

Case Study: The Dalles Middle School

Energy use to drop dramatically

When you have a lemon — you make lemonade. The Dalles School District, 83 miles east of Portland, Oregon, was faced with a big lemon: a poorly built middle school located in a landslide area. The school district decided to make lemonade and turn a negative into a positive.

“...our architect and engineers tell us we could see up to a 60 percent cost reduction (in energy).”

*– Dan Chamness
Business Manager
The Dalles School District*

The Dalles new \$12.5 million middle school opened in September 2002. It is one of the first schools in the nation that is heated and cooled with the very ground water that caused the landslides. The Oregon Office of Energy's School Program, in conjunction with Rebuild American and other U.S. Department of Energy program partners, provided technical assistance. This unique application of free geothermal energy and other energy-saving measures are expected to reduce the school's annual energy consumption by at least 46 percent.

District Business Manager Dan Chamness couldn't ask for much more. “We were conservative in our budget to reflect a 46 percent reduction in energy costs,” Chamness said. “But, our architect and engineers tell us we could see up to a 60 percent cost reduction. We hope to be pleasantly surprised.”

The 96,000 square-foot building was constructed for an estimated \$104 per square foot (not including site work), reasonable for a school in Oregon. The project was both on budget and on time. Both Chamness and District Maintenance Supervisor Ross Cain noted that the number of change orders, that only add to the bottom line, were less than anticipated, too.

The lemon was turned into lemonade. The new school is comfortable



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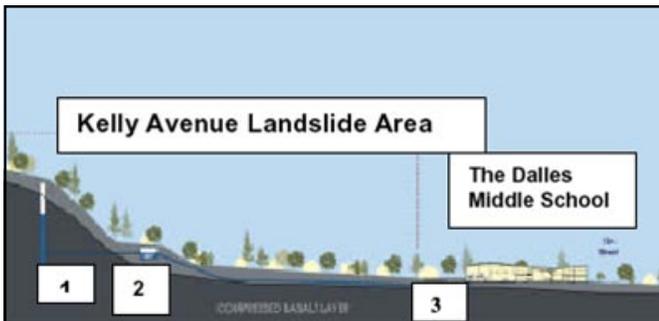
and healthy for students and staff and energy and resource efficient. It is a high performance school that will serve as a model for other Oregon schools.

A 'temporary' school

The original middle school comprised of three buildings and a gym/cafeteria opened in 1955. Construction of The Dalles Dam had brought a sudden influx of students, and the school district had to respond quickly to meet the demand. They constructed "temporary" facilities on the Kelly Avenue Landslide Area expecting to be there for 20 years or less.

The 20 years turned into 45 years. They were not easy ones for the school district, students, staff or taxpayers. The shifting ground and hurried construction of the buildings resulted in expensive repairs and labor-intensive maintenance. The classrooms were uncomfortable for students and staff. Because there was little insulation, heating and cooling bills were high. There were constant problems that stretched the maintenance staff.

There was talk of a new middle school when Cain joined the district in 1985. But, it was just that — talk. The decision to build a new middle school was made by the State Fire Marshall. He closed one of the buildings in 1995 and condemned the others following the 1999-2000 school year.



1. Dewatering wells; 2. Well water holding tank; 3. Rock key trench between slide area and new school site.

slides, the city had rehabilitated the landslide area with six dewatering wells that drew water from the ground and two large well water holding tanks. These actions had stabilized the ground.

The engineers gave their approval for a new school to be built on the existing site with the addition of a rock key trench 180 feet long, 80 feet wide and 35 feet deep between the slide area and the school to further stabilize the school grounds. In addition, the original nine-acre site was expanded to 13 acres to allow for reorientation of the school to the far end of the landslide area. Voters were asked to approve a second building bond issue. This time, they approved.

The Dalles Middle School

1200 East 12th Street
The Dalles, OR

The Dalles School District No. 12
Superintendent: Cheryl Crawley
Principal: Jan Anderson

Architect: Heinz Rudolf, BOORA
Contractors: Turner Construction
Project Manager: Heery International

Groundbreaking: August 9, 2001
Open House: August 22, 2002

Cost: \$12.5 million
600 students in grades 6,7,8
96,000-square-foot building
On 13 acres in residential area

