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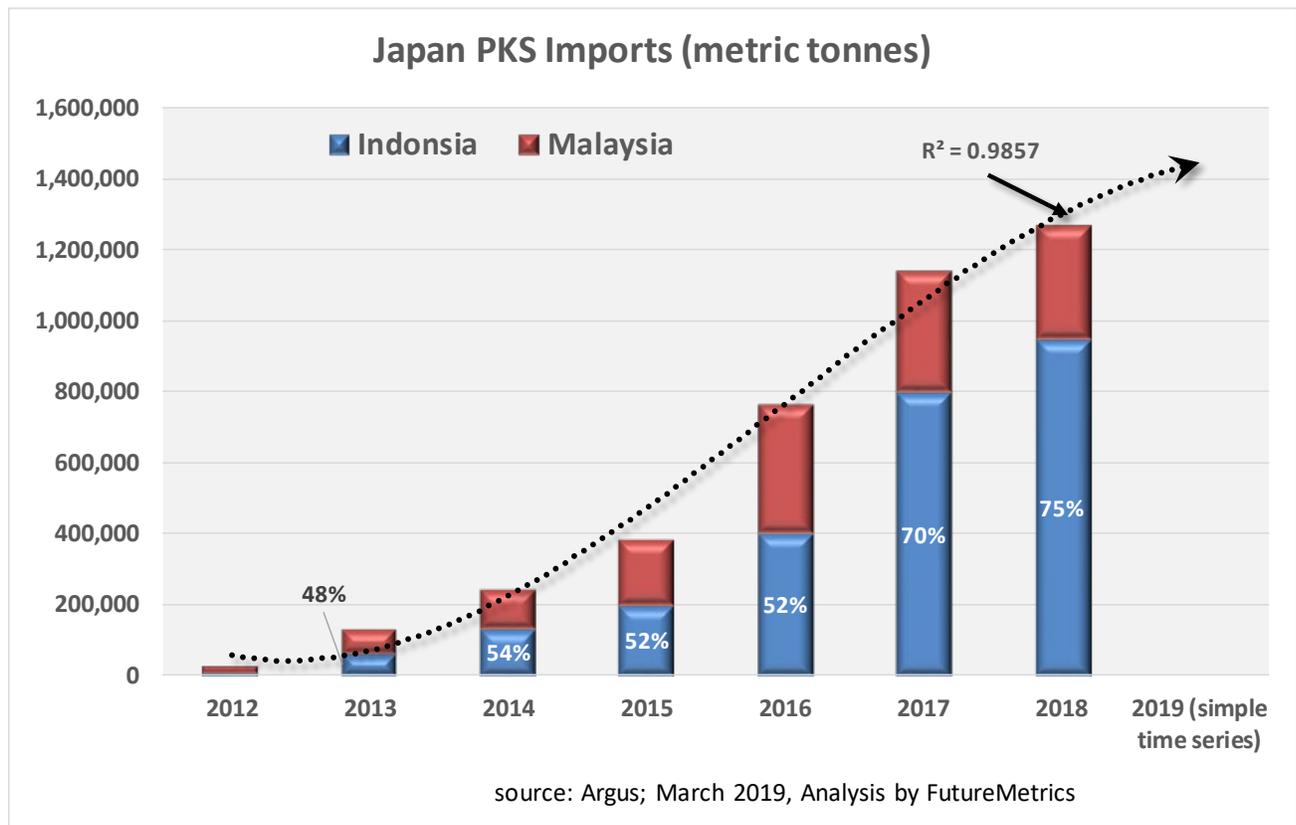
What Happens if Japan Requires Sustainability Credentials for Palm Kernel Shell (PKS)?

By William Strauss and Yoshinobu Kusano

March 29, 2019

FutureMetrics has learned that the Japanese Ministry of Economy, Trade and Industry (METI) is considering requiring palm kernel shell (PKS) to be certified as sustainably sourced. According to information that is informally circulating, it appears that the requirement of sustainability, legality, and traceability for PKS is under serious discussion and is likely to be imposed on current and new PKS procurement. The exact regulation wording is as yet not known. Furthermore, FutureMetrics is not sure if these rules will be applied to already signed contracts for PKS or not. However, it appears very probable that Japan is moving toward a more rigorous set of requirements on biomass fuel procurement. This white paper looks at the implications of a policy requiring PKS to meet sustainability criteria.

