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Report Highlights:

Thailand's newly proposed National Energy Plan (NEP) lowered the on-road biofuel consumption target to reflect the lower mandated blend rate for biodiesel and set a target for Sustainable Aviation Fuel (SAF) from 2026. Post forecasts biofuel consumption to increase by 5 percent in 2024 in line with a slight increase in E20 consumption and an increasing biodiesel blending rate. Thailand continues to base its biofuel targets on the projected supply of domestic feedstocks.

I. Executive Summary

The National Energy Policy Council (NEPC) announced intent to finalize the new National Energy Plan (known as NEP 2024) by September 2024. The NEP 2024 contains five master plans, including (a) the Oil Development Plan (ODP), which projects the overall fuel demand and greenhouse gas (GHG) emission targets in Thailand, and (b) the Alternative Energy Development Plan (AEDP) focused on reducing GHG emissions through the biofuel consumption target of 2,760 million liters by 2037, of which 675 million liters will be met through consumption of sustainable aviation fuel (SAF). Compared to the AEDP 2018 and the draft AEDP 2022, the AEDP 2024 lowers the 2037 consumption targets to 1,185 million liters of bioethanol and 900 million liters of biodiesel. The decrease in the AEDP 2024 on-road biofuel targets is due to the government's increased focus on electric vehicles (EVs), the rail transport system, declining E20 consumption and the elimination of the mandatory B10 blend rate for diesel.

Biofuel consumption in 2023 increased to 2,892 million liters, up 4 percent from 2022, due to increased biodiesel consumption. The growing biodiesel consumption offset a reduction in on-road bioethanol demand. The Ministry of Energy's Department of Energy Business reported that the mandatory biodiesel blend rate increased from 5 percent in 2022 to 6.6 percent in 2023 and boosted biodiesel demand despite a 6 percent reduction in the total 2023 diesel fuel demand. Meanwhile, 2023 ethanol consumption shrunk 9 percent despite a 3 percent increase in the total gasoline consumption. Since November 24, 2022, the Thai government reduced the price subsidy on E85, and E85 consumption fell by 81 percent from 2022 to 2023. The government aims to phase out E85 production in 2024.

Post forecasts biofuel consumption to grow to 3,030 million liters in 2024 or 5 percent over the 2023 level due to a growing demand for bioethanol and biodiesel. Ethanol consumption will likely increase by 3 percent as consumers may shift to E20 as the E10 Octane 91 subsidy ended on April 30, 2024, and the government aims to terminate the sales of E10 Octane 91 by 2025. Biodiesel consumption will likely increase by 6 percent in 2024 as the actual blend rate will approach the maximum blend rate of 7 percent to comply with the Euro 5 standard requirement in Bangkok from May 2024 and nation-wide from September 2024. The government established B7 as the primary blend rate in the market and B20 as the alternative biodiesel blend rate.

The AEDP 2024 also sets the SAF blend rate at 1 percent in 2026 and gradually reaching 8 percent by 2036 based on Thailand's projection of available domestic feedstock of used cooking oil (UCO) and molasses-derived ethanol. The government anticipates utilization of alcohol-to-jet (ATJ) SAF to be adopted when the SAF blend rate with jet fuel reaches 3-8 percent. Until that point, Thailand plans to rely on UCO as the primary feedstock for domestic SAF production.

II. Policy and Programs

The National Energy Policy Council (NEPC) chaired by the Prime Minister plans to implement the new NEP 2024 by September 2024 to support the government's goals of carbon neutrality in 2050 and net zero emissions by 2065 per Thailand's commitments at the 26th World Leaders Summit of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP26) in November 2021. The Thai government aims to reduce GHG emissions in the energy and transportation

sectors by 282 million metric tons of carbon dioxide ($MTCO_2$) by 2050. This target[1] represents a 40 percent reduction in CO_2 emissions from 2015 (base year).

The 2014 Nationally Appropriate Mitigation Action (NAMA) was the first phase of GHG emission reduction from the energy and transportation sectors. In 2020, the Thai government announced that Thailand had successfully cut GHG emissions by 57.84 $MTCO_2$ or 15.76 percent. The Nationally Determined Contribution (NDC) is the second phase to reduce GHG emissions within the UNFCCC. Thailand's 2022 NDC roadmap includes increasing renewable energy use in households, industry, and power generation; biofuel promotion; and improved efficiency in power generation, transportation, buildings, and industry. Thailand's 12th National Economic and Social Development Plan (2023 – 2027) aligns with the country's NDC.

The NEP 2024 consists of five master plans: the Alternative Energy Development Plan (AEDP 2024), the Power Development Plan (PDP 2024), the Energy Efficiency Development Plan (EEDP 2024), the Oil Development Plan (ODP 2024), and the Gas Development Plan (GDP 2024). The Ministry of Energy (MOE) will likely hold a public hearing on the new NEP 2024 in June 2024.

