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Report Highlights:

To meet its 2020 biofuel target amid declining gasoline demand due to COVID-19, Japan increases its average bioethanol blend rate to 1.9 percent. Japan's market for imported wood pellets continues to expand bolstered by the feed-in tariff (FIT) program, but U.S. suppliers remain on the margins. In June 2020, Japan revised the Renewable Energy Act, including the FIT program and its eligibility criteria. Japan meets its biofuel target via bioethanol use and does not have a national biodiesel program.

Section I. Executive Summary

Since joining the Kyoto protocol in 1997, the Government of Japan (GOJ) has established a reduction target for greenhouse gas (GHG) emissions. As part of its commitment under the Paris Agreement, Japan's Energy Basic Plan (available in English) calls for 13-14 percent of Japan's total energy supply to come from renewable sources by 2030.

The Ministry of Economy, Trade and Industry (METI) implements Japan's biofuel policy through its annual target volume, a *de facto* mandate, of 500 million liters of crude oil equivalent[1] (LOE) in the transportation sector through Japanese fiscal year (FY; April-March) 2022. The mandate continues to be entirely fulfilled through the use of bioethanol to produce bio-Ethyl Tert-Butyl Ether (ETBE), which is mostly imported and used as an additive in gasoline by Japan's oil refineries. The Sophisticated Act specifies the environmental standards of bioethanol permitted for use in Japan. The recent revisions of the GHG emission values for gasoline and bioethanol have expanded opportunities for the use of U.S. corn-based ethanol for fuel in Japan. Nevertheless, the national average blend rate for ethanol was a modest 1.6 percent in 2019, though expected to increase to 1.9 percent in 2020 due to an estimated 8 percent decrease in gasoline demand during the COVID-19 pandemic.

Over 90 percent of bio-ETBE consumed by Japan comes from a single Texas facility, which converts Brazilian sugarcane-based ethanol and U.S. corn-based ethanol into bio-ETBE. The remaining bio-ETBE consumed in Japan is produced locally, primarily with imported bioethanol. In 2019, Japan used 791 million liters of bioethanol as ETBE, of which approximately one third was derived from U.S. corn-based ethanol. 2019 ETBE imports were below the METI target due to a fire incident at the bio-ETBE facility. In 2020, Japanese consumption of bioethanol for fuel containing ETBE is expected to rebound and reach 856 million liters.

There are no financial incentives for biodiesel use and no national biodiesel program because Japan uses bio-ETBE to meet its biofuel target volume. The biodiesel market remains limited to small-scale localized activity. When the very limited supply (the current annual figure is 15 million liters) is compared to national on-road diesel use, the national average blend rate for biodiesel is below 0.1 percent. Similarly, there is no commercial use of advanced biofuels yet, nor sustainable aviation fuel (SAF).

METI's feed-in tariff (FIT) program for renewable energy drives biomass consumption in the power sector. Under the program, power companies charge customers a premium for electricity derived from eligible biomass sources for 20 years. Since 2011, METI has gradually lowered FIT payments and introduced an auction system. On June 12, 2020, METI introduced the Renewable Energy Act that supports the expansion of the power grid system to connect scattered renewable energy plants, introduces the feed-in premium (FIP) system, and promotes timely completion of FIT-approved power plants. In 2020, a panel of experts also has begun to develop environmental sustainability standards for FIT-eligible biomass feed stock.

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[1] The conversion factor for ethanol into crude oil equivalent is 0.607. Thus, 500 million liters of crude oil equivalent (LOE) is equal to 824 million liters of ethanol. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act" (Japanese only).

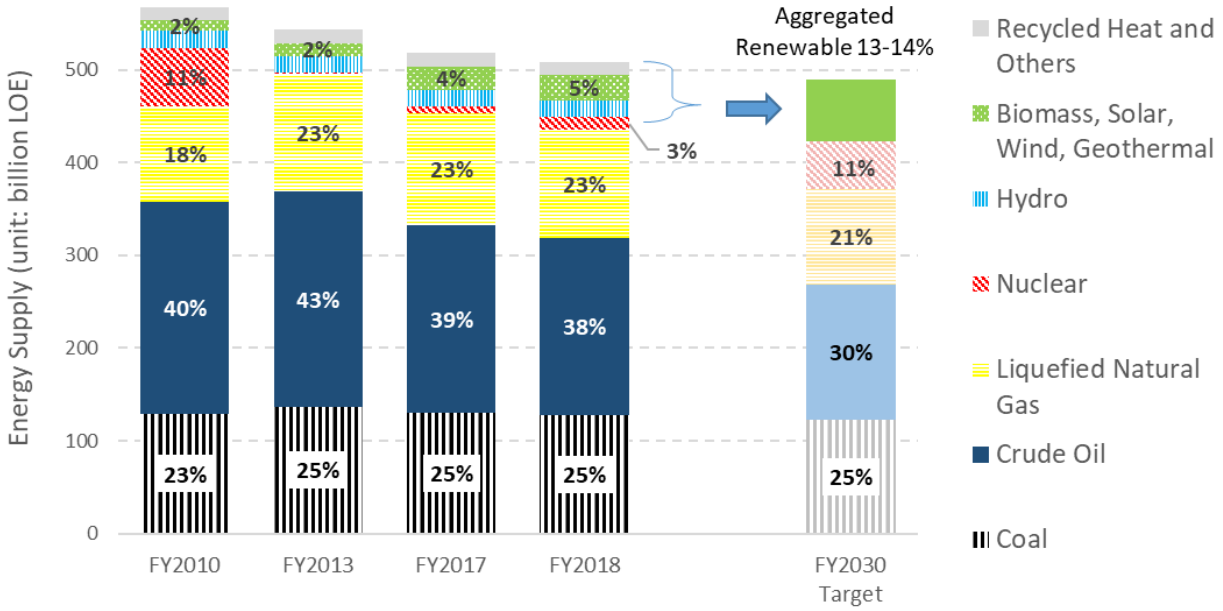
As domestic demand outpaced domestic wood chip production, Japan relies on imported woody biomass and agricultural residues to achieve Japan's GHG removal goal through land use, land use change and forestry. In 2019, Japan imported a record 1.6 million metric tons (MT) of wood pellets, of which 55 percent were from Vietnam and 37 percent were from Canada. FAS/Tokyo projects total 2020 wood pellet imports to reach 2.1 million metric tons.

Section II. Policy and Programs

GHG Emissions and Renewable Energy Policy

In July 2015, Japan submitted its Intended Nationally Determined Contribution (INDC) to United Nations Framework Convention on Climate Change (UNFCCC). According to the INDC, by FY 2030, Japan intended to reduce GHG emissions by 26 percent compared to FY 2013. On July 3, 2018, METI published the 5th Energy Basic Plan, which set the direction for achieving the INDC goal. According to Japan's 2019 Long-Term Strategy under the Paris Agreement, the INDC target specific to transport will be primarily achieved through technological advances in fuel efficiency and promotion of next generation (e.g., fuel cell and electric) vehicles, rather than improvements in biofuel blend rates.

Figure 1. Japan's Primary Energy Supply by Source



Sources: Long-term Energy Supply and Demand Outlook; ANRE Total Energy Statistics

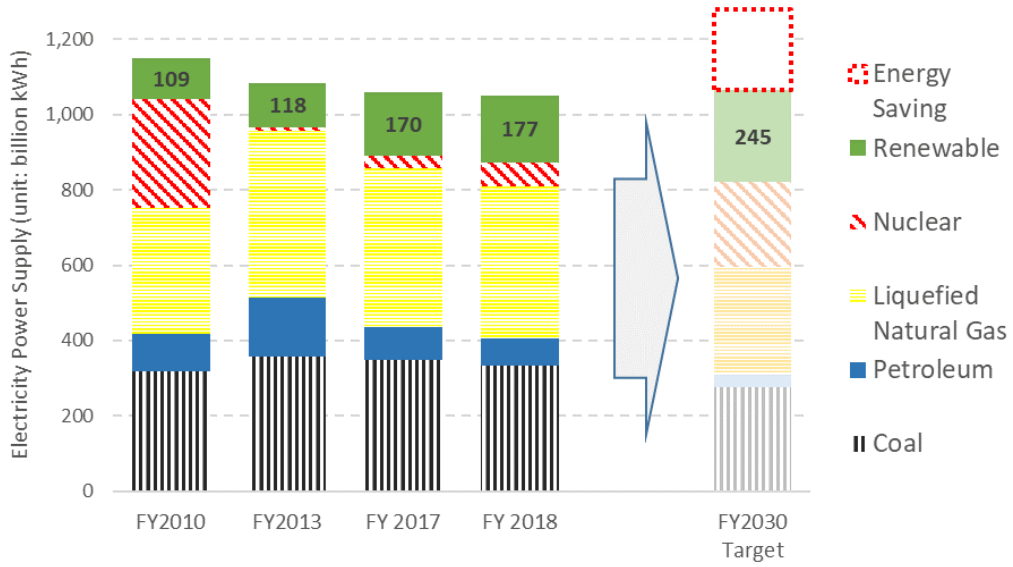
Notes:
- 1 liter crude oil equivalent (LOE) = 38.7 MJ
- FY 2019 energy data will not be available until 2021
- Aggregated renewable includes solar, biomass, wind, geothermal, hydro and recycled heat.

