Global Wood Pellet Markets:
Forecasts for Demand

Presented by William Strauss, PhD
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Director, Maine Energy Systems
Chief Economist, Biomass Thermal Energy Council
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FutureMetrics

Consultants to the World's Leading Companies in the Wood Pellet Sector

"Intelligent Analysis and Thought Leadership for the Pellet Sector"

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Bethel, ME 04217, USA
www.FutureMetrics.com

FutureMetrics people at this Conference

William Strauss

40 years of making thermal energy from MSW and wood.
Recipient of the 2012 International Excellence in Bioenergy Award.

John Swaan

The "grandfather of wood pellets". Recipient of the 2014 International Founders Award for pioneering in the wood pellet sector.

Consultants to the World's Leading Companies in the Wood Pellet Sector

Selection of Current and Recent Clients of our Team

DOOSAN

Sumitomo Corporation

draxbiomass

RAMBOLL

THE NAVIGATOR COMPANY

cosan

enviva

Hancock Natural Resource Group

ENGIE by people for people

Formerly GDF Suez

VATTENFALL

INTERFOR

ROMSPEN

RENTECH

Wikwemikong Unceded Indian Reserve Proud. Progressive.

THERMA GLO FEEL THE HEAT™ A MOHEGAN ECO-FRIENDLY COMPANY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

LAHMEYER INTERNATIONAL

DEPARTMENT OF CONSERVATION Maine Forest Service STATE OF MAINE

BTEC Biomass Thermal Energy Council

CATE STREET CAPITAL

MESYS MAINE ENERGY SYSTEMS

IOGEN CORPORATION

Holson

May, 2014
Deal Valued at $50.1 Million
NEW ENGLAND WOOD PELLET
Jaffrey, New Hampshire
HAS BEEN ACQUIRED BY
RENTECH
Denver, Colorado
FutureMetrics and its consulting partners initiated the acquisition process and provided early stage advice, analysis, and due diligence for Rentech

FULGHUM FIBRES

Trans Pacific Fibre

WEST OREGON WOOD PRODUCTS

NCIC

BioDean

BFL CANADA

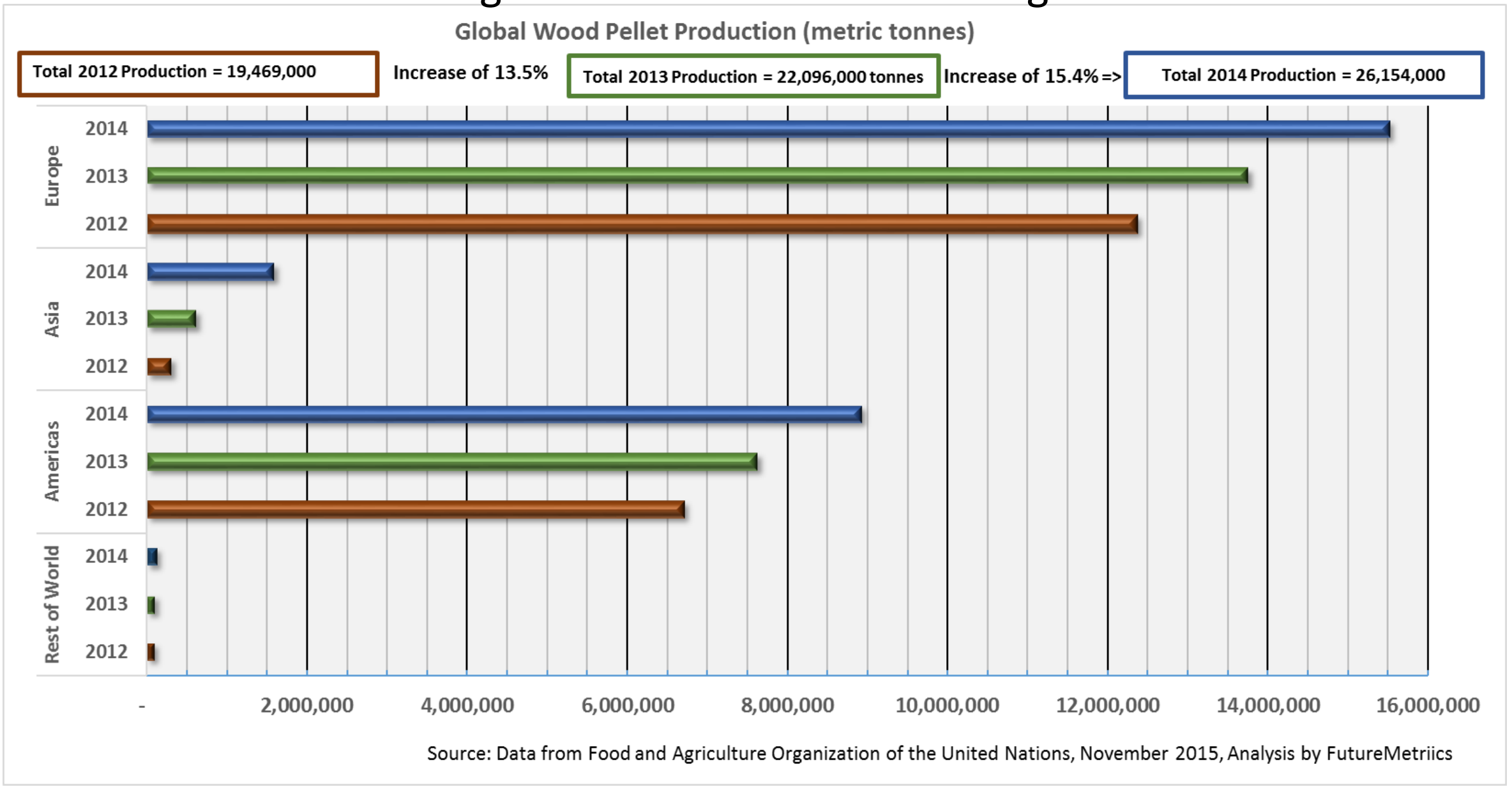
VIRIDIS ENERGY INC.

The Two Major Markets for Wood Pellets

Heating (premium)

Power Generation (industrial)

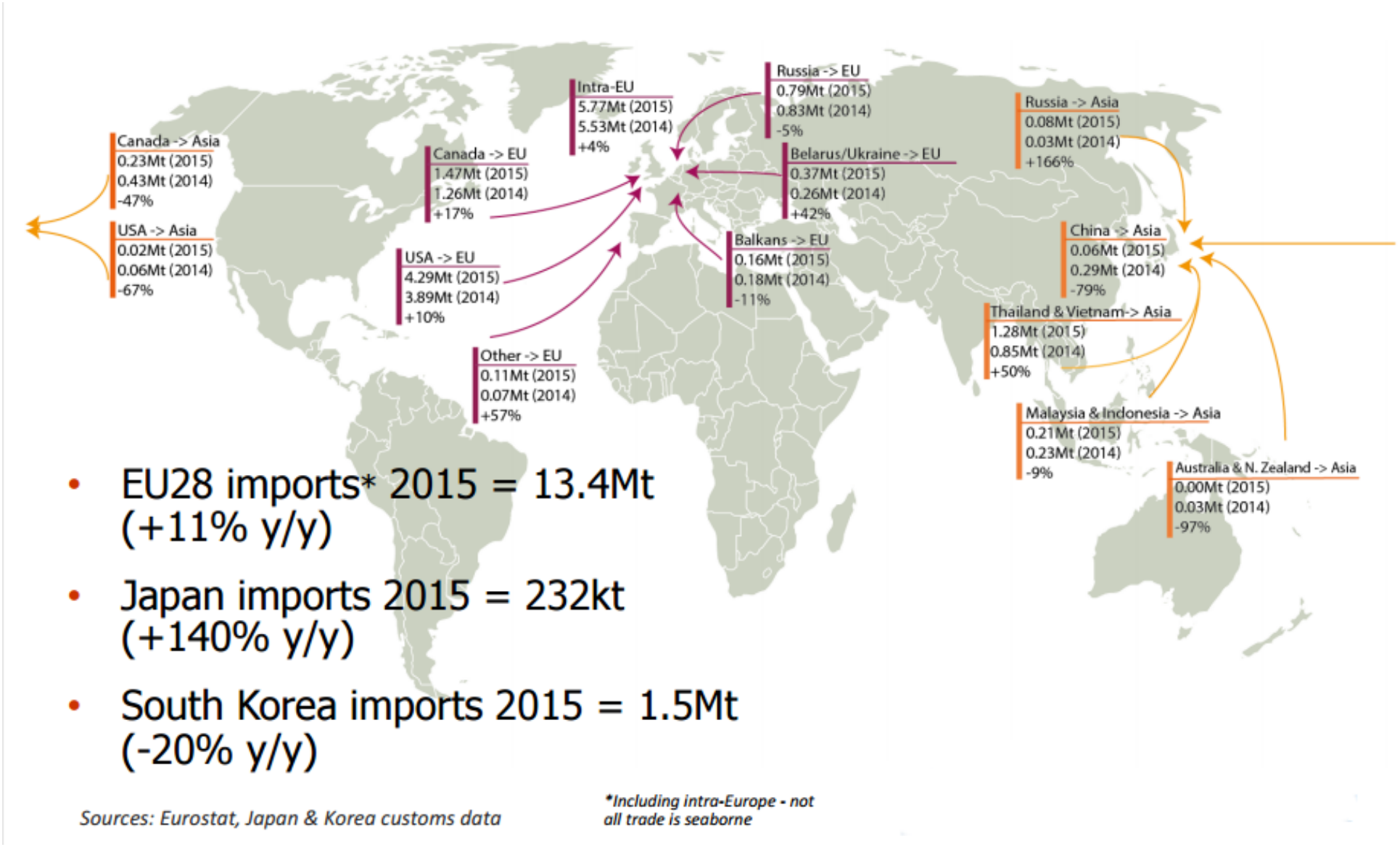
Combined Heating and Industrial Markets – Significant Growth!



