



Vineland Public Schools Constructs Learning Environment That's Great for Students and Good for the Earth

Challenge

- **Alleviate overcrowding and provide high quality learning environment**
- **Lower energy costs**
- **Minimize environmental impact**
- **Reduce maintenance demands and costs**
- **Raise facility staff productivity**
- **Improve classroom acoustics**

When Vineland New Jersey's Pauline J. Petway Elementary School opened its doors in September of 2006, it achieved its vision to provide the best possible learning environment for students while cutting costs and environmental impact. The new school is part of a district-wide expansion to alleviate overcrowding while improving indoor comfort and acoustics and reducing high energy and maintenance costs.



The 75,000-square-foot school includes 27 classrooms to serve 580 students in grades K-5, along with a media center, gymnasium/theater room, cafeteria, computer lab, health suite, conference rooms, and guidance offices. From the start, the Petway School project team, including the architectural firm of Manders-Merighi Associates, Concord Engineering Group, Schiavone Construction as general contractor, Kisby Shore Corporation as mechanical contractor, and several professionals from Vineland Public Schools, aimed to develop an innovative design that would raise the standard for Vineland Public Schools, which serves 10,473 students in 23 school buildings.

Solutions

- **Geothermal system with Trane water source heat pumps**
- **Mechanical equipment closets**
- **Factory mounted, wired, and commissioned DDC Controls from Trane**
- **Trane Tracer Summit® Building Management System**
- **Specialized acoustic design**



The Vineland district includes over 1.5 million square feet worth of building space, some of which dates all the way back to the early 1900s, with many issues in indoor air quality and maintenance and energy costs. The new schools, including Pauline J. Petway, funded by the New Jersey Schools Construction Corporation, provided an exciting opportunity for a new building design approach.

“From the start, the project team determined that the school should include mechanical equipment closets, a geothermal heating and cooling system, and improved acoustics,” says Wayne Weaver, Executive Director of Physical Facilities for Vineland Public Schools. “We had to do a lot of balancing to get the cost-per-foot to fit into the budget, but in the end the results were highly gratifying.”

Geothermal for indoor comfort and energy conservation

All of the four new schools in the Vineland district will incorporate geothermal exchange heat pumps, which uses the earth as a heat source when operating in heating mode and a heat sink when operating in cooling mode. The Petway School is equipped with a closed-loop geothermal heat pump system incorporating a bore field of hundreds of vertical bores at 180-feet-deep and a two-pipe supply and return system with individual Trane water source heat pumps for each classroom.?
?occupied space.

Utilizing the earth as a heat sink and sourceThe renewable ground heat greatly reduces the does not use of new energy, reserves, with and the only purchased energy required necessary is to operate the compressor, the circulating pumps and low-horsepower heat pump fans. “The geothermal system is the most energy efficient and environmentally acceptable of all systems we analyzed,” says Mike Fischette, P.E. and Corporate Principal at Concord Engineering Group. “It has a Life Cycle Cost that is more than two and a half million dollars less than a four pipe boiler/chiller system.”

The geothermal system uses the constant temperature of the earth at a moderate 53 degrees Fahrenheit throughout the year as the primary source of energy for heating, cooling and domestic pre-heating hot water production. When the weather is cold and exterior spaces of the building require heating, the system utilizes the heat that may be available fromorm interior spaces of the building that may require cooling before generating any new heat. and the building requires space heating from the piping loop, the interior spaces reject heat. Space generated indoors from people, lights and equipment is transferred to the re-circulating heat transfer loop from the interior heat pumps to the exterior heat pumps. This ability to recover energy from within the building allows the loop temperature to remains higher and allows the heat pumps in the heating mode to operate more efficiently.

The pumps that move water through the piping loop from the heat pumps to the bore field are equipped with variable speed control for optimal efficiency. When the space temperature reaches the right level and the heat pump compressors are not necessary, the two-way valve closes and stops water flow to the heat pump. Therefore, the only wWater is only being pumped when it is is what is required for the heat pumps in actual operation. This reduces operating pressure and flow, resulting in lower horsepower needs and uses only about two-thirds of the electrical energy that would be required to operate the primary pump continuously at full capacity.

