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Prepared By: Ponnarong Prasertsri, Agricultural Specialist

Approved By: Eric Mullis

Report Highlights:

Thailand is likely to lower biofuel consumption targets in the new AEDP 2022 due to expected lower fuel demand after 2027. The Thai government anticipates more electric vehicles on the road and increased rapid mass transit system, as well as double-track railway routes. FAS Bangkok expects biofuel consumption in 2023 to increase 6 percent. The Thai government is likely to increase the mandatory biodiesel blending rate as palm oil prices have eased.

I. Executive Summary

The National Energy Policy Council (NEPC) is likely to endorse the new National Energy Plan (NEP 2022) in September 2023 to support the government's goal to reach carbon neutrality by 2050 and net zero emissions by 2065. Thailand committed to reach these goals in the 26th World Leaders Summit of the United Nations Framework Convention on Climate Change Conference of the Parties (COP26) in November 2021. The Oil Development Plan (ODP 2022), which is one of the five master plans of the NEP 2022, will focus on reducing greenhouse gas (GHG) emissions through ethanol consumption and lowering PM 2.5 particles by requiring Euro 5 standards for biodiesel production. The new Alternative Energy Development Plan (AEDP) 2022, which is one of the NEP's master plans, set the biofuel consumption target at 2,950 million liters by 2037, which will consist of 1,380 million liters of ethanol and 1,570 million liters of biodiesel. The AEDP 2022 biofuel consumption target is lower than the AEDP 2018 target. The Thai government is actively encouraging the use of electrical vehicles (EV) and rail transport system.

Biofuel consumption in 2022 further declined to 2,781 million liters, down 7.8 percent from 2021. A reduced demand for biodiesel more than offset growing ethanol consumption. The government reduced the mandatory biodiesel blend rate from 10 percent to 7 percent at the beginning of 2022, causing demand to drop 18 percent in 2022. The mandatory blend rates went as low as B5 for diesel fuel to help curb retail prices of diesel between February and September 2022.

Post forecasts biofuel consumption to increase to 2,960 million liters in 2023. A growing demand for diesel fuel in the transportation sector will push consumption 6 percent higher than 2022. The government increased the mandatory blend rate to 6.6 percent in October 2022 when domestic palm oil prices eased from record high prices. Post expects demand for ethanol to decline 7 percent due to reduced E85 consumption. The Thai government stopped subsidizing E85 on November 24, 2022, following the plan to phase out E85 production by the beginning of 2024.

The new AEDP 2022 supports the use of sustainable aviation fuel (SAF), which is an advanced biofuel in jet fuel. The new AEDP 2022 set a beginning target blending rate of 1 percent in 2025 and aims to reach 5 percent by 2034. Limited supplies of used cooking oil that meet the International Civil Aviation Organization's (ICAO) standards will be the main constraint in achieving these targets. The alternative feedstocks for SAF production will be from excess supplies of ethanol after domestic demand for fuel ethanol reaches its peak in 2027.

II. Policy and Programs

The NEPC is likely to endorse the new NEP 2022 in September 2023 to support the government's goal to reach carbon neutrality by 2050 and net zero emissions by 2065. Thailand committed to reach these goals in the 26th World Leaders Summit of the United Nations Framework Convention on Climate Change Conference of the Parties (COP26) in November 2021. The NEP consists of the following 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). The Thai government finalized all master plans except for the ODP, which it delayed finalizing until it has finalized the new national plan (NEP 2022). The ODP is an important part of achieving the national energy plan.

The ODP aims to reduce GHG emissions through ethanol consumption and lowering PM 2.5 particles by requiring Euro 5 standards for biodiesel production. The new AEDP 2022 set the biofuel consumption target at 2,950 million liters by 2037, which will consist of 1,380 million liters of ethanol and 1,570 million liters of biodiesel. The AEDP 2022 biofuel consumption target is lower than the AEDP 2018 target. The Thai government is actively encouraging the use of electrical vehicles (EV) and the rail transport system.

The Thai government aims to reduce GHG emissions in the energy and transportation sectors by 282 million metric tons of carbon dioxide (MTCO₂) by 2050 to help reach carbon neutrality by 2050 and net zero emissions by 2065. The 40 percent reduction in CO₂ emission from 2015 (base year) is more than double the initial target of 110-140 MTCO₂ (20-25 percent of 2015 emissions) by 2030 to which Thailand committed at the 2015 Paris Climate Conference. The new target also exceeds Thailand's target in its 2015 Nationally Determined Contribution (NDC) roadmap to reduce CO₂ emissions in the energy and transportation sectors by 113 MTCO₂ by 2035.

The NDC's roadmap includes increasing renewable energy use in households, industry, and power generation; promoting biofuels; and increasing efficiency in power generation, transportation, buildings, and industry. The NDC is the second phase to reduce GHG emissions with the United Nation Framework Convention on Climate Change (UNFCCC). The first phase to reduce GHG emissions is known as the Nationally Appropriate Mitigation Action (NAMA), which aimed to reduce GHG emissions from the energy and transportation sectors by 24-74 MTCO₂ or 7-20 percent by 2020. The Thai government announced in 2020 that Thailand had successfully reduced GHG emissions by 57.84 MTCO₂ or 15.76 percent, well above the lower target of 7 percent. The Thai government incorporated the NDC into its NEP 2015 and aligned the NDC with Thailand's 11th National Economic and Social Development Plan (2012 – 2016) (please see [TH2020-0124: Biofuel Annual 2020, September 2020](#)).

