

Project Profile

A Zero Energy-Capable Building



Credit: Dean Lavenson, 2007

Overview

Site Details

- Location: Bowling Green, KY
- Building type(s): K-12 education
- New construction
- 81,100 ft²
- Completed August 2007

PLANO ELEMENTARY SCHOOL

Plano Elementary School is an 81,147 ft² building that serves as a school for 435 students in Warren County, Kentucky. The building includes 32 classrooms, 14 offices, six resource centers, media center, gym, server room, and cafeteria with kitchen. Warren County Public Schools has 20 schools in the district, and five of those have received Energy Star labels. The district leads Kentucky with the most Energy Star schools.

Energy

HVAC System. Plano's geothermal HVAC system consists of dual-compressor heat pump units and decentralized pumping. Emphasis was placed on sizing the heat pump units during the design phase. One heat pump unit serves two classrooms to maximize efficiency and reduce construction cost and maintenance. A typical unit serving two classrooms has four tons of cooling capacity. The design team chose dual-compressor heat pump units to increase the system's efficiency. During part-load operating conditions, a dual-compressor unit will operate more efficiently than a single-compressor unit. Full-load operating efficiencies occur infrequently.

Distributed Water Pumping. The design team worked together on Plano Elementary to eliminate the central pumps and associated variable frequency drive units, attempting a new pumping concept. Each heat unit has an individual water pump to recirculate the water through the entire geothermal water loop, including the well field. The water pump will not operate unless its respective heat pump is in operation. This ensures variable flow, which only responds to demand.

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The closed-loop piping system was designed to minimize the water pressure drop in the geothermal piping system. Plano's loop pressure drop is 35 ft TDH. The installed total horsepower of pumping capacity is reduced by half compared to the district's previous project.

Most pipe mains in the building were increased one pipe size to reduce the systems pressure drop. Plano's pipes are uninsulated 80 PVC for all interior piping to keep construction costs from rising.

Outdoor air is introduced to the school through the use of central equipment. Three dedicated outdoor air-handling units provide fresh air to the building and provide an exhaust-air path for building pressurization control. This allows the use of a desiccant heat recovery wheel in each outdoor air unit.

A supplemental two-pipe coil is located in the outdoor air path downstream of the heat recovery wheel. The purpose of this coil is to provide additional heat to the air stream in the winter months and supplemental dehumidification during summer months.

The centrally located geothermal heat pump chillers provide a source of heated water in the winter and chilled water in the summer. The geothermal heat pump chillers operate in the winter months only.

The county's school district tested operation of the system during the hot and humid summer months and found that the building's humidity is controlled without supplemental cooling of the outdoor air. This is attributed to the classroom heat pump's humidification capabilities in the first stage cooling, the desiccant heat recovery and tight building envelope.

For an in-depth case study, visit:

buildings.newbuildings.org/overview.cfm?projectid=1748

New Buildings Institute

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