

Case Study: Geothermal Project

Henley High finds energy in its own backyard

When Klamath County School District Business Manager Ken Hadlock heard that the district would receive Senate Bill 1149 funds to implement energy conservation projects, he didn't have to look far to find a good project at the district's 45-year-old Henley High School. It was literally right under foot—1,500 feet underground in the form of geothermal energy.

The Klamath Basin is a center for geothermal energy generated by hot water or steam from deep beneath the earth's surface. Geothermal energy is clean and renewable. And, best of all, it is "free" energy once it's accessed.

Hadlock knew the SB1149 funds could be applied to utilize the geothermal energy at Henley High.

The project would pay for itself many times over.

This was a very attractive proposition to the school district's business manager who was balancing an ever-tightening budget.

In 1989, the school district drilled a well at the edge of the Henley High School football field looking for cold water. But, the water that came from the well was 128° F. At that

time, the school district hooked up the hot water to the adjacent middle school where it was used to heat the building.

They also installed a geothermal hot water loop to a heat exchanger at the high school with the intent of preheating the domestic hot water and the main boiler hot water for that building's heating system. But, the high school's boiler required a constant flow of 160° F to 180° F water to operate properly. Klamath County School District didn't have the funds to convert the boiler to use the geothermal energy to heat the building. As a result, the geothermal energy was unusable at Henley High.

"The 1149 funds opened up this opportunity for us," said Hadlock. "We were able to spend the funds on modifications of our existing system at the high school so we could use the geothermal resource and save considerable energy."

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*-Ken Hadlock
Business Mgr.
Klamath County Sch. Dist.*

*Project is saving
\$32,400 per year*



Klamath County School District Business Manager Ken Hadlock shows off a new circulation pump at Henley High.



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The well that pumps the geothermal water to Henley High is in a small mechanical shed next to the football field.

Using the geothermal energy

The modifications made it possible to meet 25 to 30 percent of the annual heating requirements using the geothermal water. The \$96,000 project included installation of a new separate geothermal heat exchanger for the domestic hot water system, two new high efficiency domestic water heaters, new high efficiency water circulation pumps and direct digital control system to monitor performance and maximize the use of the geothermal resource to heat the facility.

Hadlock called on a local mechanical engineer, Brian Brown, P.E., to help with the Henley High project. Brown has been the geothermal consultant for the City of Klamath Falls geothermal district heating system since 1992 and for Klamath County geothermal heating projects.

“Most engineers aren’t familiar with geothermal,” said Hadlock. “Brian grew up in this area and had done work for the City of Klamath Falls.”

The district first re-piped the heat exchangers to provide separate geothermal hot water loops for the domestic hot water and the building heating system. Both had been heated with one heat exchanger piped in parallel with the main gas-fired building heating boiler, and could only be used effectively when the boiler was shut off.

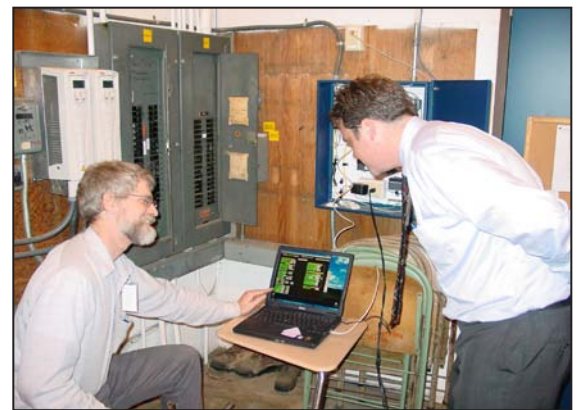
The district now runs the 128° F geothermal water through heat exchangers to preheat the potable water. The warmed potable water then goes to two new domestic hot water heaters that can now more quickly bring the water up to proper temperature for use in the kitchen, gym showers, etc. The two new water heaters connect to an existing 800-gallon hot water storage tank. The geothermal water then returns to an irrigation pond.

Heating the building

The district also uses the geothermal water in a closed-loop system to provide heat for the building, according to Brown. The building heating system was originally designed as a hydronic heating system using hot water to transport heat to the classrooms throughout the building. The hot water is pumped through heat exchangers or “coils” in the air handlers which heats the air. The warmed air is circulated to the classrooms through forced air duct systems.

The amount of heat delivered depends on the temperature of the water, sizing of the coils and flow rates. The original heating system was designed for operation with 180°F water from boilers. Less heat is required in mild weather. This allows the district to use water with a lower temperature, in this case, the 128°F geothermal water.

The district used the SB 1149 funds to replace the original



Project Engineer Brian Brown (left) and Brian Herbstrith from the Oregon Department of Energy view the state-of-the-art computer interface to the Henley High building geothermal heating system.

six constant-speed pumps with two new variable speed pumps and to modify the control valves for modulating flow control. This reduces the pumping cost. It also reduces the heating system return water temperature that allows increased use of the geothermal heat, according to Brown.

A new direct digital control (DDC) system automates and optimizes the operation of the pumps, geothermal control valve and boilers. If there is a moderate need for heat in the building, the system uses the geothermal hot water only. If more heat is needed, the new DDC system calls the boiler into action to boost the water temperature as required. If there is no need for heat, the flow stops completely.

