Small Scale Woody Biomass
Successes, Challenges &
Lessons Learned

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US Forest Service
Existing Technologies

- Heat or Cooling or Power
  Or combinations
- Ground wood
- Chipped wood
- Pellets
- Chunkwood
- Scale small to large
Windbreaks as Wood Fuel Source

• Change cost to revenue?
• Blend conservation w/ product from windbreak
• Develop a rotating line of trees harvest every few years?
• One more source among many
  - Urban wood
  - Cedar encroachment
  - Woody riparian zones
  - Wood lots
Existing Successes

Chadron State College – 17 yr
University of Idaho -25 yr

District Energy
Industry – Wood Products, Potatoes, Beer
Institutional & Commercial

Saw/Pulp Mill CHP- decades
Darby, MT K-12 - 8 yr
Chip Facility

Darby, MT
3 schools
3.3 mill btu/hr
Messersmith
Darby, MT
$850k retrofit

Offset Fuel Oil –
52k gal/yr @ $3/gal

800 tons wood chips
@ $42/green ton

Saved $100-140k/yr
for past 4 years
Pellet Systems

- Solagen
- Replaced Fuel Oil
- 750k btu/hr
- Utility grade pellets
Poultry Houses

- Pellets 32 t vs. Propane 6k gal
- 95k chicken houses
- 35k turkey houses
- Synergistic benefits for poultry
- < 4 year payback
- Opportunities to link wood energy to other farm/ ranch & community benefits
Harney Co. Hospital – Burns, OR
CTA Group

- 55k sq ft
- KOB 500k btu/hr
  ~$300k installed
- 100 tons/yr
  ~$17,000/yr
- Boiler – “plug and play”
- Offsets Propane
  ~$36,000/yr
Case Study: New Facility: Wood Pellets

Springerville USDA-Forest Service Office
Forest Energy Systems
270,000 BTU hot water boiler (Tarm USA)
St. Maries, ID

- 600 k btu/ hr Solagen
- Oil to pellets ~$32k/ yr saving
- $500k convert
- Boiler, cyclone & silo <$100k
- Integration
Plains States

- Bismark, ND – 2 systems operating
- Riley Schools – KS - in design
- Arbor Day Foundation – Lincoln, NE
  - Short rotation poplar
  - Heating and and cooling
New Construction
Glacier High School

Integrated wood during design system cost ½ freestanding
Wood system meets ½ peak load 95% annual.
Offset natural gas saving $100k/yr – 6 mill btu/hr
Project cost: $550k
What are the Opportunities?

- Boiler databases by state
- MT - 6700 boilers
- UT - 12,000+
- MI - 65,000 boilers
  - 38k <750k btu/hr - 58%
  - 15k .75-2.5 mill btu/hr - 23%
  - 3k 2.5-5 mill btu/hr
- OR - 10,700 boilers
- NEW vs Retrofit
### Table 1. Oregon Boiler Size and Age

<table>
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<tr>
<th>Size in MM BTU</th>
<th>&lt; .750</th>
<th>.75 - 2.5</th>
<th>2.5 - 5</th>
<th>5 - 20</th>
<th>20+</th>
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<td>Manuf. date:</td>
<td></td>
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<tr>
<td>0-1950</td>
<td>586</td>
<td>42</td>
<td>16</td>
<td>10</td>
<td>28</td>
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<td>1950-1970</td>
<td>1523</td>
<td>234</td>
<td>130</td>
<td>69</td>
<td>67</td>
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<td>1970-1980</td>
<td>875</td>
<td>223</td>
<td>60</td>
<td>46</td>
<td>39</td>
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<td>1980-1990</td>
<td>1359</td>
<td>539</td>
<td>90</td>
<td>41</td>
<td>46</td>
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<tr>
<td>1990-2002+</td>
<td>2901</td>
<td>1239</td>
<td>289</td>
<td>130</td>
<td>108</td>
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<tr>
<td><strong>Total:</strong></td>
<td>7244</td>
<td>2277</td>
<td>585</td>
<td>296</td>
<td>288</td>
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</table>
When Pellets vs. Chips?
Finding the Sweet Spot

• Space to put a system in;
• Heat load 2 mill btu/hr breakpoint?
• Initial cost vs. fuel cost;
• Fuel consistency/energy density
• Ease of operation and maintenance
• Distance to supply;
Fuel Cost Comparison

- **Fuel Oil**: $3.25/gallon
- **Propane**: $2.00/gallon
- **Natural Gas**: $7.50/decatherm
- **Pellets**: $170.00/ton
- **Wood Chips**: $40.00/green ton

Each price is for $ per million BTU's.
What are the Barriers?

• Fuel Fuel Fuel Fuel
  - Quality of fuel
  - Who will deliver?
  - Reliability?

• Engineers, Architects, HVAC, Contractors

• Creating a market

• Financing projects

• Air emissions
  - Green House Gases
  - Particulate Matter
Storage

• Do you need it?
• Where to put it?
• Moisture management

Chadron, NE
Grinders, Chippers

Cost Initial vs maintenance
Size and production
Pellets/ Briquets

- Refined fuel
- Consistent low fuel moisture
- Flowability
- Higher energy density higher cost
Keys To Success

• Local Champion

• Support Team
  – Technical
    • Design/ Construction
    • Fuel quality, supply, delivery
  – Financial
  – Air Emissions

• Fuel, Fuel, Fuel
Take Home Messages

• Renewable - “If you don’t grow it, you mine it!”

• Developing a new Energy Sector - production, distribution, consumption

• Opportunity save $$ & Reduce fossil C

• New market - demand development

• Fuel Factors