Japan is already a major importer of PKS. In 2018 Japan imported 1.265 million metric tonnes of PKS. 75% of Japanese PKS imports in 2018 were from Indonesia.

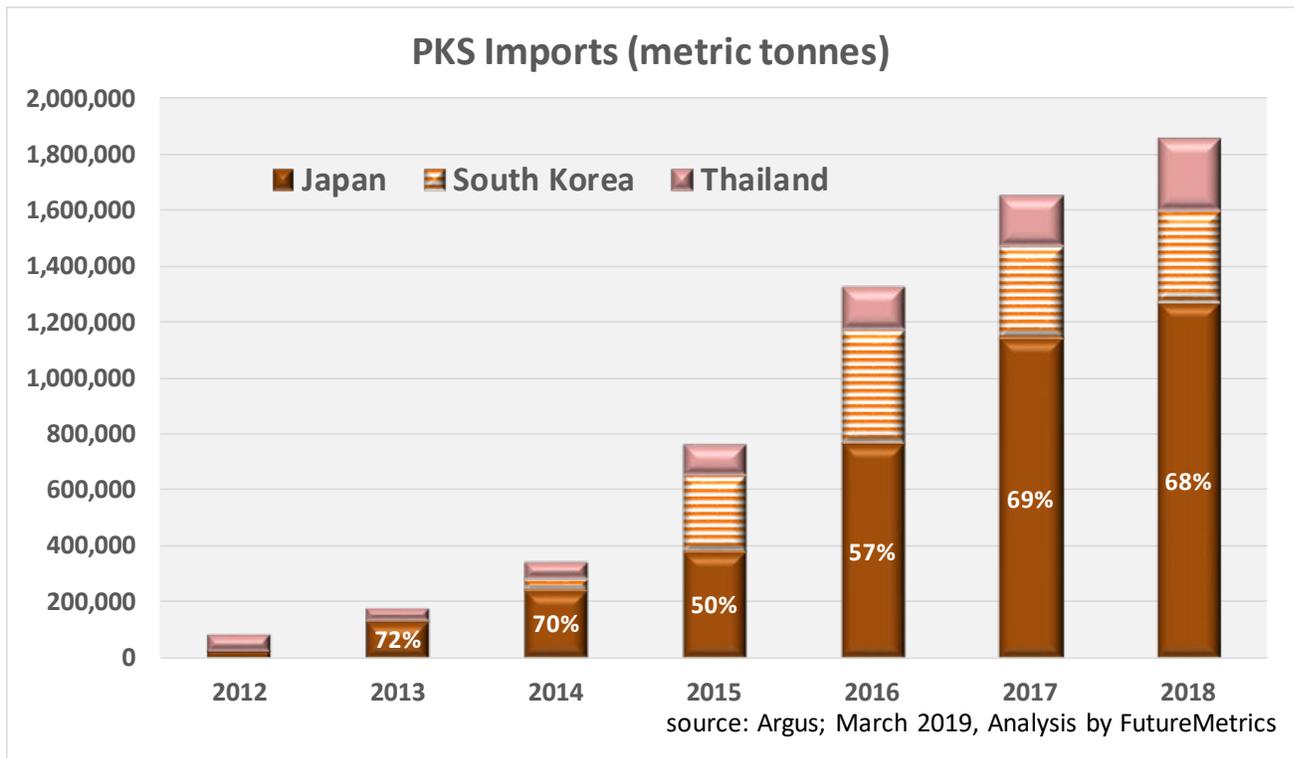


Japan is the major buyer of PKS. In 2018 Japan purchased 68% of total PKS exports. All of those exports came from the two major producing nations: Indonesia and Malaysia.



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PKS is a primary fuel for many of the Japanese independent power producers (IPPs) that are now generating or soon plan to generate power with the benefit of the feed-in-tariff (FiT). The FiT is part of the Japan's policy for increasing the proportion of low to zero carbon emitting power generation. Many IPP projects are also committed to use industrial wood pellets¹ in their fuel mix².

Some of the major Japanese utilities co-fire wood pellets with coal to lower their carbon intensity and/or to improve their calculated thermal efficiencies³. FutureMetrics expects the major utilities to increase their demand for wood pellets significantly over the next decade to meet carbon limits and efficiency requirements.

