

Serving a Dense Residential Complex with a Pellet Boiler

Residential District Wood Pellet Heating System

**Heating Capacity
(output): 615 kW
(2.1 MMBtu/hr)**

**Annual Wood Pellet
Use: 250-300 tons**

**Emissions Reduction
Equipment:
Multi-cyclone**

Year Installed: 2008

**Thermal Output:
Hot water**

When Dartmouth College was mid-project with construction of 125 new housing units for graduate students, “we began to see a real big demand for these units, which are very popular with the students—so we saw the opportunity to do a second phase of the project,” recounts Tim McNamara, a college associate director for real estate.

McNamara is also a Dartmouth graduate who majored in Environmental Studies. He was interested in biomass, he says, “particularly here in New England, where it is such a huge renewable resource. So I posed the question whether, in this second phase, we should consider doing a district heating system fueled by biomass.”

The housing complex at issue was SACHEM Village, a 50-year-old facility in West Lebanon, New Hampshire, a mile and a half from the Ivy League campus in Hanover. Both Hanover High School and the town’s Richmond Middle School have woodchip-fired heating systems.

“I talked to the operators and toured those two plants,” McNamara said. What he learned convinced him that for SACHEM Village, the better choice was wood pellets.

McNamara says he’d learned that the capital cost of a chip system “was probably twice that of a pellet system,” he says. Also, a chip system would require more frequent deliveries, not ideal for a new heating facility that “needed to be snuggled in among residential buildings.

“I was not thrilled with the idea of chip bins, of trucks making deliveries, and of the maintenance costs associated with the plant.”

So he set about looking for a pellet system at the two million Btu size that the project required. It wasn’t easy—most pellet boiler systems that he looked at were sized for smaller capacity—but he located a hybrid system, with



“a conventional Burnham boiler sitting atop a Solagen stoker. That’s pretty standard,” he says. “They hand-build the stoker, and you stick a conventional boiler on top of it.

“We decided to go through with it. We built 80 new units that we were going to hook to the district system,” plus 24 existing units that were being heated by a conventional, inefficient fuel-oil boiler. Construction of the new district heating system began in the autumn of 2007. The pellet system was commissioned in the summer of 2008.

Fine Tuning the System

“We used 290 tons of pellets over the past year,” McNamara reported a year after the system came online. “We sized this system so that at full capacity, it’s supposed to provide 95 percent of our load.” The remaining five percent is supplied by a two million Btu per hour propane system that sits beside the pellet boiler, and can take over its full load if needed.

“In extreme cold, the propane [boiler] is always there to take over and shovel a little more heat into the system,” McNamara says. The whole system also has an emergency power generator, “so if the power goes out, we’re able to keep the water in that underground loop hot all the time. We never let the loop go cold.”

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Pictured on front: Sachem Village provides graduate student housing for Dartmouth College. Eighty new and 24 existing units were connected to the pellet boiler system that went into operation in 2008. Right: Tim McNamara, Dartmouth's associate director for real estate, stands by the pellet boiler system in the student housing complex.

After its first full year of operation, “I’d say the system has run very well,” McNamara assesses. Operators began with pellets that included three percent ash, but learned that one percent pellets gave much better performance. The higher ash content created some problems with “clinkers,” hard chunks formed when partially combusted ash and minerals in the pellets fuse together during combustion.

As for air quality, the system has a state air-emissions permit, and “we monitor the stack daily,” McNamara says. “We’re all very pleased; we have no visible emissions.” The heating system operates just 20 feet from its nearest neighbors, but it has been very quiet and has drawn no complaints about smoke, odor, or noise.

“Our challenges have been controls,” he says. “This is a highly automated system—and having that feedback to our main boiler plant on the campus was a bit of a challenge initially. But I think we’ve worked through that, and we’re now able to see what is going on with the boiler remotely, because it is largely an unmanned system.” Operators are also working out smooth coordination between the Sachem Village system’s pellet and propane boilers.

“Ash removal continues to be a bit of a challenge,” McNamara adds. Because it was putting together a system that would not require daily in-person attention, Dartmouth chose automated ash removal—but then found that the system’s flexible auger tended to get bound up with clinkers. The auger has been replaced, and “we hope we’ve got it operating somewhat more reliably,” McNamara says.

Boiler Can Burn Other Biofuels

“The transitions to solid fuel is always a challenge, when people are used to propane or oil, which don’t require as much hands-on effort,” McNamara observes. “It’s been challenging, but I know we’ll get there. I think in the long term this is going to prove to be a very positive step for us, both economically and in terms of the environment.”

Economically, the price of propane “right now is very competitive with pellets—but I don’t think that will continue in the long term,” McNamara says.

“We feel good that we’re using a New England renewable resource, and that we’re doing something to reduce our carbon footprint,” he sums up. “It feels good that we’re doing the environmentally responsible thing. The boiler also has flexibility, without modifications, to burn pea coal, switchgrass pellets, dried corn—so it’s a very flexible system in terms of solid fuels.

“This fairly large, complicated district heating system sits in a fairly dense neighborhood, with no complaints. It just wasn’t the right place for a chip boiler—and it’s great to have a fairly consistent, dried fuel. I think we made the right decision, in going with pellets.”



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