Biomass Thermal
DC Summit
November 16, 2011

Heating with Biomass

Win-Win for Local Economic Development and Energy Security

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Pellet Fuels Institute
www.pelletheat.org

BTEC
Biomass Thermal Energy Council
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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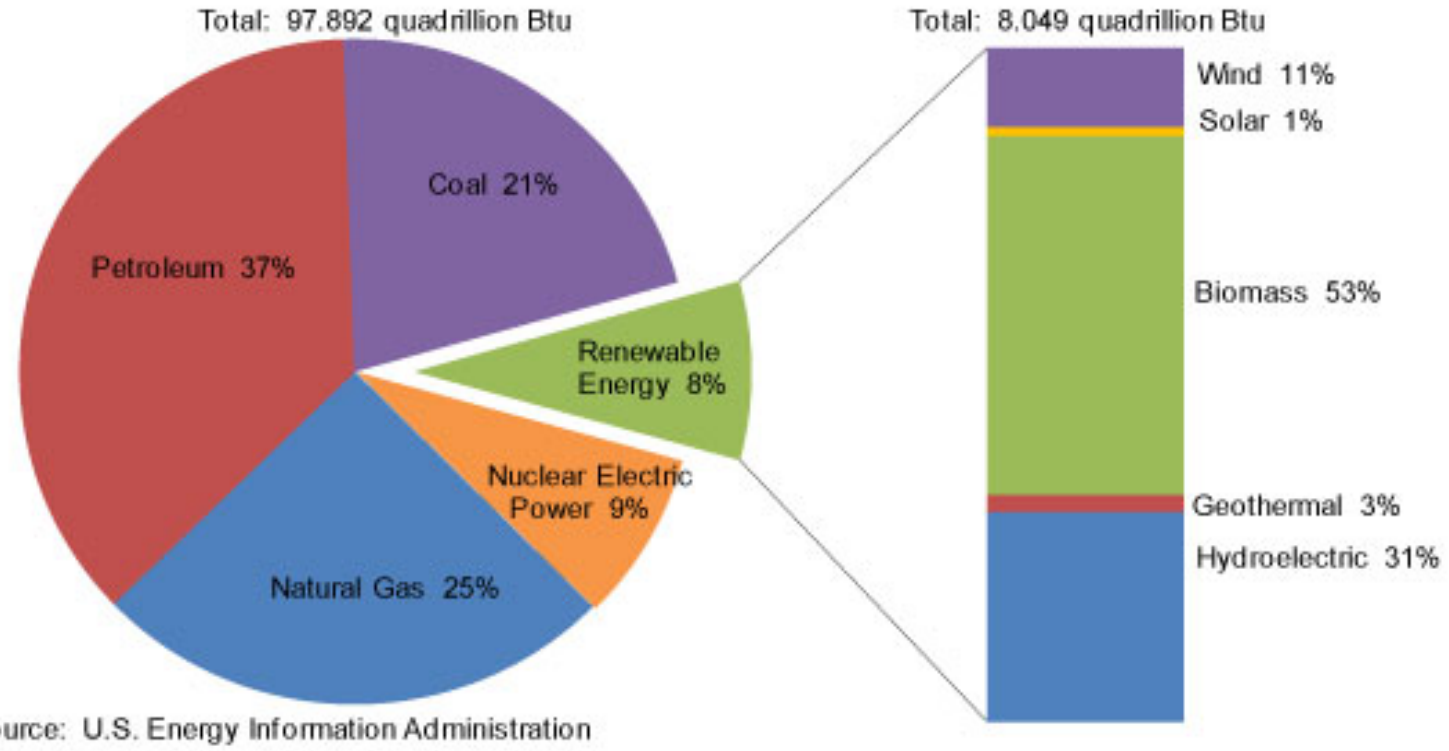
Renewable Energy in 2010

