

Michigan Wood-based Thermal Energy

North Central Schools

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North Central Area Schools
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North Central Area Schools serves K-12 classes in a rural south-central area of the Upper Peninsula of Michigan. Enrollment is about 385 students. A single building occupies 75,000 square feet, plus a separate heating plant building. The school is on the natural gas grid but heats with a wood chip boiler and radiant heat.



The original wood chip heating system was built in the early 1980s and was partially re-built in 1994. A new **3 million btu** Messersmith wood chip system and new building were installed in 2014, at a cost of \$650,000, funded through a school bond. The heating plant is 15 feet from the school and that gap is the only underground portion of the piping network. Hot water runs through a single circulatory piping network and contains 1300 gallons at a pressure of 15 psi.



Heating plant and chip storage building, next to school.



Wood chips inside storage bin. Walking auger underneath chips.

The wood chip storage bin is about 60 feet long and can hold about 40 tons of chips, about two truck loads. A local contractor delivers 300-500 green tons of hardwood chips per year using a 20-22 ton van, one load per week on average. Chips are stored indoors and move from the at-grade floor using a single walking auger, to a conveyor that feeds the combustion chamber. About 30 gallons of combustion ash are generated every 4-5 days, and 30-40 gallons of fly ash from a cyclone separator accumulate each year. All ash is disposed in a dumpster that goes to a local landfill.

Feedstock costs are \$14,500 to \$24,000 per year, with a 2015 chip price at \$48/green ton. Natural gas costs would be about 10% higher¹ but pricing over the next couple of decades is expected to be both higher and more volatile. Both propane and fuel oil would be substantially more expensive. Maintenance takes about five hours per week.



Walking auger pulls chips to a conveyor. Chips are lifted by a vertical conveyor, prior to feeding into the combustion chamber.



Combustion chamber and overhead boiler.

Fire in combustion chamber.



Computer software controls the entire heating system. Warnings can be received remotely.



¹ – Factors include wood chips (5,740,000 btu/ton & \$48/ton) and natural gas (1,021,000 btu/1000 cubic feet & \$9.93/1000 cubic feet).