The ODP 2024 aims to reduce GHG emissions through bioethanol and biodiesel consumption in on-road and jet fuel. The new AEDP 2024 sets the biofuel consumption target at 2,760 million liters by 2037, which will consist of 1,185 million liters of ethanol, 900 million liters of biodiesel, and 675 million liters of SAF. Despite setting an additional consumption target for SAF, the AEDP 2024 biofuel target is lower than the previously discussed target in the draft AEDP 2022 due to the lower than expected E20 consumption and the removal of the B10 mandatory blending rate (please see TH2023-0034, Biofuel Annual, June 6, 2023). The AEDP 2024 biofuel consumption target is also below the AEDP 2018 target as the Thai government has shifted to promoting the use of EVs and the rail transport system over internal combustion engines.

The government promotes the use of gasohol (gasoline containing directly blended ethanol) through price incentives at the gas stations and an excise tax reduction for cars compatible with E20 and E85 gasohol. To increase biodiesel consumption, the government imposes a mandatory blending requirement for diesel used for transportation. There is no mandatory blending requirement for diesel used in industry and agriculture. Industry primarily uses fossil diesel in power generators. Between 2020 and 2023, the government reduced price subsidies on gasohol and biodiesel following the enactment of the State Oil Fund Act B.E. 2562 (2019), which aimed to control the financial liability of the State Oil Fund and limit government price subsidies to strictly fossil fuel, since the government already provides subsidies for biofuel feedstocks via domestic support programs. Since 2020, the government has reduced price subsidies on E85 and B20 to encourage gas stations to shift to E20 and B7.

The AEDP biofuel consumption targets are based on the government's projections of the domestic supply of molasses and cassava for ethanol production, and palm oil for biodiesel production. Thailand's complete reliance on the domestic feedstocks and exclusion of biofuel imports mean 1) weather-related feedstock shortages, a recurring problem in the palm oil industry, lower biofuel targets and/or exposure to price surges; 2) potentially falling short of long-term biofuel use goals and COP21 commitments; 3)

[1] At the 2015 Paris Climate Conference, Thailand set its initial target at 110-140 $MTCO_2$ (20-25 percent of 2015 GHG emissions) by 2030. Thailand's 2015 Nationally Determined Contribution (NDC) roadmap aimed to reduce CO_2 emissions in the energy and transportation sectors by 113 $MTCO_2$ by 2035.

higher GHG emissions from biofuels tied to direct land use changes to support certain feedstock production; and 4) higher consumer prices for ethanol-blended gasoline.

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, the actual biofuel consumption did not hit the annual AEDP 2018 targets[2] due to the COVID-19 outbreak and the resulting economic downturn. Ethanol and biodiesel consumption in 2021 totaled 1,345 million liters and 1,672 million liters, respectively.

The AEDP 2018 target for sugarcane acreage was 16 million rai (2.6 million hectares (ha)) by 2026. The AEDP 2018 target for the average cassava yield was 7 metric tons per rai (44 metric tons/ha) by 2026, and there was no cassava acreage target. The AEDP 2018 target for oil palm acreage was 10.20 million rai (1.63 million ha) by 2036. Domestic palm oil is the primary feedstock used in biodiesel production and other feedstocks (e.g., animal fats and used cooking oil (UCO)) play a marginal role in biodiesel production.

Crop yields and acreage for these feedstocks remain far below those required to meet the targets set in the AEDP 2018. Sugarcane acreage is currently at around 10 million rai (1.6 million ha) with an average yield of 9.2 metric tons per rai (58 MT/ha). According to the Ministry of Agriculture and Cooperatives (MOAC) Office of Agricultural Economics, the average yield of cassava is currently around 3.3 metric tons per rai (21 MT/ha). A general weakness in Thailand's reliance on domestic crude palm oil (CPO) production as the primary biodiesel feedstock is significant weather-related fluctuation in supply. In addition, the upward pressure on global crude oil prices and the disruption of the global trade in sunflower oil since Russia's February 2022 invasion of Ukraine and the crisis in the Red Sea since October 2023 have slowed the growth of biodiesel consumption.

Ethanol

The expected ethanol consumption target in the new AEDP 2024 is 1,185 million liters, down from previous targets in the draft AEDP 2022, AEDP 2018, and AEDP 2015. The MOE expects ethanol consumption to peak in 2027 – 2028 and gradually decline to 1,185 million liters by 2037. The government estimated that the annual ethanol consumption of around 1,290 million liters in 2023 contributed to 3.27 $MTCO_2$ equivalent.