Japan's Energy Basic Plan is due to be revised in 2021. Power generation, with particular emphasis on nuclear and renewable energy, is expected to be the primary focus of the discussions leading up to the revision. In July 2020, METI announced that Japan aims to shut down all inefficient coal-fired power plants by 2030 and to achieve net zero emissions of carbon dioxide by 2050.

Over the past 10 years, Japan has reduced its reliance on crude oil and nuclear power for energy generation, and increased its use of renewable energy sources (Figure 1). METI's definition of renewable energy sources includes biomass, solar, wind, geothermal, hydro, and natural heat energy reutilization. In FY 2018 alone, crude oil use fell by 5.3 percent, natural gas dropped by 4.0 percent and coal dropped by 1.9 percent compared to FY 2017. To offset reduction in crude oil use, Japan aims to reduce the overall energy consumption and increase reliance on nuclear and renewable energy. In FY 2018, renewable energy utilization increased by 10 percent, and nuclear energy use almost doubled compared to FY 2017.

These overall trends in Japan's energy supply are reflected in the energy sources used in power generation (Figure 2). By FY 2030, Japan aims to increase its renewable energy share of electricity consumed to 23 percent, while nuclear energy consumption returns to pre-2011 levels (ANRE's 2015 Long-Term Energy Supply and Demand Outlook). To promote energy diversification, in 2016, METI opened up power sales to new companies, in addition to the ten regional power companies (e.g., Tokyo Electric Power (TEPCO), Kansai Electric Power (KEPCO), etc.).

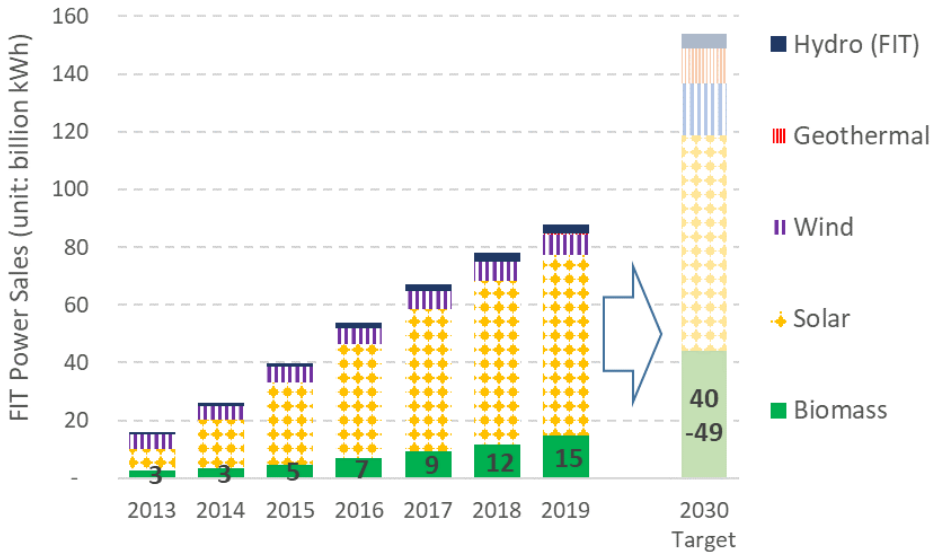
Figure 2. Japan's Historical and Target Electric Energy Consumption by Source



Sources: Long-term Energy Supply and Demand Outlook; ANRE Total Energy Statistics

Electric power generation from renewable sources has been on the rise in Japan over the past several years (Figure 3). ANRE expects biomass use for electricity increase to around 40-49 billion kWh by FY 2030 (Long-term Energy Supply and Demand Outlook).

Figure 3. Japan's Historical and Target Feed-in Tariff Electric Power Sales by Renewable Source



Sources: ANRE FIT Portal, METI Long-term Energy Supply and Demand Outlook
Note: Large-scale hydroelectric power plants are not eligible for FIT, and thus they are not included in this figure (Renewables grouping in Figure 2 includes all hydro and natural heat).

Mandate for Biofuels

In July 2009, METI formulated the first version of Sophisticated Methods of Energy Supply Structure Act (in Japanese only) (hereafter abbreviated as "Sophisticated Act") to encourage the use of renewable energy sources and reduce reliance on fossil fuels by energy suppliers. Following four years of voluntary test marketing by the industry, Japan entered into the first phase (FY 2011-2017) of the Sophisticated Act, where a crude oil equivalent target was set and then progressively raised from 51 million LOE to 500 million LOE. Having met those targets on schedule, the program entered a second phase (FY 2018-2022) holding the target steady at 500 million LOE. As of October 2020, the Sophisticated Act established the following guidelines (i) GHG emission value for gasoline at 88.74 g-CO2eq/MJ (JA2020-0162), (ii) GHG emission value for U.S. corn-based ethanol at 43.15 g-CO_2e/MJ (JA8026), (iii) GHG emission value for Brazilian sugarcane-based ethanol at 33.61 g-CO_2e/MJ, (iv) GHG emission reduction target for transport bioethanol at 55 percent, and (v) reaffirmed the annual biofuel target of 500 million LOE (equivalent to 823.7 million liters of bioethanol) through FY 2022. METI is expected to introduce a new Sophisticated Act in 2022, when the biofuel target may be revised.

Japanese oil refineries have collectively decided to focus on bioethanol (delivered in the form of bio-ETBE) over biodiesel due to variable biodiesel quality, higher biodiesel production costs, supply chain infrastructure investments required, and Japanese petroleum fuel demand. To increase the use of bioethanol and reach the biofuel target, large Japanese oil companies established the Japan Biofuels

