Forest Edge Elementary School



Scope of Work and Budget

Owner | Oregon School District Project Size | 126,600 sq. ft. Size Per Pupil | 195 sq. ft. Site Size | 12 acres Construction Type | New Construction Construction Cost | \$35,000,000 Grades housed | K-6 Student Capacity | 650 Occupancy Date | September 2020



Executive Summary

As educators and design professionals, how do we help young students learn the value of community and sustainability? One approach is to design their school building to demonstrate these values. The new Forest Edge Elementary School is a hub of innovation and 21st Century learning practices for young students in Fitchburg, Wisconsin, and a regional and national pacesetter in sustainable design. As of September 2021, the building is net zero energy verified, making it the first of its kind in Wisconsin and the largest educational building to reach that milestone in the United States.

In partnership with the design team, the school district created an innovative building with flexible learning spaces, ample daylight, and state-of-the-art sustainable infrastructure. The result is a building that not only contributes energy back to the grid but also leverages its sustainable features as teaching tools through interactive stations that highlight the unique features of the school.



Forest Edge entrance

School & Community Engagement

Just south of Madison, the City of Fitchburg and Oregon School District are nestled in a region well-known and respected for its progressive climate action. Forest Edge is a substantial contribution to the region's goals of more sustainable infrastructure.

Early in their master planning process, the district's school board expressed its concern about climate change and sought to make an impact. They saw a need for a new building to accommodate a growing student population, and they evaluated their options from an operational and educational perspective.

The vision that emerged from their study was to merge a state-of-the-art elementary learning environment with a facility that offsets all its energy use—or better yet, contributes energy to the electrical grid.

The Community

The planning for Forest Edge came on the heels of a successful referendum for facility updates that included safety and security improvements, maintenance and energy efficiency, and expanded learning environments at one of the district's existing elementary schools, the middle school, and high school. The accomplishment of this referendum and the resulting facility improvements gave momentum to the next phase of the district's master plan – a new elementary school in the northern part of the district, which was experiencing the most significant growth.

The district continued its partnership with the architecture firm to engage the community about their vision for this new, K-6 elementary school. After surveying the community and hosting several in-person planning sessions, the



planning teams learned that the community supported a net zero project and was willing to invest in a higher up-front construction cost to realize a sustainable building.

A large part of the success of Forest Edge is due to the early and sustained support the school has received from its local community, including the adjacent Terravessa neighborhood development and the City of Fitchburg. When asked about the community's response to the proposed building, an architect on the design team replied, "I remember nothing but positive feedback. There was a lot of curiosity and buzz around the project because of its projected net zero status, but perhaps more importantly, we wanted to make sure we communicated that this is a building we designed specifically for this community."

The Oregon School District

In its mission to serve over 4,000 students, the Oregon School District is dedicated to five core values:

- Relevant and empowering learning experiences
- Caring and professional educators
- Educational equity
- Strong family and community partnerships
- Whole child emphasis

The design of Forest Edge aligns with these values by connecting students to the natural environment and leveraging the building's unique features as a teaching tool. The building empowers its students to take ownership of their energy consumption, leading to habits that are not only healthier for themselves, but also for their community and the planet.

Oregon School District Values Statement

"The Oregon School District believes it is critical for the future of our planet to develop learners who are ecologically literate and environmentally responsible citizens and stewards. We believe it is important to model the district's commitment by establishing these values and developing practices consistent with them:

"The district will continue to develop building and operational practices and procedures that reflect a commitment to environmental sustainability;

"The district will have an aligned K-12 curriculum that integrates ecological and environmental sciences and issues into the curriculum, including socio-economic aspects. This may include, but is not limited to, experiences outside the classroom, project-based learning, and environmental services projects."



Challenges

Getting to net zero – Early in the design process, the project team made detailed energy models that anticipated energy use and production. These models helped the team find a "sweet spot" for net zero energy, balancing maximum energy production and efficiency with a minimal initial construction cost.

Budget - Initial construction bids on Forest Edge returned about \$1 million over budget. The foundations for the building were already in place at this point, so reducing the size of the building was not an option. Instead, the design team found cost savings through a strategic selection of construction materials without compromising the project's sustainability goals. For example, the team specified a low environmental-impact standing seam panel in combination with a ceramic-coated fiber cement rain screen system consisting of approximately 45% recycled material. Together these materials saved about \$500,000 on the building's exterior enclosure alone.



View from Forest Edge over developing Terravessa neighborhood



Available Assets

A developing neighborhood – Forest Edge would be the first building in its immediate area, setting the tone for the neighborhood that would follow in its wake. The design team worked closely with the neighborhood's developer to align goals, including:

- Use of aesthetically similar building materials
- Implementation of water-retention features, such as bioswales, into the landscape
- Alignment of amenities like public pathways to ensure a walkable community

The existing site – From the outset, the design team respected the features of the building site, including a significant grade change, a nearby park, and heritage oak trees. As a stepped building, Forest Edge takes advantage of the sloped site to maximize opportunities for windows. Not only do the windows allow natural light to spill into the building, but they also provide plentiful views of the park, trees, and surrounding landscape.