Since 2019, the government has promoted EV production and established the National EV Policy Committee on February 7, 2020 (please see TH2020-0124: Biofuel Annual 2020, September 2020). In March 2021, the Committee proposed to increase the number of EVs on the road and expand domestic production to 1.05 million vehicles by 2025. The Committee also proposed a target of EVs representing 50 percent of all new car registrations by 2030. However, on February 15, 2022, the Cabinet approved the production target of zero-emission vehicles (ZEV) at 30 percent of the total domestic vehicle production by 2030. The ZEV production target is 725,000 ZEVs (i.e., 30 percent of total domestic vehicle production) with a use target of 440,000 ZEVs by 2030. The Department of Land Transport reported that the new EV registrations grew to 100,219 units in 2023 from 20,816 EVs registered in

[2] The AEDP 2018 ethanol and biodiesel consumption targets were already lower than AEDP 2015 targets of 4,100 and 5,100 billion liters, respectively.

2022. They represented about 3 percent of the total 2023 new vehicle registrations in Thailand, a 2 percent increase from 2022. The Board of Investment (BOI) and the Excise Tax Department are encouraging the automotive industry to make Thailand a regional hub for EV and parts production. The BOI granted EV manufacturers a tax incentive since 2017 and extended it until 2027 to encourage them to set up production facilities in Thailand. In addition, on February 22, 2022, the Cabinet agreed to cut the excise tax rates from 8 percent in 2022 to 2 percent in 2023 for passenger cars and eliminated the excise tax for pickup trucks in 2023. The Cabinet also approved (a) 70,000 - 150,000-Thai baht ($2,030 – $4,350) discounts on EVs purchased from 2017 through 2023, (b) 20-40 percent tariff reductions or even elimination on imported EVs, and (c) duty free imports of nine items of completely knocked down (CKD) EVs to support EV manufacturers and encourage domestic demand for EVs. On December 19, 2023, the Cabinet approved an extension of the subsidies of 20,000 – 100,000 baht ($578 – $2,892) on purchases of EVs, as well as tax incentive on the imports of EVs between 2024 - 2027.

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 determine the size of these pools. With the intention of making E20[3] the primary blend rate, the government aims to phase out the production of octane 91 E10 by 2026 and octane 95 E10 and E85 between 2023 and 2027. All passenger cars manufactured in Thailand since 2008 are compatible with E20.

Biodiesel

The new AEDP 2024 is likely to lower the biodiesel consumption target to 900 million liters by 2037, down from 1,570 million liters estimated in the draft AEDP 2022 due to the government's removal of B10 mandatory blending rate in response to automobile manufacturers supporting vehicles compatible[4] with B7. The concern about the volatility in domestic palm oil prices and supply, the retail prices of diesel fuel, and the burden on the State Oil Fund drove the reduction in the biodiesel consumption target in the AEDP 2024. The government continues to impose mandatory blending of biodiesel and diesel on 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 to make B10 the primary diesel fuel after introducing it in 2019. 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 when prices of B100 and crude oil spiked. 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 extended the excise tax cut by 5 baht/liters (55 U.S. cent/gallon) through 2022 and until July 20, 2023. Then, the government announced on September 18, 2023, the excise tax cut

[3] According to AEDP 2024, the government aims to have gas stations offer only two gasoline-related options by 2037: premium gasoline (octane 95 blended with ETBE) and E20 gasohol.

[4] Thailand has mandated a shift to a Euro 5 standard for diesel cars to limit particulate matter (PM) emissions to 0.005 grams per kilometer. Thai vehicle manufacturers do not view Euro 5 B10 engines as economically viable.

from the normal rate of 5.99 baht per liter (65 U.S. cent/gallon) to 3.67 baht per liter (40 U.S. cent/gallon) between September 20, 2023, and December 31, 2023, to lower the cost of living of consumers. The Cabinet approved on January 16, 2024, an extension of the excise tax reduction of 1 baht/liters (11 U.S. cent/gallon) between January 20 and April 19, 2024, to curb the retail price of biodiesel at 30 baht/liters ($3.28/gallon). Due to concern about the debt burden on the State Oil Fund, the government did not extend the excise tax reduction in May 2024 and the retail prices of diesel fuel exceeded 30 baht/liter ($3.28/gallon). In April 2024, the government still subsidized retail prices of diesel fuel around 4.77 baht per liter (44 U.S. cent/gallon) through the State Oil Fund (Table 4.5).

