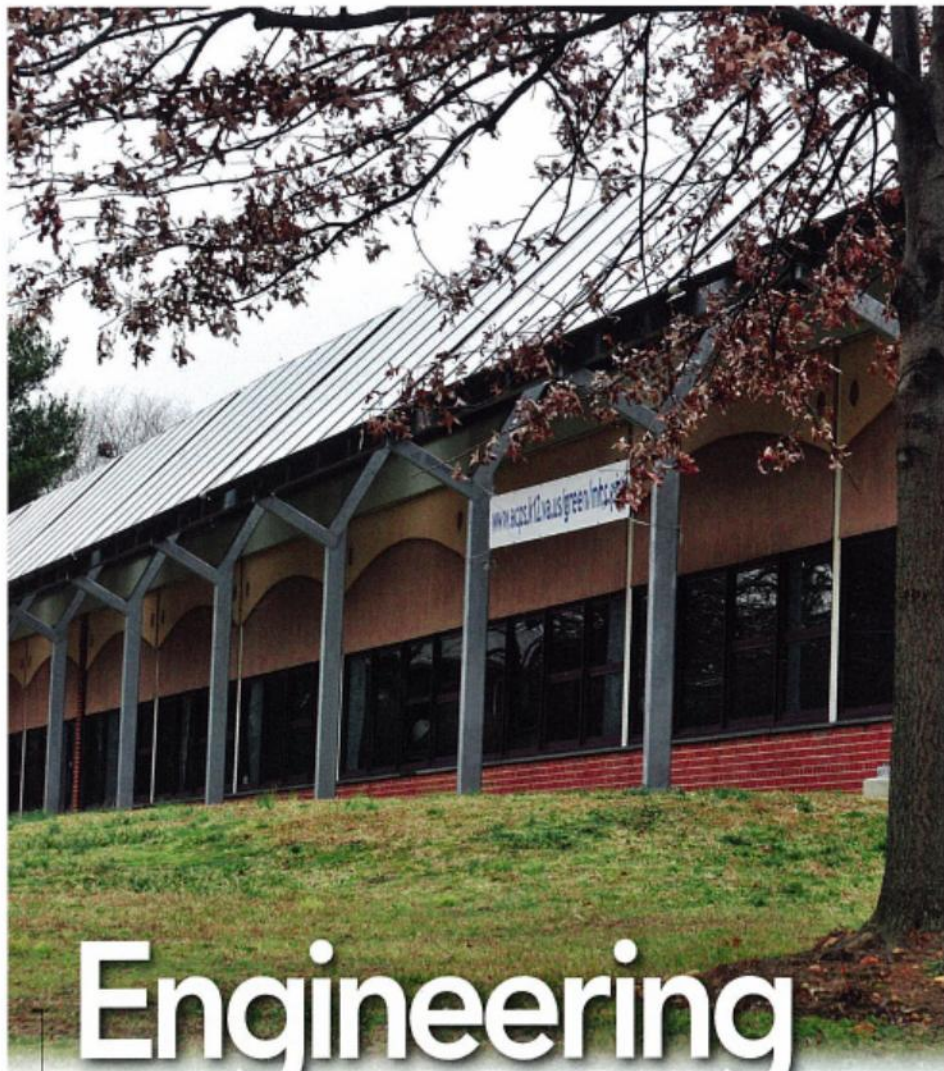


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An exterior view of the solar panels at the T.C. Williams High School Minnie Howard Campus is shown from the front lawn. Courtesy: Mattox Photography

Engineering a sustainable school

A Virginia school includes a geo-solar system in its HVAC upgrade. Engineers designed a system that was architecturally integrated, offering students a unique learning tool.

BY BRUCE BEDDOW, PE, *b2E Consulting Engineers P.C., Leesburg, Va.*



Alexandria City Public Schools (ACPS) engaged b2E Consulting Engineers P.C., Leesburg, Va., to design an energy-efficient HVAC replacement for its 134,000-sq-ft T.C. Williams High School Minnie Howard Campus, which serves ninth graders. When completed in 2009, the school's existing building was 43 years old. The existing system consisted of a two-pipe through-wall unit ventilator system with a constant flow air-cooled chiller and two water tube boilers serving the two-story 32-classroom wing, gymnasiums, and locker room areas (about 66,000 sq ft). The remainder of the building (about 68,000 sq ft) was packaged rooftop HVAC units with direct expansion (DX) cooling and natural gas fired heating.

We hired Hayes Large Architects (HLA) from Leesburg, Va., to assist in developing a master plan of sustainable design initiatives for the facility. In the process of meeting with ACPS, we determined that the client wanted an HVAC system concept that could be incorporated throughout the school district. ACPS wanted to use the energy-saving features of the building as an educational showcase with a "Greenovation Lab" to teach students the fundamentals of energy savings. In addition, ACPS wanted the energy-saving features of the building to be visible to the general public.

A ductless variable refrigerant multiple zone (VRMZ) heat pump system was appropriate for this building because it has a low slab-to-slab height. Ductwork had to be greatly reduced. The VRMZ system delivers heating and cooling through refrigerant piping using ductless ceiling-mounted terminal units in lieu of hot water (HW) and chilled water (CHW) piping and ducted ceiling-mounted fan coil units. The engineers used the Mitsubishi City-Multi System as the basis of design.

We decided that double-plate heat exchanger energy recovery ventilation units would be used to deliver 14,000 cfm 100% outside air to meet IBC-2006 code required ventilation. These units could not be supported on the existing pre-stressed concrete plank roof structure, so they had to be fit into the basement.