Comfort issues

One of the most important aspects of the project is the comfort level for the 660 students and staff at Henley High. According to Henley High Principal Mark Greif, there are fewer complaint calls now and students and staff have noticed a more uniform temperature throughout the building.

Educational opportunities

When the geothermal water has completed its task in the building, the water is returned to a cooling pond. Some of the water is used for irrigating the school sport fields. Biology students are helping construct a wetland pond using the cooled geothermal water. They will be able to observe wildlife and foliage right on their high school campus.

Saving energy, costs

The Henley High project, completed in May 2004, is saving an estimated 40,000 therms of natural gas annually or approximately \$32,400 per year. As gas prices rise, the savings will also increase.

Hadlock used the SB 1149 funds to pay for project costs. Klamath County School District is eligible for approximately \$95,000 in funds each year to apply towards energy conservation projects in all its schools.



Students at Henley High are working at constructing a pond with the geothermal water used to heat the school. The pond, located near the football field, will be used as an outdoor lab for biology students.



Project engineer Brian Brown P.E. (left) shows Energy Analyst Brian Herbstrith with the Oregon Department of Energy the modulated control valves for the Henley High geothermal HVAC heating system.

In addition, the initial project costs were reduced when Nike, Inc. agreed to be the school's partner. The energy project was eligible for a Business Energy Tax Credit from the Oregon Department of Energy. Under Legislation passed in 2001, a private business or individual can partner with a school (or other public entity, non-profit organization, or business) and accept the 35 percent tax credit eligibility for energy projects in exchange for a 25.5 percent cash payment.

Nike agreed to accept the tax credit eligibility for Henley High's project and provided Klamath County School District with a \$24,528 payment that the school district applied

to the \$96,000 in project costs. The Business Energy Tax Credit application must be completed prior to the start of the project to qualify.

Savings critical to district

Klamath County School District covers more geographical area than any other Oregon school district. Its borders stretch from central Oregon in the north to the Oregon-California line in the south and lies along the eastern slopes of the Cascade Range. The school district serves 6,400 students within the vast area.

Hadlock sees the \$32,400 savings each year in Henley High heating bills as funds that can be spent on education. He is checking off his list of energy projects as SB 1149 funds become available each year. The district is implementing projects with the fastest payoff first. They just completed major modifications and added computerized controls to the Brixner Junior High HVAC system. The payoff period on the Brixner project is estimated to be 3.3 years.

Ken Hadlock is pleased with the results of the Henley High geothermal project. It was like finding a pot of gold in his back yard.

What is Geothermal Energy?

Geo (earth) and thermal (heat) is energy created from ancient volcanic activity that is stored underground. Like oil, drilling accesses a geothermal reservoir. Geothermal is clean energy because it does not release greenhouse gases. It is available 24 hours a day, seven days a week. It is sustainable. Since the early 90s, a local Klamath Falls ordinance calls for the used geothermal water to be reinjected into the ground to keep the ground water table pressure constant. (The ordinance does not apply to the Henley High geothermal well.)

At Henley High School, the hot water is located 1,500 feet below the surface. It is piped from the well for 150 yards to the school building.

At the building, the water is used to heat the building and to preheat the potable water used in the kitchen and gym showers. This is called “direct use” because the geothermal heat is used for space heating without first converting it to electricity. Klamath Falls mechanical engineer Brian Brown estimates there are 500 wells in the K Falls area that use geothermal resources for direct use space heating.

Klamath Union High School in the Klamath Falls City Schools district also uses geothermal energy. The main school building, constructed in 1928, has a geothermal well. The heated water comes in at 132° F and is used to heat outside air and preheat potable water. Mazama High, also in Klamath Falls City Schools district, was built in 1960 with geothermal heating.

Geothermal at higher temperatures can be used to drive a turbine generator to produce electricity. Experts estimate that current geothermal electric power generation capacity in the United States is approximately 2800 megawatts.

Currently, production of geothermal energy ranks third among renewables, following hydroelectricity and biomass. It is ahead of solar and wind production.

What are SB 1149 Funds?

The Oregon Legislature passed Senate Bill 1149 that introduces competition into the retail electricity market of Oregon's two largest utilities, Portland General Electric and PacifiCorp. The bill went into effect on March 1, 2002.

SB 1149 provides that PGE and PacifiCorp must collect a public-purpose charge from consumers within their service areas that is equal to 3 percent of the total revenues from electricity services. A portion of these public purpose funds (10 percent) go towards energy efficiency efforts in the public schools within their service areas. The Oregon Department of Energy, in cooperation with the Education Service Districts and individual school districts, is administrating the schools' public purpose funds. Projects must be pre-approved to qualify for SB 1149 funding.

Business Energy Tax Credit Pass-through Option

The Business Energy Tax Credit Pass-through Option allows schools (or non-profit organizations and other public entities) to transfer its tax credit eligibility to a business or individual with an Oregon tax liability in exchange for a lump-sum cash payment. The Business Energy Tax Credit application form must be completed and sent to the Department of Energy before the project begins.

The Department of Energy can assist schools in finding a pass-through partner. The tax credit amount is 35 percent of eligible project costs. The pass-through payment is 25.5 percent of eligible project costs if project costs are more than \$20,000. The rate is 30.5 percent of eligible project cost if costs are \$20,000 or less.

Contact Greg Churchill at 1-800-221-8035 or by e-mail sb1149.sch@state.or.us for more information.



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