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



Source: U.S. Energy Information Administration

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DOE ERRE Biomass Benefits

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Biomass Program

HOME | ABOUT THE PROGRAM | RESEARCH & DEVELOPMENT | FINANCIAL OPPORTUNITIES | INFORMATION RESOURCES | NEWS

EERE » Biomass Program » About the Program

- Plans, Implementation, & Results
- Biomass Benefits
  - National Energy Security
  - Economic Growth
  - Environmental Benefits
- Biomass Policy
- Program Achievements
- Budget
- Program Partners
- International Activities
- Communications & Outreach
- Contacts

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

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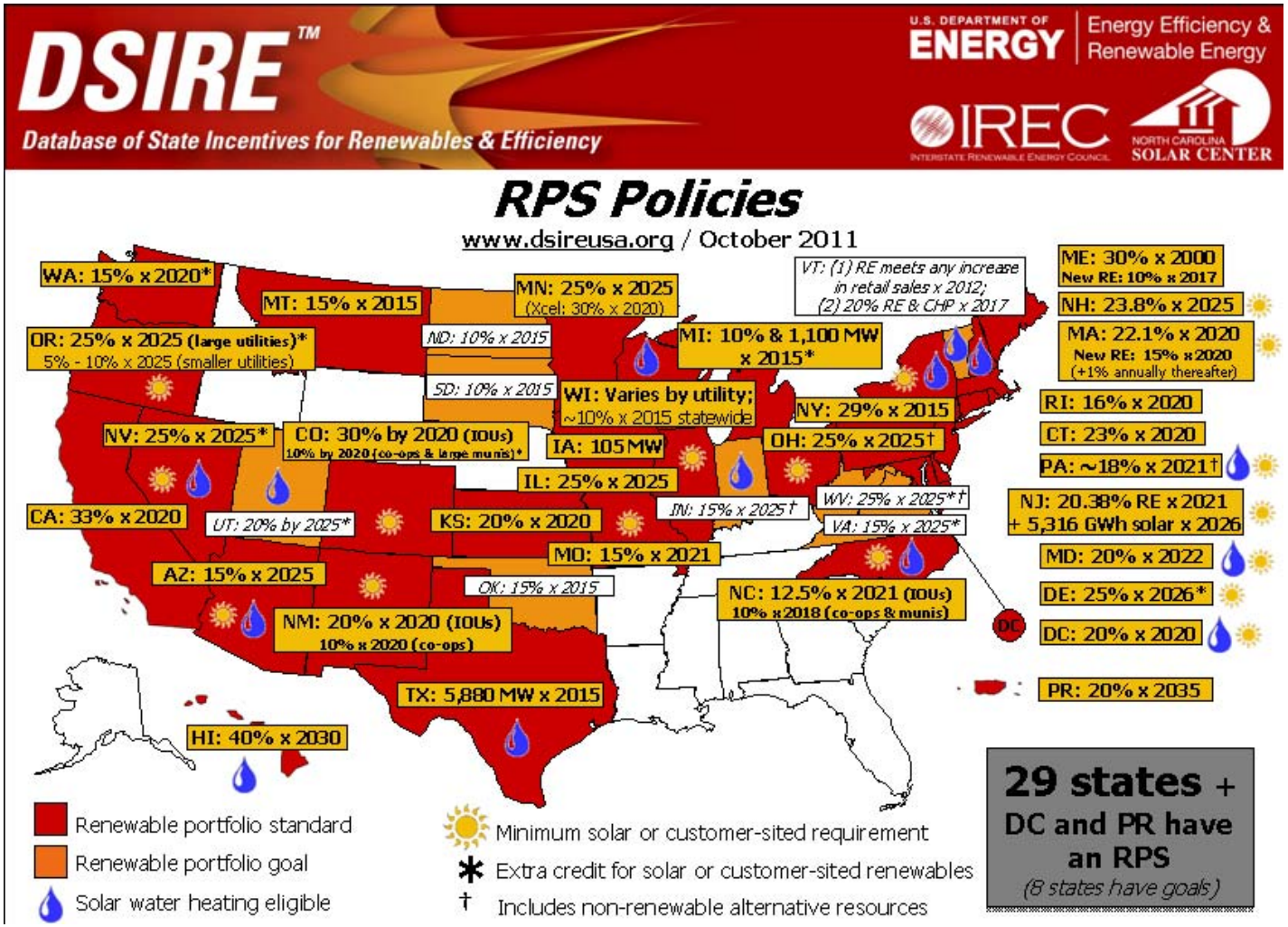
State RPS Policies in 2011



