Required Report: Required - Public Distribution **Date:** December 03, 2023

Report Number: JA2023-0125

Report Name: Biofuels Annual

Country: Japan

Post: Tokyo

Report Category: Biofuels

Prepared By: Daisuke Sasatani

Approved By: Craig Elliott

Report Highlights:

In March 2023, Japan updated its transport biofuel standards. Japan will maintain annual target volume of on-road bioethanol at 824 million liters till March 2028. Boosting domestic production of sustainable aviation fuel (SAF), including alcohol-to-jet (ATJ) SAF, is Japan's primary focus to expand biofuel consumption. Japan is planning to develop a separate SAF target volume by the time SAF becomes commercially available.

THIS REPORT CONTAINS ASSESSMENTS OF COMMODITY AND TRADE ISSUES MADE BY USDA STAFF AND NOT NECESSARILY STATEMENTS OF OFFICIAL U.S. GOVERNMENT POLICY

Section I. Executive Summary

Since 2017, Japan's biofuel standards have set an annual biofuel target volume, a de facto mandate, standing at 500 million liters of crude oil equivalent (LOE) or approximately 824 million liters of bioethanol. Japanese oil refineries have met this target largely through imports of bio-Ethyl Tert-Butyl Ether (ETBE) derived from bioethanol, as well as some domestically produced bio-ETBE from imported bioethanol.

On March 31, 2023, the Agency for Natural Resources and Energy (ANRE) of the Ministry of Economy, Trade and Industry (METI) released Japan's new biofuel standards (Notification 3.0 under the Sophisticated Act), which takes effect from Japan's 2023 fiscal year (FY[1]) start in April to FY 2027. ANRE continues to maintain the annual target volume of 500 million LOE (824 million liters of bioethanol). ANRE improved the default greenhouse gas (GHG) emissions for Brazilian sugarcane-based ethanol to 28.59 g-CO_2eq/MJ and for U.S. corn-based ethanol to 36.86 g-CO_2eq/MJ. ANRE continues to temporarily maintain the GHG emission reduction target for transport bioethanol at 55 percent. However, they are now reviewing the GHG emission value for gasoline, and the GHG emission reduction target will become 60 percent when ANRE releases a new gasoline GHG emission value.

FAS/Japan estimates Japan's bioethanol consumption in the form of bio-ETBE for on-road fuel at 837 million liters in 2022 and thus the ethanol blend rate in gasoline was at 1.9 percent. As ANRE maintains the ethanol target volume but recovery from COVID pandemic has made people consume more gasoline despite the high gas price, FAS/Tokyo forecasts that Japan's ethanol blend rate will drop marginally to 1.8 percent in 2023.

Longer term, the adoption of sustainable aviation fuel (SAF) is a key component of the Government of Japan's (GOJ) plan to increase the utilization of biofuels in the transportation sector. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is aiming to transition 10 percent of conventional jet fuel to SAF by 2030. GOJ and industry sources anticipate Japan's SAF feedstock eligibility and procurement to be driven by the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)'s default life cycle CO_2 emissions values. ANRE is currently planning to spin-off the SAF target volume from the current biofuel standards.

Some Japanese oil refineries have announced plans to launch production of CORSIA-eligible alcohol-to-jet (ATJ) SAF by 2027 with expected annual bioethanol consumption of 600 million liters. The companies will expand production capacity and it is expected annual bioethanol consumption reach at 1.3 billion liters by 2030.

In contrast, Japan's on-road biodiesel use remains very limited at about 10 million liters. For the most part, domestic biodiesel is derived from used cooking oil (UCO) and other fats and oils. As the price of UCO has surged, biodiesel manufacturers have had difficulties securing UCO.

Japanese power plants have been dramatically increasing its wood pellet and other agricultural residue imports for METI's feed-in tariff (FIT) program. Please see the 2023 Japan Biomass Annual.

[1] GOJ's FY is from April to March. For example, FY 2024 is from April 1, 2024 to March 31, 2025.

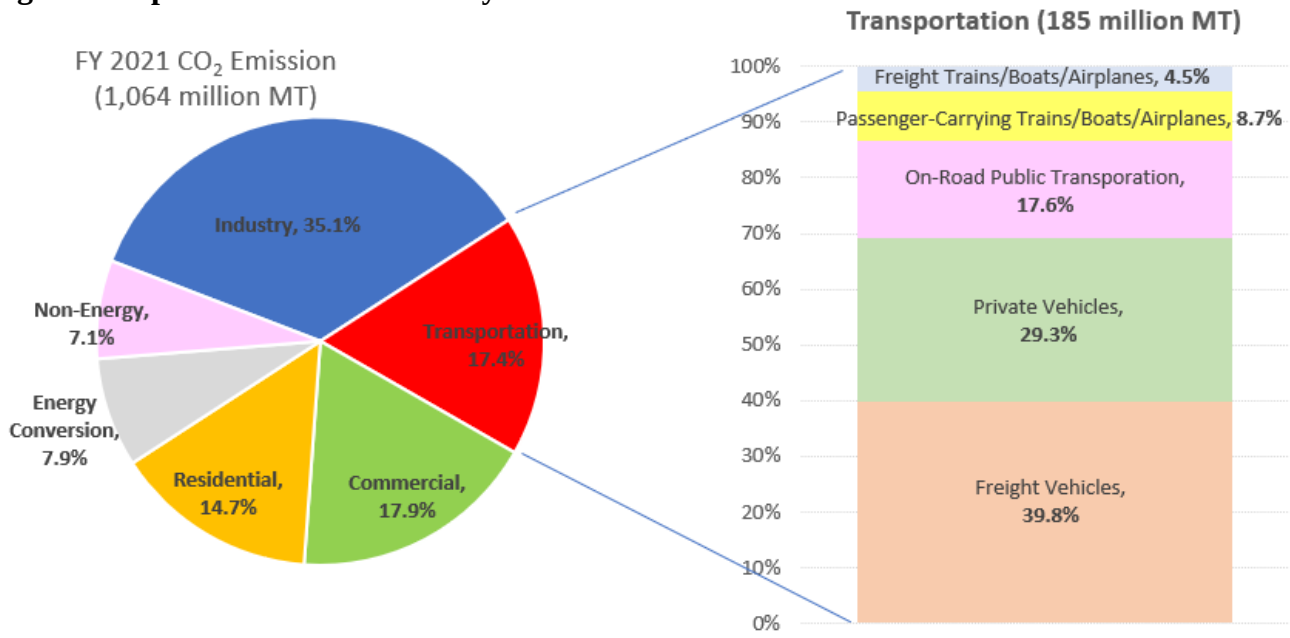
Section II. Policy and Programs

Japanese Energy Policy and GHG Emissions

Following the 1997 adoption of the Kyoto Protocol by the 3rd Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC), Japan pledged to reduce greenhouse gas (GHG) emissions by 6 percent by 2020 compared to GHG emission levels in 1990. Under the 2015 Paris Agreement, the GOJ's Intended Nationally Determined Contribution (INDC) was a 26 percent GHG emission reduction by Japanese fiscal year 2030 compared to FY 2013 levels. In April 2021, the GOJ pledged to reduce its FY 2030 GHG emissions by 46 percent, rather than the initially promised 26 percent, compared to FY 2013 levels. The GOJ further declared its aim to become carbon neutral by 2050.

