




De-mystifying wood as a renewable fuel

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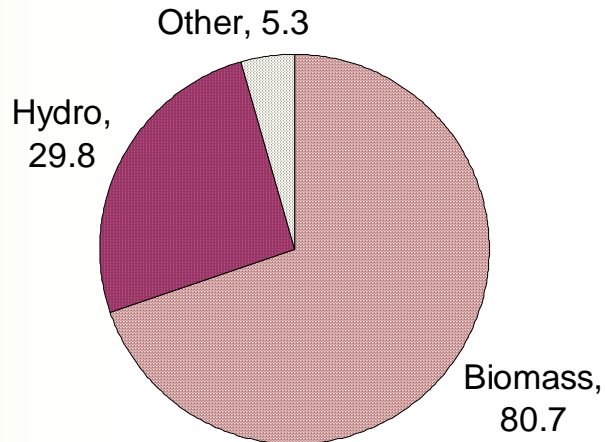
Penn State Bioenergy
Short Course Series
2010



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- <http://energy.extension.psu.edu>
 - <http://www.bioenergy.psu.edu>
 - <http://www.pafuelsforschools.psu.edu>



Wood – the Dominant Renewable Fuel



Why Use Wood Fuel?

- Price

Fuel and Price	Typical Price	HHV	% eff	\$/GJ
Clean, Green Wood Chips, 40% moisture	\$50 per ton	12.1 MJ/kg	80	\$ 5.73
Natural Gas,	\$12 per 1000 cf	38.3 MJ/m ³	80	\$ 15.35
Fuel Oil,	\$2.50 per gallon	36.4 MJ/litre	80	\$ 22.78
Electricity (resistance heat)	\$0.12 per kWh	3.6 MJ/kwh	100	\$ 33.33





Why Use Wood Fuel?

- Availability

“Between 1963 and 2007 the estimated net volume of growing stock on forestland in the northeastern region increased from 76.9 billion cu ft to 136.6 billion cu ft – a 78% increase”

Marc McDill, Penn State School of Forest Resources



Why Use Wood Fuel?

- Ecology

Typical Wood Fuel Options

- Roundwood



Typical Wood Fuel Options

- Wood Chips



Typical Wood Fuel Options

- Shredded Material – hog fuel



Typical Wood Fuel Options

- Wood Pellets



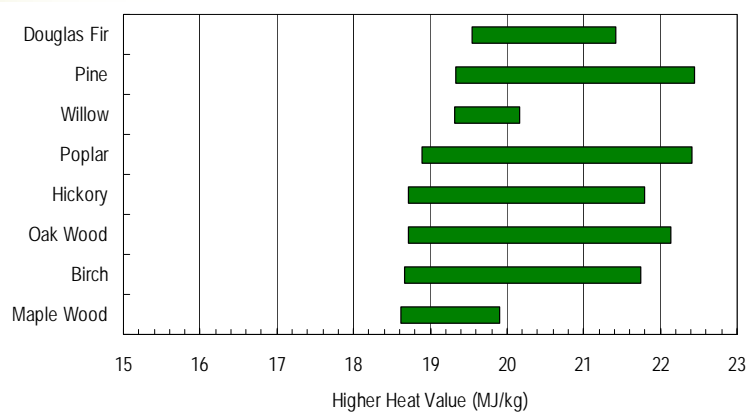
Typical Wood Fuel Options

- Sawdust



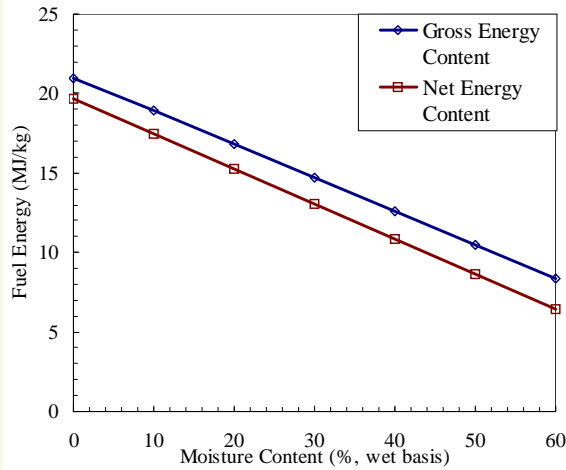
Performance Characteristics of Wood Fuel

