The Hotspots of the Global Wood Pellet Industry and Trade 2017

Webinar 1. December 2017

Presented by:
Martin Junginger, Daniela Thrän, Kay Schaubach, Fabian Schipfer, Michael Wild
Outline of today

15:30   Welcome, intro of the speakers  
        Martin Junginger

15:40   The global view: hot spots, trade and major issues  
        Daniela Thrän

15:50   North America – the large exporters  
        Kay Schaubach

16:00   Europe – the center of consumption  
        Fabian Schipfer

16:10   Sustainability legislation/criteria for wood pellets  
        Martin Junginger

16:15   Prospects of torrefaction and advantages  
        Michael Wild

16:20   Q&A  
        Martin Junginger (moderation), all

16:50   Summary  
        Daniela Thrän

17:00   Closure
The study

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The speakers

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Head of Bioenergy Department, UFZ
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Michael Wild
Austrian Representative for the IEA Bioenergy Task 40
President, The International Biomass Torrefaction Council, Brussels, Belgium
The global view: hot spots, trade and major issues

Daniela Thrän, DBFZ
The wood pellet market is continuously growing

Source: Global Wood Pellet Industry and Trade Study 2017
The global hotspots – consumption and exports

Wood Pellet consumption and exports 2015/2016

TPES Share [%]
- <0.05%
- 0.05-0.1%
- >0.1%
- Not considered

Consumption by sector and export
- Residential sector
- Industrial sector
- Export

© ESRI Country map 2012
The countries in detail

Quantities in [1,000 t/a]

United Kingdom
USA
Denmark
Italy
Germany
Sweden
South Korea
Belgium
France
Austria
Poland
China
Spain
Japan
Canada
Finland
Portugal
Switzerland
Russian Federation
Lithuania
Australia
Norway
Czech Republic
Latvia
The Netherlands
Brazil
New Zealand
Romania
Bulgaria
Estonia
Chile
Slovakia
Ukraine
Argentina
Mexico
Vietnam
Indonesia
Malaysia
Hungary
Colombia

Export
National Volumes

The sum of domestic supply and export equals the national production

source: DBFZ
The hotspots – continents and sectors

Europe (EU28):
- 75% of global consumption
- 54% of global production
- 64% for heat generation
- 36% for electricity

North America
- 12% of global consumption
- 35% of global production
- Consumption mostly heat

Asia:
- Rising, with Japan, South Korea
- China is the great unknown

A special relation:
US and UK
- UK largest global consumer with 6.7m t (2015); equals 25% of global demand
- UK has almost no domestic production
- US is the largest producer
- 56% of UK imports come from US
- since 2015, over 84% of US exports are destined for UK
The global trade flows

2015, in million tonnes; based on (AEBIOM, 2016)

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Major issues – drivers and barriers

- Regulatory framework conditions
- Ensuring sustainability along the value chain
- Transforming wood pellets into a global commodity
- For the future: new technologies (i.e. upgrading such as torrefaction) and new markets (i.e. bioeconomy)
Thank you!
North America – the large exporters

Kay Schaubach, DBFZ
Shares of global pellet production

- North America: 35%
- EU28: 50%
- North America: 35%
- Asia: 8%
- South America: 0%
- Australia & New Zealand: 1%
- Europe non EU: 6%
- South America: 0%

Source: DBFZ
North America in global perspective

Export

National Volumes

The sum of domestic supply and export equals the national production

Quantities in [1,000 t/a]

source: DBFZ
Canada and US in comparison

Exports

<table>
<thead>
<tr>
<th>metric tonnes</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>794,379</td>
<td>1,026,527</td>
<td>982,809</td>
<td>1,205,928</td>
</tr>
<tr>
<td>United States</td>
<td>86,665</td>
<td>152,271</td>
<td>218,889</td>
<td>205,743</td>
</tr>
<tr>
<td>Italy</td>
<td>85,238</td>
<td>219,551</td>
<td>204,528</td>
<td>85,513</td>
</tr>
<tr>
<td>Japan</td>
<td>105,640</td>
<td>76,018</td>
<td>61,807</td>
<td>80,203</td>
</tr>
<tr>
<td>South Korea</td>
<td>2,084</td>
<td>113,077</td>
<td>150,004</td>
<td>49,029</td>
</tr>
<tr>
<td>OTHER</td>
<td>295,171</td>
<td>52,787</td>
<td>19,355</td>
<td>1,366</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,369,177</td>
<td>1,640,231</td>
<td>1,637,393</td>
<td>1,627,784</td>
</tr>
</tbody>
</table>

Source: Global Wood Pellet Industry and Trade Study 2017
Exports – UK as center of gravity

Source: Global Wood Pellet Industry and Trade Study 2017
Location of pellet mills

Capacity distribution across Canadian provinces.