The Cabinet approved the AEDP 2018 on April 30, 2019. The AEDP 2018 set a goal that 30 percent of total energy consumption will come from renewable energy sources by 2037. The government set the consumption targets for ethanol at 2,700 million liters and biodiesel at 2,900 million liters by 2037. However, actual ethanol and biodiesel consumption was lower than the annual targets set in the AEDP 2018 due to the COVID-19 outbreak and the economic downturn that resulted from the outbreak. Ethanol and biodiesel consumption totaled 1,345 million liters and 1,672 million liters in 2021, respectively. The AEDP 2018's ethanol and biodiesel consumption targets are actually lower than the initial targets of 4,100 and 5,100 billion liters, respectively, set in the old AEDP in 2015. The AEDP 2018 lowered consumptions targets due to uncertainty in having adequate supplies of molasses and cassava for ethanol production and palm oil for biodiesel production.

The AEDP 2018's target for sugarcane acreage is 16 million rai (2.6 million hectares) by 2026, up from the 10 million rai (1.6 million hectares) target set in the AEDP 2015 to meet the ethanol consumption target. The AEDP 2018's target for average yield in cassava production is 7 metric tons per rai (44 metric tons/hectare) by 2026, up from the 3.5 metric tons per rai (22 metric tons/hectare) target set in the AEDP 2015. The AEDP 2018 does not have any acreage targets for cassava. The AEDP 2018's target for palm acreage is 10.20 million rai (1.63 million hectares) by 2036, up from the 4.4 million rai (0.70 million hectares) target set in the AEDP 2015 to meet domestic demand. Domestic palm oil is the primary feedstock used in biodiesel production and other feedstocks (e.g., animal fats and used cooking oil (UCO)) play an insignificant role in biodiesel production.

Crop yields and acreage for many of the feedstocks remain far below those required to meet the targets set in the 20-year plan. Sugarcane acreage is currently at around 10 million rai (1.6 million hectares) with an average yield of 9.4 metric tons per rai (59 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 reliance on domestic palm oil production to produce crude palm oil (CPO), the main feedstock for biodiesel production, is that supply fluctuates significantly due to weather conditions. In addition, upward pressure on global crude oil prices and the disruption of the global trade on sunflower oil from Russia's invasion of Ukraine in February 2022 have slowed the growth of biodiesel consumption.

The government promotes the use of gasohol (gasoline containing ethanol) through price incentives at the gas stations and by an excise tax reduction for cars compatible with E20 and E85 gasohol. The government imposes a mandatory biofuel blending requirement for diesel used primarily for transportation to increase biodiesel consumption. The government does not enforce a mandatory blending requirement for diesel used in industry and agriculture. Industry primarily uses based diesel in power generators. However, the government continued to reduce price subsidies on gasohol and biodiesel between 2020 and 2022, following the enactment of the new State Oil Fund Act B.E. 2562 (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 domestic support programs. The government has been reducing price subsidies on E85 and B20 since 2020, which encouraged gas stations to gradually switch to E20 and B10. E20 and B10 will be the primary blending rates for gasohol and biodiesel, respectively.

Thailand relies solely on domestic sugarcane, cassava, and palm oil production and excludes imports from playing any role in meeting current and future biofuel consumption targets. The dependency on domestic production means 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 under COP26.

Ethanol

The expected ethanol consumption target in the new AEDP 2022 is 1,380 million liters, down further from the target of 2,700 million liters in the AEDP 2018, and 4,100 million liters in the AEDP 2015. The lowered target reflects the reduced long-term demand growth for gasoline and gasohol due to increased availability of passenger and commercial EVs and the complete mass rapid transit system. The government expects ethanol consumption will decelerate in 2025 when the number of EVs on the road reaches the current growth projections. Ethanol consumption should peak in 2027 at 2,485 million liters and gradually decline to 1,380 million liters in 2037. The increase in the number of EVs on the road is also partly aligned with the goal to reduce GHS emission by 2035. The government estimated that

ethanol consumption attributed to 3.5 MTCO₂ equivalent based on annual ethanol consumption of around 1,600 million liters, which occurred in 2018.

The government has pushed the production of EV since 2019 and established the National EV Policy Committee to promote the EV industry on February 7, 2020 (please see [TH2020-0124: Biofuel Annual 2020, September 2020](#)). The National EV Policy Committee proposed to increase the number of EVs on the road and local production to 1.05 million by 2025 in March 2021. The initial target was 250,000 EVs on the road by 2025. The committee also set an ambitious target of having EVs be 50 percent of all new car registrations by 2030, up from 30 percent from the previous plan. However, the Cabinet approved a production target of zero-emission vehicles (ZEV) at 30 percent of total vehicles production by 2030 on February 15, 2022. The ZEV production target will be 725,000 ZEVs with a use target of 440,000 ZEVs in 2030. The Department of Land Transport reported that there were 20,816 new EVs registered in 2022, up significantly from 5,889 units in 2021. However, they were about two percent of total new registered vehicles in Thailand. The Board of Investment (BOI) and the Excise Tax Department are encouraging the automotive industry to make Thailand a regional hub for EVs. The BOI granted EV manufacturers an excise tax-exemption for three years to encourage them to set up production facilities in Thailand. In addition, the Cabinet approved on February 22, 2022, to cut the excise tax rates from 8 percent to 2 percent for passenger cars and zero for pickup trucks between 2022 and 2023. The Cabinet also approved subsidies of 70,000 - 150,000 baht (\$2,030 – \$4,350) on purchases of EVs, duty free or a tariff cut of 20-40 percent on imported EVs, and duty-free imports on nine items of CKD (completely knocked down) EVs to support EVs manufacturers and encourage domestic demand for EVs. The government wants Thailand to become a global hub for EV and parts production, as well as the use of ZEVs of all types.

There is no ethanol blend mandate for the entire fuel pool. Post derives the average blend rate calculated in the ethanol balance table from 1) the established blend rates (E10, E20, and E85) of different gasohol pools, and 2) the size of these various pools. The pricing policy impacts the size of the pools by accounting for a lower energy density of ethanol vs gasoline and incentivizing ethanol use. Different VAT rates for each vehicle class are changing the existing vehicle fleet, which also determines the size of these pools. The government is aiming to phase out the production of octane 91 E10 by 2022 and 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 (octane 95 gasoline) and E20 available in the market by the end of 2037.

