

Using Biomass in Minnesota



Case Study Birch Grove Community Center

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Located in Tofte, Minnesota, Birch Grove began in the 1960s as a school building. It was built to serve two hundred kids who primarily came from families working at a nearby taconite pellet plant. When the taconite plant shut down in the 1980s, so did Birch Grove for a period of time.

Nevertheless, there was a community effort to reopen Birch Grove, and after a couple of years the school was once again operational. The town of Tofte now owns the building and has partially converted it to a community center managed by the Birch Grove Foundation. The Birch Grove Community

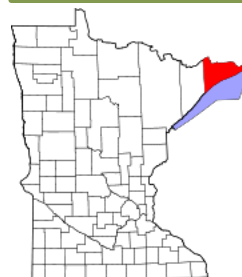
Center has grown over the years and currently houses a charter school, community center, senior center, and a hostel.

This growth combined with high fuel oil prices provided the impetus for utilizing a pellet boiler to heat the school. As Allan Olsen, the President of the Birch Grove Foundation, explains, "The primary objective in developing a biomass heating system was to address rising fuel prices." The Foundation wanted to find a heating system that was low maintenance, clean burning, and did not require a lot of staff to operate.

Considerable research went into

Case Study

Highlights



Facility

- 9 Goodneighbor Hill Road
Tofte, MN 55615
- 16,000 square feet
- ~360,000 Btu heating demand

Biomass System

- Pelco 1020 pellet boiler
- 500,000-550,000 Btu/hour
- Provides 100% of the heat load in the winter and 90% of year-round need
- Fuel oil boiler backup system

Fuel

- Pellets 100% wood fiber (pellets blended at 40% softwood, 60% hardwood)
- Supply in Wisconsin (168 miles one-way)
- 2 deliveries of ~17 tons of pellets per year (each load lasts about 2 months)
- Use ~34 tons per year
- ~\$200 per ton of finished pellets (including delivery costs)
- 5-8% moisture content

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This project was supported by the Community Assistantship Program (CAP), a program of the University of Minnesota's Center for Urban and Regional Affairs (CURA). The contents of this report are the sole responsibility of the author, and are not necessarily endorsed by the University of Minnesota, CURA, or CAP.



choosing the system that best fit Birch Grove's needs. Members of the Foundation Board talked to eight different schools in Minnesota and Wisconsin about their experiences using biomass. One school had used woodchips to heat its campus but had run into major issues. A few other schools said they were very happy using pellet boilers.

Ultimately, Birch Grove decided on a wood pellet boiler based on the positive experiences of schools that had used them. The Pelco boiler was the best option in terms of being low maintenance and clean and because other boilers were too small for their use. In 2009, Birch Grove installed the Pelco 1020 boiler to heat its entire sixteen thousand square foot facility.

The Pelco 1020 pellet boiler is the smallest Pelco boiler with a heat load between 500,000-550,000 Btu. It only takes 360,000 Btu to heat the school, which means the system has around thirty-five percent excess capacity even when the system is turned down to its lowest settings. The biomass boiler is designed to run best in winter temperatures and burns inefficiently when it is between forty and fifty degrees, so they don't start the boiler until around December when it becomes colder.

The biomass system carries one hundred percent of Birch Grove's heat load in the winter and ninety percent of the work year-round. The facility originally relied on fuel oil for heating. Now the old fuel oil boiler acts as a backup system and carries only ten percent of the heat load during the course of the year (about eight hundred gallons during the fall months). The Pelco boiler is set at 155 degrees F and the fuel oil boiler set at 140 degrees F, allowing the Pelco to do most of the work.

The components of the biomass system include a silo that can store twenty tons of pellets, an auger that feeds the system, plumbing, and two small pumps that circulate water (antifreeze solution) through a closed circuit heat exchanger that returns to the pellet boiler. On the other side of the heat exchanger is the furnace, which delivers heat to the school. The system produces a total of approximately fifty gallons of ash per year, which is automatically deposited into a garbage can. Birch Grove uses this ash as garden fertilizer and as a driveway treatment on snow and ice during the winter.

The system's components may give the impression that it would be very labor intensive to operate, but actually the opposite is true. Only one part-time staff person is needed to ensure that the system is running correctly and just one to two hours per week are needed to maintain the system.

“The primary impetus in installing a biomass heating system was to address rising fuel prices”

To help fund the biomass project, they applied for a Department of Employment and Economic Development (DEED) matching grant of \$41,800 that evenly splits the pellet boiler installation costs between the Foundation and DEED. Birch Grove took out an eight year loan from the town of Tofte to pay off its share of the project costs. The total cost of the project was \$83,600.

Unfortunately, soon after the boiler was first installed, fuel oil prices dropped, and Birch Grove was breaking even on their heating costs. Olsen explains that they figured on paying about \$160 per ton of pellets, but they are actually paying around \$200 per ton, which totals to approximately \$7,000 for fuel per year.

