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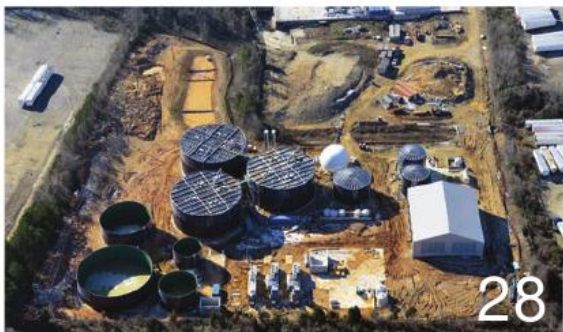
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Blue Sphere Corp. is nearing completion of its 5.2-MW, food waste-based anaerobic digestion project in Charlotte, North Carolina. Paralleling the plant's construction progress is a similar but smaller plant in Johnston, Rhode Island.

PHOTO: AERO PHOTOS

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THE ULTIMATE BIOMASS HEATING PACKAGE

Via a contractual arrangement unique to biomass heat in the U.S., Wilton, New Hampshire-based High Mowing School replaced fuel oil with a biomass district heating system from Xylogen.

BY RON KOTRBA

No one buys a furnace because it matches the décor of the room. Boilers and furnaces are purchased because conventional wisdom says they must be bought, fed and maintained to stay warm. Imagine purchasing just the heat that warms your home instead of the costly equipment, the volatily priced fuel that feeds it, and all the maintenance headaches that come with operating the system. Further envision contracting for a turnkey heating package that, in addition to reliable warmth, provides no-hassle, maintenance-free operation, zero upfront capital expenditures, consistently reliable hot water, multifuel biomass and propane capabilities, and the ability to lower costs year-over-year as energy efficiencies rise and usage or prices drop. This is precisely what a Wilton, New Hampshire-based Waldorf private school bargained for in its new biomass district heating system provided by Xylogen, a joint venture between Froling Energy and Optimal Energy Solutions LLC.

"Philosophically, the school makes an effort to treat the environment as kindly as possible," says Philip Brooks, a trustee at High Mowing School. "We tend our own gardens, grow our own organic foods. We are green and always have been." For years, the school had been providing heat and hot water to its 120 students with fuel oil boilers. "We wanted to get off oil," Brooks says. "We felt that, with global warming, it was important for us to do that but, financially, it wasn't possible because we didn't have builders or contractors who were interested in financing a biomass system for us." Then he met Mark Froling, president of Froling Energy, which started in 2008 as

a residential and commercial biomass boiler company that now predominantly installs wood pellet and chip boilers for the commercial sector.

Froling says power purchase agreements (PPA) are common with solar customers, where the customer buys the energy but not the hard assets. "So my partner and I were thinking how to copy that," Froling tells *Biomass Magazine*. With Optimal Energy Solutions' principal Henry Spindler, Xylogen was formed in 2012 to provide solar-style PPAs to biomass thermal customers.

"We are not selling heat per se, but a full-service heating package contract," Spindler says. "We don't tell customers, 'You've used this number of Btus and this is your bill.' We have an annual fee and there are both fixed and adjustable elements based on how much fuel is used. If we or the customer find ways to save energy, then we all end up ahead—the customer saves and we save. One of the things we thought of quite a bit in setting up Xylogen is how to structure incentives so everyone is enticed to minimize the amount of heat used. That was very important to us. It is unique in any sort of arrangement, where both sides benefit from doing the right thing." Essentially, the 20-year contract between Xylogen and HMS dictates that, as the customer's energy requirements rise or fall, they don't take a huge hit on the upside but they also share the benefits on the downside. "It's a breakeven situation for us," Brooks says. "We pay them a monthly bill equivalent to what we were paying for oil before." The price paid by HMS over the contract period was lowered by the value of renewable energy



credits continuously generated by the new biomass system and a grant from the public utilities commission.

HMS provided no upfront capital costs for the district heating system under contract with Xylogen, which used Froling Energy to build a new, \$800,000 boiler house on campus and install a network of underground piping to, and flat plate heat exchangers in, 10 buildings on-site. Xylogen contracted with Spindler's other company, DCM Logic, to provide automation and monitoring controls for the entire system. Feedstock silos were installed next to the boiler house and Froling Energy provides deliveries of dried wood chips to keep heat and hot water flowing throughout campus as needed.

While contract details took about a year to iron out, the entire sales cycle—from beginning negotiations to operation—was roughly two years, Froling says. The system is currently in its second winter of operation.

The boiler plant houses two side-by-side TX-150 biomass boilers from Austria-based Fröling Heizkessel- und Behälterbau Ges.m.b.H. They can run on wood pellets



or chips and are plumbed in parallel to a 3,000-gallon buffer tank that's always kept hot. "The boilers ramp up and down based on the buffer tank temperature," Froling says. Two HTP500 propane boilers were also installed as backup or for peak-demand situations. "There's a lot of security and redundancy built in because it's a boarding school and the kids can't be sent home," Froling says. "We even have a standalone backup generator, so if the power goes out, we can still provide heat." Individually, each building can bring power with a handheld or wheeled generator. "Our installation goes to a flat plate heat exchanger," Froling says. "The heat is piped from the boiler house that's connected to a heat exchanger, and the buildings each have their existing distribution system. Now, instead of a fossil fuel boiler, the buildings are pulling off of the demand side of the heat exchanger, so they're holding all the heat they need," he explains, adding that 13 oil boilers were removed during installation of the new district heating system. Nearly a half-mile of piping was installed four feet below the

ground to connect all the buildings. Froling says the boiler house has one central pumping system with double-pump redundancy to circulate hot water to each of the heat exchangers, including valves to regulate flow to each location based on demand.

