



## Commercial Case Study

### Poudre Valley School District Sets the Bar High for Green Schools Design with Energy Saving Geothermal System from ClimateMaster

For almost two decades, the Poudre Valley School District ("PSD") in Ft. Collins, Colo. has been a vanguard of energy conservation and management initiatives on a national level. In an era of ever-shrinking budgets, fewer dollars expended on energy means more of the district's funds can go toward actual education. For PSD, it isn't just about 'being green': reducing energy costs is essential to protecting the educational mission of the schools.

In the late 1990s, PSD began exploring energy and cost-efficient designs for new construction to be funded by a school district bond. A team of PSD planning, design and construction staff chose the new facilities and operations building to launch cutting-edge, energy-efficient technology it planned to include in subsequent construction projects throughout the district. The team used PSD's newly approved Sustainable Design Guidelines (adopted in 2000), ENERGY STAR ratings and other available tools as parameters to create its energy management targets. After exhaustive research, which included independent assessment and evaluation of HVAC systems then available, the PSD team specified a geoechange-driven system for the new building.

Primarily constructed to house PSD administrative staff, the facilities and operations building also serves a notable educational function. It was specifically designed to showcase all energy-saving aspects of the building, including maximized

daylighting and automated light dimming. The building was also designed with a glass-enclosed mechanical room which permits students, parents and members of the community to observe several components of the geoechange system, including the entry point of the ground loop pipes and a number of its heat pumps in action. Red, green and blue lights additionally communicate to observers when the geoechange system is in heating (red) or cooling (blue) mode, as well as when the system is not operating (green) and windows should be opened to circulate temperate outdoor air.

The PSD construction team, including architect Mellin & Associates, general contractor Thissen Construction Corporation and mechanical engineer RMH Group, Inc., evaluated the projected performance, energy savings, maintenance data and costs, access to repair and filters, and ease of installation of several geothermal heat pump suppliers. EMC Engineers, the commissioning agent, collaborated with the owner and design team to select ClimateMaster's horizontal and vertical Genesis Packaged (GS) Series geothermal heat pump units over two other manufacturers' products in a competitive bid process. According to PSD energy manager Stu Reeve, who has spent almost 25 years analyzing geothermal technology and has visited various manufacturers' facilities, "ClimateMaster units are excellently designed and built with maintenance personnel in mind - they are easy to access and work with."

The project's GeoExchange consultant and commissioning agent, Trey Austin, then an engineer with EMC Engineers (and now president of Geo Energy Services, LLC), chose ClimateMaster Genesis Packaged Series geothermal heat pumps to supply the HVAC needs for the new building. Austin, who has worked for more than 17 years in the geothermal

heat exchange business, recalls this project was high-profile as the technology was new in Colorado and it was the first-ever geothermal project to be constructed in Ft. Collins. According to Austin, because the operations building would serve as a test case for PSD, he had to be certain the system would perform better than projected.

“At the time, noise was a significant factor for PSD,” said Austin. “The ClimateMaster Genesis Packaged Ultra units not only provided the highest efficiency on the market, featuring single-stage scroll compressors, they were extremely quiet when the system was operational. Being backed by the largest ground-source heat pump manufacturer with a reputable history was also a confidence-builder in selecting them.”

Inside the building, 9 ClimateMaster Genesis Packaged (GS) vertical units supplying 18 tons of total capacity were installed above the ceiling between the first and second levels to heat and cool each of the building’s 9 zones. Outside, a geothermal borehole field comprised of 18 300-ft. deep bore holes was drilled by GHP Systems, Inc. who also installed 5,400 feet of HDPE pipe in a vertical loop configuration under what is now the parking lot adjacent to the building. Drilling and pipe installation occurred in January and February of 2002, and the entire HVAC system was operational when the building opened in May of that same year.

Admittedly, not everyone on the PSD team was initially on board with the use of geothermal heat pumps. As Tom Weatherly, then HVAC department head recalls, “I fought tooth and nail against using geothermal heat pumps because I was worried about refrigerant leaks and compressor or heat exchange failures. “After 11 years of operation, Weatherly’s concerns have been allayed completely. He is now a proponent of the technology, firmly believing that the energy saving achievements and functionality of the geothermal heat exchange system, “have surpassed all of our expectations. Since their installation more than a decade ago, the ClimateMaster heat pump units have required no replacements



at all—of motors, contactors or compressors. The only maintenance needed has been routine changing of the filters.”

Other members of the collaborative design and planning team were worried about the heat pumps’ potentially noisy operation. Those concerns have not been borne out by experience. Since construction was completed in May 2002, Weatherly confirms an altogether opposite reaction from the more than 30 occupants of the building. “We can’t hear them at all—we forget they are even there,” he shared.

