AIA PORTLAND CENTER FOR ARCHITECTURE

LOCAL FIRMS COLLABORATE FOR SUSTAINABLE URBAN REDEVELOPMENT

Architects stand at the forefront of sustainable design. So when Portland's American Institute of Architect's (AIA) chapter membership grew from 400 members in 1992 to more than 1,000 in 2010, the organization jumped at the chance to construct a new headquarters that would accommodate chapter growth and showcase sustainable design and green building technology. Their new headquarters is the first AIA building in the world to achieve a LEED® Platinum rating and boasts a 91 percent reduction in carbon emissions.

Pre-design/programming

AIA decided early on to reduce its environmental footprint by renovating an existing building instead of building from the ground up. It wanted an urban site close to public transportation. The organization's leadership eventually zeroed in on an existing 10,000 square foot former art gallery. Originally built as a livery stable, the building is thought to be the oldest surviving structure in northwest Portland's Pearl District.

Two attributes especially made the building stand-out as an excellent candidate. First: location. Within one mile of the greatest concentration of member architecture firms, the location helps cut down on carbon emissions from members commuting back and forth. Second: natural light. The existing windows and building orientation provided an abundance of year-round daylight to reduce artificial lighting needs.

Concept design/preliminary design

From the very beginning, AIA leadership committed to a collaborative design process. All chapter members and AIA staff were invited to participate in a series of design charrettes to help set sustainability and usability goals and select the project team. Through these charrettes, the organization nailed down three specific building goals:

- Provide ample space for on-site AIA events and meetings, as well as an appealing space for other organizations to rent and use.
- Achieve a LEED Platinum rating and meet the goals of the 2030 Challenge, which aims to reduce the amount of global greenhouse gas emissions toprotect the natural enviornment.
- Cut costs and maximize efficiency by utilizing high impact, low-tech solutions such as 'off-the-shelf' stock merchandise, rather than custom-designed equipment.

Schematic design

Because the organization was committed to reducing the building's carbon emissions, they prioritized energy use reduction. They looked to Energy Trust of Oregon to help recommend the most appropriate and impactful energy solutions. "We knew we wanted to reduce our carbon footprint and meet the 2030 Challenge," says Saundra Stevens, executive vice-president, AIA. "Energy Trust played a major role in identifying for us how to do that."

After thoroughly analyzing the building's current design and anticipated use by employees and guests, the team decided that making the lighting and HVAC system highly efficient would return the most bang for the buck in terms of reducing carbon emissions. The building's design already allowed for excellent daylighting, so the team decided to retain all existing door and window frames. To further reduce energy use, they specified energy-efficient lighting equipped with daylight sensors.

Next, they turned to the HVAC system design. The goal was to create a system that was highly efficient, reflected aesthetics and design ideals and could be replicated by other buildings, especially smaller facilities striving for sustainable design. They first considered an overhead duct system. But the ducts would clutter the space and the overall system wouldn't optimize energy use. The next idea on the table was a water-loop heat pump system. What made this feasible was an existing full basement not suitable for occupancy, but perfect for the plumbing this option would require. The idea was to tap into the city's sewer pipe and use it as a heat sink for the water loop. However, the sewer pipe runs under the Portland Streetcar tracks, so a water loop wasn't a viable option due to costly excavation.

With two ideas down, the team stepped back and reconsidered one of their most important goals: that the building serve as a model for smaller projects with limited resources. To meet this goal, the HVAC system needed to be easily scalable and affordable.

With this in mind, the team opted for a displacement ventilation system, which would use natural convection to move warm air up and out of the building. This system is comprised of basement ductwork and electric heat pumps that allow for diffused air heating and cooling. In addition to maximizing efficiency and comfort, this type of system would help qualify the project to receive Energy Trust incentives.

Design development

Using off-the-shelf equipment and systems, the team designed a building that exemplifies pragmatic simplicity and can be replicated by any business.

The straight-forward HVAC system combines a displacement ventilation design with passive cooling and natural ventilation strategies. In addition to energy-efficiency benefits, displacement ventilation improves

indoor air quality and increases occupant comfort. It also helps meet the goals of the 2030 Challenge by reducing carbon emissions.

