Itasca Community College
Cost Effectiveness of Woody Biomass as a Heat Source

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Itasca Community College

Grand Rapids, MN

- ~ 1000 Students
- A.A. & A.A.S Degrees
- Programs in:
  - Engineering
  - Natural Resources
  - Power Generation

Minnesota State Colleges and Universities System - MNSCU
Forest Region of Minnesota

Midwest Biomass Resources
Itasca Campus

- 3.5 MW Hot water district heating system
- 6” loop for main campus and 3” loop for engineering building
Itasca Community College Woody Biomass Project

**Objective**: Demonstrate the Effective Use of Woody Biomass for Heating a Mid-Sized Facility

**Purpose**: Supporting the Wood Product Industry

The Boiler - Phase 1:
Development of Wood Boiler for Applied Research

The Materials - Phase 2:
Examine Woody Biomass Fuel Sources and Develop Procurement Options

The Future - Phase 3:
Upgrade Boiler Facility
Demonstration Site – Educational Cooperative
The Boiler: Duel Boiler System

Existing Natural Gas Boiler

• Current Natural Gas Pricing
  – $0.5386/Therm
  – $5.39 per million Btu (MMBtu).

• ICC is on an interruptible gas pricing plan

• ’08-’09 $1.19/Therm
The Boiler: Duel Boiler System

Wood Chip Boiler

- Burnham Three Pass Generator
- Rated: 12.6 MMBtu/hour
- Peak: 5.2 MMBtu/hr
- 1 TPH at full fire
- Boiler Turndown 2:1

Assuming 75% gas boiler efficiency and 55% wood boiler efficiency
Fuel Use and Economic Impact

Wood Chip Boiler

- **2008-2009**
  - $1.19 therm natural gas
  - $56/ton wood chip
  - 492 green tons
  - $27,552 into local economy
  - Annual Savings of $13,470

- **2009-2010**
  - 437 green tons
  - $24,909 into local economy
The Materials

BAU feedstock used during the 2008/09 and 2009/10 heating season
- Debarked, chipped and screened roundwood
- Paper Quality/Pharmaceutical Grade Chips
- 40-50% Mc_{wet}
- Value delivered $56.00/ton
### The Materials

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Moisture Content</th>
<th>Heat Value as Received (Therms/Ton)</th>
<th>Price/Ton</th>
<th>$/Therm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Q Chips</td>
<td>50.60%</td>
<td>70.00</td>
<td>$56.00</td>
<td>$0.80</td>
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<tr>
<td>Balsam</td>
<td>59.60%</td>
<td>40.00</td>
<td>$32.00</td>
<td>$0.80</td>
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<tr>
<td>Birch</td>
<td>44.40%</td>
<td>60.00</td>
<td>$32.00</td>
<td>$0.53</td>
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<tr>
<td>Jackpine/ Balsam '07</td>
<td>46.49%</td>
<td>80.00</td>
<td>$32.00</td>
<td>$0.40</td>
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<tr>
<td>Hardwood/ Softwood Chips</td>
<td>47.70%</td>
<td>80.36</td>
<td>$32.00</td>
<td>$0.40</td>
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<tr>
<td>Green Aspen</td>
<td>41.80%</td>
<td>87.20</td>
<td>$32.00</td>
<td>$0.37</td>
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<tr>
<td>Jackpine/ Balsam '09</td>
<td>41.80%</td>
<td>89.11</td>
<td>$32.00</td>
<td>$0.36</td>
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<tr>
<td>Aspen (3yr dry)</td>
<td>36.20%</td>
<td>95.90</td>
<td>$32.00</td>
<td>$0.33</td>
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<td>Hardwood Tops</td>
<td>39.30%</td>
<td>96.21</td>
<td>$32.00</td>
<td>$0.33</td>
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<tr>
<td>Grind Wood</td>
<td>31.10%</td>
<td>105.28</td>
<td>$32.00</td>
<td>$0.30</td>
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</tbody>
</table>

Examination of woody fuel sources

1. Characterization of typical woody residue materials during the 2009-2010 season
2. Develop bids for supply of direct from forest

Thermal energy was analyzed by the NRRI lab in Coleraine, MN.
The Materials

Procurement

1. Chip quality
   - Size of material
   - Bark content
   - Moisture content
The Materials

Procurement (cont.)

2. Delivery time
   - Mobilization
   - Shut down/breakdown
   - Break-up
Procurement (cont.)

3. Volume
   - Range/Min-Max
   - Scaling

4. Break-up demands

Results: Three competitive bidders at ~$30.00/ton
The Future

Upgrade Boiler – Proposal for Funding
(2012 FVB Study)

• Annual Operating Cost Savings vs. Natural Gas
  – $14,434 Year 1
  – $40,116 Year 20
  – Total Savings $331,000
  – $15,000 Annual Fuel Purchase in Local Economy

• $887,000 Capital Investment

• 2014 Capital Bonding Request
The Future

Demonstration Site: Upgraded Boiler

HOTAB Eldningsteknik AB: 700 kW Biomass Boiler Plant
LIN-KA 700kw (2.39 MMBtu) High Moisture Boiler
The Future

Utilizing information from the study

• Skogforsk: Educational Cooperative
  – Demonstration Site – Upgraded Boiler

• Expand Heating District to the University of Minnesota – North Central Research and Outreach Center

• Woody Biomass Education
Questions

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• 2.8 MMBtu/hr (817 kW) with a fuel moisture content of 45%, would provide about 90% of the heat energy requirements for either scenario. The existing natural gas boiler would provide peaking capacity and warm weather capacity when the turndown limits of the biomass boiler are reached.
Current System

- Walking-floor hopper
- Auger Feed System
Current System cont.

- Day Hopper
- Injection System
- Slanted Fire Grate
- Combustion Air Supply
Current System cont.

- Heat Exchangers
- Forced Air Exhaust
- Natural Gas Boiler