As a leader in energy management, PSD fields inquiries from other school districts across the nation. To one of the frequently asked questions, “What about a back-up system?”, Weatherly and other officials told astounded listeners, “There isn’t one.” In fact, the geothermal system exclusively supplies energy to the 8,753 square foot building 12 months a year, approximately 55 hours per week. Presently in its 12th summer of operation, it has operated optimally, maintaining consistent, comfortable indoor temperatures through scorching hot summers and very cold winters.

Just as the operations building surpassed expectations for reliability, its energy performance has been nothing short of stellar. Initially earning an ENERGY STAR rating of 97 out of 100 in 2003, it received a rating of 100 in 2005, and a 99 rating for each of the last 6 years. According to Reeve, the 99 rating is 15 points higher than the average for all Colorado ENERGY STAR buildings and plants. ENERGY STAR also estimates buildings with this performance rating, achieved by only 1 percent of buildings in the nation, consume 50 percent less energy than other structures each year.

For the Poudre Valley School District, the real success story of the operations building lies in the long-term savings in energy use, and thereby costs. According to Stu Reeve, most comparably sized commercial office buildings in Colorado consume energy at an average rate of 90 kBtu per square foot per year, a measurement of thermal energy consumption that





## Poudre Valley School District Ft. Collins, CO



includes electricity and natural gas usage. In comparison, the best energy use rates for most other leading energy saving technologies is 40 kBtu per square foot per year.

“Over the last 11 years, the energy consumption of the operations building has been a steady 20 kBtu per square foot per year,” said Reeve. “If we had selected and installed a traditional high-efficiency HVAC system back in 2001, such as a hot water boiler for heating and a DX cooling rooftop unit, I’d estimate the energy efficiency would have been at least 50 percent less than that of our current geothermal heat pump-driven system.”

Reeve additionally shares that because the geothermal heat pumps supply the entire heating and cooling load, the building does not consume any natural gas. And while the energy-efficient building design and energy conscious occupants do contribute to overall energy conservation, Reeve believes the “vast majority of energy savings can be attributed to the high-efficiency operation of the HVAC system’s ClimateMaster heat pumps.”

After a resounding success in exceeding energy performance and savings targets with its operations building, PSD built four new schools earning ENERGY STAR ratings of 97 and above in their first year of operation. PSD’s green building initiatives also earned LEED® certification from the USGBC (U.S. Green Building Council) in the construction of its Fossil Ridge high school (LEED Silver certified) and Bethke elementary school (LEED Gold certified). Bethke was additionally the first school in the nation certified under the USGBC’s LEED for Schools rating system (based on LEED for New Construction), established in 2009.

In total, PSD’s energy conservation and efficiency efforts add up to 37 percent less dollars per square foot in energy spending than other school districts in the state. And in addition to energy-efficient new construction projects, PSD has implemented innumerable district-wide sustainability initiatives,

including solid waste recycling, wind power use, water conservation, bus retrofits and block heater conversions. Recognized nationally as a leader in public school energy management and environmental stewardship, PSD was selected by the EPA (U.S. Environmental Protection Agency) as the 2003 ENERGY STAR Partner of the Year for Leadership in Energy Management. Presently, out of 115 ENERGY STAR labeled schools in Colorado, 49 (nearly 43 percent) are in the Poudre Valley School District.

A pioneer at the State level, PSD received the Renewable Energy in Building Award from the Colorado Renewable Energy Society in 2002 and the Governor’s Office of Energy Management Energy Champions award for leadership in efficient new construction in 2006. PSD is also recognized as a gold leader partner in the State’s Environmental Leadership program that offers benefits and incentives to members who voluntarily exceed compliance and demonstrate commitment to environmental improvement.

In his role as energy manager, Reeve collects detailed data to track the energy use and performance of the HVAC system at the operations building.

“The ClimateMaster ground source heat pump HVAC system at our operations building has become the benchmark high-efficiency standard for both comfort and energy performance at PSD, and in the state of Colorado,” Reeve said.



Austin and Reeve routinely interact to discuss the data and marvel at its consistent performance and long-term success.

“We often guess at how the system might be even more impressive using today’s ClimateMaster Tranquility units with two-stage compressors and ECM fans,” said Austin. “This project clearly signifies the importance of a collaborative design effort and strong ongoing energy management responsibilities.”



## Poudre Valley School District

**Architect:**

Mellin & Associates

**General Contractor:**

Thissen Construction Corporation

**Mechanical Engineer:**

RMH Group, Inc.

**Commissioning Agent:**

EMC Engineers



ClimateMaster is the world's largest and most progressive manufacturer of geothermal heat pumps. The company is committed to innovation and dedicated to environmentally clean, economically sound and superbly comfortable home and business environments.

ClimateMaster has been designing and building equipment that enhances the environments we live and work in every day for more than 50 years. In addition to geothermal heat pumps, ClimateMaster offers the most extensive product line of water-source heat pumps for use in a wide variety of applications. ClimateMaster products are proudly built in the U.S.A.



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