North American Wood Pellet Production and World Markets

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Gordon Murray, Executive Director

Topics

- Wood pellets 101
- Fibre sources
- Carbon cycle
- North American pellet industry
- Market situation
- European support schemes
- Generation economics
- Logistics
- Public support
Wood Pellets 101

- Made from compressed wood fibre.
- Lignin binds the fibre. No adhesives needed.
- Used as a coal substitute for power generation and for residential/commercial/institutional heating

Wood Pellet Fibre Sources

- Sawmill residues
- Logging residues
- Tops & branches
- Commercial thinnings
- Low grade logs
Wood Pellet Extrusion

Energy Content

24.8 gigajoules per tonne

17.0 gigajoules per tonne
Bioenergy - Low Carbon Alternative

Biogenic carbon is part of a relatively rapid natural cycle that impacts atmospheric CO₂ only if the cycle is out of balance.

Fossil fuel combustion transfers geologic carbon into the atmosphere. It is a one-way process.

Graphic source: Washington Forest Protection Association

Wood Pellet Association of Canada

Wood Pellet Uses

Power generation

Heat, cooling, & hot water
Residential/commercial/institutional
Wood Pellets for Power Generation

Co-firing with coal or dedicated firing

Wood Pellets for Home Heating, Cooling, and Hot Water

1. Once or twice a year the pellets are delivered by a silo tanker. A loaded storage room of 4.5 m³ is enough to keep a single family house warm for one year.
2. The pellets are conveyed from the storage room to the boiler by a fully automatic pellet feeder.
3. After the burning process all that’s left is ash – with a weight of only 1.5 per cent of the original pellet. The ash can be disposed of with the domestic waste.
4. If the pellet boiler is interconnected with a buffer storage, emissions can be reduced and efficiency increased.
Pellet Heating – This is No Wood Stove

- Automated feeding
- Hot water & radiant heating
- Low emissions
- Low maintenance
- Also used for cooling

Need to educate public about the potential for bulk home delivery

As convenient as heating oil delivery
Global Wood Pellet Production

- 760 plants worldwide
- Growing US and Canada supply chain
- 22.4 million tonnes consumed globally
- ~18 million tonnes used in EU (power & heat)
- Can tap into same logistics as coal

Source: REN21

Wood Pellet Association of Canada
US and Canadian Pellet Plants

Global Biomass Trade Routes
The first load of industrial pellets was shipped on the *Mandarin Moon* from Prince Rupert, Canada to Helsingborg, Sweden in 1998.

### Canadian Pellet Exports 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>Thousands of Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>794</td>
</tr>
<tr>
<td>Netherlands</td>
<td>253</td>
</tr>
<tr>
<td>Japan</td>
<td>106</td>
</tr>
<tr>
<td>United States</td>
<td>87</td>
</tr>
<tr>
<td>Italy</td>
<td>85</td>
</tr>
<tr>
<td>Switzerland</td>
<td>21</td>
</tr>
<tr>
<td>Denmark</td>
<td>11</td>
</tr>
<tr>
<td>Belgium</td>
<td>6</td>
</tr>
<tr>
<td>Korea, South</td>
<td>2</td>
</tr>
<tr>
<td>Rest of World</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Statistics Canada
Wood Pellet Association of Canada

2013-12-07

Large European Utilities Using Wood Pellets for Power Generation

EU Policy Uncertainty (1)

- Passage of new UK energy act – expected by end of 2013
- UK conversion of ROC to CfD support scheme
- European Commission and EU – biomass sustainability criteria
**EU Policy Uncertainty (2)**

- Netherlands – changing MEP to SDE+ support system
- Denmark – consolidation into law of Heat Supply Act

**Negative Market Developments**

- Closure of Tilbury – July 2013
- EON Ironbridge – logistics issues delaying ramp up, limited hours under LPCD
- Dong Energy Studstrup biomass conversion – delayed until passage of Danish Heat Act
Next Demand Surge 2015?

