Fond du Lac High School

A Showcase for Renewable Technologies

The Power of an Idea

When Margie Winter and Earl Jewett learned that Fond du Lac was planning to build a new high school, she recognized a great opportunity to demonstrate the lessons about energy efficiency that she teaches her students. Along with other members of the schools' science department, she approached the school district and suggested they consider alternative fuel sources and other "green" design elements and technologies for the new school.

Margie and Earl's vision came to life in the Fall of 2001 with the opening of Fond du Lac's 400,000 square foot high school which, from an energy efficiency perspective, is the most up-to-date school building in the state. Fond du Lac High School succeeded in finding a combination of design and equipment options that enhance student comfort, promise to reduce or avoid harmful emissions, provide a unique educational opportunity for its students and the building community and avoid an estimated $290,000 annually in operation and maintenance costs when compared with more conventional choices.

Groundswell of Support

Jim Gescheidle, supervisor of building and grounds, says, "The Fond du Lac School District has always been really progressive in terms of energy conservation." So the school district responded to the teachers' suggestion by creating an energy committee to explore energy efficient systems and technologies to be considered for incorporation into the new facility. The committee included five teachers, the facilities director and custodians. The committee also brought in professionals such as energy consultants, an architect and electrical and HVAC engineers. As the committee's research progressed, they added the local utility representatives and experts from programs that offered financial services and expertise to promote renewable resources and increase efficiency.

Doing their Homework

The Committee members began by contacting those resources that might help them. The teachers, who knew of the Energy Center of Wisconsin (ECW) because it provided a K-12 Energy Education Program (KEEP) Activity Guide for teachers, contacted ECW to ask about how alternative approaches might be used in their new school. ECW suggested that they take a look at both Cool Daylighting™ and ground-source heat pump (GSHP) geothermal technology.

Around this time, Alliant Energy representatives contacted the district and gave a presentation on geothermal energy. Through the Wisconsin Focus on Energy, the school received a Demand Side Applications of Renewable Energy (DSARE) grant for technical analysis of various options and linked them with critical resources including an expert at the national Geothermal Heat Pump Consortium.

Geothermal systems "capture" the earth's natural and steady supply of heat energy and "moves" it from the earth and through a building. In the summer, heat from the building is sent back to the ground to offset cooling loads. The committee learned that GSHPs can take advantage of the earth's heat in several different ways. Soil, bedrock, water tables and other considerations determine the viable cost-effective options that exist for any particular GSHP system.

Committee members took two field trips to learn more about and see for themselves the technologies they were considering. School district representatives and the school's architect and engineer toured the Iowa Energy Center and several Iowa schools that use GSHP geothermal heating and cooling systems. A second trip was taken to Fort Wayne Indiana to tour the Water Furnace Heat Pump Plant as well as the DuPont Medical Center and other locations utilizing geothermal closed loop pond design.

Committee members also attended an ECW workshop to learn about Cool Daylighting™ which incorporates natural lighting into the building design without creating excess solar heat gain or excess glare on work surfaces and computer monitors. As they closed in on the technologies that interested them the most, they grilled manufacturing representatives. Every potential design option and technology was thoroughly researched, analyzed and considered for inclusion in the school plans.

<u>An Intrgrated Hybrid System</u>

Based on the Energy Committee's recommendations, Fond du Lac Board of Education selected a GSHP geothermal system for its new high school. In addition to adopting a renewable source of energy for their HVAC system, the school also incorporated nearly every other efficiency design option that would cost effectively save energy. These included the latest designs in lighting and insulation specifications that exceed the state's R-factor guidelines.

GSHP systems have been used for over 30 years and are a proven option that is being installed in homes, business and schools across the country. Geothermal heat pumps are not new to Wisconsin, but the school's use of a geothermal closed loop pond system, in which thousands of feet of pipe will lie on the floor of two ponds which covering 12 acres created on the property, was unique in the state in a building of this size. The most common installation, a vertical loop system, employs coils buried in deep wells to exchange heat. While this is cost

effective in many case, a structure the size of Fond du Lac High School would have required about 1000 wells, at a price tag of about $1,200 - $1,500 per well, totaling a million dollars. Finding the closed loop pond system made the best use of the schools site and made the use of geothermal viable for Fond du Lac High School.

