



August 8, 2011

## PROJECT PROFILES

# A Search for Deep Energy Savings

*Project Profiles on Nine Existing Building Energy Efficiency Renewals*

Part of: NEEA's *Study of Existing Building Energy Efficiency Renewals*

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## Acknowledgements

New Buildings Institute (NBI) would like to thank the many individuals and organizations that contributed to the development of this information on Deep Savings in Existing Buildings. Their time and resources were essential to discovery of actual energy performance, business rationale and outcomes that can serve as exemplars for future projects.

BetterBricks program of the Northwest Energy Efficiency Alliance (NEEA) was the primary funder with support from the Doris Duke Charitable Foundation and the Kresge Foundation. Mark Rehley, John Jennings and Peter Wilcox were the NEEA project leads. These project profiles, and a companion report, were developed by Cathy Higgins, Liz Whitmore and Mark Lyles of New Buildings Institute and Ric Cochrane of Preservation Green Lab.

The buildings highlighted in the nine project profiles herein are owned by the following entities: 200 Market Associates, LP; Alliance for Sustainable Colorado; Brian Runberg; Mutual Building, LLC; Northern Plains Resource Council; JDBG Inc.; Lovejoy Building, LLC; Mercy Corps; and Rose Smart Growth Investment Fund I, LP.

Individuals contributing information to the project profiles are: John Russell, 200 Market Associates; Sheryl Scali, Property Manager, 200 Market Building; Phillip Saieg, Alliance for Sustainable Colorado; Brian Runberg, Runberg Architecture Group; Jonathan Heller and Carmen Cejudo, Ecotope; Gavin Gardi, Sustainability Manager, The Christman Company; Teresa Erickson, Northern Plains Resource Council; Tim Ennis, Western Organization of Resource Councils; Ed Gulick, High Plains Architects; Ron Pecarina, Energy and Sustainable Design Consultants; Steve Allwine, Johnson Braund Design Group; James Meyer, Randall Heeb and Chris Brown, Opsi Architecture LLP; Hugh Donnelly, Manager Administration + Facilities, Mercy Corps; Nathan Taft, Jonathan Rose Companies; Peter Alspach, Arup; and Ralph DiNola, Green Building Services.

Four project profiles were initially identified through case study research originating from the Urban Land Institute, ASHRAE's *High Performance Buildings Magazine*, and AIA Seattle and the Committee on the Environment - 2008 Top Ten Green Awards.

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These Project Profiles are part of: *NEEA's Study of Existing Building Energy Efficiency Renewals*, and are located, along with a meta report on the full research work, at: <http://www.betterbricks.com/design-construction/existing-building-renewal-initiative>

Each Profile is also located in the NBI *Getting to 50* database – search by project name via the High Performance Buildings database at: <http://newbuildings.org/advanced-design/getting-50-beyond>

### Cover Photos:

1. *Beardmore Building – Priest River, Idaho. Historic Renovation of a 1922 building completed in 2008. Owner: Brian Runberg, Beardmore Company.*
2. *Home on the Range – Billings, Montana. Renovation of a 1940 building completed in 2006. Owner: Northern Plains Resource Council.*
3. *Joseph Vance Building – Seattle, Washington. Historic Renovation of a 1929 office building completed in 2007. Owner: Rose Smart Growth Investment Fund.*
4. *200 Market Building – Portland, Oregon. Efficiency improvements of 1973 office building from 1989-present. Owner: 200 Market Associates.*
5. *Johnson Braund Design Group – Seattle, Washington. Ongoing efficiency improvements of 1984 office building. Owner: JDBG Inc.*

# INTRODUCTION

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This work is part of the Northwest Energy Efficiency Alliance (NEEA) regional Existing Building Renewal (EBR) initiative to accelerate commercial market adoption of deep, integrated energy-efficient retrofits. These Project Profiles builds on an initial search which developed a list of 50 existing building projects showing improvement of 30%+ energy savings from two or more efficiency measures in the past 10 years.

From the 50 initial examples, NEEA and NBI identified the best candidates for a deeper look into the measured energy performance, characteristics and motivations of existing building efficiency projects, primarily in the Northwest. These examples will assist in identifying common technologies and practices to support its EBR initiative, in addition to addressing barriers to deep retrofits, including skepticism about performance and market outcomes; lack of knowledge on best practice strategies; and documented business rationale for pursuing energy efficiency.

These are low-energy buildings; seven of the nine saved 50% more energy than the national average<sup>[1]</sup> and have an average Energy Use Intensity (EUI<sup>[2]</sup>) of just 39 kBtu/sf/yr. For the purpose of this research “Deep Savings” was defined to be buildings performing at a minimum of 30% better than the CBECS national average for buildings of their type (all offices). This was used as a simple screening tool, since pre-existing energy use was rarely known and in most cases irrelevant due to changes in use, occupancy and hours during the renovation or ‘renewal’ of the building (e.g., a warehouse converting to an office).

A more specific comparison is made through the Energy Star Portfolio Manager program which calculates the EUI of buildings of like type, size, hours of use and climate. Energy Star ‘scores’ (not EUIs, but scores on a scale of 1-100) are also shown for all buildings. In two cases pre-existing energy use was available and relevant and is shown in the Profile. Code comparisons are not done due to the variety of time periods and locations applicable to the projects upgrades as well as the amount of end-uses not addressed through codes (unregulated areas such as plug loads). The projects all represent actual measured energy use, and the focus is on projects with energy use well below benchmarks, how they achieved deep savings and what can be learned from the owner’s decisions (information that can be used to influence other projects).

The Profiles include a front page overview followed by sections on motivations, technologies and design strategies, energy performance, financial and project results. The sections include available detail on building characteristics, efficiency measures, business and financial rationale, measured energy use compared to baselines, market and tenant impact, and barriers and innovations. Quotes from owners and design team members are widely incorporated.

Five of the nine profiles were identified by the research team through personal contacts, with the balance coming from follow-up on existing case studies or award documentation. Owner representatives were all willing to share the “stories” behind their projects, including energy data and financial information.

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<sup>[1]</sup> CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

<sup>[2]</sup> An Energy Use Intensity (EUI) is the total annual energy (gas and electric) used expressed in thousands (k) of British thermal units (Btus) divided by the square feet (sf) of the space – resulting in a commonly-used metric of energy use in kBtu/sf/yr

**Overview of Buildings** (see **Meta Report** for information on the aggregated findings at <http://www.betterbricks.com/design-construction/existing-building-renewal-initiative>)

Building Name	Location	Building Type	Owner Type	Renewal Description	Size 000's SF	Project Completed	Year Built
Alliance Center	Denver, CO	Medium Office	Owner Occupied - Non-Profit + 50% tenants	Historic Renovation	38.0	2006	1908
Beardmore	Priest River, ID	Medium Office + Multi-use	Private Investor - Tenant Occupied	Historic Renovation	28.8	2008	1922
The Christman Building	Lansing, MI	Medium Office	Owner Occupied - Green Firm	Historic Renovation	64.2	2008	1928
Home on the Range	Billings, MT	Small Office	Owner Occupied - Non Profit	Renovation	8.5	2006	1941
Johnson Braund Design Group	Seattle, WA	Small Office	Owner Occupied - Green Firm	Equip. Upgrade/ Retrofit	8.0	Ongoing	1984
Lovejoy Building	Portland, OR	Medium Office	Owner Occupied - Green Firm + 1 tenant	Renovation	12.9	2004	1910
200 Market Building	Portland, OR	Large Office	Private Investor - Tenant Occupied	Renovation / ongoing retrofits	389.0	2009	1973
Mercy Corps Headquarters	Portland, OR	Medium Office	Owner Occupied - Non Profit	Renovation + Addition	80.0	2009	1892
Vance & Sterling Bldgs	Seattle, WA	Large Office	Private Investor - Tenant Occupied	Renovation	134.0	2007	1929

**By Energy Use:**

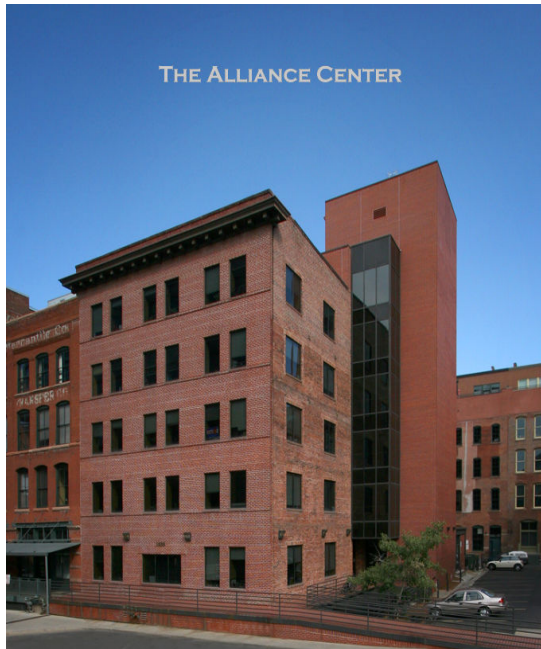
Building Name	Activity Type	Owner Type	Size 000's SF	Building Measured EUI	% Better than CBECS EUI	% Better than PM EUI	Energy Star Score
Beardmore	Multi-use	Private Investor - Tenant Occupied	28.8	32	66%	47%	90
Mercy Corps Headquarters	Medium Office	Owner Occupied - Non Profit	80.0	36	61%	50%	93
Johnson Braund Design Group	Small Office	Owner Occupied - Green Firm	8.0	36	61%	35%	94
Vance & Sterling Bldgs	Large Office	Private Investor - Tenant Occupied	134.0	39	58%	64%	98
Lovejoy Building	Medium Office	Owner Occupied - Green Firm + 1 tenant	12.9	40	57%	38%	92
Alliance Center	Medium Office	Owner Occupied - Non-Profit + 50% tenants	38.0	42	55%	39%	85
Home on the Range	Small Office	Owner Occupied - Non Profit	8.5	46	51%	72%	99
200 Market Building	Large Office	Private Investor - Tenant Occupied	389.0	65	30%	30%	98
The Christman Building	Medium Office	Owner Occupied - Green Firm	64.2	66	29%	35%	81

## ALLIANCE CENTER

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
Alliance for Sustainable Colorado	Denver, CO	Office	Major Renovation	38,000	6	2006	1908

### OVERVIEW

The Alliance for Sustainable Colorado is a nonprofit organization started in 2004 to “advance



sustainability through collaboration among nonprofits, business, government and education.” To advance this mission, the Alliance purchased a 100-year-old warehouse, previously renovated in the 1970s, in Denver’s historic Lower Downtown; a major renovation to the building in 2006 created the Alliance Center. The building provides tenant space for 35 sustainably-focused nonprofits, fostering communication and collaboration and serving as a demonstration project of advanced design strategies in a rehabilitated historic building. The Alliance for Sustainable Colorado recently launched a project titled “Modeling a NetZero Future: Energy Efficiency in Existing Buildings” to explore options that will enable it to approach a zero-net energy goal. Several documents developed for the project were referenced in this report.

