Oregon Health & Science University Center for Health and Healing

Portland, Oregon

Building Type:	**Medical office high-rise, laboratories, educational spaces, surgery suites, parking, retail, swimming pool**
Recognition Status:	**LEED for New Construction v2.1 Platinum**
Completion Date:	**2006**
Gross Square Footage:	**410,000 sq. ft. (38,000 sq. m.); 16 stories**
Total Project Cost:	**US$100 million (land excluded)**
Capital Cost Savings:	**US$3.5 million projected**
Cost Savings:	**US$660,000/yr projected**
Occupancy:	**600 staff, 4500 visitors per week**
DOE Climate Zone:	**Zone 3 (4500 HDD, 300 CDD)**

OHSU Center for Health & Healing
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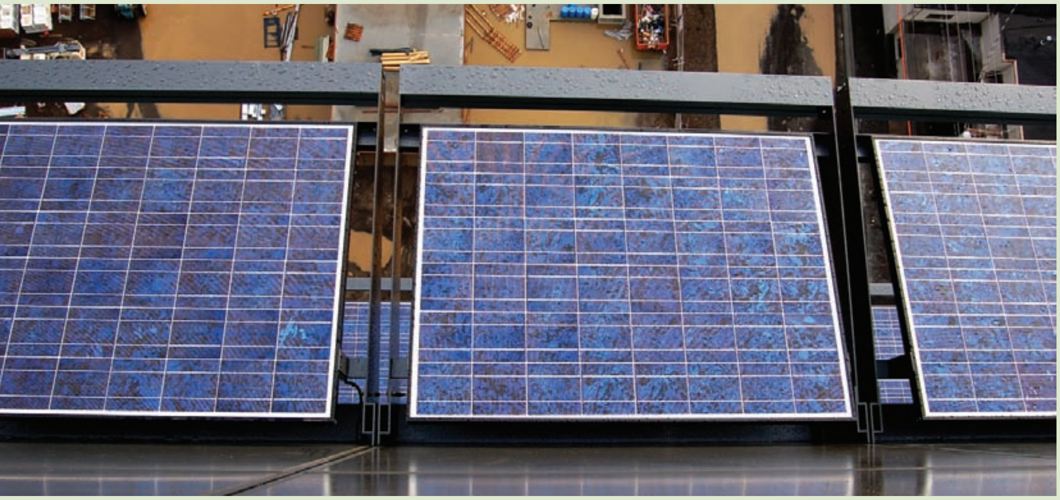
PROJECT OVERVIEW

Instead of moving to a new suburban campus, Oregon Health Sciences University (OHSU) decided to expand their urban campus to the nearby South Waterfront Urban Redevelopment District. As the first building to redevelop in the old industrial neighborhood, the Center for Health and Healing (CHH) targeted high performance and civic responsibility. The Center provides OHSU with laboratories, educational spaces, medical offices, and surgery suites. The building's public uses also include a fitness and wellness center, pharmacy, café, retail space, and a public atrium. Building occupants and visitors can access the building via a streetcar from downtown, via an aerial tram from the main OHSU campus, or by car/carpool, taking advantage of the building's three-story underground parking garage. The CHH is the first building in Portland and largest building in the region to achieve Leadership in Energy and Environmental Design (LEED) Platinum rating, all while working within a conventional budget.

CHH lobby / © Interface Engineering

THE BOTTOM LINE

The Center for Health and Healing design team leveraged synergetic relationships between integrated systems to decrease capital costs. This strategy is also known as "tunneling through the cost barrier." By using strategies such as return air plenums instead of ducts, pre-cooling the building at night, and reducing the size of air handling units based on the design of a more efficient building envelope, the engineering team was able to reduce the capital MEP budget by US$4.5 million. Subsequently, a portion of the MEP (mechanical, electrical, and plumbing) capital savings was reinvested to fund other architectural and environmental elements, including the photovoltaic and solar thermal systems. These reinvestment measures, along with the increased efficiency building systems, translate to a US$660,000 decrease in annual operating costs. By leveraging this synergy between various building systems, the CHH project team was able to create a building with "expensive" systems such as green roofs, photovoltaics, and onsite sewage treatment without adding capital cost, while also decreasing operating costs and increasing building value.



Building-integrated shading device/photovoltaics / © Brian Libby

INTEGRATED DESIGN PROCESS GENERATES SUPERIOR BUILDING

The CHH project team credits their success in creating a programmatically complex yet cost-effective, high-performance building to their dedication to an integrated design process. Where a traditional design process begins with a small schematic design team, an integrated process begins well before schematic design and includes many participants from diverse backgrounds. The initial stages of the CHH project design included engineers, a commissioning agent, the developer, and the construction company, as well as OHSU and the architect. These players participated in setting project goals, defining key issues, participating in eco-charettes, and studying design alternatives, all before schematic design was complete.

