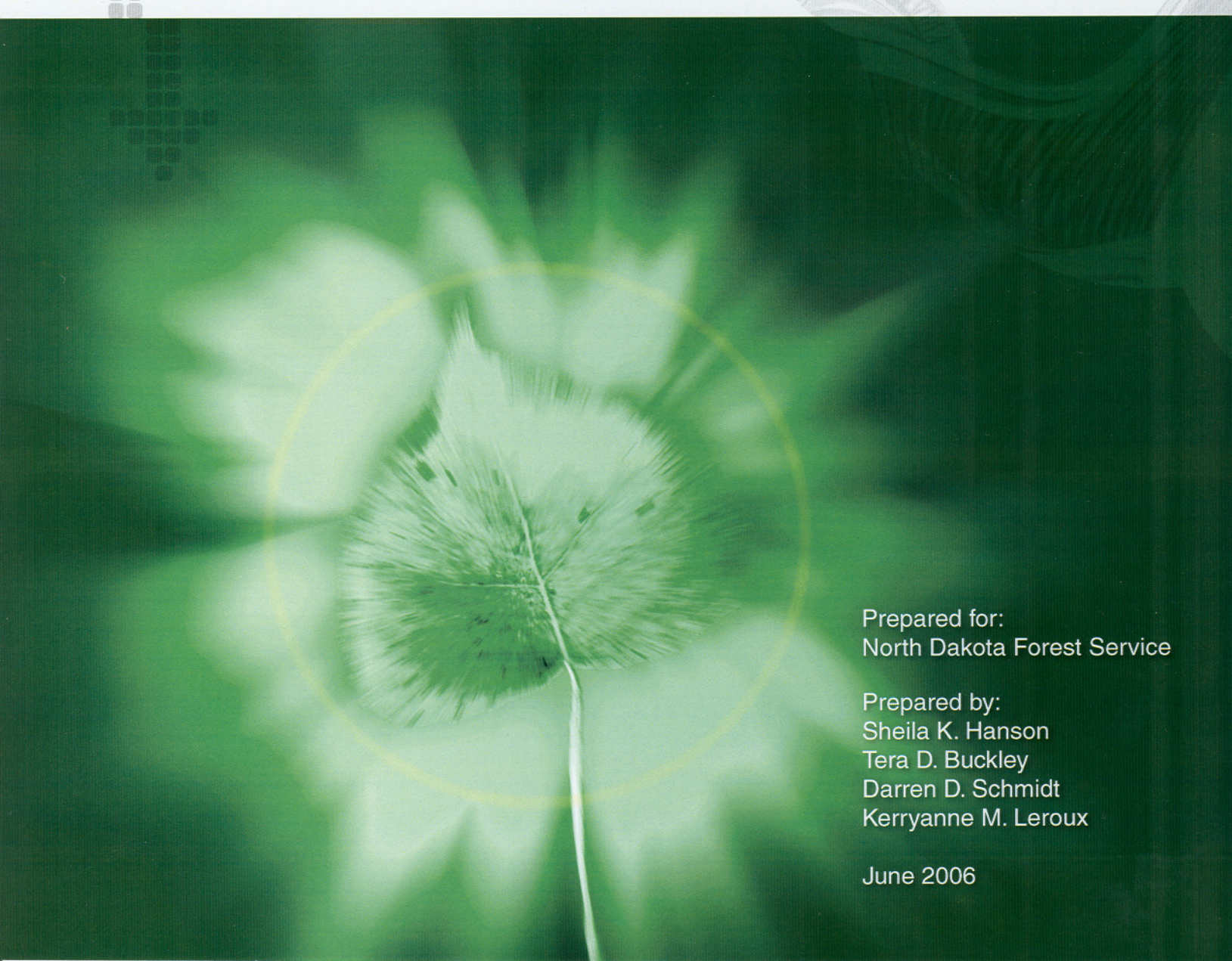
EERC
Energy & Environmental Research Center®
UND University of North Dakota
Grand Forks

GUIDE TO COMMERCIAL BIOMASS ENERGY CONVERSION SYSTEMS



Prepared for:
North Dakota Forest Service

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June 2006

DISCLAIMER

This document, prepared by the University of North Dakota Energy & Environmental Research Center (EERC), with sponsorship from the U.S. Department of Agriculture Forest Service through the North Dakota Forest Service. It is a resource for those interested in purchasing and using wood-fired biomass heating systems. The information contained in this document was gathered from manufacturers via company Web sites, promotional materials and technical data sheets, telephone interviews, and online databases. The product information was not verified. The EERC, nor any of its employees, does not make any warranty, expressed or implied, or assumes any legal liability nor responsibility for the accuracy, completeness, or usefulness of the information provided, or represents that its use would not infringe privately owned rights. Furthermore, the listing of products does not represent an endorsement by the EERC. In addition, because of the rapidly changing nature of the industry, the information contained in this document may become outdated, and the list is in no way exhaustive.

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INTRODUCTION

This *Guide to Commercial Biomass Energy Conversion Systems* was prepared for the North Dakota Forest Service to help facilitate the use of biomass energy in schools in North Dakota through the Fuels for Schools Program. The Fuels for Schools Program is an innovative venture between public schools and state and regional foresters of the Northern and Intermountain Regions of the U.S. Department of Agriculture Forest Service. This program helps public schools retrofit their fuel or gas heating systems to biomass heating systems, significantly reducing heating costs. The dramatic rise in the cost of fossil fuels creates a good opportunity for lower-cost biomass fuels, which benefit both schools and taxpayers in significant heating savings for these public facilities.

Fuels for Schools is a three-phase effort. The initial goal is to establish at least one demonstration project in each of the five states – Montana, Idaho, Nevada, Utah, and North Dakota. These demonstrations will gather monitoring data, become the model for future schools, and host tours for interested groups. The next goal is to facilitate the expansion of the program to 50 schools by 2008. Interested schools would be required to compete for federal grant assistance. The final phase would transition the Forest Service out of the primary funding role, where economics, awareness, and demand will begin to drive the program.

The first Fuels for Schools grant was to the Darby School District in Montana. The district provides heat to three schools with wood-burning boilers. This conversion reduced its fuel bill by about 43% during the first year of operation. The project requires about 500 tons of woody biomass per year, the by-product of about 50 acres' worth of fuel reduction treatments. Today, Montana has five biomass-heated schools and six new projects under way. Fuels for Schools demonstration sites are located in Bottineau, North Dakota; Bonners Ferry and Council, Idaho; and Ely, Nevada. There are other biomass-heated schools in Maine, Nevada, New Hampshire, New Mexico, South Dakota, and Vermont.

Utilization of biomass in public facilities presents a significant benefit both environmentally and economically. However, experience and support for solid-fuel furnaces, biomass in particular, is sparse and, in some cases, locally unavailable. This guide identifies regionally available manufacturers and engineering/consulting firms with appropriate capability to supply technology for firing biomass, specifically wood. This guide lists biomass combustion suppliers, biomass gasification suppliers, wood chippers and tub grinders, and engineering/consulting firms. It also contains a list of additional resources.

The technology suppliers listed in this guide sell commercially available technologies in North Dakota. Several of the suppliers are international; however, they still sell products in the United States. Numerous technologies are in the research and development stage; however, they were not included in this guide. Biomass combustion and gasification systems were limited to those capable of producing 1–20 MMBtu/hr. Wood chippers and tub grinders listed are capable of processing 5–20 tons/hr. Although a number of engineering/consulting firms are able to assist schools in the selection, permitting, installation, and operation of biomass energy conversion systems, only those with local biomass expertise were included.

BIOMASS COMBUSTION SYSTEMS

Advanced Recycling Equipment, Inc.

Address:	850 Washington Road Saint Mary's, PA 15857
Phone:	(814) 834-4470
Phone Toll Free:	(800) 611-6599
Fax:	(814) 834-3483
Web Address:	www.advancedrecyclingequip.com
E-Mail:	areinc@alltel.net
Contact:	Christine Newell, Sales
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Range, MMBtu/hr:	.75–50
Range, hp:	22.5–1500
Combusted Materials:	Wood (sawdust, particleboard, and bark, up to 50% moisture), agriculture by-products, animal waste and, other clean biomass
Product Name:	Challenger® Combustion System

The Challenger® Combustion System is fully automated, capable of maintaining a temperature within 3°–5° of a set temperature. The adjustable fuel feed and fan speed controls provide the proper mix of combustion air to fuel. The variable frequency drives allow the customer to burn fuel ranging from very dry to a moisture content of up to 50% without impacting the performance of the combustion unit. To achieve large capacities, multiple units can be combined to form a single system.

Warm-Air Unit (CCU403-A 1.5 MMBtu)

Challenger® Combustion Unit

Source: www.advancedrecyclingequip.com

AFS Energy Systems

Address:	PO Box 170 420 Oak Street Lemoyne, PA 17043-0170
Phone:	(717) 763-0286
Fax:	(717) 763-1066
Web Address:	www.afsenergy.com
E-Mail:	info@afsenergy.com
Contact:	Jay Clark, Vice President Sales
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Range, MMBtu/hr:	3.35–26.78
Range, hp:	100–800
Combusted Materials:	Wood (chips, hogged waste, hogged bark, sawdust, planer shavings, wood powder, and particleboard waste with 5%–55% moisture), gas, oil, or combination of gas and oil
Product Name:	AFS Energy Systems

AFS Energy Systems is a design-build engineering and manufacturing firm specializing in solid fuel combustion systems, dust collection systems, fuel storage, and material transfer systems. All systems are manufactured at the facilities (Advanced Fabrication Services) in Lemoyne, Pennsylvania. Installation, start-up, service, and client site training is provided by AFS Field Services Group.

AFS Systems and Equipment

- AFS wt/ft boilers 100 to 800 BHP, 20,000–75,000 pph in AFS Water Tube Boilers (Available in 15–300 psig steam and hot water)
- Pneumatic injector stoker systems
- Underfed stoker systems
- Wood gasification systems
- Wood fired hot air and heat source systems
- Complete emission control systems and retrofits
- Complete fuel handling and storage systems
- Dust
- Collection systems
- High- and low-pressure pneumatic
- Conveying systems
- Conventional gas, oil, and dual-fuel boiler systems
- Complete fuel-handling system
- Storage reclaim, conveyor, and dust collection systems
- High- and low-pressure pneumatic conveying systems

750 hp, 300 psig Wood-Fired Boiler System Installation

Wood-Fired Hot Air and Heat Source System

Source: www.afsenergy.com

Biomass Combustion Systems

Address:	67 Millbrook Street Suite 505 Worcester, MA 01606
Phone:	(508) 798-5970
Fax:	(508) 798-5971
Web Address:	www.biomasscombustion.com
E-Mail:	info@biomasscombustion.com
Contact:	Charlie Crary
Primary Activity:	Professional Services
Secondary Activity:	Manufacturer
Range, MMBtu/hr:	Boilers (3.34–40), Wood furnaces (0.45–0.8)
Range, hp:	100–1200
Combusted Materials:	Wood (3–45% moisture)
Product Name:	Horizontal Zone Grate Combustion System

Biomass Combustion Systems provides services for the biomass-to-energy industry, which includes evaluation, design, construction, cogeneration, and project management for industrial wood-fired boiler and furnace systems. The company produces a Horizontal Zone Grate Combustion System that is unique to the biomass combustion systems. It can be incorporated into new boilers and boiler retrofits.

Biomass Combustion Systems Wood-Fired Furnace

Source: www.biomasscombustion.com

Central Boiler

Address:	20502 160th Street Greenbush, MN 56726
Phone:	(218) 782-2575
Phone Toll Free:	(800) 248-4681
Fax:	(218) 782-2580
Web Address:	www.centralboiler.com
E-Mail:	info@centralfireplace.com
Contact:	Dennis Filer
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Range, MMBtu/hr:	0.25–2
Range, hp:	7.46–59.75
Combusted Materials:	Wood (pallets, remnants, cordwood, crates, etc.)
Product Name:	Pallet Burner

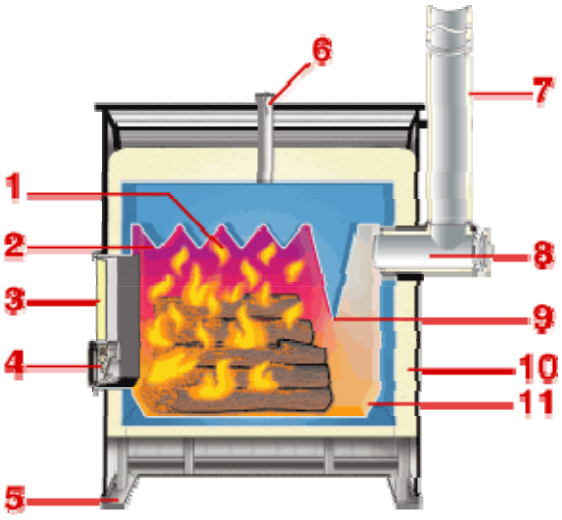
Central Boiler manufactures the Pallet Burner which is intended for high-capacity commercial or industrial use. This outdoor wood furnace is typically installed 30 to 200 feet away from a home or business and works with any existing heating system. A water jacket surrounds the furnace firebox, and heated water is circulated to the home or building through insulated underground tubes. Water-to-air or water-to-water heat exchangers or direct circulation conveys the heat into the forced-air furnace, boiler, or radiant floor heating system. This allows for normal thermostatic control of temperature. The furnace can heat multiple buildings and water. The product has a 1-year warranty. A concrete slab is required for the foundation. Fan draft options are available for all models.