¹ Wood pellets used in power generation are often referred to as "industrial" wood pellets. Pellets are also used for heating in many countries and those pellets typically do not have to certify as sustainably sourced since they are not part of a carbon mitigation policy.

² The need for wood pellets is due to how the project is financed. If there is a significant proportion of the capital cost financed by debt, the lenders typically require fuel security to minimize the risk of the project not being able to generate at its expected annual output rate over many years. Major pellet producers can offer long-term guaranteed delivery of fuel with a known price and known price adjustment scheme. Some companies offer PKS contracts. Those companies are aggregators of PKS from many palm oil mills. IPPs that rely on debt to build the project must have secure, reliable, and predictable fuel supply without the risk of disruption or price uncertainty and the counterparty must be an entity with a strong balance sheet.

³ Based on METI rules, power stations must meet a minimum efficiency by 2030. METI allows for the pellet portion of the energy input to not be counted as an energy input in the output/input=efficiency calculation. Thus, more pellets raises the calculated efficiency making this a pathway to compliance for older power plants.

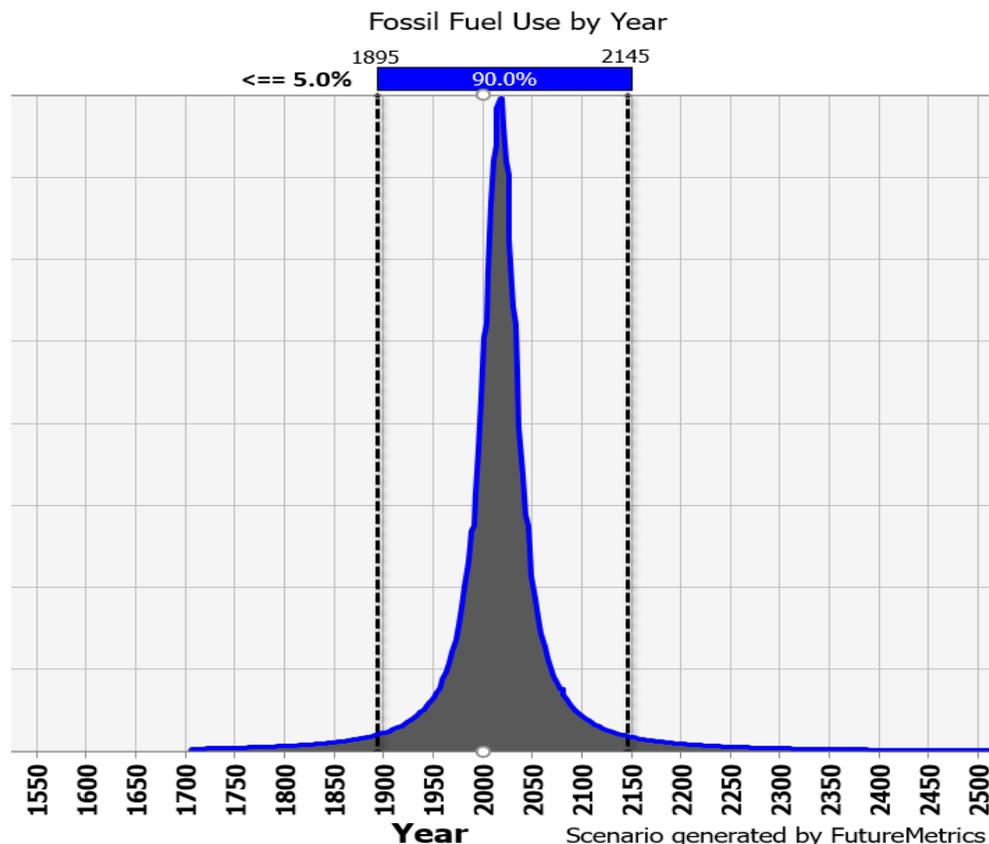


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In most jurisdictions that have policies to support the use of renewable biomass fuels, in order to gain the benefits of the policy, the biomass fuels must be certified as being produced from sustainable sources. This is the basic necessary condition that assures that all the carbon emitted by the combustion of the fuel is absorbed by the growth of the biomass that is replacing what has been harvested and used as biomass fuel. Distilled into simple terms, the carbon stock of the forest resources cannot be depleted; and this is only possible if the harvest rate does not exceed the growth rate and deforestation is not allowed. If those conditions are met, the daily emissions of carbon dioxide from the combustion of sustainable biomass fuels are absorbed contemporaneously by the new growth. The net change in atmospheric CO₂ from the use of sustainable biomass fuels is zero (or in some cases negative if the forest inventory, and thus the stock of sequestered carbon, is increasing).

