USDA Foreign Agricultural Service
GAIN Report
Global Agricultural Information Network

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

Required Report - public distribution

Date: 8/15/2017
GAIN Report Number: JA7100

Japan

Biofuels Annual

Japan Biofuels Annual 2017

Approved By:
Jess Paulson
Prepared By:
Midori Iijima

Report Highlights:
Japan's current renewable energy policy focuses on generating power from solar, wind, biomass, and geothermal sources. Japanese imports of wood pellets for thermal power generation reached a record 347 thousand metric tons in 2016, and are expected to increase further in the coming years. For biofuels, the Government of Japan (GOJ) plans to maintain its 500 million liter (crude oil equivalent) mandate until, at least, 2022. Additionally, the GOJ continues to assess alternative sources for fuel ethanol, and U.S. corn ethanol may be designated as an eligible source under Japan's sustainability policy – a decision that is expected by year's end.

Post:
Tokyo

Section I. Executive Summary

Japan's current renewable energy policy focuses on generating power from solar, wind, biomass, and geothermal sources. For biofuels, the Government of Japan (GOJ) maintains its 2010 plan to introduce 500 million liters (crude oil equivalent) of biofuels[1] by 2017, and has mandated the oil industry meet the goal. In turn, the industry is expected to introduce into the market1.940 billion liters of bio-Ethyl Tert-Butyl Ether (ETBE) in 2017, which is equal to 500 million liters (crude oil equivalent) of biofuels, nearly all of which will be imported. In 2017, Japan revealed its preliminary biofuel policy from 2018 to 2022, and it plans to maintain the 500 million liter mandate. It is also considering allowing the use of U.S. corn-based ethanol in imported ETBE, in addition to Brazilian sugar cane ethanol. Japan intends to make a final decision on the use of corn-based ethanol by the end of 2017.

As the demand for biodiesel in Japan is very limited, biodiesel plays virtually no role in meeting the 2017 goal.

Bio-ETBE blended gasoline is far more prevalent than E3 gasoline and is widely distributed.[2] In 2012, the GOJ began to permit sales of E10 and ETBE22 gasoline, and vehicles designed to use these biofuels. However, this change has had little effect on the market as the supply of E3 and E10 remains small compared to that of bio-ETBE gasoline, and the Japanese petroleum industry does not have plans to supply ETBE22 gasoline.[3]

The food-vs-fuel debate is a significant issue in Japan. Japan has a low food self-sufficiency rate -- imports comprise the majority of the food it consumes. As a result, Japanese people are highly sensitive to rising food prices, leading some in Japan to question the use of food crops to produce biofuels.

Japan has restarted a limited number of its nuclear power reactors since the 2011 Great East Japan Earthquake, forcing Japan's power companies to rely on other methods to generate power, such as hydro and coal. The power companies are also turning to wood pellets as a renewable energy source. Imports of wood pellets, which reached a record 347 thousand metric tons (MT) in 2016, are expected to further increase. The trend of mixing wood pellets with coal for thermal power generation is expected to continue, and the number of small and mid-scale biomass power facilities (below 10,000 kilowatts [kW]), which use wood materials, including wood pellets, is increasing under the Feed-in Tariff (FIT) system.

---

[1] The conversion factor for ethanol into crude oil is 0.607. Thus, 500 million liters (crude oil equivalent) of biofuels is equal to 824 million liters of ethanol. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act." (http://www.enecho.meti.go.jp/notice/topics/017/pdf/topics_017_002.pdf).

[2] There are two methods for blending bioethanol with gasoline: "direct blending" and "ETBE." The oil industry in Japan promotes the ETBE method because it is less costly for them than direct blending.

[3] E10 and ETBE22 gasoline are only allowed to be used with vehicles designed to use E10/ETBE22 fuels, and the number of these vehicles remains limited.

Section II. Policy and Programs

Overview

Biofuels is part of a larger renewable energy policy that draws from solar, wind, biomass, and geothermal sources. Japan is targeting 22-24 percent of its energy to come from renewable sources by 2030. While the bulk of Japan's carbon reduction is meant to come from nuclear energy, approximately 8 percent is envisioned to come from renewable technologies.

Major Ministries Involved in Biofuel Policy

Although a number of ministries collaborate on Japan's biofuels policy, the two ministries that play major roles in developing and implementing Japanese biofuels policies are the Ministry of Economy, Trade and Industry (METI) and the Ministry of Environment (MOE). MOE is concerned with preventing global warming and meeting Japan's commitment to reduce its greenhouse gas (GHG) emissions. In May 2016, Japan committed to reduce its GHG emissions to 26 percent of its 2013 levels by the year 2030.[4]

METI's interested in biofuels is as a supplemental source of fuel for Japan, and in analyzing the costs and benefits of shifting to renewable fuels, and their impact on automobiles and infrastructure. METI collaborates with the oil industry to determine the introduction of biofuels in the Japanese market.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) previously played a leading role in developing and implementing biofuels policies in Japan. MAFF's interest was focused on the potential to revitalize rural communities through the production of biofuels from domestic resources (e.g., rice for non-food purpose). However, its focus has shifted from biofuels to the production of renewable energies (e.g., heat and power) from the waste generated by the livestock and forestry sectors.

Policy goals

On April 11, 2014, Japan published its Basic Energy Plan, which is reviewed and revised every three to four years. The plan considers renewable energy as an important source for three reasons: (1) to ensure a stable energy supply, and where possible, through increased domestic production of renewable sources. This has become especially important since the 2011 Great East Japan Earthquake, when all of Japan's nuclear reactors were initially shut down, and Japan became more reliant on imports (an increase of approximately three trillion yen or $30 billion in imports per year); (2) as part of Japan' policy to mitigate global warming; and (3) to promote the regional distribution of power generation to revitalize regional economies.

For biofuels, the Basic Energy Plan states that "{c}oncerning biofuels, which are mostly imported, Japan will continue to introduce the fuels in light of international trends and technical developments in the next generation of biofuels." According to industry sources, this statement reflects the GOJ's policy

[4] Japan's commitment under the 2015 Paris Climate Agreement (COP21).

that biofuels should be sourced from non-food crops (e.g., cellulosic ethanol). In 2009, the GOJ passed the Sophisticated Methods of Energy Supply Structure Act (Japanese only) which establishes a use target of 500 million liters (crude oil equivalent) of biofuels by 2017 (see the table below). Japan's gasoline consumption estimate in 2017 is 51.5 billion liters. The pure ethanol equivalent of ETBE consumed, plus a small amount of ethanol consumed in direct blending, brings Japan's total fuel ethanol consumption to 890 million liters, and yields an effective national average blend rate of 1.7 percent. Although the GOJ mandated the utilization of biofuels, it left the decision of how to meet the requirement to industry which is using bio-ETBE (leaving biodiesel out of the picture).

Following a debate between industry, the MOE, and METI, the Japanese industry decided to supply 1.940 billion liters of ETBE (as it was considered the least disruptive to current facilities and investments).

