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The Current State of the Industrial Wood Pellet Markets
and
How the Japanese Market will bring New Opportunities for Growth

By William Strauss, PhD
June 8, 2016

Introduction

Growth in demand for industrial wood pellets is currently on hold. The forecasts from several years ago showing an excess of 20 million tonnes per year of demand by 2016 were wrong. Those forecasts did not anticipate the changes in the policy environment that underpins the use of wood pellets in place of coal in large power stations.

The policy changes in the UK have eliminated many of the projects that were expected to be using wood pellets. The conversion of the Lynmouth power station, and possibly the MGT Teeside station, will probably be the last big increases in pellet demand for UK power plants[1].

The delays and continued uncertainty in the Dutch markets have, at best, postponed the expected new demand for about 3.4 million tonnes per year.

The expected growth in the Belgium industrial pellet market has just had a major step forward with the purchase on June 6, 2016 of the Langerlo power station in Flanders Belgium by Graanul Invest. That plant will consume about 1.8 million tonnes per year when it begins using wood pellets in 2018.

If the MGT project and the Dutch markets move forward, it will move total industrial wood pellet demand in the EU and UK to about 21.5 million tonnes per year by 2023 (see chart below). However, as recent history has shown, until projects are actually being implemented in the UK and EU, investment decisions for new production capacity should not be made.

[1] The Lynemouth conversion is underway and it will begin using about 1.55 million tonnes per year in about 2018. The MGT Tees Renewable Energy Plant may also move forward and will, if completed, add another one million tonnes per year to total UK demand.

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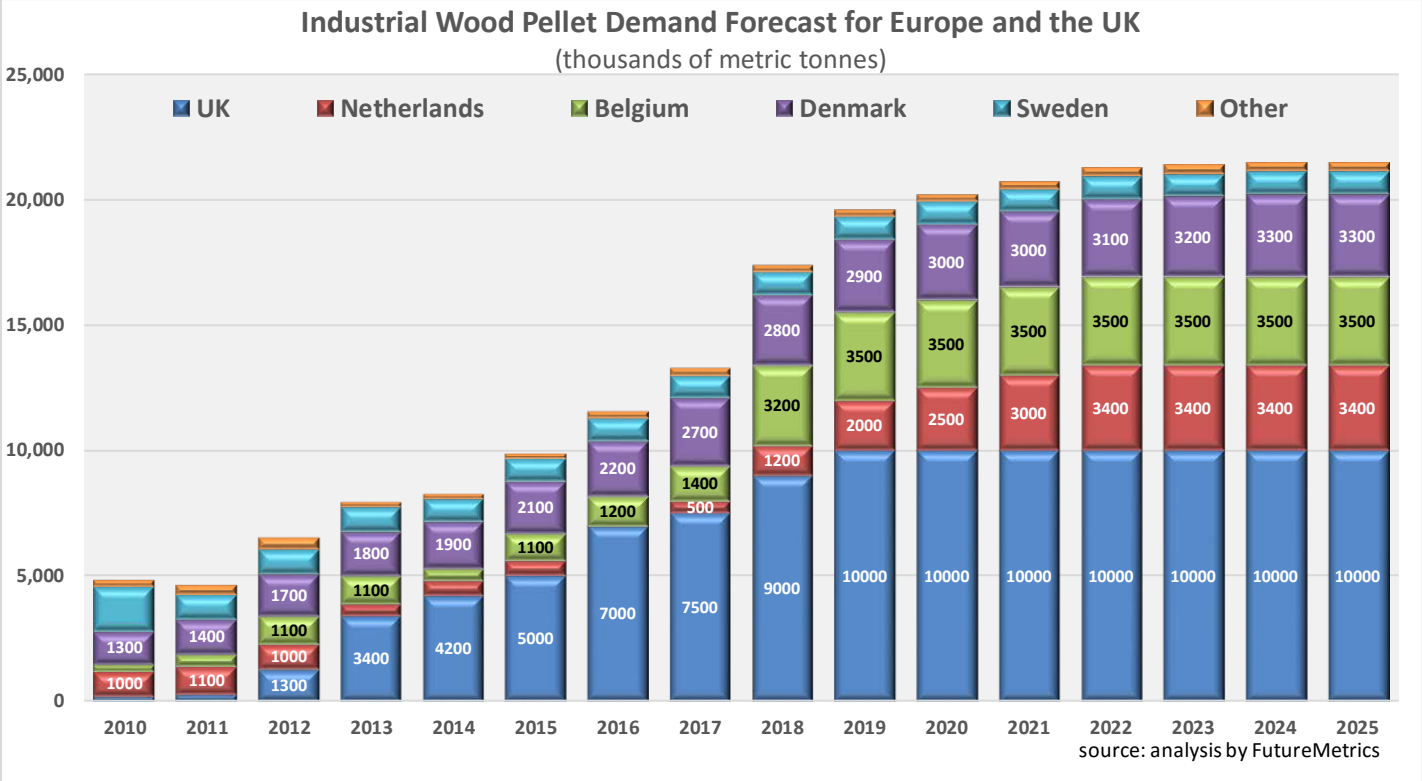

The end of growth in the European markets is clearly shown in the chart above.

But the future growth for industrial wood pellets is not just dependent on Europe and England.

FutureMetrics has already published several papers on the potential for the Clean Power Plan to enable significant industrial wood pellet demand in the US. An upcoming white paper will discuss the potential in Alberta, Canada.