This in contrast to coal and other fossil fuels which are releasing carbon that was captured over tens of millions of years of biomass growth in the span of a few hundred years. The chart below suggests that by the year 2145 95% of the earth's fossil fuels will be depleted⁴. Based on this scenario, over a span of about 150 years, 90% of the carbon that was captured over tens of millions of years will be released.



⁴ This is a simulation based on many assumptions about supply and demand. The actual shape of the curve will likely be different. However, fossil fuels will be depleted (or banned!) at some point in the not so distant future; perhaps by the time that the grandchildren of today's young adults are having their grandchildren – i.e., five or six generations hence. FutureMetrics uses [Pallisade @RISK](#) software for simulations.



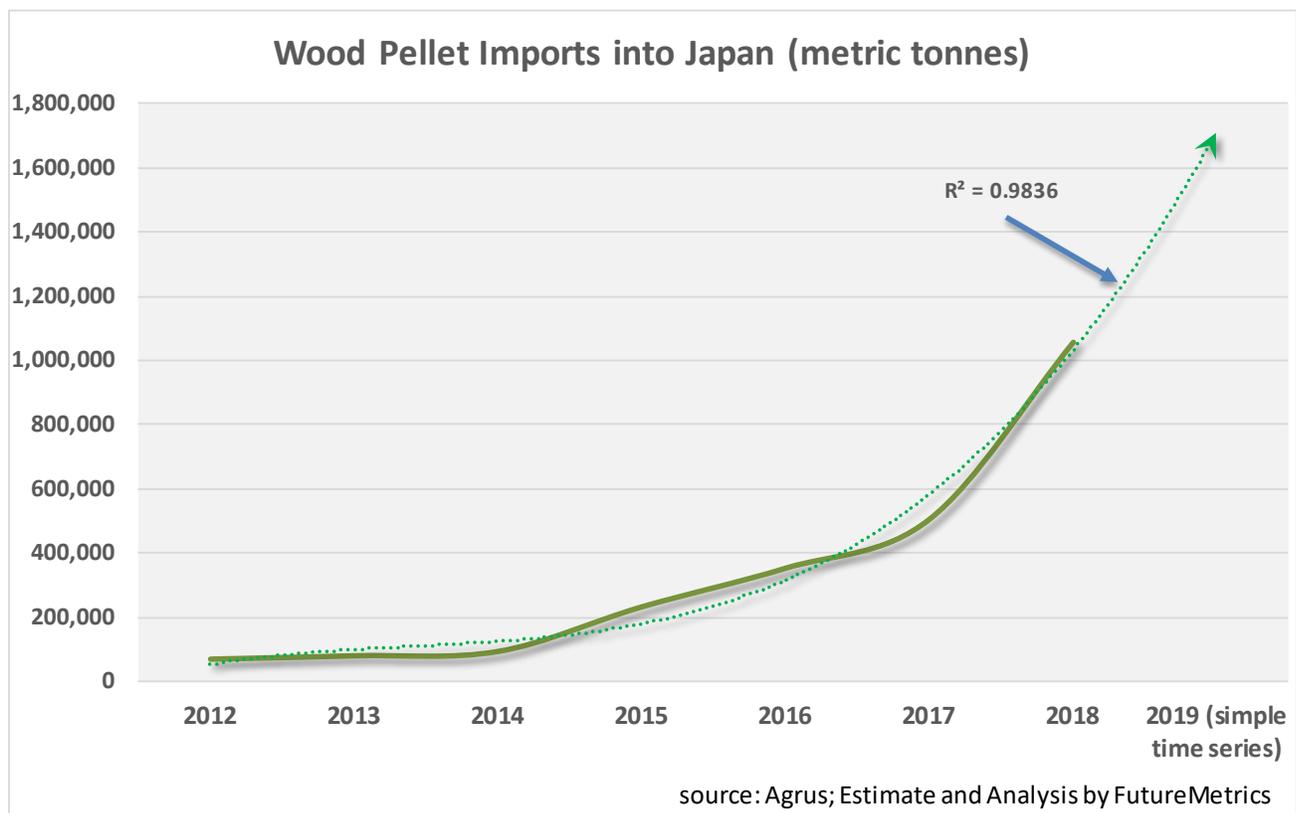
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Many of the world's nations recognize the urgency of decarbonization across all energy demanding sectors for two reasons: (1) To mitigate the impacts of the fossil fuel combustion on climate, and (2) to begin the transition to a future in which fossil fuels will not exist.

