Learning CURVE

A tale of two schools in pursuit of net zero energy

By Melissa Nosal and Jennifer Sergent

Above
Banneker Academic High School is one of the highest-performing public schools in the District of Columbia. Accordingly, the new building is designed to foster its strong culture, provide state-of-the-art labs and instructional spaces, and create a "collegiate ambiance." Copyright Joseph Romeo / Courtesy Perkins Eastman

Surrounded by a thicket of city and school officials, Washington, DC, Mayor Muriel Bowser presided over ribbon-cutting ceremonies in late August to herald the opening of two remarkable new schools that represent the latest in sustainable school design. Benjamin Banneker Academic High School and West/John Lewis Elementary are both targeting net zero energy, meaning they aim to produce at least as much energy as they expend. For Perkins Eastman, which designed both buildings, they represent the next step in what Principal Sean O'Donnell calls "Net Positive Education," a term the K-12 practice has trademarked as they advance design thinking around schools that not only look great but make a tangible impact on the students, teachers, and staff who occupy them.

"When I came to DC 20 years ago and started designing schools, schools were astonishingly tragic in their state of repair," says O'Donnell, the Perkins Eastman's K-12 practice-area leader. "It was shocking to see what we were sending students into." Dark and dingy corridors. Loud ventilation systems. Classrooms too cold or too hot, underlit or with excessive glare. Programmatic spaces that could not support the evolving curriculum. Little meaningful connection between the classroom and the outside, to say nothing of the neighborhood. Dismal to no civic presence. As we are now finding, those conditions contributed significantly to poor student outcomes.

District of Columbia Public Schools (DCPS) has since made a $4 billion commitment to modernize its schools—a long-term endeavor that began in 2007. Today, students at these modernized schools walk into bright, engaging corridors that are extensions of the learning environment, while unobtrusive mechanical systems keep the temperatures steady. Their comfortable classrooms are awash in natural light. Flexible programmatic spaces anticipate an evolving and dynamic curriculum. The classroom designs blur the boundaries between interiors and exteriors. Contextual, spatial, and literal connections embrace the surrounding community.

Cause and Effect

Perkins Eastman, in partnership with DCPS and the DC Department of General Services (DGS), has designed and delivered at least 14 of these significant school modernizations in the nation's capital—each focused around a central question: What is the connection between the built environment and educational outcomes? The results are in: A 2018 study by the firm's sustainability and design research teams concluded that upgrades such as new mechanical and ventilation systems, indoor finishes, better windows and shading elements, and improved technology resulted in statistically significant improvements in both student and faculty satisfaction and performance. "Students in modernized schools were more likely to be satisfied with the temperature, air quality, noise levels, and daylight in their classrooms compared to students in non-modernized classrooms," the study concluded, providing DCPS with a solid return on its investment. The American Institute of Architects' College of Fellows subsequently awarded the design team with its biennial Latrobe Prize in 2019, which comes with a $100,000 grant to fund research leading to significant advances in architecture. Together with Drexel University, the team is building on the 2018 study, examining 28 schools across DC and Baltimore to study more broadly how well-designed educational facilities can lead to improved student health and academic outcomes. Put another way, says Design Principal Omar Calderón Santiago, "One of the fundamental questions our practice is trying to answer is: How do we want to educate now? And how do we want to educate in the future?"

Above
The Banneker building's scale respects the neighborhood's historic rowhouses, and in this third-floor classroom that overlooks the main entrance, invites them right inside. Copyright Joseph Romeo / Courtesy Perkins Eastman

Below
The windows between Banneker's Sky Place outdoor terrace and the top level of its Learning Commons are inscribed with a letter Benjamin Banneker wrote to Thomas Jefferson, overlaid with Banneker's solar eclipse diagram. The design of this space underscores the concept that education is not limited to the building's classrooms. Glass inscriptions by DC artist Shaunte Gates. Copyright Joseph Romeo / Courtesy Perkins Eastman

Zeroing In

Banneker and West/John Lewis may hold the key to those answers with net zero energy. The schools make good models, first and foremost, because each is laudatory from multiple perspectives, including architectural and high-performance design, contributions to student and staff well-being, and civic and community involvement. But they're also working together in a way that is unprecedented in the DCPS system. West/John Lewis is projected to produce enough renewable energy for its own needs—as well as to accommodate Banneker for the high school's higher consumption. This multi-site renewable energy solution responds to DCPS' goal of reducing energy consumption and carbon emissions by nearly 50% by 2032, and demonstrates Perkins Eastman's commitment to absorb and build upon its own research into successes and challenges from previous school projects.

"Producing energy is the last part" of the equation for net zero, O'Donnell says. "Enhancing the performance of the building is the first," he adds, because the less energy it needs from the beginning, the less it will need to consume on a day-to-day basis. Patrick Davis, who recently joined Perkins Eastman as a principal after years of working with the K-12 practice as the DCPS chief operating officer, puts a finer point on that notion. Energy consumption represents the second largest investment in the school system, where the salaries of its 10,000 employees rank first. "They're spending more on utilities than on computers and educational materials," Davis says. "You reduce that line item, and that money can go to computers, so you don't have to scramble during a pandemic to find a hot spot—that's another way to enhance education."