Central Boiler has a network of authorized dealers throughout the United States and Canada.

Pallet Burner product specifications include:

Door:	54" × 50"
Firebox:	72" × 66" × 54"
Weight:	4880 lb
Water Capacity:	556 gallons

Pallet Burner



1. *Secondary burn area.*
2. *Ripple Top® heat transfer for ultimate heat extraction.*
3. *Insulated, cast iron door.*
4. *Automatic draft.*
5. *Skid base, no concrete base needed.*
6. *Vent design eliminates evaporation.*
7. *Type HT listed, factory built, all stainless chimney.*
8. *Large exhaust passage.*
9. *HeatLock Baffle™ traps heat and gases for complete combustion.*
10. *100% airtight, waterproof urethane insulation.*
11. *Tapered ash pan for easy cleaning.*

Source: www.centralboiler.com

Chiptec Wood Energy Systems

Address:	48 Helen Avenue South Burlington, VT 05403
Phone:	(802) 658-0956
Phone Toll Free:	(800) 244-4146
Fax:	(802) 660-8904
Web Address:	www.chiptec.com
E-Mail:	BobBender@chiptec.com
Contact:	Bob Bender, President
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.4–50
Range, hp:	12–1500
Combusted Materials:	Wood (chips, sawdust, shavings from 6–60% moisture), clean bio-fuel, agricultural and food processing residue, pallets, paper pellets, railroad ties, and other biomass wastes
Product Name:	CHIPTEC®

CHIPTEC® manufactures close-coupled gasifiers for existing boilers. CHIPTEC® gasifiers are able to adapt to a wide variety of heat exchangers and uses including hot water, steam, hot air furnaces, or steam turbines. CHIPTEC® gasifiers are essentially a sloping grate unit, and its heating systems are fully automated. CHIPTEC® biomass gasification products and services include:

- New biomass gasification systems
- Boiler retrofits
- Cogeneration systems
- Combustion control systems
- Waste reduction systems
- Automated fuel storage and delivery systems
- Installation services

B-Series Gasifiers, Large Scale Close-Coupled Gasifiers and Boiler Systems from 100 to 1500 hp

C-Series Gasifiers, Medium-Scale Close-Coupled Gasifiers and Boiler Systems from 23 to 300 hp

Source: www.chiptec.com and "Gasification for Distributed Generation – Task 3.5," EERC report prepared by Ronald Timpe, Michael Mann, and Darren Schmidt, May 2000

Dectra Corporation (GARN)

Address:	3425 33rd Avenue Northeast St. Anthony, MN 55418
Phone:	(612) 781-3585
Fax:	(612) 781-4236
Web Address:	www.dectra.net/garn
Contacts:	Martin Lunde, martin.lunde@dectra.net Ken Oaks, onecall@arvig.net
Primary Activity:	Manufacturer
Secondary Activity:	Installer
Range, MMBtu/hr:	0.92–2.1
Range, hp:	27–63
Combusted Materials:	Wood (cord or slab, pallet, briquettes) and air dried corn on the cob
Product Name:	GARN® WHS

GARN® WHS nonpressurized wood-fired hydronic heaters may be located within the building to be heated or remotely in a small shed. GARN® WHS wood-heating equipment interfaces will all types of hydronic delivery systems, including radiant floor, hot water baseboard, and radiators. It also interfaces easily with forced-air furnaces by utilizing an in-duct hot water coil.

In order to burn wood cleanly and efficiently in the GARN system, it must be reasonably dry (~20%). Generally, 1 year of seasoning is recommended.

Source: www.dectra.net/garn and Ken Oaks, Oaks Sales

Detroit Stoker

Address:	PO Box 732 1510 East First Street Monroe, MI 48161
Phone:	(734) 241-9500
Phone Toll Free:	(800) 786-5374
Fax:	(734) 241-7126
Web Address:	www.detroitstoker.com
E-Mail:	sales@detroitstoker.com
Contact:	Tom Tillman, Director of Marketing, ttillman@detroitstoker.com
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.1–12
Range, hp:	3–358
Combusted Materials:	Wood (bark, shavings, and sawdust up to 60% moisture), agricultural wastes, coffee refuse, sunflower shells, poultry litter
Product Name:	Detroit Hydrogate® WoodPak Stoker

The Detroit Hydrogate® WoodPak system's design features help solve many of the combustion problems associated with biomass burning, such as ash accumulation, equipment wear, and component overheating. The water-cooled surface intermittently vibrates for automatic ash discharge and permits continuous operation without shutdowns to clean grates. Because the stoker is water-cooled, its firing can be based on combustion conditions rather than cooling air requirements. This makes it possible to maintain higher combustion air temperatures necessary for burning high moisture, low ash biomass fuels without damage to the grate surface.

The WoodPak units are shop-assembled and can be applied to most types of steam boilers, hot water boilers, heat exchangers, or other drying applications in capacities from 0.1 MMBtu/hr to 12 MMBtu/hr (3 to 35 MWt).

The Plum Company in St. Paul, Minnesota, is the sales representative for North Dakota, Minnesota, South Dakota, Wisconsin, and parts of Michigan. For more information, visit www.theplumcompany.com or contact Matt Frost at the contact information below:

Matt Frost
The Plum Company
6230 10th Street, Suite 210
Saint Paul, MN 55128-6001
Phone: (651) 738-0080
Fax: (651) 738-0284
E-Mail: matt@theplumcompany.com

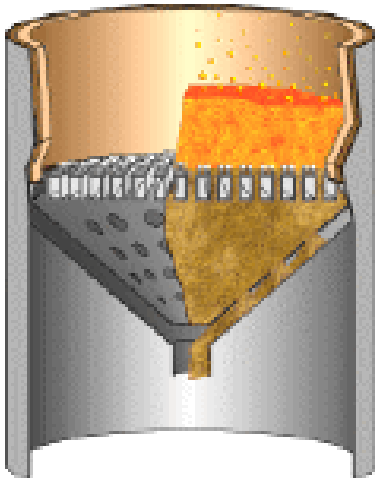
Detriot WoodPak System

Source: www.detroitstoker.com

Energy Products of Idaho

Address:	4006 Industrial Avenue Coeur d'Alene, ID 83815-8928
Phone:	(208) 765-1611
Fax:	(208) 765-0503
Web Address:	www.energyproducts.com
E-Mail:	epi2@energyproducts.com
Contact:	Michael Murphy, Director of Technology mlmurphy@energyproducts.com
Primary Activity:	Manufacturer
Range, MMBtu/hr:	14.7–163
Range, hp:	439–4,869
Combusted Materials:	Agricultural waste, municipal solid waste, wood wastes (chips and bark), industrial and municipal sludges, plastic, tires, and coal
Product Name:	EPI Fluidized-Bed Combustion Systems

Energy Products of Idaho (EPI) manufactures a fluidized-bed combustion system that uses a bed recycle system. EPI is the only company that offers uniform bed drawdown, integrated air cooling, and automatic cleaning and reinjection of the bed material. This feature enables EPI systems to operate on fuels with significant quantities of 4-inch minus noncombustible tramp material (contaminants such as rocks, metal, etc.). In grate style systems, tramp materials and ash slag can cause significant problems requiring a shutdown to correct. In other fluidized-bed systems, tramp materials can build to the point that fluidization is no longer possible, allowing clinkers to form. In these systems, a shutdown is usually also required to clean out the accumulation.



Schematic of EPI Fluidized-Bed Combustion System

Source: www.energyproducts.com

HEATMOR™, Inc.

Address:	105 Industrial Park Court Northeast PO Box 787 Warroad, MN 56763
Phone:	(218) 386-2769
Phone Toll Free:	(800) 834-7552
Fax:	(218) 386-2947
Web Address:	www.heatmor.com
E-Mail:	woodheat@heatmor.com
Contact:	Gerry Reed, President
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.45–0.80
Range, hp:	13.4–23.9
Combusted Materials:	Wood
Product Name:	Models 600 CSS and 800 CSS

HEATMOR™, Inc.'s two commercial outdoor models (600 CSS and 800 CSS) are constructed with the same 409 grade stainless steel (titanium stabilized) as its other model furnaces. To provide the strength and durability in these larger models, it utilized a heavier gauge of stainless steel (7 gauge) to endure the rigors of commercial applications.

To ensure maximum operator safety, HEATMOR™, Inc., features a water-cooled firebox door, fully insulated housing, and a CSA approved Anti-Rollout Device that guards against flashback. Features such as an ash removal auger, bladder system, and forced-air draft make the Models 600 and 800 CSS easy and efficient to operate and maintain. The large capacity firebox and firedoor opening allow for large amounts of wood to be loaded with ease.

Model	600 CSS	800 CSS
Limited Warranty	10 year	10 year
Stainless Steel	409	409
Weight (lb)	2800	5007
Height	100"	118"
Width	63"	87"
Length	106"	105"
Forced Draft (CFM)	2 × 150	1–150 (primary) 1–350 (secondary)
Chimney Diameter	10"	16"
Firebox Dimensions	60" Depth, 37" Width, 47" Height	54" Depth, 60" Width, 65" Height
Heating Area (sq ft)	18,000	25,000
Water Capacity (U.S. gallons)	285 (approx.)	487
Firebox Door Opening (W × H)	30" × 36"	56" × 50"

Model 600

Source: www.heatmore.com

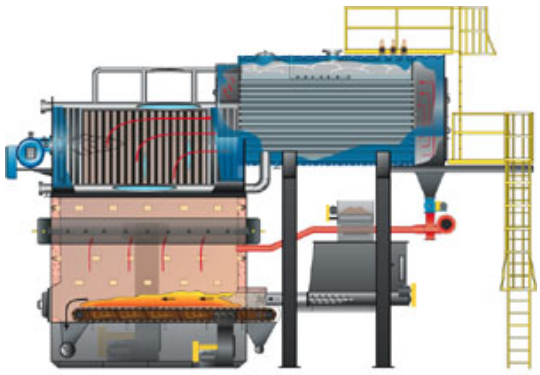
Hurst Boiler & Welding Company, Inc.

Physical Address:	Highway 319 North Coolidge, GA 31739
Mailing Address:	PO Box Drawer 530 Coolidge, GA 31738
Phone:	(229) 346-3545
Phone Toll Free:	(877) 994-8778
Fax:	(229) 346-3874
Web Address:	www.hurstboiler.com
E-Mail:	solid-fuel-sales@hurstboiler.com
Contact:	Gene Zebley, Sales
Primary Activity:	Dealer
Secondary Activity:	Manufacturer
Range, MMBtu/hr:	2–60
Range, hp:	60–1800
Combusted Materials:	Coal, wood (8%–50% moisture), or both; natural gas, propane, heavy oil, and combination of gas and oil
Product Name:	Hybrid (UF, PF, CG or RG) and Firebox LPD (UF or HF)

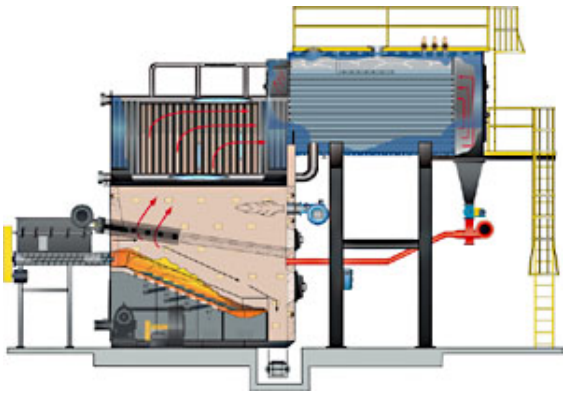
Hurst Boiler & Welding Company, Inc., supplies gas, oil, and wood-fired boilers and manufactures a complete line of boiler room peripherals such as blowdown separator surge tanks, pressurized feed water tanks, steam accumulators, and stacks.

Hyribrid UF

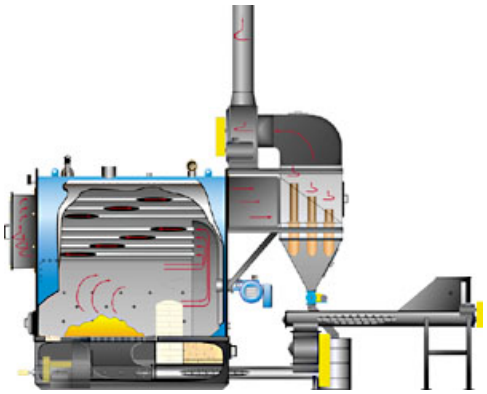
Hyribrid PF



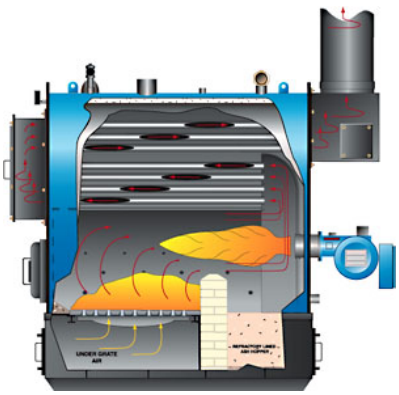
Hybrid CG



Hybrid RG



Firebox LPD UF



Firebox LPD HG

Source: www.hurstboiler.com

King Coal Furnace Corporation

Physical Address:	1270 Beach Street Igoe Industrial Park No. 5 Bismarck, ND 58504
Mailing Address:	PO Box 2161 Bismarck, ND 58502
Phone:	(701) 255-6406
Fax:	(701) 255-6916
Web Address:	www.kingcoal.com
E-Mail:	kingcoal@btinet.net
Contact:	Mike Robb, Owner
Primary Activity:	Manufacturer
Range, MMBtu/hr:	3.4–34
Range, hp:	100–1000
Combusted Materials:	Coal, wood, or combination-fired
Product Name:	King Coal Wood Burning Stokers

King Coal makes wood combustion systems that will handle bark, chips, wet or dry sawdust and shavings. All of this material must be minus 1” in size. Systems can be manufactured with hydraulic floor scrape fuel storage and conveying equipment. The stokers can go under an existing boiler or any combination of equipment.