2015 total estimated to be 28 million tonnes* – growth of about 7% from 2014

*Hawkins-Wright, June, 2016

Total Global Wood Pellet Trade – 2014 and 2015 – About 15 million metric tonnes



Sources: Eurostat, Japan and Korea customs data, analysis by Hawkins-Wright

Will that growth continue?

A look at industrial and heating markets follows….

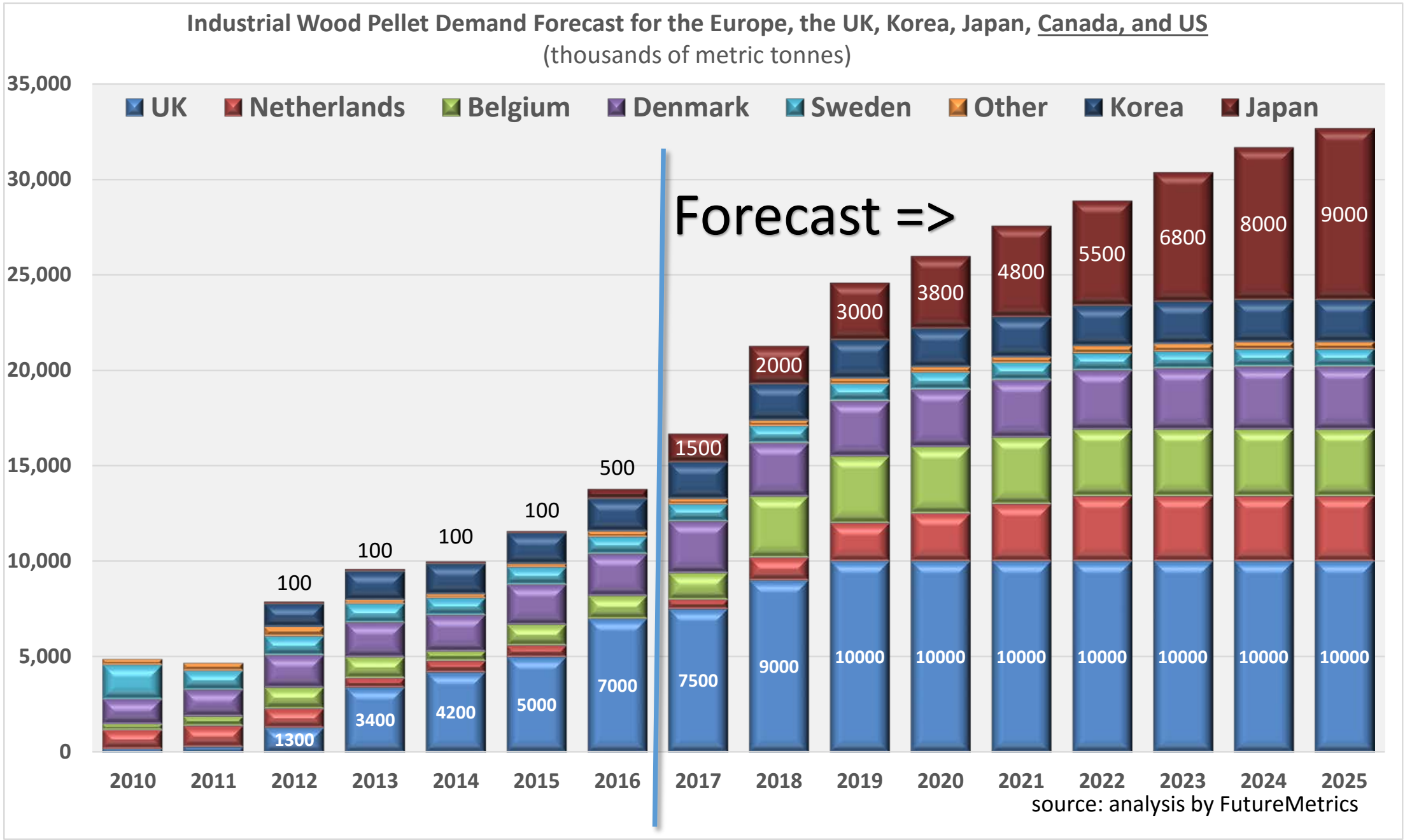
Industrial Pellets

Why Wood Pellets are an Easy Substitute for Coal in Pulverized Coal Power Plants

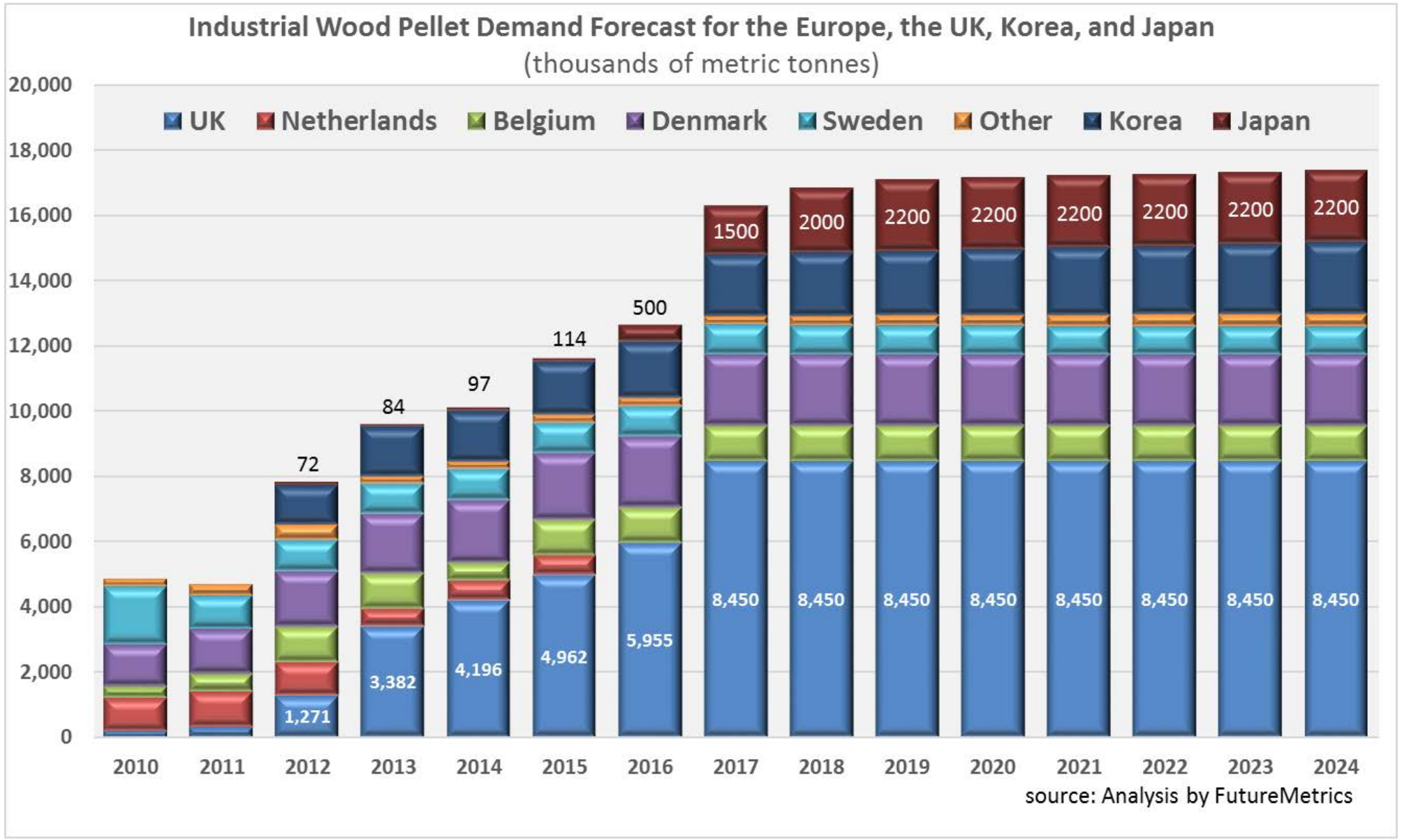
- Wood pellets are upgraded solid fuel made from biomass.
- They are grindable.
- They are dry (~6% moisture content).
- They handle easily.
- They have an energy density of ~18 Gigajoules/tonne.

At low co-firing ratios (less than ~6% white wood pellets) no modifications are required.