#### Recognitions:

- LEED-EB Gold and LEED-CI Silver
- Energy Star Leader
- USGBC National Award for Education by an Organization
- Colorado Energy Champion Award
- Mayor’s Design Award: It Ain’t Easy Being Green

The Alliance Center performs very well in terms of actual energy use when compared with other buildings. The actual energy use of the building is currently 42 kBtu/sf/yr, which is 55% better than the average for U.S. office buildings.\*

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
55%	Average for U.S. Offices*	42	85

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

## MOTIVATIONS

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**Project goal:** Before the Alliance purchased it in 2004, the building was known as the Otero Building and served as the shipping and receiving warehouse for a local bookstore. As was the case with other buildings in this historic neighborhood, this building was purchased by the Alliance with the intention of converting it to a new use. Striving to meet its mission of achieving sustainability through collaboration, the Alliance converted this former warehouse to a multi-tenant nonprofit center that would provide multiple organizations a “healthy, efficient, quality, mission-enhancing workspace.”

*“The building creates synergies and fosters partnerships that accelerate progress on issues that affect the Triple Bottom Line, ensuring consideration of impacts on Colorado’s people, environment, and economy.” – Alliance for Sustainable Colorado*

**Rationale and economic criteria:** By converting an old warehouse with historic character and value into offices, the scope of the project focused on implementing strategies that would promote building health, energy and water efficiency while preserving historic integrity. The project consisted of reconfiguring the interior spaces, updating the building HVAC, telecom and electric systems and adding new finishes.

When the project was submitted for LEED certification (EB and CI) in 2006, a post-project survey comparing low-cost/no-cost action to significant cost actions relating to specific LEED credits determined that all of the Energy and Atmosphere credits for which the Alliance Center qualified were considered “significant cost actions,” thus demonstrating the Alliance’s commitment to promoting sustainable design approaches.

**Barriers and resolutions to energy efficiency measures:** While the Alliance Center is a high-mass brick building, its construction is not very tight and it experiences considerable infiltration and heat loss. Because preserving the historic integrity of the building was a priority, only the more contemporary lobby windows received any kind of design treatment; the focus was shifted to improving the mechanical and electrical systems within the building.

## TECHNOLOGIES AND DESIGN STRATEGIES

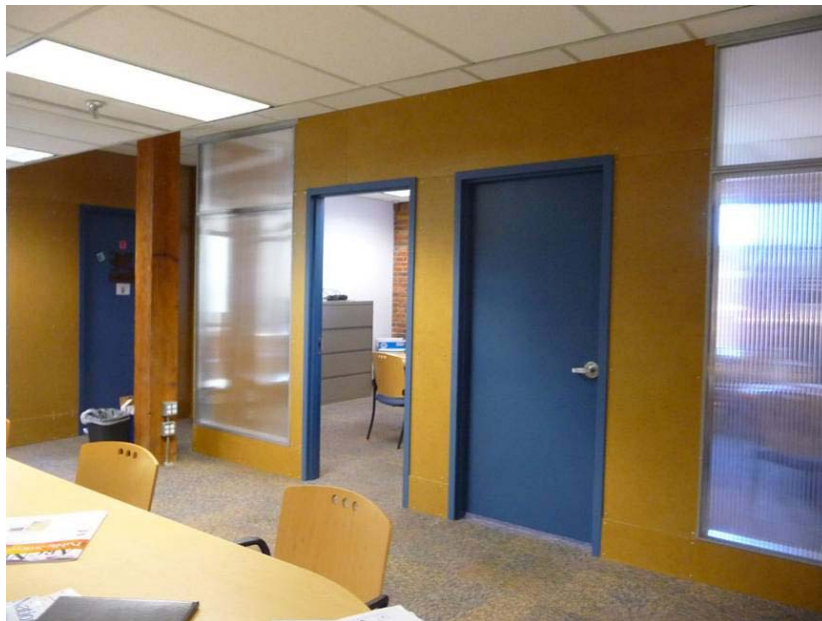
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**HVAC:** The commissioning on the existing HVAC system determined a need to increase the ventilation level and identified an opportunity to install economizers. Pneumatic temperature controls were replaced with direct digital controls (DDC) which allow the building operators to set heating and cooling levels via computer. This system has the capability for both interior temperature monitoring and “load shedding”, saving the Alliance money on peak demand rates.

**Envelope:** A Mylar film was applied on the interior of the east and west lobby curtain wall system. This curtain wall was part of a more contemporary addition executed in the 1970s to provide greater accessibility to the upper floors. Because these windows face east and west, the design team was able to effectively reduce glare and reflect 60% of the heat on sunny days. In the winter, the film reduces heat loss by reflecting internal heat back into the space.

**Lighting:** Nearly 1,000 40-watt T-12 lamps with magnetic ballasts were replaced with 32-watt T-8 lamps with high-efficiency electronic ballasts. This measure alone reduced the lighting energy consumption by approximately 40% and paid for itself in approximately 2.5 years.

**Daylighting:** Super-efficient ballasts installed on the fifth-floor east wing include photocell sensors that dim the lights



when sufficient daylight is present. Many office suites include translucent wall panels which allow the interior office spaces to receive natural daylight. The sixth-floor windows feature window shade screens which help to control light and glare levels and reduce heating gains and losses.

**Controls:** The lighting control system includes wall- and ceiling-mounted occupancy sensors in the private offices and meeting rooms. The time schedules for the air handling unit are set by a building automation system (BAS) which interfaces through the DDC system.

**Retro-Commissioning:** The mechanical engineering firm that upgraded the HVAC system to digital controls also conducted the retro-commissioning process. The firm quickly learned that the mechanical plans provided to its staff were not accurate. Much of the work involved on-site investigation and documentation, which resulted in the replacement of a rooftop unit, the addition of economizers and increased ventilation levels.

### Efficiency Measures

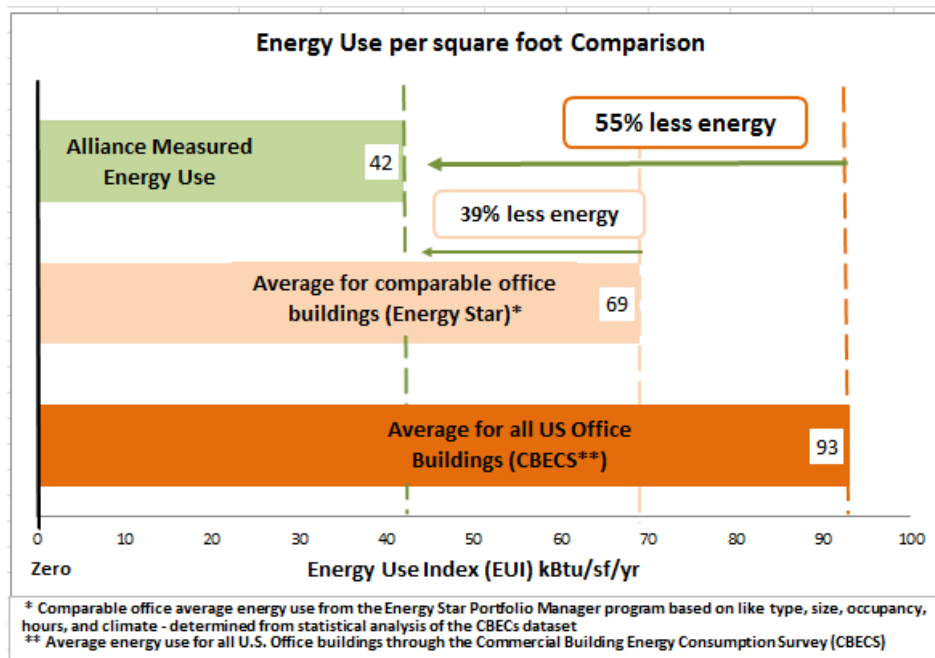
- Direct Digital HVAC Control system
- Occupancy sensors
- Photocells for daylight harvesting (fifth floor only)
- High-Efficiency glazing
- Commissioning
- T8 fixtures with dimmable ballasts
- Commissioning
- Photovoltaics
- Translucent Wall Panels
- Increased insulation
- Sun Shades (sixth floor only)
- Un-refrigerated water fountains

**Renewables:** The 2.04 kW rooftop photovoltaic array was installed in 2009 through a grant from a local solar company.

**Monitoring systems:** The Alliance Center is installing sub-meters in the building to provide detailed information on energy use. A recently completed retro-commissioning report includes a disaggregation of the utility bills, offering some insight into how energy is consumed. Area lighting uses 27%, followed by space heating at 25% and space cooling at 21 percent. The Alliance Center gets about 1,000 visitors a year given its role as a resource for implementing energy-efficient measures in businesses and homes.

## ENERGY PERFORMANCE

The Alliance Center is an all-electric building and uses utility bills to track its energy usage. Since the



Center opened in 2004, its occupancy has nearly doubled while it has continued to reduce its energy use through targeted conservation measures such as keeping plug loads low through the sharing of resources like printers and copiers. Through energy savings initiatives the Alliance Center has reduced its energy consumption by 22% since 2004. It now

uses 55% less energy compared to the average for offices in the U.S.<sup>1</sup> at 42 kBtu/sf/yr (EUI<sup>2</sup>). The U.S. average for all offices 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 calculation showed that comparable buildings would use less energy than the average for U.S. office buildings. The Alliance outperforms this reference set as well, using 39% less energy than the Energy Star estimate. The building's Energy Star rating of 85 (out of 100) places it in the top 15% of office buildings nationally.

<sup>1</sup> CBECS – The Energy Information Agency's Commercial Buildings Energy Consumption Survey 2003

<sup>2</sup> 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/yr.

## FINANCIAL

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**Total project cost:** \$117,000 \$3.07/sf (after incentives)

**Funding and Incentives:** The Alliance Center participated in the local utilities Demand Side Management program for the bulb and lighting ballast upgrades. The daylight harvesting ballasts on the fifth floor were installed independently of this program. The photovoltaic installation was funded through an \$11,200 grant from a local solar company.

The Alliance Center received a \$25,000 grant in 2006 from the Colorado Governor's Office of Energy Management and Conservation for installing informational and educational signs throughout the building, and for developing a self-guided tour and brochure.

In 2010, the Alliance Center was awarded a \$15,000 grant from the State Historic Fund in Colorado to provide a historic structure assessment and preservation plan, including detailed guidance on historic renovations, upgrades, and general upkeep.

The Alliance determined that the upgraded lighting system alone would reduce that portion of its energy costs by over 40%, and that the retrofit would pay for itself in 2½ years.

**Estimated Annual Cost Savings:** The Alliance Center estimates the building energy upgrades provide annual cost savings of \$8,800.