All King Coal wood-burning stokers are designed as a bottom feed that gasifies the wood residue on a cast alloy grate. Complete combustion occurs when the fuel gas is ignited with secondary overfire air, also commonly referred to as staged combustion.

King Coal Wood-Burning Stokers

Source: www.kingcoal.com

KMW Systems, Inc.

Address:	3330 White Oak Road London, Ontario N6E 1L8 Canada
Phone:	(519) 686-1771
Fax:	(519) 686-1132
Web Address:	www.kmwenergy.com
E-Mail:	info@kmwenergy.com
Contact:	Eril Bertil Rosen
Primary Activity:	Professional Services
Secondary Activity:	Manufacturer
Range, MMBtu/hr:	5–134
Range, hp:	150–4000
Combusted Materials:	Wood (sawdust, bark, and chips up to 60% moisture), hogfuel, agricultural waste, rice husks, sewage and mill sludge, processed domestic waste, shredded cardboard, construction debris
Product Name:	KMW Energy Systems

KMW Systems, Inc., specializes in designing, supplying and installing KMW Energy Systems to burn low-grade biomass fuel. At the heart of the system is KMW's combustion chamber which, together with auxiliary equipment such as fuel, ash and flue gas handling, and boiler emission control and automated control system, makes up a complete energy system.

Source: www.kmwenergy.com

McBurney

Address:	1650 International Court, Suite 100 Norcross, GA 30093
Phone:	(770) 925-7100
Phone toll free:	(888) 448-6610
Fax:	(770) 925-7400
Web Address:	www.mcburney.com
E-Mail:	info@mcburney.com
Contact:	Greg Imig, gregi@mcburney.com
Primary Activity:	Manufacturer
Range, MMBtu/hr:	20–80
Range, hp:	597–2,390
Combusted Materials:	Varity of biomass including wood (bark, sawdust, sanderdust)
Product Name:	Modul-Pak® boiler

The Modul-Pak® boiler is a hybrid design that combines the benefits of a watertube furnace and a multipass firetube boiler. The results are a value-engineered modular package boiler that offers unique advantages for solid fuel firing.

The upper furnace is an extended watertube furnace which offers water cooling of the primary combustion chamber that results in cooling the flame temperature prior to entering the multipass firetube boiler.

The Modul-Pak® boiler is offered in a wide variety of fuel-firing combinations. Modul-Pak® firing systems include gas/oil burners, McBurney air- or water-cooled stationary grates, and continuous ash discharge stokers including air and water-cooled vibrating grates. It has a steam capacity of 10,000–55,000 lb/hr.

Modul-Pak® Boiler

Modul-Pak® Boiler

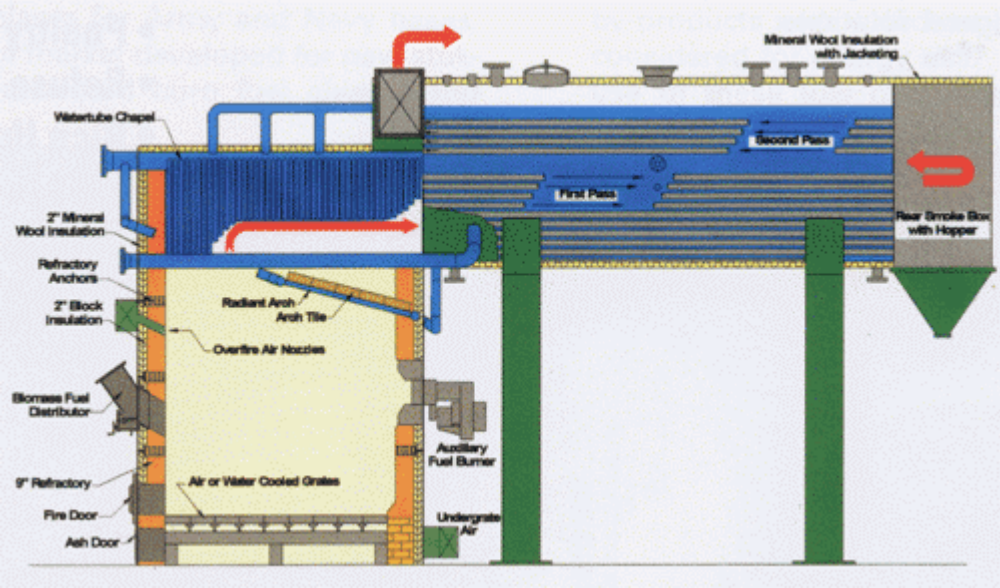


Illustration of Modul-Pak® Boiler

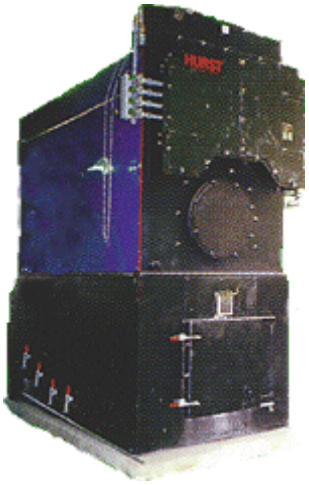
Source: www.mcburney.com

Messersmith Manufacturing, Inc.

Address:	2612 F Road Bark River, MI 49807
Phone:	(906) 466-9010
Fax:	(906) 466-2843
Web Address:	www.burnchips.com
E-Mail:	sales@burnchips.com
Contact:	Gerry Guard or Gailyn Messersmith
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Range, MMBtu/hr:	1–20
Range, hp:	30–600
Combusted Materials:	Wood or corn cobs
Product Name:	Messersmith Institutional and Industrial Combustion System

The product manufacturer claims that its industrial combustion system is compatible for schools, factories, farm buildings, shops, or greenhouses. Other product claims include:

- Burns wood chips, sawdust, chopped or broken corn cobs, and wood shavings.
- Produces less smoke, less soot, and less ash than burning logs.
- Capable of once-a-day loading depending on MMBtu/hr requirements.
- Installs easily into most wood boilers and furnaces.
- On and off cycles are regulated by a thermostat.



Messersmith Wood Boiler

Source: www.burnchips.com

Piney Manufacturing Limited

Address:	RR 5, Site 16, Comp 114 Prince Albert, Saskatchewan S6V 5R3 Canada
Phone:	(306) 922-1722
Phone Toll Free:	(800) 561-0700
Fax:	(306) 922-1662
Web Address:	www.portageandmainboilers.com
E-mail:	pm@pahydronic.com
Contact:	Brain Martin
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.17–2
Range, hp:	5–60
Combusted Materials:	Wood
Product Name:	Portage & Main Wood Boiler ML42

Piney Manufacturing Limited is now manufacturing the Portage & Main Wood Boiler. Model ML42 is an outdoor boiler and can heat more that 12,000 square feet. The ML42 weighs 2500 pounds and the dimensions are 82" × 59" × 57".

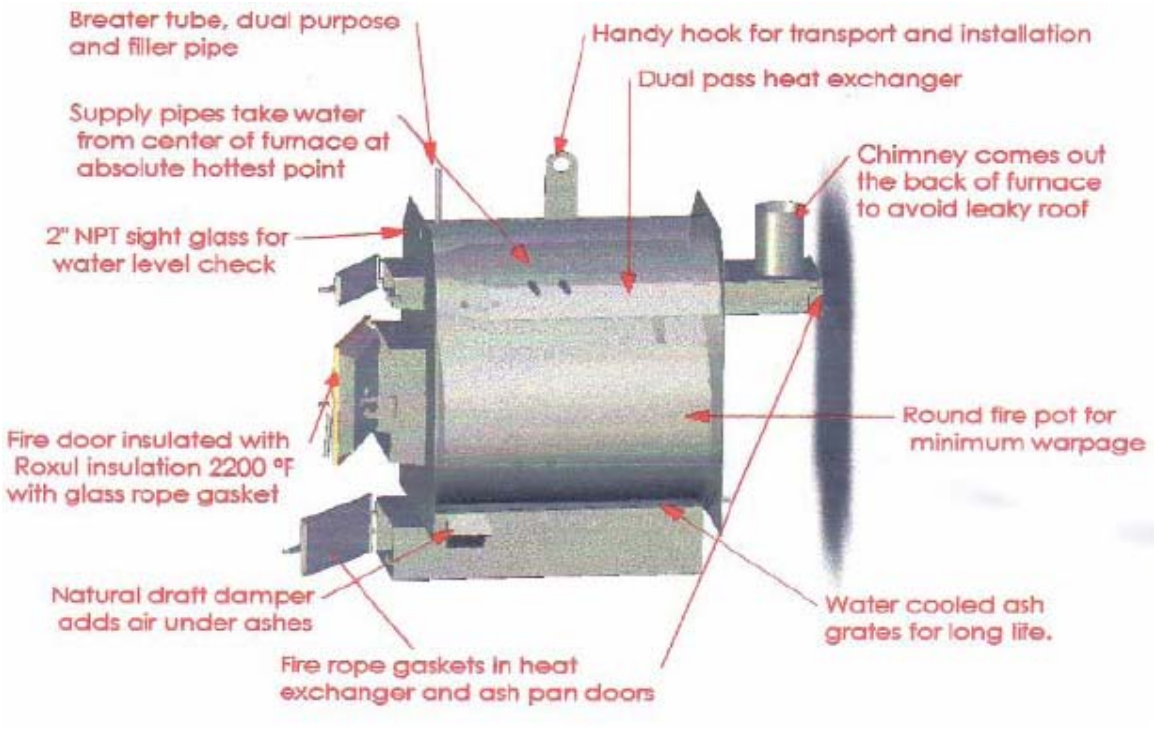


Illustration of the Portage & Main Wood Boiler

Source: www.portageandmainboilers.com

Precision Energy Services, Inc.

Address:	PO Box 1004 Hayden, ID 83835
Phone	(208) 772-4457
Phone Toll Free:	(800) 762-5186
Fax:	(208) 762-1113
Web Address:	www.pes-world.com
E-Mail:	energy@pes-world.com
Contact:	Mike Oswald, President
Primary Activity:	Professional Services
Secondary Activity:	Dealer
Range, MMBtu/hr:	Variable
Range, hp:	Variable
Combusted Materials:	Wood
Product Name:	Variable

Precision Energy Services, Inc. (PES), is a technical services company with emphasis in the field of procurement and construction. Founded in 1993, PES is in the business of providing technical services, project development, and operation and maintenance of solid fueled energy plants.

PES provides technical services to project developers, independent power producers, and industrial clients. PES is proficient in the development, design, construction, operation, and maintenance of energy projects. Power project development, fuel handling and preparation, power plant design, start-up, and operation and maintenance normally fall within PES's scope. Its services in the operation and maintenance of power plants provide the company with first-hand experience of actual equipment performance.

PES sells used equipment.

Source: www.pes-world.com

Pro-Fab Industries, Inc.

Address:	PO Box 112 Arborg, Manitoba R0C 0A0 Canada
Phone:	(204) 364-2211
Phone Toll-Free:	(888) 933-4440
Fax:	(204) 364-2472
Web Address:	www.profab.org
E-Mail:	info@profab.org
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.75–2.5
Range, hp:	22.40–74.68
Combusted Materials:	Wood, coal, corn
Product Name:	The Pelco (PC 1020, PC 1520, and PC 2520)

The Pelco is an efficient, solid fuel-fired, light industrial, hot-water boiler. The Pelco is engineered to automatically feed fuel and remove ash. The unique flue design offers more surface area to maximize heat transfer from the combustion chamber to the boiler. The flues and their self-cleaning augers not only act to prevent the loss of heat but also act as an internal spark arrester. Performance is further enhanced by the Pelco's cylindrical frame, which eliminates any water pooling, substantially increasing the performance of the boiler. The Pelco's advanced design features an open system, reducing the risk of pressurization failures. A standard feature of the Pelco is an exclusive computerized control system that manages all functions of the drive motors.

The Pelco has been used in installations with forced-air systems, with the use of heat exchangers (radiator or coil), and also with in-floor (hydronic) heating. Farmers, manufacturers, and greenhouse operators are just a few of the owners who used this system.