Industrial Market - Traditional Best Case! – Most growth after 2020 depends on Japan

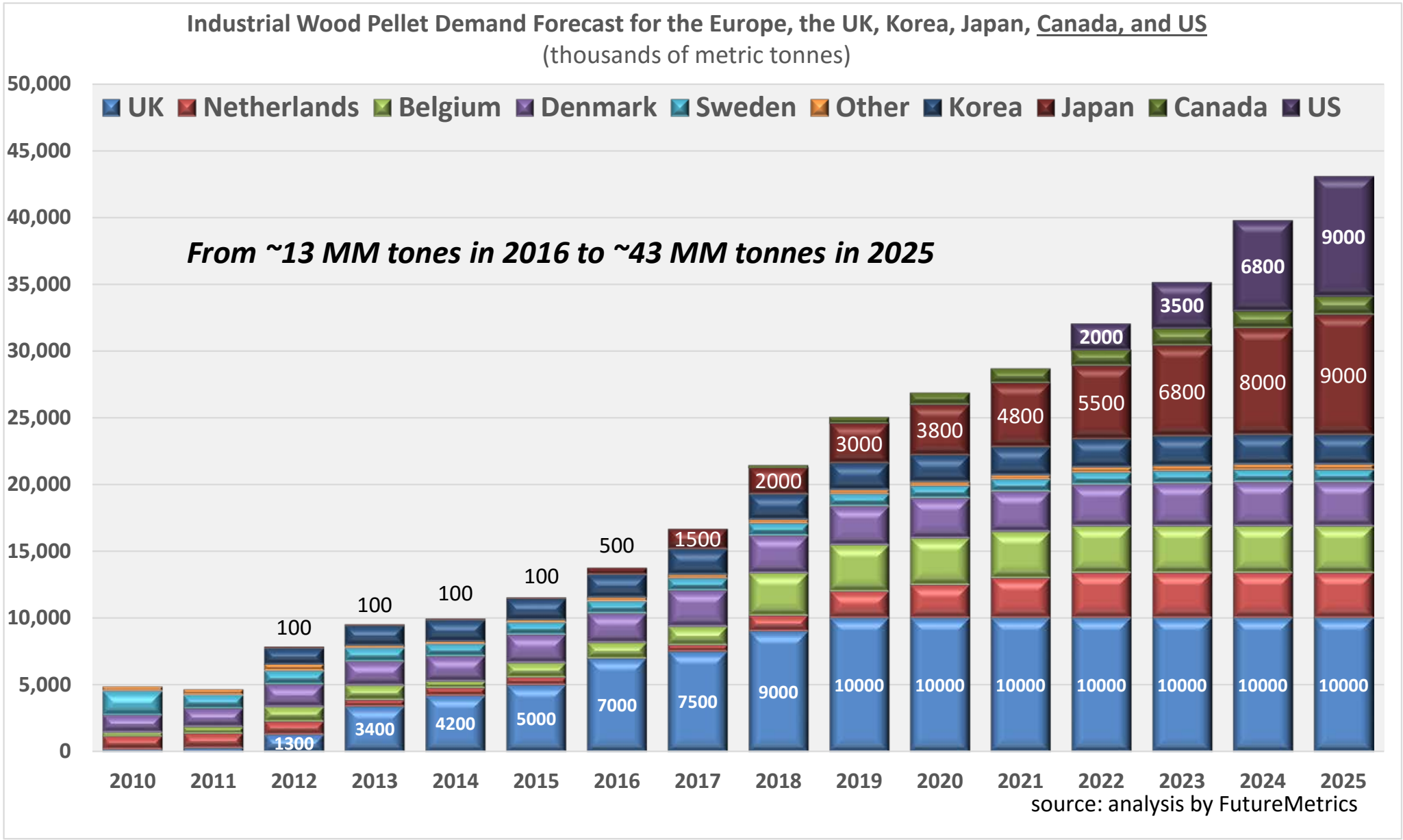


Worst Case! (compare to 33 million MT on previous slide)

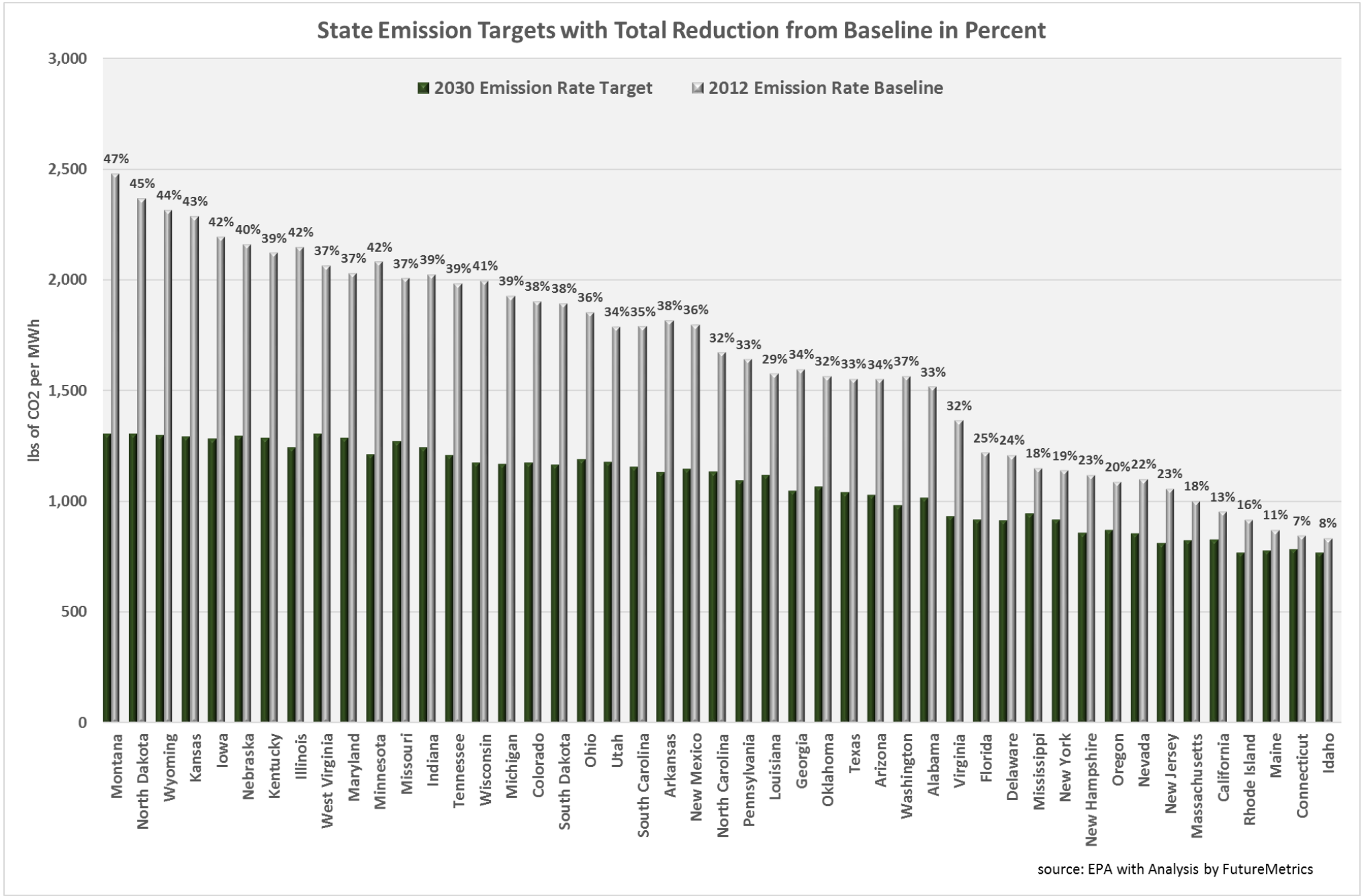


Previous slides did NOT include potential industrial wood pellet markets in the US and Canada!

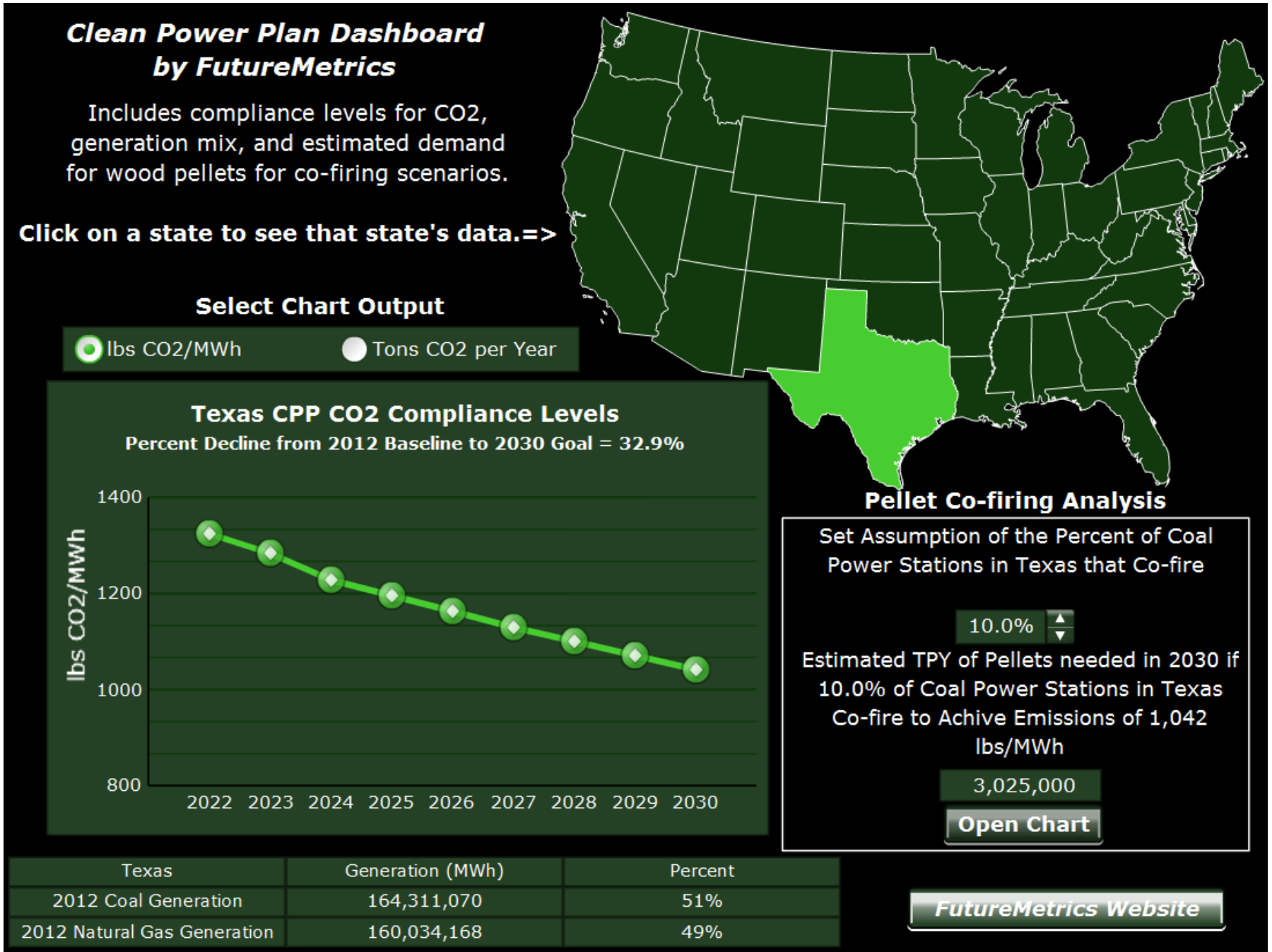
Potential (and US and Japan could be larger!)



