



FOCUS ON THE
**BUILDING
ENVELOPE**
FIRST

GLUMAC DESIGN STRATEGIES



The **EdithGreen-Wendell/Wyatt Federal Building** (LEED Platinum) features a 179kW solar array. It is also designed to use 40% less lighting than Oregon Code, and received the first "Portland 2030 Challenge Design Award."

ENHANCED EXTERIOR PERFORMANCE

BUILDING ENVELOPE

The interface between inside and out - what separates the building from unconditioned space: fenestration, doors and skylights, the roof/ceiling assembly, exterior walls, the floor assembly, insulation, and the slab edge.

Creating energy-efficient spaces begins with the building envelope. Sophisticated mechanical systems and renewable energy applications are often trumpeted as sustainable solutions for green buildings. While they are sometimes the answer, optimizing thermal mass through proper glazing and insulation choices can greatly reduce the size of mechanical and electrical systems and, in turn, significantly reduce first costs. Likewise, decreasing equipment as well as pump and piping sizes can lead to greater savings while offsetting the cost of higher insulation values, making a project's payback more immediate.

OPTIMIZED GLAZING

Selection of glass, and placement of windows, are critical to optimizing the building envelope's energy and thermal performance. Buildings lose up to 10 times more energy through windows (U factor: 0.45/2.55W/m²·°C) than all wall faces (U factor: 0.06/0.34W/m²·°C) combined.

Considering the livability of the interior environment, in terms of daylight and connectivity to the outdoors, is equally important. Many states now cap the window-

“GLUMAC DESIGNERS AIM TO UTILIZE **‘WHOLE BUILDING MODELING’** TO DEMONSTRATE TUNED GLAZING SYSTEMS THAT **OPTIMIZE PASSIVE HEATING AND COOLING** AND DAYLIGHT HARVESTING.”

to-wall ratio at 40 percent (Oregon’s code tops out at 30 percent) for prescriptive code compliance. Glumac designers aim to utilize “whole building modeling” to demonstrate tuned glazing systems that optimize passive heating and cooling and daylight harvesting – often applying 50 to 60 percent glazing on south and north façades and 40 to 50 percent on the east and west façades.

To make these decisions, our designers determine the optimal shading coefficient for each building’s orientation through modeling. A shading coefficient of 0.8 allows a significant amount of solar radiation into a space, while a coefficient of 0.1 reflects the majority of the solar heat away from the building. Clear glass provides effective passive heating but increases cooling energy consumption. Inversely, highly-reflective glazing reduces cooling consumption and passive solar gain. Identifying the optimal shading coefficient for each building façade ideally balances heating and cooling energy according to a site’s geographic location and the mechanical and lighting systems in use.

INSULATION VALUES

Insulation choices also impact the building environment. Glumac designers typically advocate for increased insulation, above what the local energy codes require. This is because if a façade is poorly insulated, more energy is likely to be spent maintaining thermal comfort, regardless of the season. Energy modeling can illustrate savings from as little as an additional one to two inches (2.54 to 5.08 cm) of insulation. Load calculations then determine further load reductions and the savings associated with small HVAC equipment.

Traditional exterior wall designs for commercial buildings utilize batt insulation between metal wall studs. Thermal bridging at the metal wall studs can degrade insulation performance (R-Value) by as much as 50 percent. In cold climates, for example, insulation between studs might need to be eliminated to mitigate the potential for the dewpoint to fall between the two insulation interfaces and condense, creating the potential

The 72,000-square-foot **Azusa Pacific University** building wraps around a steel moment structural system - its exterior integrating a “rain screen” cement board with channel glass, which adds natural illumination to laboratories and classrooms.



Glumac's comprehensive MEP strategies for a this LEED Gold science building at Azusa Pacific University (Azusa, California) focused on a highly-optimized facade that features multi-colored cement board and high-height translucent channel glass. Combined with oversized air handlers and high-efficiency boilers and lighting systems, performance of the **Segersrom Science Center** exceeds California's Title 24 Energy Code by 11 percent

for mold. Because of this, Glumac recommends providing continuous rigid insulation on the outside of a stud wall.