	PC 1020		PC 1520		PC 2520	
Height	10 ft	3 m	11 ft	3.4 m	11 ft	3.4 m
Width	53 1/2 in	136 cm	61 1/4 in	156 cm	73 1/4 in	186 cm
Water Capacity	130 gal	492 L	220 gal	833 L	350 gal	1,325 L
Shipping Weight	3500 lb	1588 kg	5000 lb	2268 kg	6250 lb	2,835 kg
Burner Size	20 in	51 cm	28 1/2 in	72 cm	36 1/2 in	93 cm
Maximum Input Btu	750,000		1,500,000		2,500,000	
Computerized Controls	Included		Included		Included	
Electrical Requirements	220 V / 20 Amp		220 V / 20 Amp		220 V / 20 Amp	
Outlet Fitting Sizes	1 1/2 in.		2 in.		2 ½ in.	

The Pelco

Source: www.profab.org

Ray Burner Company

Address:	401 Parr Boulevard Richmond, CA 94801
Phone:	(510) 236-4972
Phone Toll Free:	(800) 729-2876
Fax:	(510) 236-4083
Web Address:	www.rayburner.com
E-Mail:	rayburner@rayburner.com
Contact:	Russell Westover
Primary Activity:	Manufacturer
Range, MMBtu/hr:	1.7–85.3
Range, hp:	51–2550
Combusted Materials:	Wood (sawdust, shavings and chips up to 60% moisture)
Product Name:	Ray Woodwaste Boilers™: OMEGA 5000 Systems or SFC Systems (Soot Free Combustion)

Ray Woodwaste Boilers™ are designed for the woodworking industry. Material is delivered from the point at which it is produced to a storage bin next to the boiler. It is fed into the boiler pneumatically as needed. If the supply runs out or diminishes, the boiler automatically switches to oil or gas until more wood is available. Woodwaste Boilers have a grit arresting system that captures unburned fly ash particles and reinjects them into the furnace. This process is repeated, reducing the emission level to approximately 0.25 gr/scfm. Woodwaste Boilers produce steam or hot water. Five models, with varying Btus, are available.

The OMEGA 5000 system is unique in that it is able to regulate levels from 5% to 100% of rated output. This makes it possible to use the system in combination with other energy sources, such as windmills.

OMEGA 5000

Source: Ray Burner Company “Turns on the Heat” Product Brochure and Per Mellin, MelLink International Services

Talbott's Heating Limited

Address:	PO Box 45 Gander, Newfoundland A1V 1W5 Canada
Phone:	(709) 256-9333
Fax:	(709) 256-9993
Web Address:	www.talbottsna.com
E-Mail:	sales@talbottsna.com
Contact:	Fred Dixon, Sales Manager North America
Primary Activity:	Manufacturer
Secondary Activity:	Dealer
Range, MMBtu/hr:	0.17–13.5
Range, hp:	5–403
Combusted Materials:	Wood (shavings, sawdust, chips, fiberboard), paper, cardboard, treated timber, energy crops (short rotation coppice, straw, tree thinnings, brash, myscanthus)
Product Name:	Talbott’s Biomass ‘C’ Series

The Biomass ‘C’ series is readily adaptable to a wide range of applications and will handle a variety of biomass fuels with equal burn efficiency to produce a reliable and constant supply of hot water. Easy to use, extremely low maintenance, and very robustly built, each installation is designed and tested to give many years of trouble-free operation. The controlled burn at steady, very high temperatures that are achieved by the Biomass ‘C’ series results in virtually no emissions to atmosphere and +80% efficiency rating by a government-approved independent testing body.

Talbott’s ‘C’ Biomass System

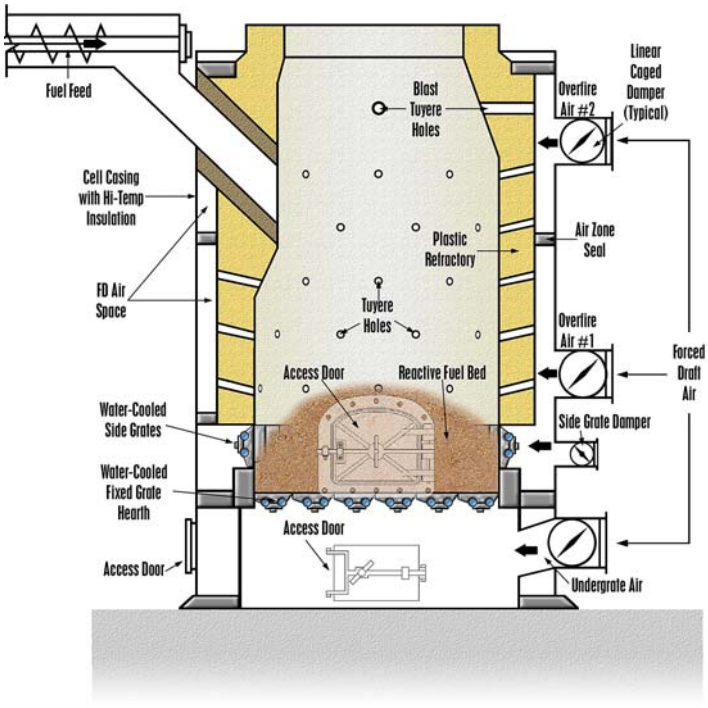
Source: www.talbottsna.com

Wellons, Inc. (Western Region)

Address:	2525 West Firestone Lane Vancouver, WA 98660
Phone:	(360) 750-3500
Fax:	(360) 750-3486
Web Address:	www.wellonsusa.com
E-Mail:	sales@wellons.com
Contact:	Bob VanWassen, BobVanWassen@wellons.com
Primary Activity:	Manufacturer
Secondary Activity:	Dealer
Range, MMBtu/hr:	5–10
Range, hp:	150–300
Combusted Materials:	Wood (hogged, bark, sawdust, shavings)
Product Name:	Wellons Wood-Fired Boiler Systems

Wellons specializes in wood-fired boiler systems. It makes a full range of boiler sizes including 100- and 200-hp watertube-firetube package boiler systems. It also manufactures fuel storage bins to go with these systems, if desired. Wellons' systems can burn virtually any combination of wood with a broad range of moisture contents, without the need for supplemental fuel for either start-up or operation.

Wellons Wood-Fired Boiler System



Wellon's Furnace Cell Cross Section, Fixed Grates

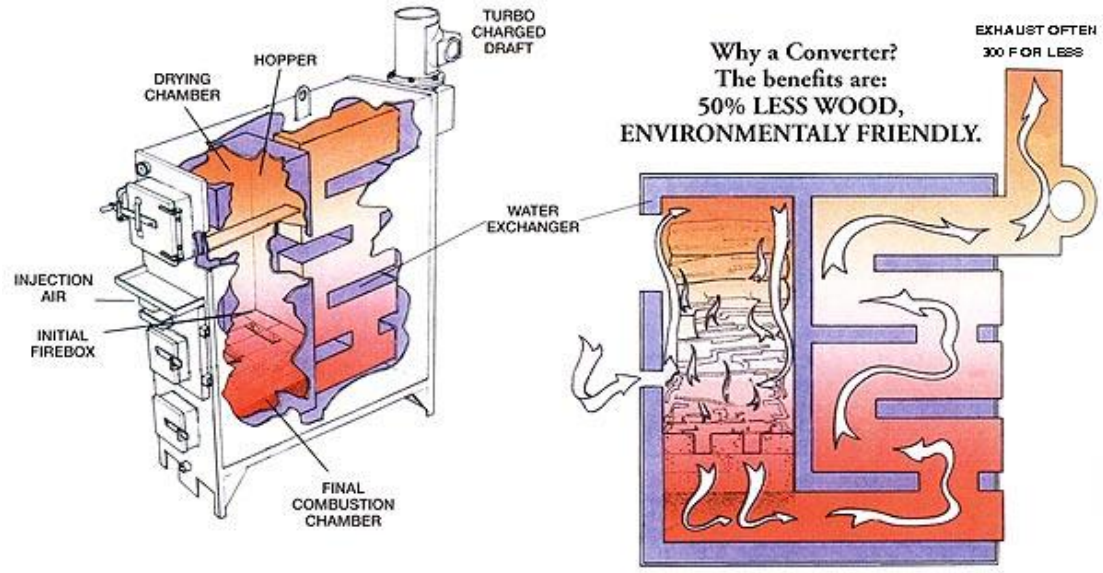
600-hp Boiler Packaged on a Truck

Source: www.wellonsusa.com and Bob VanWassen, Personal Communication

Wood Doctor Outside Heating Systems

Address:	PO Box 567 Stewiacke, Nova Scotia B0N 2J0 Canada
Phone:	(902) 639-9171
Fax:	(902) 639-1232
Web Address:	www.wooddoctorfurnace.com
E-Mail:	info@wooddoctorfurnace.com
Contact:	Darrell Anderson, Agent
Primary Activity:	Manufacturer
Range, MMBtu/hr:	Up to 1.3
Range, hp:	Up to 38.83
Combusted Materials:	Wood
Product Name:	Wood Doctor® Industrial

The Wood Doctor® converter represents the new generation of outdoor furnaces. It burns less wood and is environmentally friendly, having little smoke emission. It converts wood to gas and gas to heat.



Product specifications include:

Dimensions:	108" × 92" × 98"
Weight:	5300 lb

Source: www.wooddoctorfurnace.com

BIOMASS GASIFICATION SYSTEMS

Ankur Scientific Energy Technologies Pvt. Ltd.

Address:	Near Old Sama Jakat Naka Sama Road Baroda-390008 Gujarat, India
Phone:	91-265-2793098/2794021
Fax:	91-265-2794042.
Web Address:	www.ankurscientific.com/main.htm
E-Mail :	ascent@ankurscientific.com
Contact:	B.C. Jain
Primary Activity:	Manufacturer
Range, MMBtu/hr:	Up to 2.9
Range, hp:	Up to 87
Combusted Materials:	Wood (less than 20% moisture)
Product Name:	WBG Series

Ankur gasifier systems convert biomass materials into a combustible gas which can either be burned in an appropriate burner or fed into diesel engines for saving of liquid fuels. The smallest gasifier rating offered by Ankur in the WBG series is 3 kW/15,000 Kcal per hour, and the largest single unit is 850 kW/2.125 million Kcal per hour.

B.G. Technologies has licensed to market the Ankur technology globally outside of India. Reflective Energies is marketing a trailer-mounted gasification microtrubine system using the Ankur technology.

Gasifier Model: WBG-150, Mahabhadra Industrial Gases, in Operation Since 1994

Source: www.ankurscientific.com/main.htm and "Gasification for Distributed Generation – Task 3.5," EERC report prepared by Ronald Timpe, Michael Mann, and Darren Schmidt, May 2000

Chiptec Wood Energy Systems

Address:	48 Helen Avenue South Burlington, VT 05403
Phone:	(802) 658-0956
Phone Toll Free:	(800) 244-4146
Fax:	(802) 660-8904
Web Address:	www.chiptec.com
E-Mail:	BobBender@chiptec.com
Contact:	Bob Bender, President
Primary Activity:	Manufacturer
Range, MMBtu/hr:	0.4–50
Range, hp:	12–1500
Combusted Materials:	Wood (chips, sawdust, shavings from 6–60% moisture), clean bio-fuel, agricultural and food processing residue, pallets, paper pellets, railroad ties, and other biomass wastes
Product Name:	CHIPTEC®

Chiptec manufactures close-coupled gasifiers for existing boilers. CHIPTEC® gasifiers are able to adapt to a wide variety of heat exchangers and uses including hot water, steam, hot air furnaces, or steam turbines. CHIPTEC® gasifiers are essentially a sloping grate unit, and its heating systems are fully automated. CHIPTEC® biomass gasification products and services include:

- New biomass gasification systems.
- Boiler retrofits.
- Cogeneration systems.
- Combustion control systems.
- Waste reduction systems.
- Automated fuel storage and delivery systems.
- Installation services.

