

Case Study

Deep Energy Savings in Existing Buildings



Overview

Site Details

- Owner: 200 Market Associates
- Location: Portland, OR
- Building Type: Office, Mixed-use
- Project Description: Major Renovation
- Size SF: 388,932
- Stories: 19
- Project Completion: 1989 - Ongoing
- Year Built: 1973

Recognitions

- LEED-EB O&M Platinum 2010
- LEED-EB Gold 2006
- 2006-2009 Energy Star Awards

200 MARKET BUILDING

The 200 Market Building is a high-rise built in 1973 and located in downtown Portland, Oregon. It was purchased in 1988 by its current owner, 200 Market Associates, primarily because of its optimal location in Portland's central business district. Since 1989 the building has undergone continuous improvements in multiple phases. It is occupied by 20 office tenants and 10 retail tenants and has maintained a high level of occupancy despite the economic downturn.

Much of this success has been credited to the owner's efficiency and sustainability investments; John Russell specifically pointed to these investments as well as to the building's LEED Platinum certification as points of distinction, setting 200 Market apart from other high-rise office buildings in the district. High Performance Buildings magazine featured the 200 Market building as a case study in 2010, with information on specific energy efficiency measures and annual energy data from 2009.

Motivations

Project goal: Maintaining a high occupancy rate is a primary driver for improving energy efficiency and increasing the building's "green" profile. Working closely with the building management team, the owner has implemented a program of continuous improvement that benefits not only the current tenants but also attracts tenants that place a high value on environmental responsibility and a healthy work environment. The success of this program was reflected in 2006 when 200 Market obtained its LEED for Existing Buildings 2.0 gold certification, becoming the first multi-tenant building in the nation to do so.

“In my observation, tenants are willing to pay a premium for a building that is demonstrably better.”

- JOHN RUSSELL, OWNER REPRESENTATIVE

Rationale and economic criteria: Russell works closely with his property manager and chief engineer when selecting projects and improvements to implement. One example is the placement of timers on the exterior signage lights so they turn off at night. Russell will consider a project if it has a payback period of seven years or less.

200 Market Associates worked with sustainable development consulting firm Green Building Services to obtain LEED Gold EB certification in 2006 and Platinum EB O&M certification in 2010. In addition to providing independent verification of the building’s existing green features, the process identified new areas for improvement.

Barriers and resolutions to energy efficiency measures: For owners, overcoming the challenges facing a successful project is dependent upon the effectiveness of their team. The repeated message from the owner’s team was that improvements do not have to be projects requiring massive capital investment; success can be found through targeting small issues and implementing appropriate solutions.

200 Market utilizes a gross lease structure under which savings in operational expenses such as electrical and water usage go directly to net operating income. This approach encourages owners to incorporate efficiency measures into existing buildings, ultimately improving the bottom line.

Technologies and Design Strategies

HVAC: 200 Market was initially upgraded in 1989 when two natural gas hot water boilers replaced the original electric boilers, and variable-speed drives were added to all pumps and fans. This initial upgrade also included asbestos removal, reconfiguring of the ground floor and upgrading of the life-safety systems.

The next significant HVAC upgrade, in 1990, saw installation of water-cooled packaged variable air volume air handlers and waterside economizers for each of the 17 office floors. Cooling and condenser water is provided by two cooling towers, one of which is primary with the second serving as a back-up when temperatures exceed 90 degrees F and additional cooling is needed. The primary cooling tower operates through a plate-and-frame heat exchanger. This system allows the condenser loop to operate as a closed loop, which during unoccupied hours can recapture heat and reduce runtime for the cooling tower and boiler systems. Condenser loop heat is used in restaurants for after hour heat or dispersed on floors with water-side economizers by a direct digital control (DDC) program that opens the economizer valve and starts supply fan.

Two 15 hp city water pumps that had run 24/7 were replaced with two rooftop pressurized water storage tanks with pressure sensors, enabling the facilities team to ensure the pumps were running only when needed and that they could be turned off nights and weekends.

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Efficiency Measures

- Variable-Speed fan drives on all pumps and fans
- Variable air volume air handlers with waterside economizers
- Increased ventilation rate
- Roof insulation upgrade
- Dimmable lighting ballasts with motion sensors
- Direct Digital Control system
- Motion sensors and dimmable ballasts
- High-efficiency lighting
- Retro-commissioning

In 2006 the building team reconfigured existing smoke evacuation shafts as intakes for fresh air. This simple measure improved the ventilation rate by 70%, reduced the fan and pump energy needed to meet ventilation requirements and provided free cooling.

