Outlook for Global Biomass Markets

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Korean imports of low-cost pellets remain steady

Japanese imports of wood pellets and palm kernel shells (PKS) have increased rapidly as biomass power plants have been commissioned

~120 independent power producers (IPPs) in Japan have been approved for over 2,000 MW of woody biomass generating capacity
Korean Pellet Imports

Volume has remained strong, but price is down and the share from Vietnam has increased from 25% in 2012 to 73% in 2016
Japanese biomass imports have increased rapidly, albeit from a fairly low base, as new biomass plants begin to come on line.

Pellet imports increased with Showa Shell – Kawasaki in 2015.
Japanese Biomass IPPs

• Japanese Feed in Tariff (FiT) for “general wood,” including pellets and PKS, is ¥24/kWh.
  ▪ To be reduced to ¥21/kWh
• FiT for local biomass is ¥32/kWh.
• Japanese Paper Association counts 119 biomass power plants under the new FiT.
• Total capacity is over 2,000 MW.
  ▪ Average size 19 MW, many smaller
• The majority (by county) of these new plants are smaller and aim to use local biomass.
• Several larger plants will use various combinations of wood pellets, woodchips and PKS.
Japanese Wood Pellet Co-Firing Potential

Cumulative New Coal Capacity (GW)

Cumulative New Coal Cap.

Pellet Demand
- All New Coal
- IPP / JV
- IPP Only

Pellet Demand for Co-Firing (Million MT)

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Outlook for Asian Pellet Markets

• Japan
  - IPP demand 1.0-5.0 million tonnes
  - Another potential 1.5-7.0 million tonnes of demand from co-firing at new coal plants
    - Japan’s “dirty little secret” – 20 GW of new coal capacity in various stages of development

• Korea
  - Co-firing demand to increase, but will continue to rely on low-cost spot volume
  - Potential for dedicated biomass plants offers upside
Palm Kernel Shell

• Byproduct of palm oil processing

• Has some advantages as fuel
  ▪ High energy content

• Negatives
  ▪ Ash and other inorganics

• Finite supply
Outlook for European Biomass Markets

• Steady growth, but limited upside, continues from UK, Belgian and Danish industrial markets
• Netherlands could re-emerge as a major market
• Heating markets continue to face headwinds from low oil prices and warm winters
Global Pellet Demand Still Largely Driven by Europe
Pellet Imports, Million Tonnes
European Pellet Markets

Industrial
- Displacing coal with wood pellets
- UK, Denmark, Belgium, Netherlands
  - Significant reliance on coal
  - Lack of domestic biomass resources

Heating
- Primarily displacing oil, but also gas, cordwood, electricity
- In-home pellet stoves and boilers
- Largest markets: Italy, Germany, Austria, France, Denmark

Both markets: approximately 10 million tonnes/year
United Kingdom

• **Policy**
  - Transition from Renewables Obligation (RO) to Contracts for Difference (CfD)
  - European Commission state aid investigation over
  - Limited uncertainty surrounding Brexit

• **Outlook**
  - **Drax** – largest coal fired power plant in Europe
    - Now 50% biomass on three out of six 660 MW units
    - More than 7 million tonnes of pellets per year
  - **Lynemouth** - 420 MW power station
    - Sold from Rio Tinto Alcan to RWE then to EPH (Czech)
    - 1.5 million tonnes per year
  - **MGT Power** – 299 MW Greenfield CHP in Tees
    - Recently announced 15-year 1 million tonne per year agreement with Enviva
Belgium

Policy: Green Certificate program
Market Development
2006 – Les Awirs – Antwerp – 80 MW
2011 – Rodenhuize (Max Green) – Ghent – 200 MW (pictured)
Future: E. ON Antwerp 300 MW?
Langerlo Electrabel -> E.ON -> German Pellets -> Graanul Invest
Denmark

Heat > Power – 63% of the population gets heat from district heating
Fewer than 10 remaining large central power stations – several already converted to biomass
Danish Biomass Consuming Central Power Stations

• Dong – Avedore, Unit 2: “World’s most efficient thermal power station”
  ▪ 49% thermal efficiency for power up to 94% for CHP up to 1 million tonnes of pellets per year
  ▪ Unit 1 conversion underway – additional 600,000-700,000 tonnes per year
• Hofor – Amager (City of Copenhagen)
  ▪ Unit 1 uses roughly 300,000 tonnes of pellets per year
  ▪ Unit 4 (under construction) – 1.2 million tonnes of wood chips per year
• Dong – Herning 80 MW CHP
  ▪ Mix of chips and pellets
• Dong – Studstrup (ongoing conversion)
  ▪ 285 MW Unit 3: 800,000 tonnes of pellets per year
• Dong – Skaerbaek (upcoming conversion)
  ▪ 392 MW: more than 1 million tonnes of wood chips per year
Netherlands

- **2011** “MEP” program replaced by “SDE+”
  - Co-firing did not qualify until sustainability criteria established
- **2015** – Sustainability criteria released (25 PJ cap)
  - No contracts for co-firing were awarded (budget over subscribed)
- **2016** – Two facilities awarded contracts under the SDE+
- **2017** – Will coal plants be allowed to remain operational?
EU Heating Markets

Comparative Heating Fuel Prices in Selected EU Countries, c/kWh

- Motivated by economics more than policy
  - Cost savings over heating oil has deteriorated
- Italy – biggest market
  - More than 2 million pellet stoves installed
  - Pellets still significantly cheaper than oil (40 c/l excise tax)
European Pellet Heating Headwinds

Average Heating Degree Days in the EU 27/28

Winters 2013-2014 and 2014-2015 were the two warmest on record for much of Continental Europe
Economic Headwinds for European Heating Markets
Oil prices and exchange rates

Brent Oil Prices

PIX Continental Pellet Price Index

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Pellet Supply Outlook

- Opportunities limited outside of North America
- Exchange rates make US South less competitive
- Where will additional supply come from?
Pellet Supply Growth Has Primarily Come from North America

Exports
Million Tonnes

- USA
- Canada
- Baltics
- Vietnam
- Russia
- Portugal

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USA Has Shifted from a Low Cost Producer to Above Average on the EU Industrial Pellet Supply Curve

European Industrial Pellet Costs, Delivered to Rotterdam, 2016
Pellet Supply Outlook

• US South
  ▪ Ample opportunity for growth, cash costs higher than current market prices

• British Columbia
  ▪ Constrained by sawmill residual availability – beetle kill impact continuing

• Baltics
  ▪ Harvest at or near maximum sustainable, sawmill residual all constrained
Pellet Supply Outlook

• Russia
  ▪ Fiber plentiful in some places, inverse relationship between transportation cost and fiber cost

• Vietnam
  ▪ Furniture manufacturing supply limited
  ▪ Plantation wood requires significant price increase

• Latin America
  ▪ Tanac to start supplying Drax

• Australia and New Zealand
  ▪ New projects in development?
Thank you for your attention!
For more information:

RISI Special Study: European Pellet Supply and Cost Analysis
www.risi.com/europeanpellet

North American Bioenergy 5-Year Forecast