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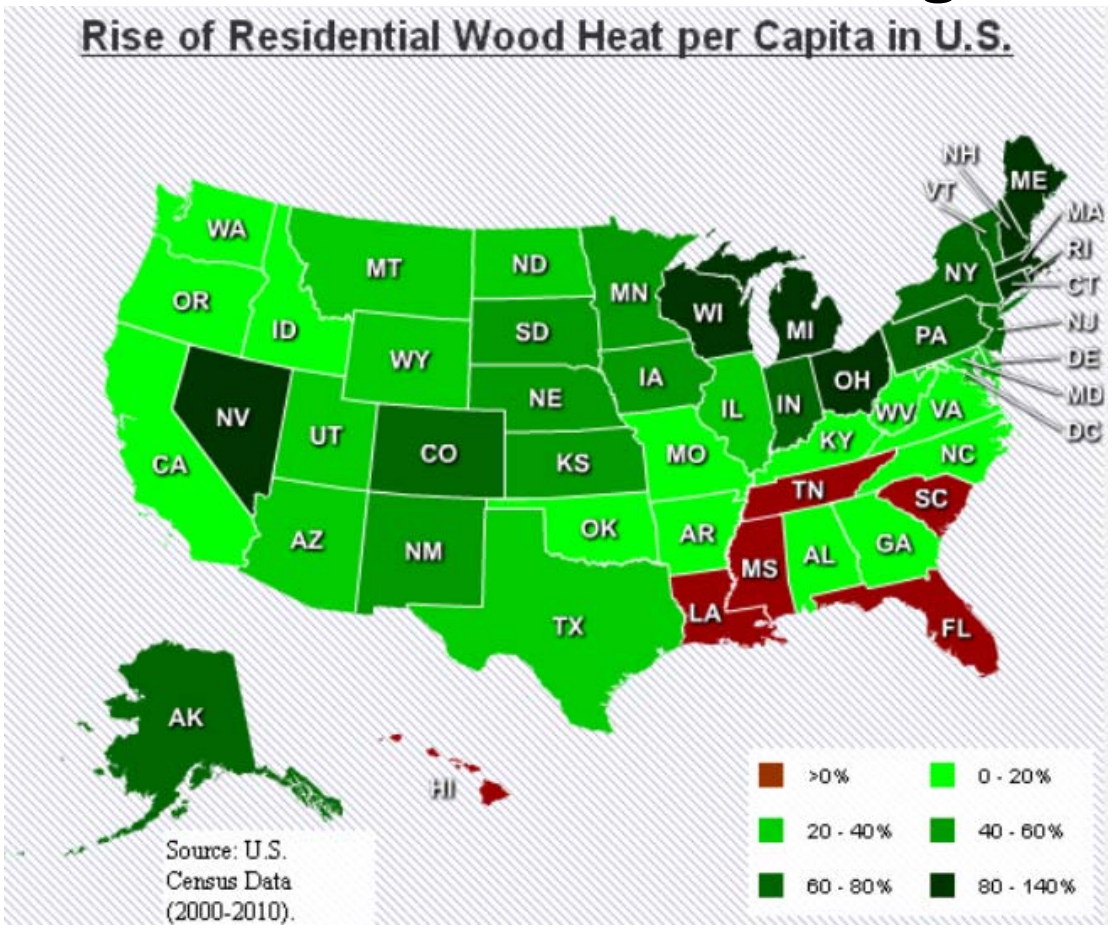
Wood #1 Growing Fuel