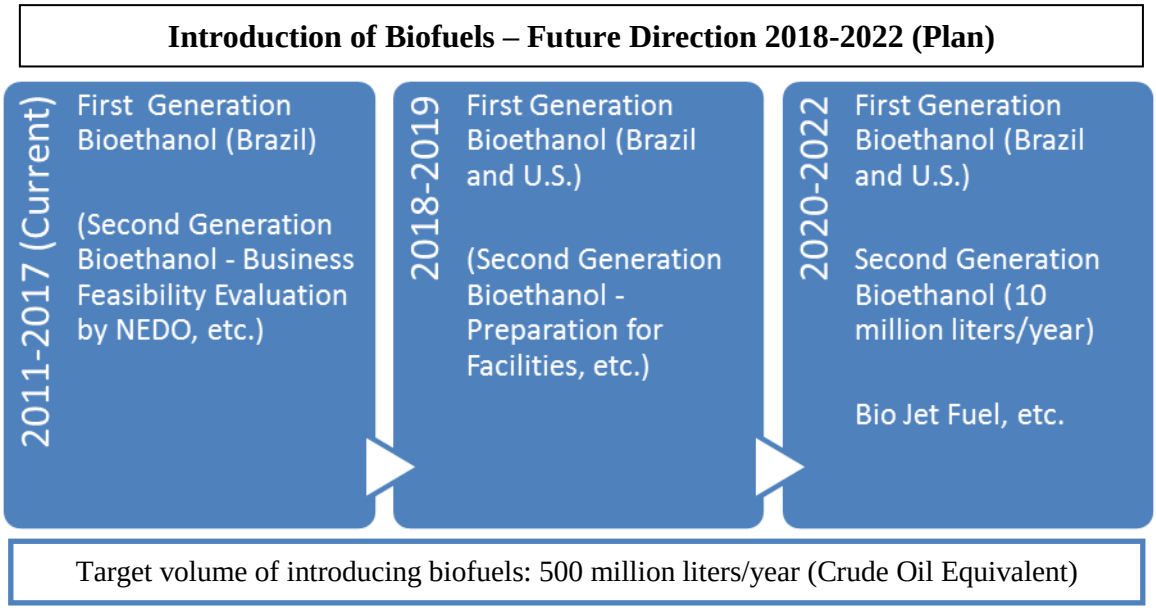
Table 1 - Petroleum Association of Japan's Road Map to Introduce Bio-ETBE in the Japanese Market

Petroleum Association of Japan's Road Map to Introduce Bio-ETBE in the Japanese Market									
1,940 million liters by 2017									
(Million Liters)									
Calendar Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Introduction Bio-ETBE - Road Map	200	840	→	→	→	→	→	→	1,940
Bio-ETBE: Penetration in Japaense Market									
Domestic Production of Bio-ETBE*	143	140	160	160	160	160	160	160	160
Imports of Bio-ETBE	57	700	693	679	787	1,081	1,271	1,624	1,780
Total	**200**	**840**	**853**	**839**	**947**	**1,241**	**1,431**	**1,784**	**1,940**
Calculated Volume of Bioethanol**	85	356	361	355	401	526	606	756	822
Crude Oil Equivalent***	51	216	219	216	244	319	368	459	500

Sources: The World Trade Atlas; Petroleum Association of Japan
* Post's Estimate based on industry sources.
** The conversion factor for ETBE into ethanol is 0.4237. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act" (http://www.enecho.meti.go.jp/notice/topics/017/pdf/topics_017_002.pdf).
*** The conversion factor for ethanol into crude oil is 0.607. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act" (http://www.enecho.meti.go.jp/notice/topics/017/pdf/topics_017_002.pdf).

In March 2017, METI published "Studies for What Japan's Future Biofuel Should be: Bioethanol," a report that outlines its preliminary biofuels policy from 2018 to 2022. In the report, METI announced its plan to maintain the 500 million liter mandate. One notable change, however, is that METI is considering allowing the use of U.S. corn-based ethanol, in addition to Brazilian sugar cane ethanol in the production of imported bio-ETBE. Another change, in the 2020-2022 period, is Japan's plan to introduce 10 million liters (crude oil equivalent) of second generation biofuels (potentially reducing the demand for first-generation ethanol), and an as-of-yet undetermined quantity of bio jet fuel in the market. METI's "Expert Committee to Discuss the Future of Biofuel Introduction in Japan," which is comprised of ten members from academia, non-profit organizations, and industry, will continue discussions until late 2017 in order to finalize these changes. After a public comment period in early 2018, the new policy is expected to be implemented in Japan's new fiscal year (which begins April 1, 2018).

Figure 1 - Introduction of Biofuels – Future Direction 2018-2022 (Plan)



Source: METI. http://www.meti.go.jp/meti_lib/report/H28FY/000069.pdf
Note: FAS Tokyo created this table based on the METI's information.

Japan has capped the maximum bioethanol blend rate at three percent (E3, except for some vehicles that have been designed specifically for a 10 percent blend (E10)). Japan justifies this limit due to concerns that modern vehicle engine designs may be damaged by blend rates that exceed E3. Accordingly, Japan is not currently considering raising the blend limit beyond E3.

The blend rate for biodiesel is five percent (B5), and is applied to cars, busses, and trucks. Of Japan's 33.6 billion liters of diesel used in 2015, approximately 76 percent (25.7 billion liters) was for on-road use. METI provides special approvals for operators to use biodiesel at a blend rate higher than five percent for trucks and buses. Trade data shows that Japan's imports of biodiesel in 2016 grew by 19.7 percent (or 210,000 liters) from the previous year. According to industry sources, this trend may be attributed to increased use by small-scale power plants and large-scale oil-fired power plants.

Government program and financial support for industry

The GOJ maintains following programs and incentives to promote the use of biofuels:

- In 2008, the GOJ amended the "Quality Control of Gasoline and Other Fuels Act" to lower the gasoline tax (¥53.8/liter) by ¥1.6 per liter (about $0.02/liter) if fuel contains 3 percent bioethanol. The incentive is effective until March 31, 2018. METI has petitioned the Ministry of Finance to extend this incentive and is currently developing the proposal to extend the incentive through Japan fiscal year 2018 (April 1, 2018 to March 31, 2019).

- In 2008, the GOJ amended the "Customs Tariff Act" and the "Temporary Measures Concerning Customs Act" to eliminate the 3.1 percent import tariff on bio-ETBE. Moreover, in 2016, it amended the Acts to eliminate the ten percent import tariff on bio-ethanol for the production of bio-ETBE. As with the gasoline tax, the Customs Tariff Act must be renewed annually and is currently approved through March 31, 2018. METI is currently developing the proposal to extend the incentive through March 31, 2019.