According to the Ministry of Environment (latest data available), as Japanese society recovered from the COVID-19 pandemic, GHG emissions in FY 2021 increased 2.0 percent from the previous year, reaching 1.12 billion CO_2-equivalent metric tons (MT), of which 1.06 billion MT were CO_2 emissions. Emissions from the transportation sector also increased to 185 million MT or 17.4 percent of Japan's CO_2 emissions in FY 2021 (Figure 1). Freight vehicles emitted 74 million MT, private vehicles emitted 54 million MT, passenger-carrying vehicles emitted 33 million MT, and train/boats/airplanes emitted 24 million MT of CO_2.

Figure 1. Japanese CO_2 Emissions by Sector in FY2021



Source: The Ministry of the Environment

Note: The figure does not include other GHG emissions: CH_4 (27.4 million MT CO_2eq), N_2O (19.5 million MT CO_2eq), and CFC substitutes (59.1 million MT CO_2eq). Separately, carbon sinks mainly through forests was 47.6 million MT CO_2eq.

To achieve the GOJ's GHG reduction goals, in February 2023 the Kishida Cabinet approved the Basic Policy for the Green Transformation (GX) Realization. The GOJ emphasizes GHG emission reductions via increased use of next generation vehicles, such as electric vehicles (EV) in on-road transportation and via commercially developing electrofuels (synthetic fuel or e-fuel). The GOJ also emphasizes the

production and use of sustainable aviation fuel (SAF) by the aviation industry. The GX Basic Policy places little importance on readily available technologies, such as biofuels.

On May 12, 2023, before Prime Minister (PM) Kishida hosted the G7 Hiroshima Summit, the GX Promotion Act was enacted. The GX Promotion Act introduced carbon pricing. The GOJ estimates that achieving carbon neutrality by 2050 will require an investment of 150 trillion yen over the next 10 years, of which 20 trillion yen will be covered by a "fossil fuel surcharge." From FY 2028, the GOJ will impose it on fossil fuel importers and others, depending on the amount of CO_2 derived from the fossil fuels they import. In advance of this compliance market scheme, the Tokyo Stock Exchange started trading carbon credits from October 11, 2023 in order to support the voluntary carbon market.

Political Leadership on Biofuels and Future Direction

On May 23, 2022, President Biden and PM Kishida issued the Japan-U.S. Joint Leaders' Statement, in which they "welcomed Japan's commitment to take all available measures to double demand for bioethanol, including for sustainable aviation fuel and on-road fuel, by 2030 to reduce dependence on imported petroleum." On October 24, 2022, PM Kishida launched the Diet Member Coalition for Promoting Domestic Biofuels and Synthetic Fuels for Carbon Neutrality.

Biofuel Policy Framework

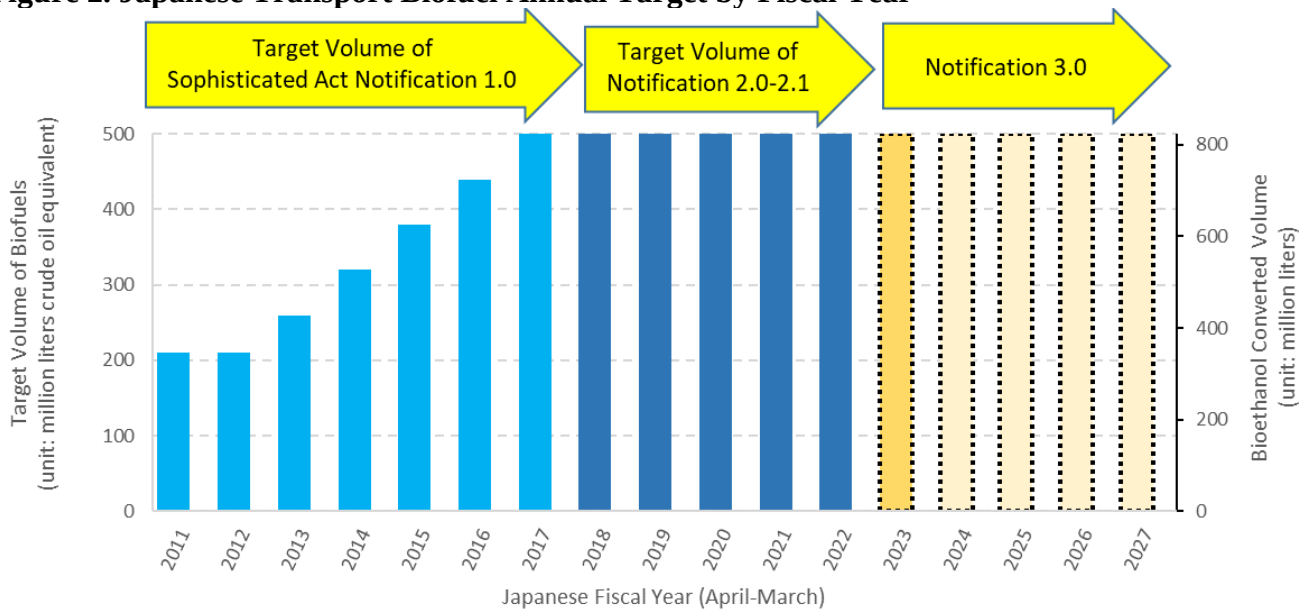
In 2009, to encourage the replacement of fossil fuels with renewable energy sources, the "Act on Promotion of Use of Non-Fossil Energy Sources and Effective Use of Fossil Energy Raw Materials by Energy Suppliers," also known as the Sophisticated Methods of Energy Supply Structure Act (hereafter referred to as "the Sophisticated Act") was enacted. The Sophisticated Act directed the METI Minister to develop basic policies and guidelines (i.e., METI Notifications) for each energy sector (e.g., oil refineries, gas suppliers, power companies, etc.). In order to encourage the Petroleum Association of Japan (PAJ) member companies to use biofuels, ANRE publish the series of METI Notifications as biofuel standards[2].

In 2010, METI Minister published its first biofuel standards (Notification 1.0), which were in effect from FY 2011 to FY 2017 and laid the groundwork for Japan's decision to use bioethanol to fulfil its biofuel commitment in on-road transportation. Japan's preference for bioethanol over biodiesel is rooted in a strong demand for gasoline, variable biodiesel quality and production costs. Notification 1.0 introduced an annual biofuel target volume, a de facto mandate, and a default GHG emission value for Brazilian sugarcane-based ethanol. The FY 2011 annual target was 210 million liters of crude oil equivalent[3] (LOE) or approximately 346 million liters of bioethanol. By FY 2017, the target gradually increased to 500 million LOE (approximately 824 million liters of bioethanol) (see Figure 2).

[2] Although oil refineries with PAJ membership are the primary suppliers of on-road fuel distributed in Japan, there are some gas stations not affiliated with PAJ. As such the fuel distributed by these companies is not subjected to the Sophisticated Act and their biofuel use does not count toward Japan's biofuel target.

