Heating with Wood Pellets in Vermont: Affordable Housing

Keeping Affordable Housing Affordable

Heating the Midwest With Renewable Biomass, April 2012

Stanislaus Housing, Rutland, VT
A former Catholic School and living quarters for teachers. Built in 1890s.
Now 20 units of affordable housing. 4.3 MM$ public/private invested including $125,000 from DOE.

Pleasant Street Apartments, Enosburg Falls, VT
30% energy reduction through building upgrades. 24 apartments available, all units reserved for low income tenants.
**Pneumatic Conveyance**

Video Here, click on black square to start.

**Pellet Fines Cyclone**

**Wood pellet storage**

**Pellet Fines in Cyclone Base**

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**Cost Break Down**

<table>
<thead>
<tr>
<th>Location</th>
<th># Of Units</th>
<th>Energy Use</th>
<th>Energy Cost Wood Pellets*</th>
<th>Savings Compared to Oil^</th>
<th>Approx. Per Unit / Month Heating Cost</th>
<th>Energy Use per Unit per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanislaus</td>
<td>21</td>
<td>Est. 26 tons</td>
<td>$6,240</td>
<td>$3,510</td>
<td>$25.00</td>
<td>25-40 Million British Thermal Units</td>
</tr>
<tr>
<td>Pleasant Street</td>
<td>24</td>
<td>Est. 45 tons</td>
<td>$10,800</td>
<td>$6,075</td>
<td>$37.50</td>
<td></td>
</tr>
</tbody>
</table>

Compare to typical residence in this area using 112 Million British Thermal Units!

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*Pellets at $340 per ton bulk delivered

^Oil at $3.75 per gallon

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More from Trevor Parsons:

• Data acquisition is helpful if an on-site person is not available
  a) Confirms system status daily
  b) Helps diagnose problems that arise

• Bi-Weekly maintenance should be planned, ½ hour per visit.

• Annual cleaning is necessary

• Total annual maintenance budget per location, figure $1,200. This will get better with time.

• Fuel quality is absolutely essential.

• Pay attention to fuel handling and storage.

• Don’t forget to consider what to do with ash.
Making Success More Likely:

• Make Energy Conservation Upgrades First.
• Get an accurate third party heat loss analysis.
• Upgrade the heating distribution if possible.
• Keep all aspects of fuel handling simple, don’t push this envelope.
• Leave funding in the project for fine tuning the operation after installation.
• Automate as much as possible. Take humans out of the equation.
• Load match or de-couple from the load.
Heating Bin Hours vs. Outdoor Temperature

Typical northern US location

- 4800 hours per year at 55 deg F or lower
- 3900 hours occur at 25°F or higher
- 80% of heating output is needed at 50% or less of peak heating load

“Small can be beautiful”

- No positive energy benefit from boiler over-sizing
- 25% under-sizing → only 1% loss of total annual wood heating output and heating oil savings
- 50% under-sizing → only 7% loss of total annual wood heating output and heating oil savings
- Reducing boiler size by 50% can save 20 to 30% in capital cost and length of payback period.

Shorter payback periods → More customers
Lower emissions → Happier neighbors
Each time the boiler turns off, CO drops. When the fan comes back on CO rises dramatically before it then begins to settle downward rapidly.

60% reduction in on/off cycling with thermal storage.

Without Thermal Storage, 1700 on/off cycles per year

With Thermal Storage, 700 on/off cycles per year

Recommend 30 gallons per 10,000 Btu of boiler output for automatic stoking boilers and 70-80 gallons per 10,000 Btu for Cord wood boilers.
Some Advantages of Cascading

- Reduce installation cost
- Increase utilization
- Add redundancy
- Match seasonal and diurnal variation

A 10% turndown ratio.

A single 600,000 Btu boiler may reduce its output by 70%.

A cascaded installation of three 200,000 Btu boilers may reduce total output by 90%