The matured oil palm acreage continues growing, reaching 6.4 million rai (1.0 million ha) in 2024. The government's oil palm acreage target is 10.2 million rai (1.63 million ha) by 2037. MOAC estimates that the production of palm fresh fruit bunches (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 expect to transition their facilities to full compliance with the Euro 5 standard in Bangkok by May 2024 and nationally by September 2024. The MOE estimated in 2021 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 biodiesel imports to protect domestic oil palm growers. Importers must obtain import permits from the MOE, which claims to issue import permits based on need and has never issued an import permit for biodiesel. 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	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024f**
Beginning Stocks	40	37	30	54	31	38	33	14	25	38
Fuel Begin Stocks	26	21	17	40	27	33	29	10	23	39
Production	1,190	1,290	1,480	1,500	1,640	1,500	1,349	1,448	1,330	1,375
Fuel Production	1,174	1,276	1,461	1,485	1,619	1,478	1,326	1,424	1,306	1,340
Imports	11	13	12	12	12	16	22	13	13	12
Fuel Imports	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	3	3
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	1,204	1,310	1,468	1,535	1,645	1,521	1,390	1,450	1,327	1,370
Fuel Consumption	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,411	1,290	1,330
Ending Stocks	37	30	54	31	38	33	14	25	38	52
Fuel Ending Stocks	21	17	40	27	33	29	10	23	39	49
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	26	26	26	26	26	26	27	27
Nameplate Capacity	1,472	1,472	1,875	1,910	1,950	1,950	1,950	1,950	1,970	2,030
Capacity Use (%)	79.8%	86.7%	77.9%	77.7%	83.1%	75.8%	68.0%	73.0%	66.3%	66.0%
Co-product Production (1,000 MT)										
Bagasse	252	216	261	262	292	234	248	211	272	245
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	915	787	949	953	1,063	850	875	768	990	890
Molasses	3,165	3,067	3,617	4,075	4,550	3,590	3,172	3,454	3,324	3,480
Cassava	2,166	3,014	3,272	2,729	2,781	3,462	3,127	3,317	2,722	2,745
Market Penetration (Million Liters)										
Fuel Ethanol Use	1,179	1,280	1,438	1,498	1,613	1,482	1,345	1,411	1,290	1,330
Gasoline Pool 1/	9,714	10,680	11,029	11,373	11,791	11,712	10,736	11,180	11,559	11,760
Blend Rate (%)	12.1%	12.0%	13.0%	13.2%	13.7%	12.7%	12.5%	12.6%	11.2%	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).
- 2024 figures are FAS estimates.

Sources: 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 2023 declined 9 percent from 2022 despite a 3 percent increase in total gasoline consumption as E85 consumption shrunk by 81 percent after the government stopped subsidizing E85 in November 2022 (Table 3.2). Without the subsidy, consumers shifted to E20 as retail prices of E82 were more expensive than E20 in 2023. (Table 3.3). Also, the number of gas stations offering E85 to consumers was limited (please see TH2022-0038: Biofuel Annual 2022, June 14, 2022). According to the Department of Energy Business (DEB), the number of gas stations having E85 available for consumer gradually declined from 1,200 stations in January 2023 to 778 stations in December 2023. Meanwhile, E20 gas stations gradually increased from 5,518 in January 2023 to 5,787 stations in December 2023. However, the 7 percent increase in E20 consumption did not offset the reduction in E85 demand.

Table 3.2: Thailand's Gasoline and Gasohol Consumption

Unit: Million Liters

Type of Gasoline	2019	2020	2021	2022	2023	January - March 2023	January - March 2024	January - March % Change
Gasoline	**388**	**392**	**408**	**364**	**282**	**80**	**70**	**-12.6**
Regular (octane 91)	41	101	167	173	114	36	30	-15.6
Premium (octane 95)	347	291	241	192	168	44	39	-10.1
Gasohol	**11,403**	**11,320**	**10,354**	**10,815**	**11,277**	**2,781**	**2,816**	**1.3**
- Gasohol E10 Octane 91	3,485	3,008	2,518	2,563	2,515	625	721	15.4
- Gasohol E10 Octane 95	5,068	5,588	5,437	5,942	6,559	1,613	1,599	-0.9
- Gasohol E20	2,379	2,394	2,114	2,008	2,147	520	490	-5.8
- Gasohol E85	471	331	286	302	57	23	7	-71.6
Total	**11,791**	**11,712**	**10,763**	**11,180**	**11,559**	**2,860**	**2,886**	**0.9**

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

Source: DEB, Ministry of Energy

Table 3.2: Price Structure of Gasoline and Gasohol in Bangkok in 2023 and 2024

April 19, 2023[5] (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/$
Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy

April 19, 2024 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	25.0495	24.9472	24.4910	25.2260	29.3424
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	9.3800	2.8000	1.7500	0.8100	0.1600
Conservation Fund	0.0500	0.0500	0.0500	0.0500	0.0500
Wholesale Price (WS)	41.6295	34.2322	32.726000	31.8060	30.6249
Value Added Tax (VAT)	2.9141	2.3963	2.2908	2.2264	2.1437
WS+VAT	44.5436	36.6285	35.0168	34.0324	32.7686
Marketing Margin	3.4546	3.4780	3.6105	3.9323	4.8798
VAT	0.2418	0.2435	0.2527	0.2753	0.3416
Retail Price	48.24	40.35	38.88	38.24	37.99