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

ALLIANCE FOR GREEN HEAT
clean, renewable & local

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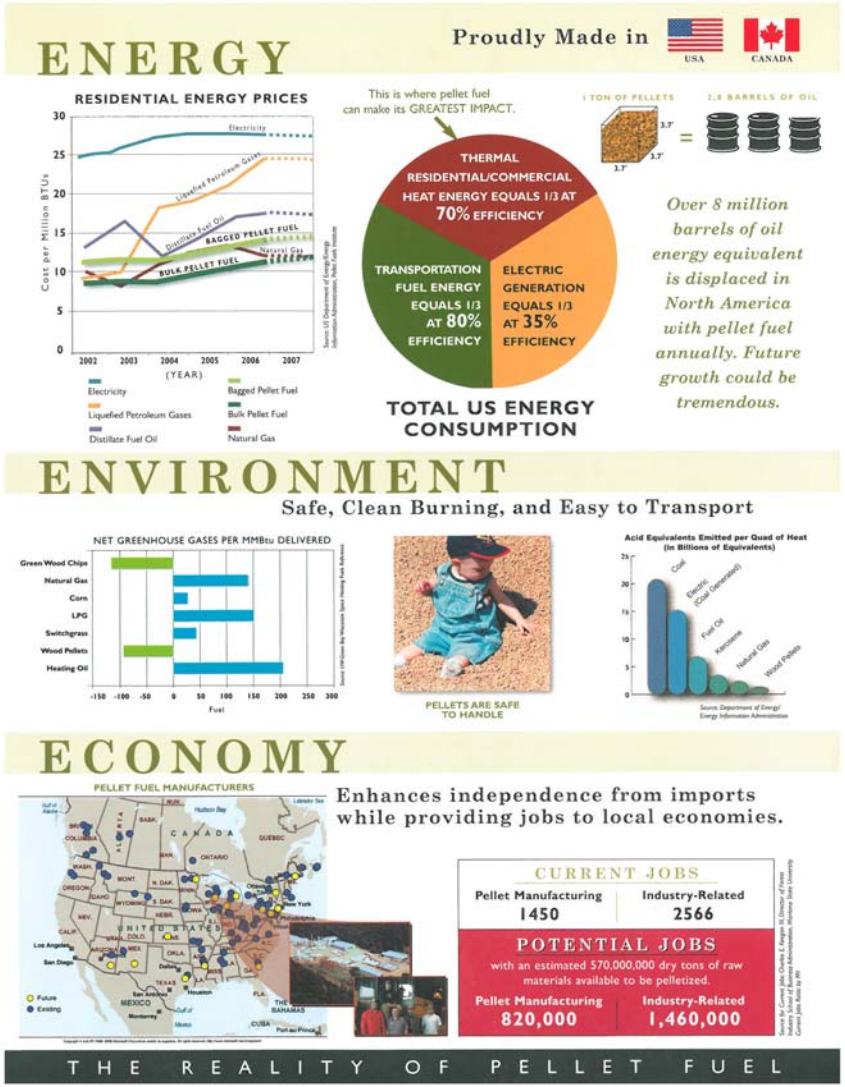
Wood Pellet Fuels