[3] The conversion factor for ethanol into crude oil equivalent is 0.607. Thus, 500 million liters of crude oil equivalent (LOE) is equal to 823.7 million liters of ethanol. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act" (Japanese only).

Figure 2. Japanese Transport Biofuel Annual Target by Fiscal Year



In 2018, the METI Minister released the updated second biofuel standards (Notification 2.0), which were in effect from FY 2018 to FY 2022. METI retained the annual biofuel target of 500 million LOE (equivalent to about 824 million liters of bioethanol). Notification 2.0 showed a default GHG emission value for U.S. corn-based ethanol, in addition to Brazilian sugarcane-based ethanol. In September 2020, METI updated gasoline GHG emission value (i.e., carbon intensity (CI) value) as Notification 2.1.

As Notification 2.1 was to expire at the end of FY 2022 (JA2022-0077), ANRE initiated a series of technical meetings to update the biofuel standard. On March 31, 2023, after two consecutive public comment periods (JA2023-0002 and JA2023-0012), METI Minister published Notification 3.0 (unofficial translation in JA2023-0014), which mainly updated the default GHG emission values of ethanol. METI has maintained the annual target volume of 500 million LOE (equivalent to approximately 824 million liters of bioethanol). Notification 3.0 established: (i) GHG emission value for gasoline temporally maintained at 88.74 g-CO_2eq/MJ, (ii) GHG emission reduction target for transport bioethanol temporarily maintained at 55 percent, iii) GHG emission default value for U.S. corn-based ethanol improved to 36.86 g-CO_2eq/MJ, and (iv) GHG emission default value for Brazilian sugarcane-based ethanol improved to 28.59 g-CO_2eq/MJ. Consumption of next generation biofuels (e.g., cellulosic bioethanol, SAF) counts twice toward the target volume, though, Japan has not used any next generation biofuel as of November 2023.

In the Notification 3.0, METI promises to start updating GHG emission value for gasoline and METI will raise the GHG emission reduction target to 60 percent once they publish the new CI value for gasoline in Notification 3.1 in near future (JA2023-0012).

Notification 3.0 considers certain types of SAF as next generation biofuel and counts it twice toward the annual target volume for transport biofuels. During expert committee meetings on Notification 3.0, some experts recommended a separate SAF target from the on-road ethanol target. On May 26, 2023, ANRE presented a draft interim report on SAF introduction in Japan and announced plans to set a new separate

target volume for SAF beyond the current 500 million liters of crude oil equivalent for the transportation sector under the Sophisticated Act before SAF is commercially available (JA2023-0050).

Table 1 compares the old (Notification 2.1) biofuel standards to the new one (Notification 3.0), and to an upcoming plan (i.e., Notification 3.1).

Table 1. Comparison of Old, New and Future Planned Biofuel Standard

	Old Biofuel Standard	New Biofuel Standard	Future Biofuel Standard
Version	Notification 2.1	Notification 3.0	Notification 3.1
Introduced	September 2020	March 2023	2024 or later
Covered Period	April 2018*-March 2023	April 2023-March 2028	Till March 2028
Annual Target Volume of Ethanol	823.7 million Liters	823.7 million Liters	823.7 million Liters
Gasoline CI Value	88.74	88.74	Recalculating
Reduction Target	55%	55%	60%
Brazilian Sugarcane Ethanol	33.61	28.59	Unchanged?
U.S. Corn Ethanol	43.15	36.86	Unchanged?
Next Gen. Biofuel	Count Twice	Count Twice	Count Twice

Note: *Notification 2.0-2.1 covers from FY 2018-2023

Gasoline Standards and Practices in Japan

Under the Quality Control of Gasoline and Other Fuels Act (hereafter referred to as the "Quality Control Act"), METI sets gasoline standards. Since 2003, regular gasoline standard allows direct blending of ethanol up to 3 percent in volume. Also, oxygen content in regular gasoline is limited to less than 1.3 percent in weight (8.3 percent of ETBE, which is equivalent to a 3.5 percent of directly blended ethanol).

Separately, the Quality Control Act established an "E10 gasoline" standard for vehicles that the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has certified as E10/ETBE22 compatible. E10 gasoline contains between 3 to 10 percent of directly blended ethanol. The maximum blend level specification for ETBE is approximately 22 percent (ETBE22) under the E10 gasoline standard. Nakagawa Bussan of Nagoya commercially introduced Japan's first E10-grade gasoline[4] in summer 2023.

Since 2011, the Petroleum Association of Japan (PAJ), which represents Japanese oil refineries, has chosen to fulfil the biofuel mandate by blending bioethanol-derived bio-Ethyl Tert-Butyl Ether (ETBE)

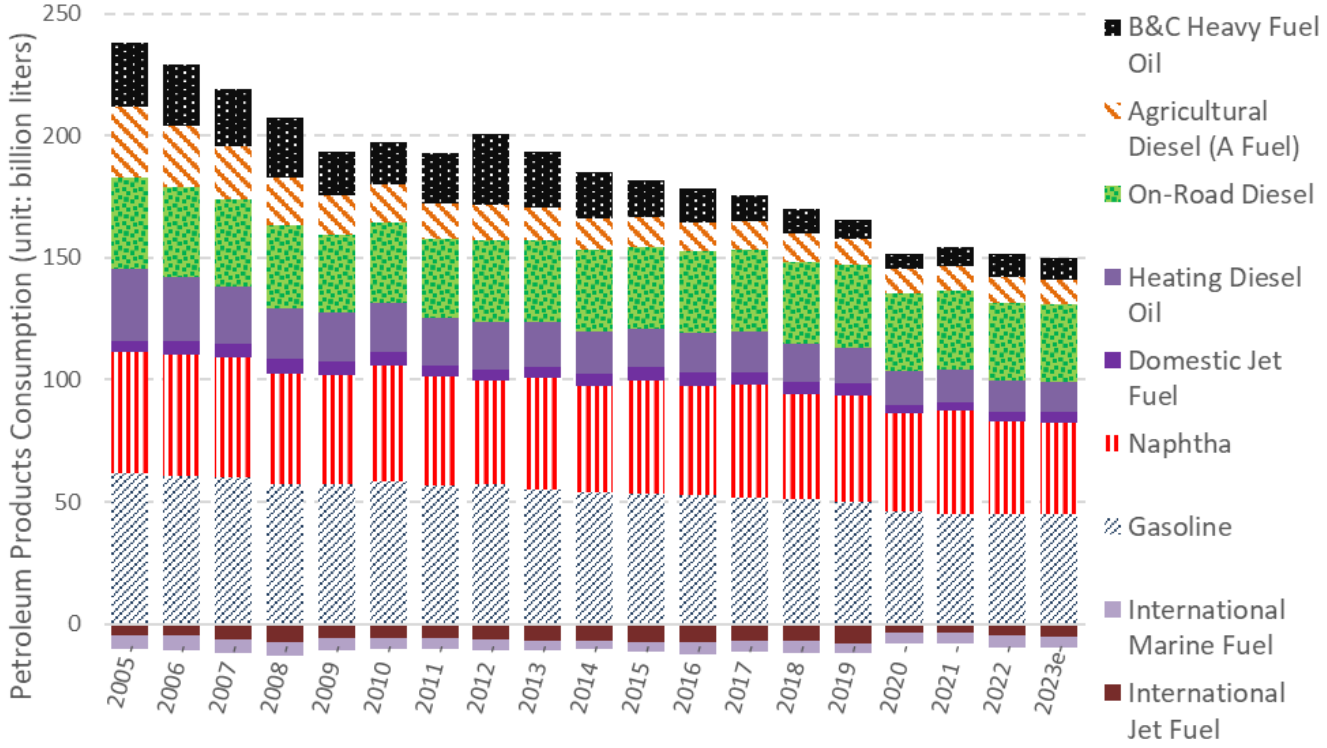
[4] Nakagawa Bussan started providing gasoline containing 7 percent of bioethanol, and they sell as E7 gasoline.

with gasoline. The Japan Biofuels Supply LLP[5] (JBSL) represents large Japanese oil companies and blends approximately 1,940 million liters of ETBE (containing approximately 823.7 million liters of bioethanol) a year to meet Japan's biofuel target. Industry sources indicate that there is also limited distribution of directly blended E3 gasoline by small gas stations not affiliated with the PAJ.

