

Required Report: Required - Public Distribution

Date: June 02, 2021

Report Number: TH2021-0040

Report Name: Biofuels Annual

Country: Thailand

Post: Bangkok

Report Category: Biofuels

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Report Highlights:

Biofuel consumption is expected to remain below AEDP 2018 targets due to the prolonged outbreak of COVID-19 in 2021. The delay in the elimination of octane 91 E10 will undermine E20 consumption growth in 2021, leading to a slight increase in ethanol consumption in line with the slow economic recovery. Biodiesel consumption will likely increase to a greater degree than overall diesel consumption due to the shift from B7 to B10.

I. Executive Summary

Biofuel consumption targets remain the same as the targets set forth in Thailand's 20-year Alternative Energy Development Plan (2018 – 2037) or AEDP 2018. AEDP 2018 aims to increase biofuel consumption to 5,600 million liters by 2037, including 2,700 million liters of ethanol and 2,900 million liters of biodiesel. Biofuel consumption in 2020, however, fell behind the targets set in the AEDP 2018 due to the adverse effect the COVID-19 outbreak had on the local economy. Thailand consumed 1,500 million liters of ethanol and 1,871 million liters of biodiesel in 2020.

The government is expected to finalize its Oil Development Plan (ODP) in 2021. The ODP incorporates the AEDP and the Energy Efficiency Development Plan (EEDP) into its plan. The ODP will be the key to the success of the national energy plan. These three plans, along with two other energy plans, make up Thailand's National Energy plan that aims to reduce greenhouse gas (GHG) emissions and the amount of PM 2.5 particles in the air through biofuel consumption. The EEDP roadmap raised the EV target usage to 1.05 million cars on the road by 2025, together with the development of supporting infrastructure, compared to the initial target of 250,000 EVs. In addition, locally produced biodiesel is expected to comply with Euro 5 environmental standards by 2024, aiming to reduce PM 2.5 particles in the air by 80 percent from 2020's levels.

Biofuel consumption is expected to increase for both ethanol and biodiesel fuel in 2021 but remain far below the AEDP 2018's annual target of 1,985 million liters for ethanol and 2,190 million liters for biodiesel. The prolonged effects of the COVID-19 outbreak on the Thai economy have reduced the demand for not only biofuel but also all fuel. Overall fuel consumption in 2021 is likely to reduce by 3 percent from 2020. Jet fuel consumption is expected to decline significantly due to reduced foreign tourists for the second consecutive year. The slight increase in gasoline and diesel consumption in 2021 will not be able to offset the reduced jet fuel consumption.

The government again postponed the elimination of octane 91 E10 until January 2022 due to concerns about limited supplies of molasses, which is the primary feedstock for ethanol production. The delay will undermine the growth of E20 consumption in 2021. Molasses-based ethanol production is expected to further decline in 2021. Supplies of molasses have been tight due to reduced sugarcane production for the second consecutive year. Ethanol demand is primarily expected to be fulfilled by cassava-based ethanol.

Biodiesel consumption is expected to increase to a greater degree than overall diesel consumption. Demand for biodiesel is expected to increase as B10 consumption rises. B10 will gradually become the primary diesel fuel in 2021 as the government's subsidization of B10 incentivizes its use of over B7 and B20.

II. Policy and Programs

Thailand committed to reduce greenhouse gas emissions by 110-140 million tons of carbon dioxide (CO₂) (20-25 percent of 2015 emissions) by 2030 at the 2015 Paris Climate Conference. The Thai government aims to reduce CO₂ emissions in the energy and transportation sectors by 113 million tons 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 Nations 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 million tons of CO₂ equivalent (MTCO₂) or 7-20 percent by 2020. The Thai government announced in 2020 that Thailand had successfully reduced GHG emissions by 57.84 million tons of CO₂ equivalent (MTCO₂) or 15.76 percent, well above the lower target of 7 percent.

The NDC was incorporated into Thailand's National Energy Plan in 2015 and aligned 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 has finalized all the master plans, except for the ODP, which is expected to be approved by the end of 2021. The ODP will be crucial in the success of the national energy plan. The ODP will also focus on reducing GHG emissions through ethanol consumption and lowering PM 2.5 particles by requiring Euro 5 standards for biodiesel production.

