Exploring the changing global supply and demand dynamics of industrial pellets

London
Laura Tovey-Fall
18 April 2018
Argus Biomass Markets

- Launched in 2009
- Includes weekly price assessments
- Commentary, news and analysis
- Freight assessments on key biomass trading routes
- Weather outlook
- Generation economics
Argus Biomass Markets pricing

• Cif ARA spot price is the benchmark price for industrial pellets delivered into the ARA region

• Market survey draws on pool of producers, traders, brokers and buyers

• Index compiled from market survey, spot transactions and firm bids and offers

• Successful completion of five PWC audits (last audit September 2017)

• Argus index listed on EEX – first trade on 15 January
Argus 90 day cif ARA spot prices
Drivers of European industrial wood pellet demand

Demand overview
Top wood pellet net importers 2017

- **UK** 6.8mn t
- **Belgium** 870,000t
- **Denmark** 2.6mn t
- **Italy*** 1.8mn t
- **South Korea** 2.4mn t

*mainly residential*
UK wood pellet consumption

- Current demand mainly driven by Drax’s biomass conversions

<table>
<thead>
<tr>
<th>Utility</th>
<th>Plant</th>
<th>Capacity</th>
<th>Status</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drax</td>
<td>Units 1,2,3</td>
<td>645MW each</td>
<td>Operating</td>
<td>7.5mn t/yr</td>
</tr>
<tr>
<td>EPH</td>
<td>Lynemouth</td>
<td>396MW</td>
<td>Commissioning</td>
<td>1.6mn t/yr</td>
</tr>
<tr>
<td>MGT Power</td>
<td>Teesside</td>
<td>299MW</td>
<td>Planned, expected 1Q20</td>
<td>1mn-1.2mn t/yr</td>
</tr>
<tr>
<td>Drax</td>
<td>Unit 4</td>
<td>645MW</td>
<td>To be converted in summer 2018</td>
<td>?</td>
</tr>
</tbody>
</table>
Maxgreen received 5 year extension from March 2018

<table>
<thead>
<tr>
<th>Utility</th>
<th>Plant</th>
<th>Capacity</th>
<th>Status</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engie/MaxGreen</td>
<td>Rodenhuize</td>
<td>180MW</td>
<td>Operating</td>
<td>800,000t/yr</td>
</tr>
<tr>
<td>Engie</td>
<td>Les Awirs</td>
<td>80MW</td>
<td>Operating</td>
<td>200,000t/yr</td>
</tr>
</tbody>
</table>
Netherlands planned wood pellet consumption

- Four projects successful in 2016 SDE+ subsidy round

<table>
<thead>
<tr>
<th>Utility</th>
<th>Plant</th>
<th>Capacity</th>
<th>Co-firing</th>
<th>Status</th>
<th>Consumption*</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWE</td>
<td>Amer 9</td>
<td>600MW</td>
<td>80pc</td>
<td>Testing, fully operational 3Q18</td>
<td>1.7-1.8mn t/yr</td>
</tr>
<tr>
<td>Uniper</td>
<td>MPP3</td>
<td>1.1GW</td>
<td>15pc</td>
<td>2018</td>
<td>200,000-250,000 t/yr</td>
</tr>
<tr>
<td>RWE</td>
<td>Eemshaven</td>
<td>2 777MW units</td>
<td>15pc</td>
<td>2019</td>
<td>800,000-830,000 t/yr</td>
</tr>
<tr>
<td>Engie</td>
<td>Rotterdam</td>
<td>731MW</td>
<td>10pc</td>
<td>TBC</td>
<td>500,000-550,000 t/yr</td>
</tr>
</tbody>
</table>

*Argus estimates
## Denmark wood pellet consumption

- Recent conversions have strongly lifted demand

<table>
<thead>
<tr>
<th>Utility</th>
<th>Plant</th>
<th>Capacity electric/heat</th>
<th>Status</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orsted</td>
<td>Avedore 1</td>
<td>254MW / 359MW</td>
<td>Operating</td>
<td>400,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Avedore 2</td>
<td>394MW / 541MW</td>
<td>Operating</td>
<td>800,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Studstrup 3</td>
<td>362MW / 513MW</td>
<td>Operating</td>
<td>600,000t/yr</td>
</tr>
<tr>
<td>Hofor</td>
<td>Amager 1</td>
<td>65MW / 360MW</td>
<td>Operating</td>
<td>350,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Herning*</td>
<td>88MW / 171MW</td>
<td>Operating</td>
<td>50,000t/yr</td>
</tr>
</tbody>
</table>