US Clean Power Plan will enable a significant industrial pellet market in the US

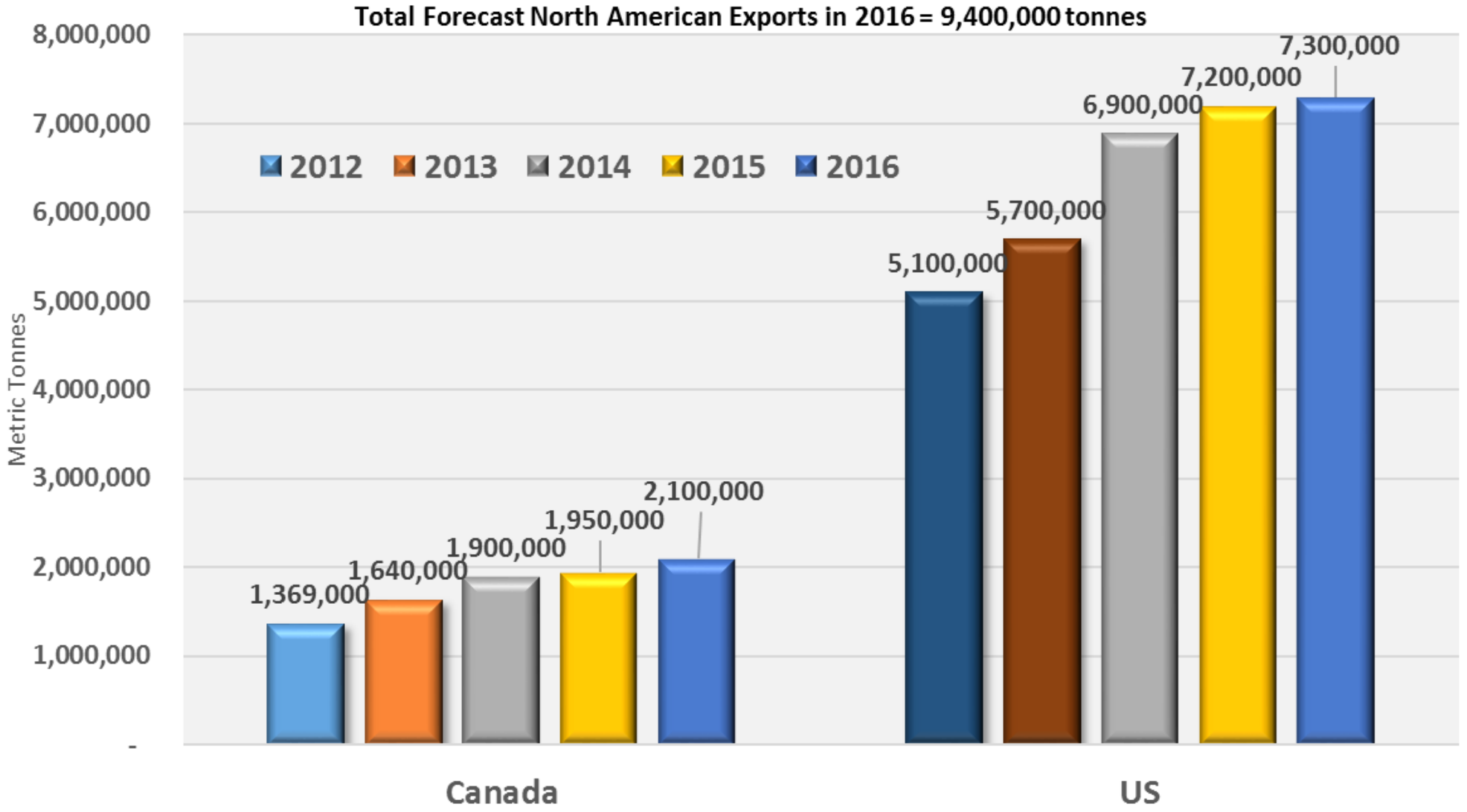


Potential for US Industrial Pellet Demand



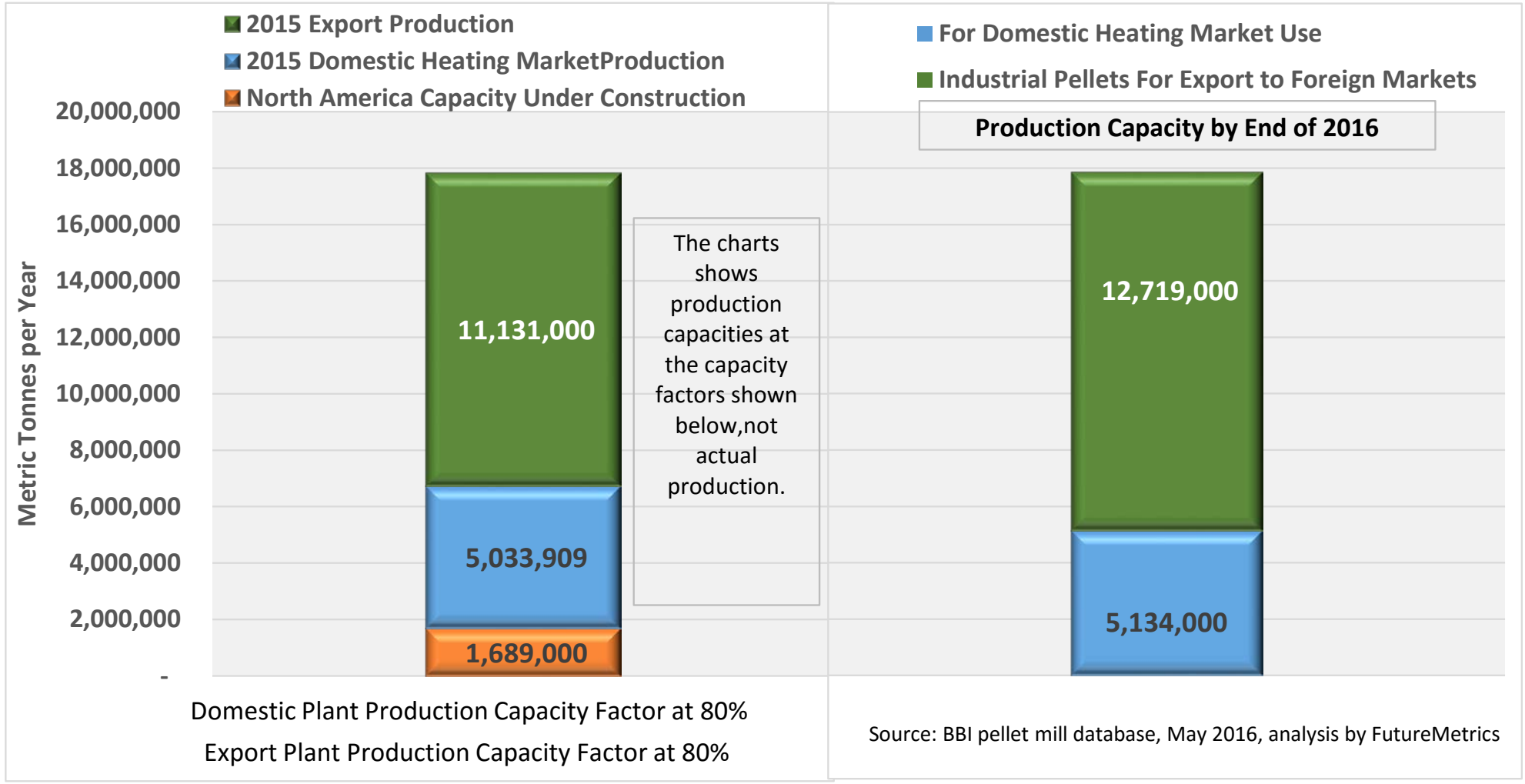
Dashboard is free to use at the FutureMetrics website.