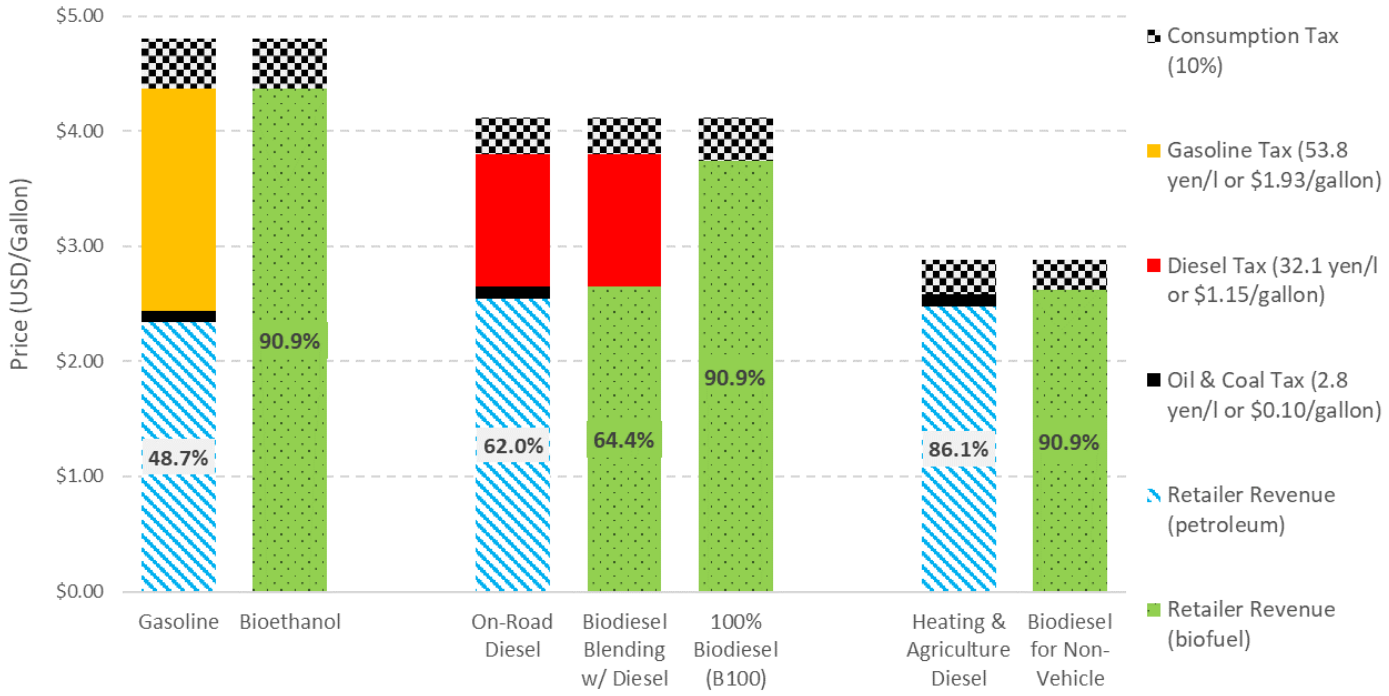
Supply LLP[2] (JBSL) in 2007. As ETBE requires less infrastructural investment than ethanol, JBSL has very firmly pursued bio-ETBE blending, instead of direct bioethanol blending. In line with METI's biofuel target of 500 million LOE, JBSL must blend 1,940 million liters of bio-ETBE (containing 823.7 million liters of bioethanol) per year through FY 2022. The ETBE blend rate for gasoline cannot exceed approximately 8.3 percent[3].

Financial Supports for Producers

Biofuels Tax Policy

Since 2008, to promote bioethanol use, Japan exempted fuel bioethanol from a gasoline tax (53.8 yen/l) and oil and coal tax (2.8 yen/liter) under the "Quality Control of Gasoline and Other Fuels Act" (hereafter abbreviated as "Quality Control Act"). Under Japan's current fuel tax structure, on a per liter basis, the retail price of bioethanol is comparable to that of gasoline (Figure 4) even though its energy density is 33 percent less.

Figure 4. Japan's Tax Structure of Fossil Fuels and Biofuels



Sources: METI; Bank of Japan (1 USD = 105.65 yen as of October 12, 2020)
Note: Average retail prices reported on October 12, 2020 for gasoline (134.1 yen/l or $4.80/gallon), on-road diesel (114.8 yen/l or $4.11/gallon) and heating oil (80.4 yen/l or $2.88/gallon).

[2] As of October 2020, JBSL membership consists of JXTG Nippon Oil & Energy Corporation (ENEOS), Idemitsu Kosan (Idemitsu and Showa Shell), Cosmo Oil, Fuji Oil Company, and Taiyo Oil Company.

[3] Japanese Industrial Standard (JIS) K2202 limits the maximum oxygen content to 1.3 percent or less.

Although Japan also exempts biodiesel from the oil and coal tax (2.8 yen/liter), biodiesel is subject to the on-road diesel tax (32.1 yen/liter) when blended with on-road diesel (e.g., B3, B5)[4]. Biodiesel producers have frequently, though unsuccessfully, petitioned METI and the Ministry of Finance to revise the tax structure to expand the biodiesel market.

Feed-In Tariff (FIT) for Biomass Used in Electrical Power

The FIT program applies only to electric power generation (Table 1). The tariff rates for unutilized woody biomass derived from domestic forest thinning operations are substantially higher than for imported biomass. The "general wood" category encompasses imported wood chips, pellets and agricultural residues/biomass, such as imported palm kernel shell (PKS). To promote smaller biomass power plants, the FIT program introduced facility-based higher tariff rates in 2015 for domestic unutilized wood and in 2017 for general wood.

Table 1. Biomass Feed-In Tariff by Fuel Category

<table>
<tr><th rowspan="2">Fiscal Year</th><th colspan="2">Domestic Unutilized Wood & Thinning</th><th colspan="3">General Wood (e.g., imported pellets, sawmill residue, PKS)</th><th rowspan="2">Liquid Biomass (palm oil)</th><th rowspan="2">Salvaged Lumber</th></tr>
<tr><th>< 2MW</th><th>2MW≤</th><th>< 10MW</th><th>10-20MW</th><th>20MW ≤</th></tr>
<tr><td>2012</td><td colspan="2">32</td><td colspan="3">24</td><td rowspan="6">General Wood</td><td>13</td></tr>
<tr><td>2013</td><td colspan="2">32</td><td colspan="3">24</td><td>13</td></tr>
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<tr><td>2018</td><td>40</td><td>32</td><td>24</td><td colspan="2">Auction (20.6*)</td><td>Auction (20.6*)</td><td>13</td></tr>
<tr><td>2019</td><td>40</td><td>32</td><td>24</td><td colspan="2">Auction (19.6*)</td><td>Auction (19.6*)</td><td>13</td></tr>
<tr><td>2020</td><td>40</td><td>32</td><td>24</td><td colspan="2">Auction</td><td>Auction</td><td>13</td></tr>
<tr><td>2021</td><td>40</td><td>32</td><td>TBA</td><td>TBA</td><td>TBA</td><td>TBA</td><td>13</td></tr>
</table>

Source: ANRE

Note: * represents maximum acceptable prices, disclosed after the auctions.
TBA = to be announced

In 2018, METI introduced an auction system for general wood power plants with output exceeding 10 megawatt (MW) and separately for biomass power plants utilizing liquid biomass (i.e., palm stearin oil). To win the FIT eligibility, bidders need to offer a bid lower than an undisclosed maximum acceptable

[4] The Quality Control Act limits the maximum biodiesel content in on-road diesel to 5 percent (B5) or less. Yet, 100 percent biodiesel falls outside the scope of the Quality Control Act, and some municipalities own B100 cars.

price. Since the introduction of the auction system, no new biomass project has been deemed eligible for FIT. Since April 2019, METI does not approve any new co-firing coal plants for FIT.
The 2020 Energy Supply Resilience Act included three FIT-related revisions: (i) under a new feed-in premium (FIP) scheme, renewable energy producers can receive a premium on top of the market price under FIP, in addition to the fixed price under FIT; (ii) FIT and FIP can be used to finance power grid enhancement to connect scattered renewable energy power plants all over Japan; and (iii) METI can revoke FIT eligibility from approved power plants that do not become operational within a certain time frame (JA2020-0165). These changes will take effect on April 2022.

Import Policy – Environmental Sustainability Requirements and Duties

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 program.

For FIT-eligible biomass, Japan's Forestry Agency publishes guidelines (in Japanese only) for verification of sustainability/legality of forestry products (JA2019-0124). The biomass sustainability requirements are currently under review.