Additional benefits were noted at the pre-occupancy tour by Rose Clemens, Research Architect from the Center for Architecture and Building Science Research at the New Jersey Institute of Technology, “The system provides users with a high level of control over indoor comfort, since each area is served with its own heat pump unit and is subject to local temperature and humidity control utilizing hot gas reheat.” Also in attendance at the tour were representatives from the New Jersey Department of Education, Education Law Center, and New Jersey Schools Construction Corporation.

The school maintains optimal thermal comfort for students and staff, and also features roof-mounted active desiccant-based dehumidification energy recovery units, which maintains comfortable and healthy air quality.

Equipment closets ease maintenance logistics



The Petway School project team developed the idea of mechanical equipment closets to facilitate maintenance logistics, optimize space, and support sound attenuation for better acoustics.



The floor plan of the school is described by architect, Larry Merighi, as having, “bi-lateral symmetrical rooms with four rooms per corridor, and two on each side. The closets, where HVAC equipment is stored, fit nicely between every two classrooms.” Air is supplied through a duct distribution system, rather than having equipment located directly in the classroom.”

“Without the bore field, the mechanical/boiler room would have been four times the size of what we actually wound up with,” says Paul Farinaccio, CEFM and Maintenance Superintendent for Vineland Public Schools. This helped to offset the additional square footage that was needed for the closet space and kept the grossing factor from getting completely out of line.

By incorporating the mechanical equipment into the design footprint, the closets provide full functionality and allow for easy accessibility for troubleshooting and preventive maintenance. They also add to a pristine environment, since it is not necessary to remove ceiling tiles for maintenance work, leaks stay contained, and staff can change filters and check equipment without class disruptions. Proximity of equipment to service areas means shorter duct runs and avoids the need for high horsepower motors to push the air to the spaces serviced.

Classroom acoustics are put to the test

It is a well-understood fact that young children and those learning English as a second language learn much better in environments with low background sound levels. In light of this, The Petway Elementary School project team hired a sound consultant, Lewis S. Goodfriend & Associates, to maximize acoustics in the learning spaces. Solutions included internally lining the interior of the heat-pump closets, the return ductwork from the classroom to the heat pump closet and the supply ductwork in the heat pump closet.

The results are excellent sound ratings of NC-36, or 43 dB(A) with the heat pumps operating. . . , where the room ambient noise was NC-25 or 33 dB(A). “There is a draft proposal for the new LEED for Schools requirements, incorporating a design goal of 45 dB(A), which the HVAC system in this school would meet,” says Mike Spencer, Senior Engineer at Lewis S. Goodfriend & Associates. He adds that the design achieves the right balance between the HVAC equipment sound and traffic noise to decrease the potential disruption to the students.

Single-source HVAC equipment and control

The district’s two newest schools, the first new schools in over 27 years, Pauline J. Petway and Thomas W. Wallace Jr. Middle School, both incorporate Trane Tracer Summit building management systems. This building automation solution provides total equipment control through a single, integrated system. A building’s climate, lighting, energy consumption, scheduling, and other controllable features can all be programmed and managed by the Tracer building control units. “As the largest school system in South Jersey, it’s wonderful that the entire DDC platform can be maintained through one system” says Farinaccio of Vineland Public Schools. He looks forward to next year when another new school will be added to his portfolio with a Trane Integrated Comfort Solution. There is also talk about moving the older schools over to the Trane Tracer Summit Building Management System as it becomes the standard across the district.

Results



- **Reduces Reduced greenhouse emissions into the atmosphere**
- **Low environmental impact**
- **Energy Savings of 30% wwith geothermal sysith geothermal system**
- **Improved maintenance logistics and low operation costs**
- **Acoustic levels below the standard in the LEED for Schools draft proposal**
- **Comfortable and healthy learning environment for K-5 students**
- **Thermal comfort control, with typical space temperature of 75-degrees dry-bulb temperature**
- **Higher level of indoor air quality and with controlled humidity control**

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For more information, contact:

Paul Napoli, Trane New Jersey Education Market Leader, 973-434-2185, pnapoli@trane.com