The AEDP 2018, approved in April 2019, 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 due to the COVID-19 outbreak and the economic downturn that resulted from the outbreak. Ethanol and biodiesel consumption totaled 1,500 million liters and 1,871 million liters in 2020, 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 consumption 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 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.

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 are 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.

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 lowered target is in anticipation of limited supplies of molasses and cassava, the primary feedstocks for ethanol production. Additionally, long-term demand growth for gasoline and gasohol is expected to slow down in the long run due to 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. Presently, EVs only account for around 1 percent of total passenger cars 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 excise tax rates will only be 2 percent after 2022 whereas the usual tax rate is 8 percent. The Excise Tax Department will finalize a tax structure for the EV sector by the end of 2021 with a goal of making Thailand competitive to become a regional hub for EV manufacturing.

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. The average blend rate calculated in the ethanol balance table is derived from 1) the established blend rates (E10, E20, and E85) of different gasohol pools, and 2) the size of these various pools. The size of the pools is impacted by pricing policy designed to account for a lower energy density of ethanol vs gasoline and incentivize ethanol use. The size of these pools is also determined by the existing vehicle fleet, which is evolving incentivized by different VAT rates for each vehicle classes. 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.

The government remains uncertain if current domestic supplies of molasses and cassava will be sufficient to meet ethanol demand if octane 91 E10 sales are eliminated. The Ministry of Energy (MOE) expects the cessation of octane 91 E10 sales will increase ethanol demand by doubling the sales of E20. The uncertainty over the availability of sufficient feedstock (and price fluctuations) has caused the government to delay the elimination of octane 91 E10 several times. The initial plan was to eliminate the sale of octane 91 E10 on January 1, 2018. The revised target is now January 2022. Concerns about the economic impact from the prolonged outbreak of COVID-19 influenced the postponement to 2022.

The current price subsidies for gasohol make gasohol 20 – 40 percent cheaper than premium gasoline. All price subsidies for gasohol, however, will be terminated by 2022 under the new State Oil Fund Act, particularly for E20 and E85. E20 and E85 are currently subsidized by the State Oil Fund at 2.28 baht/liter (27 U.S. cent/gallon) and 7.13 baht/liter (86 U.S. cent/gallon), respectively (Table 3.3.1). The price subsidies on E85 were reduced by half in 2020 and will be reduced by 25 percent in 2021 and

2022. Meanwhile, the price subsidy on E20 were reduced by 25% in 2020 and will be reduced again by 25% in 2021. The E20 price subsidy will be eliminated in 2022. The government expects that E20 will become the primary gasohol by 2022, as retail prices of E20 will be cheaper than E10 (octane 91 and octane 95) and E85 by 7-8 percent and 4-5 percent, respectively.

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

The MOE controls the import/export of fuel ethanol (HS22072011 and HS22072019) by requiring that traders apply for import/export permits. The Thai government also imposed a 2.5 baht/liter duty on ethanol imports (30 U.S. cent/gallon), based on 31.5 baht/U.S. \$1.00, as of August 28, 2020.

Biodiesel

The government lowered the biodiesel consumption target to 2,900 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. All gas stations are required to sell B10. The government provided increased price subsidies for B10 in 2020 in order to make B10 the primary diesel fuel after introducing it in 2019. The government is considering reducing price subsidies for B20 in 2021 and terminating the sale of B20 in 2022 in adherence to the new State Oil Fund Act. 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. Production of palm fresh fruit bunch (FFB) is expected to reach 29.46 million metric tons (MMT) in 2036, with 4.24 MMT of FFB expected to be processed as biodiesel in 2036.