The design incorporated four air-to-air, residential-type heat pumps to provide primary heating and cooling for each zone of the building: office, board room, gallery and education space. The displacement ventilation system supplies conditioned air near the ground level, which reduces the necessary fan power and therefore energy use.

The energy-saving potential of natural ventilation, along with the desire to connect with the community and welcome people into the space, made operable windows a must. The windows needed to be oversized to fit the large space. Instead of paying more for custom windows, the team integrated residential-type sliding patio doors with handles at the bottom as a cost-effective and practical solution. Window-mounted switches on each door work in tandem with roof-mounted turbine fans and dampers to provide passive cooling and natural ventilation. When conditions are appropriate, occupants can open the windows and the switches turn off the building's HVAC system in that zone and open the louvers on the roof-mounted turbine fan. This allows warm air to be released through the roof and pulls cooler air in through the windows.

To provide additional passive cooling during warmer months, the team designed a night flush system of small ventilation holes above the main front entry door that automatically pulls cool night air into the building when the outside air temperature drops below a certain point.

Construction

The mechanical design was crucial to optimizing energy efficiency performance. But as with any building, the design is only as good as the construction and implementation. The construction team was responsible for ensuring the building would meet design goals and attain critical LEED points for energy efficiency.

During construction, the team uncovered an issue that required creative problem solving. When preparing to install the under-floor mechanical system they discovered the basement's existing heavy-timbered structural beams had extensive dry rot. As a result, they had to demolish sections of the beams, bring in new structural pieces and reroute the duct system to accommodate the new layout.

DISPLACEMENT VENTILATION SYSTEM

The displacement ventilation system is automatically activated when the windows are opened. Louvers installed in the ceiling open to allow roof-mounted turbine fans to pull warm air up and out of the building.

PROJECT TEAM

AIA assembled a team with extensive experience in sustainable design and construction, including:

- Architect of record—Holst Architecture
- Project management—Julie Livingston AIA, LEED AP
- Sustainability coordination—Green Building Services, Inc.
- Mechanical/electrical/plumbing engineers—Glumac
- Structural engineers—DCI Structural Engineers
- Civil engineers—KPFF Consulting Engineers
- Lighting design—Luma Lighting Desing
- Street lighting—PAE Consulting Engineers, Inc.
- Audio/visual design—Spectrum Systems Design
- Interior design—Czopek & Erdenberger, Inc.
- Landscape design—Mayer/Reed

To earn more LEED points, the team designed and installed an innovative rainwater management system that captures rainwater to replace potable water in toilets and urinals. They also reused as much of the existing building as possible, and incorporated salvaged and refurbished materials.

Commissioning

The team developed fundamental and enhanced commissioning specifications for equipment and systems in project construction documents. The majority of commissioning activities were conducted during the construction period, including training the AIA staff on operations and maintenance. Commissioning processes resulted in a fine-tuned, fully functional building with complete documentation, lower operating and maintenance costs and improved HVAC equipment performance, reliability and efficiency.

Post-occupancy

A cash incentive of $20,383 from Energy Trust combined with energy savings made the project pencil out for AIA, and it is now reaping the benefits of its energy-saving strategies. The baseline design predicted an annual energy use of approximately 77,000 kilowatt hour at a cost of $11,103, based on current utility costs. The design implemented uses 47,612 kWh of energy, for a 57.1 percent savings in energy costs, as compared to the baseline design.

The connection between the staff and the building has resulted in even greater energy savings. All four staff members attended the design charrettes and were completely on-board with reducing energy use and carbon emissions. They understand and have embraced the overall system.

"There's so much natural light that we often don't turn on the lights, and when it gets too hot it's obvious that we just need to open a window," said Amy Sabin, Assistant Director of AIA Portland. "It's a no-brainer to work with the building because of the simple design."

Due to the staff's involvment, the building is running 21 percent more efficiently than first predicted in the initial model. The building is also achieving a 91 percent reduction in carbon emissions, and AIA plans to fully meet the 2030 Challenge through photovoltaic panels and the purchase of carbon offsets.

To learn more, visit **www.energytrust.org** or call **1.866.368.7878**.

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