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Report Highlights:

Thailand doubled its target to reduce greenhouse gas emissions in COP26. The Thai government has yet to finalize the new biofuel consumption targets. Biofuel consumption in 2021 and 2022 is still far below current targets due to the prolonged outbreak of COVID-19 and the slow economic recovery after the pandemic caused by Russia's invasion of Ukraine.

I. Executive Summary

Thailand doubled its target to reduce greenhouse gas emissions by 282 million tons of carbon dioxide (CO₂) equivalent (MTCO₂) in energy and transportation sector by 2050 with an objective to reach carbon neutrality in 2050 and net zero emissions by 2065. The Ministry of Energy anticipates finalizing the new National Energy Plan (NEP 2022), which will review biofuel consumption targets set in the 2018 Alternative Energy Development Plan (AEDP 2018), by the end of 2022.

Biofuel consumption in 2021 declined to 3,017 million liters, down 10 percent from 2020. The third wave of COVID-19 in mid-2021 slowed economic recovery and reduce gasohol and diesel fuel consumption. The Thai government reduced the biodiesel mandatory blending rate below B10 in October 2021 in response. Government lockdown measures also reduced fuel ethanol consumption in 2021 by 9 percent from 2020. In addition, the government postponed the plan to terminate octane 91 E10 and encourage the use of E20 for another two years or until the end of 2022. Biodiesel consumption declined 10 percent in 2021, which was to a greater degree than shrinking diesel fuel demand as the government also began to reduce mandatory blending rate below B10 in October 2021. The Thai government implemented these measures to keep retail prices of diesel fuel below 30 baht/liter (\$3.33/gallon) to help ease the impact of high energy prices on transport costs and production costs of consumer goods while prices of B100 and crude oil were under upward pressure.

Posts forecasts that gasohol and diesel fuel demand in 2022 will increase 11-12 percent, returning to pre-COVID-19 levels, while biofuel consumption will further decline 11 percent due to reduced biodiesel demand. Post expects that Biodiesel consumption will decline 1,240 million liters, down 26 percent from 2021, despite an 11 percent increase in diesel fuel demand in 2022. The government kept the mandatory blending rate as low as B5 together with a reduction in excise tax until the end of June 2022 to help ease the impact of high energy prices on transport costs and production costs of consumer goods. The Thai government could reduce the minimum blend rate of biodiesel to B3, depending on palm oil prices and local supplies of palm oil available for cooking oil purposes, which is the main priority of the government. Post forecasts that the expected economic recovery in the remainder of 2022 will increase ethanol consumption around 8 percent in line with gasohol consumption.

II. Policy and Programs

Thailand aimed to reach carbon neutrality in 2050 and net zero emissions by 2065 in the 26th World Leaders Summit of the United Nations Framework Convention on Climate Change Conference of the Parties (COP26) in November 2021. One of the targets is to reduce greenhouse gas emissions by 282 MTCO₂ in energy and transportation sector by 2050. This is a 40 percent reduction in CO₂ emission from 2015 (base year). This new target more than doubled the initial target of 110-140 million metric tons of CO₂ (20-25 percent of 2015 emissions) by 2030 to which Thailand committed at the 2015 Paris Climate Conference. Thailand then set the target to reduce CO₂ emissions in the energy and transportation sectors by 113 MTCO₂ by 2035 in its Nationally Determined Contribution (NDC) roadmap, which was endorsed in October 2015. 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 with the United Nation Framework Convention on Climate Change (UNFCCC). The first phase to reduce GHG emission is known as the Nationally Appropriate Mitigation Action (NAMA), which aims

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 National Energy Plan in 2015 (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 National Energy Plan includes 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 government finalized all master plans except for the ODP, which it delayed until it has finalized the new national plan (NEP 2022). The ODP will be crucial in the success of the national energy plan. The ODP will focus on reducing GHG emissions through ethanol consumption and lowering PM 2.5 particles by requiring Euro 5 standards for biodiesel production.