The 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	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021F
Beginning Stocks	63	22	42	40	37	30	54	31	38	33
Fuel Begin Stocks	58	20	21	26	21	17	40	27	33	29
Production	790	1,048	1,070	1,190	1,290	1,480	1,500	1,640	1,500	1,508
Fuel Production	471	950	1,058	1,174	1,276	1,461	1,485	1,619	1,478	1,485
Imports	6	5	11	11	13	12	12	12	16	17
Fuel Imports	0	0	0	0	0	0	0	0	0	0
Exports	304	64	5	0	0	0	0	0	0	4
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	533	969	1,078	1,204	1,310	1,468	1,535	1,645	1,521	1,524
Fuel Consumption	509	949	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,487
Ending Stocks	22	42	40	37	30	54	31	38	33	30
Fuel Ending Stocks	20	21	26	21	17	40	27	33	29	27
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	19	21	21	21	21	26	26	26	26	26
Nameplate Capacity	977	1,307	1,472	1,472	1,472	1,875	1,910	1,950	1,950	1,950
Capacity Use (%)	48.2%	72.7%	71.9%	79.8%	86.7%	77.9%	77.7%	83.1%	75.8%	76.2%
Co-product Production (1,000 MT)										
Bagasse	180	209	243	252	216	261	262	292	234	248
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	654	760	882	915	787	949	953	1,063	850	900
Molasses	1,418	2,615	2,895	3,165	3,067	3,617	4,075	4,550	3,590	3,000
Cassava	468	1,670	1,864	2,166	3,014	3,272	2,729	2,781	3,462	4,370
Market Penetration (Million Liters)										
Fuel Ethanol Use	509	949	1,053	1,179	1,280	1,438	1,498	1,613	1,482	1,487
Gasoline Use	7,705	8,233	8,567	9,714	10,680	11,029	11,373	11,750	11,611	11,650
Blend Rate (%)	6.6%	11.5%	12.3%	12.1%	12.0%	13.0%	13.2%	13.7%	12.8%	12.8%

Note: - 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).

- 2021 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

Ethanol consumption totaled 1,521 million liters in 2020, down 7 percent from 2019. Increased industrial ethanol consumption during the COVID-19 outbreak was not enough to offset reduced fuel ethanol demand (Table 3.1). Fuel ethanol consumption declined 8 percent in 2020, while gasohol consumption fell 1 percent (Table 3.2). E85 consumption declined significantly by 30 percent as subsidies on gasohol were reduced under the new State Oil Fund Act B.E. 2562 (2019) (please see [TH2020-0124: Biofuels Annual 2020, September 11, 2020](#)). The reduction of subsidies on the sale of E85 encouraged most gas stations to replace E85 with E20 as they now receive higher returns on E20

(Table 3.2 and 3.3). The government delayed the termination of the sale of octane 91 E10 due to tight supplies of molasses. The delay in the elimination of octane 91 E10 sale lowered actual E20 demand below what was expected in 2020. The government reduced the subsidy on the sale of octane 91 E10 in order to make retail prices of octane 91 E10 closer to those of octane 95 E10 to encourage consumers to use higher octane gasoline (octane 95 E10) or shift to E20. Consumption of octane 95 E10 and E20 increased 12 percent and 1 percent, respectively, in 2020 despite the COVID-19 outbreak.

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

Type of Gasoline	2016	2017	2018	2019	2020	January - March		
						2020	2021	% Change
Gasoline	561	508	437	347	291	73	65	-11.0
- Regular (octane 91)	71	57	39	0	0	0	0	-
- Premium (octane 95)	490	451	398	347	291	73	65	-11.0
Gasohol	10,119	10,521	10,936	11,403	11,320	2,761	2,732	-1.1
- E10 (Octane 91)	4,073	3,885	3,638	3,485	3,008	793	675	-14.9
- E10 (Octane 95)	3,968	4,350	4,739	5,068	5,588	1,275	1,417	11.1
- E20	1,753	1,903	2,122	2,379	2,394	592	570	-3.7
- E85	325	383	437	471	331	101	70	-30.7
Total	10,680	11,029	11,373	11,750	11,611	2,834	2,797	-1.3

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

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

Table 3.3: Price Structure of Gasoline and Gasohol in Bangkok in 2020 and 2021

April 30, 2020 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	5.0860	6.7241	6.3170	8.5434	18.7317
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)	18.9167	13.8791	13.4720	12.0830	12.7742
Value Added Tax (VAT)	1.3242	0.9715	0.9430	0.8458	0.8924
WS+VAT	20.2409	14.8506	14.4150	12.9293	13.6684
Marketing Margin	3.8497	1.9620	2.1168	2.3465	1.2819
VAT	0.2695	0.1373	0.1482	0.1643	0.0897
Retail Price	24.36	16.95	16.68	15.44	15.04