We also see the Japanese market becoming a significant demander of wood pellets for use in pulverized coal power stations. This white paper will discuss that market and how its growth will benefit producers not only in western Canada but also in eastern North America and other locations.

First, a look at the current state of the industrial wood pellet market.

The Current Industrial Wood Pellet Market is Oversupplied

The buildup of production capacity based on demand forecasts from a few years ago has resulted in a current state of excess supply. Some projects have been financed and built without most of their production capacity matched with an offtake agreement. Or in some cases, the power plants that were to undergo modifications or conversions that those projects expected to supply fuel to have either been abandoned or have been put on hold pending policy certainty. The “safety valve” for sending production into the European heating pellet markets has been closed due to three exceptionally warm winters.

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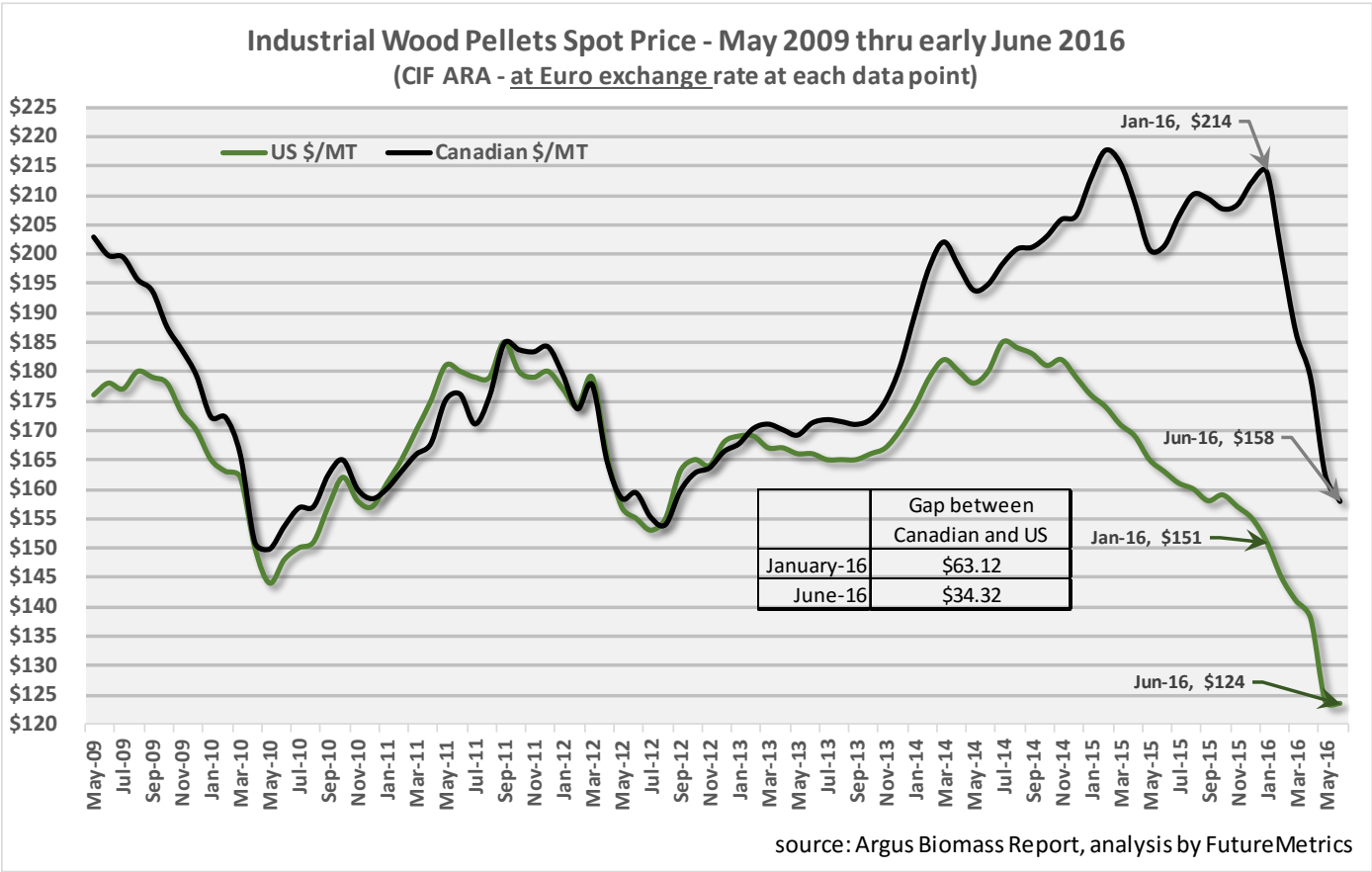
There are too many pellets chasing too few buyers. As a result, spot market prices for industrial wood pellets have hit historical lows (in US dollar terms). The chart below shows monthly average Euro spot prices converted to US and Canadian dollars. Euro exchange rate movements favored Canadian producers until this year. That gap has closed somewhat in recent months.



source: Argus Biomass Report, analysis by FutureMetrics

The chart below illustrates the mismatch between North American potential supply and actual exports that has developed in the last 18 months. The line on the chart shows the estimated excess supply (the difference between potential installed capacity and exports).

