

Biomass Briefing Paper

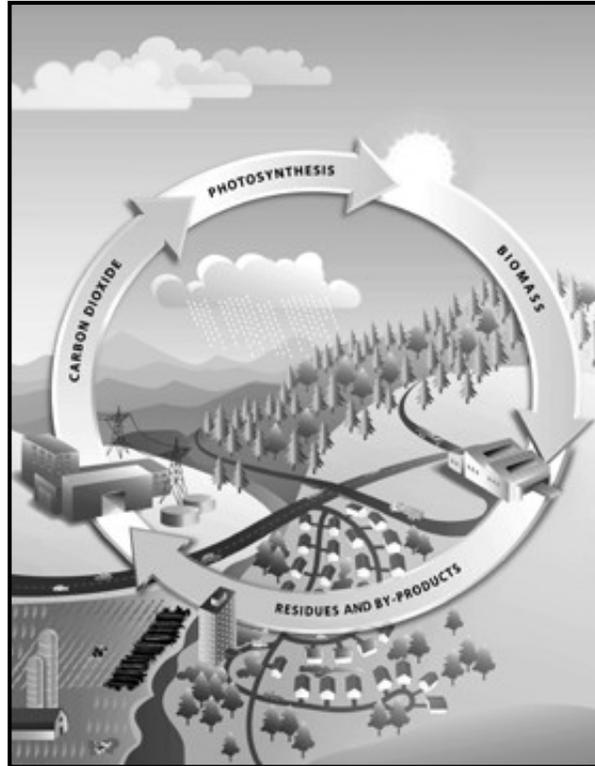


Image Source: Natural Resources Canada

Jim Williams
Fuels Technician

United States Forest Service
Northern Hills Ranger District
Black Hills National Forest
South Dakota

January 2005

The tour to Chadron State College (CSC) on January 24 was intended to familiarize facility managers with the concept of using woody biomass as a heat source. The tour covered biomass utilization from recovery in the woods to material transport to producing heat on campus. After 14 years of experience, CSC provides a model of efficient recovery and use of woody biomass as an alternative heat source for a multiple building facility.

Chadron State College's biomass system is relatively large especially when compared to the needs of a smaller facility. Biomass heating systems come in a range of sizes and styles and can be used for small applications (one building) or for large applications (college campuses, downtown districts) and can utilize firewood, wood pellets, or wood chips as fuel. While the concept of using biomass for heat may be new in the West, the technology and capability of using biomass has existed for decades. Today's biomass heating systems are computer controlled for maximum efficiency and minimum emissions and can be designed to meet the needs of most facilities.

Chadron State College Information

System Information

- CSC began heating its campus with wood chips in 1991 and has continued to do so for the last 14 years.
- CSC heats 20 buildings, about 1.1 million square feet of space.
- CSC saves approximately \$150,000/year in heating costs by using biomass instead of natural gas.
- A 10 year payback on the purchase and installation of the wood boilers was expected--it only took 7 years to payback.
- Wood fired boilers produce 90% of the college's heat.
- Natural gas is used as a backup heat source and produces 10% of the college's heat.
- CSC recently installed an absorption chiller that condenses steam produced by the wood-fired boilers to provide chilled water for campus air conditioning.

Fuel Information

- On average, 18 tons of wood chips are burned per day.
- Approximately 8,000 tons of wood chips are burned per year.
- All of the biomass burned is provided by a local contractor who obtains the material from the Pine Ridge area.
- The woody material comes from the unmerchantable slash piles (tops, limbs, and needles) that are left after timber harvest.
- The material is allowed to air dry in the woods prior to being chipped, the resulting moisture content is 20-30%.
- Local contractor delivers approximately 80 tons per day to the college.
- Fuel Price: \$35-\$40 per delivered ton (25-40% moisture content).

Emissions

- Biomass boiler system produces 3% ash that is disposed of in the local landfill once a month
- The wood-fired system meets all EPA standards and inspections

Community Enhancement

- CSC's conversion to a biomass system created 2 new full-time jobs and 1 part-time job in the Chadron area
- CSC now has a minimal contribution to greenhouse gas emissions
- CSC's use of slash from the forest helps reduce forest fuel loadings and provides a market for small diameter material giving foresters another way to manage the slash created from timber harvest.