Spindler says DCM Logic's controls are layered on top of the manufacturer's controls to make the boilers perform much better. "The monitoring is unique in this industry," he says. "Generally, the boilers are installed and if they don't break or fault in some way, they are left to their own devices. With our consistent monitoring, we can find things that would improve their performance. So we've been working on that, bringing information to bear to improve the boiler performance. It's quite a synthesized, orchestrated package."

Mike Wisnewski, head of maintenance at HMS, says the old oil boilers and hot water heaters were antiquated. "There was a lot of messing around with them, the relighting, replacing and ongoing inspections," he says. "Now there's a lot less headaches for me with the heat and hot water." Wisnewski says the

INTEGRATED DESIGN: Under High Mowing School's 20-year contract with Xylogen, Froling Energy built a boiler house on campus as part of the new district heating system that includes two biomass boilers and two backup propane boilers inside. The building design was such that it blended in with the rest of the buildings on campus.

PHOTO: HIGH MOWING SCHOOL

automation and remote access make identifying potential issues much simpler. "I can call them up if there's an issue and say, 'Hey, I got a problem in the main building,' and if it's our issue they tell us, and if it's theirs, they can fix it."

The boilers initially ran on pellets but Froling says their higher cost has put pressure on him to provide greater savings, which is why Froling Energy began manufacturing what the company calls precision dry chips (PDC). "We did not develop it, we copied the European standard," he says. In Froling Energy's wood yard the company replicated the European process to screen, rechip and dry local hardwood chips to be uniform in moisture content (25 percent) and size, which is equivalent to a matchbook. "We try to be



HMS GRADUATE: Mark Froling, pictured here with the unaffiliated Fröling Heizkessel- und Behälterbau Ges.m.b.H. biomass boilers from Austria, is a graduate from High Mowing School, which made the project of installing a new biomass district heating system particularly rewarding.

PHOTO: HIGH MOWING SCHOOL

quite precise, it's much easier for the boiler to work," Froling says. "And we can provide them at a much more reasonable cost, which is a big advantage to our customers." The chips are dry enough to be blown into vertical silos rather than dumped into underground bunker storage. "It's all very different than delivering green chips," he says. "It's much cheaper. It increases the cost of fuel a bit compared to a green chip but it decreases the capital costs of storage." He says an underground bunker costs \$250,000 to install whereas Froling installed \$35,000 worth of vertical silos at HMS. "It's a big savings on the cap-ex side, and a big breakthrough in terms of logistics," Froling says. "All our customers are staying above ground and receive delivery of dry chips with a blower truck." During the height of winter, HMS receives about two deliveries of PDCs a week.

PDCs cost about half as much per ton as wood pellets, Froling says, though he adds they're not quite as efficient because of the moisture content. He says his normal delivered cost of wood pellets to customers are \$17.20 per MMBtu vs. \$9.50 per MMBtu for PDCs. A customer like HMS can save up to \$12,000 a year by switching from pellets to PDCs, he says.

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Both parties benefit from this contract arrangement for a total biomass heating package. For the school, the contract removes the financial and operational risks and burdens. Xylogen finances, installs, operates and maintains the boilers, including ash removal, and HMS can concentrate on what it's good at—teaching kids. Conversely, Froling Energy ensures long-term customer demand for its PDCs while Xylogen and DCM Logic provide what they do best—service, monitoring, controls, maintenance and optimization of its system. Spindler says one benefit to Xylogen is they know who is maintaining and working on the units. “There aren't other parties coming and going, so it's cleaner that way,” he says. Also, over time, operations become optimized, so targeted adjustments can be made to save energy. “So there's the possibility for improvement over the term,” Spindler adds.

“This system has a lot of mechanical, moving parts, and operating and maintaining it is a much bigger hurdle than people realize,” Froling says. “Especially in an institution like this, our format is particularly beneficial. Schools like this have long-term visions, they want this technology, but their budgets don't allow them to bring in the right people to in-

stall and operate these kinds of boiler plants. With Xylogen, we bridge that gap.”

All told, Froling says HMS is saving about \$400,000 over the life of the 20-year contract compared to what the costs would have been to maintain its previous network of oil boilers, including replacement costs of units that would have reached end-of-life, the \$10,000 in annual maintenance costs, and the price of fuel oil. “It's a modest savings, but that goes long way on a campus like this,” Froling says.

This contractual arrangement is unique for biomass heat in the U.S., but not necessarily so for Europe. “I don't know why it's unique here,” says Froling. “It's common in Europe. The mentality here is that people don't like long-term contracts, so it's harder to sell long-term commitments even though we're bringing in the cash and financing, and taking all the risk on the customer's part. They have to have a real long-term vision. Businesses are interested in quarter-to-quarter decisions.”

Spindler says people are just used to buying and owning their own equipment. “It's a shift to think about doing it the other way, even though people don't know how to tend their equipment, whether it's oil or biomass.

I don't know why it's so hard to move to this setup, it's something we encounter with other customers and it's not always clear why they wouldn't. If they're capable of operating the system at a high level and can provide the capital, then they're better off buying and owning it because there's no one else to pay. But if high performance is key, the customer may not be able to provide that for themselves. And that's where we come in.”

Froling is an HMS graduate himself, so being able to provide his alma mater with a new biomass district heating system was particularly rewarding. “It was very cool,” he says. “You always want to do something that's beneficial to your school, and I'm happy with what we've accomplished there. It is an interesting project. It was our second Xylogen project, but a first of its kind to combine so many buildings and work out the details of such a large district heating plant.”

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