Biodiesel

The new AEDP 2022 is likely to lower the biodiesel consumption target to 1,570 million liters by 2037, compared to 2,900 million liters in the ADEP 2018 and 5.1 billion in the older AEDP. The Thai government is promoting railway transportation and is expanding the double-track railway routes nationwide. In addition, automobile manufacturers are economically supporting the engines that will be compatible with B7. The government expects that annual biodiesel consumption will reach 2,120 million liters between 2027 and 2029 and will gradually decline to 1,570 million liters by 2037. The concern about the volatility in domestic palm oil prices that affects retail prices of diesel fuel and the burden of the State Oil Fund to subsidize diesel prices, as well as the ability to absorb excess supplies of oil palm to help local oil palm growers, drives the revised consumption target. The government continues to impose mandatory blending of biodiesel and diesel for certain sectors, mainly for on-road use. In

2020, the government increased the mandatory blend rate to B10 to help absorb excess supplies of oil palm but still allowed B7 and B20 for older vehicles that are not compatible with B10. The Thai government requires all gas stations to sell B10 and provided increased price subsidies for B10 in 2020 in order to make B10 the primary diesel fuel after introducing it in 2019. The Thai government was considering reducing price subsidies for B20 in 2021 and terminating the sale of B20 in 2022 in adherence to the State Oil Fund Act. However, the government began to lower the biodiesel mandatory blending rate below B10 in October 2021 to keep retail prices of diesel fuel below 30 baht/liter (\$3.30/gallon) to reduce the impact of high energy prices while prices of B100 and crude oil were under upward pressure. The cabinet also approved on February 15, 2022, an excise tax cut by 3 baht per liter (33 U.S. cent/gallon) for three months between February 18 – May 20, 2022, and approved a further reduction in the excise tax on May 17, 2022, from 3 baht per liter (33 U.S. cent/gallon) to 5 baht per liter (55 U.S. cent/gallon) for another three months between May 21 - July 20, 2022. The government kept extending the excise tax cut by 5 baht/liters (55 U.S. cent/gallon) throughout 2022 and continues doing so in 2023 far until May 20, 2023.

The matured oil palm acreage continues growing, reaching around 6.2 million rai (1.0 million hectares) in 2022. The government oil palm acreage target is 10.2 million rai (1.63 million hectares) by 2037. The Ministry of Agriculture and Cooperatives estimates that production of palm fresh fruit bunch (FFB) will reach 29.46 million metric tons (MMT) in 2036, with 4.24 MMT of FFB used in biodiesel production in 2036.

The National Environment Board mandated in 2019 that locally produced biodiesel must comply with the Euro 5 standard by 2024. Diesel refineries are transitioning their facilities to comply with the Euro 5 standard. Thailand also started importing based diesel that complies with the Euro 5 standard to make B7 and B10 in 2019. The use of B7 and B10 biodiesels produced according to the Euro 5 standard is still marginal as their prices are higher than other diesel fuels in the diesel pool. The Office of Industrial Economic, MOE estimated that if all vehicles complied with the Euro 5 standard within two years, then Thailand would reduce PM 2.5 particles by 80 percent or 37,391 metric tons from 2020.

The Thai government restricts the import of biodiesel to protect domestic palm growers. Importers must 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 between B30 and B100 (pure biodiesel) (HTS 3826.00).

III. Ethanol

Table 3.1: Thailand's Production, Supply and Distribution for Ethanol Used as Fuel and Other Industrial Chemicals

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f
Beginning Stocks	42	40	37	30	54	31	38	33	14	25
Fuel Begin Stocks	21	26	21	17	40	27	33	29	10	23
Production	1,070	1,190	1,290	1,480	1,500	1,640	1,500	1,349	1,448	1,350
Fuel Production	1,058	1,174	1,276	1,461	1,485	1,619	1,478	1,326	1,424	1,330
Imports	11	11	13	12	12	12	16	22	13	15
Fuel Imports	0	0	0	0	0	0	0	0	0	0
Exports	5	0	0	0	0	0	0	0	0	0
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	1,078	1,204	1,310	1,468	1,535	1,645	1,521	1,390	1,450	1,355
Fuel Consumption	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,411	1,315
Ending Stocks	40	37	30	54	31	38	33	14	25	35
Fuel Ending Stocks	26	21	17	40	27	33	29	10	23	38
Total Balance Check	0	0	0	0	0	0	0	0	0	0
Fuel Balance Check	0	0	0	0	0	0	0	0	0	0
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	21	21	21	26	26	26	26	26	26	27
Nameplate Capacity	1,472	1,472	1,472	1,875	1,910	1,950	1,950	1,950	1,950	1,970
Capacity Use (%)	71.9%	79.8%	86.7%	77.9%	77.7%	83.1%	75.8%	68.0%	73.0%	67.5%
Co-product Production (1,000 MT)										
Bagasse	243	252	216	261	262	292	234	248	0	0
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	882	915	787	949	953	1,063	850	875	768	775
Molasses	2,895	3,165	3,067	3,617	4,075	4,550	3,590	3,172	3,454	3,335
Cassava	1,864	2,166	3,014	3,272	2,729	2,781	3,462	3,127	3,317	2,890
Market Penetration (Million Liters)										
Fuel Ethanol Use	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,411	1,315
Gasoline/Ethanol Pool 1/	8,567	9,714	10,680	11,029	11,373	11,791	11,712	10,736	11,180	11,680
Blend Rate (%)	12.3%	12.1%	12.0%	13.0%	13.2%	13.7%	12.7%	12.5%	12.6%	11.3%

Note: 1/ Covers gasoline and all biocomponents (biofuels) like ethanol and ETBE as well as MTBE if used.

f = forecast

- Beverage ethanol is not included in this table.