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 Pellet Fuels Institute

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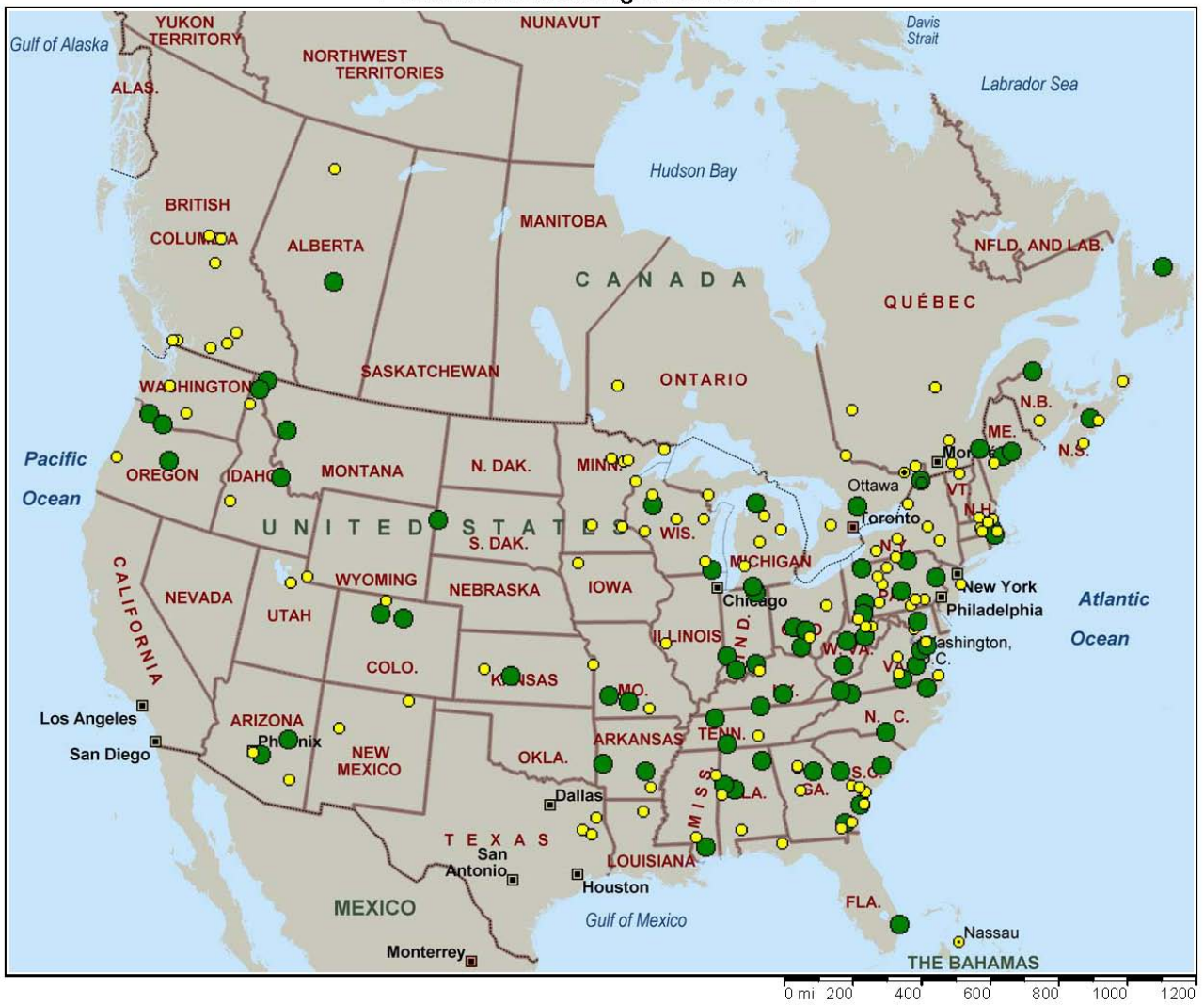
Wood Pellet Fuel Producers in 2011

Pellet Manufacturing Facilities 2011



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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

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Commercial Applications – Poultry CAFO

Heatilator ECOCHOICE

BIO-500F
pellet-burning furnace

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 integrater 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