Note: Exchange rate = 32.6002 baht/\$

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

April 30, 2021 (Baht/Liter)	Premium gasoline (octane 95)	Gasohol			
		E10 Octane 95	E10 Octane 91	E20	E85
Ex-Refinery Factory Price	15.3011	15.9190	15.5310	16.6638	23.0079
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)	29.1311	23.0740	22.6860	20.2038	17.0504
Value Added Tax (VAT)	2.0392	1.6152	1.5880	1.4143	1.1935
WS+VAT	31.1703	24.6892	24.2740	21.6181	18.2439
Marketing Margin	3.2614	2.3933	2.5290	3.8522	3.0338
VAT	0.2283	0.1675	0.1770	0.2697	0.2124
Retail Price	34.66	27.25	26.98	25.74	21.49

Note: Exchange rate = 31.4108 baht/\$

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

Ethanol consumption totaled 355 million liters in the first quarter of 2021, down 7 percent from the same period last year. The second wave of COVID-19 caused economic growth in the first quarter of 2021 to further decline by 2.6 percent. Ethanol consumption fell to a greater degree than gasohol consumption, which declined around 1 percent in the first quarter of 2021 due to a 30 percent reduction in E85 consumption. E85 consumption accounted for around 3 percent of total gasohol consumption, down slightly from 4 percent in 2019 when the government began reducing the subsidy on the sale of E85. Consumption of octane 91 E10 also declined 15 percent from the same period last year, accounting for 25 percent of total gasohol consumption. E20 consumption declined 4 percent from the same period last year but still accounts for 21 percent of total gasohol consumption like in 2020.

Fuel ethanol consumption is expected to increase slightly to 1,487 million liters in 2021 in line with gasohol consumption. This is well above the five-year average for ethanol consumption but far below the AEDP 2018's target of 1,985 million liters in 2021. The postponement of the termination of octane 91 E10 sale to the beginning of 2022 limited the growth of gasohol consumption. The MOE expected that the elimination of octane 91 E10 sales will cause 50 percent of octane 91 E10 consumption to shift to E20 consumption, followed by octane 95 E10 (45%) and E85 (5%).

Production

Fuel ethanol production totaled 1,478 million liters in 2020, down 9 percent from 2019 due to reduced gasohol demand caused by the COVID-19 outbreak. Molasses-based ethanol production declined to 861 million liters using around 3.6 million metric tons of molasses, down 21 percent from 2019 due to reduced sugarcane production caused by drought. Cassava-based ethanol production increased to 533 million liters, up 23 percent from the previous year, using 3.5 million metric tons of cassava root. Cassava-based ethanol production accounted for 37 percent of total ethanol production, up from 28 percent in 2019.

Ethanol production totaled 439 million liters in the first quarter of 2021. Ethanol production slightly declined from the same period in 2020 in line with reduced gasohol consumption. Ethanol production is expected to increase slightly to 1,485 million liters in 2021. Thailand has 26 fuel ethanol plants with a total production capacity of around 1,950 million liters per year. Molasses-based ethanol production

will likely decline for the second consecutive year to 719 million liters using 3 million metric tons of molasses, down 16 percent from 2020 due to reduced sugarcane production caused by drought (please see: [TH2021-0027: Sugar Annual 2021, April 2021](#)). Ethanol production is expected to shift toward cassava-based ethanol due to limited supplies of molasses. Cassava-based ethanol production is likely to increase to 698 million liters using 4.4 million metric tons of cassava root, up 26 percent from the previous year.

Trade

Thailand is not a major exporter of fuel ethanol as it is not price competitive. Thailand's ethanol, produced primarily from molasses and cassava, 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. In 2020, ethanol exports totaled 78,386 liters, up significantly from 2019. Most of the ethanol exports were for industrial uses and exported to Ethiopia, which accounted for around 70 percent of total ethanol exports. The government approved non-fuel ethanol exports of 4 million liters in 2021. Ethanol exports totaled only 129 liters in the first quarter of 2021, down significantly from 19,085 liters in the same period last year.

Ethanol imports totaled 16 million liters in 2020, mainly for non-fuel uses. Ethanol imports increased 27 percent from 2019 due to unusual demand for non-fuel ethanol in sanitizer products during the COVID-19 outbreak. The MOE has never approved any imports of fuel ethanol as local ethanol producers still have excess production capacities over domestic demand.