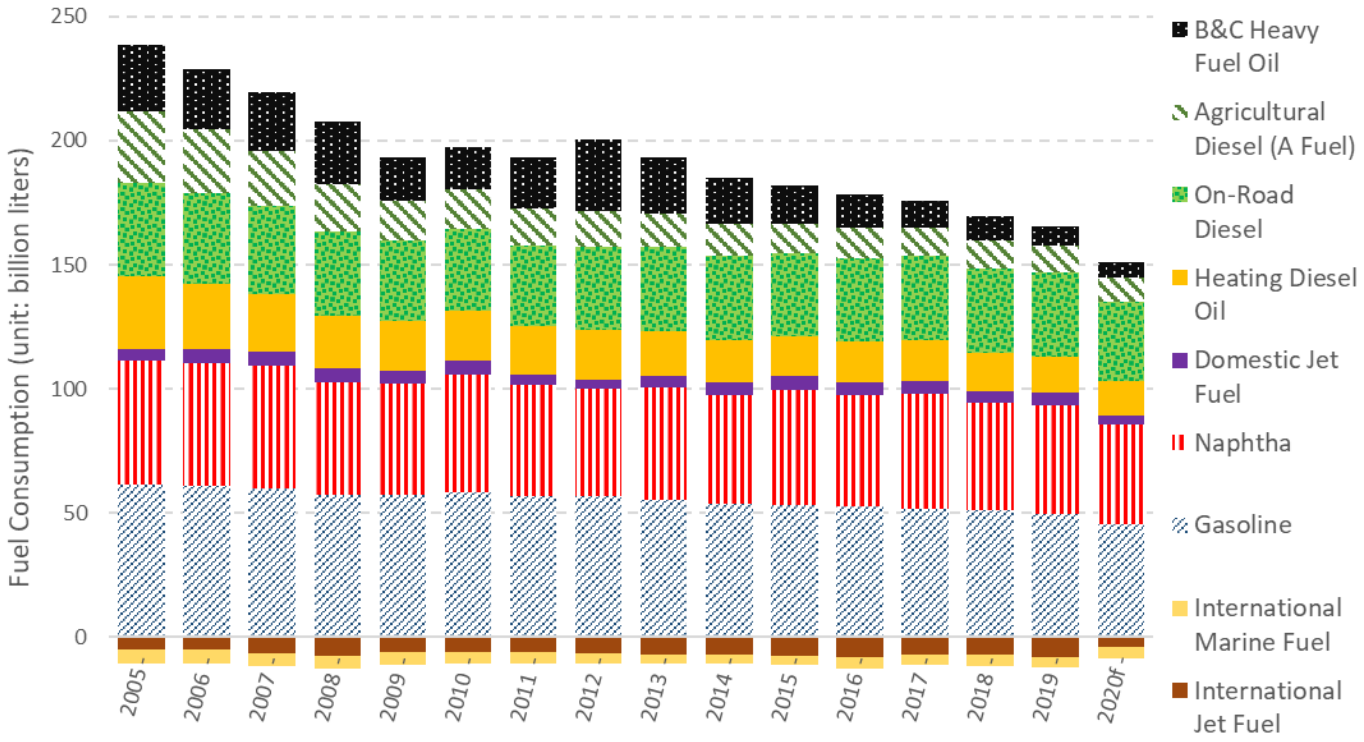
There is no tariff on bio-ETBE imports, imports of bioethanol for the production of bio-ETBE, or imports of industrial ethanol. Under the 2020 U.S.-Japan Trade Agreement, over ten years, Japan will gradually eliminate the 10 percent tariff on ethanol imports for other uses, including direct blending. Only registered alcohol importers can import ethanol. Sales of industrial alcohol are regulated under METI's Ordinance for the Enforcement of the Ethanol Business.

Japan has no tariff on wood pellets and major agricultural residues, including palm kernel shell (PKS).

Section III. Gasoline and Diesel Pools

Japan is the world's third largest petroleum importer. Yet, over the last 15 years, liquid fuel demand has fallen by more than 35 percent (Figure 5) reflecting technological and societal shifts in Japan. Improved fuel efficiency, increased use of hybrid vehicles, mass transit, and urbanization have contributed to declining gasoline consumption. In 2019, Japanese gasoline demand fell by 2.6 percent from 2018 to 49.7 billion liters.

Figure 5. Annual Petroleum Fuel Consumption by Oil Products

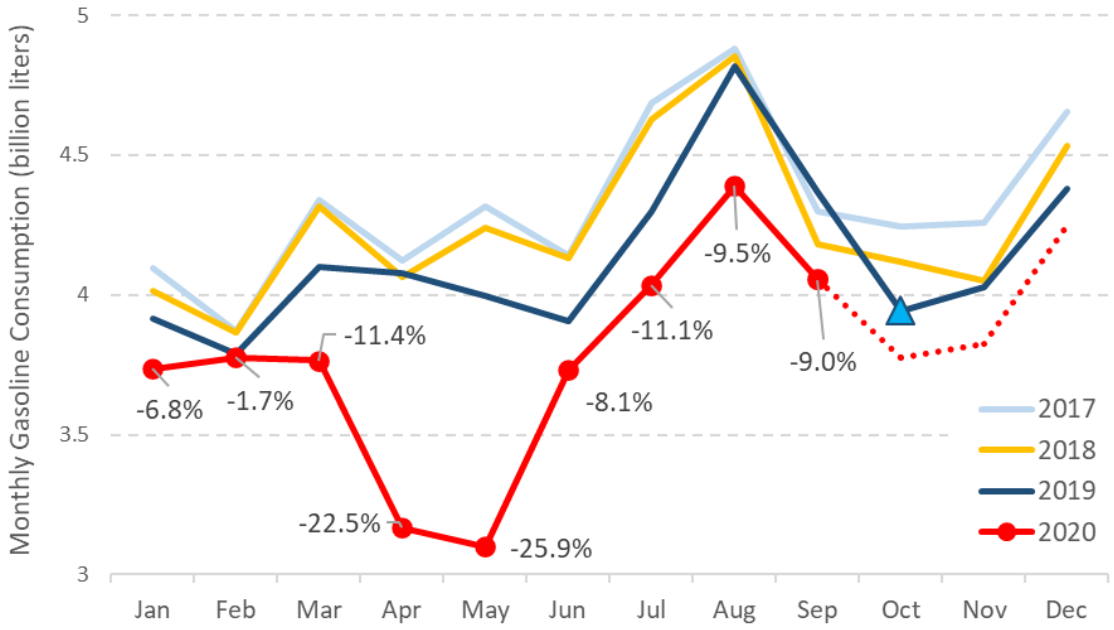


Source: ANRE Petroleum Statistics

Notes:
- *f* = forecast
- Japanese domestic fuel consumption statistics do not include fuel consumption for international flights and marine vessels. Based on export statistics, FAS/Tokyo estimated these values to chart as "International Marine Fuel" and "International Jet Fuel."
- In this report, agricultural A diesel, heating diesel oil and on-road diesel are included in the diesel pool.

In 2020, due to COVID-19 travel restrictions, FAS/Tokyo forecasts the total domestic demand for liquid petroleum fuel shrunk by 8.6 percent from 2019 to 151 billion liters excluding jet fuel for international outbound flights and marine vessels. Monthly gasoline consumption in 2020 has been substantially lower than the average for the corresponding months over the last three years three years (2017-2019), especially during the April-May State of Emergency (Figure 6). Gasoline consumption has gradually picked up since then, and FAS/Tokyo forecasts total 2020 gasoline consumption at 45.5 billion liters or 8.4 percent below 2019.

Figure 6. Monthly Gasoline Consumption by Year



Source: ANRE

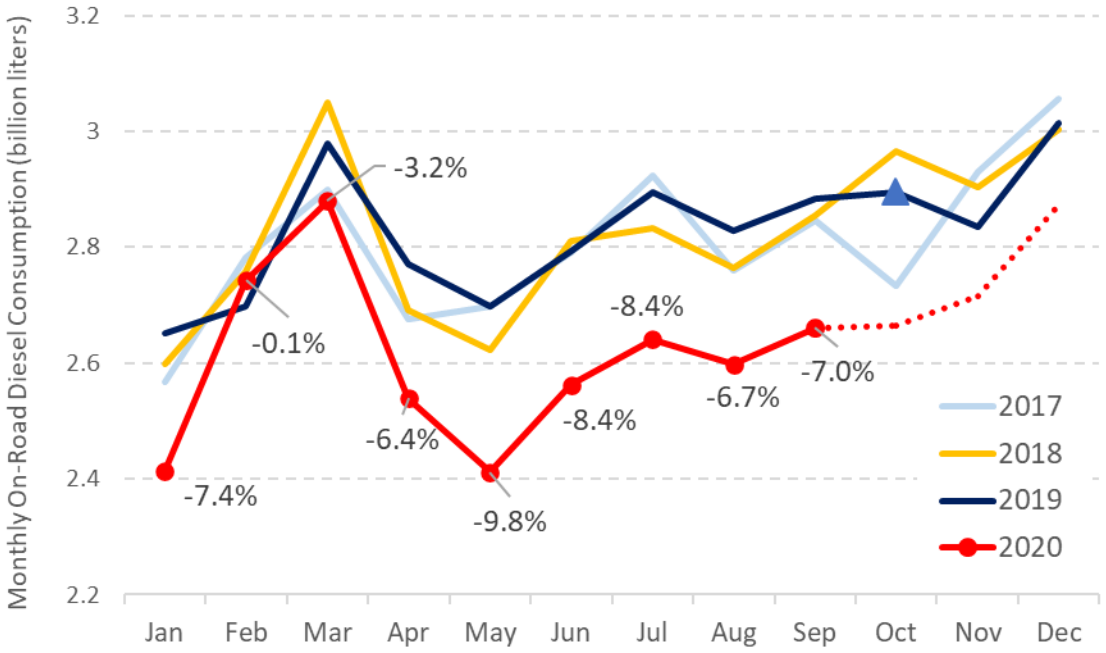
Note: Percentage refers to the proportional change of gasoline consumption in a given 2020 month relative to the average consumption for that same month in 2017-2019. Break line represents FAS/Tokyo forecasts.