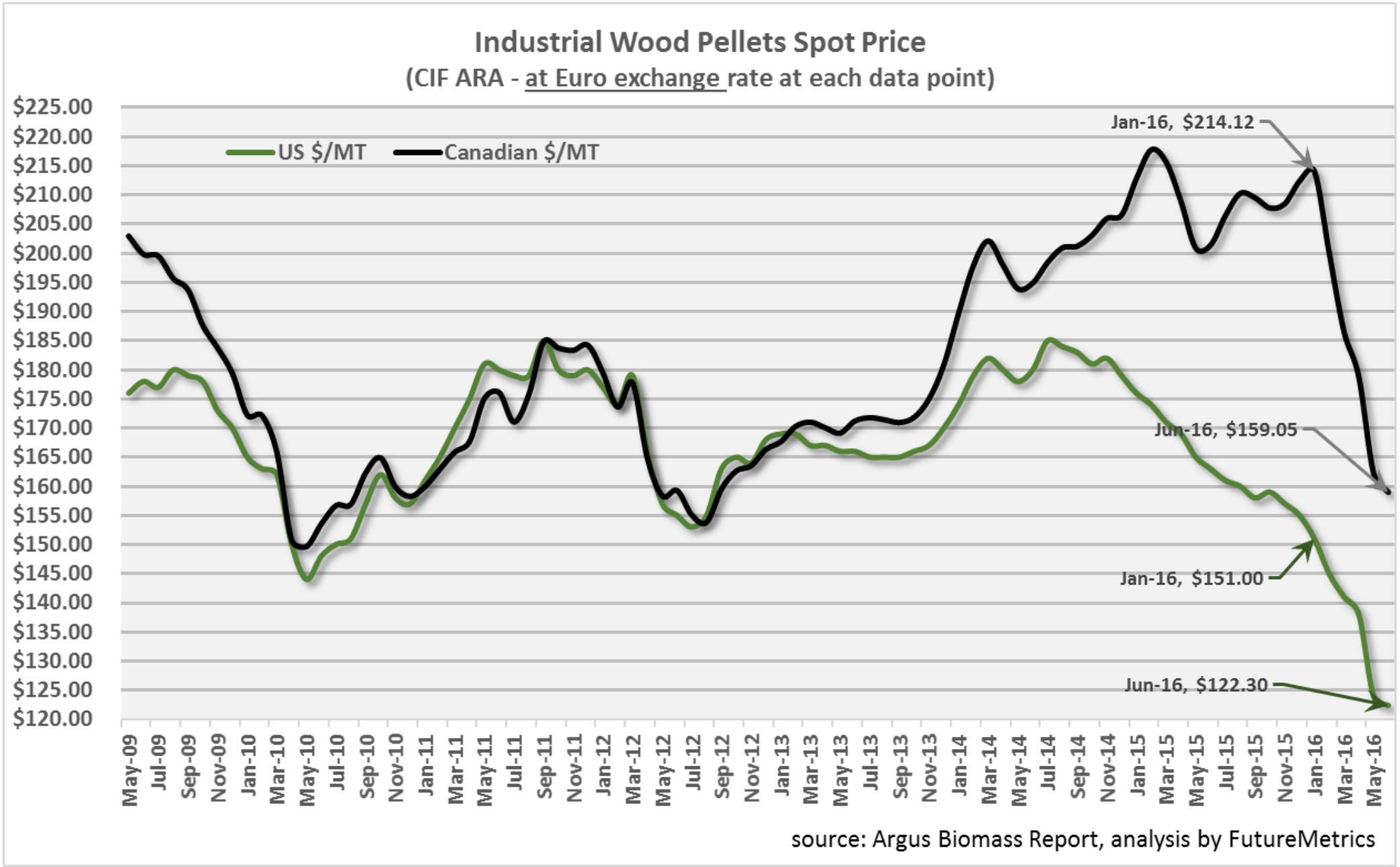
US and Canada Pellet Exports



source: 2012-2014 data from UN Food and Ag Database, November, 2015; 2015-16 forecast by FutureMetrics, Analysis by FutureMetrics

Production Capacity is Ahead of Market Demand




Industrial Wood Pellets Spot Price
(CIF ARA - at Euro exchange rate at each data point)
US $/MT
Canadian $/MT
Jan-16, $214.12
Jun-16, $159.05
Jan-16, $151.00
Jun-16, $122.30
$225.00
$220.00
$215.00
$210.00
$205.00
$200.00
$195.00
$190.00
$185.00
$180.00
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$155.00
$150.00
$145.00
$140.00
$135.00
$130.00
$125.00
$120.00
May-09
Jul-09
Sep-09
Nov-09
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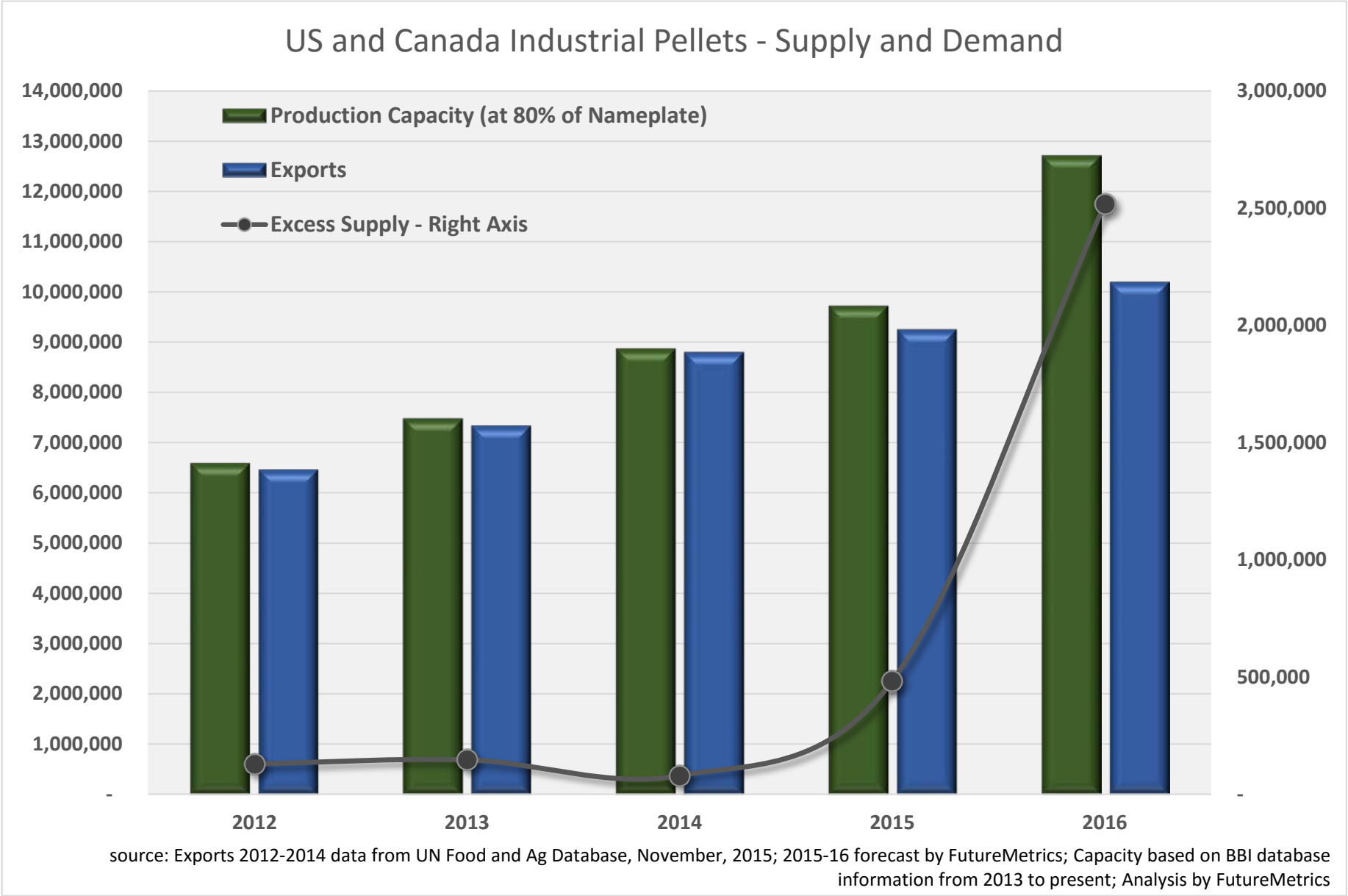
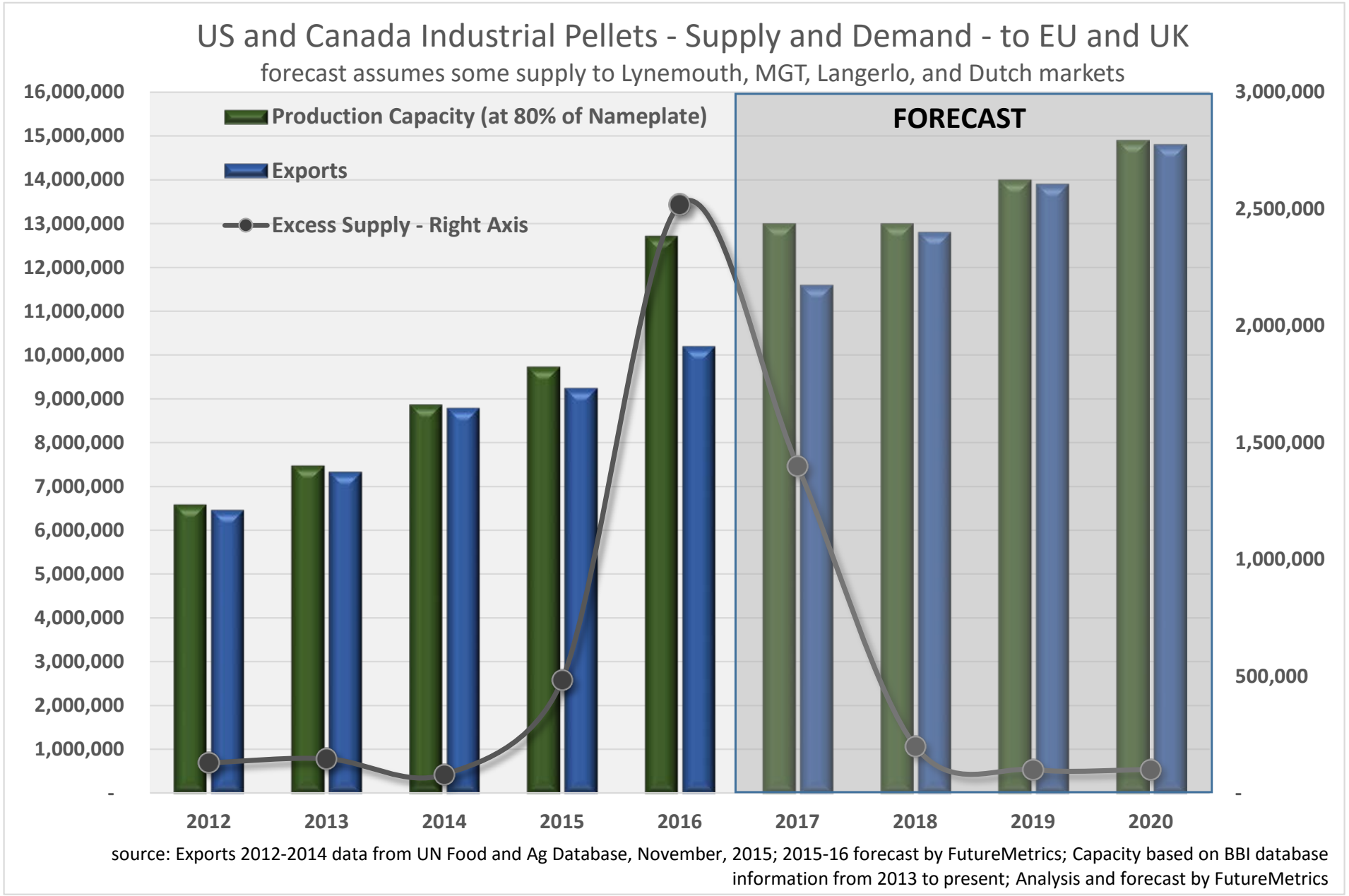
May-16
source: Argus Biomass Report, analysis by FutureMetrics