Initial goals were intentionally audacious. Dennis Wilde, the senior project manager, pushed the team, having had experience working with engineers to achieve high levels of building performance without the crutch of an increased budget. Resulting goals included a 25 percent reduction of the MEP budget, a 61 percent energy savings below Oregon Energy Code, and treatment of all sewage onsite to enable reuse of water within the building. As the team stretched to meet these goals they discovered increased savings and were able to change their initial goal of LEED Silver to LEED Platinum rating.

Before settling on a guiding design approach, the team conducted extensive, yet efficient analyses of site conditions and user needs. First the team analyzed programmatic daily, seasonal, and annual time-of-use patterns. Projecting conventional energy demands to meet the needs of those patterns, the team then determined where more efficient strategies could generate the biggest savings. Proposed strategies for achieving those savings included "right-sizing" mechanical systems by eliminating overly conservative design practices, using energy storage systems, and harvesting natural resources such as sun, wind, and water. The team then selected and balanced strategies using a variety of analytical tools including Computational Fluid Dynamics modeling, daylighting and energy modeling, and windrose, temperature, and rainfall data. The use of analytical tools early on allowed the team to make key decisions that facilitated the eventual integration of green strategies.

Rendering showing the CHH and surrounding Waterfront District
© GBD Architects Incorporated

"The bar continues to get higher and higher. Right now, we're designing living buildings, we're designing buildings that use no energy off-site."

— Andy Frichtl, PE, Principal
Interface Engineering, Inc.

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Map of South Waterfront District showing CHH in yellow at left/north end © GBD Architects Incorporated

The project team focused on gaining maximum benefit from each building system and its associated cost. The east-west linear massing of the CHH tower provides maximum solar access for daylighting and energy harvesting, facilitates natural ventilation of both the east and west stair corridors, and minimizes the impact on its neighbors' views to the Willamette River. The building's cistern stores water for fire suppression, detains storm water to prevent overload of the municipal sewer system, collects rainwater to decrease the need for municipal potable water, and provides a free source of cool water to the radiant floor slabs. By developing creative integrated solutions that target the largest potential savings, the team was able to deliver a programmatically complex, high-performance building on budget.

"We've seen in the last seven years a tremendous shift in the awareness of our tenants, of our buyers, in terms of asking —even demanding — the kinds of features we're incorporating as a matter of course in our projects."

— Dennis Wilde, Partner Gerding Edlen Development

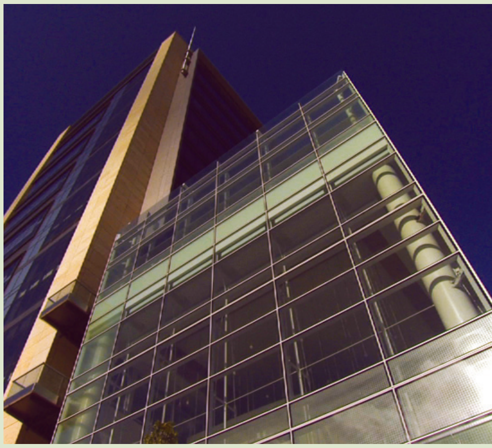
ACHIEVING MORE FOR LESS: ONE SYSTEM, MANY BENEFITS

The CHH's rainwater/groundwater reclamation system performs seven building services! This excellent example of building systems integration is economically accomplished because each part of the system performs multiple functions. The system includes a green roof, a rainwater collection system, an infiltrated groundwater reclamation system, a code-required fire suppression storage tank, a sewage treatment bioreactor, and on-site bioswales and wetlands. The system provides enough clean water to serve all toilets and urinals in the building's core, the cooling tower, the building's radiant heating and cooling system, the green roof (which also cools the building), the micro-turbine power generator, and the exterior irrigation needs. Additionally, the system detains stormwater, reducing pressure on the City stormwater collection infrastructure.

The team opted to create such an ambitious water management system largely because of the region's summer drought periods. Although the Portland area enjoys moderate rainfall for eight months of the year, an average of only five inches of rain falls from June through September.

In addition to this intermittent rain pattern, the building demands ten times more water than falls on the roof, even with the use of water-saving fixtures. The rainwater/groundwater system reuses three-quarter's of the building's water on site and is projected to reduce potable water use by 56 percent, thereby completely eliminating water used to convey sewage from the site.