Fuel Pool Size

Japan's petroleum consumption has been in a long-term decline, and it was exacerbated during the COVID-19 pandemic. In 2022, although Japanese economy gradually recovered from the COVID pandemic, demand for naphtha consumption decreased 11.2 percent from the previous year due to large-scale regular repairs of ethylene production equipment and oversupply caused by an economic slump in China. Heating diesel oil consumption decreased 3.5 percent due to the warm winter. On the other hand, domestic jet fuel consumption increased 19.9 percent due to the recovery in air travel, and heavy fuel oil consumption increased 22.9 percent due to a shift to power fuel from natural gas and coal (see Figure 3).

Figure 3. Japan's Consumption of Petroleum-Derived Products

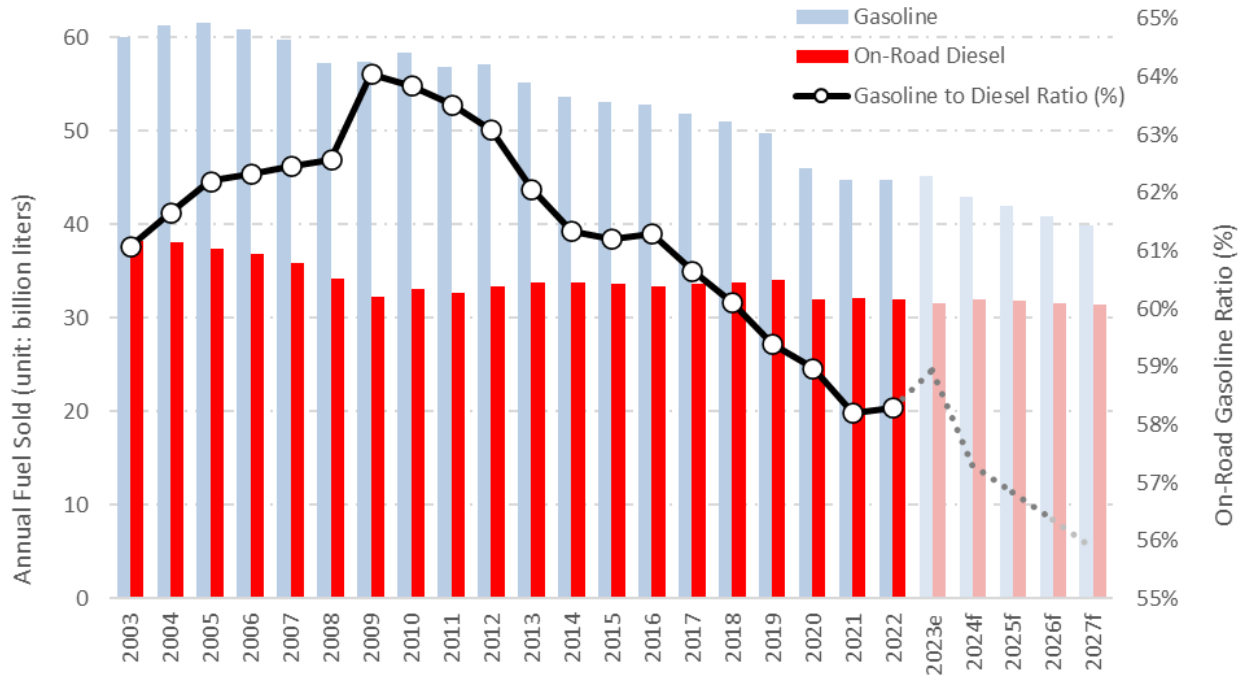


Note: "2023e" represents year-to-date estimate for CY2022 (till September 2022 monthly data)
International jet and marine fuel are estimated based on export data.
Source: ANRE

[5] As of November 2022, JBSL consists of ENEOS, Idemitsu/ShowaShell, Cosmo Oil, Fuji Oil Company, and Taiyo Oil Company.

However, the gas price stayed high, gasoline demand rebounded back from COVID-19 pandemic in 2022 and 2023. On the other hand, on-road diesel consumption was weak since the rising price inflation resulted in the stagnation of logistics and business users who tried to adjust to the high diesel price. Japan's gasoline consumption was 44.7 billion liters in 2022. The on-road diesel consumption was 32.0 billion liters in 2022. These figures lifted Japan's gasoline-to-diesel ratio to 58.3 percent, and it is estimated it will further increase to around 59 percent in 2023 (see Figure 4).

Figure 4. Japan's Past and Expected Consumption of Gasoline and On-Road Diesel

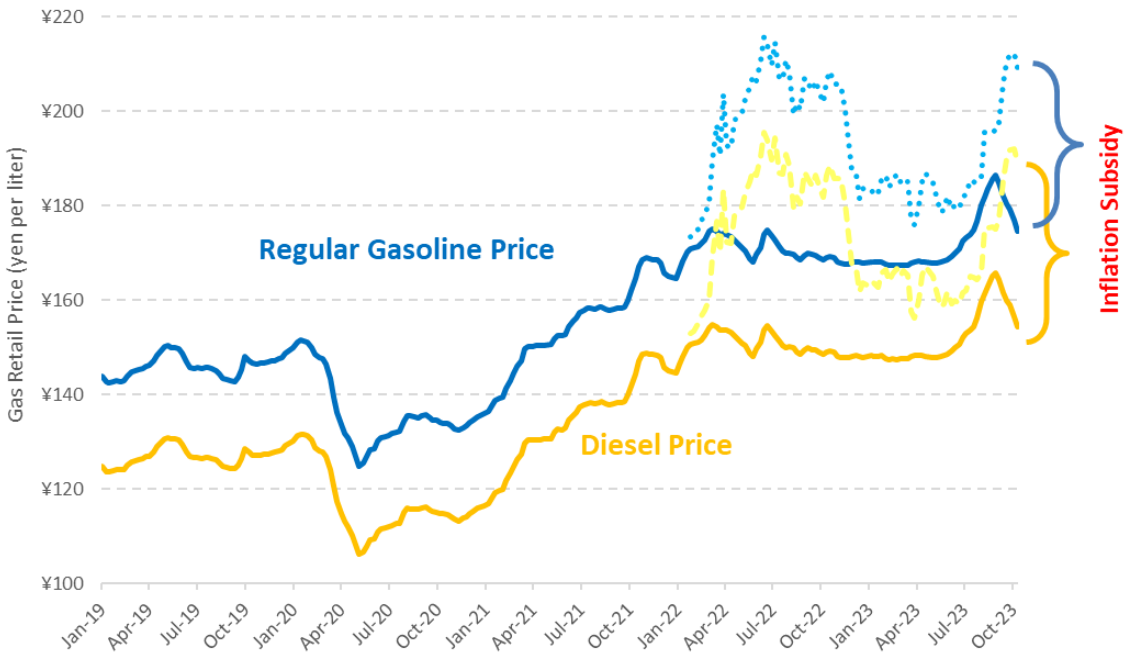


Note: The graph contains year-to-date estimate for 2023 and forecasts for 2024-2027 by METI.
Sources: METI