- Energy Content



Performance Characteristics of Wood Fuel

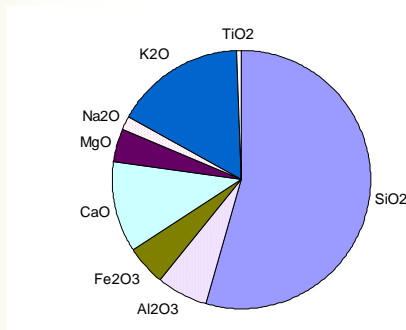
- Moisture Content



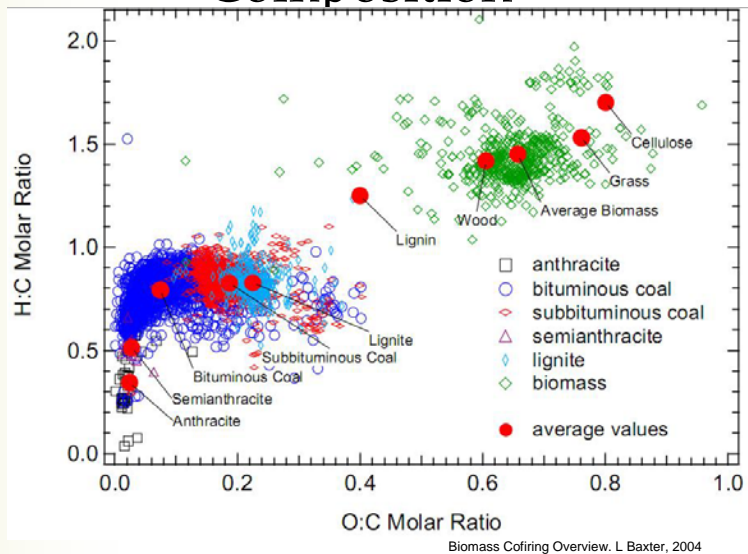
Performance Characteristics of Wood Fuel

- Ash Content

- Wood generally <1% ash
- Bark higher, 1-3% ash



Wood Elemental Composition



Bulk Density

Fuel Type	Bulk Density (kg/m ³)
Wood Chips, green	~ 480
Sawdust, green	~ 400
Wood Pellets	~ 600
Stacked Cordwood, air dry	~ 300

Performance Characteristics of Wood Fuel

- Storage Stability



Obtaining Wood Fuel for Commercial Facilities

The screenshot shows the website for "PENNSYLVANIA FUELS for SCHOOLS and BEYOND". The header features a logo with a tree and the text "Promoting renewable energy to Pennsylvania's schools and businesses". Below the header is a navigation menu with links for HOME, ABOUT US, PROGRAM GOALS, PEOPLE, PARTNERS, RESOURCES, CASE STUDIES, and RELATED LINKS. The "RESOURCES" section is highlighted and contains a "Partial List of Biomass Suppliers". A note states: "This list includes companies that biomass. Note: The following is for information purposes only and does not constitute an endorsement of any business to the exclusion of others not listed." The list of suppliers includes:

Rick Bailey Bailey Tree Service/Logging 7414 Camp Meeting Road New Tripoli, PA 18066 610.298.3064 Serve: Lehigh/Various Surrounding Counties	James Okzak Okzak Lumber Co., Inc. 192 Ridge Ave. PO Box 301 Youngstown, PA 15696 (724) 539-3846 Serve: Westmoreland
Ronald Bowers Bowers Lumber Co., Inc. 8530 Colonel Drake Hwy Mahaffey, PA 15757 814.277.9956 Serve: Clearfield/Various Surrounding Counties	Nature Conservancy PO Box 55 Long Pond, PA 18334 (570) 643-7922 ext. 12 Serve: Monroe, Lackawanna, Clinton, Chester
Richard Bromden	Todd A. Parson





Fuel Specifications

- Particle Size max/ min
- Fuel composition
- Prohibited materials
- Moisture content
- Delivery mode, reliability



Other Unique Aspects of the Wood Fuel Business

- DIY Options
- Opportunity Fuel Possibilities
- Supplier Relationships