## PROJECT RESULTS

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**User Satisfaction:** A report completed by students at the University of Colorado Denver titled "Measuring Sustainability: Quantifying Greenhouse Gas Emissions and Assessing the Value of Shared Services and Collaboration at the Alliance Center" contained a number of occupant surveys. When asked to describe the direct benefits of being associated with the Alliance Center, responses included:

*"Added organization legitimacy and credibility, recognition to organization name, a sense of unification and prestige, added recognition for dedication to the environment, built-in fundraising and networking opportunities, an enhanced organization profile as a sustainability leader."*

**Innovation:** In an interview, Alliance Center director Phillip Saieg cited the DDC installation in the Alliance Center as especially innovative. This system has allowed the building operators to continue to fine-tune the heating and cooling requirements in this historic structure.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner Representative: Phillip Saieg, The Alliance for Sustainable Colorado
- General Contractor: Sprung Construction, Inc
- Architect: ShearsAdkins Architects
- LEED Consultant: Ambient Energy
- Mechanical Engineer: E Cube

### Sources:

- The Alliance for Sustainable Colorado: Phillip Saieg
- TMCx Colorado Retro-Commissioning & Energy Analysis Report
- Slaterpaul Architects Historic Structure Assessment and Preservation Plan
- The Alliance for Sustainable Colorado Website
- Design Cost Data Case Study

**Photos:** Courtesy of Slaterpaul Architects

### 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 Getting to 50 work supported by the Doris Duke Charitable Foundation and Kresge Foundation

## EXISTING BUILDING RENEWAL INITIATIVE

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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 net-zero-energy use by commercial buildings.

*For more information on the Existing Building Renewal Initiative contact: Peter Wilcox [pwilcox@neea.org](mailto:pwilcox@neea.org) or [www.betterbricks.com](http://www.betterbricks.com)*

## THE BEARDMORE BUILDING

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
Brian Runberg	Priest River, ID	Office/Mixed-use	Major Renovation Historic	28,800	2	2009	1922

### OVERVIEW

Originally built in 1922 by Charles Beardmore, a timber and mining pioneer, the Beardmore Building in Priest River, Idaho, housed offices, mercantile shops, a ballroom and a theater. After decades of neglect under outside ownership, Brian Runberg, an architect and great-grandson of Charles Beardmore, purchased the building in 2006 and began an extensive whole building historic restoration. The location currently functions primarily as office space, with tenant leased area comprising 85% of the building (when fully occupied) and a 4,100 square foot theater to be renovated at a later time. According to Runberg, the building fosters *“a careful balance between preservation of existing features and the integration of new technologies and sustainable building practices.”* The Beardmore now has the distinction of being one of the few buildings in the country that is both LEED-Gold certified and on the National Register of Historic Places.



#### Recognitions:

- LEED-NC Gold
- 2010 American Association for State and Local History – National Award of Merit for Restoration
- 2009 Pacific Coast Builders Conference – Grand Award for Best Sustainable Adaptive Re-Use
- 2009 Pacific Coast Builders Conference – Merit Award for Outstanding Rehab Project
- 2008 The Idaho Historic Preservation Council – Orchid Award: Excellence in Historic Preservation

The project demonstrates a very successful renovation in terms of actual energy use compared to older buildings. The actual energy use of the occupied portion is currently 32 kBtu/sf/yr, 66% better than the average U.S. office building.

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
66%	Average for U.S. Offices*	32	90

\* U.S. Commercial Building Energy Consumption Survey (CBECS) 2003

## MOTIVATIONS

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**Project goal:** Committed to his family’s legacy as business owners contributing to community growth and careful stewards of the land, Brian Runberg was intent upon both restoring the building and using the sustainable and energy efficiency design principles that he incorporates into his own architectural practice. It was also important to him to play a part in revitalizing the Priest River community and economy by restoring the building to its former grandeur.

**Rationale and economic criteria:** A cost-benefit analysis was used to determine the economic impact of green building practices in terms of design, documentation, material salvage and construction. The owner/architect developed a methodology matrix to evaluate the sometimes contradictory requirements for federal and local incentives, LEED certification and preservation standards, focusing on the most cost-effective strategies for energy, water and material use.

**Barriers and resolutions to energy efficiency measures:** The ground-floor retail level had intricate leaded glass transom windows which provided almost no insulating properties. The architect first proposed to sandwich the leaded glass inside an insulated glazing unit, but this was rejected by the state historic preservation office. The approved solution allowed a separate insulated glazing unit to be applied in the interior, retaining the exterior character but providing the necessary U-value performance for the energy targets. The historic nature of the building did not allow for a vestibule to be added at the front doors, so ground-floor heat loss in the winter months is an issue.

## TECHNOLOGIES AND DESIGN STRATEGIES

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**HVAC:** Runberg installed high-efficiency, packaged rooftop heat pumps with economizers, along with demand control ventilation (DCV) with CO<sub>2</sub> sensors and modulating outside air dampers. This allows ventilation to be based on actual occupancy rather than assuming full occupancy, and thereby reduces energy needs for conditioning and moving the air. The mechanical engineer determined that the common area of the building did not require cooling and instead designed a barometric damper assisted by ceiling fans located at the curb of the skylights to exhaust air and create a convection-based air flow within the central atrium.

**Envelope:** All the original wood windows were removed, restored and re-glazed with low-E, argon-filled insulated glass. Additional glazing was added to the interior of the leaded transom glass to preserve historic integrity and to improve energy performance. Extensive insulation was added to the exterior walls, including R-50 for the roof cavities. Reduced heat island effect resulted through the use of improved roofing materials and coatings with a high solar reflectance index.

### Efficiency Measures

- High-efficiency HVAC package units with economizer controls
- DCV with CO<sub>2</sub> sensors
- Increased insulation
- Improved roofing materials with high solar reflectance index
- Low-E glazing
- Lighting exceeds utility advanced lighting requirements
- Lighting night set-back and occupancy sensors
- Commissioning

**Lighting:** Light fixtures exceed advanced lighting requirements of the local utility incentive program. Vintage light shades were preserved and rebuilt with new fixtures using high-efficiency compact fluorescents. The central lighting system has a night set-back to ensure low-to-no energy use during unoccupied times. Restrooms have occupancy sensors.

**Daylighting:** After many years spent covered up, the original skylights were removed and refitted with new glazing to provide natural daylighting and ventilation.

**Controls:** The project also included HVAC scheduling and economizer controls, night set-back and occupancy sensors for lighting.

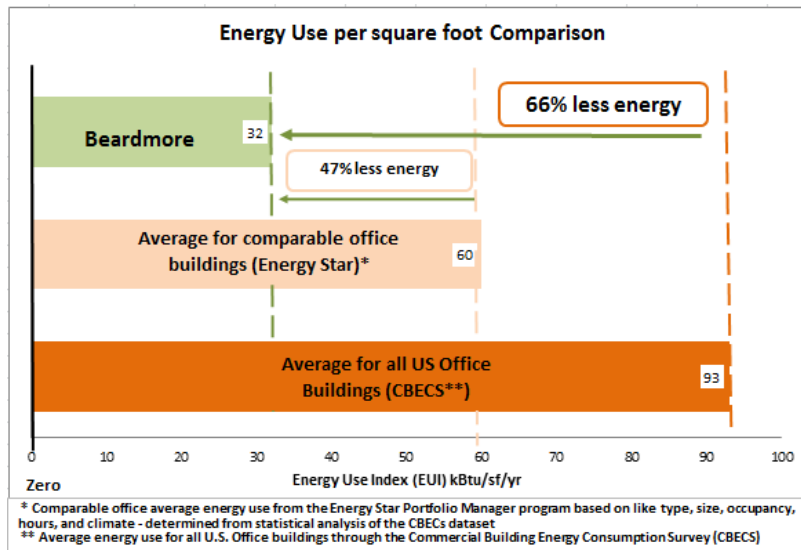
**Commissioning:** Standard commissioning prior to occupancy included testing of air infiltration, duct tightness, exhaust air flow rate and particulate and volatile organic compounds emissions.

**Structural:** While the increased exterior wall and roof insulation improved the energy performance of the building, it also resulted in more snow piling up on the roof in the winter months due to the absence of escaping heat. The structure had to be reinforced to handle the increased snow load without affecting the building’s historic character. The solution was to build a hidden steel frame on new footings inserted within the framework of the existing building, an unexpected and costly consequence for the project.

**Renewables:** The building is wired and ready for photovoltaic cell panels, but these have not been installed due to a payback period calculated to be 15-18 years and no available rebate.

**Site:** The site experienced a reduced heat island effect through the location of shaded parking areas.

**Monitoring systems:** Whole-building and individual tenant electric meters are used throughout.



## ENERGY PERFORMANCE

The Beardmore, excluding the theater, is currently using just 32 kBtu/sf/yr (EUI<sup>[1]</sup>) – 66% less energy per square foot than the average for offices in the U.S. 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

<sup>[1]</sup> An Energy Use Intensity (EUI) is the total annual energy (gas and electric) used expressed in thousands (k) of British thermal units (Btu) divided by the square feet (sf) of the space – resulting in a commonly used metric of energy use in kBtu/sf/yr.

example, the Energy Star program calculated that comparable buildings would use less energy than the average U.S. office building; yet the Beardmore performs even better - by nearly 50 percent. Based on its energy utility information entered through the Energy Star Portfolio Manager program, the Beardmore earns an ENERGY STAR score of 90 (out of 100), putting it in the top 10% of office buildings in the U.S. for energy performance. The Beardmore provides an excellent example of a dated existing building that, through the owner's attention to upgrades utilizing readily-available energy technologies and design during a major renovation, has attained a level of efficiency twice that of comparable buildings.

## FINANCIAL

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**Total project cost (excluding theater):** \$2,600,000 \$105/sf (after incentives)

**Funding and Incentives:** Because the Beardmore Building was on the historic register, the owner received a tax credit of \$366,571 for construction costs from the National Park Service. The credit was awarded for adhering to the Secretary of the Interior's Standards for Rehabilitation. The local utility provided a LEED certification and HVAC efficiency incentive of \$71,079. Due to recession market conditions at the time, construction loans were constrained and the project loan equaled about 25% of total funding.

**Estimated annual cost savings:** The LEED modeling analysis estimated an annual cost savings when fully occupied of \$23,370, a reduction of more than 50% compared to the national average of buildings of same type, size, occupancy, and climate zone.

## PROJECT RESULTS

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**Competitive positioning in the market:** The Beardmore Building has the potential for 11 tenants and is looking to be fully leased by the end of summer 2011.



According to Brian Runberg, tenants have been attracted to the Beardmore because of both its historic renovation and its LEED certification. Runberg believes the building has *"sparked new economic life into the community, giving it a renewed sense of pride and entrepreneurial spirit. Tenants saw the potential of what could happen in the building and came with innovative business ideas."*

Due to the Beardmore's energy efficiencies and overall unique historic qualities, rents average about 35% higher than other local properties.

