Wood Pellet Co-firing

Presentation to Canadian Clean Power Coalition

Gordon Murray, Executive Director
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Outline

• Introduction to wood pellets
• Comparing fuel properties
• Global and Canadian pellet production/markets
• Global co-firing experience
• Co-firing methods
Wood Pellets

• Made from compressed wood fibre.
• Lignin binds the fibre. No adhesives needed.
• Made from sawdust, shavings, logging debris, diseased and insect-killed trees.
Environmental Benefits

- Renewable & carbon neutral
- Reduce emissions: SO$_x$, NO$_x$, C$_4$H$_4$, Mercury, etc.

Carbon Cycle
## Typical Fuel Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Coal</th>
<th>Wood Pellets</th>
<th>Agriculture Residues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash content%</td>
<td>8.5-10.9</td>
<td>0.4-0.5</td>
<td>5</td>
</tr>
<tr>
<td>Moisture content%</td>
<td>6-10</td>
<td>5-10</td>
<td>17-25</td>
</tr>
<tr>
<td>Net calorific value - GJ/tonne</td>
<td>26-28.3</td>
<td>18.5-20</td>
<td>17.4</td>
</tr>
<tr>
<td>C% - db</td>
<td>76-87</td>
<td>48-52</td>
<td>45-47</td>
</tr>
<tr>
<td>H% - db</td>
<td>3.5-5</td>
<td>6.2-6.4</td>
<td>5.8-6.0</td>
</tr>
<tr>
<td>N% - db</td>
<td>0.8-1.5</td>
<td>0.1-0.5</td>
<td>0.4-0.6</td>
</tr>
<tr>
<td>O% - db</td>
<td>2.8-11.3</td>
<td>38-42</td>
<td>40-60</td>
</tr>
<tr>
<td>S% - db</td>
<td>0.5-3.1</td>
<td>&lt;0.05</td>
<td>0.05-0.2</td>
</tr>
<tr>
<td>Cl% - db</td>
<td>&lt;0.1</td>
<td>0.01-0.03</td>
<td>0.14-0.97</td>
</tr>
<tr>
<td>K% - db</td>
<td>0.003</td>
<td>0.02-0.05</td>
<td>0.69-1.3</td>
</tr>
<tr>
<td>Ca% - db</td>
<td>4-12</td>
<td>0.01-1.5</td>
<td>0.1-0.6</td>
</tr>
</tbody>
</table>
Pellet advantages over raw biomass

- Homogeneous
- Dry
- High bulk density
- Lower transportation cost
- No self-heating
- Not perishable
- Complete combustion (pyrolysis at low temp)
- No slagging, fouling, corrosion like ag residues
- Reduced pre-treatment requirement
Global pellet production in 2008: 11.7 million tonnes

Source: Poyry Forest Industry Consulting
Global pellet production growth since 2000

Source: FAO & UNECE
Global pellet consumption: 2008

- Europe: 80%
- North America: 17%
- China: 1%
- South America: 0%
- Oceania & Japan: 2%

~12 M tonnes

Source: Poyry Forest Industry Consulting
## Canadian annual pellet production capacity as of January 1, 2011 – tonnes

<table>
<thead>
<tr>
<th>Plants</th>
<th>Average</th>
<th>Largest</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Canada</td>
<td>16</td>
<td>118,000</td>
<td>400,000</td>
<td>1889,000</td>
</tr>
<tr>
<td>Eastern Canada</td>
<td>18</td>
<td>43,000</td>
<td>120,000</td>
<td>774,000</td>
</tr>
<tr>
<td>All of Canada</td>
<td>34</td>
<td>78,000</td>
<td>400,000</td>
<td>2663,000</td>
</tr>
</tbody>
</table>
Canadian pellet shipments – tonnes

<table>
<thead>
<tr>
<th>Region</th>
<th>2010</th>
<th>2011F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>1,350,000</td>
<td>1,750,000</td>
</tr>
<tr>
<td>North America</td>
<td>90,000</td>
<td>90,000</td>
</tr>
<tr>
<td>Japan</td>
<td>60,000</td>
<td>100,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,500,000</strong></td>
<td><strong>1,990,000</strong></td>
</tr>
</tbody>
</table>

*estimates only – Statistics Canada does not track wood pellets as a separate product and producers are reluctant to share data
Large Scale Combustion

• Fixed bed combustion – flexible fuel
• Fluidized bed combustion – flexible fuel
• Dust combustion – pellets only
  – Co milling and injection
  – Separate milling and injection
Co-firing Methods

- Direct co-firing
- Parallel co-firing
- Indirect co-firing (gasification)
Power Plant Modifications to Co-Fire

- Front end only
- Covered pellet storage
- Separate conveyors
- Hammer mills (coal mills will plug)
Why co-fire?

• We are allies of the coal power industry
• Cost is higher than for coal-only
• Reduce emissions – regulations coming
• Social licence to keep coal burning
• Cheapest choice of renewable options
Avoid this!

UK Protester

Ontario

Oregon

TransAlta - Washington State

Wood Pellet Association of Canada
Thank you!

QUESTIONS ANSWERED
SIMPLE  50¢
GUESSES  $1.00
INTELLIGENT $2.00
HONEST  $5.00

DUMB LOOKS
ARE STILL FREE