*uses 30pc wood pellets, 70pc wood chips
European Wood pellet power plant capacity growth

MW

Start 2016 2016 2017 2018* 2019* 2020*

UK Belgium Netherlands Denmark

Orsted’s Avedore 1
Orsted’s Studstrup 3
EPH’s Lynemouth
Drax unit 1
RWE’s Amer 9
RWE’s Eemshaven
Uniper’s MPP3
MGT’s Teesside

*Expected
Drivers of European industrial wood pellet demand
Denmark: a closer look
## Denmark wood pellet consumption

- Denmark’s wood pellet use driven by heat demand

<table>
<thead>
<tr>
<th>Utility</th>
<th>Plant</th>
<th>Capacity electric/heat</th>
<th>Status</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orsted</td>
<td>Avedore 1</td>
<td>254MW / 359MW</td>
<td>Operating</td>
<td>400,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Avedore 2</td>
<td>394MW / 541MW</td>
<td>Operating</td>
<td>800,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Studstrup 3</td>
<td>362MW / 513MW</td>
<td>Operating</td>
<td>600,000t/yr</td>
</tr>
<tr>
<td>Hofor</td>
<td>Amager 1</td>
<td>68MW / 250MW</td>
<td>Operating</td>
<td>350,000t/yr</td>
</tr>
<tr>
<td>Orsted</td>
<td>Herning*</td>
<td>88MW / 171MW</td>
<td>Operating</td>
<td>50,000t/yr</td>
</tr>
</tbody>
</table>

*uses 30pc wood pellets, 70pc wood chips
Denmark net wood pellet imports by month

- 2017 first full year for Avedore 1, Studstrup 3
- Total net imports up by 33pc in 2017
- Heat demand gives seasonal swing
Winter HDD days in Copenhagen

1Q18 colder than the 10-year average
Denmark wood pellet imports by month

- Heat demand gives seasonal swing
- 54pc increase in January 18 from a year earlier despite no new capacity
Drivers of European industrial wood pellet demand

Industrial heating demand
Heat demand continues to grow

Danish projects will have lifted 2017 still further

European pellet demand for heating reached 13.4mn t in 2016

Source: AEBIOM, Argus
• 2017 likely even stronger as first full year with Orsted’s new plants

Source: AEBIOM
Top 5 consumers of wood pellets for heat 2016

Source: AEBIOM
Biomass industrial heating capacity: Denmark, Finland, Sweden
Supply landscape
Top net wood pellet exporters 2017

- **Canada** 2mn t
- **US** 5.2mn t
- **Estonia** 1.3mn t
- **Latvia** 1.6mn t
- **Russia** 1.4mn t
- **Vietnam** 1.5mn t

Copyright © 2018 Argus Media group. All rights reserved.
North America

• Largest supply region to Europe
• Larger vessels unsuitable for some ports
• Fx rate a consideration for European buyers
• Canadian producers looking to Asia as emerging demand centre
• Cold winter in New England has absorbed some domestic US and Canadian supply
• Consolidation among producers in recent years
• Some delays at planned supply projects
North American exports

- **2012 to 2017**
  - **Canada** (blue bars)
  - **US** (gray bars)

**mn t**

- 2012: 1.5
- 2013: 1.7
- 2014: 2.1
- 2015: 3.5
- 2016: 4.5
- 2017: 5.2

**Legend:**
- Canada
- US
North American export production capacity

- Enviva’s Wiggins plant ceases
- Rentech’s Wawa plant idled
- Pinnacle’s Entwistle plant ramping up
- Pinnacle’s Smithers plant due to start
- NES’ Miramichi plant to start
- Expansions at Drax’s La Salle and Amite plants
- Enviva’s Hamlet plant to start
- Highland Pellets’ Stevens, Enterprise plants due

End 2016

2017

2018*

2019*

mn t/yr

US

Canada
Baltic region

- Both coasters and handysize vessels available
- Well placed to supply Scandinavian heating demand
- New capacity coming online
- Flooded forests => shortage of raw materials
Portugal

- Fires damaged some production capacity
- Damaged wood from forest fires just becoming available
- Production mostly SBP controlled, not yet SBP compliant, so can’t yet sell into all markets easily
- Mostly coaster freight – can access all ports
- Forth coming capacity extensions
Export production capacity in the Baltics and Iberia