- Cassava-based ethanol production mainly uses fresh cassava root as feedstock. The conversion rate 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).

- 2023 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)

Consumption

Fuel ethanol consumption in 2022 increased around 5 percent from 2021, following the economic recovery in the second half of 2022 when the government removed the stringent COVID-19 restrictions nationwide in May 2022. The number of foreign tourists jumped from 427,869 in 2021 to 11.2 million in 2022, driving the Thai economy to grow by 2.6 percent in 2022. The growth in ethanol demand was well

above the overall growth in gasohol consumption that increased 4 percent as demand for E85 remained strong as E85 prices were 18-20 percent cheaper than E10 and E20 (Table 3.2 and 3.3). E20 consumption declined 5 percent as some consumers whose vehicles were compatible with E85 decided to shift to E85 during the surge in gasohol prices, especially in the first half of 2022. The government still provided a price subsidy for E85 until November 23, 2022, despite a limited number of gas stations having E85 available for consumers during the transition to phase out E85 (please see [TH2022-0038: Biofuel Annual 2022, June 14, 2022](#)).

Table 3.2: Thailand's Gasoline and Gasohol Consumption (Unit: Million Liters)

Type of Gasoline	2018	2019	2020	2021	2022	January - March		
						2022	2023	% Change
Gasoline	437	388	392	408	364	97	80	-17.5
Regular (octane 91)	39	41	101	167	173	45	36	-19.8
Premium (octane 95)	398	347	291	241	192	52	44	-15.5
Gasohol	10,936	11,403	11,320	10,354	10,815	2,588	2,781	7.5
- Gasohol E10 Octane 91	3,638	3,485	3,008	2,518	2,563	619	625	1.0
- Gasohol E10 Octane 95	4,739	5,068	5,588	5,437	5,942	1,369	1,613	17.8
- Gasohol E20	2,122	2,379	2,394	2,114	2,008	513	520	1.3
- Gasohol E85	437	471	331	286	302	86	23	-73.5
Total	11,373	11,791	11,712	10,763	11,180	2,684	2,860	6.6

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

Source: Department of Energy Business, Ministry of Energy

Table 3.3: Price Structure of Gasoline and Gasohol in Bangkok in 2022 and 2023

April 19, 2022 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	28.1304	27.5280	27.1100	27.0375	26.6313
Excise Tax	6.5000	5.8500	5.8500	5.2000	0.9750
Municipal Tax	0.6500	0.5850	0.5850	0.5200	0.0975
State Oil Fund	7.1800	1.0200	1.0200	0.1200	-4.5300
Conservation Fund	0.0050	0.0050	0.0050	0.0050	0.0050
Wholesale Price (WS)	42.4654	34.9880	34.5700	32.8825	23.1788
Value Added Tax (VAT)	2.9726	2.4492	2.4199	2.3018	1.6225
WS+VAT	45.4380	37.4371	36.9899	35.1843	24.8013
Marketing Margin	0.9552	1.5073	1.6730	2.5755	6.0174
VAT	0.0669	0.1055	0.1171	0.1803	0.4212
Retail Price	46.46	39.05	38.78	37.94	31.24

Note: Exchange rate = 33.2447 baht/USD

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

April 19, 2023 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	22.3637	22.4884	22.0611	22.8247	27.1010
Excise Tax	6.5000	5.8500	5.8500	5.2000	0.9750
Municipal Tax	0.6500	0.5850	0.5850	0.5200	0.0975
State Oil Fund	8.5800	2.0000	2.0000	0.0100	0.0100
Conservation Fund	0.0500	0.0500	0.0500	0.0500	0.0050
Wholesale Price (WS)	38.1437	30.9734	30.5461	28.6147	28.2335
Value Added Tax (VAT)	2.6701	2.1681	2.1362	2.0023	1.9763
WS+VAT	40.8138	33.1415	32.6843	30.6070	30.2098
Marketing Margin	3.9684	3.8397	4.0147	4.0495	4.8413
VAT	0.2778	0.2688	0.2810	0.2835	0.3389
Retail Price	45.06	37.25	36.98	34.94	35.39

Note: Exchange rate = 34.5829 baht/USD

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

Ethanol consumption in the first quarter of 2023 totaled 323 million liters, down 7 percent from the same period last year due to reduced E85 consumption amid an 8 percent increase in gasohol consumption. E85 consumption declined 74 percent from the same period last year as the government stopped subsidizing E85 since November 24, 2022. The lack of a subsidy encouraged consumers to shift to E20 as retail prices of E20 and E85 converged. The price difference between E85 and E20 in April 2023 was 0.45 baht/liter (5 U.S. cent/gallon), compared to 6.70 baht/liter (74 U.S. cent/gallon) during the same period last year (Table 3.3).

Post forecasts ethanol consumption to decline around 7 percent in 2023 due to reduced E85 consumption despite an anticipated growth in gasoline demand of 5 percent. There are a limited number of gas stations that have E85 available for consumers, compared to 5,573 stations that had E20 in April 2023. Most of them had replaced the sale of E85 with E20 when the government reduced the subsidies on E85 under the State Oil Fund Act B.E. 2562 (2019). The government plans to terminate the sales of E85 by January 1, 2024 (please see [TH2020-0124: Biofuels Annual 2020, September 11, 2020](#)).

Production

Fuel ethanol production in 2022 totaled 1,424 million liters, up 7 percent from 2021. Molasses-based ethanol production, which accounted for 58 percent of total ethanol production, increased 9 percent to 828 million liters. Ethanol producers used 3.5 million metric tons of molasses in 2022, benefiting from large supplies of locally produced molasses from an increased MY2021/22 sugar production (please see [TH2022-0064: Sugar Semi-Annual, October 12, 2022](#)). Cassava-based production, which accounted for 37 percent of total ethanol production, increased 6 percent to 530 million liters, using 3.3 million metric tons of cassava chip.