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 target 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 11 million rai (1.7 million hectares) with an average yield of 6-7 metric tons per rai (38-44 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 price pressure on global crude oil prices and the global trade disruption on sunflower oil from Russia's invasion of Ukraine in February 2022 have hindered the growth potential 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 ethanol consumption target in the AEDP 2018 is 2,700 million liters in 2037, down 34 percent from the 2015 target of 4,100 million liters. The government has yet to finalize the new ethanol consumption target in the NEP 2022 by the end of 2022. The lowered target is in anticipation of limited local 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 increased availability of passenger and commercial EVs and the operation of double-track railways, which are under construction. The government expects ethanol consumption will decelerate in 2025 when the number of EVs on the road reaches the target in the AEDP 2018. 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 million tons CO₂ 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 agreed on March 24, 2021, to increase the number of EVs on the road and local production to 1.05 million by 2025, together with the development of supporting infrastructure. 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. The Department Land Transport reported that there were 5,889 new EVs

registered in 2021, up significantly from 2,999 units in 2020. However, they were still less than one 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 from January 1, 2020 to December 31, 2022, 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 (\$2,035 – 4,360) 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 zero-emission vehicles of all types.

Table 2.1: Thailand’s EVs Targets

Year	Production Target (million)	Use Target (million)
2025	1.05	1.05
2030	6.22	5.41
2035	18.41	15.58

Source: National New Generation Vehicle Committee

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 classes 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 Thai government lowered the biodiesel consumption target to 2,900 million liters by 2037 under the AEDP 2018, down 43 percent from the initial target of 5.1 billion in the old AEDP. 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 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 (\$3.33/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 matured oil palm acreage continues growing, reaching around 6.1 million rai (1.0 million hectares) in 2021. 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 in the process of 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 B7 and B10 biodiesels produced according to the Euro 5 standard currently account for only around one percent of 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% 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 Demand for Ethanol Used as Fuel and Other Industrial Chemicals

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks	22	42	40	37	30	54	31	38	33	14
Fuel Begin Stocks	20	21	26	21	17	40	27	33	29	10
Production	1,048	1,070	1,190	1,290	1,480	1,500	1,640	1,500	1,349	1,484
Fuel Production	950	1,058	1,174	1,276	1,461	1,485	1,619	1,478	1,326	1,460
Imports	5	11	11	13	12	12	12	16	22	23
Fuel Imports	0	0	0	0	0	0	0	0	0	0
Exports	64	5	0	0	0	0	0	0	0	0
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	969	1,078	1,204	1,310	1,468	1,535	1,645	1,521	1,390	1,499
Fuel Consumption	949	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,452
Ending Stocks	42	40	37	30	54	31	38	33	14	22
Fuel Ending Stocks	21	26	21	17	40	27	33	29	10	18
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	21	26	26	26	26	26	26
Nameplate Capacity	1,307	1,472	1,472	1,472	1,875	1,910	1,950	1,950	1,950	1,950
Capacity Use (%)	72.7%	71.9%	79.8%	86.7%	77.9%	77.7%	83.1%	75.8%	68.0%	74.9%
Co-product Production (1,000 MT)										
Bagasse	209	243	252	216	261	262	292	234	248	294
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	760	882	915	787	949	953	1,063	850	875	1,070
Molasses	2,615	2,895	3,165	3,067	3,617	4,075	4,550	3,590	3,172	3,545
Cassava	1,670	1,864	2,166	3,014	3,272	2,729	2,781	3,462	3,127	3,310
Market Penetration (Million Liters)										
Fuel Ethanol Use	949	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,452
Gasoline Pool 1/	8,233	8,567	9,714	10,680	11,029	11,373	11,791	11,712	10,736	12,100
Blend Rate (%)	11.5%	12.3%	12.1%	12.0%	13.0%	13.2%	13.7%	12.7%	12.5%	12.0%

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).
- 2022 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 2021 totaled 1,353 million liters, down 9 percent from 2020 due to reduced gasohol demand, which declined at the same pace. Government lockdown measures to control the third wave of the COVID-19 outbreak (Table 3.2) reduced demand for gasohol. Also, the government postponed the plan to terminate the sale of octane 91 E10 and encourage the use of E20 until the end of

2022. Gasohol consumption totaled 11,354 million liters, of which octane 95 E10 accounted for 52 percent of total gasohol demand, followed by octane 91 E10 and E20, which respectively accounted for 24 and 20 percent of total gasohol demand. Consumption of Octane 91 E10 in 2021 declined to a greater degree at 16 percent than that of Octane 95 E20, which fell 3 percent, as the government reduced the subsidy on the sale of octane 91 E10 in order to keep retail prices of octane 91 E10 closer to octane 95 E10 to encourage consumers to use higher octane gasoline (octane 95 E10) or shift to E20 while the termination of octane 91 E10 was delayed (Table 3.3). Consumption of E85, which accounted for 3 percent of total gasohol consumption, declined 14 percent in 2021 due to limited numbers of gas station having E85 available for consumers as 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) (please see [TH2020-0124: Biofuels Annual 2020, September 11, 2020](#)). Consumption of E20 in 2021 also declined 12 percent from 2020 due to government lockdown measures.