On-road diesel demand in Japan has been robust at 34.0 billion liters in 2019 or a 1.0 percent increase over 2018. Consistent demand in the construction and logistics industry, coupled with a lack of hybrid truck alternatives, underlie a steady outlook for diesel consumption. Moreover, some auto makers, such as Mazda, have pushed to sell diesel cars in Japan and many drivers take advantage of a lower diesel tax (32.1 yen/l) compared to gasoline tax (53.8 yen/l) (Figure 4). Between 2011 and 2019, on-road diesel consumption increased 4 percent while gasoline consumption fell by 13 percent. Although on-road diesel consumption is expected to decline in 2020 (Figure 7), the COVID-19 impact was not as severe as on gasoline. FAS/Tokyo forecasts 2020 total diesel consumption at 55.5 billion liters or 5.9 percent lower than 2019.

Jet fuel consumption has been most affected by COVID-19-related travel restrictions out of all liquid fuels in Japan (Figure 8). FAS/Tokyo forecasts 2020 domestic jet fuel consumption to tumble 44 percent from 2019 to 7.3 billion liters.

In 2020, METI did not publish its official projections of Japan's liquid fuel demand due to the COVID-19-related cancelation of the relevant working group meeting.

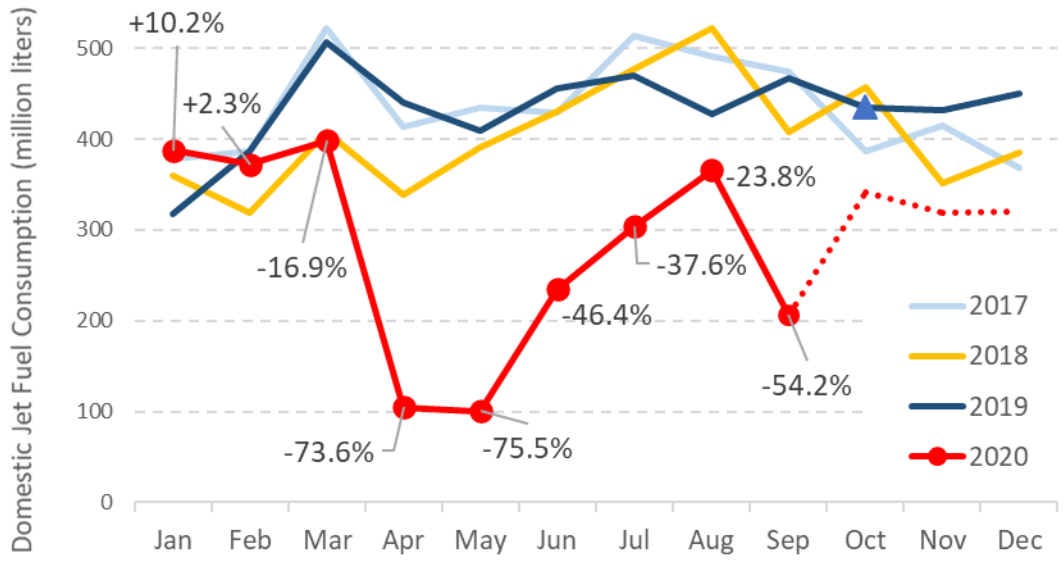
Figure 7. Monthly On-Road Diesel Consumption by Year



Source: ANRE

Note: Percentage refers to the proportional change of on-road diesel consumption in a given 2020 month relative to the average consumption for that same month in 2017-2019. Break line represents FAS/Tokyo forecasts.

Figure 8. Monthly Domestic Jet Fuel Consumption by Year



Source: ANRE

Note: Percentage refers to the proportional change of domestic jet fuel consumption in a given 2020 month relative to the average consumption for that same month in 2017-2019. Break line represents FAS/Tokyo forecasts.

Table 2. Historical Liquid Fuel Use in Japan (2011-2020)

Fuel Use (Million Liters)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Gasoline Pool	56,864	57,094	55,234	53,608	53,113	52,849	51,904	50,999	49,651	45,500
Diesel Pool	66,660	67,640	65,192	63,739	61,376	61,885	61,847	60,573	58,953	55,500
On-road	32,658	33,402	33,753	33,789	33,665	33,372	33,664	33,852	33,977	31,700
Agriculture	14,627	14,299	13,428	12,737	11,832	12,170	11,517	11,364	10,621	9,900
Heating	19,376	19,939	18,010	17,214	15,878	16,343	16,666	15,358	14,355	13,900
Jet Fuel Pool	10,421	10,529	11,617	12,216	12,948	13,072	12,284	11,910	13,014	7,300
Domestic Flights	4,306	3,965	4,874	5,215	5,407	5,327	5,243	4,848	5,199	3,600
Int'l Flights (est.)	6,115	6,564	6,743	7,001	7,541	7,745	7,041	7,062	7,815	3,700
Fuel Pool Total	133,945	135,264	132,043	129,564	127,437	127,805	126,035	123,482	121,618	108,300

Source: ANRE Petroleum Statistics; ANRE Total Energy Statistics; Japan Customs

Notes:
- *f* = forecast by FAS/Tokyo
- Naphtha and Type B & C heavy fuel oil in Figure 5 are not included.
- Gasoline total includes bio-ETBE and direct E3 blending.
- ANRE statistics only lists jet fuel consumption for domestic flights (noted as "Domestic Flights"). Jet fuel for international flights is estimated from export statistics reported by Japan Customs. Based on the Petroleum Association of Japan's annual report, international outbound flights account for 70 percent of jet fuel exports.

Section IV. Ethanol

Bioethanol (ethyl alcohol) is made by fermenting the carbohydrate components of plant materials. The most commonly used feedstocks are grains (corn, other coarse grains and wheat kernels) and sugarcane. Production and use of fossil-fuel derived "synthetic" ethanol from ethylene and naphtha is small and declining in Japan. Synthetic alcohol, not covered by this report, is only used as an industrial chemical and not as fuel, and its estimated annual use is 50-100 million liters. Fuel ethanol use volumes and market penetration (average national blend rates) are mapped out in Table 3, which documents the fuel and fuel plus other industrial chemical use balances for bioethanol.

Consumption

Fuel Use

All major Japanese oil refineries blend only bio-ETBE, rather than directly ethanol, with the exception of the National Federation of Agricultural Cooperative Associations (JA Zen-noh) gas stations that represent less than 7 percent of gasoline consumption[5]. In 2019, Japan consumed 791 million liters of bioethanol fuel, of which 725 million liters came from imported bio-ETBE (1,711 million liters of bio-ETBE) and the remaining 66 million liters was domestically produced bio-ETBE (156 million liters of bio-ETBE). FAS/Tokyo estimates that approximately 32 percent of ethanol was derived from U.S. corn-based ethanol in 2019. 2019 bioethanol consumption fell 33 million liters short of Japan's annual target volume due to a fire at the bio-ETBE production facility in Texas in early 2019. The Sophisticated Act requires refineries to make up the shortage in the following year if refineries cannot achieve the target volume. Consequently, Japan increased bio-ETBE imports in early 2020 and the average national blend rate is expected to reach 1.9 percent from 1.6 percent in 2019.