Other Facilities That Use Biomass for Heat

For nearly 20 years, biomass has been used by many schools and public facilities in Vermont and in other eastern states as an alternative heat source. These systems range from small single building units to large multi-building units. In contrast, there are only a few biomass boiler systems used for domestic heat in the West, with many of those coming on-line within the past few years. Here are some links to other facilities that heat with biomass:

The Lied Conference Center, National Arbor Day Farm--Nebraska City, Nebraska..... www.liedlodge.org
Northwest Missouri State University--Maryville, Missouri.....www.nwmissouri.edu
Darby Public Schools--Darby, Montana.....www.fuelsforschools.org/darby.html
Vermont Public Schools.....<http://bioproducts-bioenergy.gov/pdfs/bcota/abstracts/10/210.pdf>

Biomass in the Black Hills

In order for biomass to be considered a viable source of energy in a particular area, three key things are necessary:

1. plentiful and sustainable supply of biomass
2. infrastructure capable of harvesting, processing and hauling material
3. large population base located within the cost effective haul distance of the biomass

The Black Hills region has all of these components, making this area a prime place for biomass utilization.

The Black Hills region is characterized by extensive stands of ponderosa pine forests that are managed for timber production and fire hazard reduction. A byproduct of the management of these forests is small diameter woody material that can be used as biomass to heat local buildings and other facilities.

The Black Hills cover approximately 1.5 million acres—1.2 million acres are administered by the Black Hills National Forest, the remaining 289,000 acres are in private, state, or other federal agency ownership. Timber production is one of the dominant uses of the Black Hills National Forest and one of the largest industries in this region. Vegetation management has occurred in the Black Hills for over 100 years and is likely to occur indefinitely into the future.

During timber harvest, trees are processed into merchantable and unmerchantable material (slash). Merchantable material includes sawlogs, posts, and poles which are taken to a sawmill to be processed into commodities. Slash includes needles, twigs, and material less than 6 inches in diameter. Two options for slash disposal exist in the Black Hills—lop and scatter which leaves the slash in the forest and whole tree yarding which removes slash from the forest and concentrates it in one area where it is piled in large piles, called delimeter piles.

The delimeter piles created during timber harvest can be 15 to 30 feet tall and 150 to 250 feet long (see figure 1). These piles contain a significant volume of small diameter woody material, a small portion of this material is cut and gathered for personal use firewood, but the majority of it is burned on-site by Forest Service fire crews when sufficient snow cover exists.

On the Northern Hills Ranger District of the Black Hills National Forest it is estimated that **annually 29,000 green**

tons of biomass are created in the delimeter piles resulting from timber harvesting. This calculation does not include any biomass created from other vegetation management work (fuels reduction, timber stand improvement) on the District. Material from these activities adds to the total amount of biomass available. Biomass from all vegetation management on the other districts on the Forest also adds to the total amount of biomass available. It is estimated that an average of **208,000 green tons** of biomass are created **annually** from all vegetation management activities on the entire Black Hills National Forest. The amount of biomass available from South Dakota state lands, other Federal lands, and private land has not been assessed at this time, but should be considered as another viable source of biomass for this region. In addition to the material that is in the forest, local sawmills produce wood chips from sawmill residues. Sawmills in the Black Hills region produce over **100,000 green tons** of wood chips **annually**.

Biomass research and discussions with local foresters indicate that a 50 mile radius from the source of the material is the maximum cost effective distance to haul biomass due to its low value. Because several communities are interspersed in and around the Black Hills, biomass from the Black Hills National Forest, South Dakota state lands, Bureau of Land Management lands, National Park Service lands, and private land is in the cost effective haul distance of all the communities within the Hills and several of the surrounding communities.

If you are thinking about using alternative energy sources for your facility, biomass is worth considering. The Black Hills offer plentiful supply, infrastructure and technology available to process biomass and bring it to the local market, and a large population base capable of using biomass.

