinery Factory Price</b>	9.5664	10.8006	10.4095	12.1720	19.8516
<b>Excise Tax</b>	6.5000	5.8500	5.8500	5.2000	0.9750
<b>Municipal Tax</b>	0.6500	0.5850	0.5850	0.5200	0.0975
<b>State Oil Fund</b>	6.5800	0.6200	0.6200	-2.2800	-7.1300
<b>Conservation Fund</b>	0.1000	0.1000	0.1000	0.1000	0.1000
<b>Wholesale Price (WS)</b>	23.3964	17.9556	17.5645	15.7120	13.8941
<b>Value Added Tax (VAT)</b>	1.6377	1.2569	1.2295	1.0998	0.9726
<b>WS+VAT</b>	25.0341	19.2125	18.7940	16.8118	14.8667
<b>Marketing Margin</b>	3.5756	2.0911	2.2299	2.9235	2.8255
<b>VAT</b>	0.2503	0.1464	0.1561	0.2046	0.1978
<b>Retail Price</b>	28.86	21.45	21.18	19.94	17.89

Note: Exchange rate = 31.50 baht/\$

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

**Table 4.3: Thailand's Production, Supply and Demand for Ethanol Used as Fuel and Other Industrial Chemicals**

<b>Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)</b>										
Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020f
<b>Beginning Stocks</b>	48	63	22	42	40	37	30	54	31	38
Fuel Begin Stocks	22	58	20	21	26	21	17	40	27	33
<b>Production</b>	613	790	1,048	1,070	1,190	1,290	1,480	1,500	1,640	1,565
Fuel Production	486	471	950	1,058	1,174	1,276	1,461	1,485	1,619	1,540
<b>Imports</b>	6	6	5	11	11	13	12	12	12	15
Fuel Imports	0	0	0	0	0	0	0	0	0	0
<b>Exports</b>	139	304	64	5	0	0	0	0	0	5
Fuel Exports	0	0	0	0	0	0	0	0	0	0
<b>Consumption</b>	465	533	969	1,078	1,204	1,310	1,468	1,535	1,645	1,565
Fuel Consumption	450	509	949	1,053	1,179	1,280	1,438	1,498	1,613	1,530
<b>Ending Stocks</b>	63	22	42	40	37	30	54	31	38	48
Fuel Ending Stocks	58	20	21	26	21	17	40	27	33	43
Total BalanceCheck	0	0	0	0	0	0	0	0	0	0
Fuel BalanceCheck	0	0	0	0	0	0	0	0	0	0
<b>Refineries Producing Fuel Ethanol (Million Liters)</b>										
Number of Refineries	19	19	21	21	21	21	26	26	26	26
Nameplate Capacity	977	977	1,307	1,472	1,472	1,472	1,875	1,910	1,950	1,950
Capacity Use (%)	49.7%	48.2%	72.7%	71.9%	79.8%	86.7%	77.9%	77.7%	83.1%	79.0%
<b>Co-product Production (1,000 MT)</b>										
Bagasse	134	180	209	243	252	216	261	262	292	275
<b>Feedstock Use for Fuel Ethanol (1,000 MT)</b>										
Sugarcane	486	654	760	882	915	787	949	953	1,063	1,000
Molasses	1,415	1,418	2,615	2,895	3,165	3,067	3,617	4,075	4,550	3,600
Cassava	650	468	1,670	1,864	2,166	3,014	3,272	2,729	2,781	3,470
<b>Market Penetration (Million Liters)</b>										
Fuel Ethanol Use	450	509	949	1,053	1,179	1,280	1,438	1,498	1,613	1,530
Gasoline Use	7,331	7,705	8,233	8,567	9,714	10,680	11,029	11,373	11,791	11,200
Blend Rate (%)	6.1%	6.6%	11.5%	12.3%	12.1%	12.0%	13.0%	13.2%	13.7%	13.7%

Note: Beverage ethanol is not included in this table.

Cassava-based ethanol production mainly uses fresh cassava root as feedstock (35% starch content).

The conversion rate of cassava (fresh)-based ethanol is 1 MT:160 liters.

The conversion rate of molasses-based ethanol is 1 MT:240 liters.

The conversion rate of sugarcane-based ethanol is 1 MT:75 liters.