- UK Drax Power – two more 550 mw units for 1.6 mn tonnes
- UK Eggborough Power – 2000 mw, 4-8 mn tonnes
- UK GDF Suez Rugley - 1,000 mW, 2-4 mn tonnes
- Belgium EON Langerlo – 556 mw – 1.6 mn tonnes
- Netherlands – Delta 400 mw

Support Schemes (1)

- UK – transition to CfD

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Strike Price £/MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass conversion</td>
<td>105</td>
</tr>
<tr>
<td>Offshore wind</td>
<td>155</td>
</tr>
<tr>
<td>Onshore wind</td>
<td>100</td>
</tr>
<tr>
<td>Solar</td>
<td>125</td>
</tr>
<tr>
<td>Tidal</td>
<td>305</td>
</tr>
<tr>
<td>Anaerobic digestion</td>
<td>145</td>
</tr>
</tbody>
</table>
Support Schemes (2)

- Netherlands – SDE+ subsidizes difference between cost and market price with low cost energy systems given highest priority
- Belgium – green certificates, €90 MWh. Dedicated – 100%, Co-firing 50%
- Denmark – tax exemptions and binding targets
- Heat market – no support required, 30% cost advantage!

UK Generation Economics
Source: Hawkins Wright / Forest Energy Monitor

<table>
<thead>
<tr>
<th>The calculation of Clean Dark, Clean Spark and Wood Pellet Spreads United Kingdom - August 2013</th>
<th>Wood pellet 100% conversion</th>
<th>Coal</th>
<th>Natural gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity price (Base load) £/MWh</td>
<td>47.42</td>
<td>47.42</td>
<td>47.42</td>
</tr>
<tr>
<td>Fuel price (input energy) £/MWh</td>
<td>-23.54</td>
<td>-6.97</td>
<td>-22.21</td>
</tr>
<tr>
<td>Plant efficiency</td>
<td>36.0%</td>
<td>38.0%</td>
<td>49.1%</td>
</tr>
<tr>
<td>Fuel price (output energy) £/MWh</td>
<td>-65.39</td>
<td>-18.35</td>
<td>-45.20</td>
</tr>
<tr>
<td>Carbon cost (EU ETS price) £/CO2</td>
<td>-</td>
<td>-3.80</td>
<td>-3.80</td>
</tr>
<tr>
<td>Carbon cost (UK Carbon Price Support) £/CO2</td>
<td>-</td>
<td>-4.94</td>
<td>-4.94</td>
</tr>
<tr>
<td>Total carbon cost (per tCO2) £/CO2</td>
<td>-</td>
<td>-8.74</td>
<td>-8.74</td>
</tr>
<tr>
<td>CO2 emissions factor tCO2/MWh</td>
<td>-</td>
<td>0.97</td>
<td>0.41</td>
</tr>
<tr>
<td>Total carbon cost (per unit output) £/MWh</td>
<td>-</td>
<td>-8.48</td>
<td>-3.59</td>
</tr>
<tr>
<td>ROC price (1xROC/MWh) £/MWh</td>
<td>43.65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LEC price (1xLECMWh) £/MWh</td>
<td>5.24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Combined value of incentives £/MWh</td>
<td>48.89</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CLEAN SPREADS (electricity price, minus fuel, minus carbon, plus renewable electricity incentives)</td>
<td>30.95</td>
<td>20.58</td>
<td>-1.37</td>
</tr>
</tbody>
</table>

Source: Hawkins Wright / Forest Energy Monitor
**Increasing Importance of European Heat Markets**

Europe-wide 2012 estimate: 6 million mt. – 10% annual growth

<table>
<thead>
<tr>
<th>Country</th>
<th>Mt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>0.6</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.5</td>
</tr>
<tr>
<td>Germany</td>
<td>1.2</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.1</td>
</tr>
<tr>
<td>Austria</td>
<td>0.4</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.2</td>
</tr>
<tr>
<td>France</td>
<td>0.5</td>
</tr>
<tr>
<td>Italy</td>
<td>2.0</td>
</tr>
<tr>
<td>UK</td>
<td>0.1</td>
</tr>
<tr>
<td>Other</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6.1</td>
</tr>
</tbody>
</table>

Source: GF Energy

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**US Domestic Pellet Consumption**

- Residential market growth is slow and steady
  - “cheap” natural gas likely to restrict growth
- Industrial use remains minimal without further government incentives
- 2008-2011 capacity growth outpaced demand growth
- Tide of new capacity has slowed

Source: Seth Walker - RISI
US Power Market Potential

- USA coal consumption: 865 million tonnes
- Pellet potential at 5% co-firing: 65 mn tonnes
- GHG savings: 124 million tonnes
- Other renewables also needed, but pellets provide dispatchable energy = ON DEMAND

Canadian Power Market Potential

- Canada uses 60 million tonnes of coal annually
- Ontario: Atikokan coal power plant 100% conversion
- New coal emission regulations released Sept 2012
  - In force effective in 2015
  - Caps emissions at 420 tonnes CO$_2$/GWh
  - Compare to status quo at 1050 tonnes
  - Applies to new units and those aged 50+
  - Biomass emissions deducted from total
  - Potential pellet use – 4.4 mn t by 2019
Canadian Heat Market Potential

- Natural gas accounts for only about half of Canadian residential and commercial/institutional heat and hot water energy consumption.