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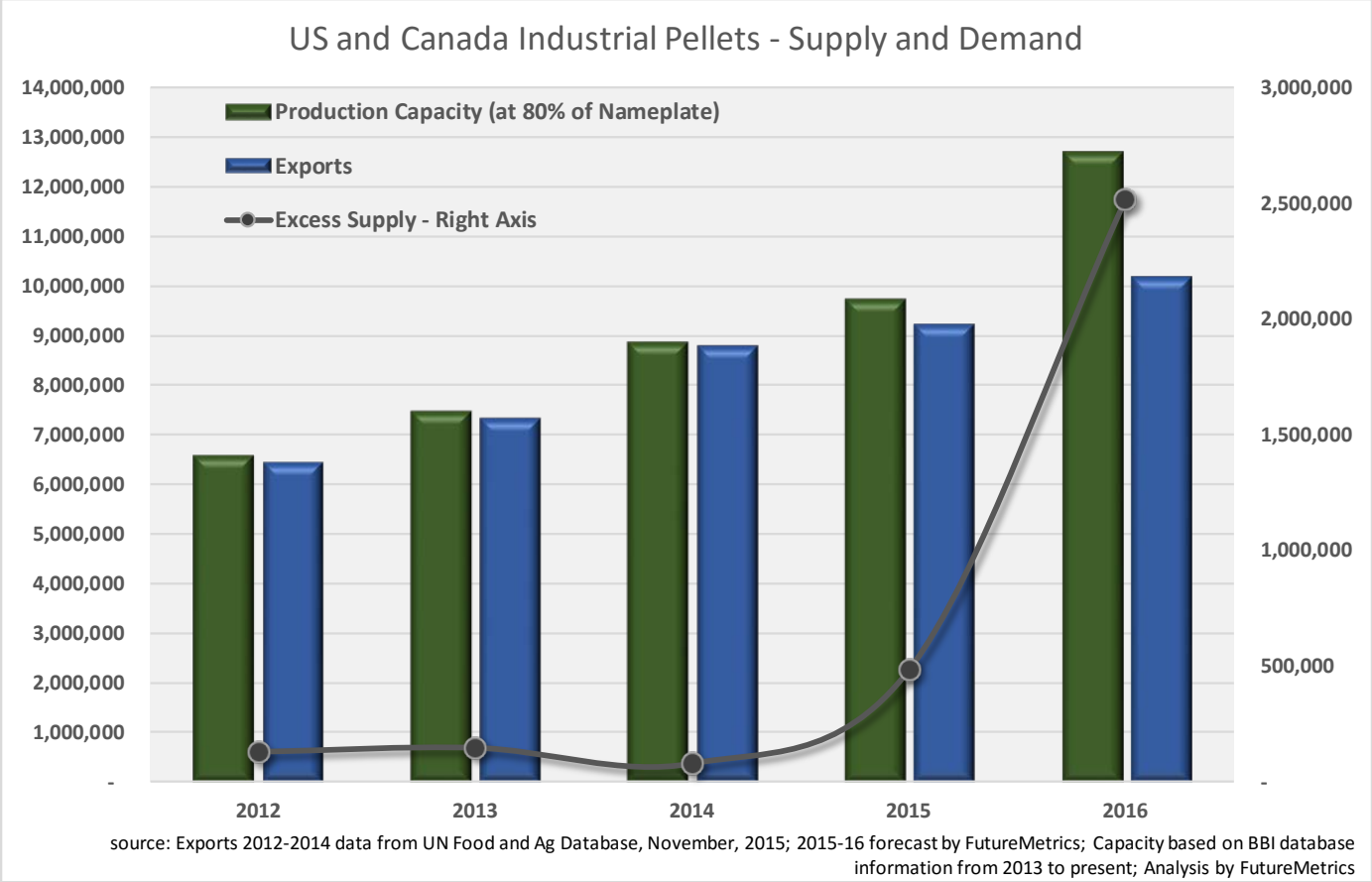

US and Canadian production capacity by the end of 2016, assuming industrial plants run at 80% of nameplate capacity, will be about 12.7 million tonnes per year if all projects under construction[2] are producing the by the end of the year. Actual 2016 exports from the US and Canada are forecast to be about 10.2 million tonnes. The estimated excess supply based on an 80% of nameplate production rate is about 2.5 million tonnes.

The industrial pellet oversupply is compounded by increased production in eastern Europe and decreased demand for heating pellets in Europe. For example, Grannul Invest has expanded production capacity to about 2.2 million tonnes per year in its Baltic pellet mills. Exchange rate challenges with the US dollar and short shipping distances have favored eastern European pellets in the industrial spot markets and EU heating markets.

With Lynemouth and Langerlo coming online in 2018, that the oversupply will be soaked up by the new demand. The chart below shows North American production capacity increasing after 2018 and assumes that a proportion of new UK and EU demand will be met by North American wood pellets.

[2] Does not include "proposed" projects. Only projects currently under construction. Nameplate capacities for producing and under construction projects from the BBI (Biomass Magazine) database, June, 2016.