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

Type of Gasoline	2017	2018	2019	2020	2021	January - March		
						2021	2022	% Change
Gasoline	508	437	388	392	408	98	97	-1.4
Regular (octane 91)	57	39	41	101	167	33	45	36.9
Premium (octane 95)	451	398	347	291	241	65	52	-20.7
Gasohol	10,521	10,936	11,403	11,320	10,354	2,732	2,588	-5.3
- Gasohol E10 Octane 91	3,885	3,638	3,485	3,008	2,518	675	619	-8.3
- Gasohol E10 Octane 95	4,350	4,739	5,068	5,588	5,437	1,416	1,369	-3.4
- Gasohol E20	1,903	2,122	2,379	2,394	2,114	570	513	-10.0
- Gasohol E85	383	437	471	331	286	70	86	22.7
Total	11,029	11,373	11,791	11,712	10,763	2,830	2,684	-5.2

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 2021 and 2022

April 19, 2021 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	15.3629	15.9733	15.5851	16.7120	23.0227
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	6.5800	0.6200	0.6200	-2.2800	-7.1300
Conservation Fund	0.1000	0.1000	0.1000	0.1000	0.1000
Wholesale Price (WS)	29.1929	23.1283	22.7401	20.2520	17.0652
Value Added Tax (VAT)	2.0435	1.6190	1.5918	1.4176	1.1946
WS+VAT	31.2364	24.7473	24.3319	21.6697	18.2598
Marketing Margin	2.6389	1.7782	1.9141	3.2433	2.6451
VAT	0.1847	0.1245	0.1340	0.2270	0.1852
Retail Price	34.06	26.65	26.38	25.14	21.09

Note: Exchange rate = 30.7836 baht/USD

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

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

Ethanol consumption in the first quarter of 2022 totaled 348 million liters, down 2 percent from the same period last year due Russia's invasion of Ukraine, which undermined an economic recovery from COVID-19 outbreak. The government reported that the Thai economic growth in the first quarter of 2022 was lower than expected at 2.2 percent from the same period last year. The reduced ethanol consumption growth was to a lesser degree than the reduction in gasohol consumption, which declined around 5 percent from the same period last year as E85 consumption increased significantly due to relatively cheaper prices of E85 by 18-20 percent than E10 and E20 amid the surge in gasohol prices (Table 3.3). Meanwhile, E10 and E20 consumption declined 5 percent and 10 percent, respectively, as some consumers shifted to liquified petroleum gas (LPG) for which demand increased by 11 percent as retail prices of LPG were still relatively cheaper than gasoline.

Post forecast ethanol consumption to increase around 8 percent in 2022 in line with gasohol consumption as the economy recovers in the second half of 2022. The Bank of Thailand forecasts that the Thai economy will grow by 3 percent in 2022 after a slow recovery of 1.6 percent in 2021. The government will gradually reduce subsidies on E85, beginning in May 2022, according to the State Oil Fund Act, which will slowdown E85 consumption for the second half of 2022 and offset the surge in E85 consumption in the first quarter of 2022. The Ministry of Energy expects the price difference between E85 and E20 to converge by the end of May 2022.

Production

Fuel ethanol production totaled 1,326 million liters in 2021, down 10 percent from 2020 due to reduced gasohol demand caused by the prolonged outbreak of COVID-19. Molasses-based ethanol production in 2021 further declined 12 percent from 2020 to 761 million liters, using 3.2 million metric tons of molasses. Molasses-based ethanol accounted for 57 percent of total ethanol production in 2021. This is a slight reduction from 58 percent in 2020 as ethanol plants used imported molasses to maintain their molasses-based ethanol production line in 2021. Supplies of locally produced molasses declined 18 percent in 2021 from 2020 to 2.8 million metric tons. Import demand for molasses doubled in 2021 to 588,239 metric tons, mainly from India. Cassava-based ethanol production totaled 500 million liters in 2021, down 10 percent from 2020 with an increase in market share from 31 percent in 2020 to 38 percent in 2021.

