Wood Pellets for Power and Heat

Legislative Energy Horizon Institute
6-9 July 2013 | Richland, WA

Gordon Murray, Executive Director
Agenda

- Bioenergy overview
- Carbon cycle
- What are wood pellets and how are they made?
- Pellets for power
- Pellets for heat
- The wood pellet industry
- Pellet opportunities
Renewable Energy Share of Global Energy Consumption

Force Behind Renewables in Power Generation

- Reduce emissions: GHGs, SOx, NOx, mercury, cadmium, arsenic and more
- Contributes to domestic energy security
- Domestic economic driver versus oil imports
- Make use of waste: wood residues, municipal solid waste
- Sustainable
Bioenergy - Low Carbon Alternative

Biogenic carbon is part of a relatively rapid natural cycle that impacts atmospheric CO$_2$ 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 pellets are made from forest residues and used to produce heat and electricity.
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 Extrusion
Wood Pellet Uses

Power generation

Heat, cooling, & hot water
Residential/commercial/institutional

Wood Pellet Association of Canada
Co-firing with coal or dedicated firing
Energy Content

24.8 gigajoules per tonne

17.0 gigajoules per tonne
Large European Utilities Using Wood Pellets for Power Generation

- Delta Energy
- DONG Energy
- E-On
- NPower
- RWE
- Essent
- Drax
- GDF Suez
- Vattenfall
Wood Pellets for Home Heating, Cooling, and Hot Water

**Wood pellet heating system**
Space heating and domestic hot water supply with pellets

1. Once or twice a year the pellets are delivered by a silo tanker. A loaded storage room of 4.5 m² is enough to keep a single-family house warm for one year.

2. The pellets are carried from the storage room to the boiler by a fully automatic pellet feed.

3. After the burning process all that’s left is ash – with a weight of only 0.5 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.

Wood pellets
2-5 cm [0.8-2 in.] in length, diameter 0.6 cm [0.24 in.]

Domestic hot water

Space heating

Storage room

Pellet boiler

Buffer storage
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
# 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.
Global Wood Pellet Production

Source: REN21
Stable Supply, Global Trading

- 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
US and Canadian Pellet Plants
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
North American Pellet Exports to EU

Source: Argus Media
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
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
“In northern states that rely heavily on imported fossil energy for home and business heating, biomass has the potential to greatly reduce our consumption of heating oil, propane, and natural gas. The Northeast in particular is extremely vulnerable to heating oil price shocks and supply disruptions; there, biomass could sustainably offset as much as 25% of oil, or over 1 billion gallons annually, used to heat homes and businesses.”
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.
## Converting 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>
Conclusions

- Wood pellets are renewable, sustainable, and can provide significant GHG savings
- Pellets can replace coal for power generation and provide electricity on demand unlike wind or solar
- Pellet heat is clean and as convenient as oil
- The pellet industry is young but has huge growth potential
- Policy support is needed to encourage fuel switching
Thank you - For more information

Gordon Murray

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

Bob Wood

- rwood@viridisenergy.ca
- (604) 558-3393 ext 233