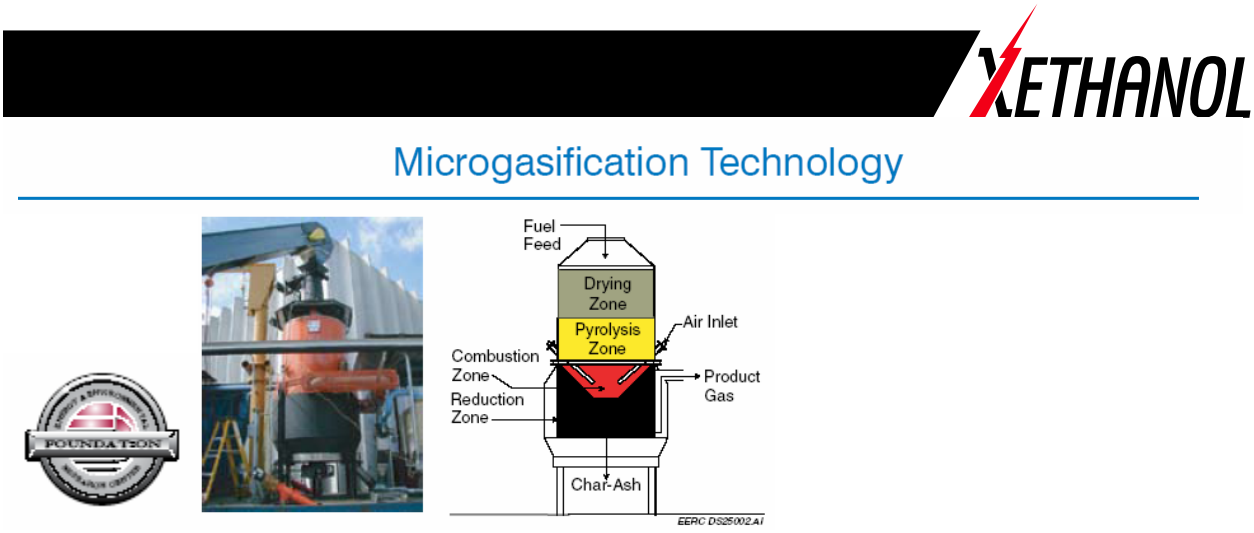
B-Series Gasifiers, Large-Scale Close-Coupled Gasifiers and Boiler Systems from 100 to 1500 hp

C-Series Gasifiers, Medium Scale Close-Coupled Gasifiers and Boiler Systems from 23 to 300 hp

Source: www.chiptec.com and "Gasification for Distributed Generation – Task 3.5," EERC report prepared by Ronald Timpe, Michael Mann, and Darren Schmidt, May 2000

Energy & Environmental Research Center (EERC)

Address:	15 North 23rd Street, Stop 9018 Grand Forks, ND 58202-9018
Phone:	(701) 777-5120
Fax:	(701) 777-5181
Web Address:	www.undeerc.org
E-Mail :	dschmidt@undeerc.org
Contact:	Darren Schmidt, Research Manager
Primary Activity:	Research and Development
Range, MMBtu/hr:	0.1–17.5
Range, hp:	2.98–522.78
Combusted Materials:	Wood, sawdust, or dry agriculture residues
Product Name:	Advanced Biomass Gasification Technologies



Advanced Biomass Gasification Technologies (ABGT), a Xethanol company, will provide combined heat and power solutions for companies considering conversion of biomass (including process residuals such as wood, sawdust, or dry agricultural residues) fuels for energy. ABGT specializes in cost-effective solutions for power production and thermal requirements of facilities that have electricity loads of 10 kW – 1 MW, have thermal loads of 0.1–17.5 MMBtu/hr, or must dispose of residues in the range of 100 tons/yr – 15,000 tons/yr. Many facilities process agricultural biomass resources or manufacture products from wood that leave residues that are either sold, available for use, or disposed at a cost. Typically, the facilities use electricity in the range of 100 kW – 1 MW, and either consume natural gas for process heat or have space heating requirements. Rising natural gas prices and high energy consumption rates have prompted facility managers to consider more competitive energy options. ABGT can provide a cost-effective biomass gasification energy system (microgasification), which can be applied at an economic advantage over steam-based combustion systems. The microgasification technology consists of a piston engine generator fired with low-Btu gas supplied from a biomass gasifier. The gasifier is fueled with wood, lignin, or other fuel sources metered from a bulk hopper and

conveyed to the gasifier. The product gas, engine exhaust, or other sources of waste heat can be used for thermal application. ABGT will network with potential customers through a sales and procurement office in Grand Forks, North Dakota, where ABGT is working in partnership with the Energy & Environmental Research Center (EERC) to demonstrate and commercialize the technology. ABGT is working through the network of project contacts previously established by EERC and Xethanol. Also, ABGT is continuing to pursue new project opportunities as they arise. ABGT will be a supplier of heat and power systems for Xethanol's distributed ethanol production facilities. ABGT is owned and supported by Xethanol Corportation, a publicly traded company on the American stock exchange.

Source: Darren Schmidt, EERC Research Manager

Foster Wheeler, Inc.

Address:	Perryville Corporate Park Clinton, NJ 08809-4000
Phone:	(908) 730-4000
Fax:	(908) 730-5315
Web Address:	www.fwc.com
E-Mail:	fw@fwc.com
Primary Activity:	Manufacturer
Range, MMBtu/hr:	10.23–119.43
Range, hp:	306–3568
Combusted Materials:	Wood
Product Name:	Pyroflow

Foster Wheeler, Inc. (FW), manufactures boiler and gasifiers. With nearly 20 years' experience in gasification technology, FW suggests that power production should be limited to pressurized intergrated gasification, combined-cycle (IGCC) operations. FW recently purchased Ahlstrom Corporation, former producers of Pyroflow, which is an atmospheric fluidized-bed gasifier. FW will continue with production of Pyroflow. FW employs 12,000 people and has net sales in the range of US$2.3 billion.

Source: "Gasification for Distributed Generation – Task 3.5," EERC report prepared by Ronald Timpe, Michael Mann, and Darren Schmidt, May 2000

Heuristic Engineering, Inc.

Address:	3040 West 5th Avenue Vancouver, B.C. V6K 1T9 Canada
Phone:	(604) 263-8005
Fax:	(604) 263-0786
Web Address:	www.heuristicengineering.com
E-Mail:	info@heuristicengineering.com
Contact:	Dr. Malcolm Lefcort, Founder
Primary Activity:	Manufacturer
Range, MMBtu/hr:	15–150
Range, hp:	448–4,480
Combusted Materials:	Wood (moisture content up to 65%) and other biomass
Product Name:	Heuristic EnvirOcycler

Heuristic Engineering, Inc., supplies waste-disposal/energy-recovery systems featuring its patent-pending two-stage combustor, the Heuristic EnvirOcycler.

The two-stage EnvirOcycler gasifies wet or dry, shredded, solid waste in a large first stage of gentle updraft gasification. Shredding the waste permits the formation of loose, fluffy fuel piles, a necessary condition for proper gasification. Underfire and overfire air are injected, under tight control into the first stage to convert the waste into a burnable producer gas.

First-stage producer gas is immediately burned in a second stage of vigorous cyclonic combustion. The second stage is located directly above the first stage. Primary combustion air is injected through a proprietary flame holder at the bottom of the second stage to ignite the producer gas. High velocity, secondary combustion air is injected tangentially through tuyères (nozzles) in the brick-lined walls to complete combustion of the burning producer gas.

By splitting combustion up into two stages, with two different, tightly controlled sources of combustion air injected into each stage, it is possible to operate the EnvirOcycler with excess air levels as low as 15%. This enables the EnvirOcycler to dispose of very wet wastes while maintaining discharge temperatures of at least 1750°F (950°C) .

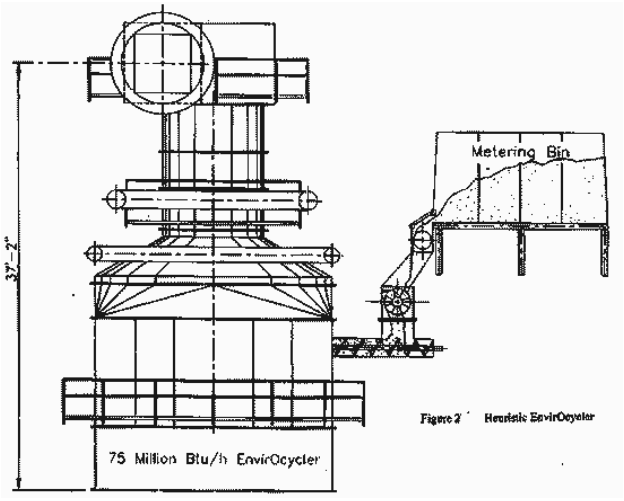


Illustration of the Heuristic EnvirOcycler

15 MMBtu/hr Unit in New Zealand

Source: www.heuristicengineering.com

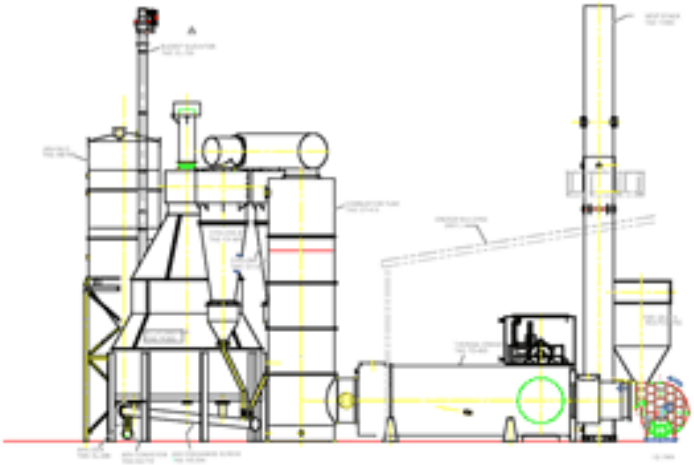
Primenergy, L.L.C

Address:	PO Box 581742 Tulsa, OK 74158
Phone:	(918) 835-1011
Fax:	(918) 835-1058
Web Address:	www.primenergy.com
E-Mail:	sales@primenergy.com
Contact:	W.N. Scott
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Range, MMBtu/hr:	Up to 43.7 (12.8 MW)
Range, hp:	1300 (17,000 electric)
Combusted Materials:	Biomass
Product Name:	Primenergy

Many possible equipment configurations can be designed by Primenergy and utilized downstream of the gasifier. The synthetic gas produced by the gasifier may be used as boiler fuel and the flue gas directed to a boiler to produce medium or high-pressure steam. Medium pressure steam has been used for various processes, i.e., rice parboiling or soybean processing. High-pressure steam has been used to drive steam turbines for the production of electricity. For some of the systems, all or a portion of the flue gas has been used both directly and indirectly to provide dry heat for material drying operations.

Primenergy has developed and patented a method of cooling and cleansing the synthesis gas to a specification necessary for use as a fuel source in an internal combustion engine called PARS™, which stands for Particulate and Aerosol Removal System. Coupled to an electrical generator, this method of electrical generation requires less capital investment and is more efficient than electrical production using steam for applications under 5 MW. The wet scrubbing of the synthesis gas does not recover the thermal energy of the gas in usable energy output, but this sacrifice is offset by the reduction in capital expense of the internal combustion engines. A second use of synthesis gas produced by the gasifier and cleansed by PARS™ may be the production of synthetic organic liquids such as ethanol, acetic acid, or synthetic crude oil stocks by either fermentation or catalytic conversion. A third use may be as a fuel for gas turbines. For large-scale energy production, the use of a synthesis gas-fueled turbine may offer increased efficiency in energy output.

Demonstration Facility



Preliminary Plan for Wood Waste Gasification and Thermal Oxidation in Little Falls, Minnesota

Source: www.primenergy.com

ENGINEERING FIRMS/CONSULTING/ RESEARCH

Advanced Mechanical Solutions

Address:	10026-A South Mingo Road, No. 175 Tulsa, OK 74133-5700
Phone:	(918) 457-4268
Fax:	(918) 457-4278
E-Mail:	info@advme.com
Web Address:	www.advme.com
Primary Activity:	Engineering/Consulting

Advanced Mechanical Solutions is a mechanical design and analysis consulting company specializing in designing and evaluating mechanical equipment and systems and in the creation of new devices, including energy conversion, electromechanical, material handling, and hydraulics.

Services offered include:

- Energy conversion power systems (wood and biomass gasifiers, solid fuel boilers, gas-fueled boilers, fuel handling, steam turbines, and electric generators).
- Boiler and heat exchanger design.
- Design evaluation and optimization.
- system diagnostics/troubleshooting.
- Technical analysis of mechanical systems.
- Combustion analysis.
- Material selection and optimization.

Source: www.advme.com

ANTARES Group, Inc.

Address:	4351 Garden City Drive Suite 301 Landover, MD 20785
Phone:	(301) 731-1900
Fax:	(301) 731-1904
Web Address:	www.antaresgroupinc.com
E-Mail:	egray@antaresgroupinc.com
Contact:	Edward Gray, PE, Principal - Technology Development, Demonstration
Primary Activity:	Engineering/Consulting

ANTARES has helped clients secure affordable biomass supplies, design handling and processing systems that are both proven and innovative, and select among the many technology options available for conversion from simple packaged solid fuel boilers to gasification systems coupled with state-of-the-art steam and gas-driven power generation equipment.

ANTARES has helped projects market the environmental attributes and reduce the risk of financing new technologies with public cost-sharing programs.

It has worked with the environmental regulatory agencies to permit commercial operations for biomass, presenting the best research on the performance of biomass systems in commercial and demonstration projects.

Source: www.antaresgroupinc.com

Biomass Energy Resource Center, Inc.

Address:	PO Box 1611 50 State Street Montpelier, VT 05601
Phone:	(802) 223-7770
Fax:	(802) 223-7772
Web Address:	www.biomasscenter.org
E-Mail:	contacts@biomasscenter.org
Contact:	Timothy Maker, Executive Director
Primary Activity:	Engineering/Consulting

The Biomass Energy Resource Center (BERC) is a project-focused organization with a public benefits mission. With over 15 years of staff expertise in the field, and extensive relationships with other experts, manufacturers, suppliers, public agencies, and consultants, BERC is involved in the assessment, development, and management of community-scale biomass energy projects.

Its work and services include:

- Providing information for potential projects.
- Carrying out or coordinating project-related prefeasibility studies, feasibility studies, and other reports.
- Carrying out, coordinating, or consulting on the development of biomass energy projects.
- Managing the operations of biomass energy projects.
- Conducting assessments of working biomass systems.

