Wood Heat Technology Options for Residential and Light Commercial Applications

Wawa Wood Trade Show
May 30, 2018 | Wawa, Ontario

John Arsenault, Eng. MBA
WPAC Director Market Access & Promotion
Outline

- WPAC
- Wood heating options
- Cost comparisons
- Certification
  - Quality
  - Sustainability
Advocate on behalf of Canadian wood pellet industry

>65 members: pellet producers, ports, stevedoring companies, traders, equipment manufacturers, engineers and consultants, insurance industry & universities.

Producers are export oriented (>85%)
- European industrial (coal)
- US and Italian heat markets
WPAC supports biomass heat

- Biomass conferences nationwide
- Industry representation at all levels of Government
- Technical support: ISO Committee, handbook publications etc.
- NRCan fuel testing
- Certification seminars
  - Quality CANplus
  - Sustainability SBP
Canadian Wood Pellet Plants

- 44 pellet plants in Canada
- Export focused, therefore concentrated near both coasts
- 4 million tonnes annual production capacity

https://www.canadianbiomassmagazine.ca/canadian-biomass-pellet-mill-map
Canadian Export Destinations
Thousands of Tonnes / calendar year

2017 exports: 2.2 million tonnes
2016 exports: 2.4 million tonnes
2013-15 exports: 1.6 million tonnes
Canadian pellet heat Destinations
Tonnes / year

[Bar chart showing the tonnage of pellets exported from Canada, Italy, and the USA to other countries from 2012 to 2017.]
Air emissions are a problem worldwide

Air pollution: an Italian Issue

90.4 percentile of PM$_{10}$ daily concentrations in 2014
µg/m$^3$
- ≤ 20
- 20–40
- 40–50
- 50–75
- > 75

Source: EEA
www.eea.europa.eu

Map and image: courtesy of EEA
MOSDark 17 March 2009 (Satellite and image processing: Defense Meteorological Satellite Program (DMSP))
New appliances are a solution

Total Pounds of Particulate per Year
normalized to the equivalent of the BTU from 1000 gallons of heating oil per year

- Fireplace: 3920.0
- Old Wood Stove: 644.0
- Modern Wood Stove: 196.0
- Pellet Stove: 68.6
- Modern European Pellet Fuel Boiler: 10.08
- Gas Boiler: 2.94
- Old Heating Oil Boiler (pre-1990s): 2.52
- Modern Heating Oil Boiler: 1.16

Wood Pellet Association of Canada
New appliances are a solution

![Total Pounds of CO₂ per Year](image)

- **Heating Oil**
  - 30,716 pounds per year
- **Propane**
  - 23,240 pounds per year
- **Natural Gas**
  - 19,502 pounds per year
- **Pellet Fuel**
  - 4,004 pounds per year

*Normalized to the equivalent of the BTU from 1000 gallons of heating oil per year.*
Biomass heating Equipment

- 1- Cordwood
- 2- Wood Pellets
- 3- Other biomass equipment

**Biomass 101 Session 3**

What types of equipment are available in the Northeast?

Richard Grondin, PE, CEM, CBCP
*Integrated Energy Systems, PLLC*
Falmouth, ME 04105
207-781-4263
rgrondin@iespllc.com

Wood Pellet Association of Canada
Cordwood Heating

Most basic heating system, manual feed, manual start

- Open Fireplace (least efficient)
- Fireplace Inserts
- Masonry Heaters (Tiled Stoves)
Cordwood Heating

More appliances:
- Wood Stoves (70-80% efficiency)
- Wood Stoves with water heaters
- Cooking Stoves
Cordwood Heating

Systems integrated with an existing house heating system:

• Wood Furnace (Hot Air)

• Separate or Add-on Furnace

• Back-up burner (gas or oil)
Cordwood Heating

- Outdoor Wood Boilers -
  - Remote from building
  - Glycol loop to building
- Indoor Wood Boilers – Residential/Commercial
  - Best operation with a storage tank
  - Some available with backup gas or oil burner
Cordwood Heating

- Commercial Wood Boilers
  - Indoor and Outdoor Boilers
  - Separate or integrated water storage
  - Some units up to 800,000 Btu/hr
Wood Pellet Heating

The very basic pellet appliances:

• Pellet Fire Logs

• Portable Pellet Grilles/Stoves

• Smokers and Grilles
Wood Pellet Heating

Pellet Stoves
• Available in many styles
• Simple to install
Wood Pellet Heating

Hot Air Furnaces

• Most have modulating output
• Residential and commercial units
• Many different sizes and features

Wood Master up to 780,000 Btu/hr  Agfuel 200,000-990,000 Btu/hr

Wood Pellet Association of Canada
Wood Pellet Heating

Hot Water and Steam Boilers
• Modulating output
• Residential and commercial units
• Single or multiple boilers
Wood Pellet Heating

Pellet Storage
• Indoor or outdoors (dry)
• 40 pound bags (retail)
• Fabric bag (1/2-10 tons)
• Steel bins
• Storage room
• Silo
• Bulk deliver by pneumatic or auger system
Wood Pellet Heating

Other Biomass Equipment

• Combined Heat and Power
  • Steam turbine
  • Sterling engine
  • Wood gas generator engine
• Cooling with absorption chillers driven
• Wood gas vehicles
# Cordwood vs pellets