Note: Exchange rate = 36.9383 baht/$
Source: Petroleum Division, Energy Policy and Planning Office, Ministry of Energy

Ethanol consumption in the first quarter of 2024 declined 4 percent due to reduced E20 and E85 consumption despite a one percent increase in gasohol consumption. E20 consumption declined 6 percent from the same period last year as consumers shifted to E10 Octane 91 after the prices of E20 and E10 Octane 91 converged following the Cabinet's October 31, 2023, approval of a subsidy on E10 Octane 91 between November 7, 2023, and April 30, 2024. Prices for E20 were around one percent cheaper than for E10 Octane 91 compared to 5 percent prior to the Cabinet's subsidy. Furthermore, E85 consumption dropped 72 percent in the first quarter of 2024 due to the lack of price incentive as the average retail E85 price exceeded E20 by around one percent. In addition, between January and March 2024, the number of gas stations with the E85 option went from 762 to 693.

Post forecasts ethanol consumption in 2024 to increase 3 percent or slightly above an expected 2 percent increase in gasoline demand as consumers are expected to moderately shift to E20 after the government

[5] DEB publishes the daily price structure and there is no official data on the average monthly prices. Table 3.2 references April data because the government's E10 octane 91 subsidy ended at the end of April 2024. The subsidy structure from May 1, 2024, looks very similar with the E20 price about 5 percent below E10 octane 91 price.

stopped subsidizing E10 Octane 91 in May 2024. The retail prices of E20 became 5 percent cheaper than E10 Octane 91 in May 2024. However, this price difference is reportedly insufficient to incentivize consumers to completely shift from E10 Octane 91 to E20. The government aimed to terminate the E10 Octane 91 sales by 2025.

Production

Fuel ethanol production in 2023 declined 9 percent from 2022 in line with reduced E85 demand and tight supplies of molasses and cassava. Molasses-based ethanol production, which accounted for 61 percent of Thailand's total ethanol production, totaled 797 million liters or down 4 percent from 2022 due to reduced molasses supplies in MY 2022/23 (please see TH2023-0059, Sugar Semi-Annual, October 4, 2023). Meanwhile, sugarcane-based ethanol production, which accounted for around 6 percent of the total ethanol production, increased 13 percent to 74 million liters in 2023 in line with a 2 percent increase in sugarcane production in MY 2022/23. Cassava-based ethanol represented a third of Thailand's ethanol output and totaled 435 million liters, down 18 percent from 2022.

In the first quarter of 2024, fuel ethanol production totaled 379 million liters, down 4 percent from the same period in 2023 due to reduced E20 and E85 consumption. Molasses-based ethanol production declined 10 percent to 220 million liters, using 0.9 million metric tons of molasses, as molasses prices spiked 65 percent from the same period in 2023 to a record 6,700 baht/MT ($194/MT). Sugarcane-based ethanol production declined to 23 million liters, down 2 percent from the same period last year due to reduced sugarcane production (please see TH2024-0026, Sugar Annual, May 6, 2024). Meanwhile, cassava-based ethanol production increased 8 percent to 135 million liters. The MOE's DEB reported in January 2024 that the number of ethanol producers remains unchanged at 27. However, ethanol production capacity increased to 2,030 million liters per annum in 2024, up 3 percent from 2023 as a molasses-based ethanol plant doubled its production capacity, which accounted for 12 percent of total molasses-based ethanol production in 2024 (based on nameplate capacity).

Post forecasts fuel ethanol production in 2024 to increase 3 percent to 1,340 million liters, driven by growing E20 demand. Molasses-based ethanol production is expected to increase to 835 million liters, up around 5 percent from 2023, following the recovery in molasses supplies to 3.6 MMT in 2024 (please see TH2024-0026, Sugar Annual, May 6, 2024). Meanwhile, Post estimates sugarcane-based ethanol production to decline to 67 million liters, down 10 percent from 2023 due to a 12 percent drop in MY 2023/24 sugarcane production from MY 2022/23 due to adverse weather. Cassava-based ethanol production is expected to increase to around 438 million liters in 2024, up 3 percent from 2023 and use approximately 2.7 MMT of cassava.

Trade

Thailand is not a major exporter of fuel ethanol as it is not price competitive. 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 government's 2023 approval of 10 million liters of non-fuel ethanol exports, the actual exports of ethanol in 2023 totaled 2.5 million liters, a substantial increase from around 40,000 liters in 2022. The government extended this ethanol export approval until 2024. All the ethanol exports were for industrial uses based on the capacity of Thailand's storage facilities.

