



Woody Biomass Heating Feasibility Project

An Alternative Fuels Project by the
South Dakota Department of Agriculture

Background

The Black Hills area of South Dakota has long been plagued with a large volume of underutilized woody biomass. Small diameter trees from non-commercial thinning projects, top wood and limb wood from sawlogs, and a weak market for medium size trees used for posts and poles has traditionally resulted in thousands of tons of slash left on the ground to rot, become fuel for the next wildfire, or piled for disposal by burning after a snowfall. Estimates indicate over 200,000 tons of slash are created in the Black Hills every year.

Wood has been used as a reliable source of heat for thousands of years. Its use has grown in and out of favor as other sources of energy, particularly fossil fuels, have become available.

Over the last twenty years, wood chips have regained popularity as an economically viable alternative to fossil fuels. A significant increase in fossil fuel prices during the fall of 2005, including as much as a 50% increase in the price of natural gas alone, has helped renew the interest in woody biomass fuels.



Slash pile photo courtesy of the Black Hills National Forest

In early 2005, the SD Department of Agriculture, Resource Conservation and Forestry Division obtained a grant from the Western Governors Association (WGA) to conduct studies to determine the feasibility of using woody biomass as a feedstock for heating schools and other public facilities in the Black Hills area. The grant, originally from the Department of Energy and administered by WGA, was designed to pay up to 90% of the cost of feasibility studies. Additional funds from a USDA Forest Service Economic Action Program grant were later dedicated to completing additional studies. Biomass Energy Resource Center (BERC) of Montpelier, VT <http://www.biomasscenter.org/> was hired to complete the feasibility studies.

Outreach



A public meeting was held in November, 2005 in Rapid City to discuss the project. Invitations were sent to Black Hills area K-12 school districts, post-secondary educational institutions, engineers, woody biomass suppliers (contractors), and landowners. Over 40 people attended the meeting representing the full spectrum of invited guests. The meeting also received coverage from the Rapid City Journal, and local television news broadcasters KOTA and KNBN. During the meeting, school and public facility representatives were encouraged to pick up an application and schedule a site visit. During the week, a representative from BERC conducted site evaluations at 14 facilities in the area where there was interest in the project.

In January 2006 the Division teamed up with the Black Hills National Forest to sponsor a tour of the woody biomass boiler and feedstock supply system of Chadron State College in Chadron, NE. Hosted by Ed Hoffman of Chadron State College and Doak Nickerson of the Nebraska Forest Service, a group of 39 people were given a presentation of the history, functionality, and economics of the only working woody biomass boiler in the area, followed by a tour of the chip bin, boiler room, absorption chiller, and the in-woods chipping operation that supplies the college.



The Project

A total of seventeen applications were received from administrators interested in having a feasibility study completed for their facility. Projects approved included six preliminary feasibility studies, one preliminary engineering study, and five preliminary feasibility assessments for district energy systems.

The feasibility studies will generate the following information for the following facilities: Lead-Deadwood High School, Hot Springs K-12 school system, Stevens High School, Rapid City Catholic School System, Spearfish East Elementary school, and Belle Fourche Middle School.



- A description of the existing facility including buildings, heating system and costs.
- Preliminary capital cost estimates for installing a biomass heating alternative.
- A financial analysis showing estimated costs and projected savings over the life of the equipment as well as an annual cash flow analysis to demonstrate the

effect on annual budgets.

- A listing of potential biomass fuel suppliers.
- A discussion of likely fuel cost and availability of fuel supply.
- Recommendation for next steps that the facility owners may want to take to pursue the concept further.

The preliminary engineering study will generate the following information for the Belle Fourche High School:

Cost estimates for:

- Purchase and installation of a new wood boiler system, fuel handling equipment, stack and any emissions control equipment if needed and controls for all wood related equipment.
- Interconnection with fossil fuel backup boiler systems
- Building renovations and new construction costs for additional space needed for the wood system (fuel storage and boiler room space).



The final output will be a report for the school facility that includes:

- A description of the existing facility including buildings, heating system and cost.
- Capital cost estimate for installing a biomass heating alternative system.

- A life cycle cost analysis showing estimated costs and projected savings over the life of the equipment as well as an annual cash flow analysis to demonstrate the impact on the annual school budget.
- A listing of potential biomass fuel suppliers.
- A discussion of likely fuel cost and availability of fuel supply.
- Recommendations for next steps that the school district may want to take to pursue the concept further.

The preliminary feasibility assessments for district energy systems will provide the following information for each of the following facilities: Rapid City Central High School/Rapid City Civic Center, South Dakota Veterans Home, Black Hills State University, Star Academy Evergreen High School, and the Black Hills Museum of Natural History.

BERC will collect the following information for each facility:



- Master site plan.
- Listing and identification of all existing buildings by function and square footage.
- Heating requirements on hourly, weekly, monthly, yearly basis, as available, with consumption of each of the heating fuels used by each of the buildings.
- Present heating system details (heating media: steam/hot water/hot air with details like pressure and temperature ratings of the media used, centralized system or multiple heating units, installed capacities of each of the heating units).
- Present fuel used (oil/natural gas/propane) with average current fuel price and on-site fuel storage capabilities.
- Layout details of present heat distribution system.
- Expansion plans.
- Existing air emissions permit details.
- Restrictions (such as height of stack or other permitting issues) which are likely to have bearing on the heating system.

The final output will be a report for each of the five facilities that include:

- A description of the existing facility including buildings, heating system and fuel cost.
- Review of the present and future heating requirements of the buildings.
- Review of the details of the fuels used for heating.
- Review of the capacities and locations of existing heating plants.
- Site assessment.
- Conceptual design of a central wood fired heating plant including plant location, building construction needs, wood storage and material handling, buried distribution piping, etc.
- Capital cost estimates for installing a biomass heating system.
- Estimates of the amount of wood fuel required for heating.



- Review of the availability, reliability and price stability of wood chips and a listing of potential biomass fuel suppliers.
- A life cycle cost analysis showing estimated costs and projected savings over the life of the equipment as well as an annual cash flow analysis to demonstrate the effect on annual budgets; and
- Recommendations for next steps that the facility owners may want to take to pursue the biomass concept further.

Follow up

Once the studies have been completed, representatives from BERC and the Division will meet with participating facility administrators to present the results and offer recommendations for next steps.

Acknowledgements

The Department of Agriculture, Resource Conservation & Forestry Division would like to thank the Western Governors Association, US Department of Energy, and USDA Forest Service for providing the grant funds to make this project possible.

Contacts

For more information about this project, contact Greg Josten, at greg.josten@state.sd.us or phone 605-394-2279 at the South Dakota Department of Agriculture, Resource Conservation & Forestry Division.