Fuel ethanol production in the first quarter of 2023 totaled 410 million liters, down one percent from 2022 due to reduced cassava-based ethanol production. Cassava-based ethanol production declined 13 percent to 124 million liters, using 773,423 metric tons of cassava chip due to tight supplies of locally produced cassava. Cassava-based ethanol production accounted for 30 percent of total ethanol production in the first quarter of 2023, down from 37 percent in 2022. However, molasses-based ethanol production increased 3 percent to 263 million liters, using 1.1 million metric tons of sugarcane. Molasses-based ethanol production accounted for 60 percent of total ethanol production in the first quarter of 2023, up from 58 percent in 2022. Also, sugarcane-based ethanol production in the first quarter of 2023 increased around one percent from the same period last year to 24 million liters as the new sugarcane-based ethanol plant began to fully operate in late 2022. This new facility will shift from producing fuel ethanol to industrial grade ethanol when the biochemical production facility is operational (please see [TH2023-0024: Sugar Annual 2023, April 17, 2023](#)). Thailand has 26 ethanol plants with a total production capacity of around 1,950 million liters.

Post forecasts ethanol production in 2023 to decline 7 percent to 1,330 million liters due to reduced E85 demand and tight supplies of molasses and cassava. Reduced supplies of molasses, which declined to around 3.4 million metric tons in 2023 following a record high sugar extraction rate, will reduce molasses-based ethanol production in 2023 by 3 percent to 800 million liters. However, molasses-based ethanol production is likely to account for 60 percent of total ethanol production, up from 58 percent in 2022. Reduced supplies of locally produced cassava in 2023 will reduce cassava-based ethanol

production from 37 percent of total ethanol production in 2022 to 35 percent in 2023. Cassava-based ethanol in 2023 will likely decline 13 percent to 462 million liters.

Trade

Thailand is not a major exporter of fuel ethanol as it is not price competitive. Thailand's ethanol, primarily molasses- and cassava-based, cannot compete against cheaper ethanol produced from corn. Ethanol producers normally only export ethanol for industrial uses. A lack of storage facilities is another constraint to the possible expansion of fuel ethanol exports.

Ethanol exports have been marginal since 2014 due to strong domestic demand. Despite the government approved non-fuel ethanol exports of 12 million liters in 2021, actual exports of ethanol in 2021 totaled 1,895 liters, down significantly from 78,386 liters in 2020. The government extended this non-fuel ethanol export approval until 2022. However, ethanol exports in 2022 were still marginal at 13,396 liters, mainly to Japan and Vietnam. All the ethanol exports were for industrial uses. The government has approved 10 million liters of non-fuel ethanol for export in 2023.

Ethanol imports in 2022 totaled 13 million liters, mainly for non-fuel uses. Larger supplies of locally produced ethanol reduced imports by 41 percent reduction from 2021. The MOE has never approved any imports of fuel ethanol as local ethanol producers still have excess production capacities over domestic demand. Post expects non-fuel ethanol imports in 2022 to further increase to 23 million liters, up around 5 percent from 2021 in anticipation of tight supplies of molasses for non-fuel ethanol production.

IV. Biodiesel

Table 4.1: Thailand's Biodiesel Production and Use

Biodiesel (Million Liters)										
Calendar Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f
Beginning Stocks	20	18	24	20	50	50	86	56	35	36
Production	1,170	1,250	1,240	1,427	1,567	1,845	1,843	1,658	1,391	1,660
Imports	12	2	5	2	2	2	1	0	0	0
Exports	4	3	16	4	1	21	3	7	9	10
Consumption	1,180	1,243	1,233	1,395	1,568	1,790	1,871	1,672	1,381	1,645
Ending Stocks	18	24	20	50	50	86	56	35	36	41
Balance Check	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)										
Number of Biorefineries	10	12	12	12	13	12	13	13	15	15
Nameplate Capacity	1,600	2,060	2,060	2,060	2,310	2,445	2,580	2,580	2,910	2,910
Capacity Use (%)	73.1%	60.7%	60.2%	69.3%	67.8%	75.5%	71.4%	64.3%	47.8%	57.0%
Feedstock Use (1,000 MT)										
RBDPO/CPO	825	857	838	965	1,060	1,267	1,264	1,138	920	1,100
Stearin	235	250	260	286	328	370	370	332	312	370
FFA of Palm Oil	55	83	82	109	102	118	117	107	89	105
Used Cooking Oil	2	2	2	3	4	5	4	3	4	5
Market Penetration (Million Liters)										
Biodiesel, On-road use	623	680	741	941	1,045	1,320	1,475	1,280	970	1,260
Diesel/Biodiesel, On-road use 1/	11,133	11,937	13,225	15,682	16,084	17,025	17,950	17,546	20,600	20,940
Blend Rate (%)	5.6%	5.7%	5.6%	6.0%	6.5%	7.8%	8.2%	7.3%	4.7%	6.0%
Diesel/Biodiesel Pool, Total 1/	21,078	21,902	22,625	23,223	23,587	24,579	23,920	23,005	26,663	27,100

Note 1/ Fuel pools are defined as fossil fuels plus all "bio-components" (biofuels) blended with fossil diesel.

2/ f = forecast

3/ 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.