Industrial Use

Over the last decade, industrial consumption of ethanol has grown by 30 percent. According to the latest data published by METI, in FY 2018, Japan consumed about 395 million liters of industrial bioethanol in 2018. The COVID-19 pandemic spurred demand for industrial ethanol to produce disinfectants. FAS/Tokyo forecasts industrial use to jump about 100 million liters (23 percent) to 504 million liters in 2020 supported by imports.

Ethanol consumption for alcoholic beverages is beyond the scope of this report.

Production

Since 2017, only one factory produces bioethanol for fuel in Japan. The JA Zen-noh operated refinery, located in the rice-growing Niigata prefecture, produced 0.15 million liters of fuel bioethanol from 0.5 million metric tons of domestic high-yield long-grain rice. The resulting bioethanol is used for an E3 blend sold at six affiliated local JA Zen-noh gas stations. As of 2020, the plant operates three months a year and is not self-sustaining.

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[5] The share of gas station in Japan: ENEOS 45 percent, Idemitsu-Showa Shell 22 percent, Cosmo 10 percent and JA Zen-noh 7 percent. JA Zen-noh does not own an oil refinery, and is not a member of Petroleum Association of Japan.

Table 3. Fuel and Industrial Bioethanol Use in Japan (2011-2020)

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Beginning Stocks	49	36	45	39	40	38	43	40	21	39
Fuel Begin Stocks	0	0	0	0	0	0	0	0	0	0
Production	26	27	20	17	2	1	0	0	0	0
Fuel Production	26	27	20	17	2	1	0.2	0.2	0.2	0.2
Imports	632	643	723	858	943	1,156	1,218	1,203	1,218	1,365
Industrial Imports	301	305	325	372	323	415	403	376	427	509
Fuel Imports	331	339	398	486	620	741	816	827	791	856
>of which to make ETBE	38	51	65	28	82	53	89	89	66	51
>imported as ETBE	294	288	334	458	539	688	727	738	725	805
Exports	5	1	0	0	0	0	0	0	0	0
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	667	660	749	875	947	1,151	1,221	1,222	1,200	1,360
Industrial Consumption	309	295	331	371	325	410	405	395	409	504
Fuel Consumption	358	365	418	504	622	741	816	827	791	856
>as bio-ETBE	356	363	415	501	620	741	816	827	791	856
Ending Stocks	36	45	39	40	38	43	40	21	39	44
Fuel Ending Stocks	0	0	0	0	0	0	0	0	0	0
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	6	5	5	5	3	3	1	1	1	1
Nameplate Capacity	35	35	34	34	34	4	1	1	1	1
Capacity Use (%)	76%	76%	58%	51%	7%	15%	19%	19%	20%	15%
Feedstock Use for Fuel Ethanol (1,000 MT)										
Rice	2	2	2	2	1	1	0.48	0.53	0.49	0.47
Molasses	2	5	8	8	8	2	-	-	-	-
Wheat Kernels	31	28	25	-	-	-	-	-	-	-
Sugar Beets	116	105	95	-	-	-	-	-	-	-
Market Penetration (Million Liters)										
Fuel Ethanol Use	358	365	418	504	622	741	816	827	791	856
Gasoline Pool	56,864	57,094	55,234	53,608	53,113	52,849	51,904	50,999	49,651	45,500
Blend Rate (%)	0.63%	0.64%	0.76%	0.94%	1.17%	1.40%	1.57%	1.62%	1.59%	1.88%

Sources: Japan Customs; Japan Alcohol Association; Zen-noh; ANRE Total Energy Statistics; ANRE Petroleum Statistics

Note: *f* = forecast based on year-to-date data by FAS/Tokyo
1 liter of bio-ETBE contains 0.4237 liters of bioethanol; 1 liter of bioethanol = 0.607 LOE

Trade

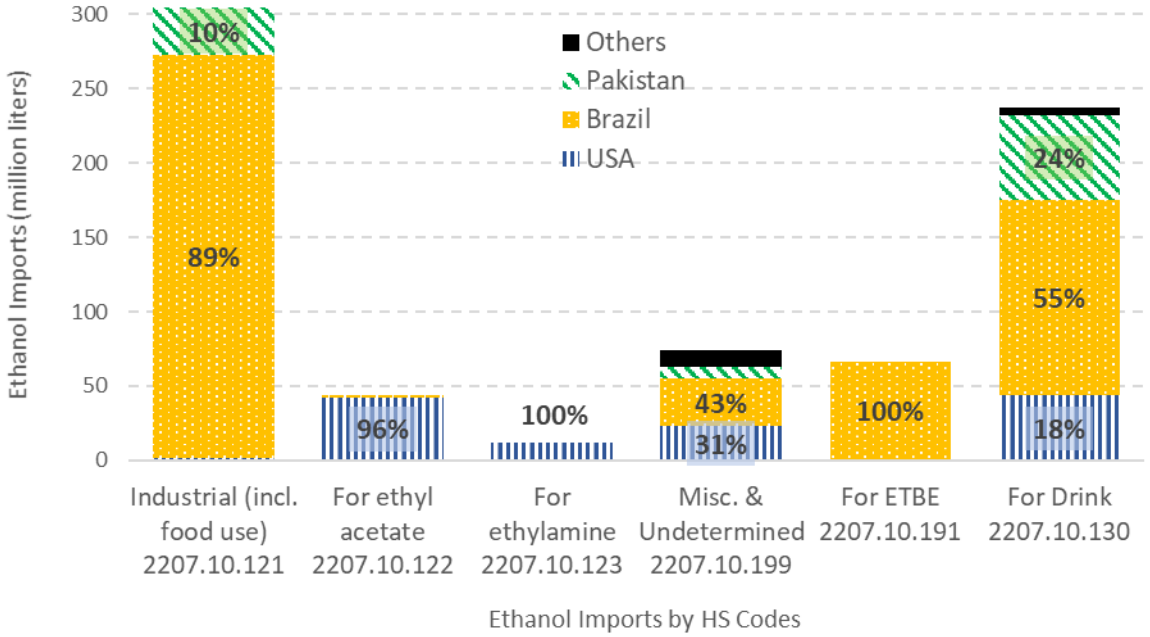
Japan's bioethanol consumption for fuel and industrial use relies almost entirely on imports (Table 4) especially since 2015. In 2019, Japan imported 1,218 million liters of bioethanol, including 791 million liters for fuel, of which 92 percent came as bio-ETBE and the remainder was used to produce bio-ETBE in Japan.

The majority of U.S. ethanol destined for Japan is stored in bonded warehouses in South Korea, prior to reaching Japan. Of note, Japan reported that it imported 79.3 million liters of industrial ethanol from the United States, whereas the United States recorded that it exported only 19.2 million liters of industrial ethanol to Japan in 2019.

Based on anticipated end use (i.e. industrial, food, bio-ETBE or unknown), Japan assigns imported ethanol a harmonized schedule (HS) code. For ethanol imports assigned HS code 2207.10.199 ("miscellaneous and undetermined"), FAS/Tokyo estimated end use (Table 3) based on the consumption data from METI.

According to industry experts, some food manufacturers that utilize ethanol request sugarcane-based ethanol. Brazil dominates the ethanol for industrial use, including food industry market, at nearly 90 percent (Figure 9).

Figure 9. Japan's Ethanol Imports by Country and End Use in 2019



Source: Japan Customs
Note: HS 2207.10.130 represents ethanol in alcoholic beverages and is not included in Table 3.

Section V. Biodiesel

Biodiesel, or fatty acid methyl esters, is produced from lipids derived from plants and animals (both virgin and waste-stream sources).

