Heating with Biomass
Win-Win for Local Economic Development and Energy Security

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www.pelletheat.org  www.biomassthermal.org
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Outline for Presentation

• Biomass #1 Renewable in America
• Recognition of Biomass as Fuel
• Wood Energy Growth – US Census Data
• Residential & Commercial Appliances
• Biomass for Advanced Biofuels?
• Comparing Biomass Costs to Fossil Fuels
• Emissions & Efficiencies

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Renewable Energy in 2010

Figure 1. Renewable energy consumption in the nation's energy supply, 2010

Total: 97.892 quadrillion Btu

- Petroleum 37%
- Nuclear Electric Power 9%
- Natural Gas 25%
- Renewable Energy 8%
- Coal 21%

Total: 8.049 quadrillion Btu

- Wind 11%
- Solar 1%
- Biomass 53%
- Geothermal 3%
- Hydroelectric 31%

Source: U.S. Energy Information Administration
Heating with Biomass
DOE ERRE Biomass Benefits

Biomass Program

EERE » Biomass Program » About the Program

Biomass Benefits
Increased production and use of biofuels will result in a variety of benefits to the nation, including:

- Improved national energy security
- Reduced reliance on foreign sources of energy
- Decreased threat of supply disruptions due to natural disasters, political instability, and price volatility
- Increased economic growth
- Economic opportunities for domestic, rural economies
- Decreased petroleum trade deficit
- Broad-based environmental benefits
- Reduced greenhouse gas emissions
- Reduced petroleum use in fuel production

http://www1.eere.energy.gov/biomass/biomass_benefits.html
Heating with Biomass
Wood #1 Growing Fuel

Key Points

• 65% Growth in PA, NY, OH, & MI

• 12MM Wood Energy Appliances & Stoves in 2005

• Most Affordable Renewable Energy Option for Most Americans

• New EPA Certified Stoves & Fuels

Courtesy of
Heating with Biomass
Wood Pellet Fuels

Key Points

• Today 8 MM barrels of oil are displaced with fuel pellets
• Potential for $4.5B from 500 MM tons of biomass
• Historically Stable Prices
• Safe, Clean, Easy Handling
• Today 1450 Direct Jobs
• Potential for 820,000 Direct Jobs

Courtesy of
Heating with Biomass
Wood Pellet Fuel Producers in 2011
Heating with Biomass
Residential Appliances

Key Points

• 2 Tons of Pellets or 2 Cords of Wood per Winter
• EPA Burn Wise Program
• Libby, MT Case Study
• Safe, Clean, & Affordable
Heating with Biomass
Commercial Applications – Poultry CAFO

Value & Dependability - The Eco-Choice Advantage
Heatilator Eco-Choice biomass furnace systems combine dependability and value from a brand you know and trust. Featuring quality technology that’s easy to operate and maintain, the BIO-500F is the cleanest and most efficient choice for growers. The simple heating system will provide energy savings, improved animal health and a better environment for years to come.

Increase integrator profit
- Improved growth rate and feed conversion
- Improved paw quality

Save the growers money
- 30-40% reduction in gas and electricity costs
- Dry heat for a dryer litter; average of $300 savings per house annually
- Payback for growers in just under 4 years
- Easy to use and maintain with standard auto-ignition convenience and optional auto ash cleaning

Improve animal health
- Improved animal health, improved livability
- Improved growth rate
- Dryer air results in lower ammonia levels, up to 60%

Protect the environment
- Reduced ammonia levels improve the working environment
- Reduced overall green house gas emissions
- Biomass is green, stable & sustainable
- Saves an estimated 100 barrels of foreign oil per year
Heating with Biomass
Commercial Applications – Poultry CAFO

- 95,000 poultry houses in U.S. growing 8.5 Billion Chickens & 300 Million Turkeys
- Potential to displace 570 MM gallons of LP with renewable biomass fuels
- Mass production of BIO-500F beginning in Iowa with sales rolling out in Southeast
Heating with Biomass
Institutional Opportunities

Campus Woodchip Heating System
Heating Capacity: 2.35 MW (8MMBtu/hr)
Annual Wood Fuel Use: 1,200-1,400 tons
Annual (Year) Savings: $2MM (2010)
Cost (Year) Installed: $4.3MM (2002)
Thermal Output: Hot water
Mount Wachusett Community College, Gardner, MA

Wood Pellet Heating System
Heating Capacity: 149 kW (0.5MMBtu/hr)
Annual Wood Pellet Use: 45 tons
Emissions Equipment: Flue gas recirculation
Year Installed: 2007
Thermal Output: Hot water
Harney County District Hospital, Burns, OR
Heating with Biomass
Woody Biomass for Biofuels vs Pellets
BioFuels Digest – Victory Plant

The Victory Plant Project

What is a Victory Plant? It produces ASTM-qualified advanced biofuels for $1.50 per US gallon (at the refinery gate) on an un-subsidized basis, can be constructed for no more than $4 per installed gallon of capacity in 24 months or less, and meets the low-carbon targets of the Renewable Fuel Standard.

Why are Victory Plants important? They dramatically reduce the investment, timelines, and risk for building advanced bioenergy projects - both in the US and around the globe.

Who can build a Victory Plant? Anyone.

Who supervises the standards? A Biofuels Council on Economics, Science, Technology. The Council will also seek, over time, to find cooperative ways for industry to reduce costs, improve carbon performance, and promote the benefits of Victory Plants.