All our initiatives aim to better inform the process of studying, assessing, and implementing projects. BERC has the tools to help state and federal agencies, and other public and private organizations, develop programs that can greatly accelerate the utilization of biomass energy in many types of applications.

Source: www.biomasscenter.org

Boiler & Steam Systems, LLC.

Address:	4675 174th Court Southeast Bellevue, WA 98006
Phone:	(425) 614-0784
Web Address:	www.boilerandsteam.com
E-Mail:	davesharpe@boilerandsteam.com
Contact:	Dave Sharpe, Founder
Primary Activity:	Dealer
Secondary Activity:	Professional Services

Boiler & Steam Systems, LLC was formed to supply and install wood-fired boiler systems. The primary territory covered by Boiler & Steam Systems, LLC, is Washington, Oregon, Idaho, Montana, and northern California. The company focuses on the following industries:

- Sawmills (hardwood and softwood)
- Plywood plants
- Pulp mills
- Veneer plants
- Board plants (particleboard, MDF, OSB, etc.)
- Corrugated sheet plants (cardboard)
- Wood processors and wood treaters

Source: www.boilerandsteam.com

Burns Best, Inc.

Address:	1409 North River Street PO Box 680 Spooner, WI 54801
Phone:	(715) 635-5300
Phone Toll Free:	(877) 983-4328
Fax:	(715) 635-5334
Web Address:	www.burnsbest.com
E-Mail:	burns@burnsbest.com
Contact:	Terry Burns, bbterry@centurytel.net
Primary Activity:	Dealer
Secondary Activity:	Engineering/Consulting

Burns Best, Inc., is a network of professionally trained local dealers who service, install, maintain, and warranty all of the product lines it carries (the Pelco, Messersmith, Biomass Combustion Systems, and FSE Boilers).

Source: www.burnsbest.com

CTA Group

Address:	PO Box 1439 13 North 23rd Street Billings, MT 59103
Phone:	(406) 248-7455
Fax:	(406) 248-3779
E-Mail:	info@ctagroup.com
Web Address:	www.ctagroup.com
Primary Activity:	Architect/Engineering

The CTA engineering group has experience in power engineering and on providing seamless integrated solutions for its clients. Strategically placed throughout CTA's network of offices, engineers maintain close communication with one another to transfer knowledge, experience, and information to allow project delivery and quality.

Source: www.ctagroup.com

Cummins & Barnard, Inc.

Address:	5405 Data Court Ann Arbor, MI 48108
Phone:	(734) 761-9130
Phone Toll Free:	(866) 761-9130
Fax:	(734) 761-9881
Web Address:	www.cummins-barnard.com
E-Mail:	info@cummins-barnard.com
Contact:	John Hesterman
Primary Activity:	Engineering/Consulting

Cummins & Barnard, Inc. (C&B), is an established, full-service engineering consulting firm headquartered in Ann Arbor, Michigan. C&B was founded in 1932 with a major focus on providing consulting and design services for thermal and electric generation and distribution to institutional, industrial, commercial, and utility clients.

Services offered include the following:

- Strategic consulting: project development and asset acquisition
- Owner's engineer services for new and retrofit projects
- Project execution plan development
- Detailed engineering and design
- Plant modifications and optimization
- Project management
- Project cost estimating and scheduling
- Site development/licensing/permitting support

Source: www.cummins-barnard.com

Dettinger Project Management

Address:	202 SW 16th Court Troutdale, OR 97060
Phone:	(503) 666-8967
Fax:	(503) 666-9356
Web Address:	www.dettinger.com
Contact:	Heinz Dettinger
Primary Activity:	Engineering/Consulting

Dettinger Project Management specializes in wood-fired boilers and dry kilns. It offers the following services:

- **Project Planning:** An environmental impact study is an important first step for any new project. Dettinger assists in obtaining permits.

- **Engineering:** Each project is individually designed and engineered to meet the specific application. The site conditions, the process requirements, and the availability of fuel is carefully evaluated.

- **Install and Commission Equipment:** Careful planning, shipping on time, and managing the installation is essential to finish and start the project on time.

- **Operator Training:** Training staff on each part of the system provides a solid basis for trouble-free operation.

Source: www.dettinger.com

Engineering, Compliance & Construction, Inc.

Address:	415 North McKinley Street, Suite 1180 Little Rock, AR 72205
Phone:	(501) 663-8247
Fax:	(501) 664-5005
Web Address:	www.ecci.com
E-Mail:	tpowers@ecci.com
Contact:	R. Stan Jorgensen, President sjorgensen@ecci.com
Primary Activity:	Engineering/Consulting

Engineering, Compliance & Construction, Inc. (ECCI), specializes in the following:

- Air pollution control and permitting
- Project and construction management
- Environmental engineering and compliance services
- Mechanical integrity assessments and process safety management
- Solid and hazardous waste management
- Site selection and acquisition assistance
- Industrial process and facilities design
- Safety and environmental training
- Water pollution control and permitting

ECCI engineers have assisted on numerous projects where wood wastes or alternative fuels are burned in boilers to produce steam or to generate electricity. ECCI's role has ranged from the initial economic assessment to dealing with major prevention of significant deterioration air permitting issues. Additional roles have included engineering of process modifications and burner optimizations to improve operating efficiency and to lower energy costs.

Source: www.ecci.com

Factory Sales and Engineering, Inc.

Address:	74378 Highway 25 Covington, LA 70435
Phone:	(985) 867-9150
Fax:	(985) 867-9155
Web Address:	www.fsela.com
Primary Activity:	Manufacturer/Designer
Secondary Activity:	Professional Services

Factory Sales and Engineering, Inc., provides the following:

- Biomass-fired boilers
- Boiler retrofits
- Engineering studies
- Biomass-fired power plants
- ASME fabrication
- Airheaters
- Replacement boiler parts
- Construction

The company has field installation crews as well as boiler maintenance crews.

Source: www.fsela.com

Mater Engineering, Ltd.

Address:	101 Southwest Western Boulevard PO Box O Corvallis, OR 97339
Phone:	(541) 753-7335
Fax:	(541) 752-2952
Web Address:	www.mater.com
E-Mail:	mater@mater.com
Contact:	Catherine Mater, President
Primary Activity:	Engineering/Consulting

Mater Engineering has provided professional consulting services and marketing research for over 55 years. With roots in finding technical solutions for problems in the forest industry, it has expanded its services to include most aspects of forest industry engineering, traditional and nontraditional forest products marketing, industrial engineering, and specialty public works engineering.

Source: www.mater.com

Power Engineers

Address:	2401 Grand Avenue Suite 400 Billings, MT 59102
Phone:	(406) 652-4834
Fax:	(406) 656-4939
Web Address:	www.powereng.com
Primary Activity:	Engineering/Consulting

Power Engineers (POWER) capabilities include lender and owner engineering, conceptual design and estimating, consultancy and studies, detail design, design/build – EPC, program management, and asset management and life extension.

POWER was contracted to complete engineering on a 3-MW wood chip-fired power plant being developed at an old sawmill site in Arizona. POWER's scope consisted of the mechanical and control portions of the work.

Source: www.powereng.com

Sebesta Blomberg & Associates, Inc.

Address:	2381 Rosegate Roseville, MN 55113-0020
Phone:	(651) 634-0775
Phone Toll Free:	(877) 706-6858
Fax:	(651) 634-7400
Web Address:	www.sebesta.com
E-Mail:	sales@sebesta.com
Contact:	David Peterson, Energy Procurement Manager
Primary Activity:	Engineering/Consulting

Established in 1994, Sebesta Blomberg provides services in commissioning, utility infrastructure, building systems design, controls, power generation and distribution, training energy management, and facility services. It has branches in Chicago, Illinois; Boston, Massachusetts; Dallas, Texas; Arlington, Virginia; and Colorado Springs, Colorado.

Its areas of expertise include:

- Energy information management: receive, audit, pay and track utility bills, and monitor real-time energy consumption information in a Web-accessible database to provide enhanced targeting of opportunities and ongoing measurement and verification of results.
- Energy procurement and price risk management: identify alternative physical and financial energy supply and pricing strategies and develop implementation plans to maximize economic return.
- Rate analysis and negotiation: analyze rate options to develop a negotiating strategy with utility suppliers, which will result in the most cost-effective use of energy in the future.
- Demand-side management: maximize utility savings by identifying ways to reduce peak energy demand (and costs) without affecting current operations.
- Infrastructure analysis: expert review and analysis of conditions and capabilities of existing systems, utilizing utility system performance modeling, and load growth projections.
- System design and optimization: conceptual design of alternative systems to maximize performance and minimize lifecycle cost.
- Alternative and renewable energy: identify alternative and renewable energy sources to improve overall cost and reduce reliance on fossil fuels.
- Environmental and operating permits: evaluate permit and compliance alternatives in the context of the client's technical, economic, and scheduling requirements.

Source: www.sebesta.com

Steam & Control Systems, Inc.

Address:	2805 Riverside Drive Chattanooga, TN 37406
Phone:	(423) 624-1727
Fax:	(423) 624-2727
Web Address:	www.scsenergy.com
E-Mail:	scs@scsenergy.com
Contact:	Perry Smith, Mechanical Engineer
Primary Activity:	Engineering/Consulting

Many plants designed and built by Steam & Control Systems, Inc. (SCS), produce energy from renewable biomass fuels including wood waste, rice hulls, bagasse, and papermill sludge. Much of the fuel used in these plants would otherwise go to landfills and decompose into carbon dioxide.

SCS utilizes years of experience in the power and process industry to offer engineering and construction solutions to its customers. Key SCS personnel have designed and built over 100 biomass-fired boilers over the past 35 years.

Source: www.scsenergy.com

WOOD CHIPPERS/TUB GRINDERS

Advanced Recycling Equipment, Inc.

Address:	850 Washington Road Saint Mary's, PA 15857
Phone:	(814) 834-4470
Phone Toll Free:	(800) 611-6599
Fax:	(814) 834-3483
Web Address:	www.advancedrecyclingequip.com
E-Mail:	areinc@alltel.net
Contact:	Christine Newell, Sales
Primary Activity:	Manufacturer
Secondary Activity:	Professional Services
Product Name:	Challenger® Grinders

Advanced Recycling Equipment, Inc. (ARE), offers a comprehensive line with over 70 models including hopper (15–20 hp, 1'–10' wide), horizontal (15–250 hp, 1'–6' wide), slab/pallet (75–250 hp, 2'–6' wide), gravity feed, and diesel power grinders. It also sells used equipment.

ARE has a new line of Challenger® Diesel Power Grinders. These grinders are available in hopper, horizontal, and slab/pallet styles. These units are powered by a Caterpillar diesel engine, equipped with hydraulic pump to power the infeed on the horizontal or the ram on a hopper model. They can be used to reduce pallets, slabs, end cuts, cants edgings, and many other types of wood waste into a marketable by-product, such as mulch, animal bedding, sawdust, and burner fuel.

CHALLENGER® CH500-40150-SR "Horizontal" Grinder Processes Hogged Hardwood Material to Fine Core Material

Source: www.advancedrecyclingequip.com

Alan Ross Machinery Corporation

Address:	3240 Commercial Avenue Northbrook, IL 60062-1907
Phone:	(847) 480-8900
Fax:	(847) 480-1830
Web Address:	www.rossmach.com
E-Mail:	director@rossmach.com
Contact:	Joel Ross, Marketing Manager
Primary Activity:	Distributor
Product Name:	Variable – Dependent Upon Inventory

Alan Ross Machinery Corporation buys, sells, and trades scrap processing and recycling equipment. It offers used and new equipment sales, appraisals, plant liquidations and auctions, and surplus industrial asset management.

Source: www.rossmach.com

Aspen Equipment Company

Address:	9150 Pillsbury Avenue South Bloomington, MN 55420
Phone:	(952) 888-2525
Phone Toll Free:	(800) 888-7671
Fax:	(952) 656-7159
Web Address:	www.aspenequipment.com
E-Mail:	mlundeen@aspeneq.com
Contact:	Mark Lundeen, Municipal Sales
Primary Activity:	Dealer
Secondary Activity:	Professional Services
Product Name:	Chippers, Screens, Tub Grinders

Aspen Equipment Company has a diverse product line from cranes, compressors, and plows to wood chippers and log loaders. It sells a variety of Brush Bandit forestry products, including hand-fed chippers, whole-tree chippers, stump grinders, waste recyclers, tracked chippers, and PTO chippers.

Wood Chipper


Horizontal Grinder

Source: www.aspenequipment.com

Bandit Industries, Inc.

Address:	6750 Millbrook Road Remus, MI 49340
Phone:	(989) 561-2270 (800) 952-0178
Fax:	(989) 561-2273
Web Address:	www.banditchippers.com
Primary Activity:	Manufacturer
Product Name:	Bandit Chippers (various models)

Bandit Industries, Inc. manufactures a full line of wood chippers and grinders, some of which include the following.

Bandit Chipper Models 150XP, 200XP, and 250XP. Three models of 12-in.-diameter-capacity Bandit chippers are available. The Model 150XP is a basic, 12-in. chipper. The Model 200XP has a faster feed rate and a few features that are optional on the 150XP. The Model 250XP has a much wider chipper opening and a bigger infeed chute. These models emphasize rugged construction, powerful feed systems, and large infeed openings. Bandit also offers a wide range of gas and diesel engine options from 56 to 130 hp.

