**Sioux City Community School District**

Bidirectional Cascading Central Geothermal System 40 percent more efficient than district’s air-cooled chiller/natural gas boiler plant • Sioux City, Iowa

The Sioux City Community School District educates students to believe in their talents and skills, achieve academic excellence, and succeed in reaching their potential. Serving over 14,000 students in seventeen elementary, three middle and three high schools, the district offers a strong academic program blended with a caring staff to provide students with excellent opportunities for learning and growth.

**Challenge**

Although the Sioux City Community School District was accustomed to using central chilled water plants (typically air-cooled) with central station air-handlers in their facilities, when plans were being drawn up for their new Spalding Park Elementary School, the district sought a different type of solution. In line with their commitment to sustainability, the district specified a more efficient geothermal system to handle their comfort needs.

**Solution**

The district discussed using a geothermal system with their mechanical/electrical consulting firm, Engineering Design Associates (EDA), and Trane, a long-term partner of both the school district and the consultant, was brought in. Trane proposed its Bidirectional Cascading Central Geothermal System to increase efficiency. EDA used Trace™ 700 modeling and analysis software to evaluate the performance and energy saving potential of the system. After reviewing the data, the district school board approved the project.

Heat pump system with centralized heating, cooling, and air handling, creating a more efficient system with better humidity control, centralized maintenance, enhanced acoustics, and superior flexibility.

The Trane Bidirectional Cascade (chiller/ heater) heat pump system provides the energy efficiency advantages of a geothermal installation, along with the flexibility and performance of a state-of-the-art central system. It includes highly efficient chillers, fans, motors and pumps; a variable air volume (VAV) system with airside economizers; and cascading energy streams. The efficient and safe operation of the geothermal system is enabled by a thoroughly documented and programmed controls sequence of operation.

A more efficient geothermal system

Geothermal heat pump systems use small, distributed heat pumps that are coupled with a ground source heat exchanger to efficiently reject heat to the ground loop in the summer and extracted it in the winter. The central geothermal system concept combines the efficiency of a traditional geothermal
Reliable, lower maintenance chiller operation

The geothermal system uses two Trane® Series R™ Helical Rotary Water-Cooled Chillers (RTWD), with water-to-water heat pump controls and heat recovery capability. The proven reliability and flexible design of the Trane rotary chiller makes it a perfect match for high-performance applications, such as the school district’s geothermal system.

A Trane service agreement keeps the chillers running at their best. Preventive maintenance schedules and practices refresh the system to factory specifications and help facility managers plan budgets and schedule regular service. With fewer moving parts and a low-speed/direct drive compressor, the advanced helical rotary chiller not only improves energy efficiency, but also reduces maintenance costs.

Efficient, quiet air handling

Trane Performance Climate Changer™ air handlers deliver efficient, reliable operation. The air handlers’ direct-drive plenum fans operate quietly for an optimal learning environment. The dedicated outdoor air system, with Trane Cool Dry Quiet (CDQ™) energy wheels, conditions and filters outdoor air to provide proper ventilation and humidity control, improving indoor air quality and comfort for students and staff. The system’s CDQ wheels also help to reduce load on the chillers, allowing them to work more efficiently, lowering overall energy use.

Results

A Trane Bidirectional Cascading Central Geothermal System installed at Sioux City Community School District’s Spalding Park Elementary School is substantially lowering energy and maintenance costs for the school district, while improving humidity levels and acoustics for a more comfortable learning environment. Comparisons to other district schools, with similar size footprint, location, usage and construction techniques, show the bidirectional cascading central system to be 17 percent more energy efficient than other central geothermal systems and 40 percent more efficient than an air-cooled chiller/natural gas boiler plant. With the bidirectional geothermal system, the district is also receiving utility incentives equal to 10 percent of the utility costs.

“We compared the bidirectional cascading central geothermal system at Spalding Park Elementary with a parallel chiller/heater central geothermal system at Liberty Elementary and an air-cooled system at our Leeds Elementary,” said Jeremy Taylor, Sioux City Community School District Energy Specialist. “Leeds’ energy costs are $42 more a day than Liberty, and Liberty uses almost three times the natural gas as Spalding Park. With the bidirectional cascading central geothermal system, Spalding Park is by far most efficient.”

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