- 100% conversion of all non-gas heat and hot water represents 60 millions of wood pellets annually. We will offer evidence.

- So 100% conversion is not achievable? How about just 5% conversion? That represents 3 million tonnes annually.

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Home Heating Fuel Cost Comparison (Ontario 2013)

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Heat Value</th>
<th>Unit Cost</th>
<th>Efficiency</th>
<th>$/GJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Oil</td>
<td>0.037 GJ/litre</td>
<td>$1.22/litre</td>
<td>80%</td>
<td>$41.22</td>
</tr>
<tr>
<td>Electricity</td>
<td>3.6 GJ/MWh</td>
<td>$123/MWh</td>
<td>100%</td>
<td>$34.17</td>
</tr>
<tr>
<td>Wood Pellets</td>
<td>17.5 GJ/tonne</td>
<td>$270/tonne</td>
<td>80%</td>
<td>$19.29</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0.037 GJ/m3</td>
<td>$0.30/m3</td>
<td>80%</td>
<td>$10.14</td>
</tr>
</tbody>
</table>

Pellets are significantly cheaper than all fuels except natural gas.
Converting Canadian Non-Gas Households to Pellets

<table>
<thead>
<tr>
<th>Conversion Target</th>
<th>Annual Pellets</th>
<th>Pellet Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>60 million tonnes</td>
<td>$16.2 billion</td>
</tr>
<tr>
<td>5%</td>
<td>3 million tonnes</td>
<td>$810 million</td>
</tr>
<tr>
<td>1%</td>
<td>600,000 tonnes</td>
<td>$162 million</td>
</tr>
</tbody>
</table>

Asia

- Korea – 5 mn tonnes by 2020
- Japan – 8 mn tonnes by 2020
- China – sleeping giant
Price Trends

Data source: Hawkins Wright
Conversions: 1 USD = 0.75 euro
1 metric tonne = 1.1 short tonnes

Canadian Pellet Logistics to Europe

Map showing the distance and logistics of Canadian pellets to Europe.
Eastern Canadian Situation

- Annual capacity – 1 million tonnes
- Surplus capacity – 630 thousand tonnes

Why?

- Small domestic market
- Crowded out of US
- Producers do not cooperate – poor economies of scale for storage and shipping
- Need dedicated port facilities – should handle 500,000 tonnes to minimize cost
Eastern Canada Pellet Plants and Ports

Western Canadian Export Success

- Cooperation
- Co-mingling
- Quality control
- Economies of scale
- Pricing?
- CN’s role
Bio-energy requires society’s acceptance

The industrial wood pellet market exists for only two reasons:
- Bioenergy is carbon neutral
- Bioenergy is sustainable

Regardless of facts, if society comes to disbelieve either of those statements, then our industry will be in grave jeopardy

There is now a well-organized anti-bioenergy movement saying:

- Cutting forests to burn for electricity is a bad idea.
- Bioenergy is causing forests to be destroyed.
- Governments are subsidizing deforestation.
- Biomass is not carbon neutral and is more damaging to the environment than coal.
- Biomass subsidies are driving up the cost of raw material for other industries.
Industry’s response?

- Counter misinformation with scientific fact
- Provide proof of sustainability
- Conduct business to highest ethical standards
- Positive information campaigns – i.e. UK’s Back Biomass Campaign (Drax, EON, USIPA and others)

Pellet Industry in Newfoundland?

Advantages:
- Timber availability
- Proximity to export markets
- Deep water ports
- Infrastructure

Challenges:
- Availability of sawmill waste?
- Reliance on round wood?
Conclusions

- Wood pellet sector is growing
- Although there are challenges, Europe remains the largest market
- Opportunities exist in North America in both power and heat markets
- Asia is emerging slowly
- There is a substantial opportunity in Newfoundland

Thank you!

Gordon Murray
- gord@pellet.org
- (250) 837-8821

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http://www.pellet.org/wpac-agm-2013