- In 2008, MAFF proposed, and the Diet passed, the "Law Concerning the Promotion of Biomass Resources as Raw Materials for Biofuels." This law provides tax breaks and financial assistance to newly built biofuel facilities that MAFF has determined qualify for benefits. Although initially available only to bioethanol producers, the benefits were extended to producers of alternative forms of bio-energy (such as bio-diesel, wood pellets, methane gas, or hydrogen gas). Under the scheme, newly built biofuel facilities that are approved for the program by 2018 will have their fixed property tax reduced by half for three years. The legislation authorizes MAFF to extend the repayment period of interest-free loans in two-year increments for a maximum of 12 years. MAFF records show that 21 programs[5] have qualified for the benefits since the program began in 2008, though some programs have ceased operations.

- In 2011, METI introduced the "Green Investment Tax Incentive." Under this system, small and medium-sized businesses are eligible for a special 30 percent depreciation on the acquisition of renewable energy assets (such as facilities and vehicles), or a seven percent reduction in corporate taxes. In 2015 (the latest data available), 11,889 operators received a total value of ¥558 billion (approximately $4.6 billion) in tax breaks.

Environmental Sustainability Standards for Liquid Biofuels Used in Transportation

In the "Sophisticated Methods of Energy Supply Structure Act" of 2010, the GOJ established an environmental sustainability standard for biofuels that required that bioethanol not compete with the food supply, and that biofuels reduce the greenhouse gas (GHG) emissions by at least 50 percent from the emissions of gasoline, based on a life cycle assessment (LCA). Also in 2010, the MOE released the first version of the "Life Cycle Assessment Guideline for Biofuels," a tool for the calculation of the environmental impact of a good, a process, or a service "from cradle to grave" (for additional information, see JA4018). The GOJ applies the same standard to the use of biodiesel, also reducing

[5] The government encourages collaboration between biofuel manufacturers and farmers producing feedstocks. Each program is operated by those two groups together.

emissions by at least 50 percent from those of light oil or diesel. According to METI's analysis of each feedstock, the only source of first generation bioethanol that can currently fulfill METI's GHG emission standard is bioethanol from sugar cane grown on existing farmland in Brazil.

However, in 2016, METI reviewed the latest statistics and data available for the GHG emissions from several sources for bioethanol and gasoline. METI concluded that the new GHG emission value for gasoline is 83.5 grams of CO2 equivalent per megajoule (gCO2eq/MJ), an increase from the previous value of 81.7 gCO2eq/MJ. METI proposed two values for U.S. corn-based ethanol, 36.4 gCO2eq/MJ and 45.4 gCO2eq/MJ, and a revised value for Brazilian sugar cane ethanol of 32.3 gCO2eq/MJ (a reduction from the current 32.7 gCO2eq/MJ). The two values for U.S. corn-based ethanol are the result of a debate about the emissions that result from the production of ethanol and its byproducts – distiller's grains with solubles (DDGS) and crude corn oil. METI announced that the GHG emissions from the production of ethanol are 36.4 gCO2eq/MJ, while the inclusion of the emissions from producing the byproducts raised the value to 45.4 gCO2eq/MJ (excluding consideration of a carbon credit). Although preliminary and still under evaluation, the new values suggest that U.S. corn-based ethanol may be an eligible source for bioethanol imports. The GOJ is expected to announce official values for U.S. corn-based ethanol by the end of calendar year 2017.

FIT System to Promote Renewable Energy in Heat and Power Plants

In July, 2012, the GOJ introduced a FIT system for the production of electricity from renewable energy sources, such as solar and wind power. Under the system, power companies are obliged to buy electricity at set rates for predetermined periods (generally 10 to 20 years). The purchase prices are reviewed annually and the costs incurred by power companies to buy electricity from renewable energy sources are passed on to consumers via electricity prices. Since the system was first introduced, the amount of power generated by renewable energy facilities has steadily increased. For example, the power generated under the FIT system by December 2012 was 5,234 MW, and it increased to 13,843 MW by December 2016.

In 2014, renewable energy accounted for 12.8 percent of Japan's total power supply (latest data available) of which 8.4 percent was from hydropower. The high cost of generating power from renewable sources,[6] however, is reportedly a challenge to increasing the percentage of total power consumption attributable to renewable energy. For example, the cost to be borne by consumers in 2016 for the FIT system was ¥2.25 (approximately $0.03) per kilowatt-hour (or ¥675 (approximately $6.70) per month per household), for a total of ¥1.8 trillion (approximately $17 billion).

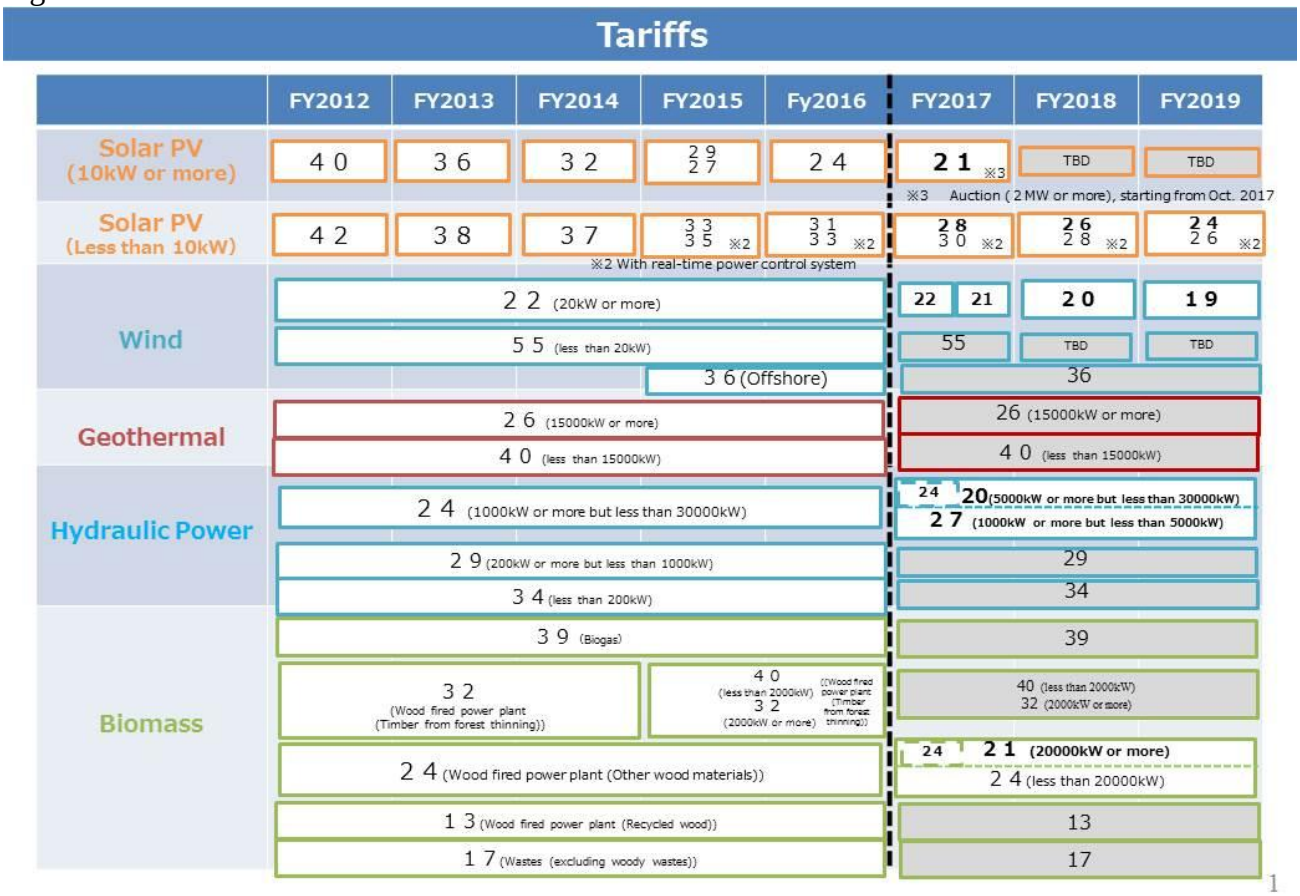
In 2016, METI made several revisions to the FIT system to minimize the public cost of utilizing renewable energy. The revisions include:

(1) achieving a balance between renewable energy sources as FIT accreditation is currently dominated by solar power;
(2) introducing cost effective measures to suppress the public cost; and
(3) establishing medium and long-term purchase rates to improve forecasts (and provide rates for the next three years).

[6] See "Feed-in Tariff Scheme in Japan" - http://www.meti.go.jp/english/policy/energy_environment/renewable/

A notable revision in the biomass category is that the "Wood fired power plant (Other wood materials)" was divided into two categories based on a facilities' power generating capacity: 20,000 kW or more and less than 20,000 kW. Beginning in Japan fiscal year 2017, the FIT for power plants with a generating capacity of 20,000 kW or more will be reduced from ¥24 per kWh to ¥21 per kWh, while the FIT for power plants with less than 20,000 kW will remain ¥24 per kWh. The "Other wood materials" include wood chips, wood pellets, and palm kernel shells (PKS), and most imported materials are supplied to power plants of 20,000 kW or more. METI justified the reduction as a means to capture some of the savings due to greater efficiency in generating power in larger scale power plants.

Figure 2 - FIT Tariff Rates for FY2012-2019



Source: Ministry of Economy, Trade and Industry
Note: ¥10 is approximately $0.10.

Section III. Gasoline and Diesel Pools

Trends in Fuel Use

The GOJ estimates that Japan's demand for gasoline will continue to decrease, largely due to three factors: (1) the decrease in the number of automobiles and miles travelled as a result of the decline in Japan's population, (2) improved vehicle fuel efficiency, and (3) the increase in "next generation vehicles," such as electric, hybrid, and fuel cell cars. In 2016, Japan's demand for gasoline was 53 billion liters, and by 2021 it is forecast to decrease to 47 billion litters.

The GOJ estimates that efficiencies in logistics systems will reduce the number of trucks that utilize diesel, contributing to a decrease in the demand for diesel. However, those efficiencies will be offset over the next several years as the number of diesel-fueled passenger cars and buses is expected to increase. In 2016, demand for on-road diesel was 26 billion liters and is forecast to remain flat for the next several years.

Overall demand for jet fuel is expected to decrease slightly. Although demand for air travel and air cargo is expected to increase slightly, in part due to the economic activity associated with hosting the Tokyo Olympic Games in 2020, improved airplane fuel efficiencies by commercial airline carriers are expected to offset the increase in demand. In 2016, demand for jet fuel was 5.4 billion liters, and it is forecast to remain unchanged for the next several years.

Japan's transportation sector (excluding railways) depends on fossil fuel for 95.2 percent of its energy (FY2016 Annual Report on Energy). In its 2014 Basic Energy Plan, the GOJ stated that it will promote diversification of energy sources in the transportation sector. Biofuels are considered to be an important energy source along with electricity, natural and LP gases, and hydrogen. The GOJ is encouraging the increased use of biofuels in jet fuel but the larger-scale commercialization of cost competitive bio jet fuel is still years away.

Table 2 - Fuel Use History

Fuel Use History (Million Liters)										
Calendar Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gasoline Total	57,473	57,347	55,643	54,116	56,207	55,419	52,975	53,127	52,645	51,509
Diesel Total	33,722	32,308	31,324	30,525	33,391	34,079	33,583	33,619	33,401	33,375
On-road	29,999	28,247	27,426	26,014	24,724	24,345	25,685	25,679	25,674	25,669
Agriculture										
Construction & Mining										
Shipping & Rail										
Industry										
Heating										
Jet Fuel Total	5,676	5,087	5,025	5,060	5,053	5,171	5,340	5,488	5,370	5,347
Total Fuel Markets	96,871	94,742	91,992	89,701	94,651	94,669	91,898	92,234	91,416	90,231

Fuel Use Projections (Million Liters)										
Calendar Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Gasoline Total	50,609	49,704	48,393	47,051	46,016	45,004	44,014	43,046	42,099	41,172
Diesel Total	33,293	33,373	33,292	33,361	33,354	33,347	33,340	33,333	33,326	33,320
On-road	25,664	25,658	25,653	25,648	25,643	25,638	25,633	25,628	25,623	25,617
Agriculture										
Construction & Mining										
Shipping & Rail										
Industry										
Heating										
Jet Fuel Total	5,333	5,340	5,330	5,338	5,332	5,327	5,321	5,316	5,311	5,306
Total Fuel Markets	89,235	88,417	87,015	85,750	84,702	83,678	82,675	81,695	80,736	79,798

Source: Ministry of Economy, Trade and Industry (METI)

Notes:

- The data for 2010 and 2011 are provided by METI, but are forecasts that were developed in 2010. Final, confirmed data for 2010 and 2011 were not collected due to the Great East Japan Earthquake, which occurred in March 2011.
- Gasoline, Diesel, and On-road Diesel Totals: METI calculated the data and forecast for Gasoline Total through 2021. Post calculated the Gasoline Total forecast from 2022 to 2027 by multiplying the five-year average geometric mean (2016-2021) by the Gasoline Total estimate for 2021, and carried this forward to 2027.
- The years reported are Japanese fiscal years, April - March (e.g., April 2017-March 2018 is 2017).

Trends in Engine Technology

In order to help reduce Japan's GHG emissions, the Japanese auto industry is promoting "next-generation vehicles," which include electric, hybrid, and fuel cell cars. Japanese auto companies began selling hydrogen fuel cell vehicles in 2014. Since the GOJ introduced subsidies and tax incentives for "next-generation vehicles" in 2009, the number of these vehicles has been increasing, with the total number of "next generation vehicles" in Japan nearing six million in 2015, the last year for which data is available. Next-generation vehicles account for 7.3 percent of the total number of automobiles in use, and their numbers and market share are expected to increase further in the future.