Co-product of sugarcane-based ethanol production is bagasse (275 kg/1 MT of sugarcane).

2020 figures are FAS estimates.

Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy (Fuel Ethanol Production Data)  
Department of Energy of Business, Ministry of Energy (Fuel Ethanol Consumption Data).  
Liquor Distillery Organization, Excise Department, Ministry of Finance (Industrial Ethanol Production and Consumption Data)  
The Customs Department, Ministry of Finance (Ethanol Export and Import Data)

## Production

In the first half of 2020, ethanol production totaled 744 million liters, produced from 26 fuel ethanol plants operating with a total production capacity of around 1.95 billion liters per year. This is an 8 percent reduction from the same period last year due to reduced gasoline and gasohol consumption during the lockdown. Although the government temporarily allowed the sale of fuel ethanol for industrial ethanol to produce hand sanitizer between March and September 2020, this will not be able to offset the reduced gasohol consumption as total sales are expected to be only around 31 million liters, even with the panic demand at the beginning of the COVID-19 outbreak. Also, domestic industrial ethanol production capacity is likely to be sufficient for the increased demand for hand sanitizer in 2020.

Fuel ethanol production is expected to decline to 1.5 billion liters in 2020, down 5 percent from 2019, due to reduced gasohol demand caused by the COVID-19 outbreak. Molasses-based ethanol production is forecast to decline to 863 million liters, using around 3.6 million metric tons of molasses, down 21 percent from 2019. This production decrease is due to a 49% reduction in available feedstock (molasses) due to drought despite the increased acreage in sugarcane over the last five years. (Very little molasses intended for export is diverted to ethanol production. Exports averaged around 0.2 million metric tons over the last five years, down slightly from around 0.5 million metric tons during the preceding five years.) The sole sugarcane-based ethanol plant is expected to operate at full capacity in 2020 using around 1 million metric tons of sugarcane. Cassava-based ethanol production is expected to increase to 602 million liters in 2020, up 23 percent from 449 million liters in 2019, using around 3.4 million metric tons of cassava root. (Exports of cassava chips, particularly to China, decreased in 2019, causing an oversupply of cassava making cassava cheaper than molasses. However, 2020 cassava supplies are tight thereby increasing the cost of cassava.)

## Trade

To date, the MOE has never approved any imports of fuel ethanol due to sufficient supplies of locally produced ethanol. Thailand is not a major exporter of fuel ethanol as it is not price competitive. Thailand's ethanol produced primarily from molasses cannot compete against the cheaper ethanol produced from corn. Ethanol producers normally only export ethanol for industrial uses and a lack of storage facilities is a long-term constraint to the export of fuel ethanol. In 2011 and 2012, Thailand exported a significant amount of ethanol, mainly to the Philippines. However, ethanol exports have been marginal since 2014 due to strong domestic demand.

In 2020, the government approved around 5 million liters of non-fuel ethanol exports, mainly for hand sanitizer production, from three ethanol manufacturers. The exports are expected to be destined mostly for China. In 2019, the government approved 40 million liters of non-fuel industrial ethanol exports from two ethanol manufacturers, but the exports did not take place. Non-fuel industrial ethanol imports totaled 11.8 million liters between January and May 2020, up significantly from 5.2 million liters in the same period last year due to tight supplies of locally produced non-fuel ethanol. Non-fuel industrial

ethanol imports in 2020 are expected to increase to 15 million liters, up 25 percent from 2018, mainly for use in the pharmaceutical and cosmetic industries. This accounts for around 1 percent of total ethanol consumption.

## **V. Biodiesel**

### Consumption

The Thai government continues to focus on increasing biodiesel blending rates. Over the past 13 years, the program has generally been successful at building its insular market to a current level of around 2 billion liters and an on-road blend rate near B10. However, blend mandate increases are often delayed when domestic feedstock is insufficient given the prohibition on the use of imports and Thailand's sole reliance on domestic palm oil. The blend mandate has even been lowered occasionally. The last time the mandated was reduced occurred during a brief four-month period in 2016.