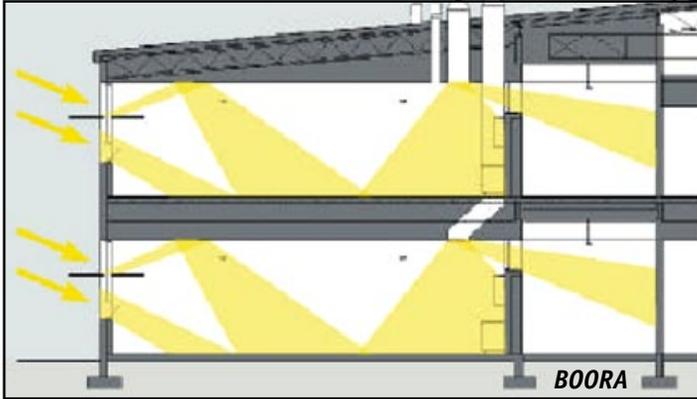
New building challenge

Building a new middle school posed quite a challenge for the district. The district selected a new school site, but voters rejected the building bond because the location was too far from the residential core. The district went back to the engineers to see if the existing site favored by the community could be used.

However, the favored site had landslide problems. In the late 1980s, in an attempt to mitigate the land-

Building Design

The school district architect, Heinz Rudolf with BOORA architectural firm of Portland, is an advocate of energy efficient, “green” or sustainable buildings. He saw the 58 to 60 degree ground water being pumped from the landslide area as a readily available source of renewable energy for a new building.



Exterior and interior lights bounce the light deep into the classroom.

School District Maintenance Supervisor Ross Cain had to see for himself that this process would work. He researched the technology and visited several geothermal sites before he gave approval.

The unusual heating/cooling system is of special interest to the foreman who installed the heat pump. Bob Loftin attended the old middle school and lives in The Dalles. “This is a feather in our cap to do this,” Loftin said. “The old school was a mess. We want to keep our kids in school and this new building will be nice. Now this community really has something they can be proud of. It puts us on the map.”

Daylighting

The Dalles School District considered other measures to reduce energy use. It incorporated lots of natural light to reduce the need for electric lighting and the associated increase in the air conditioning load. More importantly, studies show that students perform better when skylights and windows bring natural, non-glare light inside the classroom. This is called “daylighting.” (See Daylighting Report on Office of Energy Web site: www.energy.state.or.us/school/highperform.htm)

The water could provide both heating and cooling using geothermal principles. For heating, a heat pump extracts the heat from the water. For cooling, the heat pump reverses the process. In addition, the relatively cool ground water is used directly to chill the air flowing through the ventilation system that cools the building.

Heating and cooling are a large part of the energy use of a school building. Having a renewable resource, one that nature maintains at a constant supply over time, will impact on the bottom line. It is an attractive concept, but



Light tube provides light in interior wall area. High windows on the interior walls allow light into the hallway.

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The Dalles Middle School has incorporated daylighting into each classroom using four methods.

- 1) The school is oriented so classrooms face north and south. They do not get direct western sun during the hottest time of the day.
- 2) The large windows have a special glazing to minimize glare and heat, but bring lots of natural light inside the room.
- 3) Light “shelves” are built on the outside and the inside of the windows. These three-foot reflective projections are located about a third of the way down the window. They reflect the sunlight to the white ceiling which “bounces” the light deeper into the room. The shelves also shade the lower window and reduce heat gains into the room caused by the sun.
- 4) One or two light tubes are located on the inside wall of the room to bring in additional natural light. The light tubes are much smaller diameter than a skylight and made of reflective material to bring direct sunlight and ambient light through the ceiling and into the room. A diffuser spreads the light evenly. Near the light tubes, three high windows within the classroom allow some of the light into the interior hallway. Both the first and second floors have light tubes and light shelves.



Natural light comes into the interior hallways of the new school from high windows on the interior walls of classrooms.



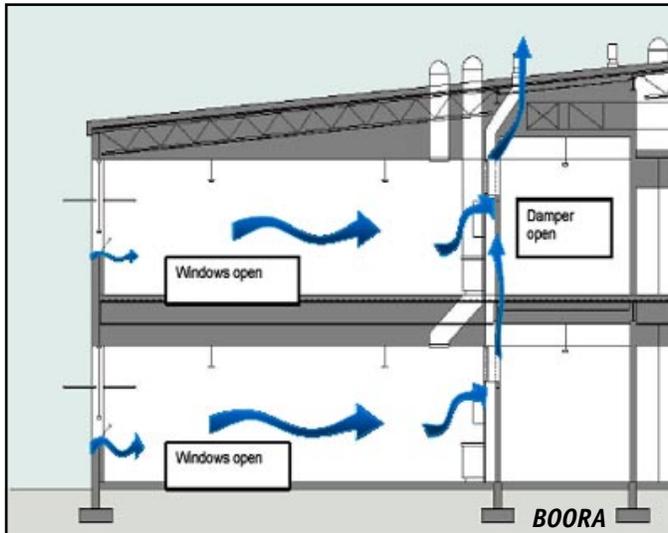
Gym skylights are lined with spun fiberglass to diffuse natural light.