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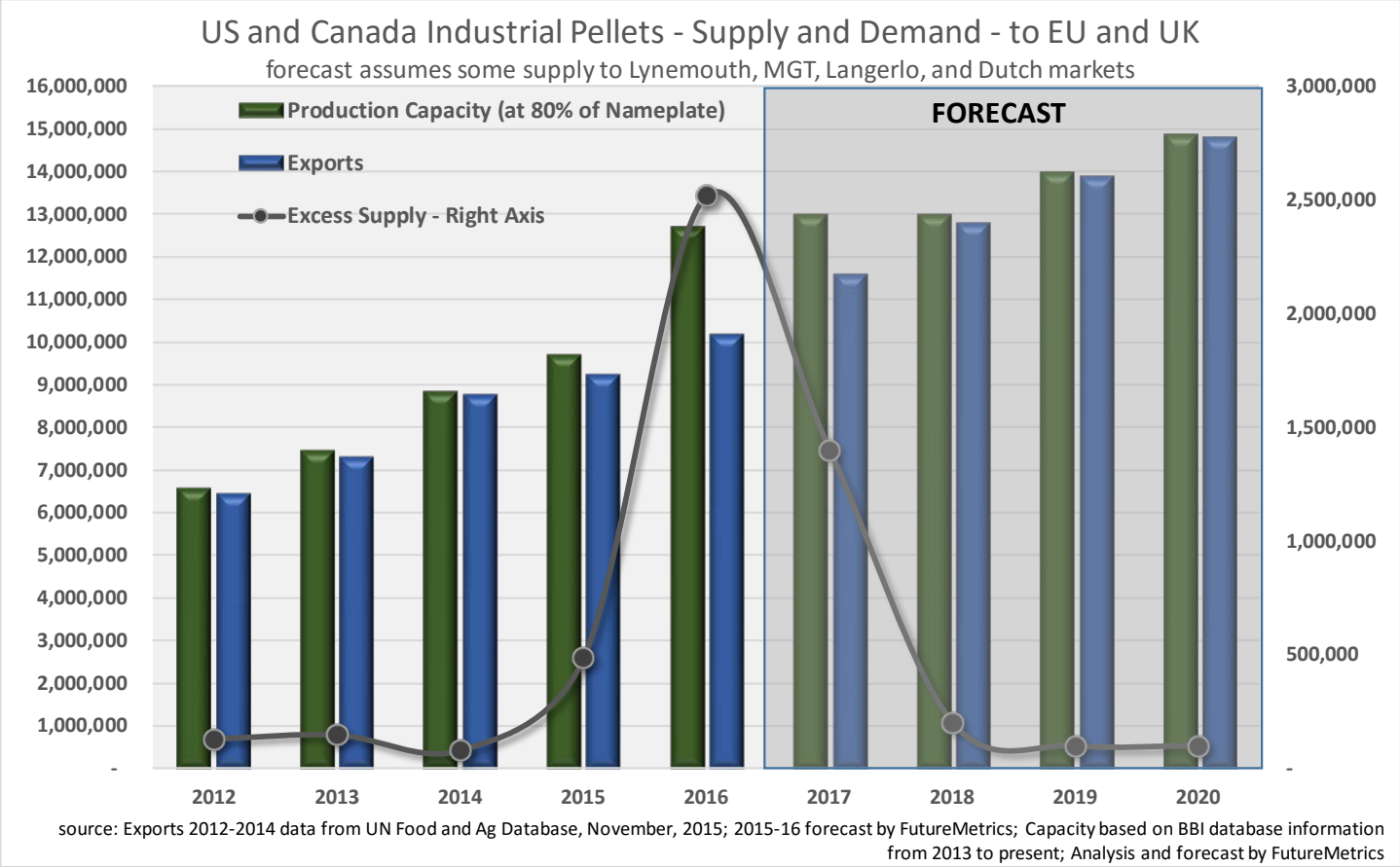


If a smaller proportion of UK and EU demand is met by North American producers (because a larger proportion comes from eastern Europe and Brazil), we would expect that the lessons of the past few years would cause the rate of growth in new North American production capacity to be less speculative and more closely match contracted demand. In either scenario, the probable growth in just the UK and EU will likely correct the current state of oversupply in the North American markets by the end of 2018. If the Dutch markets do not grow as expected, the excess supply may linger longer.