In 2018, the Thai government started subsidizing retail prices for B20, making B20 prices 3 baht/liter (36 U.S. cent/gallon) lower than B7 prices. The retail price gap between B20 and B7 was later increased to 5 baht/liter (60 U.S. cent/gallon) for 3 months from December 1, 2018 to February 28, 2019, to absorb surplus supplies of palm oil. After many years of unsuccessful incentive programs, car manufacturers in Thailand began cooperating with the Thai government to promote the use of B10 as the primary diesel. After introducing B10 supplies to the market in early 2019, the government announced on May 28, 2020, that B10 will be the primary diesel effective October 1, 2020 and that B10 supplies will be available at all gasoline stations nationwide alongside B7 and B20 in 2020. The government began providing a price subsidy for B10 on February 28, 2020, to make B10 cheaper than B7 by 3 baht/liter (36 U.S. cent/gallon) in order to attract the use of B10. The government has lowered price subsidy incentives for B20 from 5 baht/liter (60 U.S. cent/gallon) to 3 baht/liter (36 U.S. cent/gallon) cheaper than B7 since August 2019 but maintain 6.6-7.0 percent blending rates as an option for some vehicles that might be better fit for B7 use.

Below is the historical implementation of mandatory biodiesel blend rates since 2007:

Date	Mandatory Blend Rates
June 2007	B2 and voluntary use of B5
June 2010	B3 and voluntary use of B5
March 2011	B2 and voluntary use of B5
May 2011	B3-B5
July 2011	B4
January 2012	B5
July 19, 2012	B3.5
November 1, 2012	B5
January 1, 2014	B7
February 17, 2014	B3.5
May 14, 2014	B7
January 22, 2015	B3.5
April 17, 2015	B7
July 25, 2016	B5
August 25, 2016	B3
November 16, 2016	B5
May 8, 2017	B6.5-7.0
November 8, 2018	B6.6-7.0
October 1, 2020	B10 and voluntary use of B7 and B20

In 2020, diesel consumption is forecast to decline, but to a lesser degree than gasoline consumption, by 3-4 percent to 23.7 billion liters. Some necessary economic activities, including logistics, continued to operate when the government enforced the lockdown to control the spread of COVID-19. In the first half of 2020, diesel consumption totaled 11.9 million liters, down 4 percent from the same period last year. By comparison, biodiesel consumption increased 11 percent to 940 million liters over the same period due to fuel switching from B7 to B10 driven by the government's price subsidy on the B10 through the State Oil Fund. Prices of B10 are 14 percent cheaper than B7 (Table 5.1).

Biodiesel consumption in 2020 is expected to increase to a record at 1.97 billion liters, up 10 percent from the previous record of 1.8 billion liters in 2019, despite reduced diesel consumption due to the outbreak of COVID-19. As noted, this is due to the subsidized price differential, which is incentivizing fuel switching from B7 to B10. As a result, the average on-road blend rate for biodiesel is expected to jump nearly two points to 9.6 percent in 2020.

**Table 5.1: Breakdown of Biodiesel Retail Prices, Baht/liter (as of June 12, 2020)**

	<b>High-Speed Diesel (B7)</b>	<b>High-Speed Diesel (B10)</b>	<b>High-Speed Diesel (B20)</b>
Ex-Refinery Factory Price	10.6198	10.9812	12.6299
Excise Tax	5.9900	5.8000	5.153
Municipal Tax	0.5990	0.5800	0.5153
State Oil Fund	1.0000	-2.5000	-4.16
Conservation Fund	0.1000	0.1000	0.1
Wholesale Price (WS)	18.3088	14.9612	14.2322
Value Added Tax (VAT)	1.2816	1.0473	0.9963
WS+VAT	19.5900	16.0084	15.2284
Marketing Margin	2.1492	2.6930	3.1884
VAT	0.1504	0.1885	0.2232
Retail Price	21.8900	18.89	18.64
Note: Exchange rate = 31.50 baht/\$			
Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy			

The Energy Policy and Planning Office (EPPO) under the 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 transactions, with most biodiesel producers usually receiving 3-5 baht/liter (36-60 U.S. cents/gallon) lower than these reference prices due to limited competition among diesel manufacturers. In 2019, actual biodiesel (B100) prices paid by petroleum (diesel) refineries reportedly ranged between 20-25 baht/liters (U.S. \$2.5 -3/gallon).

