Use of Woody Biomass for Heating

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Use of Biomass from Logging Slash and Fuel Reduction Treatments for Energy Generation

- Key issues: Handling and transportation costs, too expensive to transport long distances

**Options:**
- Utilize resource in rural communities near where it is produced (heat &/or electricity)
- Process biomass into a more energy dense fuel (bio-oil, pellets, etc.) that can be economically transported
Use of Woody Biomass for Heating in Rural Communities

• Technology is readily available
• Has been done successfully in other places (VT, MT, Europe, etc.)
• The economics can be very favorable
• Wide range of applications
  schools, hospitals, state facilities, offices, greenhouses
  20,000 to 750,000 square feet
• Benefits - economic, environmental, forest management, fire safety
Use of Woody Biomass for Heating
Must be practical and economical

Heating Fuel Cost Comparison
($ per delivered MMBtu)

- Fuel oil
- Natural gas
- Propane
- Electricity
- Pellets
- Hardwood chips


$35.00
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00

$/MMBtu
Use of Woody Biomass for Heating

Life Cycle Cost Analysis

**Key Assumptions**
- 100,000 square feet
- 40,000 gallons oil @ $2.10/gallon
- Wood cost = $40/ton
- $650,000 financed over 20 years @ 5.5%
- Offsetting 85% heating oil
- No cost share

<table>
<thead>
<tr>
<th>First Year Fuel Savings</th>
<th>$31,420</th>
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<tbody>
<tr>
<td>Positive Cash Flow</td>
<td>Year 10</td>
</tr>
<tr>
<td>Simple Payback</td>
<td>11.7 years</td>
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<tr>
<td>30 Year Net Present Value of Savings</td>
<td>$131,450</td>
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Biomass Heating Systems

- Fuel Storage
- Fuel Conveyance
- Combustion and Heat Transfer
- Gas Exhaust and Ash Removal
- Heat Distribution
Types of Biomass Heating Systems

• Wood Chip Fired Boilers
  ≥ 1 MMBtuh economical (≥50,000 sq.ft.)
  steam or hot water, automated

• Pellet Fueled Boilers
  ≥ 50 kBtuh to 400 kBtuh, hot water
  automated, smaller footprint, more expensive fuel

• Cordwood Fired Boilers
  50 kBtuh to 300 kBtuh
  manual loading, least expensive
Wood Chip Fired System - Storage
Darby, MT

- 3 MMBtuh steam boiler
- Mfg: Messersmith
- $650,000 installed cost
- Heat 82,000 sq.ft.
- Serve 470 K-12 students
- Burn 750 tons/yr wood chips
- Replaced fuel oil boilers
- At fuel oil cost of $1.85/gal expect a 10 yr payback
- System has worked well
Wood Chip Fired System - Storage / Conveyance
Darby, MT
(traveling auger)
Wood Chip Fired System - Conveyance
Darby, MT
Wood Chip Fired System - Conveyance
Darby, MT (metering bin)
Wood Chip Fired System - Firebox
Darby, MT
Wood Chip Fired System -
Firebox & Boiler
Darby, MT
Wood Chip Fired System - Heat Distribution
Darby, MT
Wood Chip Fired System -
Heat distribution via insulated underground pipe
Darby, MT
Pellet Fueled System - Silo Storage
Townsend, MT (Tarm system)
Intended to run on whole tree pellets
Pellet Fueled System - Conveyance
Townsend, MT (flexible auger)
Pellet Fueled System - Firebox
Townsend, MT
Cordwood Gasification Boiler (GARN, Tarm, Greenwood) require seasoned wood
Cordwood Gasification Boiler
(GARN, Tarm, Greenwood)
Cordwood Gasification Boiler
(Greenwood)
Cordwood Gasification Boiler (Greenwood)
Fuel Issues - Supply and Quality

Most common problems are related to fuel issues

Desire a clean, consistent, uniform fuel supply
• Moisture
• Composition (bole wood vs. bark and needles)
• Cleanliness (free of dirt and rocks)
• Size and shape (uniform size, min. overs/unders)

Poor fuel quality = conveyance & combustion problems

Systems can be designed to handle a given fuel type, problems can occur if fuel changes

Slash and fuel reduction biomass is more varied, poses challenges
Other Requirements

- Need adequate, reliable, sustainable fuel supply
- Need teamwork and good communication
- Require more O&M than fossil fuel fired boilers
- Require back-up heating system
- Air quality: net benefits, involve AQMD early on
How Can We Move Forward?

• Look to other successful programs (VT, MT)

• Develop a couple of successful demo projects (identify opportunity, build team, find funding, install systems)

• Develop local Fuels for Schools type program (provide guidance and technical support, facilitate projects, access funding, assess market, identify prime opportunities)
Resources

Local
Humboldt State University (SERC, Forestry)
Six Rivers National Forest
Resource Conservation & Development Council
Resource Conservation Districts
Fire Safe Councils
UC Cooperative Extension
Redwood Coast Energy Authority

National
Fuels for Schools Program (western states)
Biomass Energy Resource Center (Vermont)
Contact Information

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