

## Solar Awnings, Green Walls, and Love of Light

*Oregon BEST Researcher Thinks Outside the (Building) Box*



Growing up in Egypt, **Ihab Elzeyadi** has always been fascinated with light. “I love light, but when you grow up in Cairo, you appreciate the shade,” he says. “It’s that balance between light and shade that makes spaces more interesting and stimulating.”

No wonder Elzeyadi, an Oregon BEST researcher and professor of architecture at the University of Oregon, is thinking outside the box (literally) when it comes to light and shading, solar panels and where to put them on buildings, green walls for building envelope upgrades, and how to brighten

decaying public school buildings to improve student health and performance.

“The façade of a building should do much more than just separate you from the outside,” Elzeyadi says. “And we can’t just tear down all the existing, poorly designed buildings; we need to green them.”

That’s where his solar awning comes in.

Most solar PV panels are installed out of sight on building rooftops, where they provide only one function: converting sunlight into energy. But Elzeyadi has designed a unique solar awning that can be mounted on the building facades of both existing or new buildings. When installed in combination with an interior light shelf, Elzeyadi’s solar awning provides what he calls, “energy to the power of four.”

The four energy factors related to the awning include: 1) electricity generated by the PV panels integrated into the solar awning, 2) light harvested and transferred to the interior of the building via the light shelf, 3) energy conserved to cool the building on hot days thanks to the shading the awning provides, and 4) the super-efficient nighttime lighting provided by tiny LEDs integrated in the light shelf that illuminate the interior after dark.



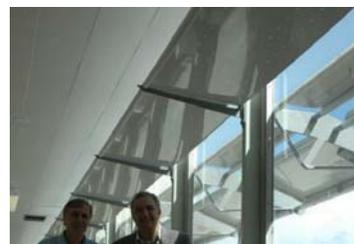
The awning prototype has been installed on a glass-walled corridor of the UO’s Onyx Bridge building where it is a learning tool and ongoing research experiment.

In addition to his research on green building technologies, Elzeyadi’s work explores how humans interact with buildings and how buildings impact people (*see video, below*).

“Buildings don’t consume energy, people do,” says Elzeyadi, who holds degrees in architecture and architectural engineering with an emphasis on human behavior and environmental psychology. “So part of energy conservation is about influencing human behavior inside buildings, like encouraging people to turn off lights, thermally adapt to their environment, and use less water.”

Elzeyadi says his goal is to assist building professionals to design “living buildings” that generate more energy than they consume and are healthy, comfortable, and most importantly appreciated by the occupants. “When you fuse these areas—energy conservation and reduced carbon emissions with improved human health and the wellbeing of occupants in buildings—the result is a healthier Planet.”

Which comes back to the solar awning.



“I know what a good daylight quality space should feel like from studying how people respond to daylighting in buildings,” Elzeyadi says. “So I designed the awning to produce good visual comfort and good thermal comfort.”

The awning overcomes glare and poor brightness patterns in the field of vision and strikes the ideal balance between too



little lighting and over-lighting, without obstructing the view out the windows. "Our research has shown a positive correlation between better views and reduced sick leave in offices, so I know the psychological impact of a view," he says.

Graduate and undergraduate students helped Elzeyadi test and refine the awning design in the Baker Lighting Lab at the UO's Dept. of Architecture, which was ranked No. 1 in sustainable design by Design Intelligence magazine. Elzeyadi

collaborated with Frank Vignola (*pictured with Elzeyadi*), director of the UO Solar Radiation Monitoring Lab, to secure funding for the project from the Oregon University System, then they worked with a local company, Image King Signs, to manufacture and install the solar awning.

Now Elzeyadi and Vignola hope to partner with an Oregon business to transform the prototype solar awning into an off-the-shelf product that architects and builders can incorporate in new green buildings and add to older buildings being retrofitted with energy saving technologies. "We hope this might lead to a spin-off company," says Elzeyadi, who is already at work on a next-generation solar awning, this one with moveable solar panels that can track the sun.

Among Elzeyadi's other research projects is a modular 'green wall' that can be attached to the exterior of buildings. Green walls can help reduce the urban heat island effect of buildings while providing shading, acoustical buffering, carbon sequestering, eco-mass, and habitat for bees, birds, and other creatures. He's working with Oregon State University professor of horticulture John Lambrinos on the green wall project, for which they're currently seeking funding for full-scale experiments and demonstration of prototypes that Elzeyadi believes will lead to a new product marketed by an Oregon company.

Elzeyadi's research has also led to development of a "Green Classroom Toolbox," which includes a checklist of 20 evidence-based best practices for architects and planners to use when planning renovations of public schools. Forty percent of the 20 billion square feet of existing U.S. public schools house some 14 million students in poor environmental conditions. Elzeyadi's team surveyed literature on the health impacts of schools buildings going green (*see video, below*) and then ran energy simulations on a prototypical elementary school building. In addition to the checklist, the toolbox features a guide that links best practices to findings on health and performance.

"You can't drastically change poor early design decisions, but our analysis shows that some minimal retrofits in the classroom can have drastic impacts," Elzeyadi says. "Under the American Recovery and Reinvestment Act of 2009, school districts will have access to federal funding to modernize and green their schools. Our work provides school designers and officials with the needed guidelines to direct this process the right way."

Who knows? Maybe some of those schools will have solar awnings and green walls designed by Oregon BEST researchers like Elzeyadi and Vignola.