Source: Ministry of Energy and Ministry of Commerce

Consumption

Biodiesel consumption in 2022 further declined 17 percent from the previous year despite a 16 percent increase in diesel fuel demand (Table 4.2). The reduction in the mandatory blending rate from B10 to B5 (Table 4.3) lowered demand for biodiesel. The government set new mandatory blending rates ranging between B7 and B20 (specifically for large trucks) in 2022 and 2023. Eventually, B7 will be the only mandatory blend rate for diesel fuel from 2024 onwards. The government set the range for the biodiesel blending rate between 5 and 7 percent for B7, 5 and 10 percent for regular high-speed diesel, and 5 and 20 percent for B20 in February 2022, while biodiesel (B100) prices increased by 50 percent in the first quarter of 2022 and doubled the prices of diesel fuel. Russia's invasion of Ukraine disrupted sunflower oil supplies and trade causing price increases in both diesel and biodiesel (please see [TH2022-0038: Biofuel Annual 2022, June 14, 2022](#)). The actual blend rate was 5 percent for both of B7 and B20 between February and October 2022, as prices of B100 surged to record levels. Farm prices of oil palm were 44 percent higher than the same period last year. The Cabinet also reduced the excise tax by 3 baht per liter (33 U.S. cent/gallon) between February and May 2022 and further reduced the excise tax cut to 5 baht per liter (55 U.S. cent/gallon) on May 17, 2022. The Thai government provided the excise tax subsidy through 2022, aiming to keep retail prices of diesel between 30-35 baht/liters (\$3.33 – 3.84/gallon) (Figure 4.1).

Table 4.2: Thailand's Diesel Consumption (Unit: Million Liters)

Type of Diesel	2018	2019	2020	2021	2022	January - March		% Change
						2022	2023	
B7	23,089	21,852	16,033	14,543	23,317	5,826	5,999	3.0
B10	-	34	5,935	7,028	834	314	97	-69.1
B20	19	1,631	1,269	360	68	19	15	-24.9
Other	478	1,062	683	1,075	2,444	704	765	8.8
Total	23,587	24,579	23,920	23,005	26,663	6,863	6,876	0.2

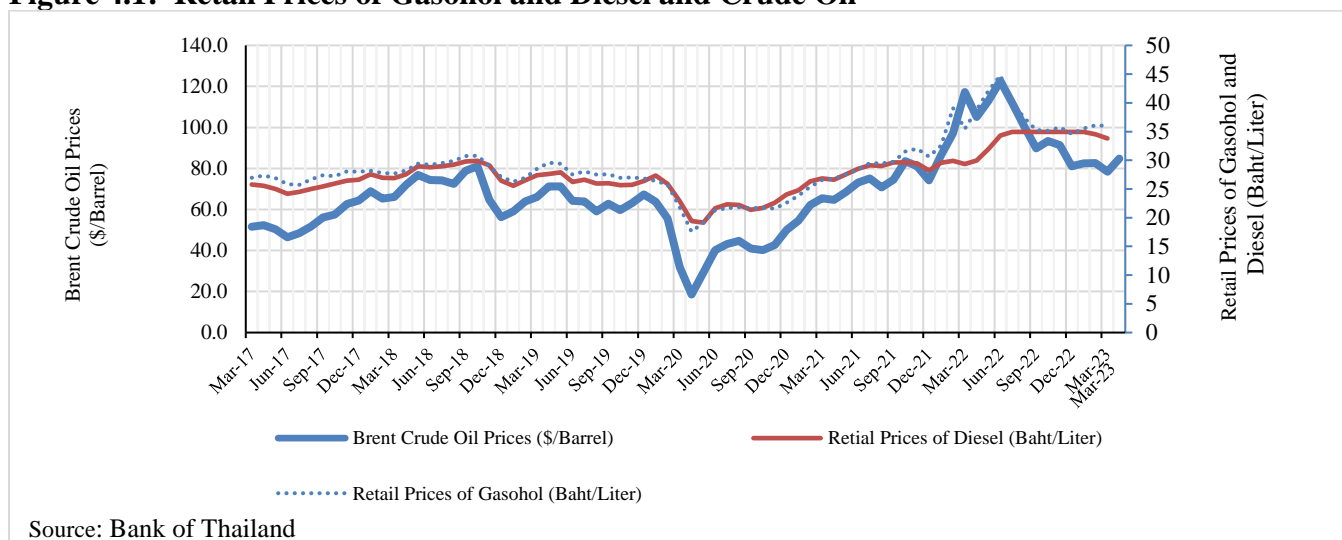
Note: Other includes Low Speed Diesel, Diesel for Fishermen, High-Sulphur Diesel, and Based Diesel.

Source: Ministry of Energy's Department of Energy Business and Department of Alternative Energy Development and Efficiency

Table 4.3: Thailand's Historical Implementation of Mandatory Biodiesel Blend Rate

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
October 4, 2021	B6
November 1, 2021	B10 and voluntary use of B7 and B20
January 31, 2022	B7 and B20 during 2022-23 and B7 from 2024 onward
February 5, 2022	B5
October 10, 2022	B6.6

Figure 4.1: Retail Prices of Gasohol and Diesel and Crude Oil



Post forecasts biodiesel consumption to increase 19 percent in 2023 due to higher mandatory blending rates. The government kept the multiple blends of B7 and B20 but adjusted the ranges for biodiesel blending rates. The range was set between 6.6 and 7 percent for B7, 6.6 and 10 percent for regular high-speed diesel, and 6.6 and 20 percent for B20. The actual blend rate has been 6.6 percent since October 2022 as farm prices of oil palm have leveled off since June 2022 and declined by 37 percent in October 2022. The government estimated that the increase in mandatory blend rate from 5 percent to 7 percent will absorb approximately 30,000 metric tons per month of excess supplies of crude palm oil. The minimum blend rate of biodiesel depends on global palm oil prices and local supplies of palm oil available for cooking oil, which is the main priority of the government. The government extended the excise tax cut of 5 baht/liter (55 U.S. cent/gallon) until May 20, 2023. Without this excise tax subsidy, retail prices of diesel would be 40 baht/liter (\$4.39/gallon).