IV. Biodiesel

Table 4.1: Thailand's Biodiesel Production and Use

Biodiesel (Million Liters)											
Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021f
Beginning Stocks	22	12	33	20	18	24	20	50	50	86	56
Production	630	910	1,080	1,170	1,250	1,240	1,427	1,567	1,845	1,843	1,915
Imports	0	5	6	12	2	5	2	2	2	1	1
Exports	0	4	49	4	3	16	4	1	21	3	4
Consumption	640	890	1,050	1,180	1,243	1,233	1,395	1,568	1,790	1,871	1,940
Ending Stocks	12	33	20	18	24	20	50	50	86	56	28
Balance Check	0	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)											
Number of Biorefineries	13	10	10	10	12	12	12	13	12	13	13
Nameplate Capacity	2,170	1,600	1,600	1,600	2,060	2,060	2,060	2,310	2,445	2,580	2,580
Capacity Use (%)	29.0%	56.9%	67.5%	73.1%	60.7%	60.2%	69.3%	67.8%	75.5%	71.4%	74.2%
Feedstock Use for Fuel (1,000 MT)											
RBDPO/CPO	390	630	775	825	857	838	965	1,060	1,267	1,266	1,320
Stearin	190	200	210	235	250	260	286	328	370	367	380
FFA of Palm Oil	0	20	25	55	83	82	109	102	118	117	120
Used Cooking Oil	1	1	1	2	2	2	3	4	5	4	4
Market Penetration (Million Liters)											
Biodiesel, on-road use	432	603	640	623	680	741	941	1,045	1,320	1,475	1,510
Diesel, on-road use	12,708	13,699	12,301	11,133	11,937	13,225	15,682	16,084	17,025	17,950	18,100
Blend Rate (%)	3.4%	4.4%	5.2%	5.6%	5.7%	5.6%	6.0%	6.5%	7.8%	8.2%	8.3%
Diesel, total use	18,484	20,529	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,919	24,180

f = forecast

Source: Ministry of Energy, Ministry of Commerce

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

Consumption

Biodiesel consumption totaled 1,871 million liters (5.1 million liters/day) in 2020, up 5 percent from 2019 despite a 3 percent reduction in diesel fuel consumption during the COVID-19 outbreak. The government increased the mandatory blending rate from B7 to B10 in 2020 (Table 4.1 and 4.2) to increase biodiesel use, which it often does. Over the past years, the mandatory biodiesel blending rate program has generally been successful at building its insular market to a current consumption level of around 2 billion liters and an on-road blend rate near B10. However, blend mandate increases are often delayed when domestic feedstock is insufficient given the prohibition on the use of imports and Thailand's sole reliance on domestic palm oil production. The blend mandate has even been lowered occasionally. The last time the mandated was reduced occurred during a brief four-month period in 2016.

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

Type of Diesel	2016	2017	2018	2019	2020	January - March		% Change
						2020	2021	
B7	22,152	22,687	23,089	21,852	16,033	4,686	3,600	-23.2
B10	-	-	-	34	5,934	580	2,155	271.6
B20	-	-	19	1,631	1,269	609	94	84.6
Other	473	536	478	1,062	683	278	201	-27.7
Total	22,625	23,223	23,587	24,579	23,919	6,153	6,050	-1.7

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

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

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

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

Biodiesel consumption totaled 456 million liters in the first quarter of 2021, down 7 percent from the same period last year due to a second wave of COVID-19. The service sector, including transportation, continues to suffer due to the dramatic reduction in the numbers of foreign tourists. Biodiesel consumption declined to a greater degree than diesel fuel consumption due to a considerably reduced demand for B20. There were limited sales of B20 in gas stations as the government planned to eliminate B20 sales by reducing the state Oil Fund's subsidies that made the retail prices of B20 and B10 converge (Table 4.4). B7 consumption also declined significantly as the government continued to reduce the subsidy on B7 sales in order to encourage more consumption of B10. The consumption of B10 increased significantly, accounting for 36 percent of total diesel fuel consumption in the first quarter of 2021.

Biodiesel consumption is expected to increase to 1,940 million liters in 2021, up 4 percent from 2020 but still well below the target of 2,190 million liters (6 million liters/day) in 2021 under the AEDP 2018.