*planned*
Supply-demand balance

• Europe’s industrial wood pellet demand may reach 16mn t/yr by 2021

• Installed production capacity in the US, Canada, the Baltics and Iberia should reach that level by 2019

• Asia: the wildcard
Asia outlook
Key wood pellet import and export countries

- South Korea is leading consumer in the region
- Japan is growing
- Vietnam is key producer
- Malaysia and Thailand supplier smaller volumes
North-east Asian wood pellet imports

- Japan
- South Korea

Copyright © 2018 Argus Media Ltd. All rights reserved.
South Korea

- Imports about 2.4mn t in 2017, demand likely closer to 2mn t
- Independent power producer projects starting up
- Most supply is secured by tender
- But REC weightings under revision, hearing planned on 20 April
Future wood pellet demand

- Yeongdong 1 conversion
- Yeongdong 2 conversion
- Hanyang-KNHP plant
- Kospo’s Samcheok Bio
- Komipo’s Gunsan plant
South Korea RPS targets

%  


0 2 4 6 8 10 12
## Renewable Energy Credits (RECs)

- Power producers not subject to RPS can earn RECs
- Power producers can sell certificates for profit
- Incentivizing privately-owned utilities to use biomass
- REC values under review

<table>
<thead>
<tr>
<th>Technology</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass – co-firing</td>
<td>1</td>
</tr>
<tr>
<td>- dedicated wood pellets</td>
<td>1.5</td>
</tr>
<tr>
<td>- dedicated PKS</td>
<td>1</td>
</tr>
<tr>
<td>Biogas</td>
<td>1</td>
</tr>
<tr>
<td>Waste-to-energy</td>
<td>0.5</td>
</tr>
<tr>
<td>Solar &gt;30kW</td>
<td>1</td>
</tr>
<tr>
<td>Solar &lt;30kW</td>
<td>1.2</td>
</tr>
<tr>
<td>Onshore wind</td>
<td>1</td>
</tr>
<tr>
<td>Offshore wind &lt;5km</td>
<td>1.5</td>
</tr>
<tr>
<td>Offshore wind &gt;5km</td>
<td>2</td>
</tr>
</tbody>
</table>

Copyright © 2018 Argus Media group. All rights reserved.
South Korean imports

Vietnam
Malaysia
Canada
Russia
Indonesia
Thailand
US
Other

2013
2017

t/yr
Japan wood pellet imports

- FiT scheme pays 21 yen/kWh for imported wood pellets
- Over 14 GW of biomass projects have governmental approval
- Co-firing and dedicated projects in the pipeline
- Long term contracts for up to 15 years
- Biomass generation capacity forecast to 3100 MW by 2028 from 2340 MW currently (OCCTO)
Recent and planned wood pellet projects

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Operator</th>
<th>Capacity</th>
<th>Co-firing</th>
<th>Demand</th>
<th>Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nakayama Nagoya 2</td>
<td>Osaka gas</td>
<td>110MW</td>
<td>30pc</td>
<td>125,000t/yr</td>
<td>September 2017</td>
</tr>
<tr>
<td>Ishinomaki plant</td>
<td>Nippon Paper and Mitsubishi</td>
<td>149MW</td>
<td>Up to 30pc</td>
<td></td>
<td>March 2018</td>
</tr>
<tr>
<td>Soma plant</td>
<td>Orix</td>
<td>112MW</td>
<td>Up to 34pc</td>
<td></td>
<td>April 2018</td>
</tr>
<tr>
<td>Akita plant</td>
<td>Nippon Paper</td>
<td>112MW</td>
<td></td>
<td></td>
<td>4Q18</td>
</tr>
<tr>
<td>Aichi plant</td>
<td>Chubu Energy</td>
<td>1070MW</td>
<td>17pc</td>
<td>500,000 t/yr</td>
<td>By 2022</td>
</tr>
<tr>
<td>Yamaguchi plant</td>
<td>Marubeni</td>
<td>300MW</td>
<td>Up to 20pc</td>
<td></td>
<td>April 2022</td>
</tr>
</tbody>
</table>
New trade routes
Established wood pellet trade routes
Emerging trade routes
Freight

• Larger vessels have economies of scale for long distances
• But smaller vessels can reach a wider range of buyers
• Increasing spread between pellet price according to vessel size
• Diverse, flexible portfolio increasingly important
Laura Tovey-Fall
Editor, Argus Biomass Markets
laura.tovey-fall@argusmedia.com
+44 20 7199 3491
London
www.argusmedia.com
http://blog.argusmedia.com