Runberg states in the *Daily Journal of Commerce*: *"This transformation of a decaying obsolete and lifeless shell into a high-performance, healthy and vibrant environment*

*carries many benefits. The initial investment has proven itself to be financially prudent, with substantially lower operation costs, greater lasting quality, and a healthy environment for its users. Yet equally important is the preservation of an important historic landmark, one in which my own history is tied.”*

The renovation of the Beardmore Building has helped Runberg elevate his own architectural practice when client discussions turn to the cost/benefits of pursuing LEED certification and energy efficiency.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner: Brian Runberg, Beardmore Company
- Architect: Brian Runberg, Runberg Architecture Group
- General Contractor: Beardmore Company, LLC
- Mechanical Engineer: Jonathan Heller, Ecotope
- Commissioning Agent: WC Tomlin

### Sources:

- Brian Runberg, Runberg Architecture Group
- Ecotope: Jonathan Heller and Carmen Cejudo
- “They Built the Beardmore,” Cate Huisman, *Idaho Magazine* – January 2010
- “Sustaining the Future while Restoring the Past,” Brian Runberg, *Daily Journal of Commerce* – April 2009
- [www.beardmoreblock.com](http://www.beardmoreblock.com)

**Photos:** Marie Dominique Verdier

### Research and Development:

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## EXISTING BUILDING RENEWAL INITIATIVE

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This work is part of the BetterBricks program 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 in coming years. This is one of the ways the region can rapidly revamp existing stock to achieve 30–60% energy savings — on the way to net-zero-energy use by commercial buildings.

*For more information on the Existing Building Renewal Initiative contact: Peter Wilcox [pwilcox@neea.org](mailto:pwilcox@neea.org) or [www.betterbricks.com](http://www.betterbricks.com)*

## THE CHRISTMAN BUILDING

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
The Christman Co.	Lansing, MI	Office	Major Renovation Historic	64,200	5	2008	1928

### OVERVIEW



The Christman Building in Lansing, Michigan, is the national headquarters for The Christman Company, a construction management and real estate development firm. Originally built in 1928 and registered as a historic landmark, the former *Mutual Building* had fallen into a state of disrepair under previous ownership. Christman purchased the building and, using its own team specializing in historic preservation; sustainable design and construction; urban revitalization; real estate development and integrated project planning, “breathed new life into the grand old building.” The project consisted of 92% major renovation and 8% new construction. Rededicated in February 2008 as the Christman Building, it currently provides office space for Christman and two additional tenants.

The Christman is one of the few Triple LEED Platinum buildings designated by the U.S. Green Building Council’s Leadership in Energy and Environment (LEED) Program. This highest-level designation through the LEED programs for Existing Buildings Operation and Management (EBOM), Core and Shell (C&S) and Commercial Interiors (CI) is a testament to a full range of sustainable practices guided by LEED but accomplished by Christman.

The building is located in a climate zone comparable to Montana, northeast Washington and eastern Idaho<sup>1</sup>, and its age and type are typical of many older buildings in small northwest cities. The measured energy use of this historic structure is now 29% better than comparable buildings in the U.S., and its Energy Star score of 81 out of 100 puts it in the top 20% in the U.S. for energy performance.

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
29%	Average for U.S. Offices*	66	81

\* U.S. Energy Information Agency’s Commercial Building Energy Use Index (CBECS 2003)

<sup>1</sup> Climate Zone 6

## MOTIVATIONS

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**Project Goals:** Christman developed the following five design criteria to help it meet its project goals:

1. Represent the company's core values, people, energy, expertise, accomplishments and history.
2. Encourage team collaboration internally, with branch offices and customers in both informal and formal settings.
3. Create an environment that shares successes and energy and provides for mental and physical breaks.
4. Maximize comfort with individual thermal and lighting controls, ergonomic workstations and daylighting.
5. Plan adaptively for growth, change and the space needs of short-term, on-site project personnel.

The Christman Company's CEO and Sustainability Manager were both enthusiastic regarding their objectives and the desired outcomes.

*"[Christman's] quest is to provide the best possible tools and expertise to customers in achieving their own green building and operations goals. What better way to learn how to do that than by taking ourselves through the process, and experiencing it first-hand from an owner's perspective?"*  
- Steve Roznowski, CEO

*"We designed to our own goals rather than relying solely on a LEED checklist; we didn't want to be 'teaching to the test.'" - Gavin Gardi, Sustainability Manager*

**Rationale and economic criteria of selecting energy efficiency options:** Using an integrated approach, Christman was able to incorporate energy efficiency into the project and to prove it could be accomplished within a tight budget. The company engaged in extensive estimating and an HVAC life-cycle cost analysis to ensure the project would remain within budget. Christman advocated strongly for the under-floor air distribution system as it improved energy efficiency and indoor air quality and resolved architectural issues.

**Barriers and resolutions to energy efficiency measures:** Christman wanted to use a daylighting approach with controls and dimmable ballasts, but found the cost at the time was too high (it was estimated to increase the cost of the light fixtures by one-third).

## TECHNOLOGIES AND DESIGN PRACTICES

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The project was a whole-building major renovation, allowing for consideration of many efficiency technologies and approaches. The building was not occupied during construction.

**HVAC:** Christman designed HVAC systems and selected equipment to minimize energy use while providing individually-controlled comfort conditions. It estimated the under-floor air distribution system to be more energy-efficient than conventional ducted systems. All cooling equipment uses refrigerants that cause minimal damage to the environment.

**Envelope:** Christman selected the white roof and 6" of added insulation to reduce the urban heat island effect and energy use. The original front façade window frames have been restored and fitted with double-glazed glass for comfort and energy efficiency. The building's side and rear exterior windows have been replaced with high-efficiency aluminum windows.

**Lighting:** Additional background lighting is provided by high-efficiency fixtures and T-5 fluorescent lamps with a very high color-rendering index (CRI). All workstations have individually controlled multi-level task lighting. Time of use is controlled by occupancy sensors in private offices and stairways and by programmed control panels in common spaces. The lighting system energy savings are projected to be 27% lower than that observed with a standard system.

**Daylighting:** Large perimeter windows provide daylighting to 92% of occupied spaces building-wide, and outside views to 90% of the occupants. Daylighting controls were not incorporated into the project due to cost.

**Controls:** The web-based building management system (BMS) has several thousand control points which are used to operate the building systems for maximum efficiency and comfort. Energy use is metered at the building and tenant levels to encourage conservation. Lighting includes program control panels and occupancy sensors.

**Computer network controls:** Christman has an IT program that enables central control of computers and monitors and allows equipment to be put into a verified sleep mode when not in use.

**Commissioning:** Re-commissioning and ongoing commissioning of all HVAC, lighting and domestic water systems ensure all systems operate as designed and are continually fine-tuned.

### Efficiency Measures

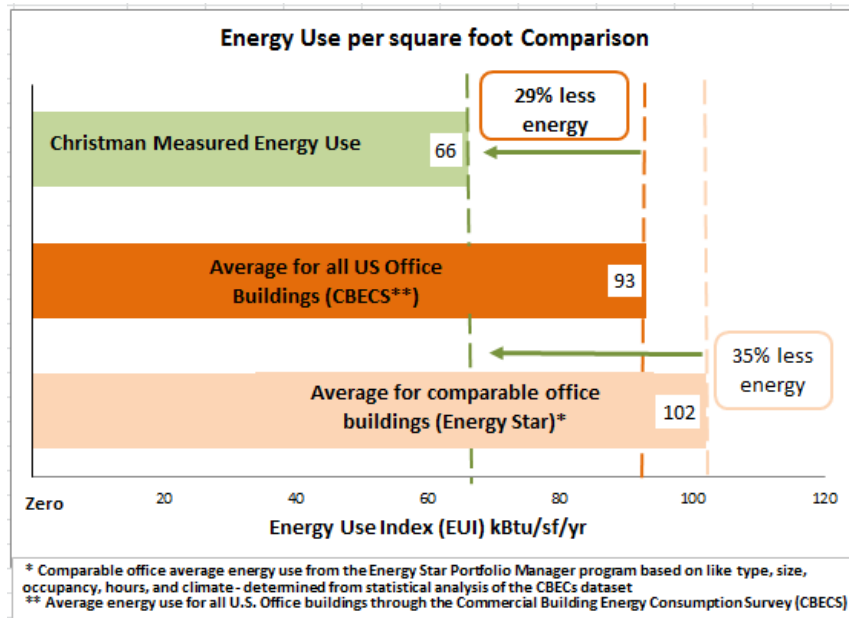
- High-efficiency HVAC units
- Under-floor air distribution system
- Increased insulation
- Reflective roof
- Insulated glazing
- T-5 fluorescent lighting
- Lighting program control panels
- Occupancy sensors
- Large windows providing daylighting
- BMS whole building controls
- Commissioning

## ENERGY PERFORMANCE

Christman found that the building was not meeting its energy goals after it opened in 2008. According to Gavin Gardi, the original building commissioning was not successful as it focused on individual sub-

systems rather than on the building as a whole.

*“We didn’t use the right approach the first time, but later when we did re-commissioning we were able to correct a lot of the energy issues.”*



The energy use for the first year of occupancy after renovation was 118 kBtu/sf/yr (EUI)<sup>2</sup>. Christman pursued a full building recommissioning and reduced its energy use by 44% the next year to 66 kBtu/sf/yr , a powerful endorsement of the value of comprehensive

recommissioning. Christman also participated in USGBC’s Building Performance Partnership program, a program to track actual performance. Its 2010 Performance Report indicated the building’s energy use (after re-commissioning) of 66 kBtu/sf/yr is 29% less energy per square foot than the average for offices in the U.S.<sup>3</sup>. The U.S. average for all offices 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 buildings of like type, size, hours of use and climate. In this example the Energy Star program calculated that comparable buildings would use more energy than the average U.S. office building (probably driven primarily by the cold Michigan climate). The Christman Building, however, uses less energy than either reference – and 35% less energy than the Energy Star estimate. The building earned an ENERGY STAR score of 81 (out of 100), placing it in the top 20% of office buildings in the U.S. The Christman Building provides an excellent example of achievable results when an owner pays continuous attention to energy use and ensures systems are operating as designed.

**Monitoring systems:** Mr. Gardi is a firm believer in the importance of metering:

*“You can’t improve what you don’t measure.”*

Christman meters the whole-building gas, electric and water and has electric sub-meters for each floor.

<sup>2</sup> An Energy Use Intensity (EUI) is the total annual energy (gas and electric) used expressed in thousands (k) of British thermal units (Btus) divided by the square feet (sf) of the space – resulting in a commonly-used metric of energy use in kBtu/sf/yr.

<sup>3</sup> CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

## FINANCIAL

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**Total project cost:** \$8,913,200, \$138/sf (after tax credits).