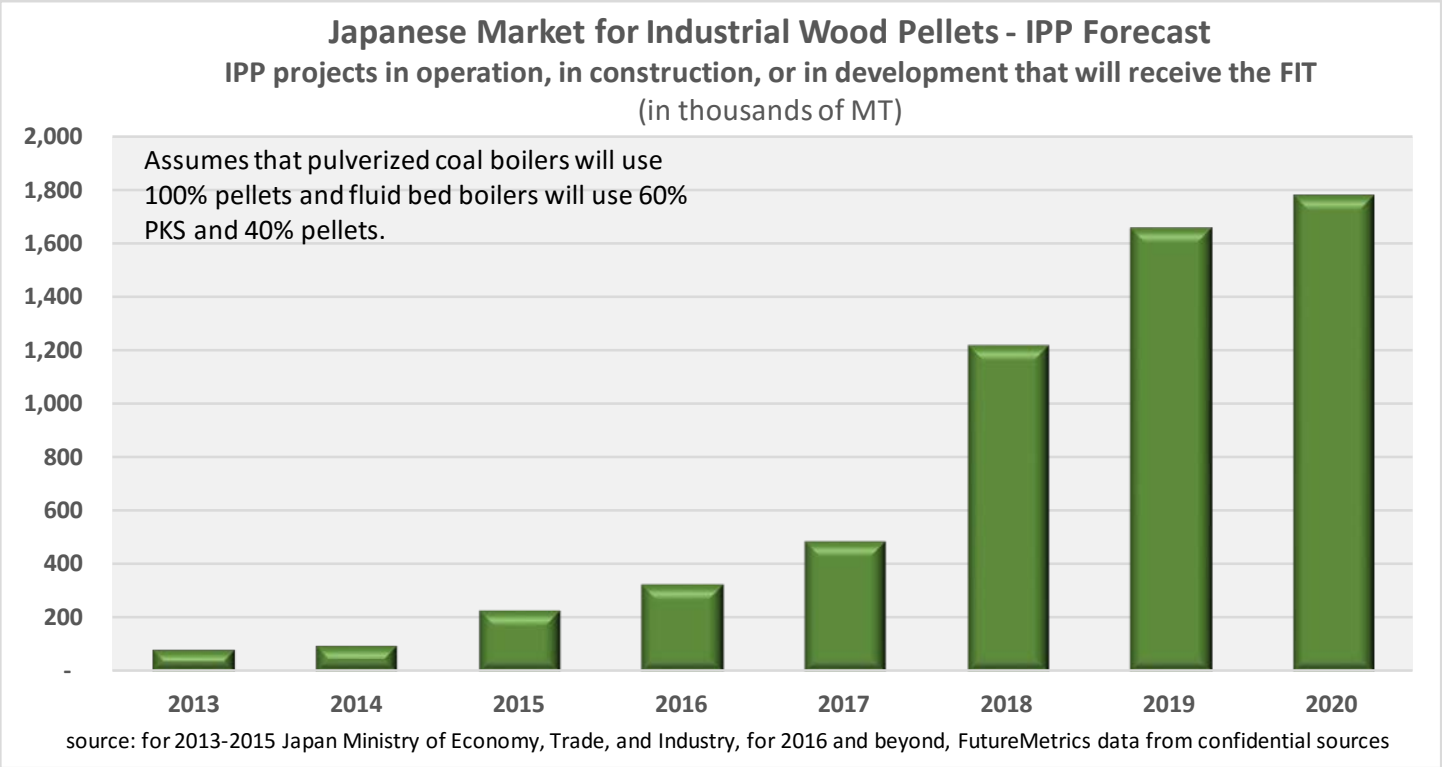
However, as the remainder of this white paper will show, there is a significant opportunity for new growth that will directly favor North American producers both in the near and longer terms.

The Japanese Market for Industrial Wood Pellets

There are several policies in Japan that are driving current growth and will drive future growth. Under one plausible scenario, Japan could be demanding well in excess of 15 million tonnes per year of wood pellets by the mid-2020's.

The policy that is in place that is currently having a strong impact on the demand for wood pellets is the Feed in Tariff (FIT). The FIT is offered to independent power producers (IPPs) at rates that vary depending on the type of energy. For wood pellets and other biomass such as palm kernel shells (PKS) the current FIT is

24 Yen per kWh. This converts to about $0.225/kWh or $225/MWh. The rate is set and guaranteed for 20 years.



As the chart shows, data on projects that are currently receiving the FIT, or are being built based on having been approved or expecting to be approved to receive the FIT, suggest that just the IPPs may be demanding almost 2 million tonnes per year by 2020.

Some of the IPP projects use circulating fluid bed (CFB) boilers. Those boilers can use a wide variety of fuels including wood chip and PKS. About 55% of the IPP projects are CFB and the rest are based on pulverized fuel. The pulverized fuel systems can only use wood pellets. Some of the CFB projects will use a variety of fuels including wood pellets. The chart above is based on the assumption that CFB systems will use 40% pellets and 60% other biomass fuels. If all CFB projects use 100% PKS or other biomass fuels other than pellets, pellet demand by the IPPs is expected to be about 1.2 million tons per year.

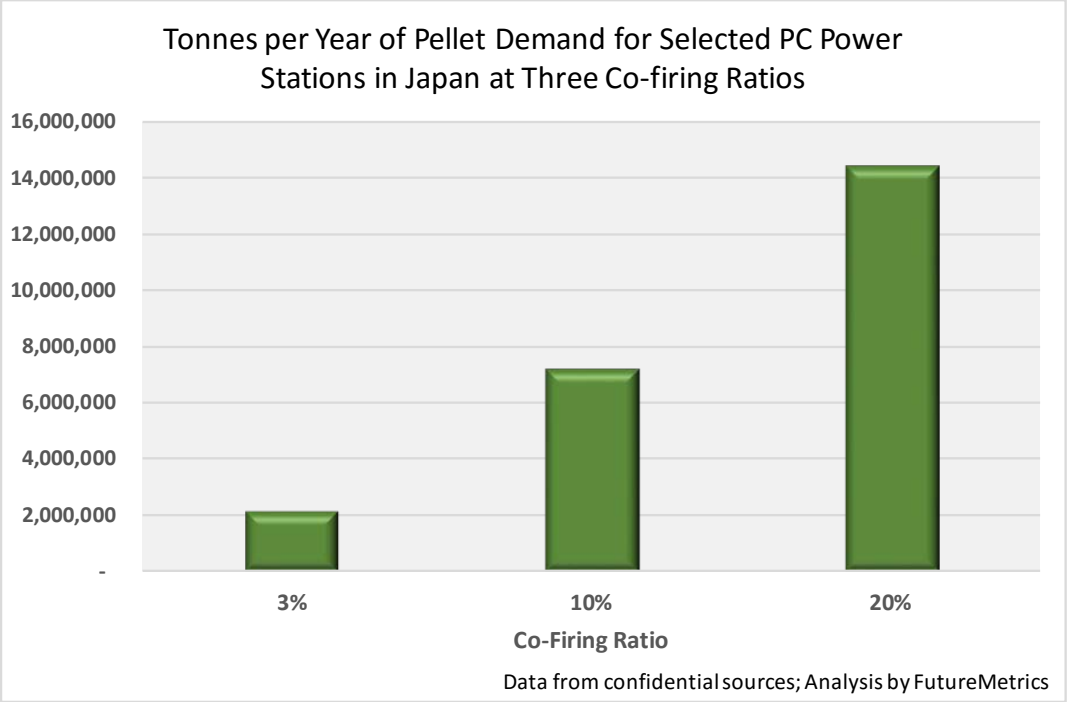
There are two other fundamental policy goals that will influence wood pellet demand in Japan: (1) Carbon emission targets, and (2) the government's desired energy mix by 2030.

