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INNOVATIVE WAYS TO MAKE SCHOOLS SUSTAINABLE



**A BATTLE WORTH
FIGHTING**

COMBATING RISING
ENERGY COSTS

**SECURITY
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TAKING A SENSIBLE,
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**CLOUD
COMPUTING**

DOING MORE
WITH LESS



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HEALTHY LEARNING ENVIRONMENTS

Green Building Initiatives

A platform for student education.

by BRUCE BEDDOW, PE

WITH STUDENTS FROM 80 countries speaking more than 60 different languages, Alexandria City Public Schools (ACPS), Alexandria, Va., is one of the most diverse school systems in the country. The City of Alexandria was recently named one of the Top 100 Communities for Young People by America's Promise Alliance, a partnership founded by Colin and Alma Powell that is committed to childhood education.

Families move to Alexandria because of the quality of the school programs. With 19 schools spanning pre-kindergarten to 12th grade, ACPS has always enjoyed tremendous community support and has implemented energy conservation and earth-friendly practices for years.

In 2008, ACPS officials realized that many of the school district's buildings were operating on mechanical systems that were at least a half-century old, and energy costs

were adding up. Many schools used antiquated boiler and chiller systems that were both inefficient and costly to maintain. In addition, the lack of ventilation made obtaining an excellent level of indoor air quality difficult.

Believing that a healthy school is as integral to a student's learning environment as the curriculum itself, ACPS decided to look for building initiatives and solutions that would make its buildings healthier

and save money on energy costs in the long term.

Greenovation: Cooling and Heating Using Earth and Sky

Despite operating under budget restrictions typical for public school systems, ACPS began undertaking an aggressive environmental protocol in 2009 that would increase environmental quality for students and employees while cutting costs associated with energy usage. Called "Greenovation," this code defines the ACPS' district-wide environmental philosophy that combines energy-efficient building practices with a unique emphasis on using green building initiatives as a platform for student education. The result is that ACPS now has some of the most energy-efficient schools and building management practices in the nation, as well as a unique

curriculum that uses the sustainable building initiatives as learning opportunities for the students.

Having been the first Virginia public school to achieve LEED Gold in 2009 with the T.C. Williams High School campus, ACPS wanted to reach for even higher sustainability goals with this new districtwide initiative. The school board initiated policies in its Strategic Plan that set as a priority the use of best practices for energy efficiency and sustainability to help provide clean and safe environments conducive to learning. When it came time to renovate the T.C. Williams High School's Minnie Howard Campus for ninth-grade students, ACPS enlisted the help of Hayes Large Architects, Leesburg, Va., and b2E Consulting Engineers, Leesburg, Va., to design one of the most energy-efficient systems in the country.

Using renewable geothermal energy to cool and renewable solar energy to heat hot water, the system designed by b2E Consulting Engineers resulted in exceptional cost savings for the school, and it is projected to completely pay for itself within 12 years. This new geo-solar heat pump system became the precursor to an ever-evolving approach to green design within the school system.

How It Works: Minnie Howard as the Green Prototype

The mechanical system at Minnie Howard Campus involves a creative combination of solar energy, geothermal energy and a high-efficiency water-source HVAC system from Mitsubishi Electric Cooling & Heating, Suwanee, Ga., that uses hot water as a heat exchange medium to simultaneously cool and heat the building.

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Energy collected from a 170-foot-long solar array heats water for the school's domestic hot water and is used as a heat source for the water-source VRF system; an energy recovery unit supplies fresh air to the building. The solar panels also serve double duty as a sun shade, reducing glare and saving on cooling costs. Any unneeded heat energy from the solar panels is stored underground in the geothermal wells; a field of mechanical water wells located under the school's parking lot that supply water to the cooling and heating system. Underground temperatures are more stable than above ground air. Storing the water in the underground wells lessens the energy needed to cool or heat the water to the desired temperature.

Synchronizing all of these sophisticated technologies into one unique system was a challenge. B2E chose Mitsubishi Electric's water-source W-Series systems for the building's HVAC. Small mechanical room space, efficiency and sustainability were the driving factors for this choice. Both the small footprint required for the indoor units and the VRF zoning technology work perfectly with the efficiencies of the geothermal field while also supporting the plan's aggressive profile for efficiency and sustainability.

This system at Minnie Howard worked: Six compact water-source indoor units replaced two unsightly, locomotive-sized boilers and chillers in the building's mechanical room. Three mailbox-sized backup boilers were installed but have been rarely used, even during an exceptionally cold 2010-2011 winter.