The overall project cost was reduced from \$187/sf by actively pursuing several tax credits:

- \$672,500 in Michigan Brownfield Single Business Tax (SBT) Credits
- \$2 million in Federal Historic Tax Credits and \$500,000 in State Historic Tax Credits
- \$8.5 million in Federal New Market Qualified Investment Funds
- \$1.2 million (\$100,000/year for 12 years) in Property Tax Relief through establishment of a Federal Obsolete Property Rehabilitation Act (OPRA) District



**Funding:** Project funding was based on a public/private partnership. Through a development agreement via the Brownfield Authority with the City of Lansing, the project qualified for the Michigan Single Business Tax Credits for eligible costs associated with the project. The City also provided key economic information that supported requests for the New Market Tax Credits. Due to its expertise in making projects affordable, Christman successfully used these programs to achieve financial feasibility for rehabilitation of the obsolete building.

## PROJECT RESULTS

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**Competitive positioning in the market:** Christman describes its headquarters as the world's first triple LEED-Platinum (CI, CS, EBOM) building. Sustainability manager Gavin Gardi believes the building differentiates his company from others:

*"Tenants enjoy working here, the air feels fresh and is good for people with allergies; operating costs are low. People rave about the building."*

**Staff education/user satisfaction:** According to Gardi, Christmas has conducted some staff education on energy use, but more is needed. Staff members are aware of the need to turn off lights when they leave. One of the goals of the company is to keep employees and tenants as comfortable as possible.

**Innovation:** Gardi describes the most innovative aspect of the project as

*"...taking a historic building and transforming it into a high-quality, high-performance building at no additional cost within a tight budget."*

**Estimated annual cost savings:** The energy efficiency upgrades incorporated into the project result in an estimated annual savings of \$45,659. Implementation costs for the energy efficiency upgrades were \$22,693, with a payback period of six months.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner Representative: The Mutual Building, LLC
- Construction Manager: The Christman Company
- General Contractor: The Christman Company
- Architect: SmithGroup
- Commissioning Agent: The Christman Company
- M & E, Lighting designer: SmithGroup

### Sources:

- The Christman Company: Gavin Gardi, Sustainability Manager
- Christman website: [http://www.christmanco.com/portfolio.asp?id=106&cat\\_id=25](http://www.christmanco.com/portfolio.asp?id=106&cat_id=25)
- Building Green LEED case studies (membership required)  
<http://www.buildinggreen.com/hpb/overview.cfm?projectID=1894>  
<http://www.buildinggreen.com/hpb/overview.cfm?projectID=966>
- USGBC BPP Performance Report
- TCB Energy Savings Measures

**Photos:** Courtesy of The Christman Company and Gene Meadows

### Research and Development:

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

### Funding:

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

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## HOME ON THE RANGE

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
Northern Plains Resource Council	Billings, MT	Office	Major Renovation	8,500	1	2006	1940

### OVERVIEW

Northern Plains Resource Council (NPRC) organizes Montana citizens to protect the region's water quality, family farms and ranches, and unique quality of life. It is a member of the Western Organization



of Resource Councils (WORC), a regional network of seven grassroots community organizations. In 2003, Northern Plains and WORC decided to create a permanent home by purchasing and renovating an existing building - a vacant concrete block building constructed in 1940 as a grocery store. Working with High Plains Architects and Hardy Construction

Company, they managed to transform an uninsulated, largely windowless building — widely considered one of the most blighted properties in Billings, Montana — into a demonstration of “green” building strategies and technologies. *Northern Plains Resource Council website*

The U.S. Green Building Council (USGBC) prepared a case study on the Home on the Range Project in 2008, including data on energy performance for one year. This Project Profile builds on that information and provides updated owner feedback and energy use data.

#### Recognitions:

- LEED-NC Platinum
- 2007 Energy Star Award
- AIA Top 10 Green Awards 2008

Home on the Range (HOTR) demonstrates a very successful renovation in terms of actual energy use compared with older buildings. The actual energy use of the building is currently 46 kBtu/sf/yr, 51% better than the average U.S. office building.\*

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
51%	Average for U.S. Offices*	46	99

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

## MOTIVATIONS

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**Project goal:** The goal was to express the organizations' commitment to energy conservation and community values. The Home on the Range energy strategy is to minimize demand, incorporate as much energy efficiency as possible and maximize the use of renewable energy sources. Teresa Erickson, staff director at the Northern Plains Resource Council, felt it was important that the nonprofit become a model for green building for both the City of Billings and the State of Montana, with the ability to influence other buildings and owners. The building achieved LEED-NC Platinum and received the EPA Energy Star Award in 2007.

**Rationale and economic criteria:** According to owner representative Teresa Erickson, the building needed to align with

*"[their] values of promoting clean and renewable energy and fighting dirty energy. We don't want to pay any higher utility bills than we have to."*

NPRC consistently looked at costs and eliminated anything that was not functional, but eventually incorporated most energy efficiency measures considered into the project. Daylighting and radiant floors were the highest priority measures.

**Barriers and resolutions to energy efficiency measures:** Northern Plains Resource Council did extensive research into energy efficiency. Its employees knew what they wanted for their building, but were often questioned regarding their approach by the design professionals. NPRC was challenged to get the architect, engineers and contractors on board and transform them into "believers" in a low-energy building (NPRC succeeded). In addition, the project was built during a construction boom when prices were high, posing an additional challenge. This factored into their decision to install a permeable parking lot made from recycled, pulverized glass in response to a tripling in the cost of asphalt.

## TECHNOLOGIES AND DESIGN STRATEGIES

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**HVAC:** The building has a high-efficiency boiler; a radiant-floor hydronic system, which uses less energy than an air-based system; and a direct evaporative cooling system, which is more efficient than refrigeration air conditioning in Billings' climate zone. Fans use variable frequency drives. Monitoring CO<sub>2</sub> levels allows Northern Plains to minimize the percentage of outside air exchanged in the building while meeting American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards for commercial buildings.

**Envelope:** Energy demand was minimized with a building shell insulated to a higher degree than required by code. Because the wall insulation is on the exterior of the concrete block walls, the building benefits from considerable thermal mass. The renovation included low-E windows. Exterior walls and roofs were painted a light color, and the south windows incorporate the use of exterior louvers, awnings and trellises to reduce solar heat gain.

**Lighting:** T8 fixtures are used throughout the building. NPRC had looked at T5 and dimming ballasts but ultimately chose T8 since the lumens per watt were comparable. Daylight sensors turn off or dim fixtures when sufficient ambient light exists. According to Erickson, the general area lighting served by the T8 system is dimmed to the lowest reasonable level, with only task lighting in work areas for the majority of the year. Only during the winter months is natural light insufficient for general illumination. Erickson also noted the ideal would be sufficient penetration of daylight to work surfaces to eliminate the need for task lighting, but the task lighting does allow staff to exercise their personal preferences.

**Daylighting:** The building was designed in an open floor plan to allow daylighting to penetrate the space. Openings in the existing building (which was virtually windowless) were strategically located around the perimeter and on the roof (skylights) to deliver the right amount of daylight where needed. Perimeter windows have light shelves that evenly distribute daylight deeper into the building by reflecting it to the ceiling plane. The building is almost entirely day-lit. NEEA/BetterBricks provided a daylighting analysis and lighting technical assistance through the Daylighting Lab in Seattle.

**Controls:** Lighting controls consist of on/off photoelectric daylight sensors and occupancy sensors. The occupants routinely override the lighting controls in favor of flexibility, but as daylighting is the primary source of light, lights are off most of the time. HVAC controls incorporated into the project are thermostats with night set-back and occupancy-based CO<sub>2</sub> demand control ventilation (DCV). DCV allows for ventilation to be based on actual occupancy rather than assuming full occupancy, thereby reducing energy for conditioning and moving the air. According to Technology Coordinator Tim Ennis:

*“We have been continually fine-tuning the building controls to maintain a healthy, comfortable work space and at the same time prevent the wasting of energy.”*

**Commissioning:** One of the major lessons learned was the value of commissioning. Initially the owners did not want to pay the upfront cost, but the contractor was committed to the project and gave them a reduction in cost. The commissioning agent identified problems with the installation of the radiant-floor hydronic system and worked closely with the controls contractor to fine-tune the control system and allow for easier identification of issues by the building operator. Through the commissioning process, Home on the Range realized substantial savings in both maintenance and energy costs.

**Renewables:** The building has a 9.9 kW photovoltaic (PV) system and a solar water heater on the roof. The PV system has produced an average of 34% of the electricity and 15% of total energy over the 2006-2010 period, and the system includes net metering, which facilitates the sell-back of excess electricity produced in the summer. Purchased energy is offset with green tags for wind power supplied through a

### Efficiency Measures

- High-efficiency boiler
- Radiant-floor hydronic system
- Variable frequency drives
- Demand Control Ventilation (CO<sub>2</sub> sensors)
- Increased insulation
- Low-e glazing
- Commissioning
- T8 fixtures with dimmable ballasts and daylighting controls
- Light shelves
- Occupancy sensors
- HVAC controls
- Photovoltaics

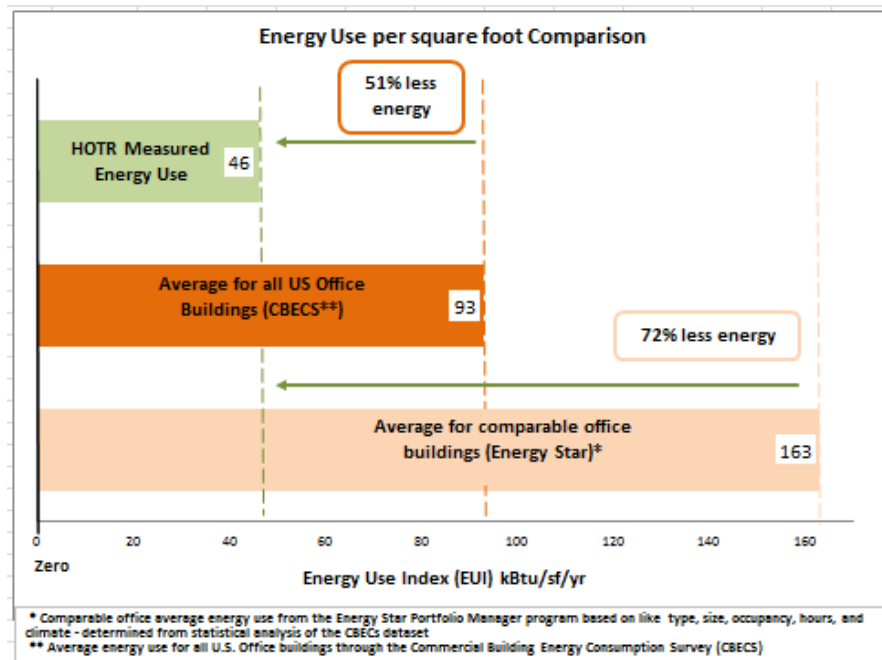
Green-e renewable energy contract. The efficiency aspects of the building – particularly evaporative cooling and daylight sensors to reduce electric lighting – lead to a peak electricity need on hot days lower than the PV generation. As a result, the Home on the Range building actually contributed electricity to the grid during hot, brownout-prone summer spells.

