Biomass Pellet Prices – Drivers and Outlook
What is the worst that can happen?

European Biomass Power Generation
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PÖYRY GROUP

Pöyry Group is a global management consulting and engineering company dedicated to balanced sustainability. Over 7,000 experts in 50 countries working on 17,000 projects annually.
PÖYRY MANAGEMENT CONSULTING

**Corporate and Business Strategy**
- Portfolio strategy
- Growth strategies
- Business strategies and business plans
- Business model development
- Scenario analysis
- Risk management
- Environmental strategies
- Market entry strategies
- Cooperation strategies

**Market Insights and Modeling**
- Market analysis
- Market forecasts
- Demand, supply, and cost analysis
- Price projections
- Industry cost curves
- Market design and modeling
- Market regulatory frameworks
- Market scenarios

**Resource and Technology Strategies**
- Resource base valuations and development
- Technology mapping
- Technology benchmarking
- Technology options evaluation
- Technology strategies
- R&D portfolio strategies
- Technology acquisitions

**Sales and Supply Chain Strategies**
- Supply/market analysis
- Pricing strategies
- Contract negotiations
- Supply chain optimization
- Sourcing strategy formulation
- Supplier assessments
- Transfer Pricing

**Operational and Organizational Excellence**
- Performance improvement
- Operational and organizational benchmarking
- Corporate restructuring
- Organizational design
- Business transformation
- Change management
- Post merger integration
- Manufacturing strategies
- Energy efficiency
- Asset Management
- Maintenance Strategies

**Investments and M&A**
- Acquisitions
- Divestments
- Asset valuations
- Business valuations
- Project pre-feasibility / feasibility assessments
- Due Diligence (strategy, business, technical, environmental)
- Business valuation vs. Asset valuations
1. Biomass Supply & Demand for Power Generation in Europe
2. Biomass Availability
3. Pellet Demand
4. Wood Pellet Trade Flows
5. Wood Pellet Supply
6. Pricing Dynamics for Pellets
7. Pellet Market Liquidity
8. Summary and Conclusions
Based on NREAP, the 9 most energy consuming European countries will have a combined solid biomass-based demand of ~1,600 PJ for power generation by 2020.
A total biomass supply gap of ~50 Modt/a (wood equivalent) is likely to develop by 2020.
WOOD BIOMASS AVAILABILITY – GLOBAL

Woody biomass availability
- Increasing harvest potential
- Stable harvest potential
- Stable harvest potential but in high demand
- Raw material deficit
GLOBAL PELLET CONSUMPTION – 2015 AND 2020 OUTLOOK

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>16 million tonnes/a</td>
</tr>
<tr>
<td>2015</td>
<td>37 million tonnes/a</td>
</tr>
<tr>
<td>2020</td>
<td>59 million tonnes/a</td>
</tr>
</tbody>
</table>

Source: Pöyry Wood Pellet Multiclient
WORLD PELLET TRADE FLOWS IN 2011

Increasing volumes will be exported from the US and Brazil to Europe.

Trade flows (1,000 tonnes)
- Current
- Emerging

* EU 27 internal trade
More than 80 pellet production projects have been announced globally.

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Brazil</th>
<th>Russia</th>
<th>Canada</th>
<th>UK</th>
<th>Germany</th>
<th>China</th>
<th>Latvia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of planned mills</td>
<td>20</td>
<td>3</td>
<td>14</td>
<td>5</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Total planned capacity (1,000 mt)</td>
<td>4,024</td>
<td>3,000</td>
<td>1,817</td>
<td>1,055</td>
<td>795</td>
<td>560</td>
<td>350</td>
<td>200</td>
</tr>
</tbody>
</table>

Capacity increase hot spots
INDUSTRIAL PELLETS – PRICING DYNAMICS AND OUTLOOK

New emerging supply from lower wood cost regions may push higher cost producers further back on the global cost/supply curve.

- Delivered cost to end-user, USD/GJ-

Key variables:
- speed of demand vs. supply development
- cost woody biomass
- cost for transport
- exchange rates
- pellet paying capability

Potential additional low cost supply

- Cumulative capacity, million tonnes/a -
# PÖYRY’S PELLET PRICING MODEL

We construct forward supply and demand curves from our data on power plants, pellet mills, and our views on future markets and regulatory environment.

<table>
<thead>
<tr>
<th>Supply</th>
<th>Demand</th>
</tr>
</thead>
</table>
| **Volume** | • Capacity of existing and planned mills  
  • new pellet mills endogenously deployed within the model, adding to supply volumes.  

| **Price** | Each power plant and CHP plant has a paying capability, for the peak and off-peak block of each month, based on:  
  • wholesale **power price**;  
  • **coal** and **carbon** price (including Carbon support in GB);  
  • biomass **incentives**; and  
  • each individual plant’s **efficiency**. |
| Each pellet mill is modeled using Pöyry’s proprietary **Virtual Pellet Mill**  
  • Pellet **production costs** – wood, power, propane, labour  
  • **Transport** to ARA – inland transport cost (rail or road) and shipping cost  
  • **CAPEX**, where the market can support it |
### ALTERNATIVE SCENARIOS

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Demand</th>
<th>Supply</th>
<th>Transportation costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, power and carbon prices</td>
<td>• High empty cell</td>
<td>• Highest supply costs</td>
<td>• Indexed to high oil price</td>
</tr>
<tr>
<td>Level of conversion and co-firing</td>
<td>• High empty cell</td>
<td>• Central supply costs</td>
<td>• Indexed to central oil price</td>
</tr>
<tr>
<td></td>
<td>• High empty cell</td>
<td>• Low empty cell</td>
<td>• Indexed to low oil price</td>
</tr>
<tr>
<td></td>
<td>• High empty cell</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• High empty cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Central empty cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Moderate empty cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Limited empty cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Low empty cell</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **High scenario**: High pellet demand, High paying capability
- **Central scenario**: Central demand, Central paying capability
- **Low scenario**: Low pellet demand, Low paying capability
SUPPLY AND DEMAND DYNAMICS – ATLANTIC BASIN

Each point on the supply and demand curve represents an individual pellet mill, or power plant.

**Main Drivers**

- **UK** - conversion of a few large coal fired plants.
- **Denmark** - new Energy Plan drives the conversion of numerous coal CHPs to biomass.
- **Netherlands** - 10% co firing mandate.
- **Belgium** - favourable incentives for co-firing in Flanders.
Dutch APX-ENDEX has recently launched an exchange for wood pellets delivered to ARA. Trade of wood pellets currently takes place only to very limited extent. Churn rates are estimated to be near 1, i.e. traded volumes are approx. equal to physical volumes. Currently, only suppliers and users participate – introduction of clearing shall change this. If establishment of the APX-ENDEX exchange is successful, market liquidity is expected to increase.

**LIQUIDITY OF PELLET MARKET – CURRENT STATUS**

<table>
<thead>
<tr>
<th></th>
<th>Wood Pellets</th>
<th>Crude Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Churn Rate</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>Bid/Ask Spread</td>
<td>6.8%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
Note: Long-term supply agreements persist beyond pellet mill debt term.
SUMMARY AND CONCLUSIONS

- Wood Pellet demand in Europe will continue to grow, driven by subsidies and legislation.
- The emergence of large pellet production facilities in low cost regions will shift the supply cost curve to the right, mitigating price rises.
- We expect market liquidity to remain relatively low - project financing requirements mean long term contracts will dominate.
- Pellet availability and pricing will not be a limitation to the growth of biomass power. The worst that can happen is in the hands of governments.
Thank You!

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