Table 4. Biodiesel Production and Use in Japan (2011-2020)

Biodiesel (Million Liters)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Beginning Stocks	0	0	0	0	0	0	0	0	0	0
Production	9	9	10	16	17	15	17	21	23	23
Imports	0	0	1	1	1	1	1	1	1	1
Exports	N/A	2	3	3	4	6	6	7	9	9
Consumption	9	7	7	13	15	11	13	15	15	15
Ending Stocks	0	0	0	0	0	0	0	0	0	0
Production Capacity (Million Liters)										
# of Biorefineries	58	46	46	43	43	44	41	41	41	41
Nameplate Capacity	21	21	21	37	34	35	35	35	35	35
Capacity Use (%)	41.1%	42.9%	45.5%	43.3%	50.0%	42.9%	48.6%	60.0%	65.7%	65.7%
Feedstock Use for Fuel (1,000 MT)										
Used Cooking Oil	8	9	9	15	16	14	16	20	22	22
Rapeseed Oil	0	0	1	1	0	0	-	-	-	-
Market Penetration (Million Liters)										
Biodiesel, on-road	7	5	6	11	12	9	10	12	12	12
On-road diesel	32,658	33,402	33,753	33,789	33,665	33,372	33,664	33,852	33,977	31,700
Blend Rate (%)	0.02%	0.02%	0.02%	0.03%	0.03%	0.03%	0.03%	0.04%	0.04%	0.04%
Diesel Pool, total	66,660	67,640	65,192	63,739	61,376	61,885	61,847	60,573	58,953	55,500

Note: *f* = forecast by FAS/Tokyo
Sources: National Biodiesel Fuel Utilization Promotion Council; METI; Japan Customs

Japanese oil industry does not expect biodiesel to become a major automotive fuel in Japan or play any role beyond the very limited and localized role it now plays. Still, many municipalities have small-scale, highly localized environmental projects focused on biodiesel production from used cooking oil (UCO), essentially the only feedstock used as of 2020. FAS/Tokyo estimates Japan's 2019 biodiesel consumption at 15 million liters based on the National Biodiesel Fuel Utilization Promotion Council's annual survey results, with approximately 80 percent directly blended with on-road diesel for public transit and other vehicles. Biodiesel consumption is expected to remain steady in 2020 at about 23 million liters.

In 2019, Japan exported 8.9 million liters of biodiesel primarily to the European Union and Switzerland, a 30 percent increase from 2018. The EU Renewable Energy Directive's provision on UCO-based biodiesel incentivizes biodiesel exports from Japan. Since 2013, Japan has imported roughly 1 million liters of biodiesel per year, mostly from Malaysia for use other than on-road fuel.

Section VI. Advanced Biofuels

As of October 2020, Japan does not commercially produce or consume any advanced biofuels. In line with international carbon-reduction initiatives by the International Civil Aviation Organization (ICAO), METI intends to introduce new sustainable aviation fuel (SAF) regulations in the Sophisticated Act expected to be introduced in 2022.

On October 13, 2020, METI and the U.S. Department of Energy signed a memorandum of cooperation that recognized technologies involving carbon capture, utilization and storage (CCUS) and carbon recycling as one of the most promising future options for achieving carbon neutrality.

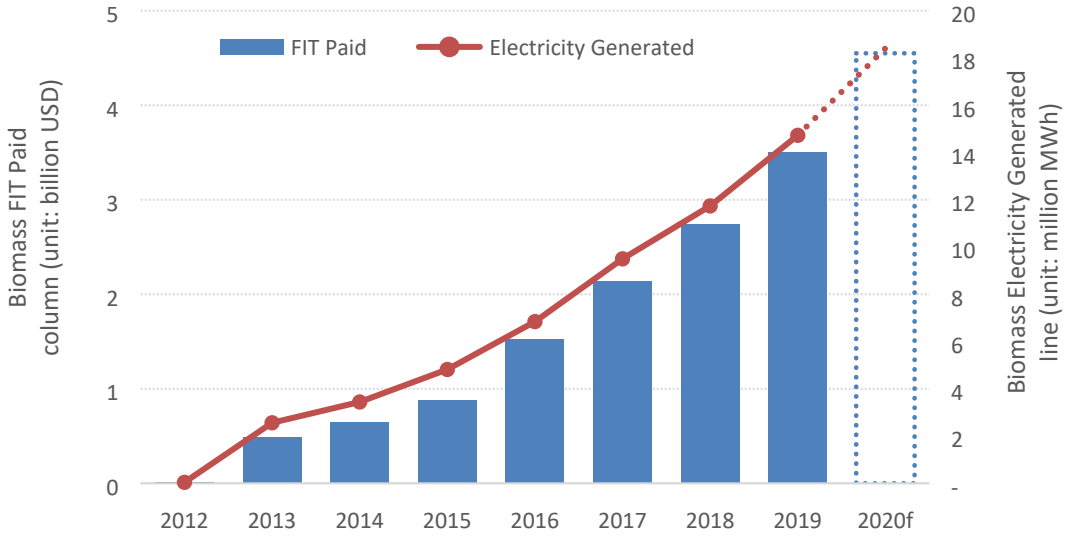
As a part of CCUS and carbon recycling technology, Japan is exploring commercialization of biodiesel and bio jet fuel production derived from algae. The New Energy and Industrial Technology Development Organization (NEDO) have two ongoing METI-funded biofuel projects. One is bio-jet fuel technology research and development project, with a budget of 4.95 billion yen ($47.1 million). The other is a local community independent system brought by biomass energy pilot project, with a 1.13 billion yen budget ($10.8 million). Pilot projects participated into these two projects produce laboratory scale advanced biofuels, and they are mainly used for local public transportation.

Section VII. Biomass for Power and Heat

Consumption

Japan aims to meet at least 4.6 percent of its electricity demand through biomass-derived power by 2030 (Figure 3). As reflected by FIT payments, Japan's biomass consumption for power generation is on the rise (Figure 10). In 2019, total biomass FIT payments exceeded 382 billion yen ($3.5 billion[6]), a 26.4 percent increase over 2018. The 2019 payments represent 14.7 million MWh of biomass-generated electricity.

Figure 10. Annual FIT paid to biomass energy producers and electricity generated



Source: ANRE

By December 2019, METI had approved 372 biomass plants with a total operating capacity of 8,665 MW, but only 179 woody biomass power plants[7] were operational and generated only 2,368 MW of electricity or 27.3 percent of the approved capacity under FIT. The difficulty in securing a reliable source of woody biomass feedstock is at the root of the delays in operationalizing many approved FIT projects.

Since 2015, Forestry Agency has collected biomass consumption data for Japanese power plants, co-generation plants and boilers. By 2019, the total consumption of biomass (both domestic and imported) has increased by more than 50 percent from 2015 to 12.9 million bone-dry metric tons (BDt) (Figure 11). Domestically produced woody biomass supply has been stable at around 10 million BDt since 2017. Despite Japan's increasing tree harvesting, industry sources indicate that rapidly growing biomass demand will outstrip domestic supply, especially as the availability of salvaged lumber and sawmill chips declines due to falling production.

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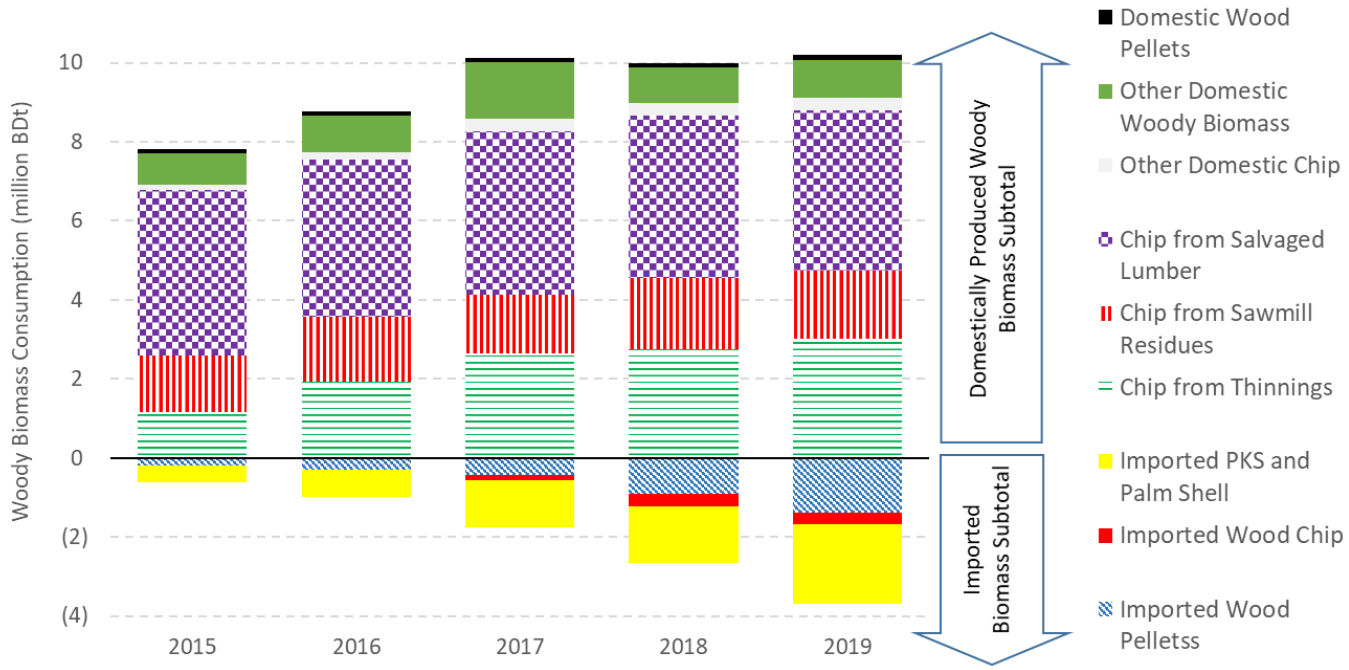
[6] Based on Bank of Japan 2019 average exchange rate

