

# WILDE LAKE MIDDLE SCHOOL

*Net Zero is All About the Details*



*Photo courtesy of TCA Architects.*

When faced with the decision to renovate or replace an existing 1960's era middle school, Howard County Public School Systems (HCPSS) opted to take advantage of a grant of up to \$2.773 million from the Maryland Energy Administration's (MEA) Net Zero Energy School Program to build a new school designed and constructed to operate as net zero energy (NZE). After the first year of operation, the new Wilde Lake Middle School (WLMS) was confirmed to be operating as an NZE school, with the school producing more energy than is used in the course of a year, and is a potential example for future Maryland public schools.

Economic and environmental benefits from the reduction in school energy use and greenhouse gas emissions were important, but not the only drivers in the HCPSS's decision to construct NZE. The modest incremental cost of construction to HCPSS, after factoring in the available grant funds, and the tangible opportunities available to enhance the classroom, building, and school site also helped cement the decision.

WLMS's construction incorporates the major tenants of a NZE and high-performance building. The school operates as NZE because of careful, thoughtful, and practical considerations made during the planning and construction process.

## NET ZERO ENERGY FEATURES

Upgraded Building Envelope

Enhanced Commissioning and Monitoring

Daylighting and Lighting Controls

Ground Source Heat Pumps

High-Efficiency Kitchen and Refrigeration

Roof- and Grade-Mounted Solar Photovoltaic System

## Strong Energy Performance

**73% More Efficient than the Original WLMS (weather normalized, on an EUI basis)**

## SUCCESS IN ACHIEVING NZE

The road to NZE began with a prescribed program goal of a facility that ultimately would use 25 kBTU/square foot/year or less. The planning process, starting from the earliest stages of design, was heavily informed by the collective input from County, school, and State stakeholders, as well as design professionals with past NZE energy experience. School administrators provided survey responses that defined building usage and operations parameters and informed school and after-hours space use, while the County provided input on school construction standards and long-term use requirements. The design team challenged the status quo and championed improvements in building performance that reflect current school and curriculum needs, while providing flexibility for change throughout the school's operational life. As an example, the HCPSS food service model has meals "cooked" in centralized high school kitchens before being transported to smaller schools for distribution, meaning the new Wilde Lake Middle was able to leverage less energy-intensive food warming equipment rather than a full commercial kitchen.

NZE design was achieved not simply by producing more energy on-site than is consumed from the electric grid but rather by first reducing energy consumption as much as possible. Hence, WLMS first incorporated high-performance and energy-efficient building systems and strategies such as a thermally efficient building envelope and ground source heat pumps that harmoniously work together to reduce space heating and cooling loads. The collective impact of these design choices provided a significant reduction in energy consumption when compared to Maryland's building energy code at time of design. Only after the school's energy consumption had first been minimized were roof- and ground-mounted solar photovoltaic systems added to the design to offset building consumption.

Detailed design, commissioning, and construction practices also played a significant role in WLMS achieving NZE. First, the school was designed to achieve a maximum energy usage intensity (EUI) of 25 with a safety factor that accounted for after-hours building usage, anticipated due to the likely increased interest in the facility associated with being the first NZE energy public school in Maryland. Secondly, extensive commissioning, testing, and verification of the building envelope, space heating, and cooling systems produced not just highly efficient systems, but an extremely efficient building.



Source: Google Maps Street View.<sup>1</sup>

### VALUE PROPOSITION

Reduced Operation and Maintenance Costs

Hedged Long Term Energy Costs

### ADDITIONAL BENEFITS

Natural Daylighting

Thermal Comfort

Educational Tool for Students and Visitors

Avoided greenhouse gas emissions



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## SUCCESS IN MAINTAINING NZE

Having attained NZE performance, WLMS implemented processes to ensure that it remains energy efficient, and NZE energy. During the first year, the school was operating as planned and maintaining performance through an ongoing review of energy data, by County personnel and the project's commissioning agent, aimed to swiftly identify and correct system and building anomalies affecting energy performance.

## IMPACTS AND OUTCOMES

With 782 MWh of annual solar production in the first year, WLMS produced nearly double the 470 MWh in total equivalent energy it consumed. This scenario provides future flexibility to accommodate anticipated student growth and respond to unexpected changes in use, while maintaining long term NZE operation.

On its own and without the NZE school financial incentives, it does not appear that this first NZE energy school project would likely be cost effective as a standalone project.<sup>2</sup> However, this first-of-its-kind (in Maryland) project was constructed with significant safety factors (i.e., additional solar capacity) to ensure NZE energy status was achieved, which increased project costs but also will help compensate for decreases in solar panel generation later in the life of the project as the solar panels age. Looking forward, the economics of future NZE energy projects could potentially be improved by more closely sizing the renewable energy generation system to the initial energy needs of the school.

WLMS school is a concrete example of how careful and thoughtful planning, when added to traditional design and construction practices, can be used to obtain significant improvements in energy efficiency. The WLMS project provides a template for other potential NZE energy school construction projects, a model of energy-efficient construction and commissioning best practices for more traditional school construction projects, and a learning tool for students.



Source: Google Earth<sup>3</sup>

Want to learn more about  
Wild Lake's Net Zero  
Features?