The Bad News…



source: Exports 2012-2014 data from UN Food and Ag Database, November, 2015; 2015-16 forecast by FutureMetrics; Capacity based on BBI database information from 2013 to present; Analysis by FutureMetrics

The Good News…



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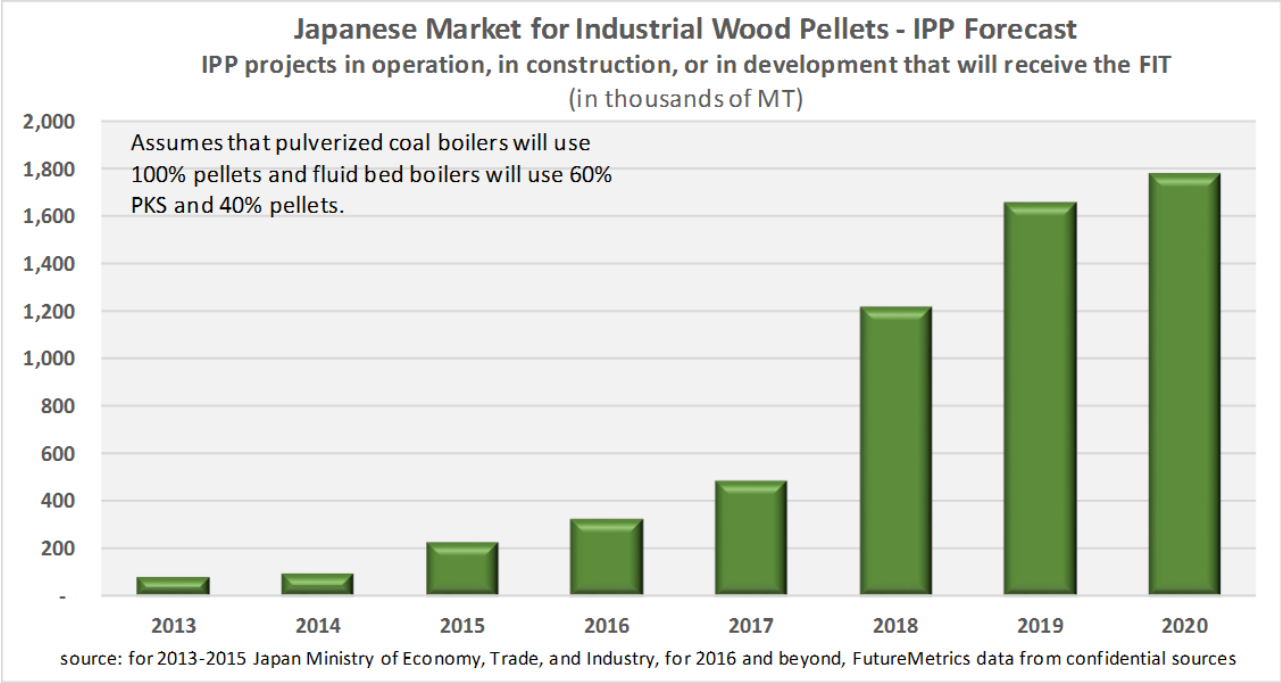


Growth in Japan is expected to be strong. The Japanese buyers care about long-term contract, rule of law, and sustainability.

← IPP's enjoy the FIT

Baseload under the "Best Energy Mix" ➔

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

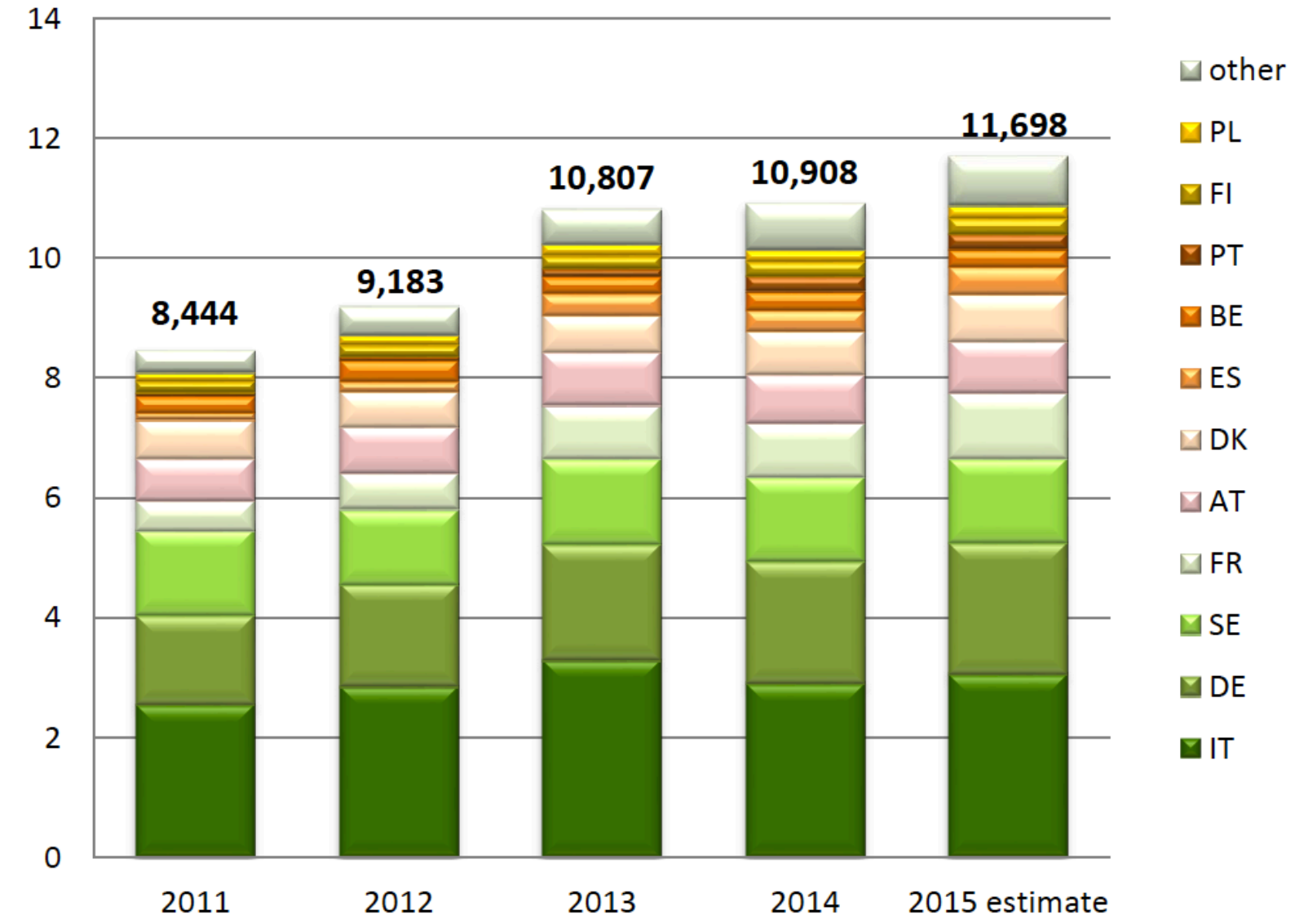
Based on 1,065 Million MWh's of Demand in 2030	Energy Mix	Millions of MWh's		***Renewable Portion***	Energy Mix	Millions of MWh's	Capacity Factor	Nameplate MW's Needed	Tonnes of Wood Pellets per Year if 30% of Needed MW's are Produced from Pellets
Renewable	23%	244.95		Geothermal	1.0%	10.65	90%	1,351	
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

