Using Biomass in Minnesota

Case Study
Len Busch Roses

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Len Busch Roses first opened in 1965 with a few employees, a modest 28,000 square feet of space, and a crop of pom poms. Since then, the company has grown to 530,000 square feet of greenhouses and 160 full-time workers. Len Busch Roses produces a wide variety of flowers including roses, alstroemeria, lilies, tulips, snapdragons, gerberas, and potted flowering plants. Over seven million stems and pots are produced and sold each year through its greenhouses. Len Busch Roses is one of the only rose growers in the country outside of California.

Growing roses has demanding heating requirements, especially in Minnesota's climate, and biomass has played an integral part in heating Len Busch Roses' greenhouses for over thirty years. The company's founder, Len Busch, installed the first biomass boiler in 1977 when oil prices were soaring during the energy crisis. The original boiler (from Hurst Manufacturing) used very clean and pre-processed fuel from the byproducts of kitchen cabinet manufacturers and handled the heat load for the facility. As the greenhouses were expanded, they added gas boilers to handle the additional load.

Case Study

Highlights

Facility

- 4045 County Road 101 North, Plymouth, Minnesota 55446
- 530,000 square feet

Biomass System

- System provides 95-98% of heat load
- Natural gas backup system
- 2 Hurst biomass boilers: A 10 million and a 13 million Btu/hour unit
- Units keep the greenhouses heated to 72 degrees F with high humidity
- Total cost to install 2006 boiler: $1.1 million ($600,000 for the boiler)

Fuel

- Tree trimming waste (all green)
- Supply within 10 mile radius of greenhouses
- ~20 loads delivered per day (~80 yards)
- Fuel is mix of chips (~50%), logs (~30%), and brush (~20%)

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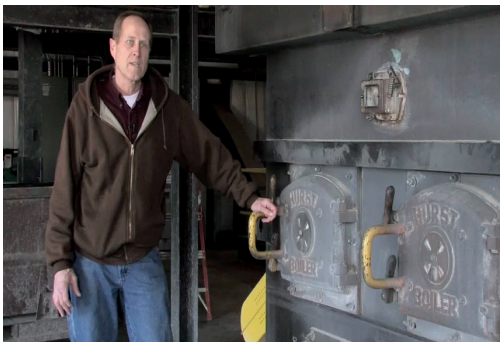
In 2000, Patrick Busch bought the company from his father Len. As the company continued to grow, the biomass system was expanded again with the addition of a second biomass boiler installed in 2006. According to Pat Etzel, Len Busch Roses' Senior Maintenance Technician, the project to install the new boiler was simple and straightforward. Part of the project was subcontracted. Overall, the project took around eight months to complete and cost $1.1 million.

In investigating which biomass model would best meet the greenhouses' heating needs, staff visited a number of installations and talked with various operators. Through Len Busch Roses' many years of experience using biomass for heating, they knew that burning wood was the easy part and that issues related to fuel variability and metering were the critical elements. So, they researched systems known for reliable fuel handling and flexibility. In the end, and following a visit to an operator in Wisconsin who had installed a similar system, the company chose a Hurst boiler based on its heavy-duty construction and ability to handle the volume and variability of their fuel supply.

The new boiler is a four hundred horsepower firebox unit with an output of thirteen million Btu per hour and 2,600 square feet of heating surface. The older biomass boiler has an output of ten million Btu per hour. Together, the two biomass units handle between ninety-five and ninety-eight percent of the heat load with gas boilers acting as backup units.

After the new Hurst boiler was installed, the company was able to largely discontinue reliance on natural gas. However, cabinet manufacturing byproducts were no longer sufficient to meet the company's heating needs, so they went after a more local,



renewable source of fuel: tree trimming residue from customers and local residents. According to Etzel, "The key thing about the fuel we burn now is that it comes from a close, local supply. The price kept going up with our original fuel source [natural gas], which provided us the impetus to change to a local supply." The trimming residue comes within a ten-mile radius of the greenhouses and is a mix of chips, logs, and brush. Between ten and twelve thousand tons of fuel are burned annually. Because of the solar gain of the greenhouses, the boilers can be shutdown four weeks of the year when a heating source is not required.