In the near future, METI forecasts gasoline consumption to decrease 2.4-2.6 percent a year through 2027 due to greater fuel efficiency of new vehicles (e.g., hybrid engine). METI also forecasts on-road diesel consumption to fall 0.5-0.6 percent a year through 2027 (see Figure 4).

Gasoline and diesel prices have been rising steadily in Japan due to the weakening yen and higher global crude oil prices. In response, since January 27, 2022, the GOJ has implemented an "emergency" subsidy program aimed to minimize fuel price spikes (see Figure 5). The program, which has stabilized fuel demand, covers gasoline, on-road diesel, heating oil, and fuel oil. The GOJ initially planned to gradually terminate the program by September 2023. However, gasoline prices started increasing around summer 2023, resulting in the GOJ deciding to extend the subsidy program. As a result, the Japanese retail price for gasoline has hovered around 170 yen per liter, while on-road diesel has been around 150 yen per liter (see Figure 5). As of November 2023, the GOJ announced that they would extend the program until March 2024.

Figure 5. Gasoline and On-Road Diesel Retail Price and Subsidy Program



Note: Dotted lines represent the expected retail price by METI without the gas subsidy program based on the Dubai Fateh Crude Oil Price.
Sources: METI

SAF as an Emerging Biofuel Opportunity

In 2016, the International Civil Aviation Organization (ICAO) adopted a global, market-based mechanism named the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to address CO_2 emissions resulting from international aviation.

The adoption of SAF is a key component of the GOJ's plan to reduce GHG emissions in aviation. On April 22, 2022, MLIT and METI jointly launched a public-private partnership to facilitate the introduction of an international competitive supply chain for SAF (JA2022-0041). In the summer of 2022, METI launched SAF production and supply working group meetings, while separately MLIT initiated the SAF distribution working group meetings.

On October 4, 2022, MLIT published the draft Basic Policy for Promoting Decarbonization of Aviation (JA2022-0085). In the proposed Basic Policy, there are three targets for airlines; 1) stabilization of CO_2 emissions (i.e., carbon-neutral growth) from international flights at FY 2020 levels; 2) reduction in CO_2 emissions per unit transport from domestic flights by 16 percent by FY 2030 compared to FY 2013 levels; and 3) carbon neutrality for both international and domestic flights by FY 2050. Japan is aiming to replace 10 percent of jet fuel with SAF by 2030. MLIT estimates that by 2030 Japanese airports

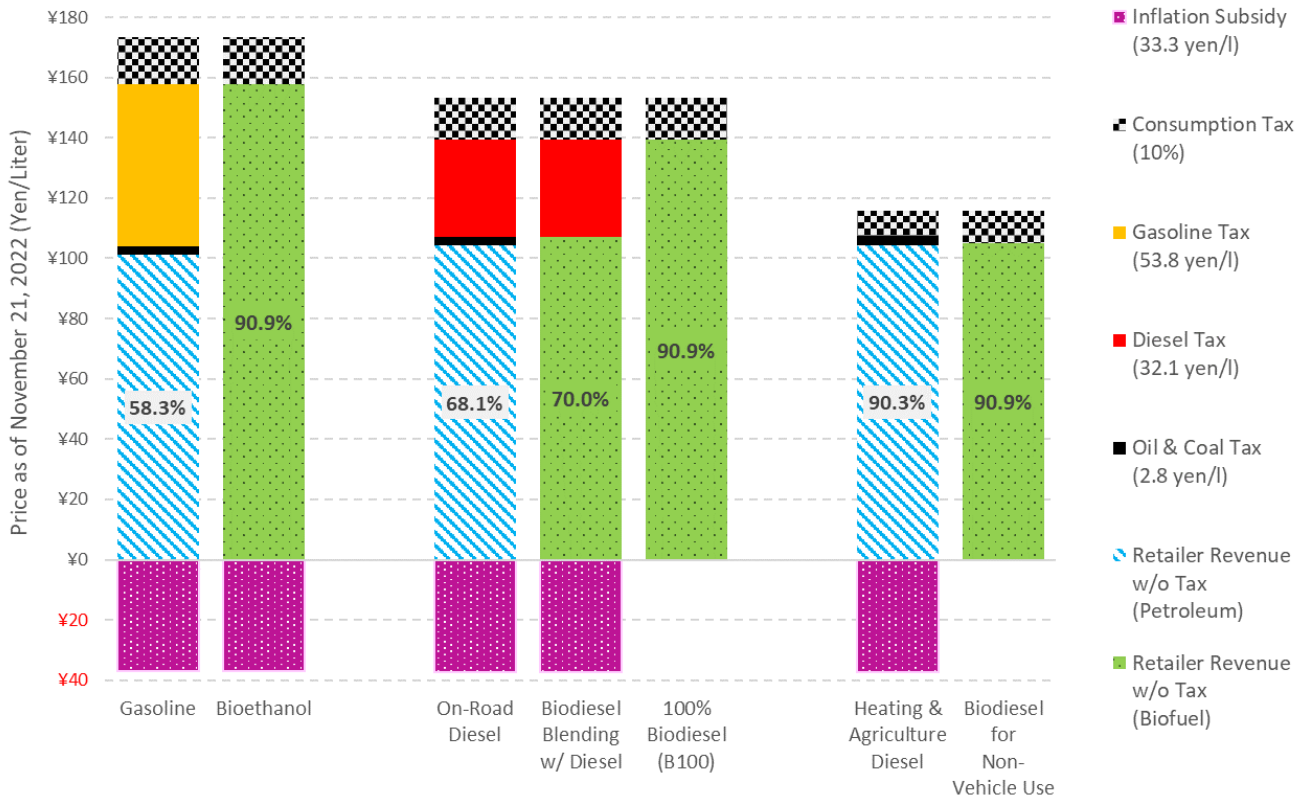
would like to use 2.5 to 5.6 billion liters of SAF out of a total of 10.9 to 12.3 billion liters of jet fuel consumption to meet the CORSIA goal[6].
With domestic demand for gasoline expected to decline by about 2 percent a year, Japanese industry sees SAF as a real opportunity to expand Japan's liquid biofuel market. For its part, the GOJ has focused on stimulating domestic neat SAF production over SAF imports and has repeatedly identified bioethanol as the most promising feedstock[7] for neat SAF production in Japan. Industry and GOJ sources indicate that CORSIA's default life cycle emissions values for fuels will likely serve as the guide to SAF feedstock eligibility.

