Canadian Wood Pellet Opportunities

IEACCC – EPPEI Joint Workshop – COFIRING BIOMASS WITH COAL
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Outline

- Renewable energy, cost comparisons, the wood pellet market and Canada in context.
- Why Canada?
  - Fibre
  - Manufacturing
  - Quality
  - Logistics
- Solid fuel choices and comparisons.
Comparison of Renewable Technology costs in the USA

Levelized cost of Energy for each energy source

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Capital Cost</th>
<th>Subsidies</th>
<th>Fixed O&amp;M</th>
<th>Variable O&amp;M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>38.28</td>
<td>9.2</td>
<td>97.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>45.19</td>
<td>12.4</td>
<td>78</td>
<td>9.5</td>
</tr>
<tr>
<td>Nuclear</td>
<td>16.25</td>
<td>9.9</td>
<td>91.25</td>
<td>18.4</td>
</tr>
<tr>
<td>Wind</td>
<td>9.9</td>
<td>18.4</td>
<td>70.7</td>
<td></td>
</tr>
<tr>
<td>Solar PV</td>
<td>186.6</td>
<td>56</td>
<td>43.3</td>
<td></td>
</tr>
<tr>
<td>Solar Thermal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td>35</td>
<td>14.9</td>
<td>44.9</td>
<td></td>
</tr>
</tbody>
</table>

Source: US DOE 2015
Comparison of Renewable Technology costs in the UK

Total systems costs vs competing technologies

- Biomass: £84 MWh
- Solar: £96 MWh
- Onshore wind: £97 MWh
- Offshore wind: £127 MWh

Source: NERA 2015
Renewable, Low Carbon Bio-Energy

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Global Wood Pellet Production

Sources: Hawkins Wright, REN 21, Future Metrics

2010 to 2015 average annual growth – 14%
Wood Pellet Uses

- **Power generation**: Efficiency ~ 40%
- **Heat, & hot water**: Efficiency ~ 90%
- **Animal bedding & oil patch absorbent**: 400% by weight

- **Electricity**: 13M tonnes
- **Heat**: 13M tonnes
- **Other**: 1M tonnes
Canada’s Geographic Advantage

[Map showing distances from Canada to various destinations, e.g., Vancouver to Shanghai: 9,000 km, Halifax to Malaysia: 5,000 km, and Saint John to Shanghai: 12,400 km.]
Canada’s Wood Pellet Plants
Canada’s Regional Capacity Split

Total Canadian Capacity About 4 million Tonnes

BC has 58% of Canadian Wood Pellet Capacity

42% of Canadian capacity would logistically flow through the East coast.

**Canadian Wood Pellet Sector**

- 44 wood pellet plants
- 1,000,000 tonnes new capacity, last 18 months
- 400,000 tonnes under construction
- 4,000,000 tonnes annual capacity
- 400,000 tonnes under construction
- Two west coast export terminals
Western Canadian Pellet Plants

1. Canfor/Pacific Bio – Fort St John
2. Canfor/Pacific Bio – Chetwynd
3. Pinnacle/Canfor – Houston
4. Pinnacle – Burns Lake
5. Premium Pellet – Vanderhoof
6. Pacific BioEnergy – Prince George
7. Pinnacle – Meadowbank
8. Pinnacle – Quesnel
9. Pinnacle – Williams Lake
10. Pinnacle – Armstrong
11. Princeton Pellet - Princeton
12. Pinnacle/Tolko – Lavington
13. Diacarbon – Merritt
14. La Crete Sawmills – La Crete
15. Pinnacle – Entwistle
16. Foothills FP – Grande Cache
17. Vanderwells – Slave Lake

= 3 million tonnes annual capacity
Why Canada Makes Sense

FIBRE

MANUFACTURING

QUALITY

LOGISTICS
Canada’s Forests

9% of the world’s forest cover

347 M Hectares of forest

Wood Pellet Association of Canada
Global Forest Area

Data source: FAO, Global Forest Resources Assessment 2015.
Global Forest Certification

