

Middlebury College's Biomass Heating and Cooling Plant Aims to Cut Carbon and Costs—in Big Ways

Campus Woodchip District Energy System

Heating Capacity (output): 8.8 MW (30 MMBtu/hr)

Year Installed: 2008

Thermal Output: Steam

In 2004, when Middlebury College committed itself to cutting by eight percent its carbon emissions—a pledge it would later strengthen, to full carbon neutrality by 2016—“among the different actions that were identified, biomass was clearly one that could make a big difference,” recalls Jack Byrne, sustainability coordinator at the renowned Vermont liberal-arts college.

As the biggest of its emissions-reduction efforts, the college invested in a biomass-fueled, district heating and cooling system. After a feasibility study by BERC showed the idea to be practical, Middlebury broke ground in 2007 on an \$11 million biomass plant. Once online in late 2008, the new system is expected to be the primary heating and cooling source for the school's district energy system—and steam from it will also help fuel the college's cogeneration system, which meets about one-fifth of the campus's electricity needs.

When the college began looking at biomass in 2004, the price of No. 6 fuel oil—of which it was using about two million gallons per year—was \$.89 per gallon, notes Tom Corbin, director of business services. By summer 2008, it was more than \$3.00 per gallon. Middlebury expects the biomass facility to cut its fuel-oil usage by half, replacing that million tons of oil with 20,000-21,000 tons of chips per year. At fuel-oil price levels in summer 2008, that predicts an annual cost savings of about \$2 million.

At the same time, the college has planted 10 acres of fast-growing willow shrubs, on fallow farmland that it owns, as a test project to determine if it can raise enough biomass to meet up to half of its system's needs.

With or without the willow project, Middlebury also expects its biomass plant to:

- cut by almost 12,500 tons per year, or about 40 percent, the volume of greenhouse gases that it emits;
- replace a distant fuel source with a local one, as the college requires that all of its biomass must come from fewer than 75 miles away;



- generate 2-2.5 million kilowatt hours of electricity, with a renewable fuel;
- benefit the economy of its home region, especially its forest-products industry—along with area farmers, if the willow project catches on; and
- serve as a learning and demonstration lab for biomass gasification technology in action.

“Our hope is that the college's entry into biomass will greatly stimulate the growth of the local, sustainable woodchip market and bioenergy economy in Addison County and Vermont,” says Nan Jenks-Jay, Middlebury's dean of environmental affairs.

Added college President Ronald Liebowitz: “The biomass plant exemplifies the college's longstanding commitment to the environment—not only as an academic subject, but also as an integral part of the institution's operations.”

‘Maximum Participation and ‘Onboardness’

Middlebury students have played key roles in evolving the college's commitment to going carbon-neutral. Formed in 2002, a Carbon Reduction Initiative Working Group included student, staff, faculty, and administration representatives—and students successfully urged the trustees to adopt its two successive carbon-reduction goals.



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“Middlebury’s approach to reducing its carbon footprint was, and continues to be, maximum participation and ‘onboardness,’” write Jenks-Jay and Byrne in a chapter they co-authored for a recently published book, *The Green Planet: Meeting the Challenge of Environmental Sustainability* (APPA, 2008).

The carbon-reduction working group noted that three-quarters of the college’s emissions came from burning No. 6 fuel oil for heating and cooling—and a woodchip system could displace half of that. A BEREC study affirmed the potential for a biomass system that would use locally harvested fuel and could generate economic and learning benefits.

In 2004, trustees committed Middlebury to reducing greenhouse gas emissions eight percent below 1990 levels by 2012. In late 2006, trustees approved the biomass-system plan—and in 2007, they voted that the college would go entirely carbon-neutral by 2016. To meet that goal, the college is also moving on a brace of additional strategies, from mixing 20 percent vegetable oil into the fuel used in furnaces for 100 buildings not on the biomass district system to replacing college vehicles with hybrid cars and electric carts.

Test-Growing a Fuel Supply

“Really looking at the supply question, for us, was the critical piece,” said Byrne in summing up lessons learned in the process of moving to biomass district energy. Initially hoping to find a single, nearby supplier for all its woodchips, the college found that wasn’t possible and contracted instead with a New Hampshire wood-products broker. Middlebury has required that its chip supply be obtained from within 75 miles of the campus, and that a stockpile of it be stored no more than 25 miles away.

“That guarantees us a six-week supply,” said Byrne, who expects the biomass system to meet all of the college’s heating and cooling needs “for probably eight months of the year.”

“The other question it’s important to ask, that we asked for our willow project, is: Okay, right now there’s sufficient [fuel] capacity. But what happens five years from now, if many more people switch to wood as a fuel source, which is quite likely to happen?”

In hopes of ensuring its own, reliable, sustainably produced supply, the college looked into farming trees for fuel. It found that the State University of New York (SUNY) College of Environmental Science and Forestry in Syracuse had been growing, testing, and studying willow crops for several decades.

“They said, ‘You should do a test planting, and see how it goes,’” says Corbin, the college’s business-services director. So the college planted about 10 acres in 2007.

The willows—in this case, more fast-growing shrubs than trees—are first harvested after four years, then on a three-year rotation. The college hopes to harvest 25-30 tons per acre, the yield achieved by SUNY ESF. If it does, then planting and/or contract for the planting of 1,200 acres would meet half of the college’s biomass needs.

“That’s a lot of willows—and that’s a lot of work!” says Corbin. “The logistics are not going to be easy, but we look at it as investing in the willow crop.” Several people in the area have already inquired about raising willows, he said. The college has advised them to wait and see how the test plot fares.

“Ten years from now, I may look real smart,” Corbin quips. “Who knows? We’re going to have to try some of this stuff. We’ve got a lot of options.”

One key aim, he summed up, is to “control your supply of fuel—to know where it’s coming from, and how ‘green’ it is.

“On balance, our fuel source now is greener. That’s where we’re going.”

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

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