Financial Supports for Biofuels

Fossil Fuel Tax Policy

Since 2008, Japan has exempted fuel bioethanol from the gasoline tax (53.8 yen/liter) and oil and coal tax (2.8 yen/liter) under the Quality Control Act. This system (see Figure 6) facilitates price competitiveness of bioethanol relative to gasoline, which has a 33 percent higher energy density.

Figure 6. Japan's Tax and Subsidy Structures for Liquid Fossil Fuels and Biofuels



Sources: METI

[6] https://www.mlit.go.jp/common/001407977.pdf (Japanese only)

[7] Please see Japan Oilseeds and Products Annual for more detail about the availability of used cooking oil.

Although Japan exempts biodiesel from the oil and coal tax (2.8 yen/liter), biodiesel is subject to the on-road diesel local tax (32.1 yen/liter) when blended with on-road diesel (e.g., B3, B5)[8]. Biodiesel producers have frequently, though unsuccessfully, petitioned METI and the Ministry of Finance to revise the tax structure to expand the biodiesel market. On the other hand, pure biodiesel, B100, is not considered as fossil fuel, and accordingly is not subject to fuel regulations and fuel tax.

Bioethanol blended with gasoline and biodiesel blended with on-road diesel are also eligible for the GOJ's recent subsidy program to reduce the impact of fuel price inflation (see Figure 6 and 5).

On November 15, 2023, the average retail price of regular gasoline was 173.5 yen/liter (≈$4.33/gallon), on-road diesel was 153.2 yen/liter (≈$3.82/gallon), and heating oil was 115.7 yen/liter (≈$2.89/gallon)[9]. The inflation subsidy was 25.1 yen/liter.

In addition, as previously mentioned, Japan introduced carbon pricing mechanism under the GX Promotion Act. Starting from FY 2028, crude oil importers will be subject to a "fossil fuel surcharge" based on the amount of CO_2 derived from fossil fuels they import.

Financial Supports for Commercialization of Advanced Biofuel, SAF, and E-fuel Projects

In 2020, METI introduced a 2.3 trillion yen (approximately $15 billion[9]) Green Innovation Fund to support research, development, and commercialization of environmentally innovative projects through the New Energy and Industrial Technology Development Organization (NEDO). E-fuels and SAF are key targets for this initiative. For e-fuels, the GOJ aims to achieve a liquid fuel yield of 80 percent of produced hydrocarbon in pilot projects by 2030 and commercialization by 2040. For ATJ SAF, NEDO announced plans for commercial production by 2030 with a liquid fuel yield of at least 50 percent and production cost of 100 yen per liter.

As part of METI's Green Innovation Fund, on April 19, 2022[10], NEDO awarded 114.5 billion yen (about $755 million[9]) in grants to pilot projects for developing e-fuels, SAF, and other renewable fuels. In FY 2023, METI separately provided 5.18 billion yen ($34 million[9]) to the bio-jet fuel technology research and development projects of NEDO.

Environmental Sustainability and Certification

To meet the biofuel target established under the Sophisticated Act, METI requires a proof of sustainability. JBSL typically relies on the International Sustainability and Carbon Certification (ISCC).

[8] The Quality Control Act, which limits biodiesel content to 5 percent (B5) in on-road diesel, only sets out requirements for fossil fuels and does not extend to B100 or 100 percent biodiesel.

[9] $1 USD = 151.72 yen (as of Nov 14, 2023 by BOJ)

[10] NEDO has not opened new applications for SAF and e-fuel projects since then (as of Nov. 2023).

Import Tariff

METI's Ordinance for the Enforcement of the Ethanol Business strictly regulates ethanol imports and sales in Japan. Japan does not impose a tariff on bio-ETBE imports, imports of bioethanol for the production of bio-ETBE, or imports of industrial "crude" ethanol destined for Japanese distilleries. Under the 2020 U.S.-Japan Trade Agreement (USJTA), by FY 2028, Japan will eliminate the 10 percent tariff on ethanol imports for "other" uses (Harmonized System (HS): 2207.10-199), including fuel ethanol for direct blending (see Table 1). Ethanol imports from the EU and the United Kingdom receive similar tariff treatment, and Japanese ethanol importers noted a recent increase in Japan's imports of synthetic (i.e., ethylene-derived) ethanol from the EU and UK. Japan Customs does not proactively or retroactively apply the preferential tariff schedule under the USJTA unless importers specifically request it prior to import.

Table 1. Tariff Reduction Staging Table under USJTA (HS: 2207.10-199)

2207.10-199	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028
United States	4.5%	3.6%	2.7%	1.8%	0.9%	0%

The tariff on biodiesel imports is 3.9 percent for WTO members, including the United States. Japan eliminated the tariff on biodiesel for a number of countries with free trade agreements (e.g., UK, Switzerland, EU, Comprehensive and Progressive Agreement for Trans-Pacific (CPTPP), and ASEAN). Japan currently does not import biodiesel for on-road use.

Section III. Ethanol

Bioethanol is made by fermenting the carbohydrate components of plant materials, such as corn, sugarcane, or rice. Table 2 breaks down bioethanol consumption for fuel and industrial[11] purposes and provides FAS/Japan's estimate of Japan's average national blend rate.

Consumption

Fuel Use

All major Japanese oil refineries (PAJ members) blend gasolines with bioethanol-derived ETBE, rather than directly with bioethanol. As Japanese biofuel standards set an annual 500 million LOE target, on average, Japan consumes 823.7 million liters of bioethanol (entirely in the form of ETBE) every year. In 2022, Japan imported approximately 92 percent of its consumed ETBE and produced the remained 8 percent domestically with Brazilian ethanol. Some independent local gas stations voluntary sell direct blend gasoline, but the total consumption of bioethanol in these projects is not counted toward the biofuel target under the Sophisticated Act and is under half a million liters. Decreased gasoline demand coupled with a set biofuel volume target has resulted in a higher average ethanol blend rate at 1.8 to 1.9 percent since 2020.

[11] FAS/Tokyo estimated and eliminated (i) approximately 200-260 million liters of bioethanol imported annual for alcoholic beverage production and (ii) domestically manufactured and imported synthetic ethanol used in chemical manufacturing and other purposes from official trade and consumption data.