Fuel ethanol production in the first quarter of 2022 totaled 415 million liters, down 5 percent from the same period last year in line with reduced gasohol demand. Molasses-based ethanol accounted for 61 percent of total ethanol production in the first quarter of 2022, up from 57 percent in 2021 due to increased supplies of locally produced molasses. Meanwhile, cassava-based ethanol accounted for 33 percent of total ethanol production in the first quarter of 2022, down from 38 percent in 2021. Sugarcane-based ethanol accounted for 6 percent of total ethanol production in the first quarter of 2022, up slightly from 5 percent in 2021. Posts expects that molasses will be the primary feedstocks for ethanol production in the remainder of 2022 due to the gradual recovery in sugarcane production in the Marketing Year (MY)2021/22 from two consecutive years of severe drought during MY2019/20 and MY2020/21.

Post forecasts fuel ethanol production in 2022 to increase to 1,460 million liters, up 10 percent from 2021 and molasses-based ethanol to increase to 850 million liters, up 12 percent from 2021. Molasses-based ethanol will account for around 58 percent of total ethanol production in 2022, using approximately 3.5 million metric tons of molasses. This is still lower than the levels prior to two years of severe drought when molasses-based ethanol production accounted for 67 of total ethanol production in 2019. The increased MY2021/22 sugarcane production is still far below MY2018/19's production levels as acreage expansion was limited after farmers shifted to more drought-tolerant crops like cassava in the past years as the returns from cassava was relatively higher than sugarcane (please see [TH2022-0030: Sugar Annual, April 5, 2022](#)). Posts expects cassava-based ethanol to increase to 530 million liters, up 6 percent from 2021, accounting for 36 percent of ethanol production and using approximately 3.3 million metric tons of cassava root. Post also expects sugarcane-based ethanol to increase to 80 million liters, up 22 percent from 2021, accounting for around 5 percent of total ethanol production and using approximately 1.1 million tons of sugarcane. Thailand still has 26 ethanol plants with a total production capacity of around 1,950 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. All the ethanol exports were for industrial uses and mainly went to Vietnam. The government extended this non-fuel ethanol export approval until 2022. However, ethanol exports in the first quarter of 2022 were still marginal at 10,085 liters but increased significantly from 88 liters in the same period last year.

Ethanol imports in 2021 totaled 22 million liters, mainly for non-fuel uses. This is a 38 percent increase from 2020 due to tight supplies of locally produced ethanol. 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	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 ^f
Beginning Stocks	33	20	18	24	20	50	50	86	56	35
Production	1,080	1,170	1,250	1,240	1,427	1,567	1,845	1,843	1,658	1,330
Imports	6	12	2	5	2	2	2	1	0	0
Exports	49	4	3	16	4	1	21	3	7	65
Consumption	1,050	1,180	1,243	1,233	1,395	1,568	1,790	1,871	1,672	1,240
Ending Stocks	20	18	24	20	50	50	86	56	35	60
Balance Check	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)										
Number of Biorefineries	10	10	12	12	12	13	12	13	13	13
Nameplate Capacity	1,600	1,600	2,060	2,060	2,060	2,310	2,445	2,580	2,580	2,580
Capacity Use (%)	67.5%	73.1%	60.7%	60.2%	69.3%	67.8%	75.5%	71.4%	64.3%	51.6%
Feedstock Use (1,000 MT)										
RBDPO/CPO	775	825	857	838	965	1,060	1,267	1,264	1,138	915
Stearin	210	235	250	260	286	328	370	370	332	265
FFA of Palm Oil	25	55	83	82	109	102	118	117	107	85
Used Cooking Oil	1	2	2	2	3	4	5	4	3	5
Market Penetration (Million Liters)										
Biodiesel, on-road use	640	623	680	741	941	1,045	1,320	1,475	1,280	970
Diesel Pool, on-road use 1/ Blend Rate (%)	12,301 5.2%	11,133 5.6%	11,937 5.7%	13,225 5.6%	15,682 6.0%	16,084 6.5%	17,025 7.8%	17,950 8.2%	17,546 7.3%	19,450 5.0%
Diesel Pool, total 1/	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,920	23,005	25,500