A key component of the system is the heat recovery on the ventilated air. The system recovers up to 80% of the heat exhausted when fresh air is brought into the school. Rooms are provided with fifteen cubic feet per minute of fresh air with seven air exchanges per hour. Heat recovery made it possible to have a smaller system and allowed the heat pumps to meet the entire ventilation load. Four 1.9 million BTU high efficiency boilers are used to back-up the loop and the ventilation system during extreme weather conditions.

The school's design maximizes their use of daylighting, which reduces the need for electric lighting and space cooling. The roof was designed with a higher pitch, in some areas, to bring in more daylight. The high performance Low E glass used for the windows reduces glare as well as heat gain or loss. The window blinds were placed between the glazing to reduce maintenance cost and assist with indoor air quality issues. The school also adopted the latest technologies in efficient lighting including energy efficient lighting fixtures, light level and room occupancy sensors and dual lighting controls.

While some initial installation costs were higher than less efficient options, the School Board supported the approach that considered life-cycle economies. The school's operating and maintenance costs are expected to be 40% lower than they would have been when compared with a conventional HVAC system. Taxpayers will benefit from the cost avoidance and a more stable budget since the school will be less reliant on energy resources that are subject to price fluctuations. Fond du Lac School Superintendent Dr. Dewitt R. Jones notes "There were critics of the proposal for the high school but the Board's response was that future boards would look back and thank them for making this investment."

Many Benefits

Making the numbers and funding work was a high priority, but the committee recognized that their recommendations also had to work for the students, teachers and staff. The geothermal system and other design decisions offer a variety of on-going benefits including increased comfort, superior air quality enhanced atmosphere for learning, reduced environmental impacts and a unique learning opportunity for students and others.

One of the attractions of geothermal was that the system can be zoned. The system the school district selected uses 179 water-to-air heat pumps – with one for each classroom so teachers have direct control over the heating and cooling

for their classrooms. Adding to students' comfort is the many benefits daylighting offers beyond energy savings and reduced construction costs. Studies show that students' performance improves when daylighting is available in the classroom.

The use of a renewable technology also provides a benefit for the environment. Estimates are that the school's system will result in a 15% reduction in CO_2 emissions.

The teachers who convinced the district to look at alternatives are now taking full advantage of the learning opportunities the school's unique system offers them. Specially installed monitoring equipment will help the school track its energy use and provide students, as well as engineers, architects and energy professionals, with an on-going laboratory for learning about the system's effectiveness, efficiency and impact on the environment.

Lessons for All

The Fond du Lac High School project may have begun with one teacher but is the culmination of the efforts of many people who, according to Dr. Jones were "willing to step outside of their comfort zones." Along the way, the school has created and strengthened a new community of experts and advocates for energy efficient technologies which can inform and inspire other Wisconsin businesses, institutions and residents to explore energy options that can benefit them economically and environmentally.

Primary Contractors
CDH Energy Corporation – Energy Technologies Engineer
Bray Associates Architects, Inc. - Architect
Thelen Engineering – Design Engineer
C. D. Smith Construction – General Contractor
J.F. Ahern Co. – HVAC, Plumbing and Fire Protection Contractor
J&H Controls – Direct Digital Controls Contractor

Information and Resources

Wisconsin Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The program encourages energy efficiency and use of renewable energy as a means to enhance the environment and ensure the future supply of energy for Wisconsin. The services of Wisconsin Focus on Energy are delivered by a group of firms contracted by the Wisconsin Department of Administration's Division of Energy.

If you are interested in learning more about GSHP systems or other energy efficiency options for your school, business, farm, or home Wisconsin Focus on Energy is the place to start. We will help you identify, access and evaluate sources of information, link you with key programs, resources and experts and help you navigate energy efficiency options and programs including potential grants and financing mechanisms.

For information, call 1-800-762-7077.