How can I become involved, or learn more? You can join the Council, become a recognized builder of Victory Plants, or just learn more, by registering your interest here.
Heating with Biomass
Woody Biomass for Biofuels vs Pellets
Wood Pellet Fuel – Victory?

1 Ton of pellets = 2.8 barrels of oil
2.8 barrels of Oil = 117 g
Pellets @ $177/Ton = $1.50 g
AWF-VA Capacity = 8.5MM g
AWF-VA Capital = <$2/MM g

WHO’S THE VICTOR?

FIGURE 1.
FUEL EQUIVALENCIES

For heating, one ton of wood pellets equals...
- 120 gallons of heating oil
- 170 gallons of propane
- 16,000 ft³ of natural gas
- 4,775 kilowatt hours (kWh) of electricity

Paying $200/ton for pellets is the same as paying...
- $1.67 per gallon for heating oil
- $1.18 per gallon for propane
- $12.50 per (1,000 ft³) for natural gas
- $0.04 per kWh for electricity

Biomass Energy Resource Center 2007
# Heating with Biomass

## Comparing Wood to Fossil Fuels

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Fuel Unit</th>
<th>Fuel Price Per Unit (dollars)</th>
<th>Fuel Heat Content Per Unit (Btu)</th>
<th>Fuel Price Per Million Btu (dollars)</th>
<th>Heating Appliance Type</th>
<th>Type of Efficiency Rating</th>
<th>Efficiency Rating or Estimate</th>
<th>Approx. Efficiency (%)</th>
<th>Fuel Cost Per Million Btu (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil (#2)</td>
<td>Gallon</td>
<td>$3.79</td>
<td>136,690</td>
<td>$27.39</td>
<td>Furnace or Boiler</td>
<td>AFUE</td>
<td>76.0</td>
<td>70%</td>
<td>$35.03</td>
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<tr>
<td>Electricity</td>
<td>KWh/heat-hour</td>
<td>$0.114</td>
<td>3,412</td>
<td>$33.47</td>
<td>Furnace or Boiler</td>
<td>Estimate</td>
<td>96.0</td>
<td>98%</td>
<td>$34.15</td>
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<tr>
<td>Natural Gas</td>
<td>Therm 1</td>
<td>$1.03</td>
<td>100,000</td>
<td>$10.33</td>
<td>Furnace or Boiler</td>
<td>AFUE</td>
<td>76.0</td>
<td>70%</td>
<td>$13.24</td>
</tr>
<tr>
<td>Propane</td>
<td>Gallon</td>
<td>$2.79</td>
<td>91,333</td>
<td>$30.56</td>
<td>Furnace or Boiler</td>
<td>AFUE</td>
<td>76.0</td>
<td>70%</td>
<td>$33.16</td>
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<tr>
<td>Wood</td>
<td>Cord</td>
<td>$200.00</td>
<td>22,000,000</td>
<td>$9.09</td>
<td>Room Heater (vented)</td>
<td>AFUE</td>
<td>66.0</td>
<td>66%</td>
<td>$16.63</td>
</tr>
<tr>
<td>Pellets</td>
<td>Ton</td>
<td>$225.00</td>
<td>16,500,000</td>
<td>$13.64</td>
<td>Room Heater (vented)</td>
<td>AFUE</td>
<td>66.0</td>
<td>66%</td>
<td>$16.63</td>
</tr>
<tr>
<td>Corn (kernels)</td>
<td>Ton</td>
<td>$275.00</td>
<td>16,500,000</td>
<td>$16.67</td>
<td>Room Heater (vented)</td>
<td>AFUE</td>
<td>66.0</td>
<td>60%</td>
<td>$18.18</td>
</tr>
<tr>
<td>Kerosene</td>
<td>Gallon</td>
<td>$3.73</td>
<td>135,000</td>
<td>$27.63</td>
<td>Room Heater (vented)</td>
<td>Estimate</td>
<td>60.0</td>
<td>80%</td>
<td>$34.54</td>
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<tr>
<td>Coal (Anthracite)</td>
<td>Ton</td>
<td>$200.00</td>
<td>25,000,000</td>
<td>$8.00</td>
<td>Furnace/Boiler/Stove</td>
<td>Estimate</td>
<td>75.0</td>
<td>75%</td>
<td>$10.67</td>
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</tbody>
</table>

**NOTES:**
1. Natural gas is typically sold to residential customers in units of “therms,” but may be sold in units of hundreds of cubic feet (ccf).
2. One therm = 100,000 Btu, and is equivalent to about 97.376 cubic feet (or 0.974 ccf), when there are 1,027 Btu/ft³.
   To convert prices in $/Mcf (1,000 cubic feet) to $/therm, divide the $/Mcf price price by 10.27.
3. The heat content value for a cord of wood varies by tree species and is greatly affected by moisture content; 20 million Btu per cord is a rough approximation.
4. For definitions of Efficiency Ratings and referrals to where they can be obtained, click on the EFFICIENCY INFO tab below.
   Some types of heaters do not have efficiency ratings; the ratings in the yellow cells are comparable estimates for new appliances with basic features.
5. The default values are the minimum efficiency standards set by the U.S. Department Energy. Estimated “ratings” are provided for heating equipment for which there are no DOE standards.
6. Air-Source Heat Pump Ratings: The actual heating efficiency and seasonal performance of a “conventional” air-source heat pump may vary significantly from its rated heating season performance factor (HSPF). Below is a procedure for determining an adjusted HSPF for your location for an air-source
Biomass to thermal has the highest conversion efficiency.

Controlled wood emissions release less SO2, and GHG emissions than coal and natural gas.
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