Table 3 - Number of Next-Generation Vehicles in Japan

Number of Next-Generation Vehicles in Use					
	2011	2012	2013	2014	2015
Electric vehicles Hybrid cars	13,266	24,983	38,794	52,639	62,134
Plug-in hybrid cars	4,132	17,281	30,171	44,012	57,130
Fuel cell vehicles	-	-	-	150	630
Hybrid electric cars	2,029,009	2,852,105	3,813,387	4,717,344	5,764,401
Total	2,055,403	2,908,093	3,898,315	4,832,212	5,902,672

Source: Next Generation Vehicle Promotion Center

Development in Vehicle Fleet Efficiency

In 2012, a new standard for vehicle fleet efficiency was established for gasoline fueled passenger vehicles. The goal of the new standard is to attain vehicle fleet efficiency of 20.3 km per liter by 2020, compared to the 2009 level of 16.3 km per liter. As a result of efforts made by the auto industry to develop technologies to improve efficiency, by 2014, the average fleet efficiency for gasoline fueled passenger cars was 21.8 km per liter (exceeding earlier expectations). The Ministry of Land, Infrastructure and Transport will start to consider setting a new standard in three years.

Section IV. Ethanol

Production

Virtually all (99+ percent) ethanol, used for both fuel and other industrial purposes in Japan, is imported. Japan imports about 360-370 million liters of unrefined ethanol each year, which is then distilled to produce refined ethanol for industrial purposes. There are about 30 such refineries throughout the country. Currently, two companies produce a total of approximately one million liters of synthetic ethanol annually from ethylene for use in industrial chemicals. Synthetic ethanol is not included in the ethanol balance (Table 4) because it is made from fossil fuels and is not a bio-based, renewable product.

Japan's number of bio-ethanol plants and combined production capacity, which was as high as 6 plants with 35 million liters capacity, has diminished. Today, Japan has one refinery that produces approximately 0.2 million liters of bioethanol for fuel use from domestic rice. There is no change expected in 2018. The refinery is located in Niigata Prefecture and is operated by JA Zen-noh, the federation of agricultural cooperatives. It uses high yield rice grown specifically for biofuel production. The ethanol is used as part of an E3 blend, and the E3 gasoline is sold at six affiliated gas stations around Niigata Prefecture.

Two Ethanol Projects in Okinawa were Terminated

Two projects producing bioethanol for fuel from molasses in Okinawa Prefecture were terminated last year.

The ethanol for fuel project on the main island of Okinawa was supervised by MOE. A government oversight body required MOE to discontinue assistance to this project in 2016 because it determined that the project would not be commercially viable without government support.[7] The second project was conducted on Miyakojima Island, about 300 kilometers southwest of the main island. The project on Miyakojima Island was run by the Miyakojima City Government, in cooperation with a local subsidiary of Brazil's Petrobras. In 2016, the subsidiary of Petrobras closed their operations in Okinawa and ceased supplying sub-octane gasoline, which is used to blend with ethanol to make E3. As Miyakojima City was unable to find another supplier, it decided to discontinue the project and shut down the ethanol facility. Until 2015, the two facilities produced a combined 1.9 million liters of ethanol annually from molasses, which is obtained from the processing of sugarcane. The ethanol produced through these projects was sold in E3 and E10 blends at gas stations on the two islands.

Domestic Production of ETBE

In 2010, Japan Biofuels Supply LLP started to produce ETBE domestically. Each year, the company produces 140 million liters of ETBE, using 59 million liters of ethanol. Previously, mostly imported ethanol with some domestically produced ethanol added were used to make ETBE, but following the closure of two ethanol refineries in Hokkaido in 2014 (a result of the discontinuation of MAFF's financial support), the company became fully reliant on imported ethanol. No change is expected in 2018.

Consumption

Biofuels Blend Rates

Japan's direct blend cap for ethanol is regulated in the "Gasoline Quality Assurance Law" at three percent (E3). The blend rate of ETBE into gasoline is seven percent. In April 2012, the law was revised to allow the sale of gasoline blended with 10 percent of ethanol (E10) or 22 percent of ETBE (ETBE22). The E10 or ETBE22 gasoline is only allowed to be used with vehicles designed to use E10/ETBE22 fuel. Japanese automakers have introduced some automobile models that can run on E10 or ETBE22, but the number of these cars remains limited, and the oil industry, which is selling ETBE blended gasoline nationwide, reportedly has no plan to market ETBE22 blended gasoline.

[7] The refinery, located in adjacent Kagoshima Prefecture, was producing bioethanol for fuel from molasses, but it shut down its operation.

Consumption and Distribution Channel

In 2015 (the latest data available), 42 percent of ethanol was used for food processing, cosmetics and toiletry products, and medical and hygienic purposes, while 58 percent of ethanol was used for fuel. Fuel ethanol consumption has risen each year with the first year of full-scale implementation in 2010 following the Petroleum Association's road map for the introduction of bio-ETBE devised to meet the 2017 goal set forth in the 2009 Act (previously discussed). Since 2010, bio-ethanol consumption has more than doubled to 758 million liters in 2016 and an estimated 890 million liters in 2017. This expansion couple with some decline in the fuel pool over the same period has led to a near three-fold increase in the national average blending rate for bio-ethanol from 0.6% to 1.7% estimated in 2017. Despite this progress, Japan remains a minor ethanol market with annual usage below 1 billion liters even though it has far greater potential being the world's 5th largest gasoline market if the EU is treated as a single market. Compared to the EU and another 15 countries with effective ethanol programs, Japan's blending rate ranks close to the bottom.

The 2017 goal is expected to be met on time this year and even slightly exceeded with 1.940 billion liters of ETBE (containing 822 million liters of ethanol) consumed and 0.2 million liters of ethanol consumed in E3 production. With the expected on-time achievement of the 2017 goal, Post forecasts no change in ethanol consumption in 2018 given METI's plans to maintain this level of consumption and the announcement that there will be no quantitative change in the 500 million liter goal through 2022.

Most of the ethanol for fuel is used in ETBE. The distribution channel for ethanol blended gasoline (E3) is limited compared to that of ETBE blended gasoline. Presently, E3 gasoline is available at only six gas stations in Niigata Prefecture, while ETBE blended gasoline is available throughout the nation.

Trade

In 2016, Japan imported 757 million liters of ethanol for transportation, consisting of 696 million liters of ethanol imported as ETBE and 61 million liters of ethanol used in domestic ETBE production. Due to sustainability requirements previously noted, all imported ethanol used in domestic ETBE currently comes from Brazil, and all imported ETBE which is currently manufactured in the United States uses Brazilian ethanol. The GOJ is currently assessing alternative sources for fuel ethanol, and U.S. corn ethanol may be designated as eligible under Japan's sustainability policy (see Policy and Programs section for more information on Japan's requirement to reduce GHG emission by at least 50 percent). The use of ETBE is expected to increase further, as the PAJ aims to supply 1.94 billion liters of ETBE by 2017. Accordingly, the PAJ is forecasted to continue to supply the same amount of ETBE in 2018. Of the 1.94 billion liters of ETBE, the PAJ expects to import 1.8 billion liters, all of which will come from the United States.