Bandit Chipper Model 280XP. This model has an 18-n. chipping capacity, making it a highly productive hand-fed chipper. The unit has an 18 × 20 in. chipper opening that, along with the powerful feed system, allows the 280XP to chip limbed, forked trees, and multiple stems. It is useful for both big tree takedowns and light land clearing. This machine is a hydraulic-feed, disc-style chipper with the 45° angled feed. Engine options include Cummins, John Deere, Perkins, and Ford from 100 to 200 hp.

Bandit PTO Chippers. Bandit's Models 65, 90XP, 95, 150XP, 200+XP, and 250XP are offered with a PTO drive. The PTO chippers come trailerized with up to three axles or with a three-point hitch. A self-contained hydraulic system incorporated into the drive provides the power to the feed system on all of the Bandit PTO chippers.

Bandit Models 1290 and 1690. The conventional drum chippers come with a fixed-end discharge, and a side chute with a defer is available to discharge material at a right angle through the rear discharge. Bandit offers two models: the 1290, which features a 12-in.-wide roller, and the 1690, which features a 16-in.-wide roller. The drum chippers have gas and diesel engine options from 65 to 120 hp.

PTO Drive Chipper

Aspen Equipment is the Bandit dealer in North Dakota.

Source: www.banditchippers.com and MSW Management, “Making Molehills from Mountains: Portable Tub Grinders & Screeners,” March/April 2001

Big Timber Sales

Address:	400 16th Street Corning, IA 50841
Phone:	(641) 322-4358
Fax:	(641) 322-5411
Web Address:	www.bigtimbersales.com
E-Mail:	bigtimb@frontiernet.net
Contact:	Jerry Walker, President
Primary Activity:	Dealer
Product Name:	W.H.O. Tub Grinders and Sundance Kid Utility Grinders

Big Timber Sales specializes in selling environmental equipment. It offers the following two brands of wood grinders.

W.H.O. Tub Grinders
These machines are mostly made-to-order for each particular grinding situation. Standard models are from 43" to 63" and up to 850 hp.

W.H.O. Tub Grinder

Sundance Kid Utility Grinders

These grinders are typically used for resizing demolition grind wood mulch and are great for curbside storm cleanup. It does not have a recutter screen to plug with wet materials. It may be fed with skid-steer or hand fed.

Sundance Kid Utility Grinders

Source: www.bigtimbersales.com

Continental Biomass Industries, Inc.

Address:	22 Whittier Street Newton, NH 03858
Phone:	(603) 382-0556
Fax:	(603) 382-0557
Web Address:	www.cbi-inc.com
E-Mail:	info@cbi-inc.com
Contact:	Ed Donovan, Sales
Primary Activity:	Manufacturer
Product Name:	CBI Grizzly Mill

Continental Biomass Industries, Inc. (CBI), manufactures grinders, chippers, shredders, custom, and screening systems for the logging industry. It also sells used equipment. The CBI Grizzly Mill is the backbone of CBI Biomass Recovery systems and is designed specifically for waste wood such as stumps, logs, demolition debris, poles and ties, stringy bark, and yard waste. The Grizzly Mill is available in 7 mill sizes ranging from 200 to 1000 hp.

CBI Grizzly Mill

Source: www.cbi-inc.com

CW Manufacturing, Inc.

Address:	14 Commerce Drive Sabetha, KS 66534
Phone:	(785) 284-3454
Phone Toll Free:	(800) 743-3491
Fax:	(785) 284-3601
Web Address:	www.hogzilla.com
E-Mail:	hogzilla@cwmill.com
Contact:	Angie Lourance, Marketing Manager
Primary Activity:	Manufacturer
Product Name:	HogZilla WC Series

CW Manufacturing, Inc., manufactures HogZilla grinders for waste reduction, recycling, land clearing, and construction demolition. The company now manufactures eleven standard HogZilla models ranging from midsized to massive including self-propelled track-driven and self-loading units. The WC series range from 525–1000 hp and have a production rate between 40 and 80 tons per hour, depending on what material is ground. CW Manufacturing, Inc., also sells used equipment.

HogZilla WC Series

Source: www.hogzilla.com

Diamond Z Manufacturing

Address:	11299 Bass Lane Caldwell, ID 83605-7958
Phone:	(208) 585-2929
Phone Toll Free:	(800) 949-2383
Fax:	(208) 585-2112
Web Address:	www.diamondz.com
E-Mail:	diamondz@diamondz.com
Contact:	Randy Dodd
Primary Activity:	Manufacturer
Secondary Activity:	Dealer
Product Name:	Diamond Z Model 1136B

This model applies up to 30 hp to each of fourteen 40-lb hammers operating in a 36-in.-diameter hammer mill. It weighs 19 tons with a tub diameter of 11 ft. A 300- to 425-hp Cat engine powers its direct drive. Production rates vary with type of material. Stumps and logs can be processed at 30 tph, yard and brush waste at 40 tph, and pallets and construction waste up to 45 tph. The primary application for this model is small-scale wood and construction debris grinding operations. Production rates include:

- Stumps and logs – up to 30 tons or 90 yards per hour.
- Brush and yard waste – up to 40 tons or 160 yards per hour.
- Pallets and construction waste – up to 45 tons or 315 yards per hour.

Diamond Z Model 1136B

Source: MSW Management. Making Molehills from Mountains: Portable Tub Grinders & Screeners. March/April 2001.

DuraTech Industries International, Inc.

Address:	PO Box 1940 3780 Highway 281 Southeast Jamestown, ND 58402-1940
Phone:	(701) 252-4601
Phone Toll Free:	(800) 243-4601
Fax:	(701) 252-0502
Web Address:	www.duratechindustries.net
E-Mail:	ind.sales@duratechindustries.net
Contact:	Keith Hermanson, Industrial Field Manager keith.hermanson@duratechindustries.net
Primary Activity:	Manufacturer
Product Name:	DuraTech Model 2009 Industrial Tub Grinder

The DuraTech Model 2009 Industrial Grinder is suitable for grinding jobs that do not require high horsepower. It is powered by a 325-hp (242.4 kW) Caterpiller electronic diesel engine that meets Tier III emission standards and is connected to the heavy-duty mill by a PT self-adjusting, microprocessor-controlled clutch.

DuraTech Model 2009 Industrial Tub Grinder

Source: www.duratechindustries.net

EarthSaver Equipment, Inc.

Address:	PO Box 7325 Kalispell, MT 59904
Phone:	(406) 755-9611
Fax:	(406) 755-9655
Web Address:	www.earthsaverequipment.com
E-Mail:	support@earthsaverequipment.com
Contact:	Powell Clinton, President
Primary Activity:	Dealer
Product Name:	Variable

EarthSaver Equipment specializes in equipment for wood and green waste recycling. It buys, sells, and salvages an array of equipment, including tub grinders, horizontal grinders, and other recycling equipment and systems. It sells replacement parts for Diamond Z Manufacturing; DuraTech Industries International, Inc.; Fuel Harvester; Morbark, Inc.; Toro-Precision; Vermeer Manufacturing Company; and W.H.O. Manufacturing Co., Inc.

EarthSaver P-12 with Grapple

Source: www.earthsaverequipment.com

Hud-Son Forest Equipment, Inc.

Address:	PO Box 345 8187 State Route 12 Barneveld, NY 13304
Phone:	(315) 896-2217
Phone Toll Free:	(800) 765-7297
Fax:	(315) 896-2627
Web Address:	www.hud-son.com
E-Mail:	info@hud-son.com
Contact:	Alis Vincent
Primary Activity:	Distributor
Product Name:	Valby Wood Chipper

Hud-Son Forest Equipment offers a range of Valby wood chippers. The wood chippers are used to eliminate tree limbs, branches, and other debris. The Valby wood chipper will grind branches and tree limbs virtually anywhere because of its maneuverability. Its CH260 0EM Model will produce 3–15 tons per hour. Used equipment is available.

CH 260 with Hydraulic Power Feed

Source: www.hud-son.com

Morbark, Inc.

Address:	PO Box 1000 8507 South Winn Road Winn, MI 48896
Phone:	(989) 866-2381
Phone Toll Free:	(800) 233-6065
Fax:	(989) 866-2280
Web Address:	www.morbark.com
E-Mail:	inquire@morbark.com
Contact:	John Foote, Vice President Sales
Primary Activity:	Manufacturer
Secondary Activity:	Distributor
Product Name:	Morbark Tub Grinder Model 950

The Morbark Tub Grinder Model 950 will grind bark, yard waste, and brush into pellets and mill waste. The grinder is typically used by smaller municipalities and landfills, tree service companies, recycling yards, golf courses, and sawmills. It has power unit options up to 205 hp. Among standard features are the hydraulic tub tilt, full break-away torque limiter, dual-discharge augers, and heavy-duty hammer mill equipped with 24 hard-surfaced fixed hammers.

Morbark Tub Grinder Model 950

Source: www.morbark.com

Precision Husky Corporation

Address:	PO Drawer 507 Leeds, AL 35094-0507
Phone:	(205) 640-5181
Fax:	(205) 640-1147
Web Address:	www.precisionhusky.com
E-Mail:	sales@precisionhusky.com
Contact:	John Falkner, Vice President Sales
Primary Activity:	Manufacturer
Product Name:	ProGrind 900

The ProGrind 900 is a compact grinding solution for community-based solid waste programs, smaller municipalities, golf courses, landscape operations, and cemeteries. Product specifications include:

- 100 to 150 hp [74.57 to 111.9 kW] Cummins diesel engine.
- Three different hammer options for grinding versatility.
- Two 12-in. [305-mm] discharge augers move material from mill area.
- Tub tilts forward 38 degrees for easy access to hammer mill, screens, and lower auger area.
- Optional stacking conveyor and magnetic head roller.
- Control panel, complete with operating switches, hydraulic controls, and gauges.
- Electronic control system.
- 2 5/16-inch [587-mm] ball hitch for towing (pintle ring option available).

ProGrind 900

Source: www.precisionhusky.com

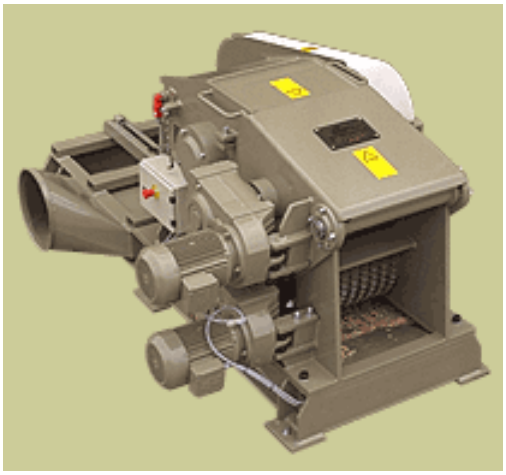
Ram Group, Inc. (The)

Address:	13520 South Chippewa Trail Lockport, IL 60441
Phone:	(708) 301-0660
Fax:	(708) 301-0669
Web Address:	www.theramgroupinc.com
E-Mail:	ram13520@aol.com
Contact:	Rob Martin, President
Primary Activity:	Manufacturer
Secondary Activity:	Dealer
Product Name:	Scan Hugger Hopper Style Grinders and Horizontal Feed Chippers and Grinders

The Scan Hugger Hopper Style Grinders are capable of shredding all types of wood waste (solid wood, particleboard, MDF (medium-density fiberboard), pallets, cardboard, and paper). It is offered in eight different models with horsepowers ranging from 10 to 125 and have the capability of processing up to 2 tons per hour depending on the material to be processed and the desired chip quality.

Scan Hugger Hopper Style Grinder

The Scan Hugger Horizontal Feed Chippers are ideally suited for cutting rib edgings, slabs, and off-cuts to a precise chip. The chipper can be placed in the factory at the source of waste. Operating in-line with a straight- or gang rib saw, it continuously reduces the waste produced and eliminates the handling of slabs and edgings.



Scan Hugger Horizontal Feed Chipper

Source: www.theramgroupinc.com

Rayco Manufacturing, Inc.

Address:	4255 Lincoln Way East Wooster, OH 44691-8601
Phone:	(330) 264-8699
Phone Toll Free:	(800) 392-2686
Fax:	(330) 264.3697
Web Address:	www.raycomfg.com
E-Mail:	rayco@raycomfg.com
Primary Activity:	Manufacturer
Product Name:	RC6D, RC12, RC12D, RC20^{XP}

The entire Rayco line of brush chippers is manufactured in the United States at Rayco's facilities. Rayco supplies authorized Rayco dealers with readily available replacement parts. Its brush chipper product line is detailed below.

RC6D

- 25 hp
- 6-in.-diameter chipping capacity
- Intake rate of 39.5 ft/lb @ 2800 rpm

RC6D

RC12

- 80 hp, 4-cylinder, diesel engine
- 12-in.-diameter chipping capacity
- Intake rate up to 130 ft/minute

RC12

RC12D

- 115 hp, 4-cylinder, diesel engine
- 12-in.-diameter chipping capacity
- Intake rate up to 120 ft/minute

RC12D

RC20^{XP}

- 225 hp, 6-cylinder, diesel engine
- 20-in.-diameter chipping capacity
- Intake rate up to 105 ft/minute

RC20^{XP}

Source: www.raycomfg.com

Universal Refiner Corporation

Address:	PO Box 151 1305 Wynooche Avenue Montesano, WA 98563
Phone:	(360) 249-4415
Phone Toll Free:	(800) 277-8068
Fax:	(360) 249-4773
Web Address:	www.universalrefiner.com
E-Mail:	UniversalRefiner@Techline.com
Contact:	Lori Minzey, Sales Manager
Primary Activity:	Manufacturer
Product Name:	TDR-90 Rascal H.A.W.G.