Biodiesel consumption, however, is expected to increase to a greater degree than the general diesel consumption, which is likely to increase slightly following a slow economic recovery (Table 4.5). The government's subsidization of B10 will make B10 the primary diesel fuel for the rest of 2021 by incentivizing B10 over B7 and B20. As a result, the average on-road blend rate for biodiesel is expected to trend upward to 8.3 percent in 2021.

While diesel fuel consumption, including gasoline fuel consumption, is expected to increase slightly in 2021, total fuel energy consumption is likely to decline 3 percent from 2020. A slight increase in gasoline and diesel consumption is not likely to offset reduced jet fuel consumption. The prolonged outbreak of COVID-19 is expected to cause a further reduction in the numbers of foreign tourists to less than 2 million, down from 6.7 million in 2020 and from 39.9 million tourists 2019 prior the COVID-19 outbreak.

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

April 30, 2020 (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	0.1000
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/\$

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

April 30, 2021 (Baht/Liter)	High-Speed Diesel (B7)	High-Speed Diesel (B10)	High-Speed Diesel (B20)
Ex-Refinery Factory Price	15.5350	16.0662	18.2798
Excise Tax	5.9900	5.8000	5.1530
Municipal Tax	0.5990	0.5800	0.5153
State Oil Fund	1.0000	-2.5000	-4.16
Conservation Fund	0.1000	0.1000	0.1000
Wholesale Price (WS)	23.2240	20.0462	19.8881
Value Added Tax (VAT)	1.6257	1.4032	1.3922
WS+VAT	24.8497	21.4495	21.2803
Marketing Margin	2.0938	2.4678	2.3922
VAT	0.1466	0.1727	0.1675
Retail Price	27.0900	24.09	23.84

Note: Exchange rate = 31.4108 baht/\$

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

Table 4.5: Thailand's Fuel Use (2012 – 2021)

Calendar Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021 (F)
Gasoline Total	7,705	8,233	8,567	9,714	10,680	11,030	11,373	11,750	11,611	11,650
Diesel Total	20,529	20,832	21,078	21,902	22,625	23,223	23,587	24,579	23,919	24,180
On-road	13,699	12,301	11,133	11,937	13,225	15,682	16,084	17,025	17,950	18,100
Agriculture	4,296	4,439	4,518	4,457	3,390	3,048	3,300	3,364	2,649	2,700
Construction & Mining	142	150	139	147	140	136	114	129	89	90
Shipping & Rail	266	270	244	261	270	301	315	306	284	290
Industry	2,126	3,672	5,044	5,100	5,600	4,056	3,774	3,755	2,947	3,000
Heating	0	0	0	0	0	0	0	0	0	0
Jet Fuel Total	5,091	5,562	5,513	6,034	6,468	6,743	7,096	7,153	2,746	1,330
Total Fuel Markets	33,325	34,627	35,158	37,650	39,773	40,996	42,056	43,482	38,276	37,160

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

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

Biodiesel production declined slightly due to reduced palm oil production caused by drought in 2020. However, biodiesel production declined to a lesser degree than overall diesel production, which dropped due to the COVID-19 outbreak, as consumers gradually switched from B7 to B10. The amount of CPO used in biodiesel production as a percentage of total CPO production increased from 44 to 51 percent. The increase in the percent of CPO used resulted from having excess supplies of CPO. Domestic consumption of processed food, including cooking oil, decreased following the outbreak of COVID-19, which led to a reduced demand for CPO in food processing. It is estimated that 72 percent of biodiesel was derived from RBDPO or CPO, 21 percent from palm stearin, and 7 percent from FFA. There are 13 producers with an estimated total production capacity of 2.58 billion liters per annum (Table 4.6).

Biodiesel production totaled 439 million liters in the first quarter of 2021, down 7 percent from the same period last year. However, biodiesel production declined to a lesser degree than the 13 percent reduction in overall diesel production due to the second wave of COVID-19 in Thailand. The amount of CPO used in biodiesel production as a percentage of total CPO production continued rising, reaching 57 percent in the first quarter of 2021. Biodiesel derived from RBDPO or CPO reportedly remained unchanged at 72 percent of total biodiesel production, followed by 21 percent from palm stearin, and 7 percent from FFA.