<table>
<thead>
<tr>
<th>Cordwood</th>
<th>Pellets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low density: Large storage required</td>
<td>High density, efficient, low volume of storage</td>
</tr>
<tr>
<td>local supply (water test)</td>
<td>long distance friendly</td>
</tr>
<tr>
<td>Green: hardwood best</td>
<td>Greener: because of higher efficiency</td>
</tr>
<tr>
<td>Low cost, Medium service required: ash, debris</td>
<td>Higher cost, Low maintenance: ash, bags.. Etc.</td>
</tr>
<tr>
<td>Manual operation</td>
<td>Automatic available at several levels</td>
</tr>
<tr>
<td>Good heat content if seasoned</td>
<td>High heat content (dry)</td>
</tr>
<tr>
<td>Can be stored outside, best covered</td>
<td>Must be protected from water</td>
</tr>
<tr>
<td>Runs without electricity</td>
<td>Needs auxiliary power (battery) in blackouts</td>
</tr>
</tbody>
</table>
Energy Costs

- Heating oil – 1$ per litre ($3.25/usg), 85% efficiency
- Natural gas – 27 cents per cubic metre ($7.7/MMbtu), 85% efficiency
- Wood pellets - $300 per ton, 85% efficiency
- Electricity – 15.4 cents per kWh, 100% efficiency
- Logs: $300/cord (4') wood 75% efficiency

Source: Enbridge website
Wood Pellet Association of Canada
Ontario Domestic Fuel Costs - 2017

$/GJ, adjusted for efficiency

Sources: Enbridge, National Energy Board, WPAC research

Wood Pellet Association of Canada
Conversion numbers

- 1,5 4' cord of softwood = 1000 litres heating oil
- 1,1 4' cord of hardwood = 1000 litres heating oil
- 2 tonnes of pellets = 1000 litres Heating oil
- 2 kg pellets = 1 litre heating oil.
- Bagged pellets sold by the short ton (50 bags)
  1 tonne = 55 bags (18,1 kg)
WPAC national Licenser for Enplus since 2013
ENplus is labelled CANplus in Canada
Currently two Canadian certified producers
Request for info from several others
WPAC Hosts training seminars on a regular basis: + 25 participants in March
## Certification Quality

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>PFI Premium</th>
<th>NSPS</th>
<th>CANplus A1</th>
<th>CANplus A2</th>
<th>CANplus B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>mm</td>
<td>5.84 – 7.24</td>
<td>5.85 ≤ diameter ≤ 7.23</td>
<td>5.85 ≤ diameter ≤ 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>mm</td>
<td>≤ 1 % greater than 1.5&quot; (38.1)</td>
<td>≤ 38.1</td>
<td>3.15 &lt; L ≤ 38.1 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>w-% 2)</td>
<td>≤ 8.0</td>
<td>≤ 2.0</td>
<td>≤ 0.7</td>
<td>≤ 1.2</td>
<td>≤ 2.0</td>
</tr>
<tr>
<td>Ash</td>
<td>w-% 3)</td>
<td>≤ 1.0</td>
<td>≤ 2.0</td>
<td>≤ 0.7</td>
<td>≤ 1.2</td>
<td>≤ 2.0</td>
</tr>
<tr>
<td>Mechanical Durability</td>
<td>w-% 2)</td>
<td>≥ 96.5</td>
<td>≥ 98.0 5)</td>
<td>≥ 97.5 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fines (&lt; 3.15 mm)</td>
<td>w-% 2)</td>
<td>≤ 0.5 (3.18 mm)</td>
<td>≤ 1.0</td>
<td>≤ 1.0 6)(≤ 0.5 7)</td>
<td>(≤ 3.15 mm)</td>
<td></td>
</tr>
<tr>
<td>Temperature of pellets</td>
<td>°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≤ 40 8)</td>
</tr>
<tr>
<td>Net Calorific Value</td>
<td>kWh/kg 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥ 4.6 9)</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>kg/m³ 2)</td>
<td>641 – 768 kg/m³</td>
<td>≥ 609</td>
<td></td>
<td>641 ≤ BD ≤ 750</td>
<td></td>
</tr>
<tr>
<td>Additives</td>
<td>w-% 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≤ 2 10)</td>
</tr>
</tbody>
</table>
Quality certification

- Canada recently mirrored ISO solid fuel standards into CSA standards
- ISO documents distributed by Natural Resources Canada (NRCan) recently

Sustainability
Canada’s Forests

- 350 million ha, 92% publicly owned
- Canada is recognized as a global leader in sustainable forest management, meeting the environmental, social and economic needs of current and future generations.
- Canada is a leader in third party certified forests with more than any other country.
Sustainability
Canada’s Forests

Canada’s forests by numbers

Canada has

- 347 million hectares of forest
- 166 million hectares of forest independently certified as sustainably managed (2015)
- 0.41 million hectares artificially regenerated on provincial Crown lands (2014)
- 0.03 million hectares of forest deforested (2014)
- 20.3 million hectares of forest damaged by insects (2014)
- 24 million hectares of protected forest
- 0.72 million hectares of forest harvested (2014)
- 3.9 million hectares of forest burned in forest fires (2015)
WPAC has participated in the Sustainable Biomass Programme (SBP) since day one
Did V.0 testing in 2015
Currently member of its stakeholder committee
Twelve Canadian Certificates to date,
WPAC offering promotion and support to producers for certification
https://sbp-cert.org/accreditations-and-certifications/certificate-holders
Questions?
Thank you!

For more information:
Contact John Arsenault
john@pellet.org
(819) 583-7477

www.pellet.org/wpac-agm/