

Case Study - Valley Stream, NY

William L. Buck Elementary School



William L. Buck Elementary School Innovative Geothermal System Saves \$600,000

Geothermal Heat Pump System Uses Utility's Water Instead of Wells to Save Cost



Courtesy William L. Buck School

BACKGROUND

Bosch Thermotechnology Corp. (Londonderry, New Hampshire) and American Water Company (Voorhees, New Jersey) have provided a novel approach to commercial building environment control.

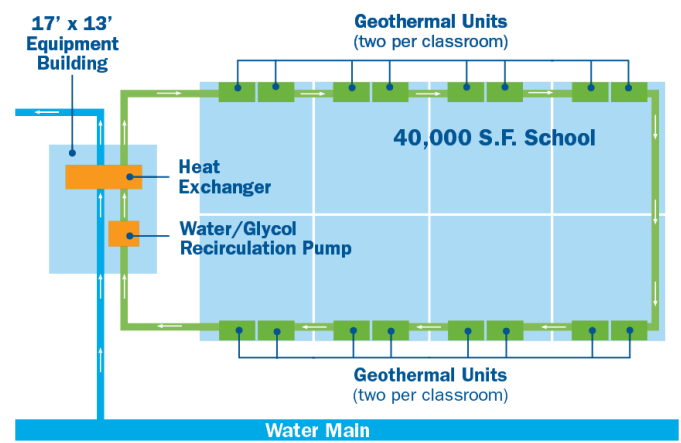
The companies combined their knowledge, products and talents to introduce a sustainable, energy efficient technology for environmentally sound, large-scale heating and cooling systems in cooperation with the City and State of New York and Nassau County. Although Bosch has equipped many schools with traditional geothermal and water source heat pump systems, this school's installation is unique. An innovative heat exchanger in this particular application eliminates the need to drill multiple geothermal ground loops.

In this proof-of-concept installation, Bosch FHP water source heat pumps are supplied with the utility's water as the transfer medium to heat and cool the building. It is a natural extension of proven geothermal heat pump technology. In a departure from traditional geothermal, which requires drilling multiple bore holes up to hundreds of feet into the ground to install a geothermal loop, this geothermal pilot project uses water from the water utility's main distribution system to heat and cool the 1950's era William L. Buck Elementary School in Valley Stream, New York.

INSTALLATION SUMMARY

Retrofitting the old and antiquated system in the school to the new Bosch high-efficiency geothermal system began in September 2014 with construction crews working at night for minimum disruption to student learning. By February 2015, piping and ductwork was completed, the heating and cooling geothermal quiet console units had been installed in each classroom, and the system was put into service.

In heating mode, the utility's water main feeds ground-temperature water into a food-grade heat exchanger located in a 13 x 17 ft. pump house on the school's grounds, where heat from the water is extracted and transferred to the water/glycol solution piped into the 63-year old school building and delivered to its rooms. Each room has its own Bosch CA model water source console unit with individual Hi-Lo fan-speed control. Bosch FHP model EC Large Capacity water-to-air geothermal units located above the ceiling and in utility space circulate heated or cooled air through ductwork, providing conditioned air to open areas in the building such as the cafeteria and gymnasium. All forty heat pump units are supplied with water/glycol closed-loop system via the school's pump room incorporating a flat-plate heat exchanger.



The utility's water supplies ground source heat pumps at 200 gpm flow rate with temperature rise <2F. HVAC system is monitored and controlled remotely by the facilities manager using computer software application.

Courtesy American Water

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Bosch technical engineer Edgton Wright (left) examines water supply system inside the pump building; flat plate heat exchanger (center) transfers heat from utility's water system to a water/glycol loop through the building. (right) Bosch FHP water-to-air geothermal heat pumps installed in building crawlspace provide conditioned air via ductwork and are fed by water/glycol piping.

Many U.S. schools do not have year-round heating and cooling, but the use of computer technology has dramatically increased the building's internal heat gain, creating an uncomfortable environment in the classrooms. Geothermal technology delivers comfort year-round. The advantage of a ground source heat pump is that in cooling mode, the water/glycol solution extracts heat from the rooms and transfers it to the utility's water through the heat exchanger and in reverse, for heating mode, the water/glycol solution extracts heat from the utility's water through the heat exchanger and sends it into the rooms. With the geothermal heating system in place, there's no extra cost to have a cooling system.