Carbon Emission Targets

Japan has already implemented a target reduction of CO_2 emissions that will require all power companies to reduce CO_2 per kWh by 35% from 2013 levels by 2030. This is a reduction of from 0.57kg of CO_2/kWh to 0.37kg of CO_2/kWh. It is currently a voluntary target but a few major utilities are already co-firing wood

pellets at modest 3% ratios. One facility that the author of this paper recently visited, the 2000 MW Shinchi coal power station (not very far from the damaged Fukusima Daiichi nuclear reactor station) is already co-firing at about 3% (about 160,000 tonnes per year) with no direct monetary support. At such low co-firing rates, there are no modifications needed to the fuel delivery systems and burners. Wood pellets are literally sprinkled onto the coal conveyer prior to the pulverizers.

There are a few other pulverized coal (PC) power stations also co-firing and there are some that are having discussions for pellet fuel supply. Those stations either currently co-firing or in discussions about fuel supply add up to about 18,700 MWs. The chart below shows the pellet demand at these stations under three co-firing ratios. At the higher co-firing ratios, the plants will need modifications and/or retrofits to pulverizers, burners, pneumatic fuel conveyance systems, and some other components.



The voluntary policy for carbon emissions mitigation may change. Japan has committed to the international agreement for CO_2 reduction. That target is for a 27% reduction by 2030.

Some of that CO_2 reduction will achieved with renewables and some with nuclear. The government's energy mix goals show how this might be achieved.

Energy Mix by 2030

The Japanese government's analysis expects the nation to demand about 1,065 billion kWh's in 2030. The government's strategic plan includes a breakdown of the desired energy mix in 2030. The nation will be expected to produce power based on the breakdown shown in the table below.

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Based on 1,065 Million MWh's of Demand in 2030	Energy Mix	Millions of MWh's		***Renewable Portion***	Energy Mix	Millions of MWh's
Renewable	23%	244.95		Geothermal	1.0%	10.65
Nuclear	21%	223.65		Biomass	4.3%	45.80
LNG	27%	287.55		Wind	1.7%	18.11
Coal	26%	276.90		Solar	7.0%	74.55
Oil	3%	31.95		Hydro	9.0%	95.85
TOTALS	100%	1,065.00			23.0%	244.95

The "best energy mix" shows that renewables will account for 23% of the total power generated in Japan. Of that 245 gigawatt-hours, 45.8 GWh's, or about 4.3%, is to be produced from biomass. Assuming an 85% capacity factor for biomass generation, that amounts to biomass generation capacity of about 6,150 MW's[3].

6,150 MWs will require a significant amount of biomass fuel. Some of that will be wood pellets.

Large existing power plants use pulverized coal fuel systems in which the coal is ground to a powder and pneumatically conveyed to the burners. Only wood pellets can be easily ground to powder and used in PC boilers. In the table below, we assume that 30% of the 6,150 MWs are produced from pellets being co-fired with coal in modified existing coal power stations. The rest of the biomass fuel may be imported palm kernel shells (PKS), construction waste, and other wood wastes; none of which are easily pulverizable.

Under the assumption that about 1,845 MWs of the biomass generation will be from wood pellets, Japan's power sector would use about 7.6 million tonnes per year (about the same annual pellet demand as the Drax power station in the UK). It is possible that more than 30% of the needed baseload MW's will come from wood pellets since non-pulverizable solid biomass is not compatible with PC boilers.

[3] Analysis is based on wood pellets having an energy content of 17.5 gigajoules per metric tonne and an average power plant efficiency of 37%. This yields a generation rate of 1.798 MW's of electricity per tonne of pellet fuel. Actual nameplate is likely to be higher if a proportion of biomass generation is from lower energy density and higher moisture content fuel.