To keep the project within its budget, the team had to find creative ways to offset the additional capital cost of these water systems. Added costs ranged from separate service-side potable and non-potable piping, to increased sizing of the steel structure needed to support the green roof. However, the City's high service fees for wastewater and stormwater, municipal system usage charges (impact fees), and ownership of the on-site sewage treatment facility by a third-party vendor, created enough savings to make the rainwater/groundwater system cost-neutral.



Lower façade of the CHH © Rocky Mountain Institute

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"The sun is going to shine, the wind is going to blow, [and] it's going to rain. These are the things that are going to happen and you might as well take advantage of them."

— Kyle Anderson, AIA
Lead Designer, GDB Architects

GOOD BUILDING, GOOD NEIGHBOR

When Oregon Health Sciences University needed more space, they initially looked at relocating to a suburban campus outside the Portland city center. Given that OHSU is the city's largest employer, the move would have seriously damaged Portland's urban economic and social success. Working together, City and OHSU officials created a strategy to keep OHSU in the city center, while allowing OHSU to expand in the Willamette River Bank/Marquam Hill Redevelopment District. OHSU recognized that remaining in Portland would attract higher quality academic talent and the City saw an opportunity to gain an anchor tenant for the new neighborhood.

Although the City government and OHSU easily recognized the shared benefit of the CHH, they had to put forth additional effort to address citizen concerns about the project. Portlanders were apprehensive about the impact on river views from Marquam Hill, potential damage to salmon habitat in the Willamette River, contribution to vehicular congestion downtown, and the amount of public money allocated to the project. These concerns were addressed through the design of the new CHH building. The massing of the 16-story tower minimizes impacts on views by minimizing façade area facing the residential Marquam Hill neighborhood, while the low-rise base helps to create a human-scale streetscape. The CHH also protects and even creates wildlife habitat with its green roofs, rainwater collection system, and on-site bioswales. Located on public transportation lines including an aerial tram connecting to the main OHSU campus and the trolley running to the downtown center, the project minimizes impact on auto congestion. Financially, the building was created through a public/private partnership, which included US$1.3 million in energy tax subsidies and rebates, Tax Increment Financing, and other strategies. The building also provides publicly accessible amenities such as the retail space, café, and wellness center, which would not typically be open to the public in an institutional building. Overall, the design team cites the publication of their ambitious green objectives as key to winning public support for the project.

Lobby atrium / © Rocky Mountain Institute

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Pedestrian-friendly streetscape / © Rocky Mountain Institute

THE COMPLEXITY OF ENERGY SAVINGS

The CHH employs 42 distinct strategies for energy-efficiency. The engineering team began by modeling the initial building design to produce a base line energy-use profile and to identify the areas primed for the greatest savings. The mechanical engineers "right-sized" the HVAC (heating, ventilation, and air conditioning) system, downsizing the equipment by 30-tons based on the assumption of a more energy-efficient building envelope and a wider allowable temperature range in some spaces. Savings from the mechanical system were used to fund the more efficient building envelope, including sun-shading devices, high-performance glazing, and additional insulation. Shading of the façade to limit undesirable heat gain is accomplished by a 60kW array of solar panels. Also, a natural gas micro-turbine efficiently generates 30 percent of the building's power while excess thermal energy is captured and used to heat the building. This heat, along with cool thermal energy from infiltrated groundwater, is captured by the rainwater/groundwater system and stored in the building's concrete mass, fire suppression tank, and swimming pool to offset peak energy loads. However, the complexity and interdependency of the various building systems necessitated a longer commissioning period that overlapped into initial building occupancy. This prompted one of the design team members to comment that next time the goal should be to accomplish the same results with half of the "stuff."

PROJECT TEAM

Owner:
Rimco, LLC and OHSU Medical Group

Developer:
Gerding Elden Development

Architect and Interior Design:
GBD Architects Incorporated

Medical Tenant Improvement Architect:
Petersen Kolberg & Associates Architects/Planners

Civil Engineer:
OTAK

Structural Engineer:
KPFF Consulting Engineers

Mechanical, Electrical, Lighting, and Plumbing Engineer:
Interface Engineering

Landscape Architect:
Walker Macy

Energy Consultants:
Brightworks Northwest and Interface Engineering

LEED Consultant:
Brightworks Northwest

Commissioning Agent:
Interface Engineering

Contractor:
Hoffman Construction

SOURCES

Andy Frichtl, PE, Principal, Interface Engineering, Inc.