Envelope: The addition of two inches of polyisocyanurate insulation with a white asphalt cap on the roof in 1999 constituted the most significant improvement to the building's envelope. In addition, the facilities team has been adding translucent cloth shades on the perimeter single-pane windows over the last 10 years, reducing heat gain and infiltration.

Lighting: The 2008 lighting upgrade started with implementing efficiency measures in the stairwells and parking lot, including upgrading to fixtures with dimmable ballasts and installing motion sensors. In the underground garage, safety requirements stipulate 24-hour illumination. By installing dimmable ballast and motion sensors, the team cut output in the garage by 25% at ground level and by 50% on the second and third underground levels.

Upgrades in the tenant spaces take place during the tenant improvement (TI) process. This includes the installation of high-efficiency fixtures and occupancy sensors. Since 2005 roughly 20% of the tenant spaces have been renovated.

Daylighting: In the most recent TI (April 2011), the 200 Market property management team installed daylighting sensors as an experimental project with the potential to be incorporated into future TI projects.

Controls: The HVAC is operated by a direct digital control system which ensures the system is performing optimally. It operates the pumps on the cooling tower, optimizes the chilled water loop and overrides the pressure controls on the water storage tanks when the building is occupied. The elevators received a \$1 million upgrade in 2004, which included adding new controls and converting to alternating current drives that run only when the elevators are in use. These measures reduced the operating electric load of the elevators by about 40 percent.

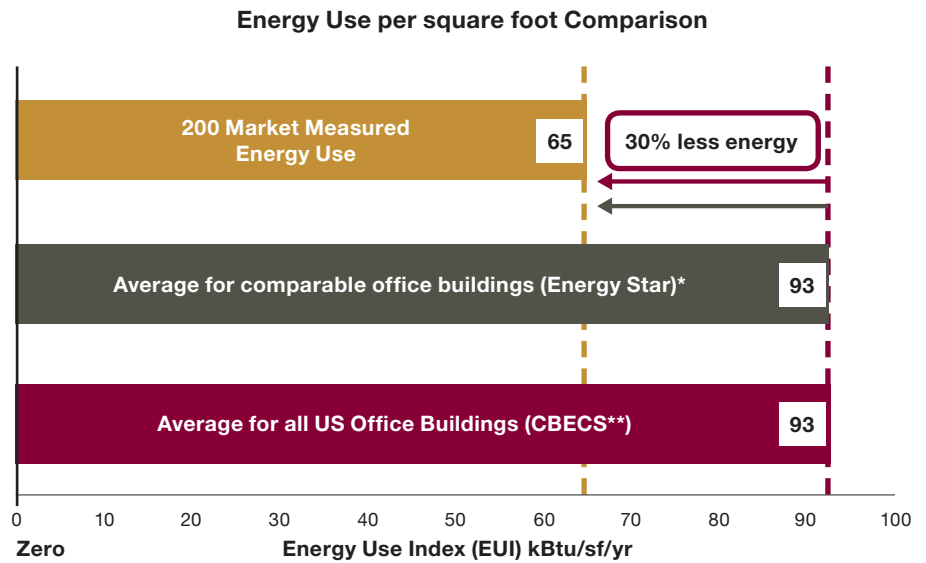
As part of the water pump replacement project in 2000, the team installed temperature sensors on the hot water pumps' return lines so they no longer ran continuously. This simple measure paid for itself in two weeks.

Commissioning: The building was retro-commissioned in 2009 as part of the LEED certification process, with the outcome of installation of failure sensors on the outdoor air fans. However, the facilities team continues to use the functional testing procedures that were part of the retro-commissioning process to maintain sensor calibration and optimal efficiency.

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Monitoring systems: The facilities management team monitors its monthly utility bills and can graphically compare its usage against multiple years of data. It also checks the DDC system on a daily basis for inconsistencies. In order to generate its Energy Star score (98), the team enters its data into Portfolio Manager every couple of months; Portfolio Manager then benchmarks the building once a year.

Energy Performance



* Comparable office average energy use from the Energy Star Portfolio Manager program based on like type, size, occupancy, hours, and climate - determined from statistical analysis of the CBECS dataset
 **Average energy use for all U.S. Office buildings through the Commercial Building Energy Consumption Survey (CBECS)

Energy Performance

% Better than Baseline	30%
Baseline	Average for U.S. Offices*
Measured Energy Use (KBtu/SF/yr)	65
Energy Star Score	98

* CBECS – U.S. DOE Energy Information Agency’s Commercial Building Energy Use Index 2003

The 200 Market Building’s measured energy use is 65 kBtu/sf/yr (EUI¹), 30% less energy per square foot than the average for offices in the U.S.² The U.S. office energy average is a good basis for quickly comparing buildings of the same type. A more specific comparison can be made through the Energy Star Portfolio Manager program, which determines the energy use of comparable buildings of like type, size, hours of use and climate. In this example, the Energy Star program calculations showed that comparable buildings would use the same energy as the average for U.S. office buildings.