Source: Global Wood Pellet Industry and Trade Study 2017
Projections, drivers and barriers in Canada

- Export markets continue to dominate
  - Japan and South Korea might be growth markets

- Domestic demand might increase through
  - Co-firing: competition with other biomass options critical
  - Residential heating will be stable unless increase in prices for crude oil and heating
  - Industrial application (e.g. concrete) is potential pathway, but advantages of pellets not yet perceived there
Projections, drivers and barriers in the US

- Export markets continue to dominate, esp. UK

- Domestic demand is impacted by
  - No incentives for industrial use
  - Heating depends on fossil fuel prices and advantages in comfort
  - Small incentives for residential heating
  - Statewise renewable portfolio standards (quotas) for utilities, biomass one option to provide power

- U.S. Southeast pellet production partially fills wood demand void created by closure of pulp and paper mills
Thank you!
Europe – the center of consumption

Fabian Schipfer, TU Vienna
Europe – the context

- What’s driving EUs wood pellet consumption?
- For what are they used?
- How is the market developing within Europe?
- Current prices?
- Where does the market go?
Consumer portfolio

Types of consumers

▪ Small-scale heating (single family houses) – Stoves and Boilers
▪ Smaller medium-scale heating (multi family houses, schools, hospitals)
▪ Small-scale combined heat and power (rare, with Stirling-engine)
▪ Medium-scale heating (district heating or, rare, process-heat in industry)
▪ Medium- to large-scale combined heat and power (district heating and power provision/feed-in)
▪ Large-scale power (formerly coal-fired power plants)
Consumers in EU28

Mainly power production


Source: DBFZ
Consumers in EU28

Mainly for medium & large-scale market


Source: DBFZ
Consumers in EU28

Residential heating (mainly stoves)


Source: DBFZ
Consumers in EU28


Residential heating (mainly boilers)

Source: DBFZ
Producers in EU28


Source: DBFZ
Prices

- Prices for residential consumers between 200-250€/t
- Price drop during 2016 due to oversupply
- Different consumer types & countries – different price data & quality
- Seasonality (monthly development) important
- Co-movement of DE, IT, AT pellet prices (!?)

Comparison of wood pellet prices for small-scale consumers, either delivered in bulk or prices for pellets in bags. Sources: (AVEBIOM, 2017; BFS, 2017; CARMEN, 2017; GSE, 2017; MEEM, 2017; Pelletsförbundet, 2017; ProPellets, 2017)
Prices

- Prices for residential consumers between 200-250€/t
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- Seasonality (monthly development) important
- Co-movement of DE, IT, AT pellet prices (!?)

Price data quality/comparability

- No harmonised methodology
- Collected for different purchase quantities
- Only in a few cases on more than country level
- Different delivery distances and additional costs (in-blowing)
- At least monthly basis important

Comparison of wood pellet prices for small-scale consumers, either delivered in bulk or prices for pellets in bags.
Sources: (AVEBIOM, 2017; BFS, 2017; CARMEN, 2017; GSE, 2017; MEEM, 2017; Pelletsförbundet, 2017; ProPellets, 2017)
Outlook

- Europe: Most likely also in the future defined by local consumption
- Wild cards (positive or negative impact on pellet consumption): Policy impact on large-scale consumers like DRAX, RWE, Hofor
Outlook

- Europe: Most likely also in the future defined by local consumption
- Wild cards (positive or negative impact on pellet consumption): Policy impact on large-scale consumers like DRAX, RWE, Hofor