As the basis for carbon emissions mitigation in the power sector, industrial wood pellets used as a substitute for coal in power stations in western Europe and England must meet strict and rigorously applied rules proving that the forest inventories are not being depleted⁵ in order to qualify for the policy support the goals of which are to lower the carbon intensity of generated electricity.

As noted above, Japan is a major importer of wood pellets⁶. If the trend shown in the chart below is followed, Japan's pellet imports will exceed its PKS imports in 2019.



Because of the history of sustainability requirements for EU and UK industrial wood pellets, industrial wood pellets produced in the major producing nations are almost 100% certified under one of several recognized and accredited certifying bodies.

⁵ See for example the Sustainable Biomass Program <https://sbp-cert.org/>

⁶ FutureMetrics published a comprehensive research paper on the Japanese biomass markets in January 2018. That paper will be updated in 2019. www.FutureMetrics.com



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Thus, when Japan finalizes its sustainability requirements for biomass fuels, pellets produced by many of the pellet producers in Canada, the US, Europe, Australia, Russia, and South America⁷ will already have the credentials to be legally considered as qualifying fuel in FiT supported IPPs and in those utility power plants that co-fire⁸.

This is not the case with PKS.

The PKS supply chain is highly fragmented with many independent smallholder farmers. Some estimates have smallholders in Indonesia comprising 60% of the total production of palm oil by 2030⁹. Yet an estimate by WRI¹⁰ suggests that less than 1% of independent smallholders are certified as sustainable by the Roundtable on Sustainable Palm Oil (RSPO¹¹) and Indonesia Sustainable Palm Oil (ISPO¹²). Whatever the actual totals, a significant portion of PKS is derived from uncertified sources.

Indonesia and Malaysia, due to a legacy of rapid and massive deforestation to clear land for small and large palm oil plantations¹³ have challenges in building credibility. Managing the growth of the industry and controlling deforestation has been a difficult balance for the palm oil producing nations. Expanding smallholder certification will be a positive change but it will take time. Building trust in how future growth is managed will also take time.

There are also structural differences in the supply chains for PKS and pellets that present challenges. Whereas pellet producers have invested many hundreds of millions of dollars to build pellet factories and need to have a reliable and consistent output over many years to satisfy the return on investment criteria of the investors and lenders, PKS aggregators have relatively little capital invested as there is no conversion of the raw material to an upgraded product. Unlike with industrial wood pellets, PKS markets do not have producers with significant capital invested that can engage in long-term offtake agreements with quantity and quality guarantees, and with delivered price certainty.

What does this mean for Japanese PKS users if METI requires certification of imported PKS? FutureMetrics expects that some portion of the current imports from Malaysia and Indonesia will be curtailed. The reduction in the quantity of PKS imported into Japan will depend on the final METI rules and the ability of PKS suppliers to meet those rules. But a curtailment is very likely.

Since PKS is used in circulating fluidized bed (CFB) boilers which are quite robust in terms of the types of fuels they can consume, a loss of PKS fuel can be replaced with other low-grade biomass such as wood chips

⁷ For a list of SBP certified pellet producers, click [HERE](#).

⁸ This is assuming that either SBP or a set of criteria similar to SBP will be the foundation of the Japanese sustainability requirements.