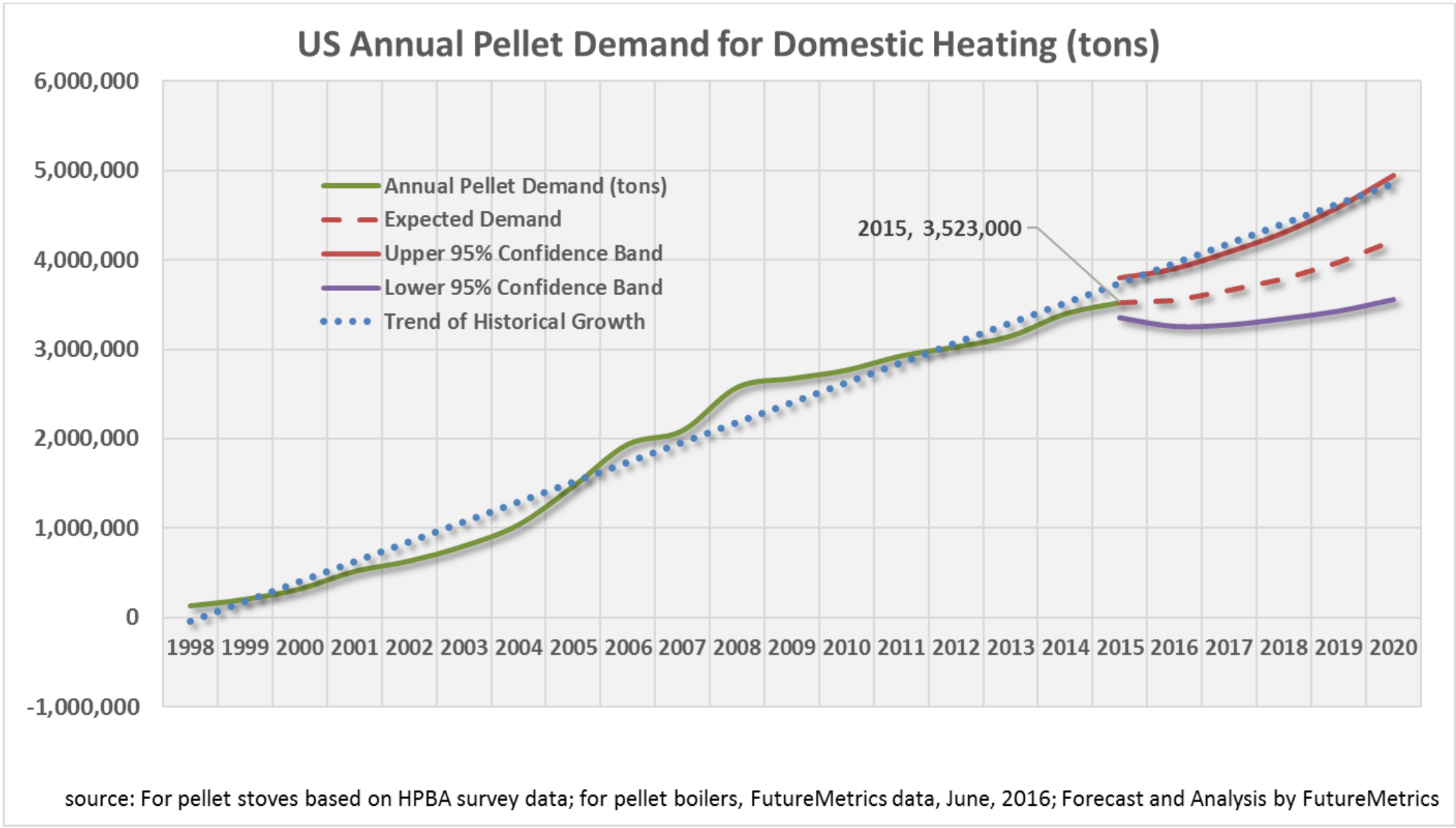
Analysis by FutureMetrics

Heating Markets

EU wood pellet consumption for heating (excluding CHP)

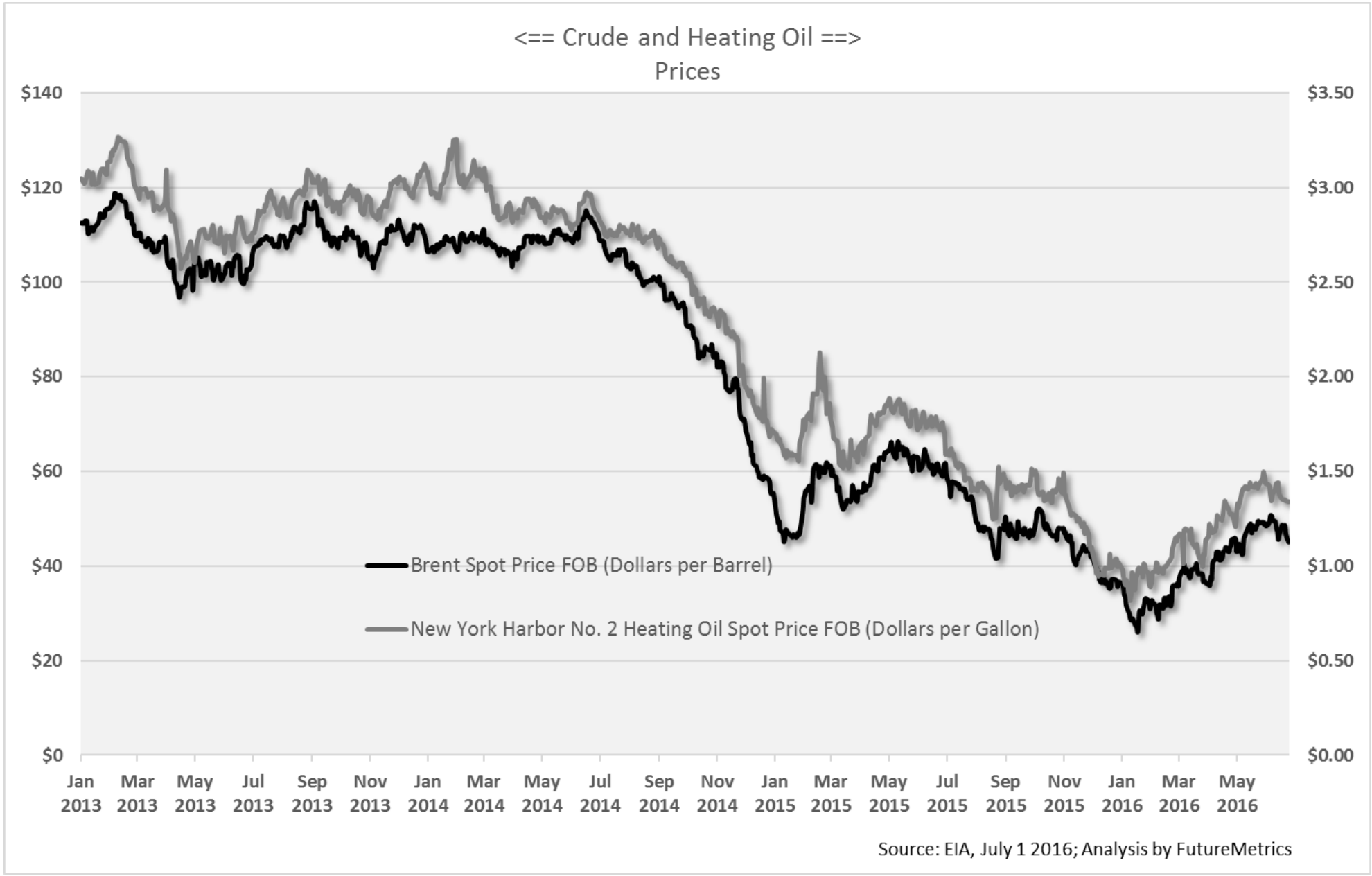


Source: EPC Survey



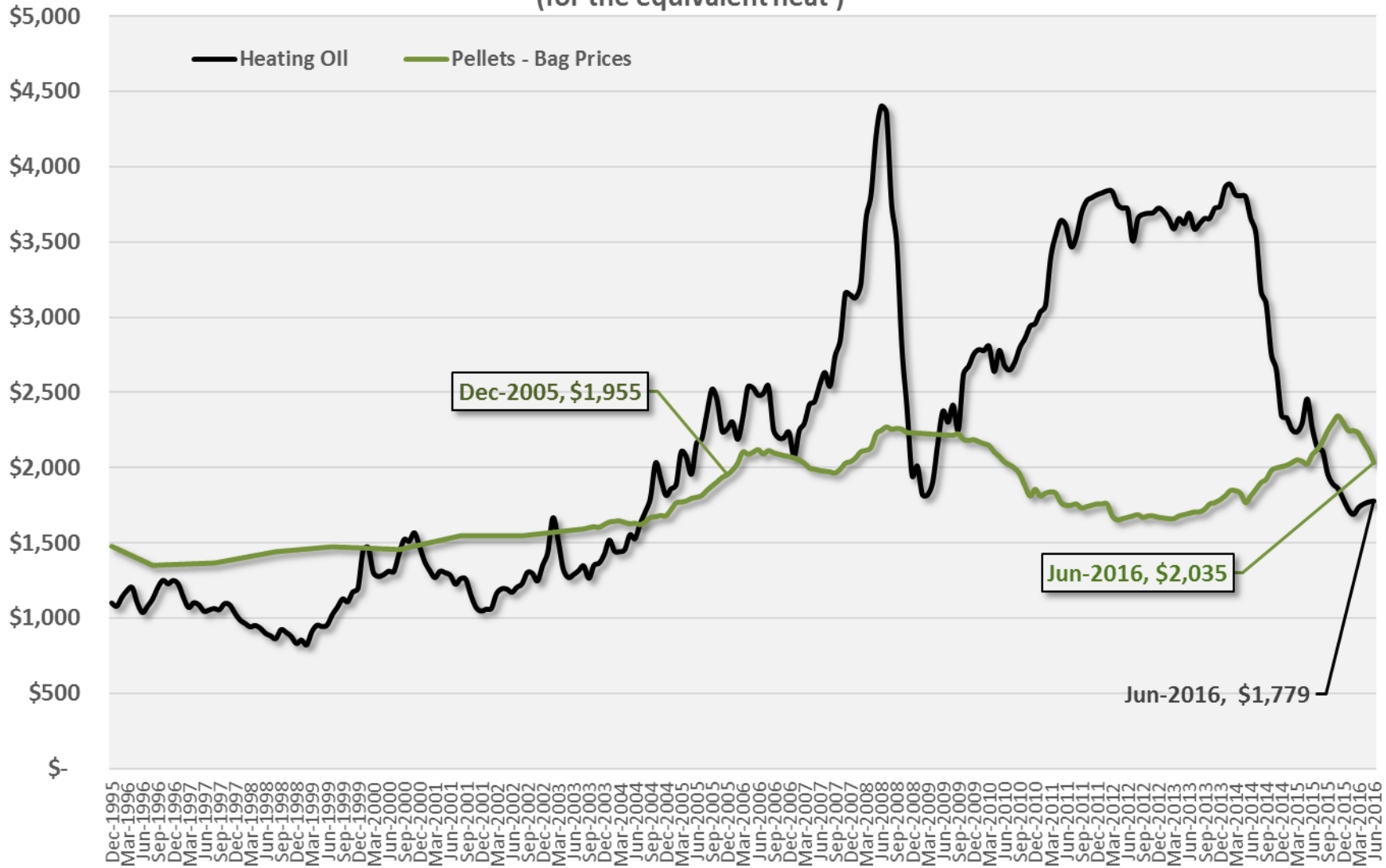
Growth over the next five years is expected to be below the trend…

Here is Why!!