Much of the unexpectedly higher fuel cost is the result of not having a local supplier. Currently, Birch Grove hires an auger truck (Widdes Feed and Farm) to pickup and deliver pellets from Great Lakes Renewable Energy in Wisconsin (one-way trip of 168 miles). The total cost is roughly \$3,000 for fifteen tons of pellets (which includes the cost of both the pellets and delivery).

In the future, Olsen believes that more local people will begin using pellets, which will help Birch Grove reduce its supply costs. The creation of a local pellet plant would be an ideal way to deal with fuel costs. They are also interested in opportunities for cooperative buying schemes that could lower costs. Currently, only small residential houses in the community have pellet boilers to heat their homes and do not have silos or buy in bulk. Potentially, if another facility put in a pellet boiler with a silo, they could team up and split delivery costs.

Nevertheless, now that the price of heating fuels has risen, Birch Grove is once again saving money through reduced heating costs.



At \$3.50 a gallon for fuel oil, Birch Grove saves about \$8,000 per year using pellets and is able to pay off their eight-year loan at \$5,000 per year. This is a savings of \$3,000 per year.

The pellets Birch Grove uses for fuel are a blended pellet comprised of forty percent softwood (pine species) and sixty percent hardwood tree species (oak, birch, maple). GLRE pellets are first wood chips that are ground in a large hog mill grinder, then go through a rotary drum dryer, and finally into a finish grinder. The fiber is then tempered in a storage vessel and sent to the pellet mill, heated to approximately two hundred degrees F and 45,000psi pressure. The newly manufactured pellets are then cooled in an air driven cooler and packaged into bulk containers for future unloading into auger trucks and delivery to Birch Grove.

Birch Grove does not want to have too many pellets stored at any point, just enough to provide for their heating needs during cold winter months. They use about thirty-four tons of pellets per year with two sixteen to seventeen ton loads of delivered pellets (each load lasts them about two months).

As Olsen explains, there are a number of

advantages aside from cost in using pellets as a fuel source versus fuel oil. One is that pellets are produced regionally, which benefits the local economy and is more environmentally friendly. Birch Grove is also able to use the system as a teaching tool for school kids by explaining how it works. It is also a clean way to generate heating, which is especially important for Birch Grove because a clinic operates nearby and school children are present.

However, there are also a number of disadvantages when using pellets for heating. The pellet boiler is not as flexible as fuel oil in terms of just being able to turn it on and off with a flip of a switch. Also, it is not possible to store a lot of fuel throughout the summer because it collects moisture. Lastly, as mentioned earlier, delivery costs are also an issue because their supply comes from 168 miles away.

Overall, Olsen says that they are very happy with the new pellet boiler. It offers more stable fuel prices, it is low maintenance, and it is easy to operate. The only thing he feels they may have done differently is to step up the size of the storage silo because the cost of getting fuel delivered is high. If they had a forty-ton silo, they could have enough fuel stored so they would only need one delivery per year rather than two.

The most important lesson Birch Grove learned through the development of the project is that “a lot of the fears and concerns that we had could be engineered out. We thought it would smoke a lot, it didn’t. We thought the maintenance would be bad, it wasn’t. We thought that it would smell, it doesn’t.”

Olsen mentioned a number of important considerations in deciding whether or not to convert to biomass. One is to understand that you need a backup heating system when it is

relatively warm out (i.e. around fifty degrees) because a biomass boiler loses a lot of efficiency when it is not cold outside. Biomass cannot turn on and off easily in temperate climates and can put out too much heat, causing people to open their windows wasting energy.

As far as Birch Grove’s future in using biomass is concerned, Olsen said that they are planning to tie future buildings into the system. They can get forty percent more out of the Pelco boiler and increased demand will improve the efficiency of the system. There are plans to add a nine hundred square foot warming house, which will help utilize some of the excess capacity. When they get more experience, the town may also look at heating their second largest building (the town hall) in the future.

“Probably the biggest lesson we learned developing the project is that a lot of the fears and concerns that we had could be engineered out”

Case Study

Highlights

Fuel

- \$7,000 total pellet fuel cost per year
- 20 ton outdoor storage silo
- Input raw fuel materials come from around 60% private and 40% public land
- Produces ~50 gallons of ash per year

Funding

- DEED 50% matching funds (\$41,800)

Costs/Savings

- Total project cost \$83,600
- Save ~\$8,000 per year using pellets
- Paying off the loan \$5,000 per year and will have it paid off in 8 years
- Still save \$3,000 per year even while paying off loan
- Maintenance costs ~\$6,000 per year (same maintenance costs as with only fuel oil boiler)

Operations

- 1 part-time (1-2 hours per week) staff person required for operations