⁹ <https://www.iopri.org/wp-content/uploads/2017/10/WPLACE-17-1.1.-OIL-PALM-SMALLHOLDER-Bungaran-Saragih.pdf>

¹⁰ <https://www.wri.org/blog/2018/03/smallholder-farmers-are-key-making-palm-oil-industry-sustainable#fn:1>

¹¹ <https://rspo.org/>

¹² <http://www.ispo-org.or.id/index.php?lang=en>

¹³ See this story from March 7, 2019 issue of The Economist magazine:

<https://www.economist.com/asia/2019/03/09/the-palm-oil-industrys-effort-to-curb-deforestation-has-lots-of-flaws>



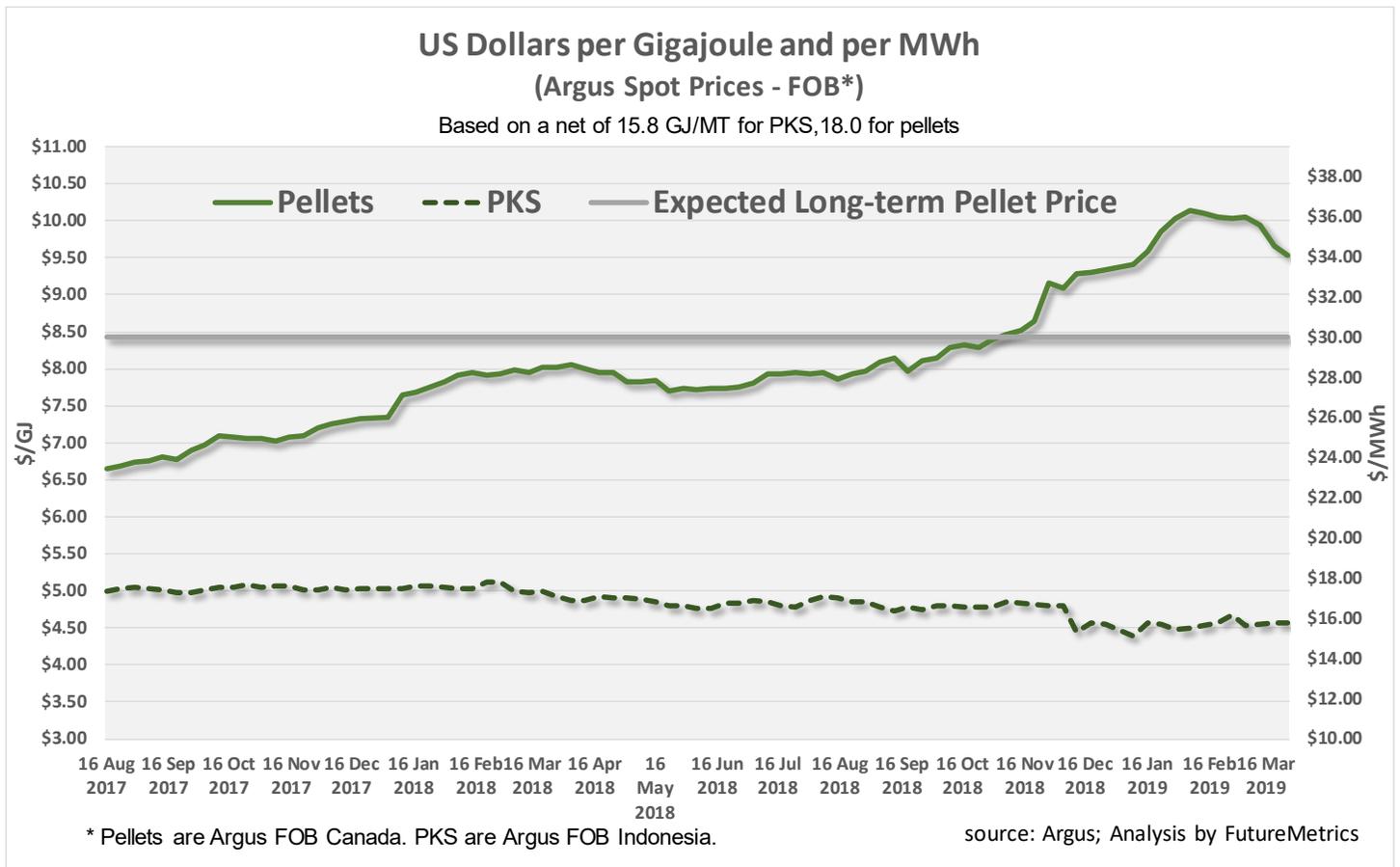
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and other relatively dense by-products of agriculture. However, there are not a lot of options for Japanese IPPs that are able to provide the large and consistent quantities of fuel and the sustainability credentials needed. Industrial wood pellets are a viable option.