The manufacturing byproducts used to fuel the older biomass system were a very clean fuel source that produced little ash (one to two percent of clean wood is ash). Based on experience with this fuel there was little concern with ash in selecting a new boiler system. However, trimming residue is a much

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dirtier fuel (two to eight percent ash), and they learned that ash is a much bigger issue to deal with than they had anticipated. Ash needs to be manually removed from the boiler once or twice a day and is applied to crop fields as a fertilizer. As Etzel pointed out, if they had known how much work was required to handle the ash, they would have considered installing an automatic ash removal system.

Len Busch Roses also has its own onsite facilities to store and process its fuel. They have a yard open 24/7 to encourage people to drop off their trimming waste. On average, about twenty loads (two hundred yards) of residue are dropped off per day.

Once the fuel is delivered, it needs to be processed. A special processing and storage area were built to accomplish this task. Originally, the company attempted to burn chips directly without any processing but found that for ease of operation, the fuel needed to be processed. All of the fuel now goes through a three hundred horsepower (one hundred cubic yards per hour) grinder to achieve the necessary fuel specifications (less than three inches). When grinding logs and brush, they prefer to do an initial coarse grind (six inches plus) and then leave the fuel to dry out until it is ready to use.

Fuel storage has been an especially important component of the new system. Work to improve storage facilities has been continuous because it is a big challenge to handle the tree-trimming residue that comes in during the summer. The trimming residue is delivered green and put into an open-sided storage building to reduce its moisture content. For the older boiler, fuel is stored in a silo that holds two days worth of fuel and then is automatically delivered to the boiler via an auger. The new boiler has storage via a walking floor system that walks the fuel through a series of conveyors and ultimately to the boiler. Through these improvements, the company significantly lowered its heating costs between 2006 and 2007.

Overall, it takes about four to six hours of labor per day to grind the wood, rake, clean boilers, and lubricate the system. Every week, around twenty to twenty-five hours of labor are needed in the summer and forty plus hours in the winter.

Etzel believes that the main advantage of using biomass as a heating system is cost savings. Assuming an efficiency between eighty-two and eighty-three percent for gas and seventy percent for wood, the fuel cost for gas is between $7.00-$13.00 per deca therm. With labor costs for wood around $40,000 per year, the cost per million Btu for biomass is about $1.50 per deca therm, representing an eighty to ninety percent heating cost savings. Annually, Len Busch Roses saves between $150,000-$200,000 heating with biomass compared to gas or oil. Through these savings, they expect to have the boiler paid off in four to five years.

However, using biomass for heating is not without its challenges. There is a lot of equipment to maintain and the system cannot be flipped on and off like a conventional gas or oil fired system. There is also considerable fuel variability from size to potential contaminants. Lastly, you need to be able to respond during any hour of the day in case of emergencies.

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Overall, Etzel says that they have been very happy with using biomass for heating: "Biomass has been essential for the survival of the company to keep heating costs at a reasonable level. It also fits what we're trying to do as a company in terms of being more sustainable."

Etzel thinks some of the most important lessons to take away from Len Busch Roses' experience in utilizing biomass are to take ash removal seriously, recognize that biomass is a variable fuel source, and there are ways to deal with these issues (e.g. alarm systems, sufficient staffing levels, etc). Also, assessing the availability of a fuel supply that can be relied upon is a critical consideration when deciding whether to adopt a biomass heating system.

Case Study

Highlights

Fuel

- ~10,000-12,000 tons burned per year
- Costs ~$1.50 per million Btu
- Fuel processing: grinding wood
- Store ~8,000 tons of fuel
- Burned wood is about 2-8% ash

Costs/Savings

- Fuel cost for gas is between $7.00-$13.00/deca therm
- Cost per million Btu for biomass is about $1.50/deca therm
- 80-90% heating cost savings
- Annually save between $150,000-$200,000 heating with biomass compared to gas or oil.

Operations

- 4-6 hours per day required for maintenance
- ~20-25 hours (per week) in summer and 40+ hours in winter needed in labor
- 4 staff maintain and operate the boiler

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