[7] The total includes 77 unutilized domestic wood power plants, 67 general wood power plans, and 35 salvaged lumber power plants.

Figure 11. Woody Biomass Consumption for Electricity and Heat in Japan



Sources: Forestry Agency; Japan Customs
Note: FAS/Tokyo estimated bone-dry metric ton (BDt) values from trade statistics under the assumption of 15 percent moisture in imported biomass except for palm kernel shell (PKS), which is 20 percent.

Production

To meet its 2030 GHG emission target, Japan allocates 120 billion yen ($1.1 billion) a year to thinning and selective logging on about 520,000 hectares of private and public land. Wood yielded from these operations is used in construction and power generation (see JA9098).

Japan's domestic woody biomass production reached 10.2 million BDt in 2019 (Figure 11). To reduce processing costs, most domestic feedstock is consumed as wood chips. In 2019, the chips came from forest residues and thinnings (43.0 percent), domestic sawmill residues (40.3 percent), and salvaged wood construction material (16.4 percent).

In addition, Japan produced 147,000 MT of wood pellets in 2019, a 12.1 percent increase from 2018 (Table 6). As Japan's pellet production is largely supplied by small producers in mountainous regions, volumes are very limited and large power plants must rely on other supplies of biomass. Domestic wood pellets are commonly used for small scale boilers and residential wood stoves especially in Japan's northern regions.

Trade

Japan's 2019 imports of woody biomass have grown considerably in recent years and reached 3.7 million BDt (2 million BDt of PKS and 1.4 million BDt of wood pellets) (Figure 11).
In 2019, Japan imported 1.61 million MT of wood pellets, a 52.3 percent increase over 2018 (Table 6). Since 2012, when trade data for wood pellets first became available, Canada and Vietnam have accounted for the dominant share of Japan's wood pellet imports. In 2019, Vietnam, with its booming furniture and wood processing industry, overtook Canada as the leading exporter of wood pellet to Japan. In 2019, Vietnam held 55.0 percent of the Japanese market, and Canada represented 36.5 percent. As of October 2020, when this report was prepared, the United States has not begun to export wood pellets on a commercial scale to Japan.

Since the introduction of the FIT program, PKS and palm shell imports have increased exponentially (see JA2020-0110). Medium-sized biomass power plants use PKS as a constant and inexpensive biomass fuel to qualify for the FIT program. Japan's 2019 PKS and palm shell imports increased 41.8 percent from 2018 to reach 2.51 million MT. Nevertheless, due to a greater reliability of the wood pellet supply, large biomass power plants prefer wood pellets over PKS.

Japan has also increased imports of palm stearin oil for palm oil powerplants, which are eligible for FIT for liquid biomass. These palm oil power plants use diesel engine generators. In 2019, Japan imported 167,197 MT (approximately 190 million liters) of palm stearin oil, which is not further covered in this report (for details, see JA2020-0067).

Table 6. Supply and Demand of Wood Pellets

Wood Pellets (1,000 MT)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Beginning Stocks	5	5	7	8	9	15	19	26	50	75
Production	78	98	110	126	120	120	127	131	147	170
Imports	N/A	72	84	97	232	347	506	1,060	1,614	2,100
Exports	0	3	5	4	0	0	0	0	0	0
Consumption	78	165	188	218	346	462	626	1,168	1,736	2,250
Ending Stocks	5	7	8	9	15	19	26	50	75	95
Production Capacity										
Number of Plants	108	109	120	141	142	148	147	154	147	147

Note: *f* = forecast by FAS/Tokyo
Unit is wet metric ton, not dry ton: This report assumes 1000 MT of wood pellets = 850 BDt.
Sources: Forestry Agency; Japan Customs

Section VII. Notes on Statistical Data

General Terms

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
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.
CCUS: carbon capture, utilization and storage
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-CO2e/MJ.
E3: blend of 97 percent gasoline and 3 percent bioethanol
E10: blend of 90 percent gasoline and 10 percent bioethanol
ETBE: Ethyl Tert-Butyl Ether
FIT: Feed-in Tariff
FIP: Feed-in Premium
FY: Japanese fiscal year (April-March), for example, FY 2020 is April 2020 – March 2021.
GHG: greenhouse gas
LCA: life cycle assessment
LULUCF: land use, land-use change, and forestry
HS: harmonized system of tariff schedule codes
INDC: intended nationally determined contribution
JIS: Japanese Industrial Standard
PKS: palm kernel shell
RPS: renewable portfolio standard
SAF: sustainable aviation fuel
UCO: used cooking oil

Units

BDt: bone-dry metric ton, bone-dry means 0 percent moisture content in the product. We assume wood pellets contain 15 percent and palm kernel shell contain 20 percent moisture.
g-CO_2e: grams of carbon dioxide equivalent
GJ: gigajoule, 1 GJ = 1,000,000,000 joule = 1,000 MJ
GW: gigawatt
l: liter, 1l = 0.264 gallon
LOE: liters of crude oil equivalent
kW: kilowatt
kWh: kilowatt hour, 1 kWh = 1 kW x 1 hour
MJ: megajoule, 1 MJ = 1,000,000 joule
MT: metric ton, 1 MT = 1,000 kg = 2,204.6 pounds = 1.1 short ton
MMT: million metric ton
MW: megawatt 1 MW= 1,000 kW
MWh: megawatt hour, 1 MWh = 1 MW x 1 hour

Organizations and Companies
ANRE: The Agency for Natural Resources and Energy of METI
FAS/Tokyo: Tokyo Office of Agricultural Affairs of the Foreign Agriculture Service
GOJ: The Government of Japan
ICAO: The International Civil Aviation Organization
IMO: International Maritime Organization
JA: Japan Agricultural Cooperatives
JBSL: Japan Biofuels Supply LLP
METI: Ministry of Economy, Trade and Industry
NEDO: New Energy and Industrial Technology Development Organization
UNFCCC: The United Nations Framework Convention on Climate Change
Zen-noh: National Federation of Agricultural Co-operative Associations

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
1 kWh = 3.6 MJ = 1,000 joule/second x 3,600 seconds (primary energy). To generate 1 kWh of electricity (secondary energy) higher primary energy inputs are required. For example, if the energy conversion efficiency is 40 percent, 9.0 MJ (or 0.233 LOE) of feedstock (i.e., primary energy) is required to generate 1 kWh of electricity.
1 GJ = 1,000 MJ = 1,000,000,000 J
1 GW = 1,000 MW = 1,000,000 kW = 1,000,000,000 W

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 to biodiesel: 1 MT = 1,043 liters

Biomass Conversion Rates
1000 MT of wood pellets yields 850 MT BDt
1000 MT of PKS yields 800 MT BDt
Softwood chip weight-to-volume conversion: 1 MT = 2.2 m^3
Hardwood chip weight-to-volume conversion: 1 MT = 1.7 m^3

Attachments:

No Attachments