**Site:** The City of Billings granted the project a variance to allow for a permeable parking lot. Instead of asphalt, the parking lot is made of recycled, pulverized glass which is aesthetically pleasing, functions well and makes use of material that would otherwise go to waste. The glass parking lot has two other environmental benefits: its reflectivity mitigates the urban heat island effect and allows the wattage of parking-area lighting to be reduced.

**Monitoring systems:** While it does not sub-meter the building, Northern Plains does track utility bills on a monthly basis. By fine-tuning controls, it has achieved an estimated five percent additional savings over the last five years. The building is typically occupied by 25 people working a standard 40-hour office work week. NPRC also averages 20 visitors per week (approximately two hours per visitor).

## ENERGY PERFORMANCE

Home on the Range has tracked its electric and gas bills since occupancy in mid-2006. This data showed the energy use of the building in 2010 of 46 kBtu/sf/yr (EUI<sup>1</sup>) and an average energy use since



occupancy of just 44 kBtu/sf/yr - approximately half that of the average for offices in the U.S.<sup>2</sup> A more specific comparison can be made through the Energy Star Portfolio Manager program, which determines the energy use of a building of like type, size, hours of use and climate. In this example the Energy Star program calculated that comparable buildings would use more energy than the average for U.S. office buildings (probably

<sup>1</sup> An Energy Use Intensity (EUI) is the total energy (gas and electric) used expressed in thousands (k) of British thermal units (Btu) divided by the square feet (sf) of the space – resulting in a commonly-used metric of energy use in kBtu/sf/yr.

<sup>2</sup> CBCECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

driven primarily by the cold Montana climate). The HOTR Building, however, uses less energy than either reference point, and 72% less energy than the Energy Star estimate. The HOTR Building earns an ENERGY STAR score of 99 (out of 100), putting it in the top 1% of office buildings in the U.S. The actual whole-building energy use is also 12% below the LEED energy modeling analysis done for the renovation, which estimated 53 kBtu/sf/yr. The measured energy data also verified an approximate five percent drop from its 2008 use, indicative of continued improvement. At HOTR, photovoltaics produce close to 35% of total electricity and roughly 12% of total energy.

The HOTR Building is an impressive example of investing in design and systems during a remodel that optimize energy efficiency and that truly yield measurable results in terms of savings.

## FINANCIAL

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**Total project cost:** \$1,435,243, \$169/sf (after incentives)

**Funding and Incentives:** Member donations provided the bulk of initial funding, which was later supplemented by private foundation grants, a loan and grants from the Downtown Billings Partnership, and renewable energy incentives from Northwestern Energy. Northern Plains did a cost analysis comparing renting versus buying and found the cost of retrofitting was \$147/sf, compared to new construction without energy efficiency and green measures at \$186/sf. The property and existing building were purchased for \$182,808.

**Estimated annual cost savings:** Demolishing the existing structure and building a new office building the same size to the model energy code (ASHRAE-90.1-1999) would have cost approximately \$325,000 more than the cost of renovating to LEED Platinum status. Northern Plains realized an upfront cost savings of more than 20% to create a building with operating costs estimated to be 72% lower over a 20-year period. The payback period is negative.

## PROJECT RESULTS

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**Staff Education/User Satisfaction:** Northern Plains has implemented some staff education, but recognizes the need to do more. It requires employees to turn off computers, printers and lights when not in use. While it has not conducted formal user satisfaction surveys, Erickson said staff enjoys the daylighting and views:

*“Everyone loves the building, and the community has taken great pride in it.”*

**Innovation:** Erickson believes the most innovative aspects of the project are the light shelves and the pulverized glass parking lot.

*“The fact that we were able to ‘walk our talk’ has given us an advantage point as an organization.”*

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner Representative: Teresa Erickson, Northern Plains Resource Council
- General Contractor: Greg Hardy, Hardy Construction Company
- Architect: Randy Hafer and Ed Gulick, High Plains Architects
- Commissioning Agent: Ron Pecarina, Energy and Sustainable Design Consultants, Inc.
- Mechanical Engineer: Art Fust P.E., Energy A.D.

### Sources:

- Northern Plains Resource Council: Teresa Erickson
- Western Organization of Resource Councils: Tim Ennis
- High Plains Architects: Ed Gulick
- Energy and Sustainable Design Consultants: Ron Pecarina
- Northern Plains Resource Council website
- USGBC LEED case study: <http://leedcasestudies.usgbc.org/overview.cfm?ProjectID=902>
- AIA Seattle 2010 Regional Top Ten Green Awards: *"What Makes it Green?"*

**Photos:** Courtesy of Northern Plains Resource Council and High Plains Architects

### Research and Development:

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

### Funding:

- The BetterBricks program of the Northwest Energy Efficiency Alliance (NEEA): Peter Wilcox, John Jennings and Mark Rehley
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## JOHNSON BRAUND DESIGN GROUP

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
JBDG Inc	Seattle, WA	Office	Equip Upgrade	8,000	2	Ongoing	1984

### OVERVIEW

Johnson Braund Design Group, Inc., is a full-service architecture, landscape architecture and interior design firm located in Seattle, Washington. In 2002, JBDG purchased a two-story office building built in 1984 to house its growing practice. The 8,000 square foot office space consumed over 400 kWh of



electricity per day, with a majority of that consumption coming from the building's original HVAC system, which was nearing the end of its life cycle. The owners sought to reduce this energy use by half while maintaining a realistic budget. By choosing to upgrade the HVAC system, lighting and controls, as well as adding rooftop photovoltaics, JBDG was able to dramatically improve the building's energy performance, reduce operating

costs and provide a test ground for energy-efficient design strategies to influence its clients. The JBDG Building now uses 69% less energy than the average for U.S. office buildings.\*

#### Recognitions:

- Pursuing LEED - O & M Platinum
- EPA Small Business Innovation Award

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
69%	Average for U.S. Offices*	29	94

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

## MOTIVATIONS

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**Project goals:** JBDG developed the following goals for the building renovation:

1. Reduce electrical grid consumption by 50%
2. Reduce water grid consumption by 50%
3. Receive a reasonable financial payback on all improvements
4. Improve occupant comfort

The energy focus of this project was initiated in 2007 when the original HVAC rooftop units failed. In considering its replacement and upgrade, the firm saw an opportunity to increase efficiency by cutting energy consumption in half while meeting a return on investment (ROI) goal of between five and six years. This basic principle was applied to all subsequent equipment replacements and upgrades.

**Rationale and economic criteria:** At the time of the HVAC replacement, a larger list was drawn up and included other energy efficiency upgrades that could be implemented to further reduce the building's energy load. A majority of these items have been acted upon with a focus primarily on HVAC, lighting and plug load measures. Envelope measures such as window replacement did not meet JBDG's five- to six-year ROI goal.



**Barriers and resolutions to energy efficiency measures:** Working with their in-house designers and engineers, JBDG had enough technically-qualified staff to identify, implement and track key measures and successes. The firm did run into some bureaucratic barriers with utility coverage. Due to its location at the "end of the line," JBDG did not qualify for fuel switching which would have enabled them to become an all-electric building and therefore offset more of their load through the use of on-site renewable power generation.

## TECHNOLOGIES AND DESIGN STRATEGIES

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The building was occupied during the various stages of work. Most of the obtrusive work occurred during non-business hours.

**HVAC:** The project team worked with a major manufacturer to specify a residential multi-fuel, high-efficiency heat pump in a side-by-side arrangement. The benefits of this selection included greater control flexibility, increased ventilation rates and a wider selection of high-efficiency heat pumps. This system is responsible for a majority of the building's energy savings. JBDG has also implemented an energy recovery strategy that reduces the cooling load to the server and uses the recovered heat to warm areas within the office.

**Envelope:** A glazed entrance was added to the front of the building to create a buffered transition space between the interior and exterior.

**Lighting:** Lighting was upgraded to T5-based fixtures with programmable start/stop ballasts that include occupancy sensors for the restrooms and kitchen area. In the open work area, individual work stations include built-in task lighting and an ambient uplighting element. The lighting control package includes daylighting and occupancy sensors. The connected lighting load is approximately 1.25 W/ft<sup>2</sup> (code at the time) but the daylighting and occupant controls significantly reduce the actual energy use.

**Daylighting:** Daylighting controls are incorporated in the open portion of the office.

**Controls:** Metering occurs at three primary panels. JBDG is able to monitor HVAC and server loads using an electricity management monitoring system. The lighting package provides data on lighting energy use.

**Renewables:** A photovoltaic system on the roof provides an annual output of 7,897 kWh, which offsets energy consumption by 14 percent.

**Plug Load Management:** Individual computer workstations are transitioning to laptops and LED monitors.

**Monitoring systems:** JBDG tracks overall office energy in three ways:

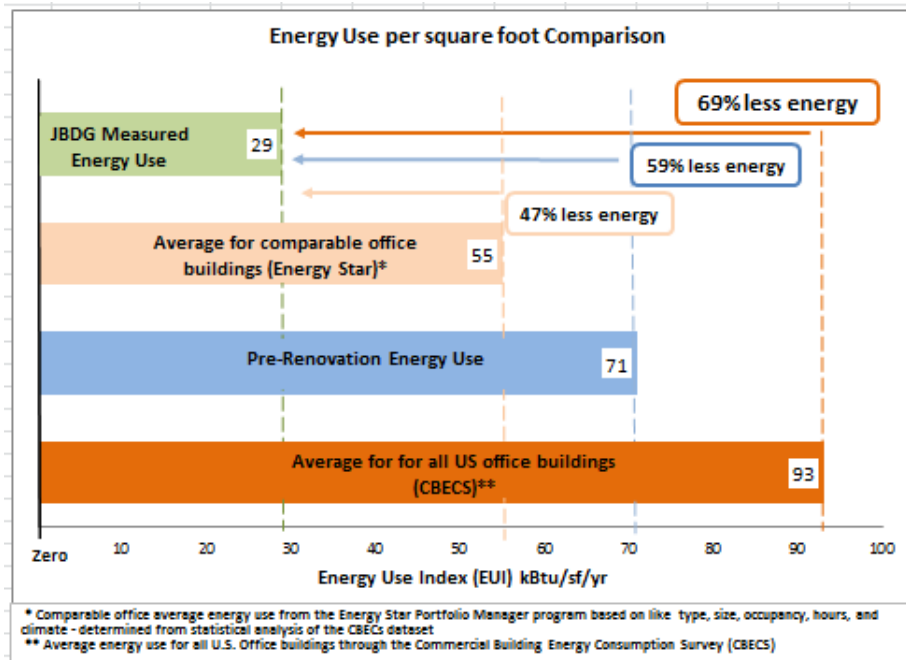
1. Electricity management monitoring system
2. Utility bills used to track performance in Portfolio Manager
3. Individual plug-in meters used to track the energy consumption of individual pieces of equipment

### Efficiency Measures

- High-efficiency HVAC heat pump
- Heat recovery
- Replaced entry doors
- Sealed and caulked existing windows
- Lighting upgrade to T5 fixtures
- Daylighting controls
- Occupancy sensors
- Electricity management monitoring system

## ENERGY PERFORMANCE

The JBDG office building has seen continuous energy use improvements since the firm began tracking energy use in late 2004. Its energy use intensity (EUI) for their first year of occupancy in 2004 was 71



kBTu/sf/yr (EUI<sup>1</sup>). The most dramatic improvement occurred after the fall of 2007 with the installation of the new HVAC system. Based on its energy utility billing data, the current energy use for the JBDG office building is just 29 kBTu/sf/yr – a 59% reduction compared to its first year of occupancy. The JBDG building uses 69% less energy when compared against the

average for offices in the U.S.<sup>2</sup> The U.S. average for all offices 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 calculation showed that comparable buildings would use less energy than the average for U.S. office buildings; the JBDG Building uses 47% less energy than the Energy Star average estimate. The building’s Energy Star rating of 94 (out of 100) places it in the top 6% of office buildings nationally.