Factors that could have an impact on …

<table>
<thead>
<tr>
<th>… pellet consumption increase</th>
<th>… pellet consumption decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellet commodity market transition to adulthood/maturity</td>
<td>Better isolation of buildings</td>
</tr>
<tr>
<td>Utilisation of pellets for process-heat in European industries</td>
<td>Increased utilisation of excess industry heat</td>
</tr>
<tr>
<td>Micro-CHP parity</td>
<td>Increasing use of heat pumps for excess wind- and PV-power</td>
</tr>
<tr>
<td>Biorefineries for 2\textsuperscript{nd}-gen biofuels (gasification)</td>
<td>Global warming</td>
</tr>
</tbody>
</table>
Thank you!
Sustainability legislation - criteria for wood pellets

Martin Junginger, University Utrecht
Overview

- No mandatory sustainability criteria known for residential / non-industrial use of wood pellets in any country.
- Contrary to liquid & gaseous transport biofuels, no uniform sustainability criteria apply to solid biomass use for energy in the EU.
- Four EU countries have developed national schemes: UK, Netherlands, Belgium and Denmark, with similar but slightly different criteria.
- Currently, no sustainability criteria in Japan, situation unclear in South Korea, but concerns about sustainability of feedstocks are increasing.
Table 3. Summary of sustainability requirements and possibilities for harmonization.

<table>
<thead>
<tr>
<th>I. Level of requirements</th>
<th>RO, RHI, CFDs RTFO - UK</th>
<th>GCs Wallonia–BE</th>
<th>GCs Flanders – BE</th>
<th>IA - DK</th>
<th>SDE+ - NL</th>
<th>Current Harmonization Level</th>
<th>Harmonization Possibilities</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legally binding to receive support</td>
<td>Legally binding to receive support</td>
<td>Legally binding to receive support</td>
<td>Voluntary</td>
<td>Legally binding to receive support</td>
<td>Low</td>
<td>±</td>
<td>Harmonization possible between the Netherlands and the UK</td>
<td></td>
</tr>
</tbody>
</table>

| II. Timeline of implementation | March 2016 | Already implemented | Already implemented | January 2016 | To be determined | Medium | ± | Harmonization possible between four countries |

<table>
<thead>
<tr>
<th>III. Sustainability Requirements Coverage</th>
</tr>
</thead>
</table>

**Greenhouse Gas Emission:**

- Calculation method: ✓ ✓ ✓ ✓ ✓ ✓ Medium ± Harmonization possible between four countries
- Limit compared with 1990 level: ✓ ✓ ✓ ✓ ✓ Medium — Harmonization possible between four countries
- Time of implementation: ✓ ✓ ✓ ✓ ✓ High — Harmonization possible between four countries

**Land Use:**

- Sustainable forest management:
  - Legal, sustainable sourcing & certification: ✓ ± ± ✓ ✓ Low — Harmonization possible between the four countries
  - Forest productivity and well-functioning: ✓ ± ± ✓ ✓ High ✓ Harmonization possible between four countries
  - Biodiversity protection: ✓ ± ± ✓ ✓ Medium ✓ Harmonization possible between four countries
  - Ecosystems conservation: ✓ ± ± ✓ ✓ High ✓ Harmonization possible between four countries
  - Feedstock categories: ✓ ± ± ✓ x Low — Harmonization rarely possible between four countries
  - iLUC: x x x x ✓ x x Harmonization possible between four countries
Harmonisation

- Harmonisation of sustainability criteria/systems will be important to ensure fungibility / tradability of wood pellets as a commodity
- However, with different types of criteria (iLUC, carbon debt), different indicators and threshold levels, this is anything but easy
- Implementation of systems also ongoing in the Netherlands / under review in Denmark
- Currently, the Sustainable Biomass Program is aiming to meet the sustainability requirements in all four countries
The near future: Ongoing RED-II discussions

- The recast of the EU-Renewable Energy Directive (RED-II) is currently discussed between the commission, the parliament and the council.
- Initial proposal by the EC included a feedstock approach, supports a Risk Based Approach, and requires GHG savings of 80% (2021) going to 85% (in 2026, tough!) in efficient CHP plants.
- New proposals include amongst others:
  - No imports from countries not ratifying the Paris agreement.
  - Waste hierarchy: proving no significant distortion of markets.
  - Possibility for individual member states to set additional criteria.