Other energy efficient measures to include:

- The electric lights installed in the classroom are energy efficient fluorescent T-5s. They can be controlled separately so the fixture closest to the windows can be turned off, while the one closest to the interior wall can be left on, if necessary.
- The media center and computer labs have an entire wall of windows. There are no light tubes in these rooms as the wall of windows brings in abundant light.
- Windows that face west have vertical sunscreens that provide shade in late afternoon without blocking the view.
- In the gym, several interior skylights are lined with a spun fiberglass. This diffuses the light so there is no direct sunlight on the gym floor.

Natural ventilation

The middle school design included an old concept into the new building — natural ventilation. The operable windows pull fresh air into one side of the classroom, while ventilation stacks (chimney-like devices) pull the air out on the opposite side of the classroom.



Green/red light system lets teachers know when to open windows.

When outside temperature conditions are within a certain range, teachers can open the windows. When outside temperatures are too high or too low, the back-up mechanical ventilation system automatically turns on.

The benefits of natural ventilation are substantiated in studies of student performances. (See Daylighting Report on Office of Energy Web site: www.energy.state.or.us/school/highperform.htm). Natural ventilation connects students and staff to the outside and can be easily controlled. In addition, natural ventilation saves energy, maintenance and has lower initial costs.

Sustainable Building

The school district took considerable care to make the building a high performance school that will save energy, natural resources and money. For example:

- They controlled erosion through grading, sediment control and landscaping, in addition to rehabilitating the damaged landslide area.
- They used light-colored concrete for the parking area to reduce heat “islands.”
- They directed the exterior lighting downward to reduce night light pollution.
- They included 176 bicycle parking spots and even an area for a future electric car charging station.
- They used drought-resistant plantings.
- They are irrigating the three ball fields behind the school with the reclaimed ground water.
- Building materials were specified to contain post-consumer recycled content.
- They had building contractors recycle or salvage construction waste.
- They specified that building materials contain post-consumer recycled content.
- They ordered toilet and shower partitions made from recycled plastic.
- They used ceiling tiles produced from 75 percent post-consumer recycled waste.
- They used local building products when possible to avoid transporting materials long distances and consuming more fuel.
- They designed a recycling center in the building.
- They used paints, wood stains and sealers with low or no-volatile organic compounds (VOCs) as much as possible.
- They mechanically zoned science classrooms to avoid exposure to hazardous chemicals.
- They stained the concrete walls to look like basalt rock and to blend with the colors of the natural landscape.

Commissioning

A key to operating a building as it was intended to run is to have a commissioning agent involved during the construction process. Commissioning is the systematic process of ensuring that building systems are designed, installed, tested and capable of being operated and maintained to perform according to the design intent and owners' needs. The Dalles School District included this expense in their plans.

Commissioning begins in the design phase. The commissioning agent's task is to identify system deficiencies as early as possible in the project and to track their status until they are corrected. The result will be improved tenant comfort and productivity, improved air quality, reduced operation, maintenance and equipment replacement costs and lower energy costs. It includes the training of operating staff. Commissioning agents may be an independent third party, a design professional, a general contractor or a mechanical contractor.



The new school walls are concrete and stained to look like basalt rock. Note the shading the light shelves provide to reduce glare and heat gain inside the classroom.

The cost of commissioning can vary considerably with the size of each project and the level of commissioning. For whole-building commissioning, the price range is normally 0.5 to 1.5 percent of total design and construction cost. For The Dalles building, commissioning costs were \$55,000.

Going for Gold

Because the building incorporates numerous sustainable materials and ideas as well as many energy-saving measures, The Dalles School District has applied for the gold certification level from the U.S. Green Building Council's LEED™ (Leadership in Energy and Environmental Design) Program. The U.S. Green Building Council independently reviews all the construction documents for energy efficiency and environmentally sustainable products. The gold certification is the second highest level. Only 26 schools in the nation have applied for a LEED certification rating.

The Dalles Middle School also received an Energy Award from the Oregon Office of Energy for outstanding design achievement.

“The Dalles School District has created a high performance school that is an asset to the community, enhances teaching and learning, reduces operating costs and protects the environment,” said Director of the Oregon Office of Energy Michael Grainey.

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This case study was published under a grant funded by the U.S. Department of Energy, Grant No. DE-FG51-01R021294. The funding provided by the U.S. Department of Energy (DOE) does not constitute an endorsement by US DOE for any of the views or findings expressed in the case study.