<sup>1</sup> 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/yr.

<sup>2</sup> CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

## FINANCIAL

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**Total project cost:** \$250,000 \$31/sf (after incentives)

**Funding and Incentives:** Funding for the upgrades was provided through conventional bank financing typical to capital improvement projects. Incentives granted for the photovoltaic installation were:

- 30% Federal Tax Credit for photovoltaic installation
- Washington Renewable Energy Production incentive: \$5,000/year

**Estimated annual cost savings:** These improvements reduced annual operating costs by \$3,840, or \$.48/sf.

## PROJECT RESULTS

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**Innovation and Lessons Learned:** As a design firm, these projects and improvements have provided JBDG with what Steve Allwine, owner representative for JBDG, calls “*real world expertise*” and a high level of legitimacy when it comes to encouraging clients to undertake such projects. Allwine pointed specifically to the heat recovery solution installed as part of the HVAC upgrade, which has since been included in two bank projects on which the firm has worked. He believed the strategy was especially innovative as it captured heat from the computer servers, reduced the need for cooling and recirculated the heat to reduce the heating load.

In a case in which the design team was unable to convince a client to include a renewable energy source on its project, JBDG’s experience with photovoltaics helped the firm make the case for ensuring the project is solar-ready.

Allwine views Seattle’s *energy disclosure ordinance*<sup>3</sup>, adopted in January 2010, as an important requirement for building owners to seriously evaluate energy performance and act upon what they learn.

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<sup>3</sup> At the end of 2010 the Seattle City Council passed legislation (CB116731) requiring regular energy performance measurement and reporting for non-residential and multi-family buildings.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner Representative: Steve Allwine, Johnson Braund Design Group
- Construction Manager: Johnson Braund Design Group
- Architect: Johnson Braund Design Group
- Lighting Designer: Johnson Braund Design Group
- Mechanical and Electrical Engineer: Robison Engineering

### Sources:

- Johnson Braund Design Group: Steve Allwine, Facility and Project Manager
- [www.jbdg.com](http://www.jbdg.com)
- USDOE Buildings Database
- Energy Star Portfolio Manager
- JBDG Case Study - “Small Office Renovation”

**Photos:** Courtesy of Johnson Braund Design Group

### 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

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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 net-zero-energy use by commercial buildings.

*For more information on the Existing Building Renewal Initiative contact: Peter Wilcox [pwilcox@neea.org](mailto:pwilcox@neea.org) or [www.betterbricks.com](http://www.betterbricks.com)*

## THE LOVEJOY BUILDING

Owner	Location	Building Type	Renewal Description	Size SF	Stories	Project Completion	Year Built
Lovejoy Building LLC	Portland, OR	Office	Major Renovation	20,000	2	2004	1910

### OVERVIEW

Originally built in 1910 as the stables for the Marshall-Wells Hardware Company, the Lovejoy Building is the home of Opsis, an architectural design firm practicing sustainable design. The building is located in Northwest Portland in an area known as “Slabtown,” formerly home to early lumber mill workers. The owner architects purchased and renovated the historic building in 2003 to house their growing business and to provide ground-floor office lease space and second-floor offices for their firm. Retrofit of the



existing load-bearing brick structure required a major seismic upgrade. The architects used this as an opportunity for an integrated response to advanced structural upgrades, enhanced user thermal comfort and improved energy savings.

Opsis wanted to use the building to experience and demonstrate the technologies and practices it

promotes with clients. Creating an open, comfortable and resource-efficient office space was a priority; incorporating upgraded efficiency features was considered an integral part of the normal project budget.

The building’s actual energy use is 40 kBtu/sf/yr, 57% better than the average for office buildings in the U.S. The building also qualified for the U.S. Green Building Council’s Leadership in Energy and Environment (LEED) certification at a Gold level in 2006.

#### Recognition:

- LEED-NC Gold

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
57%	Average for U.S. Offices*	40	92

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

## MOTIVATIONS

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**Project goal:** The goal of the project was to create a building that aligned with the culture and professional objectives of Opsis. The owners designed their space to formulate a living laboratory to showcase, and experience, the various energy-efficient and sustainable design features they incorporate into their work. According to one of the owners, James Meyer:

*“There can be a disconnect for architects to understand the real world and what it means to be the one to write the check. We wanted to ‘walk the talk’ as proponents of green building design for our clients.”*

**Rationale and economic criteria for selecting energy efficiency options:** The architects at Opsis placed priority on a large uninterrupted office space supporting an open collaborative work environment. An in-floor hydronic heating and cooling system was chosen to optimize open space as well as to provide greater individual thermal comfort. Vertical and horizontal glazing offered everyone access to an effectively daylighted work environment and enhanced views to the outside. Opsis recognized the common tendency to consider energy efficiency measures as “add-ons” that can be value-engineered out during cost-cutting sessions. The firm’s design approach demonstrated a holistic integration of all components, with efficiency as an imbedded part inseparable from the design and project program.

**Barriers and resolutions to energy efficiency measures:** Opsis wanted to incorporate as many energy-efficient measures into the building as possible, and it was able to include almost everything it considered. Lighting controls, operable windows and night flush were some of the measures for which the owners were willing to pay more. Radiant concrete walls were studied but were determined to be cost-ineffective.

## TECHNOLOGIES AND DESIGN STRATEGIES

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The project included a whole-building envelope upgrade (the building was not occupied during the renovation). The additional efficiency strategies outlined below were incorporated into the 13,660 sf occupied by Opsis. A subtenant leases the remaining area, which has three different mechanical systems; the owners currently have efficiency or green tenant lease requirements.

**HVAC:** An in-floor PEX pipe hydronic system provides the building’s primary heating and cooling, coupled with an integrated natural ventilation strategy using windows, skylights and ventilators. In the winter, water runs through the thermal mass, creating a stable temperature range while introducing heat low in the space. In the summer, the building is set for a night purge: cool night air introduced into the building removes the heat gains of the previous day, leaving the space cool for the next morning. In addition, the radiant slab hydronic system collects heat out of the slab, running the water through a rooftop chiller where the heat is removed; the cool water is then recycled back through the in-slab piping system. The radiant floor strategy requires significantly less space for equivalent heating and

cooling than a material- and energy-intensive forced air system, with the additional benefit of less recirculated air, resulting in improved air quality and human comfort.

**Envelope:** A seismic upgrade required adding to the thermal mass of the building. New high fly-ash concrete perimeter walls and a concrete floor system were poured in place, with the added benefit of improving the efficiency of heating and cooling the building by increasing its thermal mass. The original windows were enlarged to improve views and bring light deep into the space. The addition of 14 skylights provides additional natural light to the top floor of the building. Low-E high-efficiency glass is used to minimize heat, and operable windows are controlled by the building management system to maintain temperature and air quality. Automated sunshades on the west face of the building block unwanted light and heat gains.

**Lighting:** The primary lighting system is suspended direct/indirect T8 fixtures with dimmable ballasts. The lighting system includes integrated daylighting controls to automatically dim electrical light.

**Daylighting:** The office space was modeled for uniform natural balanced daylight using a heliodon at the Energy Studies and Buildings Laboratory in Portland. Daylighting strategies include open office space, enlarged windows, skylights and a white ceiling for reflective purposes. Daylight controls reduce electric lighting, and west facing exterior automated sunshades reduce glare and heat gain.

**Controls:** The lighting and HVAC systems are controlled by a whole-building Energy Management Control System (EMCS) and sensors. The digital system modulates lighting according to daylight levels with zoned photocell sensors located on the open office ceiling. Automated sunshades on the west face of the building are controlled by photocells set to an astronomical clock.

Rather than using the standard fixed ventilation rates per person based on assumed full occupancy, Opsis uses carbon dioxide (CO<sub>2</sub>) sensors in the office to interpret occupancy density. This system of CO<sub>2</sub> sensors, known as Demand Control Ventilation (DCV), sends data to the building management system to modulate ventilation air (which requires energy for conditioning) to accommodate actual occupancy needs.

**Plug Load Management:** When the staff at Opsis moved into their new space, they replaced their old CRT monitors with more energy-efficient flat screens. Opsis recently installed an electricity management monitoring system to review plug loads and energy usage in real time.

**Commissioning:** The project included enhanced commissioning, and the electricity management monitoring system allows for feedback to direct ongoing commissioning.