Visit  
<https://buildingos.com/storyboard8603/?chapterId=51893>

Wilde Lake Middle School's solar PV system produced 782,031 kWh solar energy during the first year. That is the equivalent to offsetting:

- 554 Metric Tons of CO<sub>2</sub> greenhouse gas emissions
- 108 homes – annual electricity usage
- 123 gasoline-powered passenger vehicles - annual driving emissions

**Source:** EPA Emissions Calculator ([www.epa.gov/energy/greenhouse-gas-equivalencies-calculator](http://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator))

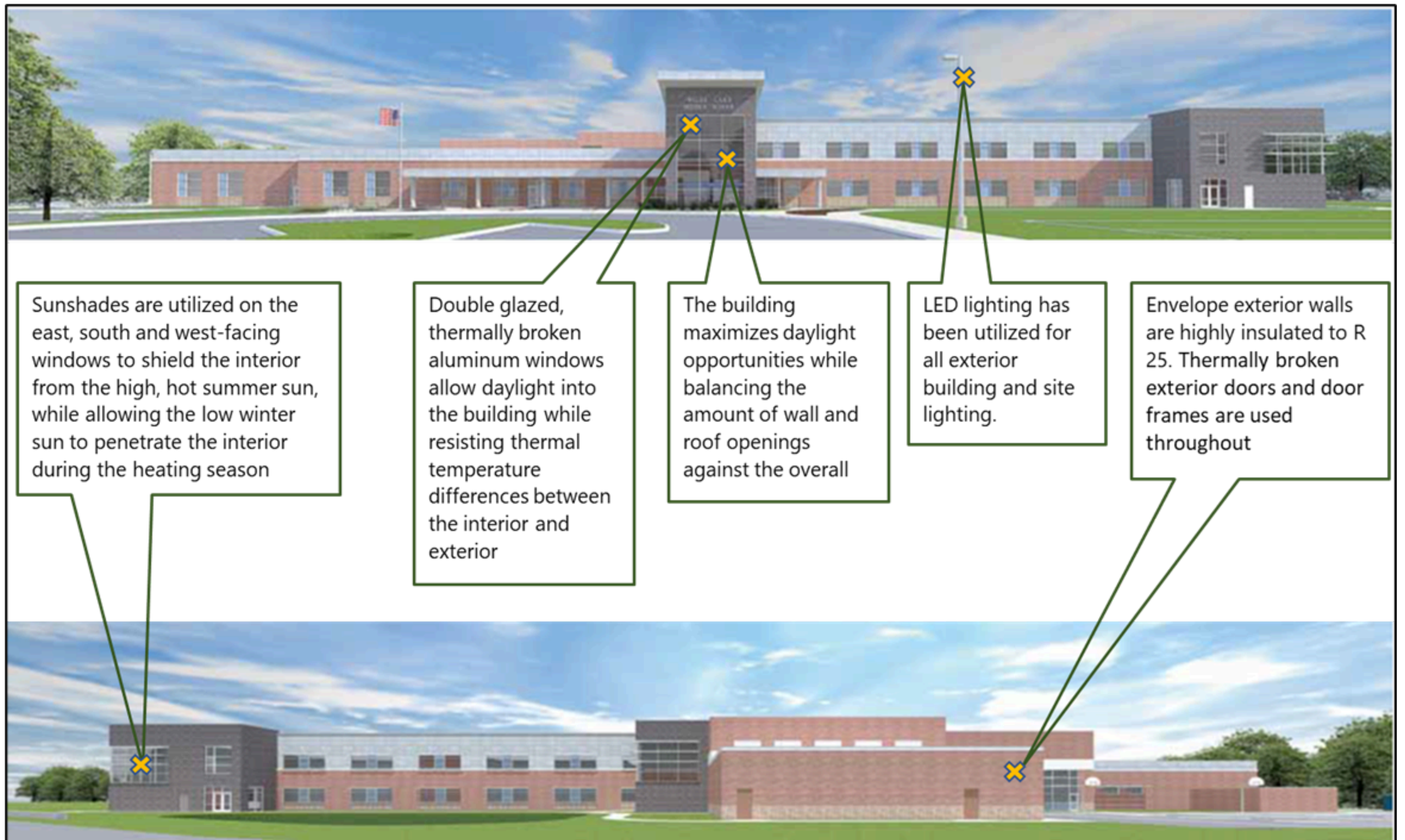
<sup>2</sup>) Within the first twenty years of operation and a discount rate of 3%. Twenty years is used initially as the anticipated life of the ground source heat pumps and the anticipated life of the solar panels is assumed to be between 20-25 years. A discount rate of 1% would have resulted in the project being deemed cost-effective.

<sup>3</sup>) <https://www.google.com/maps/@39.2170657,-76.8767066,166m/data=!3m1!1e3>, obtained 11/17/21.



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Sunshades are utilized on the east, south and west-facing windows to shield the interior from the high, hot summer sun, while allowing the low winter sun to penetrate the interior during the heating season

Double glazed, thermally broken aluminum windows allow daylight into the building while resisting thermal temperature differences between the interior and exterior

The building maximizes daylight opportunities while balancing the amount of wall and roof openings against the overall

LED lighting has been utilized for all exterior building and site lighting.

Envelope exterior walls are highly insulated to R 25. Thermally broken exterior doors and door frames are used throughout

Source of original image: TCA Architects; Construction Document Report. Callouts of energy measures added for the purposes of this case study.

The Net Zero Energy School Program provided financial incentives to eligible local educational agencies in Maryland to encourage the development and help offset the incremental costs to design and construct NZE schools. Funding for this program came from the Customer Investment Fund established through Case #9271 at the Maryland Public Service Commission.

For more information:

**Howard County Public Schools**

<https://www.hcpss.org/schools/net-zero-wlms/>

**Maryland Energy Administration**

<https://energy.maryland.gov/Pages/SchoolDecarbonization.aspx>