Table 2. Fuel and Industrial Bioethanol Use in Japan (2014-2023)

Ethanol Used as Fuel and Other Industrial Uses (Million Liters)										
Calendar Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023e**
Beginning Stocks	62	95	82	89	84	60	78	62	64	92
Fuel Begin Stocks	23	55	44	46	44	22	23	16	18	55
Production	17	2	1	0	0	0	0	0	0	0
Fuel Production	17	2	1	0	0	0	0	0	0	0
Imports	843	946	1,143	1,194	1,198	1,173	1,381	1,293	1,436	1,356
Industrial Imports	325	347	385	412	373	388	538	461	562	566
Fuel Imports	518	599	758	782	825	785	843	832	874	790
>of which to make ETBE	60	60	70	55	87	60	54	66	71	55
>imported as ETBE	458	539	688	727	738	725	789	766	803	729
Exports	0	0	0	0	0	0	0	0	0	0
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	827	961	1,137	1,199	1,222	1,155	1,397	1,291	1,408	1,378
Industrial Consumption	324	349	380	415	375	371	547	461	571	553
>for food industry	183	188	190	186	202	209	246	240	240	240
Fuel Consumption	503	612	757	784	847	784	850	830	837	825
Ending Stocks	95	82	89	84	60	78	62	64	92	70
Fuel Ending Stocks	55	44	46	44	22	23	16	18	55	20
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	5	3	3	1	1	1	1	0	0	0
Nameplate Capacity	34	34	4	1	1	1	1	0	0	0
Capacity Use (%)	50%	6%	25%	19%	20%	18%	20%	N/A	N/A	N/A
Feedstock Use for Fuel Ethanol (1,000 MT)										
Molasses	8	8	2	-	-	-	-	-	-	-
Rice	2	1	1	0	1	0	0	-	-	-
Market Penetration (Million Liters)										
Fuel Ethanol Use	503	612	757	784	847	784	850	830	837	825
Gasoline & bio-ETBE	53,608	53,113	52,849	51,904	50,999	49,785	46,052	44,768	44,781	45,200
Ethanol Blend Rate (%)	0.9%	1.2%	1.4%	1.5%	1.7%	1.6%	1.8%	1.9%	1.9%	1.8%

Sources: Japan Customs; Japan Alcohol Association; ANRE Total Energy Statistics; ANRE Petroleum Statistics
Note: *e* = estimate by FAS/Tokyo
1 liter of bio-ETBE contains 0.4237 liters of bioethanol; 1 liter of bioethanol = 0.607 LOE
Bioethanol imported for alcoholic beverage (e.g., *ko-rui shochu*) production and estimated synthetic ethanol volumes are excluded.

Industrial Use

The COVID-19 pandemic boosted industrial ethanol demand by 47 percent in 2020 to 547 million liters, especially for sanitization purposes. The consumption of industrial bioethanol dropped to 461 million liters in 2021, but rebounded back to 560 million liters in 2022. Part of the reason was Japan needed to import more bioethanol as the availability of domestic synthetic ethanol decreased. Japan's ethylene output declined amid continued weakness in China's economy since 2022. Also, some petrochemical companies tried to increase the use of bioethanol. FAS/Tokyo estimates that the industrial bioethanol consumption will stay around the 2022 level in 2023 based on year-to-date trade statistics.

For details about Japan's distribution structure for non-fuel ethanol, please see JA2021-0072. Consumption of imported bioethanol in the production of alcoholic beverages (e.g., *ko-rui shochu*) is outside of the scope of this report.

Production

Since the National Federation of Agricultural Cooperative Associations (JA Zen-noh) halted its bioethanol production since 2021, Japan has not produced domestic fuel ethanol. Japan's annual production of 80 to 100 million liters of synthetic ethanol is not included in Table 2.

Trade

Japan's fuel bioethanol consumption relies entirely on imports (see Table 2). In 2022, Japan imported 1.9 billion liters of bio-ETBE derived from approximately 803 million liters of bioethanol. In addition, Japanese oil refineries produced ETBE from 71 million liters of ethanol from Brazil. The large portion of U.S. ethanol exports to Japan are for industrial use and usually transshipped through Ulsan, South Korea. Therefore, there is a substantial difference between U.S. export data and Japan's import data for ethanol (see JA2021-0072 for details).

According to industry experts, some food manufacturers that utilize ethanol request sugarcane-based ethanol. Brazil dominates the ethanol market for Japan's "industrial" use, including the food industry market. Pakistan also increased ethanol shipments to Japan in 2022.

Section IV. Biodiesel

METI and Japanese oil refineries have not promoted on-road biodiesel use due to limited demand[12], variable biodiesel quality, and feedstock availability.

Some municipalities have small-scale, highly localized environmental projects focused on biodiesel production from used cooking oil (UCO) and vegetable oils. For example, the City of Kyoto has the largest biodiesel project in Japan with a daily capacity of 5,000 liters. In FY 2022, the City of Kyoto used about 0.42 million liters of biodiesel.

[12] However, on-road diesel ratio has been increasing as gasoline demand has declined in last decade.

In FY 2021 (the most recently available energy statistics from ANRE), Japan consumed 10.2 million liters of biodiesel, a drop from 13.4 million liters in FY 2020. The COVID-19 pandemic reduced UCO generated from restaurants. Also, as the vegetable oil price spiked, UCO was also traded at high prices and some supply was exported to Singapore for SAF production (see Japan Oilseeds and Products Annual).

Since 2011, Japan has exported biodiesel to European countries. In 2022, Japan exported 4.5 million liters of biodiesel to Switzerland, just about half compared to the 2020 level. On the other hand, Japan has imported roughly 1 million liters of biodiesel (HS code 3826.00-000) per year, mostly palm oil from Malaysia and jatropha oil from the Philippines for uses other than on-road fuel. In 2022, Japan's imports of biodiesel dropped to 150,000 liters. In 2023, Japan imported about 800,000 liters of biodiesel from Belgium.
According to UCO Japan, Japan generated 0.5 million MT of UCO in 2022, of which 0.2 million MT went toward animal feed, 0.12 million MT was exported for foreign SAF production, 50,000 MT used in chemical manufacturing (e.g., soap and detergent), and 10,000 MT for biodiesel feedstock. Japanese feed manufacturers experienced a UCO shortage since around 2021 and had to import 0.2 million MT of palm oil for compound feed. For further information about Japanese UCO and vegetable oil market, please see Japan Oilseeds and Products Annual.

Section V. Advanced Biofuels

As of November 2023, Japan does not produce advanced biofuels on a commercial scale. Table 3 describes major SAF projects announced by Japanese oil refineries. There are a number of small-scale pilot projects focusing on SAF supported by NEDO and the Ministry of Environment, which are not included in Table 3.

Table 3. Ongoing Japanese Major SAF Projects

Oil Company	Main Partners	Location	Operation	Estimated Annual SAF Production (million liters)	& Feedstock	Status
Cosmo	JGC, Revo	Sakai, Osaka	Late 2024	30	UCO	Under Construction (2023 June)
ENEOS	TotalEnergies	Arida, Wakayama	2026	400	UCO, Animal Fat	Plan
Cosmo	Mitsui	Chiba?	2027	220	Ethanol	Plan
Idemitsu	N/A	Chiba	2027	100	Ethanol	Plan
Fuji Sekiyu	Itochu	Sodegaura, Chiba	2027	180	UCO?	Plan
Taiyo Sekiyu	Mitsui	Okinawa	2028	220	Ethanol	Plan
Idemitsu	N/A	Nagoya?	2030	400	Ethanol	Plan

Cosmo Oil, JGC Holdings, and Revo International established a joint venture called Saffaire Sky Energy, and the group started construction in May 2023 on Japan's first SAF production facility in Cosmo's Sakai Refinery in Osaka. Cosmo Oil anticipates finishing the construction by the second half of FY 2024. Cosmo is planning to use UCO to produce hydro-processed esters and fatty acids (HEFA) SAF and would like to supply 30 million liters annually.