The 200 Market building has made continuous energy retrofits and system improvements. Those efforts have moved the building from an ENERGY STAR score of 79 in 2006 to a score of 98 (out of 100) in 2010, indicating it is performing in the top two percent of U.S. commercial office buildings. This is an

1 An Energy Use Intensity (EUI) is the total energy (gas and electric) used in thousands (k) of British thermal units (Btu) divided by the square feet (sf) of the space – resulting in a commonly used metric of kBtu/sf.
 2 CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003.

Project costs

Below are specific project costs of 200 Market that were disclosed.

- \$25,000,000 (1989) for boiler upgrade, variable-speed drives added to all pumps and fans and asbestos removal, the reconfiguring of the ground floor and upgrading of the life-safety systems.
- \$11,000 (2000) for pressurized water tank/pressure sensor replacement of water pumps.
- \$1,000,000 (2004) for elevator upgrade including conversion to alternating current drives and new controls.
- \$180,000 (2008) for garage lighting upgrade.

impressive feat for a building of almost 400,000 square feet built in the 1970s and a clear result of the ongoing attention to energy efficiency by the owners, manager and facility staff. Continuing to optimize the energy performance of this building, through the use of reliable, contemporary energy systems, is part of a larger plan for the 200 Market building to be well-leased for years to come.

Financial

Funding and Incentives: The energy conservation measures used by 200 Market qualified the building owner for Oregon Department of Energy business energy tax credits.

Estimated annual cost savings: According to a report on the cost of green buildings, the operating expenses for 200 Market declined by 0.6% from 2007 to 2008. Significant savings were also achieved from 1989 through 2006, though specific cost information is not available. The report projected operating expenses to decline by an additional 3.3% in 2009.

Project Results

Staff Education/User Satisfaction: A quarterly electronic newsletter is published by the building's management team to update tenants on ongoing green efforts and to provide tips on energy conservation measures.

Innovation: Both Russell and Chief Engineer Mark Montgomery felt the use of existing smoke evacuation shafts to increase the building's ventilation rate was particularly innovative, especially when it exceeded their initial expectations by improving occupant comfort and reducing fan energy.

Acknowledgements and Sources

Project Team:

- Owner Representative: John Russell, 200 Market Associates, LP
- Property Manager: Sheryl Scali, Property Manager, 200 Market Building
- Chief Engineer: Mark Montgomery, 200 Market Building
- LEED Consultant: Green Building Services Inc.

Sources:

- 200 Market Associates, LP: John Russell
- Russell Development Company: Sheryl Scali
- 200 Market Building, Chief Engineer: Mark Montgomery
- USGBC 2010 BPP Annual Performance Report
- "Green Dividends" by Elaine Aye and Ted Spear; High Performance Buildings, Summer 2010
- "High Performance Green Buildings: What's it Worth?" by Theddi Wright Chappell and Chris Corp, May 2009 www.nxtbook.com/nxtbooks/ashrae/hpb_2010summer/index.php#/88

Photos: Cushman & Wakefield

Research and Development:

- New Buildings Institute (NBI): Mark Lyles, Cathy Higgins, Liz Whitmore

Funding:

- The BetterBricks program of the Northwest Energy Efficiency Alliance (NEEA): Mark Rehley, John Jennings
- NBI's work is also supported by the Doris Duke Charitable Foundation and the Kresge Foundation

Existing Building Renewal Initiative

This work is part of NEEA's regional Existing Building Renewal initiative to accelerate the market's adoption of deep, integrated energy-efficient renovations. The initiative currently focuses on office buildings but will add other market sectors with large potential energy savings. This is one of the ways the region can rapidly revamp existing stock to achieve 30–60% energy savings — on the way to netzero-energy use by commercial buildings.

For more information on the Existing Building Renewal Initiative contact:

Peter Wilcox pwilcox@neea.org or www.betterbricks.com

For additional case studies highlighting high performance commercial buildings, visit NBI's Getting to 50 Database:

buildings.newbuildings.org/

For more information about NBI's efforts to improve the energy performance of existing buildings, visit:

newbuildings.org/advanced-design/existing-buildings

New Buildings Institute

New Buildings Institute (NBI) is a nonprofit organization working collaboratively with commercial building professionals and the energy industry to improve the energy performance of commercial buildings.