Ethanol imports in 2023 declined slightly to 12.9 million liters from 13.0 million liters in 2022, mainly for non-fuel uses. The MOE has never approved any imports of ethanol for fuel to protect domestic ethanol producers, which have excess production capacity. Post expects non-fuel ethanol imports in 2024 to bounce back to 13 million liters in anticipation of tight supplies of cassava.

A liberalization of Thailand's ethanol import regime could 1) lower health costs tied to toxic air pollution from fossil fuels and 2) allow Thailand to more reliably meet its GHG reduction targets under COP26.

IV. Biodiesel

Table 4.1: Thailand's Biodiesel Production and Use

Biodiesel (Million Liters)										
Calendar Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024f**
Beginning Stocks	18	24	20	50	50	86	56	35	36	48
Production	1,250	1,240	1,427	1,567	1,845	1,843	1,658	1,391	1,670	1,770
Imports	2	5	2	2	2	1	0	0	0	0
Exports	3	16	4	1	21	3	7	9	56	65
Consumption	1,243	1,233	1,395	1,568	1,790	1,871	1,672	1,381	1,602	1,700
Ending Stocks	24	20	50	50	86	56	35	36	48	53
Balance Check	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)										
Number of Biorefineries	12	12	12	13	12	13	13	15	15	15
Nameplate Capacity	2,060	2,060	2,060	2,310	2,445	2,580	2,580	2,910	2,910	3,320
Capacity Use (%)	60.7%	60.2%	69.3%	67.8%	75.5%	71.4%	64.3%	47.8%	57.0%	53.3%
Feedstock Use (1,000 MT)										
RBDPO/CPO	857	838	965	1,060	1,267	1,264	1,138	920	1,035	1,217
Stearin	250	260	286	328	370	370	332	312	445	355
FFA of Palm Oil	83	82	109	102	118	117	107	89	106	113
Used Cooking Oil	2	2	3	4	5	4	3	4	5	5
Market Penetration (Million Liters)										
Biodiesel, On-road use	680	741	941	1,045	1,320	1,475	1,280	1,100	1,240	1,315
Diesel Pool, On-road use !/	11,937	13,225	15,682	16,084	17,025	17,950	17,546	20,600	19,445	19,480
Blend Rate (%)	5.7%	5.6%	6.0%	6.5%	7.8%	8.2%	7.3%	5.3%	6.4%	6.8%
Diesel Pool 1/	21,902	22,625	23,223	23,587	24,579	23,920	23,005	26,663	25,153	25,210

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 2023 increased 16 percent from the previous year (Table 4.4) due to the increase in the mandatory blend rates from 5 percent in 2022 to 6.6 percent in 2023. At the same time, there was a 6 percent reduction in the total diesel fuel demand in 2022, caused by a shrinking demand for diesel fuel in on-road transportation and agricultural sector following a 2.9 percent reduction in exports and reduced agricultural production caused by drought in 2023 (Table 4.1, 4.2, and 4.3). The government began to increase the mandatory blend rate to 6.6 percent from the last quarter of 2022 when the crude palm oil price leveled off from record levels. In addition, on October 1, 2023, the government altered the biodiesel blending rate[6] from 5-7 percent for B7, 5-10 percent for B10, and 5-20 percent for B20 set in February 2022 (please see TH2023-0034, Biofuel Annual, June 6, 2023), to 6.6 – 7.0 percent for B7, 6.6 – 10 percent for B10, and 6.6 – 20 percent for B20. Average reference prices of B100 in 2023 declined to 34 baht/liter ($3.72/gallon), down 27 percent from the record high in 2022, following the reduced average wholesale prices of crude palm oil in 2023 by 31 percent from the record high in 2022 (please see TH2024-0022, Thailand: Oilseeds and Products Annual, April 5, 2024).

[6] The government sets the blend rate for B7, B10 and B20 fuel standards within specific ranges to allow some flexibility, especially when crude palm oil prices are volatile.

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

Type of Diesel	2019	2020	2021	2022	2023	January - March		
						2023	2024	% Change
B7	21,852	16,033	14,543	23,317	23,509	5,999	6,271	4.5
B10	34	5,935	7,028	834	336	97	35	-63.8
B20	1,631	1,269	360	68	55	15	14	-2.8
Other	1,062	683	1,075	2,444	1,253	765	152	-80.2
Total	**24,579**	**23,920**	**23,005**	**26,663**	**25,153**	**6,876**	**6,472**	**-5.9**

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

Source: Department of Energy Business, Ministry of Energy

Table 4.3: Thailand's Fuel Use (2015 – 2024)