A progressive community – From the beginning, the community welcomed and encouraged a net zero building. The school is also plugged into the city's extensive network of bicycle paths and public transportation.

Value of Process

Early programming efforts

The district selected a diverse group of teachers from all their schools to develop the program for the new elementary school. With the guidance of the architecture firm's educational visioning team, district staff identified specific goals for the new building that aimed to create a safe, comfortable, and engaging learning environment (see below).

Outcomes from early efforts

- Every space should be conducive to learning, including resource areas, courtyards, and corridors.
- Bring as much natural light into the building as possible to benefit the building's occupants and reduce reliance on artificial lights. *(See figures 1.1 and 1.2)*
- Maximize transparency between classrooms, common areas, and the outdoors without sacrificing privacy and security. *(See figure 2)*
- Leverage the building's anticipated sustainable infrastructure as learning tools for students.







Educational Environment

Synergy Among the Architecture, Curriculum, and Environment

The Forest Edge building responds to the district's intent to be a leader in educational and environmental stewardship. It supports the district's value of educating the whole child, which supplements classroom learning with equal attention to building character, developing a positive culture, and community involvement.

- The core planning team developed the concept of "energy grounded in nature"
- The team met with teachers to understand how the building, nature, and energy would tie into their curriculum
- The planning team issued a survey to teachers, asking questions such as:
 - How would you explain "energy grounded in nature to an elementary-age student?"
 - How do graphics/illustrations aid your teaching and student learning?
 - Are there aspects of your curriculum that relate to nature and energy? If so, please explain.



Environmental Branding Engages Students

With input from the teacher group, the design team developed:

Environmental branding graphics with relatable analogies and informative plaques.

- **Example:** the depth of the geothermal wells compared to the height of the nearby capitol building
- Example: Informative plaques answer students' questions about wind, including what it is, where it goes, and how it can be harnessed to produce electricity

Learning Launch Pads featuring the building's real-time energy performance data.

- Information about the building's solar and geothermal systems
- Information about the building's spaces and educational resources, such as the STEAM classroom
- Current and past energy consumption and production, and tracking of the building's quarterly trash and recycling output
- Current weather conditions





When students begin the school year in August, the building is producing more energy than it consumes. This relationship inverts at the onset of winter. It eventually flips back in mid to late May, at which point the school throws a party to celebrate the end of the school year and the return to net positive energy production.



Support For a Variety of Learning + Teaching Styles

- STEAM lab for hands-on learning
- Art gallery for visual learners
- Glass "jewel boxes" in the Discovery Center provide acoustic privacy for one-on-one instruction without compromising daylight
- The Discovery Center's nest area offers calming views of the forest and is conducive to quiet reading
- Strategic "grass" areas with "boulder" seating provide fun, nature-oriented spaces for small-group collaborations





Flexible and Adaptable Environments

Classrooms at Forest Edge are arranged in groupings of four called groves, with each grove sharing a central resource space and access to outdoor courtyards. Glass doors and oversized sidelights connect classrooms with their respective resource areas, providing teachers the ability to combine classes and extend the learning environment to accommodate large-group activities. Flexible furniture in the groves allows students to arrange themselves to best suit each learning activity.

The building is designed to have a capacity of 650 students, leaving room for an anticipated enrollment increase over the next few years. As the student body expands and collaboration among grade levels increases, the classroom groves that currently house single grade levels can instead be organized around curricular objectives or staff availability.



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THERMAL

WATER



Secondary Learning/Play/Outdoor

SPACES KEY

Administrative
Support
Primary Learning

first floor plan

WIND





Physical Environment

The site and local context informed many attributes of the environment, including:

- Feature Wall A north-south feature wall begins at the pedestrian plaza, is implied through the interior of the building, and reemerges behind the building, reaching out to the forest. The wall reinforces the school as a link between the grove and the developing neighborhood.
- Landscaping Rain gardens with native and low-maintenance vegetation also provide refuge for butterflies.
- **Reclaimed Materials** Wood from on-site trees has a new life as countertops at the reception desk and library circulation desk, and reclaimed boulders offer seating in the entry plaza.
- **Building Envelope** Vertical panels on the feature wall and the seams of the exterior metal cladding are a nod to the towering trees of the forest.
- **Roofs** Overhangs provide shade during the summer months and offer a surface for green roofs with drought-tolerant vegetation.
- Rhythm and Colors The pattern of exterior panels and interior ceiling planks references the aesthetic of the region's many agricultural buildings. Earth tones with bursts of red-orange throughout the building allude to Wisconsin's fall landscape.
- Windows Windows offer views within the building and to the outdoors, including the forest to the north and park to the west.
- Locker, Activity, and Restroom Areas Initially conceived as "beehives," these are critical support areas support for students throughout the day.
- Sustainable Material Selection Selections include low-maintenance materials, such as rubber flooring, that will save the district money; materials that are acoustically appropriate for the space, improving occupant comfort; and materials with a high percentage of recycled content and the ability to be reclaimed at the end of their lifespan.