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

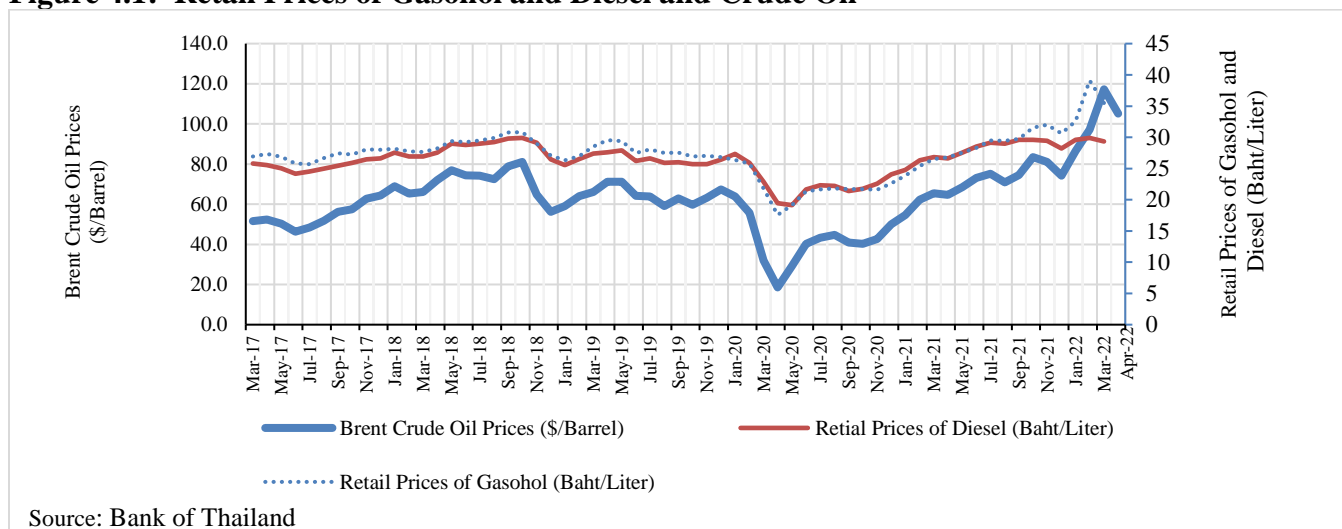
Biodiesel consumption in 2021 totaled 1,675 million liters, down 10 percent from 2020 in line with reduced diesel fuel demand. Government lockdown measures in mid-2021 reduced diesel fuel demand by 4 percent from the previous year (Table 4.2). The upward price pressure on palm oil prices and the surge in crude oil prices in October 2021 to a three-year record of \$81.4/barrel prompted the government to reduce the B10 mandatory blend rate of biodiesel in diesel fuel to keep retail prices of diesel at 30 baht/liter (\$3.33/gallon) (Figure 4.1).

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

Types of Diesel Fuel	2017	2018	2019	2020	2021	January - March		% Change
						2021	2022	
B7	22,687	23,089	21,852	16,033	14,543	3,599	5,826	61.9
B10	-	-	34	5,935	7,028	2,155	314	-85.4
B20	-	19	1,631	1,269	360	94	19	-79.4
Other	536	478	1,062	683	1,075	203	704	246.9
Total	23,223	23,587	24,579	23,920	23,005	6,050	6,863	13.4

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

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



Although diesel fuel consumption in the first quarter of 2022 increased 13 percent from the same period last year, biodiesel demand declined 22 percent from 456 million liters in the same period last year due to the reduction in the mandatory blending rate from B10 to B5 in 2021. The disruption of sunflower oil supplies and trade from Russia’s invasion of Ukraine increased biodiesel (B100) prices by around 50 percent from the same period last year and doubled the prices of diesel fuel. The new mandatory blend rate will have multiple blend rates of B7 and B20 (specifically for large trucks) between 2022 and 2023 (Table 4.3). Eventually, B7 will be the only mandatory blend rate for diesel fuel from 2024 onward. However, the government set the range of 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 between February 5 - March 31, 2022. The cabinet also approved an excise tax cut by 3 baht per liter (33 U.S. cent/gallon) for three months between February 18 – May 20, 2022.