### Production

Biodiesel is produced from palm oil-derived feedstock such as CPO, refined bleached deodorized palm oil (RBDPO), palm stearin, and free fatty acids of palm oil (FFA). Thailand's campaign to utilize used cooking oil (UCO) for biodiesel production exists among one or two biodiesel companies as a corporate social responsibility campaign; however, the use is limited to 4-5 million liters per annum. Biodiesel production is driven by government mandates and is mainly aimed at helping palm farmers. All palm oil feedstocks used for biodiesel are domestic since the government strictly controls the import of palm oil. Meanwhile, blending of biodiesel among petroleum refineries is strictly controlled and monitored to comply with the mandatory biodiesel blending requirements. All domestic diesel is required to meet

these blending requirements including diesel for on-road inland shipping, trains, agriculture, and industrial power.

**Table 5.2: Biodiesel Production and Use in Thailand**

<b>Biodiesel (Million Liters)</b>										
Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020f
<b>Beginning Stocks</b>	22	12	33	20	18	24	20	50	50	83
<b>Production</b>	630	910	1,080	1,170	1,250	1,240	1,427	1,567	1,845	1,980
<b>Imports</b>	0	5	6	12	2	5	2	2	2	2
<b>Exports</b>	0	4	49	4	3	16	4	1	20	2
<b>Consumption</b>	640	890	1,050	1,180	1,243	1,233	1,395	1,568	1,794	1,970
<b>Ending Stocks</b>	12	33	20	18	24	20	50	50	83	93
BalanceCheck	0	0	0	0	0	0	0	0	0	0
<b>Production Capacity (Million Liters)</b>										
Number of Biorefineries	13	10	10	10	12	12	12	13	12	13
Nameplate Capacity	2,170	1,600	1,600	1,600	2,060	2,060	2,060	2,310	2,445	2,580
Capacity Use (%)	29.0%	56.9%	67.5%	73.1%	60.7%	60.2%	69.3%	67.8%	75.5%	76.7%
<b>Feedstock Use for Fuel (1,000 MT)</b>										
RBDPO/CPO	390	630	775	825	857	838	965	1,060	1,267	1,355
Stearin	190	200	210	235	250	260	286	328	370	400
FFA of Palm Oil	0	20	25	55	83	82	109	102	118	130
Used Cooking Oil	1	1	1	2	2	2	3	4	5	5
<b>Market Penetration (Million Liters)</b>										
Biodiesel, on-road use	432	603	640	623	680	741	941	1,045	1,320	1,580
Diesel, on-road use	12,708	13,699	12,301	11,133	11,937	13,225	15,682	16,084	17,015	16,400
Blend Rate (%)	3.4%	4.4%	5.2%	5.6%	5.7%	5.6%	6.0%	6.5%	7.8%	9.6%
Diesel, total use	18,484	20,529	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,690

f = forecast

Source: Ministry of Energy, Ministry of Commerce

Note: In this report, the biodiesel yields for all type of feedstock (RBDPO, CPO, stearin, FFA of palm oil, and used cooking oil) are the same at 1,050 liters per metric tons of feedstock weight.

Palm oil production in 2020 is forecast to increase by 4 percent to 3.1 MMT from 3 MMT in 2019, due mainly to increased harvested area and an increased number of mature palm plantations. Biodiesel production in 2020 is expected to reach a record around 2 billion liters, up approximately 7 percent from a record 1.8 billion liters in 2019 due to the increased demand as consumers switch from B7 to B10, which will more than offset the expected 4 percent decline in the diesel pool. If the 2 billion liters of biodiesel production is realized in 2020, this would represent a doubling in production since 2013. Over this same period, the amount of CPO used in biodiesel production as a percentage of total CPO production has risen from 38 to 43 percent. It is estimated that currently 72 percent of biodiesel is derived from RBDPO or CPO, 21 percent from palm stearin, and 7 percent from FFA. There are currently 13 producers with an estimated total production capacity of 2.58 billion liters per annum.