Calendar Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024(F)
Gasoline Total	**9,714**	**10,680**	**11,030**	**11,373**	**11,791**	**11,712**	**10,763**	**11,180**	**11,559**	**11,760**
Diesel Total	**21,902**	**22,625**	**23,223**	**23,587**	**24,579**	**23,920**	**23,005**	**26,663**	**25,161**	**25,210**
On-road	11,937	13,225	15,682	16,084	17,025	17,950	17,546	20,600	19,445	19,480
Agriculture	4,457	3,390	3,048	3,300	3,364	2,648	2,448	2,708	2,580	2,585
Construction & Mining	147	140	136	114	129	92	82	118	106	107
Shipping & Rail	261	270	301	315	306	283	299	366	348	350
Industry	5,100	5,600	4,056	3,774	3,755	2,947	2,630	2,871	2,682	2,688
Heating	-	-	-	-	-	-	-	-	-	-
Jet Fuel Total	**6,034**	**6,468**	**6,743**	**7,096**	**7,153**	**2,745**	**1,792**	**3,337**	**5,007**	**6,290**
Total Fuel Markets	**37,650**	**39,773**	**40,996**	**42,056**	**43,523**	**38,377**	**35,560**	**40,180**	**41,727**	**43,260**

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

Table 4.4: 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
October 1, 2023 - April 30, 2024	B7 (6.6 - 7.0%), B10 (6.6 - 10%), and B20 (6.6 - 20%)
May 1, 2024	B7 (6.6 – 7.0%) and B20 (19 - 20%)

Source: Ministry of Energy

Post forecasts biodiesel consumption to increase around 6 percent in 2024 due to the increased blending rate for biodiesel as actual biodiesel blending rate is likely to approach 7 percent for the maximum blend rate under the Euro 5 standard in Bangkok in May 2024 and nationwide from September 2024, per Cabinet's approval in February 2024 of B7 as the primary diesel fuel in the market and B20 as an alternative diesel fuel. This is well above total diesel fuel consumption growth in 2024 that the MOE expected to increase slightly 0.2 percent from 2023. In the first quarter of 2024, biodiesel consumption increased 3 percent from the same period in 2023 despite a 6 percent reduction in diesel fuel consumption as the MOE reported that the actual average biodiesel blending rate increased to around 6.8 percent in the first quarter of 2024, up from an average actual blending rate of 6.4 percent in 2023. The government revised the mandatory blending rate to include only B7 and B20, beginning on May 1, 2024, as automobile manufacturers struggled to produce economically viable engines compatible with Euro 5 B10. However, the government kept the range of biodiesel blending rates between 6.6 – 7.0

percent for B7 and increased the blending rate for B20 from 6.6-20 percent to 19-20 percent. The elimination of B10 will not cause a reduction in biodiesel demand as the actual blending rate of B10 in 2023 was at the same levels as B7 and B20, following the government's measures to curb the retail prices of diesel fuel since April 2022 (Table 4.5).

Table 4.5: Price Structure of Diesel in Bangkok in 2023 and 2024

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/$

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

April 19, 2024 (Baht/Liter)	**High-Speed Diesel (B7)**	**High-Speed Diesel (B10)**	**High-Speed Diesel (B20)**
Ex-Refinery Factory Price	24.9227	24.9227	24.9227
Excise Tax	5.0600	5.0600	5.0600
Municipal Tax	0.5060	0.5060	0.5060
State Oil Fund	-4.7700	-4.7700	-4.7700
Conservation Fund	0.0500	0.0500	0.0500
Wholesale Price (WS)	25.7687	25.7687	25.7687
Value Added Tax (VAT)	1.8038	1.8038	1.8038
WS+VAT	27.5725	27.5725	27.5725
Marketing Margin	2.6799	2.6799	2.6799
VAT	0.1867	0.1867	0.1867
Retail Price	30.44	30.44	30.44

Note: Exchange rate = 36.9383 baht/$

Source: Petroleum Division, Energy Policy and Planning Office, 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. One or two of Thailand's biodiesel companies have adopted as a corporate social responsibility commitment to utilize UCO for biodiesel production. Still, the use is limited to 4-5 million liters (approximately 360,000-450,000 liters of biodiesel) per year. Government mandates drive biodiesel production and are aimed at helping oil 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 2023 increased 20 percent from 2022. In addition, the government provided excise tax exemption incentive for biodiesel producers to export biodiesel to reduce the excess supplies of CPO.

The DEB reported on January 4, 2024, that the number of biodiesel producers stayed at 15 (Table 4.6). However, biodiesel production capacity increased to 3,320 million liters per annum in 2024, up 14 percent from 2023, as one vegetable oil producer who was the second largest B100 producer, doubled their production capacity, accounting for around 26 percent of total biodiesel production capacity in 2024, up from 16 percent in 2023 (Table 4.6).