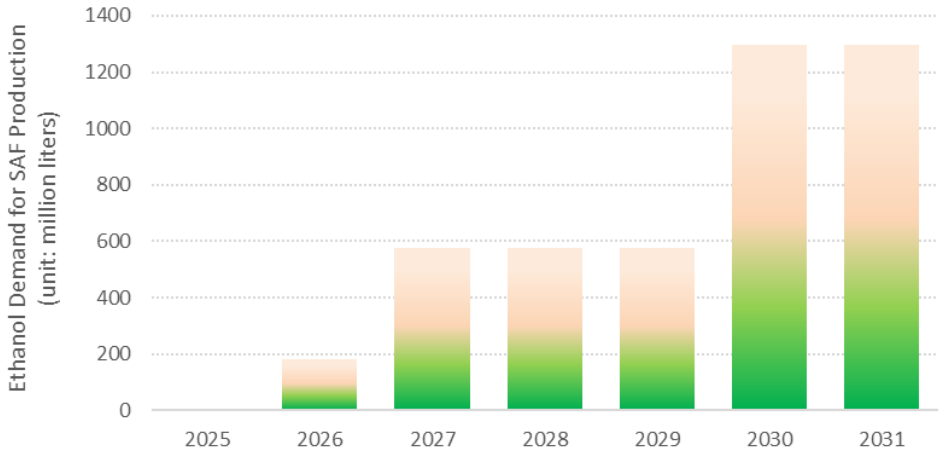
The largest Japanese oil refinery, ENEOS, and French TotalEnergies are now planning to establish a HEFA SAF production facility at the ENEOS Wakayama Refinery in Arida[13]. ENEOS is planning to use UCO and animal fats to produce 300 thousand tons of SAF by 2026.

In 2022, the Idemitsu Kosan Company received 29.2 billion yen (about $192 million[14]) for a 5-year project to develop and commercialize its SAF supply chain using the Alcohol-to-Jet (ATJ) technology. According to an Idemitsu press release, the company will annually procure 180 million liters of bioethanol to produce 100 million liters of neat SAF. This pilot production is slated to start by 2026 in Chiba prefecture. By 2030, Idemitsu aims to launch second and third SAF plants and expects the combined production capacity to reach 500 million liters a year of ATJ SAF (JA2022-0041).

Cosmo Oil separately collaborates with Mitsui & Co. and they announced joint plans for an ATJ SAF manufacturing facility using LanzaJet's technology. They aim to produce 220 million liters of SAF per year by FY 2027.

If the Idemitsu and Cosmo-Mitsui project unfold as planned, Japan will require approximately 1.3 billion liters of CORSIA-eligible bioethanol by 2030 (see Figure 7), in addition to the demand for on-road bioethanol.

Figure 7. Announced Ethanol Demand by ATJ SAF Manufacturers



Note: These volumes are based on press releases by Cosmo Oil, Mitsui and Idemitsu. FAS/Tokyo does not include any subjective analysis in Figure 7.

[13] ENEOS was initially planning to establish one in Yokohama Negishi Refinery, but changed the plan.
[14] $1 USD = 151.72 yen (as of Nov 14, 2023 by BOJ)

Before domestic SAF production will commercially launch, Japanese airliners will likely rely on imported SAF. With support from MLIT, in March 2023, Itochu imported about 5,000 liters of neat SAF from Neste to blend with conventional jet fuel as a part of a demonstration project.

Section VI. Solid Biomass

Japan has been dramatically increasing its wood pellet imports and other agricultural residues for its feed-in tariff (FIT) program, as more large-scale FIT-approved biomass power plants become operational. In 2022, Japan imported 4.4 million MT of wood pellets, of which 54 percent came from Vietnam, 31 percent came from Canada, and 7 percent came from the United States. Please see the 2023 Japan Biomass Annual.

Section VII. Notes on Statistical Data

General Terms

ATJ: alcohol-to-jet process to produce SAF
Bioethanol: ethanol produced from biomass, forestry, and other biomass feedstock
Biodiesel: fatty acid methyl ester produced from both animal or plant lipids, both virgin (first time use) or waste streams (such as used cooking oils)
Bio-ETBE: ETBE made from bioethanol
B3, B5: blend of biodiesel with petroleum diesel with the number indicating the maximum percentage by volume of biodiesel in the blend.
B100: 100 percent pure biodiesel
CPTPP: Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CI Value: carbon intensity value, a value measuring GHG emissions released when consuming products (e.g., ethanol, gasoline). This value is derived from LCA. The unit of value is g-CO_2e/MJ.
CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation
E3: blend of 97 percent gasoline and 3 percent bioethanol
E10: blend of 90 percent gasoline and 10 percent bioethanol
e-fuels: electrofuels (synthetic fuels) made from carbon dioxide and hydrogen
EPA: economic partnership agreement
ETBE: Ethyl Tert-Butyl Ether
EV: electric vehicle
FY: Japanese fiscal year (April-March), for example, FY 2021 is April 2021 – March 2022.
GHG: greenhouse gas
LCA: life cycle assessment
HEFA: hydro-processed esters and fatty acids
HS: harmonized system of tariff schedule codes
INDC: intended nationally determined contribution
PM: Prime Minister
SAF: sustainable aviation fuel
UCO: used cooking oil
USJTA: U.S.-Japan Trade Agreement

Units

g-CO_2eq: grams of carbon dioxide equivalent of GHG emission
l: liter, 1l = 0.264 gallon
LOE: liters of crude oil equivalent; unit of energy used by METI
MJ: megajoule, 1 MJ = 1,000,000 joule
MT: metric ton, 1 MT = 1,000 kg = 2,204.6 pounds = 1.1 short ton
MT-CO2eq: metric ton CO2 equivalent of GHG emission

Organizations and Companies

ANRE: The Agency for Natural Resources and Energy of METI
ASEAN: Association of South-East Asian Nations
EU: European Union
FAS/Tokyo: Tokyo Office of Agricultural Affairs of the Foreign Agricultural Service
GOJ: The Government of Japan
ICAO: The International Civil Aviation Organization
IMO: International Maritime Organization
JA Zen-noh: National Federation of Agricultural Co-operative Associations
JBSL: Japan Biofuels Supply LLP
METI: The Ministry of Economy, Trade and Industry
MLIT: The Ministry of Land, Infrastructure, Transport and Tourism
NEDO: New Energy and Industrial Technology Development Organization
PAJ: Petroleum Association of Japan
UNFCCC: The United Nations Framework Convention on Climate Change

Conversion Factors

1 liter crude oil equivalent (LOE) = 9,250 kcal = 38.7 MJ
1 liter of bio-ETBE contains 0.4237 liters of bioethanol
1 liter of bioethanol = 0.607 LOE

Energy Content

Gasoline 43.10 GJ/MT
Bioethanol 26.90 GJ/MT
Diesel 42.80 GJ/MT
Biodiesel 37.50 GJ/MT

Domestic Feedstock-to-Biofuel Conversion Rates

Rice to bioethanol: 1 MT = 371 liters (actual value by Zen-noh in 2019)
UCO and Vegetable Oil to biodiesel: 1 MT = 1,043 liters

Attachments:

No Attachments