**Table 5.3: List of Operating Biodiesel Producers in Thailand**

	<b>Company</b>	<b>2020 Nameplate Production Capacity (Million Liters/Year)</b>	<b>Feedstock Type</b>
1	Pure Energy	265	Palm Stearin, CPO
2	Patum Vegetable Oil	460	CPO, RBDPO, Stearin
3	GI Green Power 1/	70	CPO, RBDPO, Stearin
4	A.I. Energy	165	Palm Stearin
5	Veera Suwan	65	Palm Stearin, RBDPO
6	Global Green Chemical	520	CPO, RBDPO
7	New Biodiesel	330	CPO, RBDPO, Stearin, FFA
8	Absolute Power P	100	CPO, RBDPO, Stearin
9	Bangchak Biofuel	280	CPO, Stearin
10	PPP Green Complex	150	RBDPO, Stearin
11	Bio Synergy	10	CPO, used cooking oil
12	Trang Palm Oil	30	CPO, RBDPO, Stearin
13	Suksomboon Energy	135	CPO, RBDPO, Stearin
	<b>Total</b>	<b>2,580</b>	

Note: 1/ originally called B. Grimm Green Power

Source: Department of Energy Business and FAS Estimates

### Trade

Thailand's biodiesel imports and exports are minimal and are found by looking at biodiesel (adjusted to B100 equivalent) traded under HTS codes 3826.00 and 2710.20. Imports of biodiesel (B100 equivalent) are restricted and have remained at two million liters since 2017. Meanwhile, exports of biodiesel (B100 equivalent) were 20 million liters in 2019 (as compared to one million liters in 2018) and are projected to fall to 2 million liters in 2020. They remain marginal compared to total biodiesel production.

## **VI. Advanced Biofuels**

The AEDP 2015 includes a production objective for pyrolysis oil (also known as bio-oil or biocrude) of 194 million liters per annum by 2036. The first commercial pyrolysis oil company, called Ayutthaya Clean Energy, will have a capacity of 7.92 million liters when operational. The main feedstock for the facility will be waste plastic, and all pyrolysis oil production from the plant will be used as fuel for Ayutthaya Clean Energy's electricity generation plant, which has a capacity of 3 megawatts (MW). The development of biojet fuel production in Thailand is also possible, but it is under technical and feasibility studies. The TIEB 2015 also set the production target for second and third generation biofuels at 10 kilotons of oil equivalent (ktoe) by 2036. The government supports this objective by supporting related research at Thai universities. The development of second-generation biofuels from biomass and third-generation biofuels from algae are still in the research and development phase and not close to commercialization.



There has been no progress in the commercialization of other types of advanced biofuels in Thailand, and the potential for progress is further dimmed due to weaker global prices for petroleum products and the lowered biofuel use targets for 2037. For example, the plan to construct a dual feedstock plant (molasses-based and bagasse-based cellulosic ethanol plant) has stalled due to commercial infeasibility. The production of hydrogenation-derived renewable diesel (HDRD), a type of renewable drop-in diesel, is no longer being commercialized in Thailand due to unsubsidized and high production costs. Thailand is unlikely to allow the imports of HVO as a supplement to its biodiesel market for the same reason it does not permit biodiesel imports.

## **VII. Statistical Information**

While ethanol is harmonized under HS2207.10 and HS2207.20, Post's estimate of ethanol imports and exports in the Ethanol PS&D (Table 4.3) is based on HS2207.20.11 and HS2207.20.19 reported by the Thai Customs Department. These codes represent ethanol for fuel and industrial uses. Meanwhile, other import and export figures of ethanol under HS2207.10 and HS2207.20 include beverage ethanol which is not included in the ethanol supply/demand balance table.

Post's estimates of biodiesel imports and exports is based on HS2710.20, described as petroleum oils containing up to and including 30 percent biodiesel by volume, and HS3826.00, described as biodiesel above B30 and including B100, both reported by Thai Customs Department. All data in the Biodiesel PS&D (Table 5.2) are reported in B100 equivalent and it is assumed all products traded under 3826.00 are B100 and all products traded under 2710.20 contain 5% biodiesel.

Post's estimate for ethanol stocks is based on the weekly ethanol stocks reported by the Thai Ethanol Manufacturing Association. As there is no similar data source for biodiesel, Post's estimate for biodiesel stocks is based on conversations with biodiesel producers and equals a stocks-to-use ratio of 2-4% in past years.

End of report.

**Attachments:**

No Attachments