Biomass: Wood as Energy

Bureau of Indian Affairs
Tribal Providers Conference

Anchorage, Alaska
2 December 2015

Daniel J. Parrent
R10 Biomass & Forest Stewardship Coordinator
USDA Forest Service
State & Private Forestry
Alaska’s Forest Resources

Alaska has extensive forest resources:
* approximately 120 million acres of forest land
* approximately 3 million cords of wood grown annually
* wildfires average 1-2 million acres annually (range is 500,000 to 6.2 million; 2015 was 2nd worst @ 5+ million)

Alaskans burn approximately 100,000 cords annually for heat

Benefits of forest management:
* reduce risk and severity of wildfires
* utilize trees killed by insects, disease and fire
* enhance/restore wildlife habitat and forest health
Modern Woody Biomass

Sources:
- Forest thinnings
- Logging slash
- Sawmill residues
- Land clearing
- C&D, MSW, dunnage

Forms:
- Hog fuel
- Cordwood
- Fuel logs / briquettes
- Chips
- Pellets
Advantages and Disadvantages of Woody Biomass Fuels and Boilers

**Advantages**

Renewable
Carbon neutral and sulfur free
Local in origin (supports local economy and creates jobs)
Low-grade or waste material
Price stability
Saves money

**Disadvantages**

Bulky; requires considerable on-site storage
More difficult to deliver & convey
Non-uniform, inconsistent (compared to oil, gas, electricity)
High system capital costs
Operational learning curve
Requires some attention daily, weekly
Not always well-suited for “shoulder” seasons or “peak” demand

HELE Woody biomass boiler systems reliably meet State and Federal clean air standards
## Characteristics of Wood Fuels

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordwood Slabwood</td>
<td>Readily available&lt;br&gt;Low cost (generally)&lt;br&gt;Dry-able; Btu/lb variable</td>
<td>Requires manual fuel delivery &amp; stoking</td>
</tr>
<tr>
<td>Pellets</td>
<td>Meter easily; easy to convey&lt;br&gt;Dry; High Btu/lb</td>
<td>Limited availability&lt;br&gt;High cost</td>
</tr>
<tr>
<td>Chips Hog fuel</td>
<td>Lowest cost (generally)&lt;br&gt;Automated delivery possible</td>
<td>Availability ???&lt;br&gt;Wet; generally not dry-able&lt;br&gt;Lowest Btu/lb</td>
</tr>
<tr>
<td>Building Type</td>
<td>Fuel Type</td>
<td>Heat Output</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Homes</td>
<td>Cordwood</td>
<td>0.1 MMBtu/hr</td>
</tr>
<tr>
<td>Small Buildings</td>
<td>Pellets</td>
<td>0.3 MMBtu/hr</td>
</tr>
<tr>
<td>Large Buildings</td>
<td>Chips</td>
<td>1.0 MMBtu/hr</td>
</tr>
<tr>
<td>Large Districts</td>
<td></td>
<td>3.0 MMBtu/hr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 MMBtu/hr</td>
</tr>
</tbody>
</table>

Photos by D. Bihn
Major System Types

Type I. *Manual* Fuel Delivery

**FUEL**: Cordwood, slabwood, briquettes

**COST**: Lowest-Cost Option (usually)

**APPLICATION**: most suitable for medium-sized facilities; scalable to larger facilities; can also be used residentially
High efficiency, low emission (HELE) Manual, stick-wood boiler systems
Major System Types

Type II. **Automatic** Fuel Delivery

**FUEL:** “Meter-able” fuels (pellets, chips, hog fuel, cubes, pucks)

**COST:** Higher/Highest initial investment cost

**APPLICATION:** Suitable for residential (pellets), medium and large facilities
Meter-able fuel systems generally consist of a fuel storage bunker or silo, fuel conveyances (augers, conveyor belts), metering bin (not labeled), fire-box, boiler, and exhaust system. Very large systems may incorporate automatic ash removal capabilities and particulate emissions controls.

This schematic diagram of a wood pellet system shows the components of a typical biomass boiler system including a place to store the fuel, equipment to move it to the boiler and equipment to manage the byproducts — ash and combustion gases.

courtesy SolaGen Inc.
Pellets are typically delivered like fuel oil and are stored in silos.
Chips and hog fuel are generally delivered by dump trucks or walking-floor trailers
Fuel is stored in bunkers, bins or silos and moved to the firebox *automatically* by augers and/or belt conveyors.
Semi-automatic systems achieve some cost savings by using on-grade fuel storage (instead of below grade), and . . .
... typically use a small front-end loader, tractor or skid-steer (Bobcat) to load a day’s worth of fuel into a “day bin.”

There is a trade off between initial investment cost and annual operating cost.
Chip- and hog fuel-fired systems are more expensive to build and install than pellet-fired systems, and are most appropriate in larger applications. Relatively speaking, the fuel is generally lowest in cost. And while dry fuel is better than wet fuel, chips and hog fuel will not physically deteriorate if they get wet, as do pellets.
“Simple Payback Period (SPP)” is a Simple Measure of Cost Effectiveness

(PV, NPV, IRR, and LCCA are more detailed financial analysis tools)

Simple Payback = Total Project Cost
                    Annual Fuel Cost Savings

“No-Brainer”                        SPP -- 5 years or less
Highly feasible                     SPP -- 5 to 10 years
Medium Payback                      SPP -- 10 to 15 years
Long-term investment                 SPP -- 15+ years

Most facilities realize a 25 to 50% reduction in annual fuel costs
QUESTIONS ???
Daniel J. Parrent
R10 Biomass & Forest Stewardship Coordinator
USDA Forest Service, State & Private Forestry
161 East 1st Ave, Anchorage, AK 99501
Tel: (907) 743-9467
E-mail: djparrent@fs.fed.us