Source: www.certificationcanada.org as of Dec 31/15
Canadian Sustainable Supply

Harvest vs Annual Allowable Cut

Wood Pellet Association of Canada
Wood Pellets 101

- Renewable fuel
- Made from compressed wood fibre.
- Lignin binds the fibre. No adhesives needed.
Canadian Wood Pellet Fibre Sources

Sawmill residues

Logging residues
Typical Feedstock of a Canadian Pellet Plant

- **Sawmilling Residues**
  - Sawdust
  - Shavings
  - Bark
  - **80%**

- **Harvesting Residues**
  - Logging residue
  - Thinnings
  - Trimmings
  - **15%**

- **Roundwood**
  - Undersized
  - Diseased
  - Burnt
  - **5%**

- **Pellet Processing**
- **Grinding**
- **Chipping / Grinding**
Unloading Sawmill Residuals at the Pellet Plant
Bush Grinding Harvest Residuals
Wood Pellet Extrusion
Canada’s High Quality Pellet Plants

Pinnacle Renewable Energy Inc., Lavington Plant, BC
Canada’s High Quality Pellet Plants

Pinnacle Houston Plant, BC

Pinnacle Lavington Plant, BC
Costs of Producing High Quality Pellets

- Clean, Sustainable fibre.
- Environmental compliance.
- Rule of law and fair treatment of workers.
- Health and safety.
- Preventative maintenance.
- Best Available Technology.
- Quality control.
Canada’s Competition in SEA
Canada’s Competition in SEA
Canada’s Logistics Advantages

- Enclosed 100t railcars
- Full range of Handy to Panamax vessel sizes
- High speed, low impact loading to 2,000tph
Canada’s Infrastructure vs Competitors
Canadian Export Destinations (1,000 T)

2016 exports: 2.4 million tonnes
2015 exports: 1.6 million tonnes
Principal Options for Biomass Power

- Grate fed or fluidized bed combustion systems
- Co-firing with coal in PC boilers
- Conversion of PC boilers to 100% biomass

Ontario Power Generation’s Atikokan Power Plant: converted from coal, now firing on 100% wood pellets
Common Solid Biofuel Options

Wood pellets

Palm kernel shells

Wood chips
Canadian Wood Pellet Characteristics

- Moisture content around 4-6%
- Calorific value as received >18 GJ/tonne
- Ash < 3%, N <0.5%, S <0.1%, Cl <0.1%
- Durability >98%
- 6mm diameter, <40mm length

- Ash effect on boiler is usually benign
- PC power plant conversion is relatively easy
- Flexible – can use in any kind of boiler
Wood Chip Characteristics

- Moisture content around 45-60%.
- Calorific value as received around 6 to 10 GJ/tonne.
- Ash < 1%, N <0.5%, S <0.1%, Cl <0.1%.

- Ash effect on boiler is usually benign.
- Low cost, but expensive to transport due to high moisture and low bulk density.
- Not suitable for PC boiler since chips can’t easily be pulverized.
Sustainability concerns.
Difficult to aggregate.
Normally up to 15% moisture and 10% ash.
Calorific value similar to wood.
N 5-6%, S <0.3%, Cl <0.4% as fired.

High quartz content.
Will not pulverize.
Not suitable for PC boilers.
PKS Compared to Wood Pellet

- Quality and cleanliness variability.
- Lower ash melting temperature and rich in silica means increased boiler slagging and fouling.
- More problems with ash disposal.
- Undesirable Nox and Sox emissions.
- Higher Cl: boiler surface corrosion.
Screening required to remove waste / extraneous material – itself a disposal issue.

Higher quartz content causes erosion of fuel handling, firing, and ash handling equipment.

At low co-firing percentages, boiler effects are minimal.

As percentages increase, effects are magnified.
Black pellets

- Almost no commercial production today.
- Does not reduce total supply chain investment. It merely pushes it back onto pellet producers.
- Pellet producers will be willing supply black pellets if generators are willing to pay substantially more than for white pellets.
Canada has a vast forest resource that is the world’s most sustainable.
Canada is a dependable exporter of high quality wood pellets.
We are interested in long term business relationships.
Asia is highly attractive to us.
Let’s talk.
Thank you!

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