According to William Varley, at the time President of NY American Water, and Sr. Vice President of American Water's northeast division, "the transfer of heat between the utility's water and the geothermal loop occurs within the heat exchanger unit (which is small - about 4 x 4 feet). The heat exchanger is a food grade, double wall containment unit, which ensures that there is absolutely no contact between the water and the geothermal loop. Educators know that physical, quiet comfort affects the learning environment, so not only does the system save money and reduce a school's carbon footprint, it also helps to improve education - a triple win!"

In the pilot phase, the water passing through the heat exchanger is constantly being sampled with an analyzer to determine any change in quality and is then diverted into a diffusion well. Once the pilot is complete and receives regulatory and health department approval, the water will be recirculated into the utility's distribution system, so there is virtually zero water waste.

Jack DiEnna, executive director of the Geothermal National and International Initiative (Geo-NII), said geothermal systems are in place in more than 1,000 schools in the United States, but none like this. The system at Buck costs far less to install because there is no need to drill bore holes for the ground loop. "With the support of New York City and State for innovative energy efficiency standards, it's going to become a reproducible model," DiEnna said. "This pilot program proves it can be used in schools, military bases, commercial and public facilities across the country that do not have the land area to support a loop field."

DiEnna added that the system maintains the school at a steady temperature, regardless of the weather outdoors. "The kids aren't too hot or too cold," he said. "It gives them an environment for more effective learning."



Bosch console units provide custom comfort in classrooms.

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CONCLUSION

The entire system saved approximately \$600,000 by eliminating the cost and disruption required to drill over 100 geothermal bore holes. Preliminary data shows that the geothermal system has saved the school district more than \$40,000 per year in heating costs, while increasing comfort in the summer and the swing months (September, May and June) by providing cooling. Two oil-fired boilers remain unused in the building, but are available for emergency use if ever required. The facilities manager monitors and controls the entire HVAC system via a computer application.

Among the many benefits of geothermal heating and cooling in this application:

- ▶ It's clean and efficient
- ▶ It's quiet and equipment is protected from wind and damaging weather
- ▶ It's safer for the environment
- ▶ It's practical and reproducible in schools and commercial buildings throughout the U.S.
- ▶ It facilitates comfort for building occupants and improves security by keeping windows and doors closed

In conclusion, this first-of-its-kind installation proves it can save significant cost and add value to older facilities in populated areas that may not be suitable for traditional geothermal installations.

ABOUT BOSCH THERMOTECHNOLOGY CORP.

Bosch Thermotechnology Corp. is a leading source of high quality heating, cooling and hot water systems. The Company offers Bosch tankless, point-of-use and electric water heaters, Bosch and Buderus floor-standing and wall-hung boilers, Bosch and FHP water-source, geothermal and air-source heat pump systems, as well as controls and accessories for every product line.

Bosch Thermotechnology is committed to reinventing energy efficiency by offering smart products that work together as integrated systems that enhance quality of life in an ultra-efficient and environmentally friendly manner.

Bosch strives to bring the most energy-efficient and environmentally responsible products to global consumers. In delivering the best products at affordable prices to our markets, Bosch has established multiple collaborations and joint ventures on a global scale to bring the latest technologies to North America. All global manufacturing facilities must adhere to stringent quality standards in order to provide the trusted Bosch brand.

For more information, visit www.boschheatingandcooling.com.

ABOUT AMERICAN WATER

Founded in 1886, American Water is the largest and most geographically diverse publicly traded U.S. water and wastewater utility company. With headquarters in Voorhees, N.J., the company employs 6,800 dedicated professionals who provide regulated and market-based drinking water, wastewater and other related services to an estimated 15 million people in 47 states and Ontario, Canada. More information can be found at www.amwater.com.

Bosch Thermotechnology Corp.

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Further Resources

Geothermal Systems – Bosch Thermotechnology Corp.
Water Utility – American Water Company
Engineer – Don Penn, Image Engineering Group, Ltd
Geothermal Consultant – Jack DiEnna, Geo-NII
Mechanical Contractor – Bancker Construction