Large windows allow natural light to flood all areas of the building and offer views of the nearby community

Connection to the Community

A key challenge of this project was to position the building on its site to maximize energy efficiency, while also optimizing its visual presence in the community and respecting its proximity to the nearby forest that inspired the school's name. The east-west axis of the building is elongated to increase the amount of south-facing surface area for photovoltaic solar panels. The extended façade also increases the school's exposure in the community. **The main entry doors face the nearby Terravessa neighborhood, and a dedicated pedestrian plaza extends to the main street, welcoming students, parents, and community members to the school.**





Color-coordinated kindergarten murals teach the unique landscapes of Wisconsin: the forest, the wetland, the lake, and the prairie

Inspiration and Motivation

Through visible infrastructure, educational design, and environmental branding, the school helps students connect the physical building with its landscape, fueling understanding of the value of sustainability and community. The key assets that inspire and motivate students include:

- Environmental branding
- Colorful interiors
- Courtyards
- Discovery Center (library)
- Learning Launch Pads





Results of the Process & Project

Achieving Educational and Project Goals

Environmental branding in each resource area activates the space and supplements classroom lessons. Large wall graphics describe five natural energy sources – life, light, thermal, water, and wind – and students are encouraged to explore projects within their science curriculum that align with these elements. Windows with direct views to the building's net zero energy infrastructure, including the solar panels and geothermal systems, paired with informative window graphics, encourage students to learn about their school's unique and sustainable features. Students can also interact with digital screens at the Learning Launch Pads, located in the library and cafeteria, that provide real-time data on the building's energy performance.

Forest Edge is a regional and national pacesetter in sustainable design. At the time it was verified in September 2021, Forest Edge was not only the first net zero school in Wisconsin, but it was also the largest verified net zero educational building in the United States. Its sustainable features include:

- **90 geothermal wells** connected to electric water-source heat pumps, which moderate the building's temperature and reduce the electrical demand from its heating and cooling systems
- An array of 1,704 solar panels on the building's roof, which produces 646 kW of electricity
- A state-of-the art **125 kW battery for storing excess energy** produced by the solar panels that can be released during high-demand times or sold back to the utility company
- Electrochromic glass that automatically tints exterior windows to help regulate solar gains and improve occupant comfort
- Elimination of natural gas service on the building's site

The net zero status of Forest Edge yields significant cost savings for the district. School officials estimate that their investment in energy efficiency and renewable energy will save the district about \$60,000 annually.

Achieving Community Goals

Forest Edge is not only a state-of-art learning facility for its students, but it is also an asset to the public. The design team made sure that the building respected access to the nearby public amenities, for which Terravessa is well known. Directly to the west of the school's site is a conservancy park. The design team was intentional about placing the school's playground next to the conservancy's green space, easing access to the equipment for public use.

Terravessa is a walkable community, and the design team honored this by aligning the main entrance of Forest Edge with the neighborhood's primary thoroughfare. The community also has access to a dedicated room within the school where community leaders can host public meetings and gatherings.



Unintended Results and Achievements

As the first verified net zero energy school in the state, Forest Design and building a net zero building is a challenge for any team, especially when a building like Forest Edge is the first of its kind in the state.

i. Implementing battery technology – Batteries are an important part of any solar grid system but selecting the right battery can be a challenge given how fast the technology is evolving. After weighing several factors, including storage capacity, longevity, and cost, the team selected a Schneider / LG Chem battery with a 125kW capacity. The stored electricity can be released during high-demand times or sold back to the utility company.

ii. Electrochromic glass – Implementing windows with electrochromic glass was a first-time experience for many on the design team, but the results reduce the strain on the building's heating and cooling system. The windows are also a point of interest for students. Kerri Modjeski, principal at Forest Edge, mentioned that students continue to be fascinated by the self-shading windows. The electrochromic glass has proven to be another feature that engages students and connects them to their environments.

iii. Flexibility of spaces for COVID precautions – Forest Edge opened in the fall of 2020, and like so many other schools across the world, teachers and staff had to quickly adapt their learning spaces to accommodate pandemic restrictions. To meet social distancing guidelines, the large courtyard became a recess area, but one without the benefit of playground equipment – or any equipment at all. Instead, students used their creativity to make up games to play with each other, aided by the courtyard's grassy slopes, large boulders, and other landscaping features. The building's cafeteria also doubled as a classroom during the pandemic, offering ample space for separating desks and plenty of natural light with the help of floor-to-ceiling windows overlooking the adjacent courtyard.