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Analysis of Potential Wood Pellet Demand Based on Government's Best Energy Mix Policy for 2030

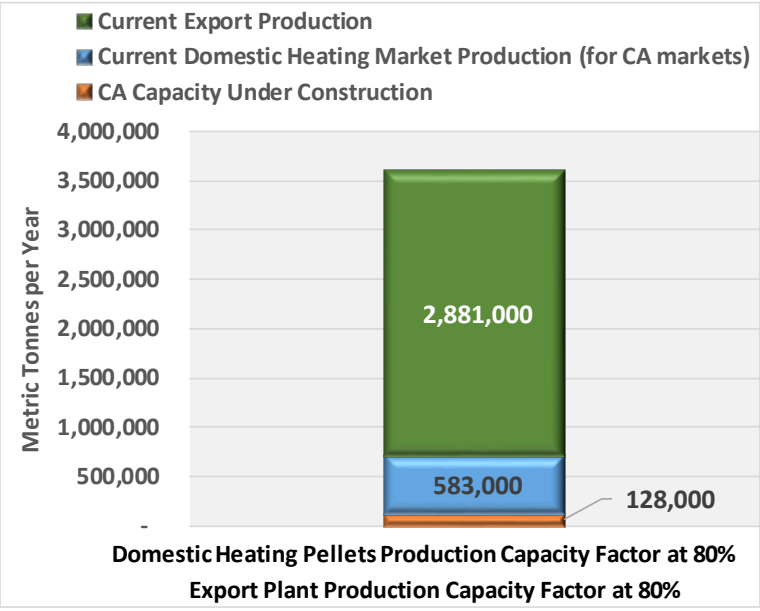
Based on 1,065 Million MWh's of Demand in 2030	Energy Mix	Millions of MWh's		***Renewable Portion***	Energy Mix	Millions of MWh's	Capacity Factor	Nameplate MW's Needed	Tonnes of Wood Pellets per Year if 30% of Needed MW's are Produced from Pellets
Renewable	23%	244.95		Geothermal	1.0%	10.65	90%	1,351	
Nuclear	21%	223.65		Biomass	4.3%	45.80	85%	6,150	7,640,000
LNG	27%	287.55		Wind	1.7%	18.11	30%	6,889	
Coal	26%	276.90		Solar	7.0%	74.55	25%	34,041	
Oil	3%	31.95		Hydro	9.0%	95.85	90%	12,158	
TOTALS	100%	1,065.00			23.0%	244.95		60,589	

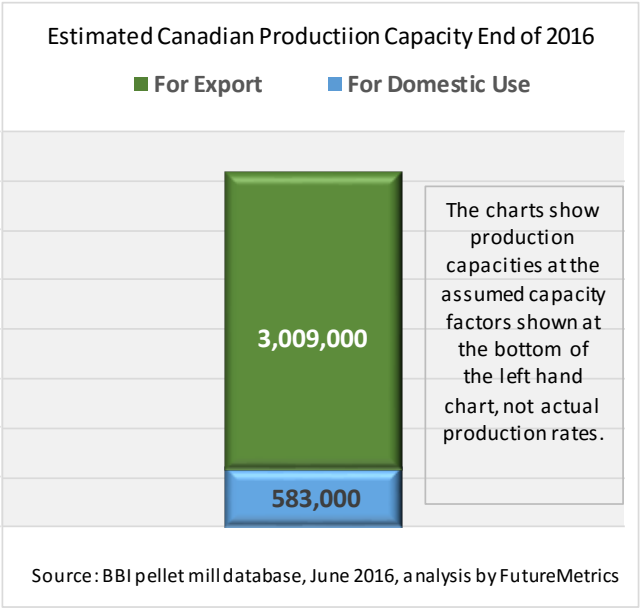
2030 MWh demand and energy mix from Japan Ministry of Economy, Trade, and Industry

Analysis by FutureMetrics

The Japanese utilities and/or the Japanese trading houses are interested in long-term contracts with well-established suppliers and strict accountability for sustainability and the legality of harvesting. These requirements favor some producing nations and disfavor others.

Western Canada is already a major producer of industrial wood pellets and western Canada has existing relationships with the Japanese trading houses. Most Canadian forest products are sourced from well-managed forests that meet or exceed the most rigorous requirements for sustainable forest management and the corresponding carbon benefits.





Other countries with favorable shipping logistics and the foundations for sustainable sourcing and durable contracts are the western US, New Zealand, Australia, and Chile; all of which could also supply the Japanese markets with pellet fuel. Southeast Asian producers (such as Viet Nam, Thailand, Myanmar, Malaysia, Indonesia) would have to significantly improve accountability for sustainability and for the legality of

logging. The durability of long-term contracts and long-term security for access to fiber may increase the perceived risk of using those sources.

Since most of western Canada's current annual production is being shipped via the Panama Canal to the UK and EU, increased demand from Japan will encourage a change in logistics. If those western Canadian pellets go to the Japanese markets, new production capacity in the eastern US and eastern Canada would be needed to replace those cargos that are no longer supplying the UK and EU markets.

There is a scenario in which the Japanese market's demand for biomass could be much larger. Under the government's policy for the best energy best mix, any generation not produced by nuclear has to be made up by low carbon renewable generation. Many experts in Japan think that it is unlikely that Japan will generate 23% of its power from nuclear stations in 2030.

If nuclear does not reach 23%, the best available renewable low carbon pathway that can supply baseload power is pellets being co-fired in existing utility PC power stations.

The table below shows a scenario in which 12% of power is from nuclear and the resulting shortfall in MWh's is made up with biomass.