In the first quarter of 2024, biodiesel production totaled 425 million liters, down one percent from the same period in 2023 despite growing domestic demand for biodiesel. The slight reduction in biodiesel production is due to reduced biodiesel export demand which offset the 3 percent increase in domestic consumption of biodiesel. The volume of CPO used in biodiesel production as a percentage of total CPO production increased to 36 percent, compared to 27 percent in the same period in 2022 due to reduced export demand for crude palm oil. Biodiesel derived from RBDPO or CPO reportedly remained at around 72 percent of total biodiesel production, followed by 21 percent from palm stearin, and 7 percent from FFA.

Post expects Thailand's biodiesel production in 2024 to increase around 6 percent from 2023 in line with a higher mandatory blend rate in diesel fuel and growing biodiesel export demand. MOAC's Office of Agricultural Economics forecasted oil palm production to increase 2 percent due to continued expansion of harvesting areas since 2021, when oil palm plantation replaced rubber plantation, rice crops, and abandoned land, in response to attractive palm oil prices (please see TH2024, Oilseeds and Products Annual, April 5, 2024).

Table 4.6: List of Operating Biodiesel Producers in Thailand in 2024

	Company	Nameplate Production Capacity (Million Liters/Year)	Feedstock Type
1	Pure Energy	265	Palm Stearin, CPO
2	Patum Vegetable Oil	870	CPO, RBDPO, Stearin
3	GI Green Power ⅟	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	BBGI (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	3,260	

Note: ⅟originally called B. Grimm Green Power
Source: Department of Energy Business and FAS Estimates

Trade

Thailand's biodiesel imports and exports are minimal and traded as biodiesel (adjusted to B100 equivalent) under HTS codes 3826.00 and 2710.20. Thailand restricts imports of biodiesel (B100 equivalent), which remained marginal in 2023. Exports of biodiesel (B100 equivalent) in 2023 increased to a record 56 million liters mainly to Malaysia and China, driven by the government's measures to eliminate excess CPO supplies. Post forecasts biodiesel exports to continue to increase in 2024, following an expanded production capacity of biodiesel production, especially for export-oriented renewable biodiesel production. Still, exports of biodiesel remain marginal, accounting for around 3 percent of Thailand's total biodiesel production.

V. Advanced Biofuels

The new AEDP 2024 proposes a 1 percent blend rate target for SAF with conventional jet fuel in 2026. The SAF blend rate in jet fuel is set to increase to 2 percent between 2027 and 2029, 3 percent in 2030-2032, 5 percent in 2033-2035, and 8 percent by 2036, based on Thailand's projection of domestic supplies of used cooking oil and molasses-based ethanol. Thailand aims to meet its 2026-2029 SAF targets with UCO-based SAF. Thailand's first SAF production facility will be owed by Bangchak Corporation Public Company Limited and is expected to enter operational status in the first quarter of 2025 with a daily production capacity of one million liters. This facility aims to only use UCO as

feedstock. According to the MOE estimate, UCO supplies for SAF production that will meet the ICAO's standards total around 58,000 MT, which will yield around 34 million liters of SAF[7]. AEDP 2024 also specifies molasses-based ethanol as the alternative SAF feedstock as Thailand expects excess ethanol supplies to mainly derive from molasses-based ethanol production. Thailand plans to manufacture alcohol-to-jet SAF when the SAF target blend rate increases to 3-8%.

The new AEDP 2024 removed 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 lower commercialization potential. 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. 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 insufficient commercial feasibility. The production of hydrogenation-derived renewable diesel (HDRD), a type of renewable drop-in diesel, is no longer commercialized in Thailand due to the removal of subsidies and high production costs. Thailand is unlikely to allow the imports of hydrotreated vegetable oil (HVO) as a supplement to its biodiesel market for the same reason that it does not permit biodiesel imports. However, the government included a consumption target of hydrogen fuel for on-road transportation at 4 kiloton of oil equivalent (ktoe) by 2037 in the new AEDP 2024. Presently, automotive manufacturers are developing hydrogen fuel cell vehicle (FCV) trucks to promote biomass-based hydrogen as an alternative energy source for long-haul transportation of up to 1,000 kilometers, compared to around 300 kilometers from batteries alone. The plan is to commercialize hydrogen fuel by 2035 if it is commercially feasible.

VI. Statistical Information

While ethanol is harmonized under HS2207.10 and HS2207.20, Post's estimates of ethanol imports and exports in Table 3.1 are 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 tables.

Post's estimates of biodiesel imports and exports are 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, as reported by the Thai Customs Department. All data in 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 report 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 recent years.

[7] According to the MOE estimate, the demand for SAF will reach 73 million liters by 2026, when AEDP 2024 set the mandatory SAF blend rate at 1 percent.

Attachments:

No Attachments