Extensive daylighting, photovoltaics, and SIP construction make Finn Hill one of Washington’s most efficient schools

When it came time to replace the aging Finn Hill Middle School in Kirkland, Washington, the Lake Washington School District took the opportunity to build a cutting edge school that demonstrates the district’s leadership in energy efficiency, sustainability, and progressive learning environments. They partnered with Seattle-based architecture firm Mahlum to craft an innovative zero-energy-ready design that harnesses the efficiency of a structural insulated panel (SIP) building enclosure and exceeds the ENERGY STAR median by nearly 50 percent.
Aggressive Energy Reduction Strategy

To meet the Lake Washington School District’s ambitious goal of a zero-energy-ready building, Mahlum calculated the proposed energy use intensity (EUI), or amount of energy the building will consume per square foot each year. For the Finn Hill Middle School, the design goal was 25 kBTU/sq. ft./yr., which is 47 percent lower than the ENERGY STAR median and more efficient than a typical school built to the building code.

According to Anjali Grant, an Associate at Mahlum, reaching this level of efficiency is not easy and requires a careful examination of all aspects of building design. The school is oriented so that every classroom receives balanced daylighting via operable windows and an integrated clerestory. Dimming sensors detect when natural light is present and adjust electric lights accordingly.

“If you walk through the building on a typical overcast day during the daylight hours you’ll find that most of the lights are off,” said Grant. “The quality of the light is better for teaching and learning, and the
district reaps the benefit of the cost savings."

The next priority that Grant and her design team tackled was the building enclosure. They worked with structural engineering firm Coughlin Porter Lundeen to determine an enclosure system that would meet their thermal and structural performance requirements. After examining several options, they settled on structural insulated panels (SIPs) from Premier SIPs.

Prefabricated SIPs consist of an insulating foam core laminated between two structural facings of oriented strand board (OSB). SIPs deliver uninterrupted insulation with minimal thermal bridging while also establishing a continuous air barrier that limits convective losses through the building envelope.

"Thermal insulation is important and SIPs play a big role in that," said Grant. "There are a couple of different goals with thermal insulation, one is just having that continuous rigid insulation around the exterior envelope, another one is reducing the infiltration, and yet another is pulling our structure inboard of the SIPs so we don’t have pieces of steel bridging the thermal gap."

Placing structural elements inside the thermal envelope added an aesthetic element as well, exposing the school’s simple yet elegant glulam beam roof structure. The spanning capabilities of SIPs allowed the building to be designed based on a modular system of 14-ft. and 16-ft. spans, reducing both material waste and cost.

“When you start looking at SIPs, you can’t look at just SIPs versus a conventional wall,” said Grant. “SIPs allow me to reduce structure, they allow me to avoid installing continuous rigid insulation on the exterior walls, and when you add all those things together it starts to look more comparable, but you have to look at it more holistically.”
Indoor Learning Environment

Improving the performance of the building envelope allows for smaller heating equipment to be specified—in this case an extremely efficient central air source heat pump. Each of the five learning “pods” that house the classrooms also contains a heat recovery ventilator (HRV) that provides mechanical ventilation, ensuring healthy indoor air quality and capturing heat from air that is exhausted from the building. Carbon dioxide sensors determine when mechanical ventilation is needed based on occupancy and how much natural ventilation is being provided through operable windows.

“In addition to daylighting, the other thing the windows in each classroom are doing is providing natural ventilation and cooling,” said Grant. “The district does not air condition schools so we designed as many operable windows as possible to meet a target of 10 percent of the floor area for cooling.”

Connecting with Energy and Ecology

At 355 kW, the photovoltaic installation on top of the Finn Hill Middle School is the largest on any school in the state. It provides 40 percent of the school’s electricity needs, and the building is designed with enough south-facing roof area to make the school net-zero-energy in the future.

The solar panels are split between each of the five pods. Each pod of classrooms is metered separately and the results are displayed on a touchscreen in the main gallery, allowing students to see differences in energy use and production.

Finn Hill is also unique in that it will manage 80 percent of its stormwater onsite through a series of rain gardens. Rainwater funnels off roofs and other hard surfaces through courtyard rain gardens where it will supply native plants. Through the windows in each classroom and the school’s environmental curriculum, students maintain a direct relationship with the outdoors and natural ecology.