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

Posts forecasts biodiesel consumption to decline to 1,240 million liters in 2022, down 26 percent from 2021, despite an 11 percent increase in diesel fuel demand in 2022 (Table 4.5). The government extended the mandatory blending rate of B5 together with the reduction in excise tax until the end of June 2022. The minimum blend rate of biodiesel could be reduced to 3 percent, depending on global palm oil prices and local supplies of palm oil available for cooking oil, which is the main priority of the government. On May 17, 2022, the Cabinet also approved a further reduction in the excise tax from 3 baht per liter (33 U.S. cent/gallon) to 5 baht per liter (55 U.S. cent/gallon) and extended the reduction until July 20, 2022. However, the government began reducing the State Oil Fund’s subsidies on May 1, 2022, which increased to around 10 baht per liter (\$1.1/gallon) in April 2020 to keep retail prices of diesel fuel at 30 baht per liters (\$3.33/gallon) (Table 4.4). The government will let retail prices of diesel fuel gradually increase until they reach 35 baht per liter (\$3.85/gallon) or the subsidies decrease by 50 percent from the subsidy levels in April 2022 to limit the burden of the State Oil Fund.

Table 4.4: Price Structure of Diesel in Bangkok in 2020 and 2021

April 19, 2021 (Baht/Liter)	High-Speed Diesel (B7)	High-Speed Diesel (B10)	High-Speed Diesel (B20)
Ex-Refinery Factory Price	6.9768	7.4083	9.3701
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)	14.6658	11.3883	10.9784
Value Added Tax (VAT)	1.0266	0.7972	0.7685
WS+VAT	15.6924	12.1855	11.7469
Marketing Margin	1.5866	2.0603	2.2366
VAT	0.1111	0.1442	0.1566
Retail Price	17.3900	14.39	14.14

Note: Exchange rate = 32.6002 baht/USD

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

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

Table 4.5: Thailand's Fuel Use (2013 – 2022)

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 (F)
Gasoline Total	8,233	8,567	9,714	10,680	11,030	11,373	11,791	11,712	10,763	12,100
Diesel Total	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,920	23,005	25,500
On-road	12,301	11,133	11,937	13,225	15,682	16,084	17,025	17,950	17,546	19,450
Agriculture	4,439	4,518	4,457	3,390	3,048	3,300	3,364	2,648	2,448	2,710
Construction & Mining	150	139	147	140	136	114	129	92	82	90
Shipping & Rail	270	244	261	270	301	315	306	283	299	330
Industry	3,672	5,044	5,100	5,600	4,056	3,774	3,755	2,947	2,630	2,919
Heating	-	-	-	-	-	-	-	-	-	-
Jet Fuel Total	5,562	5,513	6,034	6,468	6,743	7,096	7,153	2,745	1,792	2,500
Total Fuel Markets	34,627	35,158	37,650	39,773	40,996	42,056	43,523	38,377	35,560	40,100

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 2021 declined to 1,658 million liters, down 10 percent from 2020 in line with reduced diesel fuel consumption. The reduced biodiesel production was to a lesser degree than overall diesel production which declined 16 percent from 2020. The government increased the mandatory blending rate to B10 between October 2020 and September 2021 from B7, which had been the mandatory blending rate since May 2017. While the amount of CPO used in biodiesel production as a percentage of total CPO production declined to 39 percent in 2021 from 51 percent in 2020, food processors and consumer product manufacturers absorbed excess supplies of locally produced CPO, which increased by 6 percent in 2021, driven by strong export demand of cooking 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