-> Discussion likely to continue well into 2018.
Some thoughts

- Uniform EU sustainability criteria could in principal provide clear security and guidance to the industry and facilitate trade of wood pellets
- Different criteria for use of wood for different end-uses and/or in different member states remain problematic
- Ultimately, with biorefineries also producing 2nd generation biofuels and biochemicals from woody biomass, a single set of criteria for all woody biomass regardless of the end use would be preferable
- These should also be aligned on a global level (e.g. with other regions such as East Asia) to avoid leakage effects and to facilitate global trade of wood pellets
Thank you!
Prospects of torrefaction and its advantages

Michael Wild, IBTC
Quality - Standardisation

ISO 17225  Solid biofuels – Fuel specifications and classes
ISO TS 17225 - 8:
Part 8: Graded thermally treated and densified biomass fuels

Different Classes
- Woody and Non Woody;
- NCV, Durability, Bulk Density, Volatile Matter etc.

Additional parameters in ISO working group:
- Grindability
- Water resistance
- Energy balance
**Torrefied Biomass in its field**

<table>
<thead>
<tr>
<th></th>
<th>White Wood Pellets</th>
<th>Steam Exploded Pellets</th>
<th>Torrefied Pellets</th>
<th>Steam Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>feedstock Wood</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>feedstock Agro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk density</td>
<td>kg/m3</td>
<td>650</td>
<td>750</td>
<td>700-800</td>
</tr>
<tr>
<td>Moisture ar</td>
<td>%</td>
<td>7</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>NCV</td>
<td>GJ/mt</td>
<td>16,5-17-5</td>
<td>18-19</td>
<td>21-25</td>
</tr>
<tr>
<td>NCV uplift vs WWP</td>
<td>GJ/mt</td>
<td>0</td>
<td>0,5-1,5</td>
<td>3,5-8</td>
</tr>
<tr>
<td>shipping density</td>
<td>GJ/m3</td>
<td>11,38</td>
<td>14,25</td>
<td>av. 17</td>
</tr>
<tr>
<td>storeable at coal yard</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>grindable in coal mill</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>pneumatic transport like coal</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>-</td>
</tr>
</tbody>
</table>

Sources: Futuremetrics, Valmet, Arbaflame, ECN, IBTC, brighthubengineering
Comparison torrefaction vs. white wood pellet production (same feedstock, 1 GJ)

Torrefaction Pellets (from aggregated averages survey entries)

- feedstock: 1.089 GJ
- weight: 101.4 kg
- moisture content: 36.2 wt%

Production Process

- torrefied wood pellets: 1.000 GJ
- weight: 50.2 kg
- moisture content: 4.5 wt%

Heat (GJ/GJ prod): 0.015

White Pellets (from average data compilation)

- feedstock: 0.952 GJ
- weight: 87.1 kg
- moisture content: 36.2 wt%

Production Process

- white wood pellets: 1.000 GJ
- weight: 58.0 kg
- moisture content: 6.0 wt%

Heat (GJ/GJ prod): 0.145

Overall thermal η (LHVar basis)

- Torrefaction: 90.6%
- White Pellets: 91.1%

Total electricity consumption

- Torrefaction: 188 kWh/ton, 9.4 kWh/GJ
- White Pellets: 152 kWh/ton, 8.8 kWh/GJ
WWP versus TP - Energy consumed in MJ per GJ energy delivered – Full Chain Comparison