The TDR-90 Rascal H.A.W.G. grinds stumps and chunks up to 80-in.-diameter × 5000 lb and can be fed with a bobcat or farm tractor and bucket. Other specifications include:

- One axle unit with M11-300 Cummins engine with conveyor discharge.
- 102-in.-diameter infeed and URC high-performance drive package.
- Auger discharge standard.
- 300 hp.

TDR-90 Rascal H.A.W.G.

Source: www.universalrefiner.com

Vermeer Manufacturing Company

Address:	PO Box 200 1210 Vermeer Road East Pella, IA 50219
Phone:	(641) 628-3141
Phone Toll Free:	(888) 837-6337
Fax:	(641) 621-7734
Web Address:	www.vermeer.com
E-Mail:	salesinfo@vermeer.com
Contact:	Chris Nichols, Sales Manager
Primary Activity:	Manufacturer
Secondary Activity:	Dealer
Product Name:	Horizontal Grinder 365E

The HG365E can be configured to meet a wide variety of on-site, electric-powered grinding applications. A 250-hp (186.5-kW), 460-volt three-phase Baldor electric motor powers the hammer mill, while all other hydraulic functions are driven by a separate 50-hp (37.28-kW) Baldor motor. The HG365E offers the same innovative and labor saving features—such as the SmartGrind system and the patented Duplex Drum Rotor—as the mobile Vermeer HG365.

Horizontal Grinder 365E

Local Vermeer Sales and Service dealerships are located in Bismarck, North Dakota; Minot, North Dakota; and Moorhead, Minnesota.

Source: www.vermeer.com

West Salem Machinery

Address:	PO Box 5288 665 Murlark Avenue Northwest Salem, OR 97304
Phone:	(503) 364-2213
Phone Toll Free:	(800) 722-3530
Fax:	(503) 364-1398
Web Address:	www.westsalem.com
E-Mail:	sales@westsalem.com
Primary Activity:	Manufacturer
Product Name:	WSM processing machinery

WSM's processing machinery keeps your fuel system up and operating at peak efficiency. Some products available include:

- WSM chippers are used in mill applications for processing slab wood, trim ends/edgings, and small logs. WSM chippers are available with 48- to 84-in.-diameter discs with four to eight knives. Production capacities range from 1 to 100 units an hour.
- WSM horizontal grinding systems are ideal for processing long edgings and panels, as well as shorter trim material. The powered feed mechanism ensures a metered and controlled feed to the shredder, producing a consistent finished product, while the slow-speed, high-torque cutting action means lower horsepower and lower noise. This complete wood waste processing system comes with a belt or vibrating infeed conveyor, power feed mechanism, grinder, and electrical control panel. WSM horizontal grinders are available in a full range of sizes with 12-, 24-, 36-, and 74-in.-wide feed openings.
- The horizontal hogging system from WSM includes the infeed conveyor, power feed mechanism, and horizontal hog. Material is fed to the hog by the infeed conveyor. As material approaches the throat opening, the pivoting power feed mechanism grips the material and meters it into the grinding chamber of the hog. Material is sheared against an anvil by the hammers and forced through the sizing screens, reducing it to the desired size. WSM horizontal hogging systems are available in a full range of machine sizes for processing from 1 to 150 tons an hour.

Shredded Wood Fiber Processed Through WSM Horizontal Hog

WSM Horizontal Hog Processing Pallets and Mixed Wood Waste

WSM Model 4048BHI Processing Slab Wood into Boiler Fuel in Malaysia

Source: www.westsalem.com

W.H.O. Manufacturing Company, Inc.

Address:	PO Box 1153 Lamar, CO 81052
Phone:	(719) 336-7433
Fax:	(719) 336-7052
Web Address:	www.who-mfg.com
E-Mail:	who@who-mfg.com
Contact:	Jeff Heilmann, Sales Manager
Primary Activity:	Manufacturer
Product Name:	Model S12-56 Stationary Tub Grinder PTO10-43HD Portable Tub Grinder

The standard Stationary Tub Grinder Model S12-56 is constructed with the same materials used in the P12-56 Portable Tub Grinder.

Model S12-56 Stationary Tub Grinder

- With engine options of up to 500 hp and weighing 12,000 lb without engine.
- The frame is 12-in. channel iron, and the supports are made of ¼-in. plate steel. The discharge area under the cylinder is built to the specifications of the customer. Built for large capacities, the standard cylinder shaft is 56 in. long and 4 7/8-in. in diameter, with a 3 3/16-in.-diameter bearing journal. There are eight rods in the cylinder which go through the cylinder plates and one end of each hammer. Twelve hammers, 3/8 in. thick, are spaced between every other cylinder plate for a total of 96 hammers. The weight of the hammers, when in motion with the cylinder, acts as a flywheel, giving the cylinder a more uniform balance and even motion. Two cylinders can be used in the same tub if additional capacity is desired or extra fine grinding is anticipated. The cylinder is factory-balanced for vibration-free operation.
- The cylinder is driven by an electric motor or engine. The power is transferred by jackshafts and 10 V-belts (for use on 50-Hz electric power). The belts reduce vibration and load shock from the cylinder to the motor.
- The tub is tilted hydraulically for changing screens or for servicing.

Model S12-56 Stationary Tub Grinder

PTO10-43HD Portable Tub Grinder

- The cylinder is 43 in. long with a 47/8-in.-diameter shaft. Thirty-four 1-in.-thick hammers are spaced between every other cylinder plate in four rows around the cylinder. The cylinder is factory-balanced and can be balanced on-site by following the owner's manual. Bearings on the cylinder shaft are heavy-duty SKF ball bearings. The cylinder is driven by 16 V-belts linked to the engine by the jackshaft. The belts help reduce vibration and load shock from the cylinder to the engine.
- Ground material passes through the screens and is deposited on the moving dragbox conveyor belt which deposits it on the elevator belt. In turn, it is moved up the elevator and deposited to the rear of the grinder.
- The tub is driven by a Sundstrand planetary gear with a ratio of 22:1.
- The tub is tilted hydraulically for changing screens or for servicing.
- A heavy-duty 81XHHR chain withstands sudden load changes. The tub rests on seven tub rollers. Each roller is supported by two pillowblock ball bearings which are standard over-the-counter items. Four adjustable tub guides with smooth rollers make centering the tub easy.
- The magnetic pulley assembly removes ferrous metal from the ground material and discharges it down the slide, producing a salable product.
- The hydraulic folding elevator can be folded/unfolded and raised or lowered from the same control area at the base of the elevator.

PTO10-43HD Portable Tub Grinder

Source: www.who-mjg.com

Woodsman Chippers

Address:	320 East Ludington Drive Farwell, MI 48622
Phone:	(989) 588-4295
Phone Toll Free:	(800) 953-5532
Web Address:	www.woodsmanchippers.com
E-Mail:	sales@woodsmanchippers.com
Primary Activity:	Manufacturer
Product Name:	Brush Chippers 12X, 15X, 18Xtreme, and 20X

Woodsman brush chippers have been on the market since 1994 and are available in a range of sizes and horse powers:

12X

- 83–130 hp
- 25-in.-wide × 20-in.-high chipper opening

12X

15X

- 83–130 hp
- 25-in.-wide × 24-in.-high chipper opening

15X

18Xtreme

- 116–275 hp
- 25-in.-wide × 24-in.-high chipper opening

18Xtreme

20X

- 200–320 hp
- 37-in.-wide × 22-in.-high chipper opening

20X

Source: www.woodsmanchippers.com

ADDITIONAL RESOURCES

Brandon, D. *The Ground Rules for Buying a Grinder*; www.morbark.com/Equipment/Buyatub.pdf (accessed June 2006).

This article discusses how to select a tub or horizontal grinder, how to talk to equipment sales representatives and the Top 10 Buying Factors for buying a grinder.

CANMET Energy Diversification Research Laboratory and SGA Energy Limited. *Buyer's Guide to Small Commercial Biomass Combustion Systems*; Prepared for the Renewable and Electrical Energy Division, Energy Resources Branch, Natural Resources Canada, www.canren.gc.ca/prod_serv/index.asp?CaId=130&PgId=729 (accessed June 2006).

This Guide is intended to provide a practical approach to planning, procuring, and operating a Biomass Combustion System (BCS). It outlines considerations the buyer should take into account before seeking the professional services of experts in the field. The Guide is not intended as a "how to" manual for the design, procurement, and installation or servicing of a BCS.

Fraunhofer USA Center for Energy and Environment. *Decision Making Guide, Wood Gasification for Energy Generation*; Prepared for the Pennsylvania Department of Environmental Protection, www.depweb.state.pa.us/energy/lib/energy/WoodGasificationDecisionMakingGuide.pdf (accessed June 2006).

This guide was developed to help communities, industry, and others interested in investigating the feasibility of a wood gasification project. Chapter 2 describes how an assessment can be carried out; Chapter 3 provides a detailed description of wood combustion and gasification technologies; Chapter 4 contains background information on possible business structures and financial aspects such as funding opportunities; and Chapter 5 lists references and contacts.

Gupta, S., Minnesotans for an Energy-Efficient Economy. *Biomass-Fueled Community Energy Systems: A Viable Near-Term Option for Minnesota Communities*; www.me3.org/issues/biomass/community.pdf (accessed June 2006).

This report explores the feasibility of biomass-fueled community energy systems in Minnesota. The report includes discussion on the local availability of biomass fuel supplies, economics of biomass electricity production, and the status of Minnesota's biomass mandate and Renewable Energy Objective.

Maker, T., Biomass Energy Resource Center for the Coalition of Northeastern Governors Policy Research Center. *Wood-Chip Heating Systems, A Guide for Institutional and Commercial Boiler Installations*; www.biomasscenter.org/pdfs/Wood-Chip-Heating-Guide.pdf (accessed June 2006).

This guide discusses in detail the steps involved in investigating the feasibility of burning wood chips, studying its cost-effectiveness, and installing a biomass system that will meet various facility needs.

Schmidt, D.D.; Hanson, S.K.; Martin, K.E. *Identifying Resources and Options to Mitigate the Risk of Wildland Fires in North Dakota*; Prepared for the North Dakota Forest Service, www.undeerc.org/centersofexcellence/biomass/pdfs/wildfire.pdf (accessed June 2006).

This three-part study examines 1) North Dakota's biomass resources, 2) North Dakota's energy infrastructure of registered boilers, and 3) market analysis potential for value-added products from wood resources in North Dakota.

Schmidt, D.D.; Pinapati, V. *Opportunities for Small Biomass Power Systems*; Prepared for the U.S. Department of Energy, www.undeerc.org/centersofexcellence/biomass/pdfs/ds_smallbiomass.pdf (accessed June 2006).

This study provides information to key stakeholders and the general public about biomass resource potential for power generation. Ten types of biomass are identified and evaluated. The quantities available for power generation were estimated separately for five U.S. regions and Canada. A method entitled "competitive resource profile" was used to rank resources based on economics, utilization, and environmental impact. The results of the analysis may be used to set priorities for utilization of biomass in each U.S. region. A review of current biomass conversion technologies was accomplished, linking technologies to resources.

Timpe, R.C.; Mann, M.D.; Schmidt, D.D. *Gasification for Distributed Generation – Task 3.5*; Prepared for the U.S. Department of Energy National Energy Technology Laboratory, www.osti.gov/bridge/servlets/purl/824977-CdHCRS/native/824977.pdf (accessed June 2006).

This report is a part of a search into emerging gasification technologies that can provide power under 30 MW in a distributed generation setting. Larger-scale gasification has been used commercially for more than 50 years to produce clean synthesis gas for the refining, chemical, and power industries, and it is probable that scaled-down applications for use in remote areas will become viable. The appendix to this report contains a list, description, and sources of currently available gasification technologies that could be or are being commercially applied for distributed generation. This list was gathered from current sources and provides information about the supplier, the relative size range, and the status of the technology.

University of Wisconsin-Madison Forest Ecology and Management. *Wood-Fueled Boiler Financial Feasibility User's Manual*; http://forest.wisc.edu/extension/boilermanual.htm (accessed June 2006).

"Wood-Fueled Boiler Financial Feasibility" is a spreadsheet program designed for use on a personal computer. This program provides a starting point for interested parties to perform financial feasibility analysis of a steam boiler system for space heating or process heat. By

allowing users to input the conditions applicable to their current or proposed fuel systems, "Wood-Fueled Boiler Financial Feasibility" provides an opportunity to compare wood or bark fuel as alternates to the existing fuel.

U.S. Department of Agriculture Forest Service. *Fuels for Schools, A Business Outlook*; www.fuelsforschools.org/pdf/business_outlook.pdf (accessed June 2006).

This article discusses the status of the Fuels for Schools Program, as of January 2004 and the benefits of the program.

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Continued . . .

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