Low Nuclear Scenario				**Low nuclear made up by baseload biomass**					
Based on 1,065 Million MWh's of Demand in 2030	Energy Mix	Millions of MWh's		***Renewable Portion***	Energy Mix	Millions of MWh's	Capacity factor	Nameplate MW's Needed	Tonnes of Wood Pellets per Year if 30% of Needed MW's are Produced from Pellets
Renewable	32%	340.80		Geothermal	1.0%	14.82	90%	1,879	
Nuclear	12%	127.80		Biomass	13.3%	197.07	85%	26,467	32,880,000
LNG	27%	287.55		Wind	1.7%	25.19	30%	9,585	
Coal	26%	276.90		Solar	7.0%	103.72	25%	47,362	
Oil	3%	31.95		Hydro	9.0%	133.36	90%	16,915	
TOTALS	100%	1,065.00			32.0%	474.16		102,208	

2030 MWh demand and energy mix from Japan Ministry of Economy, Trade, and Industry

Analysis by FutureMetrics

The lower nuclear generation capacity in the scenario shown in the table above is compensated for by in an increase in biomass. Now rather than 6,150 MW's, more than 26,000 MW's of biomass generation would be needed. If the same 30% proportion of that demand as was used in the earlier example is produced from wood pellets, annual demand would be nearly 33 million tonnes per year by 2030.

Conclusion

Is that possible! We think it is for several reasons.

By 2030 we think that the demand for printed media will be very low. The traditional use for a major part of working forests has been for the pulp and paper industry. Changes in that sector are already releasing many

millions of tonnes per year of wood that was grown for making paper and now has limited commercial use. That fiber could be making wood pellets. The potential growth in wood pellet production from the US southeast is significant.

But as we have noted in many of our white papers, the limit to growth in the wood pellet sector is defined by the absolute necessary condition of maintaining the stock of carbon held in the living and growing working forests. As long as the harvest rate does not exceed the growth rate, every tonne of carbon released from combustion is re-sequestered contemporaneously by the continuous growth of the working forests.

As the demand for pulp for paper-making declines, the wood pellet sector in the southeastern US has the potential to produce much higher volumes of carbon beneficial wood pellet fuel. The data in the table below shows that the wood pellet sector in the southeast US is currently a very small proportion of the total annual harvest from the vast southern yellow pine tree farms. The table also shows that the forests, and therefore the carbon stock held in the forests, are growing rather than shrinking even as the pellet sector has grown.

	Atlantic Region					Gulf Region				
	Pulpwood			Total Pine		Pulpwood			Total Pine	
Year	Inventory	Removals for Pulp Mills	Removals for Pellet Mills	Inventory	Removals	Inventory	Removals for Pulp Mills	Removals for Pellet Mills	Inventory	Removals
	(million tons)	% of Inventory	% of Inventory	(million tons)	% of Inventory	(million tons)	% of Inventory	% of Inventory	(million tons)	% of Inventory
2000	491	7.8%		1,363	5.3%	517.2	11.20%		1,655	7.4%
2001	490	7.5%		1,366	5.1%	522.9	11.00%		1,671	7.3%
2002	496	8.1%		1,386	5.2%	529	10.60%		1,697	7.1%
2003	496	8.7%		1,388	5.4%	536.5	10.00%		1,729	7.0%
2004	506	8.6%		1,418	5.3%	544.4	10.50%		1,768	7.1%
2005	505	8.5%		1,444	5.3%	548.8	10.90%		1,800	7.3%
2006	506	9.0%		1,455	5.3%	555	11.10%		1,840	7.0%
2007	512	9.2%		1,484	5.4%	563.8	11.30%		1,858	6.8%
2008	516	9.4%		1,504	4.9%	567.6	11.10%	0.00%	1,876	5.8%
2009	513	9.4%	0.00%	1,517	4.6%	573.8	10.60%	0.00%	1,903	5.3%
2010	505	10.0%	0.00%	1,540	4.8%	586.1	11.30%	0.10%	1,949	5.5%
2011	503	10.0%	0.20%	1,573	4.8%	607.1	10.30%	0.10%	2,015	5.3%
2012	506	10.1%	0.30%	1,620	4.9%	623.6	10.20%	0.10%	2,074	5.3%
2013	518	9.8%	0.40%	1,679	4.8%	641.5	10.20%	0.20%	2,147	5.3%
2014	525	10.0%	0.30%	1,732	4.8%	653.9	10.00%	0.30%	2,219	5.3%
Increase in Inventory from 2000 to 2014 =>	**6.91%**			**27.10%**		**26.43%**			**34.12%**	

source: Forest2Market, analysis by FutureMetrics

Also of significance are the developments of alternative feedstocks such as the by-products from the cultivation and processing of sugarcane. Brazil alone has the potential to produce tens of millions of tonnes of pellet fuel. Current sugarcane production in Brazil creates enough unused by-products to produce 80 million tonnes of pellets per year. The recent joint venture between Cosan and Sumitomo, which formed the new company Cosan Biomassa, is currently working to develop that resource.

As we have noted in other white papers, substituting pellets for coal should be part of a pragmatic and rational strategy for the transition to a decarbonized future. Until there is a way to store electricity at the huge quantities needed to supply the grid and keep the lights on continuously, intermittent solar and wind generated power cannot provide the baseload and peaking demands of a reliable electric grid.

So although the future growth of the European and UK industrial wood pellet demand is expected to flatten over the next several years, there is a high probability for Japan, the US (Clean Power Plan) and other nations to embrace the only low carbon fuel that can be used in existing large utility power plants.

And as demand grows, the production of renewing and sustainable carbon neutral (in combustion) solid fuel that easily substitutes for coal in existing power stations will grow as well.