These two schools feature an array of high-performance design solutions that dramatically reduce energy consumption—geothermal fields, solar panels, high-performance envelopes, high-efficiency equipment, advanced metering capabilities, access to high-quality daylight, and real-time energy consumption monitoring. "They are expected to be the District's first two net zero energy buildings. DCPS has always been on the forefront of sustainability. But we wanted to push the boundaries even more," says Davis, who works with the firm's PE Strategies consulting arm so he can share these innovations with more school district clients looking to follow DCPS' lead.

Davis and the K-12 practice are building the Net Positive Education mission with an arsenal of articles, research, and videos demonstrating the myriad links between high-performance design and student outcomes. Based on its research and experience with other high-performance schools such as Dunbar Senior High School in DC and the Dr. Martin Luther King, Jr., School in Cambridge, MA, new and remodeled schools need more ventilation and fresh air to drive down levels of carbon dioxide, which leads to greater cognitive performance. That element in particular makes buildings consume

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To create a "collegiate ambiance," the Learning Commons—a dynamic and collaborative evolution of the library—functions as Banneker's literal and figurative heart. Every level of this vertical, four-story campus engages this central space, providing formal and informal places to gather, socialize, and collaborate. Copyright Joseph Romeo / Courtesy Perkins Eastman

Opposite page
Top: West/John Lewis Elementary School sets a new standard for 21st-century learning environments. Designed to be among the first schools in DC to achieve net zero energy, the project is also pursuing LEED Platinum and WELL certification—which would make it the first school in the world to achieve all three. Copyright Joseph Romeo / Courtesy Perkins Eastman

Middle: The West/John Lewis design emphasizes outdoor recreation and connections with the natural world—known to improve student health and academic achievement. And the building's massing echoes the massing and setbacks of the houses across the street. Each discrete volume corresponds to an academic neighborhood or a major community asset such as the gym, a strategy that helps make the program legible to the children and faculty who use it. Copyright Joseph Romeo / Courtesy Perkins Eastman

Bottom: West/John Lewis honors its proximity to nearby Rock Creek Park with interior and exterior references, the most prominent of which is the "Treehouse" that encloses a creative space overlooking the library, which is also anchored by a sweeping mural from a beloved local Colombian artist, Mas Paz. Copyright Joseph Romeo / Courtesy Perkins Eastman

slightly more energy because its systems need to work harder to provide a higher amount of filtered fresh air, but in the case of Banneker and West/John Lewis, O'Donnell says, it's balanced with on-site energy production. In that respect, student well-being "is intimately tied with the pursuit of net zero energy. Yes, you get better energy performance, but you also get better performance from the students and users of the building."

Lessons Learned

But what does it take to get there? "There's a misconception in the industry that in order for you to get to net zero energy, you need to invest in very expensive systems and very high-tech equipment," says Juan Guarin, sustainability specialist at Perkins Eastman. Guarin continues, "In reality, net zero energy is something that you can achieve by applying smart decisions—smart, simple design decisions that most of the time are cost neutral." They include orienting a new school building so classroom windows aren't in the path of the harsh early morning and late afternoon sun, which can add unwanted heat and glare. Well-placed windows, by the same token, provide enough natural light so you don't have to turn on the light switch inside. "It's the ability to make free decisions that have no impact on construction or design cost," Davis says, "but it impacts significantly the energy the building needs."

In the case of Banneker and West/John Lewis, Perkins Eastman's sustainability team worked with computer simulations throughout the design process to collect and synthesize data around hypothetical building performance from the perspectives of energy, daylight, and acoustics. As a result, Guarin says, "We were able to tell the team, 'Hey, for this room, we need to make the windows a little bit smaller. For this one, we need to increase the insulation. Here, we need to reduce the insulation.' We provided this information to the team on an almost weekly basis so they could make informed design decisions."

At West/John Lewis, furthermore, a high-performance dashboard tracks and displays the building's energy consumption, showcases its sustainability features, and links to the school's curriculum so students learn how to contextualize the metrics. Accessible to the public both physically and online, it reflects education in real time. The dashboard is a perfect example of how net zero energy informs Perkins Eastman's Net Positive Education agenda, which O'Donnell describes as "the overarching idea behind our approach to school design. The tools and the rigor of the net zero energy program allow us to create a school that's a better place to learn," because it favorably supports the health and education of its occupants—and frees money for increased investment in that education. "Projects like these are our dream projects," O'Donnell says. "We have built our practice over the past 20 years to help our clients and our communities create amazing places to learn. As both an architect and resident of the District of Columbia, I'm incredibly proud to now have schools of this caliber for our students." **N**