BIOMASS
CASE STUDIES SERIES

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

A Large Campus System Saves $5 Million Annually on Fuel

Campus Woodchip Heating System

Heating Capacity (output): 18 MW (60 MMBtu/hr)

Emissions Reduction and Combustion Control Equipment: Multi-cyclone, O_2 sensor control, moving grates, air pre-heater, economizer

Year Installed: 1986

Thermal Output: Steam

Since 1986, the University of Idaho has been heating its campus, and more recently also air-conditioning it, with woodchip biomass. "They say on the average that they save $5 million a year over the cost of natural gas," reports Mike Tennery, Idaho coordinator for the Fuels For Schools program.

In Moscow, on the border with Washington state, the university first looked into installing a biomass backup boiler for its campus heating system in 1978. Studies projected that a wood-fueled boiler would be cost effective, so the university had one installed to back up its natural gas-fired system.

"As the new boiler was brought on line to produce high-pressure steam to heat 70 percent (three million square feet) of campus building space and provide hot water, it was found the biomass operation was very economical," Tennery related in a 2006 report. "The biomass boiler became the lead boiler. It is run 95 percent of the time. Currently the university estimates heating costs, using the biomass-fueled boiler, are between one-quarter and one-third the costs of heating with natural gas."

Two years after the biomass unit went online, "they 'mothballed' one of the [three] gas-fired boilers. That was 18 years ago, and it's still mothballed," said the '06 report.

The system primarily burns cedar chips, mixed at about a two-to-one ratio with "slash" or scrapwood from logging, primarily white pine.

With the slash fuel, "you have to really watch the quality," says Tennery—"how much dirt there is in the fuel, whether you've got needles and if somebody has ground up a bunch of stumps, which have a lot of dirt and rocks.

"They bring in woodchips from a radius that varies, depending on the cost of diesel fuel." Diesel powers both the trucks that haul the chips and many of the chippers that produce them. The lower diesel prices go, the farther the plant can go to source chips.

"The current radius that we're using for practicality is between 50 and 60 miles," Tennery says.

Maintenance needs at the college's heating plant are regular but generally routine, said Dave Reber, an operating engineer at the plant. "About every six months we go inside the boiler to replace a lot of grates. Our augers wear out, so we replace them pretty frequently."

"The boiler itself is fairly reliable—it's just handling wood" that is the challenge, adds plant manager Michael Lyngholm. "There are jams. It doesn't flow through the pipeline like natural gas would. But I guess it's no worse than coal."

Saving Over $5,000 Per Day

One natural gas boiler remains as backup, but the university uses its biomass boiler close to 100 percent of the time.

"In 2003, the wood-fired boiler was shut down for a week to do routine cleaning and maintenance," Tennery reported. "Up to shutdown the university was burning $1,700 per day in cedar chips. While the wood boiler was down, natural gas for the backup boiler cost $7,000 per day."

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Pictured on front: The University of Idaho's central heating plant, whose woodchip system has been operating since 1986, sits in the middle of the Moscow campus. Right: Truck dumper and fuel receiving station with fuel silo in the background.

The biomass-powered Zurn plant produces steam heated to 150 psi; pressure-reducing valves cut that down to 60 psi for campus-wide distribution.

"The lower 60 psi pressure provides safety in the tunnel system that connects the steam plant to the buildings on campus," said Tennery's report. "The higher pressure at the boiler functions as a sort of heat storage to cover demand on campus; for example, the increased load generated by 4,000 dormitory residents all taking morning showers. A byproduct of central heating is snow-free campus sidewalks that lie above the steam tunnels."

To add air conditioning to the system, the university installed eight water chillers during the 1990s. Five are powered by steam from wood, the others by electricity. "Summer steam loads are almost as high as winter heating loads," said the '06 report.

Fuel consumption runs to about 70 daily tons in the winter and up to 100 tons per day in extreme cold weather. During the July 2004-June 2005 fiscal year, the university burned 23,000 dry tons of chips, or 1,660 truckoads. The system has used pellets and shredded paper, along with the cedar chips and logging slash. Moisture content works best at 30-40 percent, though the system has used fuel at up to 60 percent moisture. A small volume of wood ash, produced as waste from the boiler, is used as a soil acidity balancer on campus lawns.

"The steam plant is proud of its environmental record," Fuels For Schools reported. "The plant passed emissions testing in 2005 with the stack emitting less than one half the allowable particulates. Stack gases are usually invisible."

"The System Works"

"This system was designed to experiment, originally, with different grades of wood fuel and different types of wood fuel," Tennery adds. "Their air-quality permits require them to monitor their stack emissions very closely, which they do. They graph that, and they can adjust what's going out of their stack by adjusting their burn rates."

"About 90 percent of steam is condensed, collected and returned to the plant for reheating, saving heat, water and chemicals," said the Fuels For Schools report.

In Idaho's dry climate, the chip fuel is stored in the open, in a large off-campus stockpile that normally has several thousand tons of chips. A new covered storage shed has recently been built to protect some of the stockpiled fuel from precipitation. Maintenance workers haul the fuel into the boiler plant using a university truck. At both the storage yard and the boiler plant, a hydraulic "tipper" lift raises the closed end of the trailer almost 90 degrees, to empty the chips from the open rear end.

"Chips are then transported using an auger system adapted from grain-storage silo systems," Fuels For Schools reported. "This system uses agricultural components which are readily available in the local area, making repair inexpensive and parts readily available."

"The system works," says Tennery. "They're considering some changes to the system at the moment—but so far, none of them have been made."

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For more information on this and other biomass energy projects, contact:

Biomass Energy Resource Center
PO Box 1611, Montpelier, VT 05601
ph 802-223-7770 | fax 802-223-7772
info@biomasscenter.org
www.biomasscenter.org