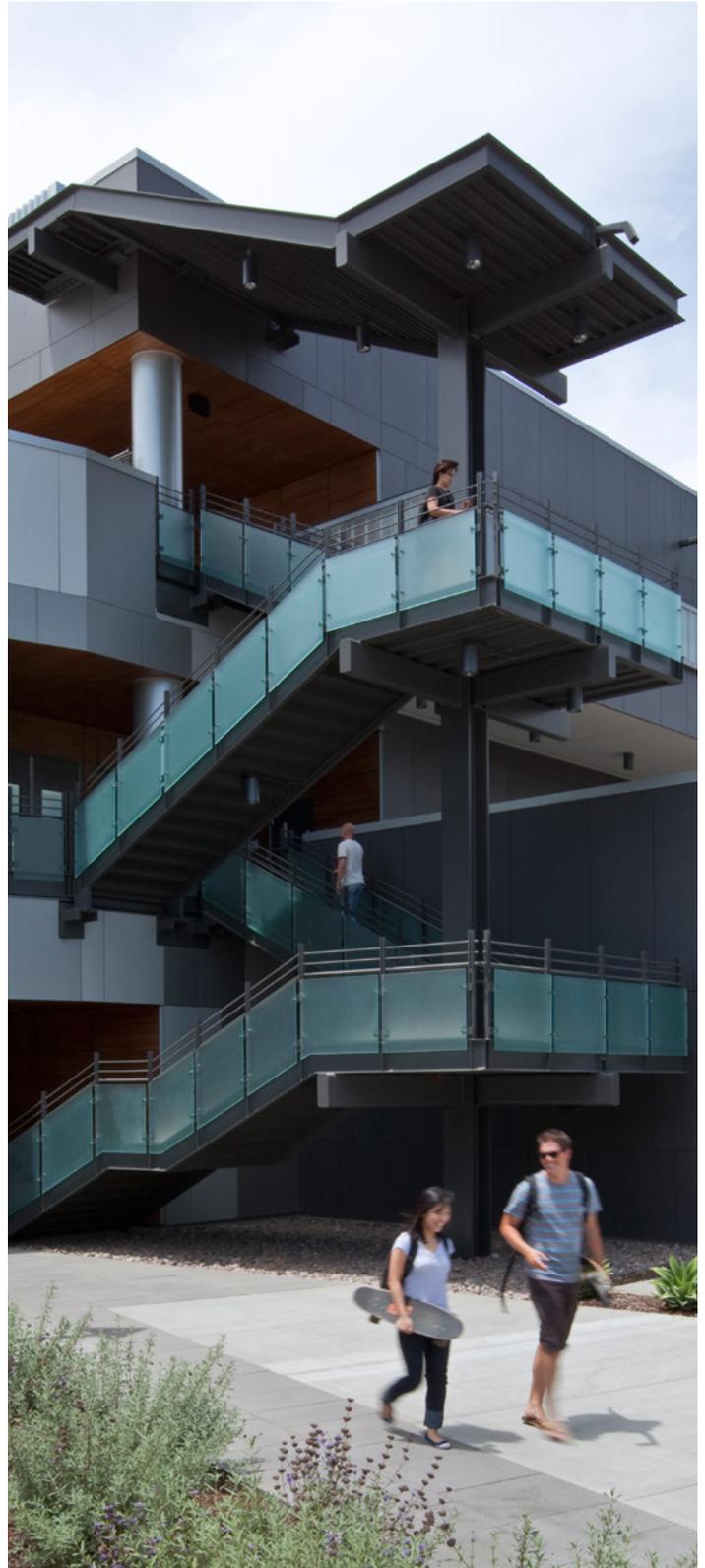
PROCESS/TOOLS

Each Glumac team begins pre-design and design work with a careful examination of state energy code requirements. While specifics vary, most states adhere to a local energy code and its commercial envelope provisions as defined by climate zone and type of construction. Glumac engineers also consider a building's planned use. As one example, office spaces may be optimally designed with exterior shades and a dual-pass system – utilizing 100 percent outside air for ventilation, with a radiant floor supplying heating and cooling. Glumac's team calculates anticipated energy use and building loads. Then, an energy analyst examines potential energy savings and the project's mechanical engineer sizes equipment, with an eye on reducing capital costs and eliminating systems (primarily heating) through proper placement of insulation. Finally, designers create Autodesk Revit® models to import into other analytical programs, making it possible to quickly model envelope alternatives.

FURTHER DESIGN FACTORS

The building envelope also creates opportunities for daylight harvesting, a strategy that should be approached with caution. With the popularity of floor-to-ceiling vision glass, the glass allocated for natural light often exceeds the amount needed. As a result, tenants may close blinds and sun shades, which disables dimming controls for lighting and renders façades with daylighting ineffective. Some buildings use excessive daylighting to save money by reducing electric lighting costs; again, this design may dramatically increase cooling energy demand far beyond any potential savings.

It's especially important to collaborate with architectural designers on a building façade that incorporates natural ventilation, a sustainable design feature applicable in most parts of the country. Temperate spring and fall seasons offer many hours fresh air, even in regions with extremely hot summers and cold winters. **G**



FOR FURTHER INFORMATION, PLEASE CONTACT US BY EMAIL VIA contactus@glumac.com.

Seattle | Portland | Corvallis | Reno | Sacramento | San Francisco | Silicon Valley | Las Vegas | Los Angeles | Irvine | San Diego | Austin | Shanghai | **GLUMAC.COM**