Table 4.6: List of Operating Biodiesel Producers in Thailand

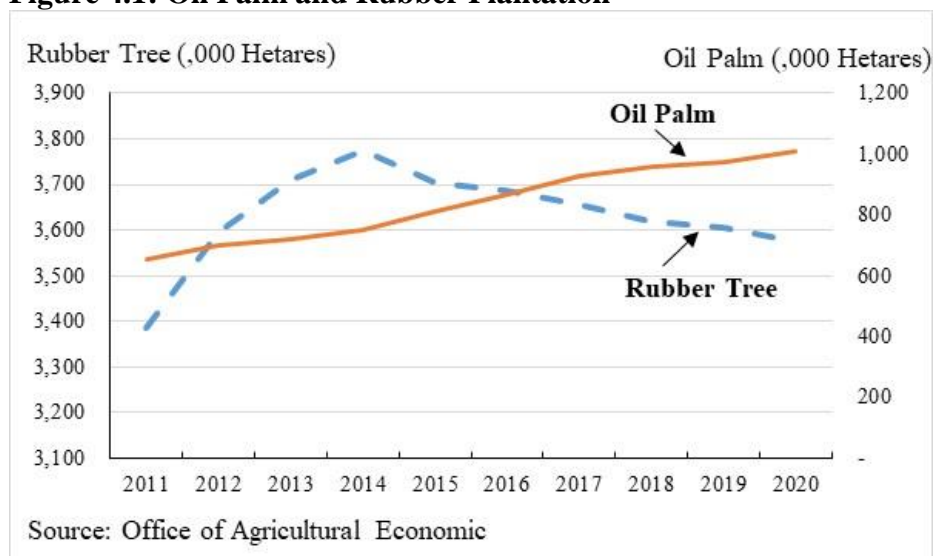
	Company	2020 Nameplate Production Capacity (Million Liters/Year)	Feedstock Type
1	Pure Energy	265	Palm Stearin, CPO
2	Patum Vegetable Oil	460	CPO, RBDPO, Stearin
3	GI Green Power 1/	70	CPO, RBDPO, Stearin
4	A.I. Energy	165	Palm Stearin
5	Veera Suwan	65	Palm Stearin, RBDPO
6	Global Green Chemical	520	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
	Total	2,580	

Note: 1/ originally called B. Grimm Green Power

Source: Department of Energy Business and FAS Estimates

Biodiesel production is expected to increase to 1,915 million liters in 2021, up 4 percent from 2020. Biodiesel production will likely increase more than overall diesel production, which is expected to increase around one percent from 2020. The increased biodiesel production is expected to be fulfilled by increased palm oil production that increased 7 percent from 2020. The increased palm oil production in MY2020/21 is mainly attributed to acreage expansion at the expense of rubber plantation (Figure 4.1 and please see [TH2021-0026: Oilseeds and Products Annual 2021, April 2021](#)). More than half of CPO production is still expected to be used for biodiesel production in 2021.

Figure 4.1: 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. Imports of biodiesel (B100 equivalent) are restricted and have remained at two million liters since 2017. Exports of biodiesel (B100 equivalent) declined significantly to 3 million liters in 2020 but are projected to increase to around 4 million liters in 2021, which is 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 all pyrolysis oil production from the plant will be used as fuel for Ayutthaya Clean Energy's electricity generation plant, which has a capacity of 3 megawatts (MW). The development of biojet fuel production in Thailand is also possible, but it is under technical and feasibility studies. 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 the lowered biofuel use targets for 2037. For example, the plan to construct a dual feedstock plant (molasses-based and bagasse-based cellulosic ethanol plant) has stalled due to commercial infeasibility. The production of hydrogenation-derived renewable diesel (HDRD), a type of renewable drop-in diesel, is no longer being commercialized in Thailand due to 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 4.3) is based on HS2207.20.11 and HS2207.20.19 reported by the Thai Customs Department. These codes represent ethanol for fuel and industrial uses. Meanwhile, other import and export figures of ethanol under HS2207.10 and HS2207.20 include beverage ethanol which is not included in the ethanol supply/demand balance table.

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

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

End of report.

Attachments:

No Attachments