Table 4.4: Price Structure of Diesel in Bangkok in 2022 and 2023

April 19, 2022 (Baht/Liter)	High-Speed Diesel (B7)	High-Speed Diesel (B10)	High-Speed Diesel (B20)
Ex-Refinery Factory Price	34.2619	34.2619	34.261855
Excise Tax	3.2000	3.2000	3.2000
Municipal Tax	0.3200	0.3200	0.32
State Oil Fund	-10.4800	-10.4800	-10.48
Conservation Fund	0.0050	0.0050	0.005
Wholesale Price (WS)	27.3069	27.3069	27.306855
Value Added Tax (VAT)	1.9115	1.9115	1.91147985
WS+VAT	29.2183	29.2183	29.21833485
Marketing Margin	0.6745	0.6745	0.674453411
VAT	0.0472	0.0472	0.047211739
Retail Price	29.9400	29.94	29.94

Note: Exchange rate = 33.2447 baht/USD

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

April 19, 2023 (Baht/Liter)	High-Speed Diesel (B7)	High-Speed Diesel (B10)	High-Speed Diesel (B20)
Ex-Refinery Factory Price	22.5267	22.5267	22.5267
Excise Tax	1.3400	1.3400	1.3400
Municipal Tax	0.1340	0.1340	0.1340
State Oil Fund	4.8100	4.8100	4.8100
Conservation Fund	0.0500	0.0050	0.0500
Wholesale Price (WS)	28.8607	28.8607	28.8607
Value Added Tax (VAT)	2.0202	2.0202	2.0202
WS+VAT	30.8809	30.8809	30.8809
Marketing Margin	1.9244	1.9244	1.9244
VAT	0.1347	0.1347	0.1347
Retail Price	32.94	32.94	32.94

Note: Exchange rate = 34.5829 baht/USD

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

Table 4.5: Thailand's Fuel Use (2014 – 2023)

Calendar Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023(F)
Gasoline Total	8,567	9,714	10,680	11,030	11,373	11,791	11,712	10,763	11,180	11,680
Diesel Total	21,078	21,902	22,625	23,223	23,587	24,579	23,920	23,005	26,663	27,100
On-road	11,133	11,937	13,225	15,682	16,084	17,025	17,950	17,546	20,600	20,940
Agriculture	4,518	4,457	3,390	3,048	3,300	3,364	2,648	2,448	2,708	2,750
Construction & Mining	139	147	140	136	114	129	92	82	118	120
Shipping & Rail	244	261	270	301	315	306	283	299	366	370
Industry	5,044	5,100	5,600	4,056	3,774	3,755	2,947	2,630	2,871	2,920
Heating	-	-	-	-	-	-	-	-	-	-
Jet Fuel Total	5,513	6,034	6,468	6,743	7,096	7,153	2,745	1,792	3,337	6,170
Total Fuel Markets	35,158	37,650	39,773	40,996	42,056	43,523	38,377	35,560	40,100	44,950

Note: F = forecast. All fuel pool categories above contain biofuels where used.

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

Production

Palm oil-derived feedstocks such as CPO, refined bleached deodorized palm oil (RBDPO), palm stearin, and free fatty acids of palm oil (FFA) are the main feedstocks in biodiesel production. 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. Government mandates drive biodiesel production and are aimed at helping palm farmers. All palm oil feedstocks used for biodiesel are domestic since the government strictly controls the import of palm oil and its derived feedstocks. Blending of biodiesel among petroleum refineries is also strictly controlled and monitored to comply with mandatory biodiesel blending requirements. All domestic diesel for on-road uses is required to meet these blending requirements.

Biodiesel production in 2022 declined 16 percent from 2021 due to reduced mandatory blending rates caused by the surge in domestic palm oil prices in line with global palm oil prices. Oil palm production in 2022 increased 14 percent from 2021 (please see [TH2023-0021: Oilseeds and Product Annual, April 3, 2023](#)) due to increased harvesting areas and favorable weather conditions. The amount of CPO used in biodiesel production as a percentage of total CPO production declined to 27 percent in 2022 from 39 percent in 2021. Strong export demand for CPO, which increased 67 percent in 2022, absorbed excess supplies of locally produced CPO. Domestic demand for CPO from food processors and consumer product manufacturers increased only around one percent in 2022, as consumers partly substituted palm

oil with alternative vegetable oil that was relatively cheaper than palm oil. RBDPO and CPO are still the primary feedstocks for biodiesel production, accounting for around 72 percent of total feedstocks, followed by palm stearin and FFA, which accounted for 21 percent and 7 percent, respectively. There are 15 producers with an estimated total production capacity of 2,910 million liters per annum in 2022, up 13 percent from 13 producers with a production capacity of 2,580 million liters per annum in 2021 (Table 4.6).