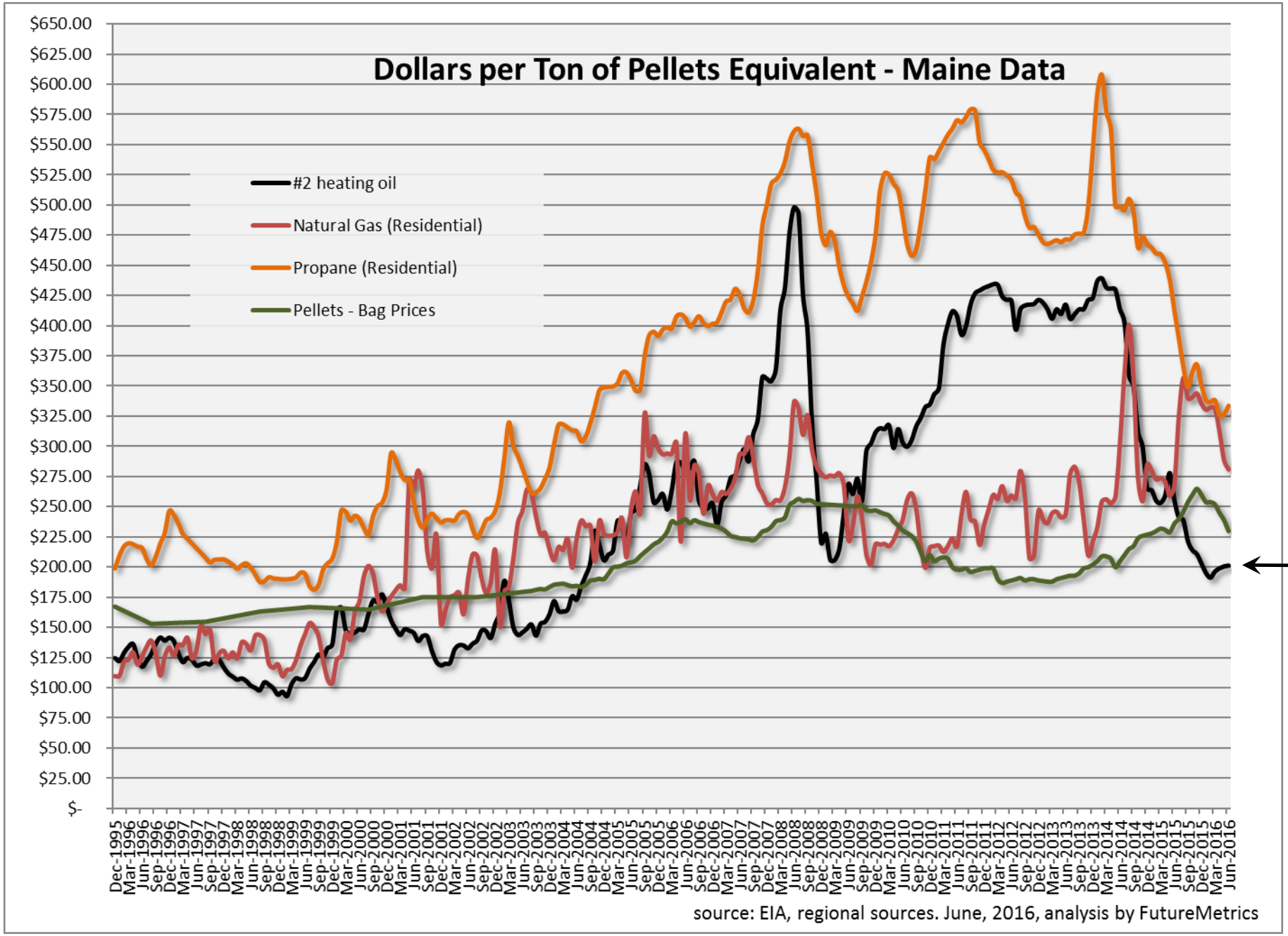

<== Crude and Heating Oil ==>
Prices
$140
$120
$100
$80
$60
$40
$20
$0
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Brent Spot Price FOB (Dollars per Barrel)
New York Harbor No. 2 Heating Oil Spot Price FOB (Dollars per Gallon)
Jan 2013
Mar 2013
May 2013
Jul 2013
Sep 2013
Nov 2013
Jan 2014
Mar 2014
May 2014
Jul 2014
Sep 2014
Nov 2014
Jan 2015
Mar 2015
May 2015
Jul 2015
Sep 2015
Nov 2015
Jan 2016
Mar 2016
May 2016
Source: EIA, July 1 2016; Analysis by FutureMetrics

Annual Heating Oil and Pellet Fuel Cost for a Typical Home in the Northeast

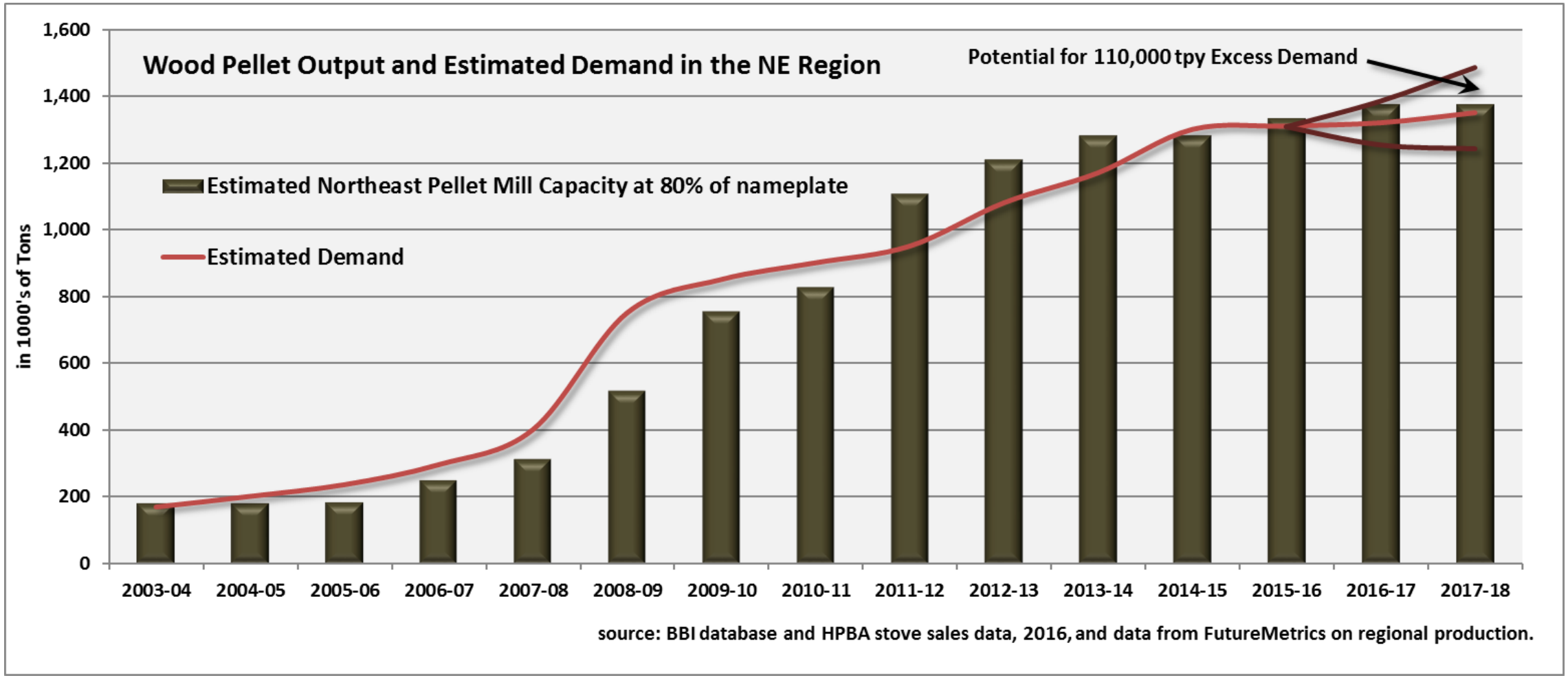
(for the equivalent heat)



source: EIA, 2016, regional sources, FutureMetrics' pellet price database, June, 2016. Analysis by FutureMetrics



Pellets have to retail at about $200/ton to breakeven with current heating oil prices.


Wood Pellet Output and Estimated Demand in the NE Region
Potential for 110,000 tpy Excess Demand
Estimated Northeast Pellet Mill Capacity at 80% of nameplate
Estimated Demand
in 1000's of Tons
1,600
1,400
1,200
1,000
800
600
400
200
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
source: BBI database and HPBA stove sales data, 2016, and data from FutureMetrics on regional production.

Growth in the heating markets will depend on oil prices. At about $60/barrel, at current pellet prices, pellets breakeven with heating oil.

There are always weather related fluctuations in demand. But it is cheap alternative heating energy that is the major challenge in the heating pellet markets.

<u>IF</u> there were a price on carbon, it would change everything!

The industrial pellet markets have the potential to grow significantly in the next decade. That all depends on policy for carbon emissions mitigation.

Thank You!

www.FutureMetrics.com

William Strauss, PhD

Fritz loves to go on mountain bike rides…