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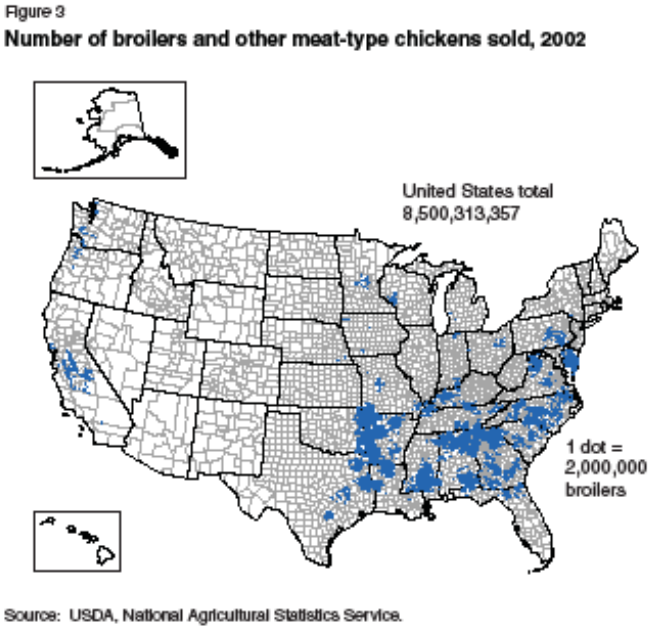

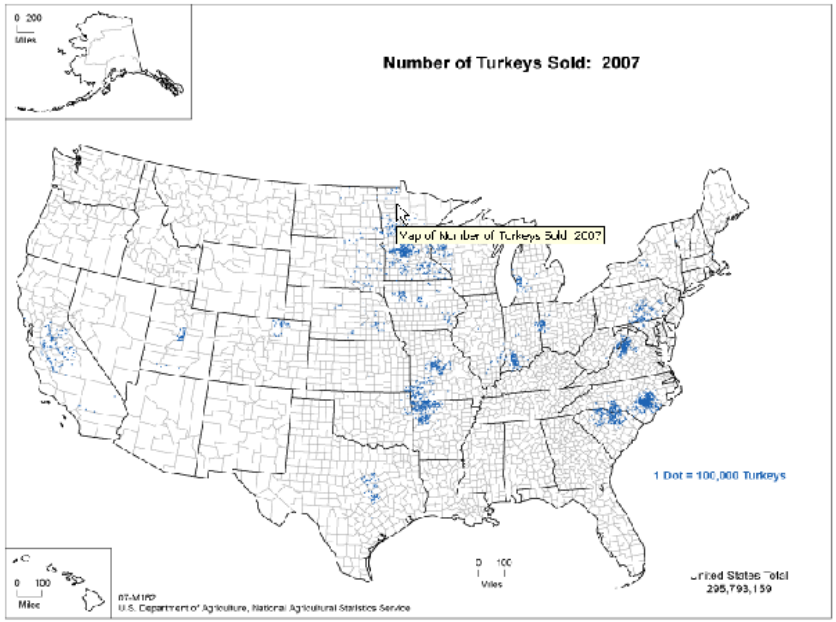

- 95,000 poultry houses in U.S. growing 8.5 Billion Chickens & 300 Million Turkeys
- Potential to displace 570 MM gallons of LP with renewable biomass fuels
- Mass production of BIO-500F beginning in Iowa with sales rolling out in Southeast

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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

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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.

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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 Capacity = <$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 ft^3 of natural gas
- 4,775 kilowatt hours (kWh) 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 ft^3) for natural gas
- $0.04 per kWh for electricity

Biomass Energy Resource Center 2007

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Comparing Wood to Fossil Fuels