The import tariffs of ETBE derived from biomass and ethanol to make ETBE are free until March 31, 2018.

Japan does not export either ETBE or ethanol.

Table 4 - PS&D – Bio-Ethanol

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Beginning Stocks	15	13	12	3	3	4	4	5	5	7
Fuel Begin Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production	20	25	24	23	22	2	2	1	0.2	0.2
Fuel Production *	20	25	24	23	22	2	2	1	0.2	0.2
Imports	346	669	697	682	737	874	965	1,131	1,257	1,257
Fuel Imports	66	336	345	341	389	517	607	757	890	890
*>of which is ETBE (a)***	24	296	294	288	334	458	539	696	822	822
Exports	11	5	5	1	0	0	0	0	0	0
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	357	690	725	704	758	876	966	1,132	1,255	1,257
Fuel Consumption	86	361	369	364	411	519	609	758	890	890
Ending Stocks	13	12	3	3	4	4	5	5	7	7
Fuel Ending Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity (Million Liters)										
Number of Refineries***	6	6	6	5	5	5	3	3	1	1
Nameplate Capacity	35	35	35	34	34	34	4	4	1	1
Capacity Use (%)	57%	71%	68%	68%	65%	6%	54%	27%	20%	20%
Feedstock Use for Fuel (1,000 MT)										
Molasses	1	1	2	5	8	8	8	2	0	0
Rice****	2	2	2	2	2	2	0.5	0.5	0.5	0.5
Wheat Kernals	25	31	31	28	25	0	0	0	0	0
Sugar Beets	95	124	116	105	95	0	0	0	0	0
Market Penetration (Million Liters)										
Fuel Ethanol	86	361	369	364	411	519	609	758	890	890
Gasoline	57,347	55,643	54,116	56,207	55,419	52,975	53,127	52,645	51,509	50,609
Blend Rate (%)	0.1%	0.6%	0.7%	0.6%	0.7%	1.0%	1.1%	1.4%	1.7%	1.8%

Sources: The World Trade Atlas; Ministry of Economy, Trade and Industry; Ministry of Agriculture, Forestry and Fisheries

Notes:

N/A = not available and not included in balance.

* Post's estimates are based on interviews with industry and government sources.

** The conversion factor for ETBE into ethanol is 0.4237. Reference: METI's "Provisions related to the Sophisticated Methods of Energy Supply Structure Act" (http://www.enecho.meti.go.jp/notice/topics/017/pdf/topics_017_002.pdf).

*** The conversion rate for rice into ethanol: 1MT=445 liters. Reference: JA Zen-noh, "Making the energy recycling model in Niigata Prefecture by rice made bio-ethanol"

V. Biodiesel/Renewable Diesel

Overview

Japan's biodiesel market is extremely limited, meeting just 0.04 percent of national on-road transportation demand for diesel fuel, and there is no renewable diesel market. Post estimates biodiesel production was 16 million liters in 2016 based on the data provided by the National Biodiesel Fuel Utilization Council (NBUC). Post forecasts that the production will increase to 17 million liters due to a minor increase in exports of biodiesel, primarily to the Netherlands, and little to no change in consumption and imports. However, no change is expected in 2018 supply and demand. Domestic demand for biodiesel remains small mainly because no established distribution channels exist for the fuel, few established larger-scale collection systems for feedstock exist, and its use is largely limited to small fleets of municipal vehicles in local and regional programs.

Biodiesel has no role in meeting the GOJ target to introduce 500 million liters of biofuels (crude oil equivalent) in the market, even though there is considerable unrealized potential since Japan is the 4th largest diesel market following the EU, United States and Brazil. The Japanese oil industry selected bio-ETBE and bioethanol to meet the renewable fuel target because this solution requires no significant oil industry investment in new delivery infrastructure. That said, renewable diesel (hydrogenated vegetable oil is one type which is produced on a commercial scale in Europe, Singapore and the United States) is fully substitutable with fossil diesel and thus requires no new investments in infrastructure. Also, used cooking oil (UCO) is the only abundant feedstock locally available and few large-scale collection systems exist to exploit this resource in a cost effective manner.

Production

Post estimates that Japan's biodiesel production in 2016 was approximately 16 million liters rising to 17 million liters in 2017, based on data provided by the NBUC. The most common feedstock for biodiesel production in Japan is UCO. It is reported that the annual supply of UCO is about 450,000 MT, from which about 410 million liters of biodiesel (or renewable diesel) could be produced. Some 18,000 MT of UCO is currently used to produce biodiesel.

There are currently 116 projects being administered by municipal governments and regional non-profit organizations across Japan that are taking part in small-scale biodiesel projects known as the "Rapeseed Project." The projects involve growing rapeseed to produce cooking oil, collecting the used oil, and recycling it as biodiesel fuel. The biodiesel fuel is used mainly for garbage and cargo trucks.

There is another project by the City of Kyoto to collect UCO from restaurants and individual households. The oil is processed into biodiesel at the city's refinery, which produces 5,000 liters per day. Approximately 1.3 million liters of biodiesel fuel is produced annually in the refinery, and it is used for the city's garbage trucks (B100) and municipal buses (B20).

Furthermore, in Kyoto, there is also a private company producing UCO-based biodiesel. The firm started from a citizen's group whose activities included collecting UCO for the purpose of environmental protection. To date, the firm has established its own network to collect feedstock from individual households, restaurants, and any public or private organization nationwide. Its refinery in Kyoto can produce 11 million liters of biodiesel annually. According to the company, it is the largest capacity biodiesel refinery in Japan. Since 2011, the company has been exporting a steady stream of biodiesel fuel to the Netherlands.

Consumption

Japan's consumption of diesel for on-road transportation in 2016 was 26 billion liters. Biodiesel on on-road use was estimated at 11 million liters in 2016, or 93 percent of biodiesel consumed. The calculated national average blend rate is a mere 0.04 percent. Given that on-road diesel use is expected to remain flat for some years, no change in the biodiesel market or blend rate is expected unless a new role for biodiesel is established.

Japan's blend limit for biodiesel is regulated in the "Gasoline Quality Assurance Law" at five percent (B5). However, METI may grant a special dispensation for operators to blend biodiesel at a rate higher for their trucks and buses, as is the case for the City of Kyoto.

According to a survey conducted in 2015 by the NBUC, approximately 87 percent of biodiesel in Japan is used for trucks and buses, followed by passenger cars (five percent), heavy machinery at construction sites (four percent), agricultural machinery (two percent), and power generation (one percent). The survey also shows that the use of biodiesel for heavy machinery at construction sites and power generators is gradually increasing.