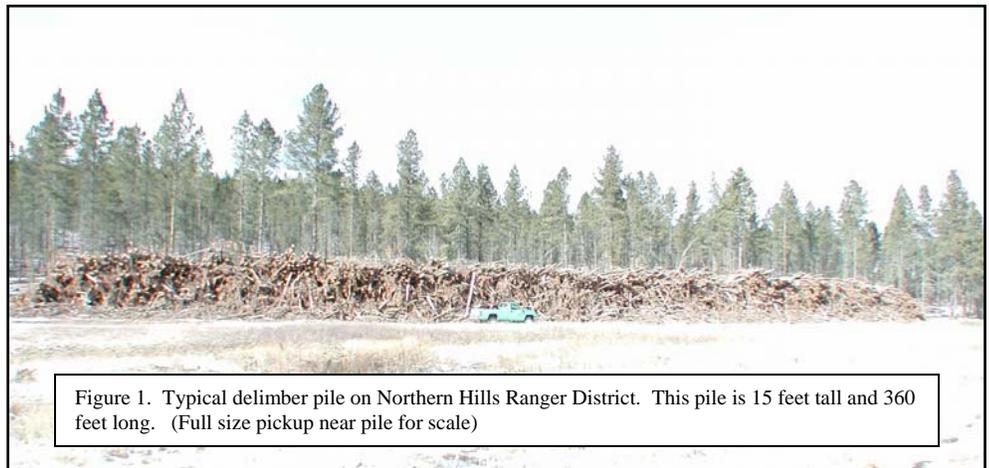


Figure 1. Typical delimeter pile on Northern Hills Ranger District. This pile is 15 feet tall and 360 feet long. (Full size pickup near pile for scale)

Other Benefits of Using Biomass

Economics, in the form of savings on energy costs, are generally the main consideration for a facility manager when making decisions about the type of energy that will be used to provide heat to a facility. Economically, biomass competes very well with fossil fuels and electricity, but also offers social and environmental benefits that may not be realized by other energy sources:

- Biomass fuel comes from a renewable and sustainable resource base.
- The fuel is available in great quantities in the Black Hills region.
- Biomass fuel dollars stay in the local and state economy, helping the local tax base and building tax revenues.
- Biomass fuel prices have been stable historically and are not subject to national or global energy market fluctuations.
- Biomass pricing is not subject to monopolistic control because it is provided by several smaller local suppliers.
- Biomass has low sulfur content so it does not contribute to atmospheric sulphur oxides that can cause acid rain.
- Utilization of biomass increases the health of the local forest by removing excess slash and overabundant small diameter trees.

Biomass Websites

With the increased interest in biomass utilization throughout the country more information is becoming available. One of the primary sources of information is the internet, below is a list of different websites that may be of interest to you.

Wood Boiler/Furnace Manufacturers	Programs and Organizations	Funding/Grants
www.hurstboiler.com/biomass.htm	www.fuelsforschools.org	www.steppfoundation.org
www.yukon-eagle.com	www.colostate.edu/programs/cowood	www.grants.gov
www.magnumfireplace.com	www.fs.fed.us/forestmanagement/WoodyBiomassUtilization	www.rurdev.usda.gov
www.charmaster.com	www.biomasscenter.org/index.html	www.eere.energy.gov
www.dectra.net/garn	www.bera1.org	
www.dakacorp.com	www.eere.energy.gov	
www.aqua-therm.com	www.biomass.govtools.us/about/bio_act.asp	
www.centralboiler.com	www.nrel.gov	
www.Hud-son.com		
www.heatmor.com		
www.woodboilers.com/mh_home.asp		
www.burnchips.com		
www.garn.com		
www.biomasscombustion.com		

In closing, I hope that the tour to Chadron State College was informative and that it illustrated the possibilities of using biomass to heat a facility in the Black Hills area. If you have questions regarding biomass in the Black Hills or would like more information about biomass and its uses please contact:

Jim Williams
 U.S. Forest Service
 Black Hills National Forest
 Northern Hills Ranger District
 2014 N. Main
 Spearfish, SD 57783

(605) 642-4622
 jimwilliams@fs.fed.us

Greg Josten
 South Dakota Department of Agriculture
 Division of Resource Conservation and Forestry
 3305 1/2 West South St.
 Rapid City, SD 57702

(605) 394-2279
 greg.josten@state.sd.us