Fuel Type	Fuel Unit	Fuel Price Per Unit (dollars)	Fuel Heat Content Per Unit (Btu)	Fuel Price Per Million Btu (dollars)	Heating Appliance Type	Type of Efficiency Rating [4]	Effiency Rating or Estimate [5]	Approx. Efficiency (%)	Fuel Cost Per Million Btu (dollars)
Fuel Oil (#2)	Gallon	$3.79	138,690	$27.33	Furnace or Boiler	AFUE	78.0	78%	$35.03
Electricity	KiloWatt-hour	$0.114	3,412	$33.47	Furnace or Boiler	Estimate	98.0	98%	$34.15
					Air-Source Heat Pump [6]	HSPF [6]	7.7	226%	$14.83
					Geothermal Heat Pump	COP	3.3	330%	$10.14
					Baseboard/Room Heater	Estimate	100.0	100%	$33.47
Natural Gas [1]	Therm [2]	$1.03	100,000	$10.33	Furnace or Boiler	AFUE	78.0	78%	$13.24
					Room Heater (Vented)	AFUE	65.0	65%	$15.89
					Room Heater (Unvented)	Estimate	100.0	100%	$10.33
Propane	Gallon	$2.79	91,333	$30.55	Furnace or Boiler	AFUE	78.0	78%	$39.16
					Room Heater (Vented)	AFUE	65.0	65%	$47.00
Wood [3]	Cord	$200.00	22,000,000	$9.09	Room Heater (Vented)	Estimate	55.0	55%	$16.53
Pellets	Ton	$225.00	16,500,000	$13.64	Room Heater (Vented)	Estimate	75.0	75%	$18.18
Corn (kernels)	Ton	$275.00	16,500,000	$16.67	Room Heater (Vented)	Estimate	68.0	68%	$24.51
Kerosene	Gallon	$3.73	135,000	$27.63	Room Heater (Vented)	Estimate	80.0	80%	$34.54
Coal (Anthracite)	Ton	$200.00	25,000,000	$8.00	Furnace/Boiler/Stove	Estimate	75.0	75%	$10.67

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 97.378 cubic feet (or 0.974 ccf), when there are 1,027 Btu/cf.
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 approximatio

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*

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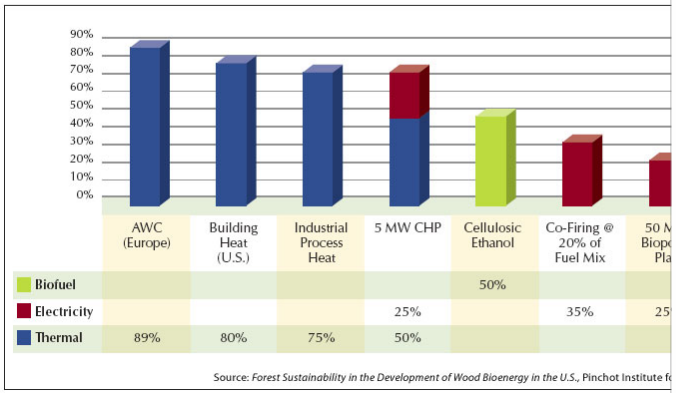
Emissions & Efficiency

Relative biomass conversion efficiency of bioenergy technologies.



Source: *Forest Sustainability in the Development of Wood Bioenergy in the U.S.*, Pinchot Institute f

- Biomass to thermal has the highest conversion efficiency
- Controlled wood emissions release less SO2, and GHG emissions than coal and natural gas

Table 2

Forest Biomass and Air Emissions

Controlled Emissions Comparison

Pollutant	WOOD, LB/MMBtu Spreader-stoker	COAL LB/MMBtu	NATURAL GAS combined cycle turbine, LB/MMBtu	WOOD slash burn LB/MMBtu
NOX	0.1	0.07-0.38	0.0082	0.3
CO	0.35	0.025	0.0050	12.4
SO2	0.025	0.18-0.044 (varies based on control technology)	0.0028	Not available
VOC	0.0052	Not normally limited	0.0014	0.8
PM	0.01-0.02	0.0009-0.02 (range of permitted values)	0.0083	1.3 (PM >10 microns only)
HCl	Not normally limited	Not normally limited	Not normally limited	
Hg	Not normally limited	0-90% reduction required, varies by state	Not normally limited	
Mn	Not normally limited	Not normally limited	Not normally limited	
GHG emissions (CO2e)	211.39 (including CO2) 4.45 (excluding CO2 as carbon neutral)[1]	214.91	117.76	
CO2	206.94	214.04	116.97	206.94
CH4	0.0200	0.0022	0.0084	
N2O	0.0130	0.0015	0.0020	

Source: Ecology 2/24/2010

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