Source and Copyright: W&P
Advantages along chain from FOB

WWP versus TP: Energy consumed in shipping in MJ/GJ shipped

Energy Consumption from vessel to plant stockyard in MJ/GJ

Source and Copyright: W&P
GHG Comparison

Source: D. Thrän, DBFZ

01/12/2017
# Torrefaction Implementation Indicator

<table>
<thead>
<tr>
<th>Torr-gas Handling and Utilisation</th>
<th>done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous torrefaction</td>
<td>done</td>
</tr>
<tr>
<td>Predictability and consistency of product</td>
<td>for most feedstock</td>
</tr>
<tr>
<td>Densification</td>
<td>done</td>
</tr>
<tr>
<td>Feedstock flexibility</td>
<td>done</td>
</tr>
<tr>
<td>Plant Safety</td>
<td>done</td>
</tr>
<tr>
<td>Indoor storage</td>
<td>done</td>
</tr>
<tr>
<td>Outdoor storage</td>
<td>in optimisation</td>
</tr>
<tr>
<td>Standardisation of product</td>
<td>ISO TS 17225-8</td>
</tr>
<tr>
<td>Safety along supply chain</td>
<td>in progress</td>
</tr>
<tr>
<td>Trade Registrations and Permissions</td>
<td>in progress</td>
</tr>
<tr>
<td>Co-firing trials</td>
<td>done in EU</td>
</tr>
<tr>
<td>Co-firing burn tests</td>
<td>several done</td>
</tr>
<tr>
<td>Co-firing full scale</td>
<td>several done</td>
</tr>
<tr>
<td>Heat application trials</td>
<td>in progress</td>
</tr>
<tr>
<td>Further industrial applications trials</td>
<td>in progress</td>
</tr>
</tbody>
</table>

MW 08 2017
# Torrefied Biomass Capacity of Selected Producers

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Size mt/a</th>
<th>Country</th>
<th>Feedstock</th>
<th>Commission date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Castle, LA</td>
<td>15,000</td>
<td>US</td>
<td>Sugar Cane Harvest residue</td>
<td></td>
</tr>
<tr>
<td>Dilsem Stokkem</td>
<td>28,000</td>
<td>B</td>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Derby</td>
<td>30,000</td>
<td>UK</td>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Umea</td>
<td>16,000</td>
<td>Swe</td>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Quitman</td>
<td>30,000</td>
<td>US</td>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Beauneur</td>
<td>15,000</td>
<td>Can</td>
<td>Wood</td>
<td></td>
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<tr>
<td><strong>Committed to</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Castle, LA</td>
<td>200,000</td>
<td>US</td>
<td>Sugar cane harvest residue</td>
<td>Q4/18</td>
</tr>
<tr>
<td>Quitman</td>
<td>200,000</td>
<td>US</td>
<td>Wood</td>
<td>Q4/18</td>
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<tr>
<td>HW NorthWest</td>
<td>150,000</td>
<td>US</td>
<td>Wood</td>
<td>Q1/19</td>
</tr>
<tr>
<td>CEG Baltania</td>
<td>200,000</td>
<td>Estonia</td>
<td>Wood</td>
<td>Q1/19</td>
</tr>
<tr>
<td>Finland</td>
<td>200,000</td>
<td>Finland</td>
<td>Wood</td>
<td>Q4/18</td>
</tr>
<tr>
<td>Jacques Cartier</td>
<td>15,000</td>
<td>Can</td>
<td>Wood</td>
<td>Q1/19</td>
</tr>
<tr>
<td>Holmsund Bicrocarbon</td>
<td>120,000</td>
<td>Swe</td>
<td>Wood</td>
<td>Q1/19</td>
</tr>
<tr>
<td><strong>In the pipeline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 in Louisana and Florids</td>
<td>200,000 each</td>
<td>US</td>
<td>Sugar cane harvest residue</td>
<td>2019-22</td>
</tr>
<tr>
<td>S Central/South America</td>
<td>200,000 each</td>
<td></td>
<td></td>
<td>2019-22</td>
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<tr>
<td>CEG</td>
<td>500,000</td>
<td>North America/Asia</td>
<td>Wood</td>
<td>2020-22</td>
</tr>
<tr>
<td>Fleetway</td>
<td>350,000</td>
<td>US/Asia</td>
<td>Wood</td>
<td>2020-21</td>
</tr>
<tr>
<td>AIREK</td>
<td>275,000</td>
<td>Canada</td>
<td>Wood</td>
<td>2019</td>
</tr>
<tr>
<td>Bioendev</td>
<td>180000</td>
<td>Nordic Countries</td>
<td>Wood</td>
<td>2020-21</td>
</tr>
</tbody>
</table>
Thank you!
Questions and Answers

Martin Junginger
Summary

Daniela Thrän
Thank you very much for your attention!

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