FutureMetrics expects that industrial wood pellet demand in Japan will increase as IPPs seek alternative fuel to keep the rate of power generation from their power stations at the required level. At least in the near-term and medium-term, the FiT is sufficient to compensate for the higher cost of pellet fuel.

The chart below shows that the difference between the expected long-term FOB price of pellets (the horizontal line) and PKS in terms of dollars per gigajoule (\$/GJ) and in terms of dollars per megawatt-hour (\$/MWh). Spot prices have reached record levels in recent months. FutureMetrics expects the spot price to trend to about \$155-\$160 FOB Canada. The chart shows that as the horizontal line.



Assuming an efficiency of 38% for the power plant, it takes about 2.63 MWh's of input energy to make a MWh of electricity. The chart above shows FOB prices. To estimate the delivered CIF price the following adjustments are used.



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Shipping Cost Assumptions			
	Per tonne	Per GJ	Per MWh
Pellets	\$25.00	\$1.39	\$4.96
PKS	\$20.00	\$1.27	\$4.52

This leads to the following costs for delivered fuels.

38% power plant efficiency		
2.63 MWhs of Fuel to Make One MWh Power		
	Delivered Fuel Cost per MWh Produced	% of Revenue (biomass from FiT, coal from day ahead rate)
Pellets	\$84.13	38%
PKS	<u>\$51.75</u>	<u>24%</u>
Difference	\$32.38	15%
Coal	\$40.49	61%

The fuel cost for a MWh of power from PKS is about \$52 and for power from pellets is about \$84 (using the expected long-term FOB price for pellet fuel of about \$30/MWh).

In the table above the calculation for the delivered coal cost is based on data from several sources. Japanese steam coal has averaged around \$100 to \$110 per tonne¹⁴. Assuming 6.5 MWh per tonne (23.4 GJ), the table shows the delivered cost of about \$40.50 per tonne.

The FiT provides most IPP's with ¥24/kWh which, at current exchange rates, equals \$0.22/kWh or \$220/MWh. As the table above shows, PKS and pellet CIF fuel costs are 24% and 38% of the revenue per MWh from the FiT. In Japan, the current day ahead price for power is about ¥7.28/kWh¹⁵. At current exchange rates that equals about \$0.066/kWh or about \$66/MWh. Thus, as the table above shows, coal costs are about 61% of the revenue from the wholesale market sale of power; which is significantly more than the fuel cost for pellets under the FiT.

If a coal fueled power plant can operate without losing money with fuel costs equaling 61% of the revenue in the wholesale power market, then an IPP operated CFB power plant should be able to operate profitably on the higher cost pellet fuel under the FiT where fuel costs are under 40% of revenue.

Conclusion

When METI promulgates the rules for the sustainability of imported biomass fuels, some portion of the current PKS imports will be unqualified and will not be allowed as fuel for IPPs who want to enjoy the FiT

¹⁴ https://www.quandl.com/data/BP/COAL_PRICES-Coal-Prices

¹⁵ <http://www.jepx.org/english/>



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rate. The Japanese IPPs will respond by increasing their use of industrial wood pellets. The IPPs' margins will shrink because pellet fuel is about 15% higher cost per MWh than PKS.

But the way the FiT is crafted, with a fixed rate over 20 years, the FiT is very generous in the early years in order to provide a buffer between a fixed top line revenue and the inevitable increasing costs of fuel and plant operations that will occur over 20 years. In later years margins are expected to shrink due to cost increases (inflation) while the top line FiT revenue remains fixed.

In these early years of the FiT, there is enough buffer built into the rate to allow higher cost pellet fuel to substitute for PKS. Presumably, as the palm oil producers respond to certification requirements over time, PKS imports will trend upward after what is likely to be a rapid and relatively sudden drop when sustainability requirements are implemented.

In the near to medium terms, after METI requires sustainability certification for imported biomass derived fuels, unless there are exemptions for PKS, the demand for industrial wood pellets in Japan will increase significantly and quickly.