Table 4.6: List of Operating Biodiesel Producers in Thailand

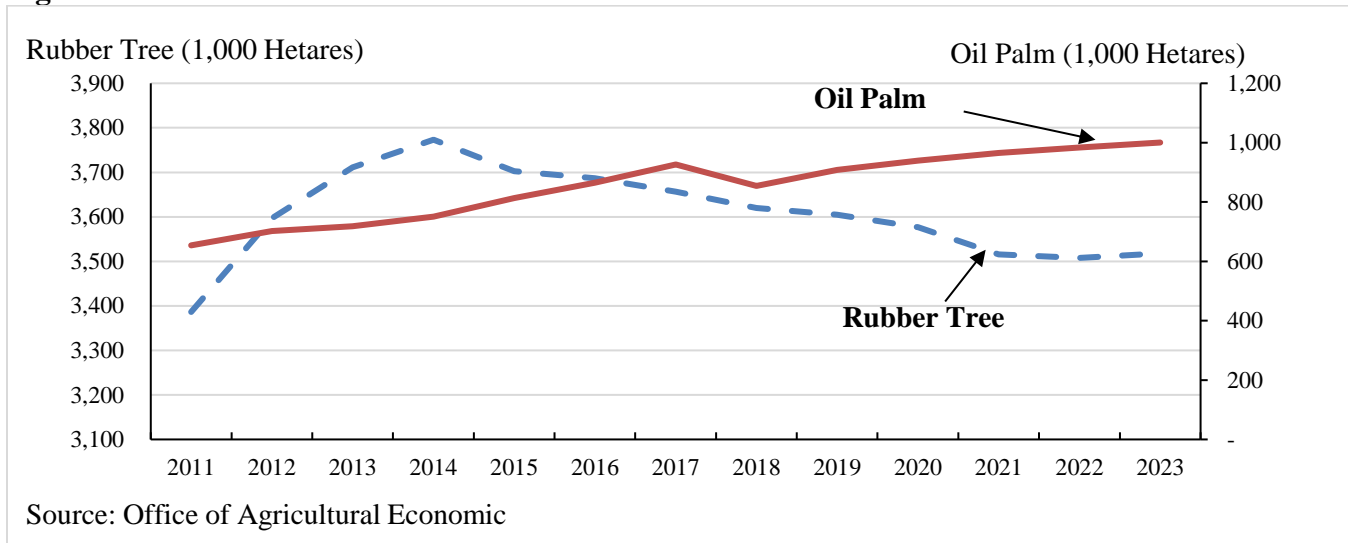
Company	2022 Nameplate Production Capacity (Million Liters/Year)	Feedstock Type
Pure Energy	265	Palm Stearin, CPO
Patum Vegetable Oil	460	CPO, RBDPO, Stearin
GI Green Power 1/	70	CPO, RBDPO, Stearin
A.I. Energy	165	Palm Stearin
Veera Suwan	65	Palm Stearin, RBDPO
Global Green Chemical	520	CPO, RBDPO
New Biodiesel	330	CPO, RBDPO, Stearin, FFA
Absolute Power P	100	CPO, RBDPO, Stearin
BBGI (Bangchak Biofuel)	280	CPO, Stearin
PPP Green Complex	150	RBDPO, Stearin
Bio Synergy	10	CPO, used cooking oil
Trang Palm Oil	30	CPO, RBDPO, Stearin
Suksomboon Energy	135	CPO, RBDPO, Stearin
Circular Energy	180	CPO, RBDPO, Stearin
Thanachok Oil Light	90	CPO, used cooking oil
Total	2,910	

Note: 1/ originally called B. Grimm Green Power
Source: Department of Energy Business and FAS Estimates

Biodiesel production in the first quarter of 2023 increased to 428 million liters, up 20 percent from the same period last year with an increase in the mandatory blending rate from B5 to B6.6. The amount used in biodiesel production as a percentage of total CPO production remained unchanged at 27 percent like in the first quarter of 2022 due to strong CPO export demand, which increased 408 percent from the same period last year. Biodiesel derived from RBDPO or CPP reportedly remained unchanged at around 72 percent of total biodiesel production, followed by 21 percent from palm stearin, and 7 percent from FFA.

Posts expects biodiesel production to increase 19 percent in 2023 in line with the higher mandatory blending rates and growing diesel fuel demand. The Office of Agricultural Economics forecasts oil palm production to increase 4 percent in 2023 due mainly to acreage expansion at the expense of rubber plantations (Figure 4.2). Post expects the amount of CPO used in biodiesel production as a percentage of total CPO production in 2023 will be the same as in 2022 as export demand for CPO will likely remain strong for the rest of 2023.

Figure 4.2: Oil Palm and Rubber Plantation



Trade

Thailand’s biodiesel imports and exports are minimal and found by looking at biodiesel (adjusted to B100 equivalent) traded under HTS codes 3826.00 and 2710.20. Thailand restricts imports of biodiesel (B100 equivalent), which have remained marginal in 2022. Exports of biodiesel (B100 equivalent) totaled 9 million liters in 2022, up 29 percent from 2021. Post forecasts they will further increase to 10 million liters 2022, which is still marginal compared to total biodiesel production.

V. Advanced Biofuels

The new AEDP 2022 aims to promote commercial SAF to blend with jet fuel, beginning with a 1 percent blending rate in 2025. The target blending rate is set at 5 percent by 2034, based on available supplies of feedstocks, which will consist of used cooking oil and ethanol. The first commercial SAF production will be a used cooking oil based SAF that a Thai refinery Bangchak Corporation Public Company Limited will commercialize for international aviation in the last quarter of 2024 with a daily production capacity of one million liters. However, the government anticipates a limited supply of used cooking oil for SAF production that meets ICAO’s standards, totaling around 58,000 metric tons and able to produce around 34 million liters of SAF. The alternative feedstocks for SAF production will be ethanol. The Thai government expects the ethanol based SAF to be commercialized in the following years when SAF blending rates increase to 2-5 percent. Thailand has a commitment with the ICAO’s Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to blend SAF with jet fuel by January 1, 2027, to help achieve carbon neutrality by 2050 and net zero emission by 2065.

The new AEDP 2022 will likely remove the production target for pyrolysis oil (also known as bio-oil or biocrude), which was set at 194 million liters per annum by 2037 in the AEDP 2018 due to less potential for commercialization. Also, the development of second-generation biofuels from biomass and third-generation biofuels from algae are still only at the research phase at universities and not close to commercialization. In addition, there has been no progress in the commercialization of other types of advanced biofuels in Thailand, and weaker global prices for petroleum products and lowered biofuel use

targets for 2037 further dims the potential for progress. 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 the removal of subsidies 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.

VI. 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 3.1) 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/distribution 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 the Thai Customs Department. All data in the Biodiesel PS&D (Table 4.1) 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 percent 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 percent in past years.

End of report.

Attachments:

No Attachments