According to an industry source, consumption of biodiesel in the transportation sector is not expected to increase beyond small changes because distribution channels are not established and fuel standards limit blending due to concern that the fuel blended rate at higher rates may damage engines.

Trade

Since 2011, a private company in Kyoto has been exporting biodiesel to the Netherlands (see Production section above).[8] Exports have risen over the years but remain very limited, reaching 5.5 million liters in 2016 and forecasted to total 6 million liters in 2017 and 2018.

While Japan's imports of biodiesel increased last year, they still remain limited. According to some industry sources, biodiesel may be imported for generating power at oil-fired power plants. In 2016, Japan imported 1.27 million liters of biodiesel (of this, 98 percent was from Malaysia). The import tariff for biodiesel from Malaysia is zero as a result of a bilateral economic partnership agreement. Japan's WTO bound import tariff is 3.9 percent.

[8] The company focuses on overseas markets as the domestic biodiesel market is limited.

Table 5 - Key Suppliers of Biodiesel to Japan

Key Suppliers of Biodiesel to Japan (Million liters)					
Parter Country	2012	2013	2014	2015	2016
World	0.08	0.49	0.61	1.06	1.27
Malaysia	-	0.42	0.44	1.02	1.24
Philippines	-	-	-	-	0.02
United Kingdom	0.00	-	-	-	0.01
Germany	0.03	0.03	0.04	0.04	0.01

Source: The World Trade Atlas
Note: HS Code 3826-00

Table 6 - PS&D - Biodiesel

Biodiesel (Million Liters)										
Calendar Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Beginning Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production*	9	10	12	14	14	15	15	16	17	17
Imports	N/A	N/A	N/A	0.1	0.5	0.6	1.1	1.3	1.4	1.4
Exports	N/A	N/A	N/A	2.3	3.1	3.2	3.6	5.5	6	6
Consumption	9	10	12	12	11	12	13	12	12	12
Ending Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity (Million Liters)										
Number of Biorefineries**	66	58	58	40	46	43	43	43	43	43
Nameplate Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity Use (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock Use for Fuel (1,000 MT)										
Used Cooking Oil***	10	11	13	15	15	16	16	17	18	18
Market Penetration (Million Liters)										
Biodiesel, on-road use	9	10	12	12	11	12	12	11	11	11
Diesel, on-road use	28,247	27,426	26,014	24,724	24,345	25,685	25,679	25,674	25,669	25,664
Blend Rate (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Diesel, total use	32,308	31,324	30,525	33,391	34,079	33,583	33,619	33,401	33,375	33,293

Sources: National Biodiesel Fuel Utilization Council (NBUC); The World Trade Atlas; Ministry of Economy, Trade and Industry
Notes:
N/A = not available; stocks, imports and exports designated as such are not included in balance.
Years are Japanese fiscal year, April-March.
* Post's estimates are based on information provided by NBUC.
** The number of bio-refineries is based on an annual survey conducted by the NBUC.
*** Post's estimate for the average recycle rate of 91% is based on data from the NBUC.

Section VI. Advanced Biofuels

Research and Development

Japanese private companies and Japan's scientific community, including universities and public and private research institutions, have continued to work toward basic and applied research related to biofuels. The focus of their research projects is cellulosic and algal feedstock and technologies to produce biofuels at commercial scale in a sustainable way. Several joint research projects aim to produce commercial-scale bio jet fuel from algae, with the goal of commercializing these fuels by 2030.

Development in Fuels from Algae

The GOJ wants to introduce bio jet fuel for commercial flights in 2020, the year that the Summer Olympic Games and Paralympic Games will be held in Tokyo. In 2015, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and METI jointly established a "Committee for the Introduction of Bio Jet Fuel for the 2020 Summer Olympic Games and Paralympic Games in Tokyo." The committee has two working groups: one studies the supply chain of bio jet fuel, and the other examines fuel production. The committee may consider importing bio jet fuel if the quantity of domestic production proves insufficient. The volume of Japan's bio jet fuel production in 2020 is ambitiously estimated to be 100,000 to 1 million liters (pure biofuel basis).

A venture firm in Tokyo whose official serves as a member of the Bio Jet Fuel Committee is building a facility in Yokohama City to produce and commercialize bio jet fuel by 2020. The fuel will be made from euglena algae that it will grow on Ishigaki Island in Okinawa Prefecture. The facility will be operational in the first half of 2019, and will have an annual production capacity goal of 125,000 liters of bio jet fuel.

Production and Consumption of Cellulosic Ethanol

The Bioethanol Division of a private company in Sakai City, Osaka, that operates recycling facilities to process waste products and materials, began production of ethanol from wood and lumber waste in 2007. Its annual production capacity is 1.4 million liters. For the first several years, the company supplied ethanol to a couple of oil distributors who make E3 gasoline to sell at the distributors' affiliated gas stations. However, because E3 gasoline did not come into wide use, there is little demand for the company's ethanol. The company is currently using most of the ethanol it produces to generate power for its facility, and it sells the rest of the ethanol to an industrial alcohol distributor.

Section VII. Biomass for Heat and Power

Wood Pellets and Palm Kernel Shells

Overview

Japan shut down all of its nuclear power reactors following the Great East Japan Earthquake in March 2011. As of June 2017, only five reactors have resumed operation, and of Japan's 57 nuclear power plants, 14 are slated for decommissioning due to their age. METI's target of having renewable energy sources provide 22-24 percent of Japan's energy needs by 2030 is based on the resumption of power generation at all of the remaining 43 nuclear power plants, but the number of plants that will resume operation remains a topic of national debate. Accordingly, Japan currently relies on other energy sources to generate power – primarily coal and liquid natural gas.

After the accident in Fukushima, power companies began using wood pellets as a source for thermal power generation, though coal is still the main source. The companies use imported wood pellets, as

prices are lower compared to those produced domestically. Japan has a zero import tariff for wood pellets (HS4401.31).

Japan's FIT incentive for the generation of electricity from biomass (as described in the Program and Policies section above) has driven a rapid increase in demand for biomass, including domestic and imported wood pellets, and the import of palm kernel shells (PKS). Although Japan has abundant biomass resources, it is unable to harvest and transport those resources economically. Imports of wood pellets and PKS are therefore likely to increase in the coming years as existing coal thermal power plants are able to co-fire with wood pellets or PKS.