The new system earned an average yearly energy savings of 63 percent, seven percent better than original energy models calculated. The system is projected to save more than \$400,000 over the life of the equipment. A reduction in non-renewable energy usage by 87 percent and natural gas consumption by 80 percent was also achieved.

Using Minnie Howard as a prototype, ACPS is expanding on these initiatives in other school buildings. James K. Polk Elementary School (Polk) uses the geo-solar



system in the same manner as Minnie Howard but goes a step further by implementing the use of photovoltaic cells (funded in part by a grant from the Virginia Department of Mines and Energy), which use the sun to generate electricity for the school. Expected to achieve a LEED Gold rating, the new Polk classrooms are on track to be ACPS' first net-zero classrooms and are expected to feed energy back into the electrical grid.

Other Green Building Initiatives in the Schools

Additional environmentally friendly building components at ACPS include low-flow plumbing fixtures, automated lighting controls, LED lighting and solar tubes that direct sunlight from the rooftop to classrooms, bathrooms and corridors, supplementing minimal artificial light. These solar tubes will save hundreds of

Out With the Old. Locomotive-sized boilers from the mid-20th century were standard in many of the older schools in the Alexandria (Va.) School District. The energy-hog boilers that ran 24/7 were replaced with small and sleek energy-efficient water-source heat pumps that only run when heat or cool is called for.

dollars per year in electricity and maintenance costs per classroom. School grounds use xeriscaping, a type of environmentally friendly landscaping that uses only indigenous species of plants and is designed to conserve water and improve the soil. The school system will also use green roofs on some buildings, which save energy by acting as a form of insulation and reduce stormwater runoff.

Education and Greenovation: Schoolwide Initiatives

As an integrated philosophy, Greenovation doesn't stop with the school buildings. Students have the opportunity to take the schools' green initiatives and use these practices as an opportunity to learn about the technology behind them. Sustainability education is integrated into the everyday life of the children at the schools. Green building



Green Laboratory. The solar-powered geothermal Minnie Howard Campus, in Alexandria, Va., has been turned into a “green laboratory.” The “Greenovation” program inaugurated by Minnie Howard students is an inspiration not only for the entire district, but is a model that is studied by school districts from Pennsylvania to Florida. The photo on the right is the new modular classroom at James K. Polk Elementary, where the district is using the same technology.

initiatives are broadcast widely, and any time a new green initiative occurs, it is used as a learning opportunity for the students. At ACPS, students are encouraged to compost their food, and some students help tend vegetable gardens that grow the fresh produce served to them at lunch. Ongoing recycling efforts, conservation programs and a greenhouse also give students the opportunity to participate firsthand in green practices.

Environmental Stewardship Program

Each school in the ACPS system has an environmental steward, whose job is to help connect students with green initiatives within the school district. The stewards also educate students about green-collar career opportunities, lead the composting and recycling efforts in classrooms and cafeterias, and participate in sustainability-focused learning activities. Ultimately, each steward will lead the efforts of students, staff and the community in the creation of environmental action plans for their schools. Each environmental steward also sponsors a before- or after-school club for interested students and

coordinates participation in community events such as Earth Day.


What's Next for ACPS: The Future of Greenovation

ACPS plans on taking its Greenovation practices a step further with each new project. In addition to the photovoltaic and geo-solar initiatives at Polk, the school also uses modular classrooms to accommodate the growing number of students in the school. The modular classrooms, manufactured in nearby Winchester, Va., are all LEED rated and designed with sustainability as the highest priority. These additions look like permanent structures and can be built up to seven stories high.

With significant growth predicted over the next few years, the school system is shifting completely to the modular design for all future school additions and new school construction. By using modular classrooms, the school system can assemble a new school wing in days, rather than years, all while providing minimal disruption to the students. Also, should extra space be needed for one school, a

section of one modular classroom can be unbolted and transferred from one campus to another. Currently, there are modular additions in progress at three schools in the school system, with an additional three to four new schools scheduled to be built using only the modular structures.

Funding Greenovation in Tough Economic Times

The building advancements that ACPS has undertaken have all been accomplished during tough economic times. According to ACPS, the key to pushing Greenovation initiatives is encouraging people to think forward — past the initial cost and toward total cost over the lifespan of the systems and the total energy savings involved. Most importantly, a key aspect of obtaining funding for these green initiatives has been encouraging people to think beyond the quick, cheap fix and truly consider what it takes to create the most productive, positive education environment for the children. 

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