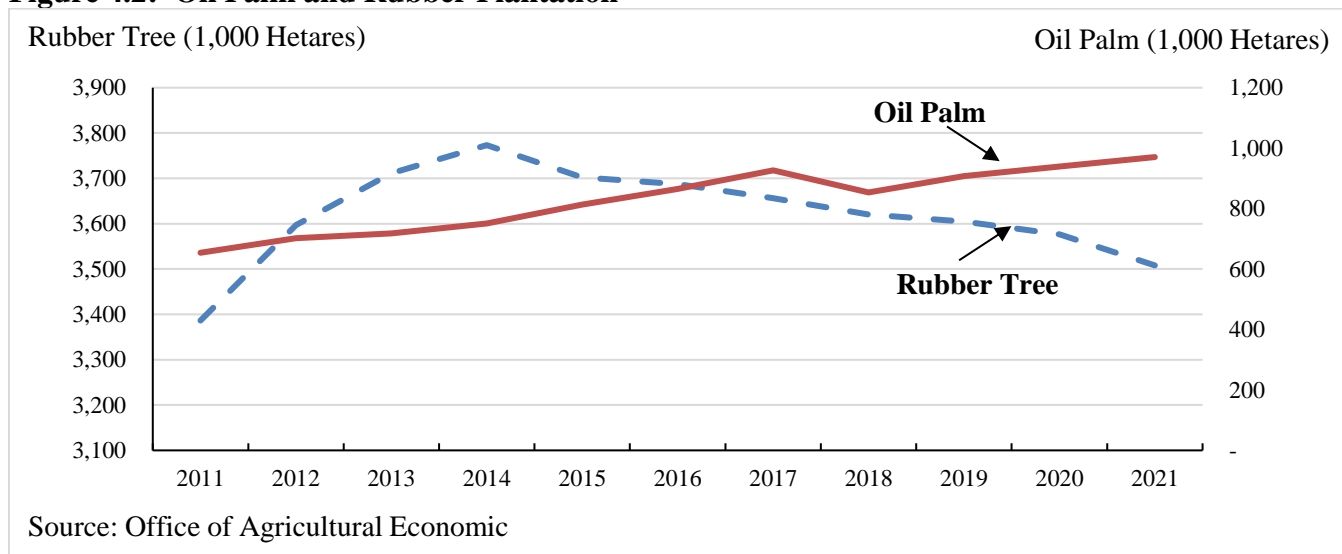
	Company	2020 Nameplate Production Capacity (Million Liters/Year)	Feedstock Type
1	Pure Energy	265	Palm Stearin, CPO
2	Patum Vegetable Oil	460	CPO, RBDPO, Stearin
3	GI Green Power 1/2	70	CPO, RBDPO, Stearin
4	A.I. Energy	165	Palm Stearin
5	Veera Suwan	65	Palm Stearin, RBDPO
6	Global Green Chemical	520	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
14	Circular Energy	180	CPO, RBDPO, Stearin
15	Thanachok Oil Light	90	CPO, used cooking oil
	Total	2,910	

Note: 1/2 originally called B. Grimm Green Power
Source: Department of Energy Business and FAS Estimates

Biodiesel production in the first quarter of 2022 declined to 335 million liters, a 19 percent reduction from the same period last year despite a 6 percent increase in diesel fuel production due to the reduced mandatory blending rate from B10 to B5 in 2021. The amount of CPO used in biodiesel production as a percentage of total CPO production further declined to 38 percent in the first quarter of 2022. 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 decline to 1,330 million liters in 2022, a 20 percent reduction from 2021 due to reduced mandatory blending rate, even though oil palm production will increase 6 percent in 2022 from 2021 (please see [TH2022-0027: Oilseeds and Product Annual, April 6, 2022](#)), and diesel fuel demand will increase 11 percent in 2022. Oil palm tree acreage expansion at the expense of rubber plantation is the main driver for increased palm oil production in MY2021/22 (Figure 4.2). Post expects the amount of CPO used in biodiesel production as a percentage of total CPO production in 2022 to further decline from 39 percent in 2021.

Figure 4.2: Oil Palm and Rubber Plantation



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. Thailand restricts imports of biodiesel (B100 equivalent), which have remained at two million liters since 2017. Exports of biodiesel (B100 equivalent) doubled to 7 million liters in 2021, and Post forecasts they will further increase significantly to around 60 million liters in 2022, which is still marginal compared to total biodiesel production.

V. Advanced Biofuels

The AEDP 2018 maintained a production objective for pyrolysis oil (also known as bio-oil or biocrude) of 194 million liters per annum by 2037. 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 Ayutthaya Clean Energy’s electricity generation plant, which has a

capacity of 3 megawatts (MW), will use all pyrolysis oil production from the plant. The development of biojet fuel production in Thailand is also possible and likely to begin in 2024 after several years of technical and feasibility studies. However, the AEDP 2018 removed the production target for second and third generation biofuels, which was initially set at 10 kilotons of oil equivalent (ktoe) by 2036 in AEDP 2015. 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.

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 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 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% 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