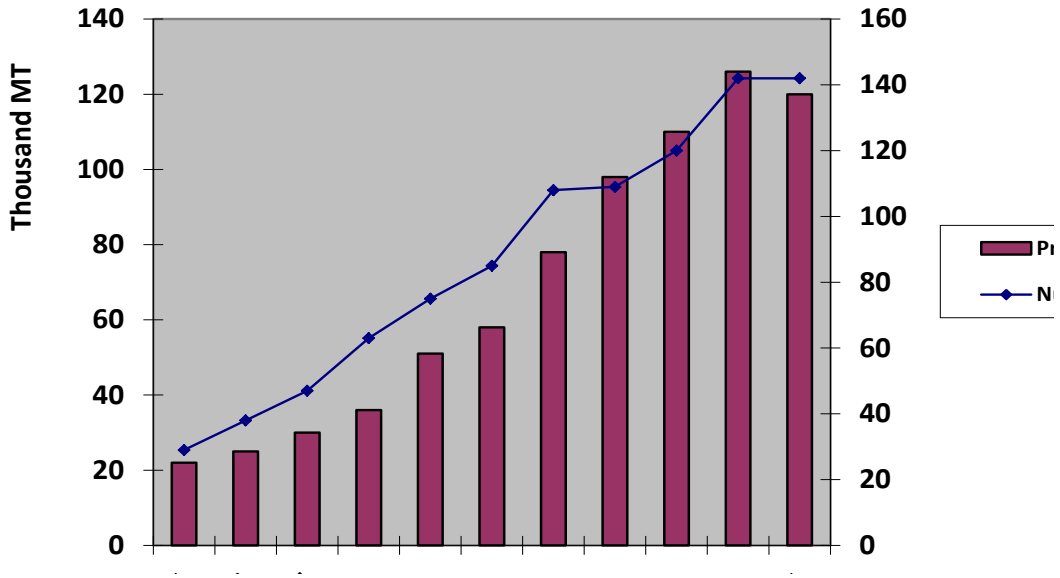
Wood Pellet Production and Consumption

Since the GOJ's "Biomass Nippon Strategy" was unveiled in 2002, the introduction of pellet boilers and stoves for heating in public facilities and ordinary households has expanded. Accordingly, the number of plants and the production of pellets have increased significantly. In 2015, Japan's production of wood pellets was 120,000 MT, and there were 142 plants. The production of wood pellets in 2015 decreased by 4.8 percent from the previous year as demands for heating decreased mainly due to a mild winter. According to an industry source, production of wood pellets in 2018 is expected to recover to record-high 2014 levels as the use of cogeneration units running on wood pellets has started to spread across Japan. Accordingly, moving forward, domestic wood pellet suppliers are forecasting an increase in demand.

The production scale of wood pellet plants in Japan is very small compared to modern commercial plants in the United States and Europe. About 60 percent of the plants in Japan produce a mere 100 – 1,000 MT each year. Among the 142 plants, only three plants have production capacity of more than 10,000 MT per year, and two of the three plants are producing wood pellets mainly for coal-fired power plants for mixed combustion. In Japan, demand for wood pellets by coal-fired power plant operators is strong. The power operators rely on imported wood pellets mainly due to their price competiveness and availability. As noted in the FY2016 Annual Report on Forest and Forestry in Japan, in order to increase competitiveness of domestically produced wood pellets, MAFF states that the production scale of the wood pellets plants must increase.

Japan is considering establishing its own standards to address concerns about environmental sustainability criteria for biomass products. Accordingly, post will continue to monitor the development of this policy plan.

Chart 1 – Wood Pellet Production and Number of Plants in Japan



Source: MAFF/Forestry Agency

Table 7 - PS& D – Wood Pellets

Wood Pellets (1,000 MT)										
Calendar Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Beginning Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production*	51	58	78	98	110	126	120	125	125	125
Imports**	59	73	74	72	84	97	232	347	400	430
Exports**	3	3	4	3	5	4	0.5	0.3	0.5	0.5
Consumption	107	128	148	167	189	219	352	472	525	555
Ending Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity										
Number of Plants	75	85	108	109	120	142	142	145	145	145
Nameplate Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity Use (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Sources: Ministry of Agriculture, Forestry and Fisheries (Production), and The World Trade Atlas (Imports/Exports)
Notes:
N/A = not available and not included in balance.
* The level of production forecast from 2016 on was prepared by Post, based on industry sources.
** The volume of trade forecast for 2017 on was prepared by Post, based on industry sources.

Wood Pellet and Palm Kernel Trade

In 2016, Japan's imports of wood pellets increased 49 percent from the previous year to 347 thousand MT. Of these, 261,000 MT, or 75 percent, were imported from Canada, followed by Vietnam (18 percent) and China (6 percent). According to industry sources, Canada is the leading supplier due to its competitive prices and quality. Imports of wood pellets are likely to increase in the coming years because the trend of mixing wood pellets with coal for thermal power generation is expected to continue, and the number of small and medium-scale biomass power facilities (below 10,000 kW), which use wood materials (including wood pellets and PKS) is increasing under the FIT system (see

the section II. Policy and Programs).

Japan has a zero import tariff for both wood pellets (HS4401.31) and palm kernel shells (HS2306.60.000).

Table 8 - Key Suppliers of Wood Pellets to Japan

Key Suppliers of Wood Pellets to Japan							
	Quantity (Metric Tons)						
Partner Country	2012	2013	2014	2015	2016	Jan-Apr 2016	Jan-Apr 2017
World	71,981	83,769	96,745	232,425	346,855	100,888	123,853
Canada	66,470	72,151	90,676	146,150	260,935	81,590	82,059
Vietnam	3,533	2,897	1,979	27,440	62,441	13,304	39,204
China	653	5,242	-	57,870	20,733	5,250	9
Malaysia	393	1,170	128	162	1,418	68	1,911
Thailand	265	1,242	2,682	194	451	208	409
Indonesia	15	629	410	304	425	113	120
United States	233	326	563	237	306	70	84

Source: The World Trade Atlas
Note: HS Code 4401.31

Table 9 - Japan – Import Price of Wood Pellets

Japan - Import Price of Wood Pellets					
	U.S. Dollars per Metric Ton				
Partner Country	2012	2013	2014	2015	2016
World	269	242	251	196	182
Canada	272	248	255	198	191
Vietnam	160	176	197	161	136
China	451	215	0	209	199
Malaysia	164	152	157	142	127
Thailand	200	135	138	162	137
Indonesia	177	174	146	142	183
United States	418	453	477	441	430

Source: The World Trade Atlas
Note: HS Code 4401.31

Japan's imports of PKS are also increasing as a source for biomass power generation. In 2016, imports of PKS increased by 67 percent from the previous year to 761,410 MT, most of which came from Indonesia and Malaysia. Japan has a zero import tariff for PKS. Imports of PKS as well as wood pellets are expected to increase for years to come.

Table 10 - Japan Import Statistics of Palm Kernel Shells

Japan Import Statistics					
Commodity: 2306.60.000, Palm Kernel Shells and Others					
Partner Country	Quantity (Metric Tons)				
	2012	2013	2014	2015	2016
World	26,211	131,224	244,178	456,084	761,410
Indonesia	8,673	62,645	131,678	255,104	398,171
Malaysia	17,143	68,560	112,500	200,913	363,239

Source: The World Trade Atlas