**Monitoring systems:** The building has two electrical meters, one for Opsis and the other for its tenant.

### Efficiency Measures

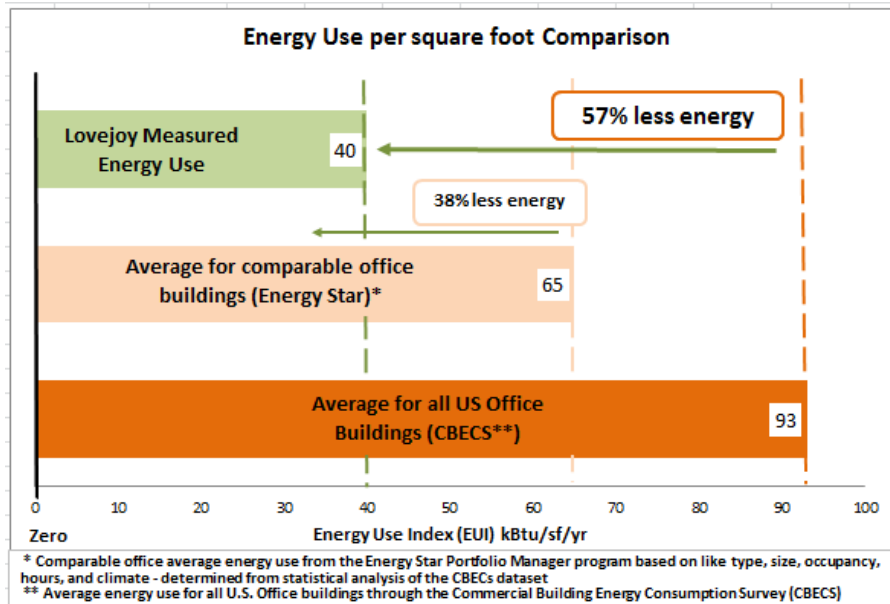
- High thermal-mass envelope
- In-floor radiant slab with hydronic heating and cooling
- Night cool air purge
- Low-E glazing
- Automated sunshades
- Skylights
- Dimmable ballasts with integrated daylight controls
- Demand control ventilation with CO<sub>2</sub> sensors
- Open office with light surfaces
- Energy management control system

**Post-Renovation Additional Measures:** The original Direct Digital Controls (DDC) purchased for the building were reasonably-priced, but they lacked clear feedback and guidance. After three years, Opsis bought higher-end, more user-friendly controls.

**Renewables:** A photovoltaic system on the roof provides 2,500-watt maximum output – enough to power six workstation computer environments.

## ENERGY PERFORMANCE

**Energy performance/savings:** Opsis has been tracking its monthly gas and electric bills since 2008. In 2010, energy use was 40 kBtu/sf/yr (EUI<sup>1</sup>) for the Opsis office space area – 57% less energy per square foot than the average for offices in the U.S.<sup>2</sup> 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 calculation showed that comparable buildings would use less energy than the average U.S. office building, yet the Lovejoy performs even better – using 38% less energy than the Energy Star estimate.

The Lovejoy Building earned an ENERGY STAR score of 92 (out of 100),

placing it in the top 10% of office buildings in the U.S. for energy performance. During 2010 the owners calculated a cost savings of over \$5,000 in energy (gas and electric) compared to the predicted energy costs for the renovated building through the LEED design model.

The Lovejoy Building showcases the energy efficiency potential of an older building upgraded with readily-available energy technologies and thoughtful design. The owners' interest in the energy features and continual monitoring increases the likelihood of success and provides a real-world example to their clients.

<sup>1</sup> 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.

<sup>2</sup> CBECS – The Energy Information Agency's Commercial Buildings Energy Consumption Survey 2003

## FINANCIAL

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**Total project cost:** \$2,300,000, \$115/sf

**Funding:** The owners used a construction loan to finance the building, receiving an Oregon Business Energy Tax Credit (BETC), but felt they were not as aggressive as they could have been in pursuing additional tax credits. They decided against registering the building as a historic landmark, thus giving up the associated tax credits, in order to retain the flexibility to enlarge the exterior windows and add sunshades. Opsis also chose not to go beyond LEED-NC Gold due to cost. According to James Meyer:

*“We took everything as far as we could within a tight budget and were able to prove that if you are smart with the design, you can achieve LEED-Gold cost-effectively.”*

## PROJECT RESULTS

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**Competitive positioning in the market:** Because the building is LEED-Gold, Opsis has been able to attract tenants committed to sustainability. While this does not necessarily mean higher rents, the space has been continuously occupied since it was constructed. The current tenant is an open source web design software company.



**Staff education/user satisfaction:** Opsis has a staff policy regarding turning off lights and computers when not in use. They did a Post-Occupancy Survey and found the majority of their employees were “satisfied” or “very satisfied” with their renovated work environment. Daylighting received the most positive response from users. When asked their levels of satisfaction with the quality of daylighting in the building, 70% of employees responded “very satisfied” and 30% “satisfied.” Eighty percent of employees surveyed

“strongly agreed” that working in a building that uses less energy and fewer resources was important to them, and the balance (20%) “agreed” that it was important.

**Innovation and Lessons Learned:** The architects at Opsis believe the most innovative aspect of their building is the in-floor hydronic heating and cooling system, as it is not common practice to incorporate both. The energy efficiency of the system has matched their high expectations and the user comfort has exceeded them. Although the straightforward daylighting strategy is not high-tech, they consider this aspect of the project very successful and most enjoyable.

## ACKNOWLEDGEMENTS AND SOURCES

### Project Team:

- Owner and Architect: Opsi Architecture LLP
- General Contractor: Gray Purcell
- Mechanical Engineer: Interface Engineering, Inc
- Electrical Engineer: Greenway Electric
- Sustainability Consultant: Brightworks

### Sources:

- Opsi: James Meyer, owner and principal
- Opsi: Randall Heeb and Chris Brown, architects
- Lovejoy Opsi Building case study
- Integrated Design in Contemporary Architecture by Kiel Moe

**Photos:** Courtesy of Opsi Architecture/Gene Faulkner

### Research and Development:

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

### Funding:

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

## EXISTING BUILDING RENEWAL INITIATIVE

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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 in coming years. This is one of the ways the region can rapidly revamp existing stock to achieve 30–60% energy savings — on the way to net-zero-energy use by commercial buildings.

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## 200 MARKET BUILDING

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

### OVERVIEW



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.

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

- John Russell, owner representative

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.

#### Recognitions:

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

#### Energy Performance:

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

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

## MOTIVATIONS

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**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.

**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

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**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.

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.

### Efficiency Measures

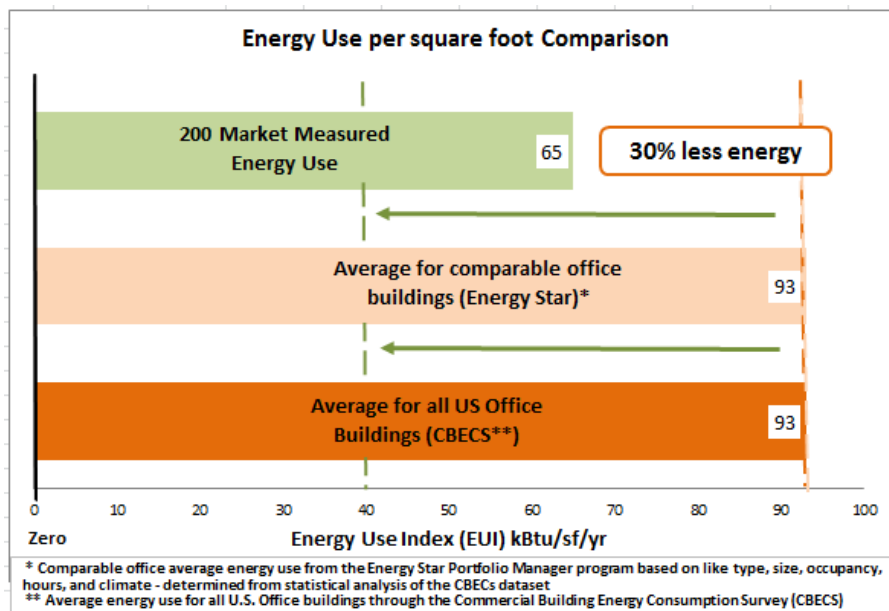
- Variable-Speed fan drives on all pumps and fans
- Variable air volume air handlers with waterside economizers
- Increased ventilation rate
- Roof insulation upgrade
- Dimmable lighting ballasts with motion sensors
- Direct Digital Control system
- Motion sensors and dimmable ballasts
- High-efficiency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

**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.

**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

The 200 Market Building’s measured energy use is 65 kBtu/sf/yr (EUI<sup>1</sup>), 30% less energy per square foot



than the average for offices in the U.S.<sup>2</sup> 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 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.

<sup>1</sup> 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.

<sup>2</sup> CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

## FINANCIAL

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**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

**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. The same report projected operating expenses to decline by an additional 3.3% in 2009.

## PROJECT RESULTS

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**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

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### 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](http://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:

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## MERCY CORPS HEADQUARTERS

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
Mercy Corps	Portland, OR	Office	Major Renovation and New Addition	83,000	4	2009	1892

### OVERVIEW

Mercy Corps is an international organization providing emergency relief service and sustainable economic development in 36 countries around the world. Its new global headquarters is located in the Packer-Scott building, a Portland landmark originally built in 1892. This building is 50% historic



renovation and 50% new construction, with a seismic retrofit acting as the “knuckle” between existing and new. The four-story building (with one floor below grade on the existing portion) includes corporate offices on the upper floors and a global learning center on the ground floor. Mercy Corps describes its new headquarters as

*“a green building, reflecting our commitment*

*to environmental sustainability. Climate change is one of our planet’s most critical challenges and a consideration in many of our programs around the world. Locally, we are seeking to reduce our organization’s carbon footprint which includes energy consumption, water usage and other environmental impacts.”*

The information in this profile addresses both the renovated and the new parts of the building.

#### Recognition:

- LEED-NC Platinum

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
61%	National Average*	36	93

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

## MOTIVATIONS

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**Project goal:** Mercy Corps' decision to build a new headquarters was based on the following goals:

1. Commitment to cost efficiency
2. Create a smaller environmental footprint
3. Provide additional space and consolidation of employees in a single location
4. Improved public involvement in its work

Having paid more than \$34,324 in monthly rent at its previous location, Mercy Corps determined that owning a building was more cost-effective than renting. Paying a mortgage resulted in a lower monthly payment going toward an appreciable asset that Mercy Corps now owns.

**Rationale and economic criteria:** It was important to Mercy Corps that the organization be fiscally responsible with donor contributions throughout the construction process. Pursuing energy efficiency supports its mission of sustainability, and lower operating costs allow it to spend more money on projects throughout the world. Mercy Corps was particularly interested in natural ventilation, so operable windows and motorized clerestory windows were included in the design. THA Architecture played a major role in guiding the design process with the owner, advocating for the energy efficiency and sustainable measures ultimately incorporated into the project.

## TECHNOLOGIES AND DESIGN STRATEGIES

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**HVAC:** The building's primary heating and cooling are provided by a multi-variable refrigerant flow (VRF) fan coil system. The system consists of 10 outdoor variable-speed compressor heat pump condensing units mounted on the roof. Two insulated refrigerant pipes connect the unit to a BC Controller. A central ventilation and exhaust shaft provides fresh air to each major space through a variable air volume (VAV) box controlled by carbon dioxide sensors. Energy savings from this system are realized through reduced pumping energy, a variable speed compressor, fan coils and outside air (OSA) set up in parallel, with heat recovery.

**Envelope:** Insulation was added at all exterior walls (R-10) and roof cavities (R-15). Existing windows are operable, and the glazing was replaced with double-paned insulated low-E glass. At the central atrium, motorized clerestory windows open to exhaust air.

**Lighting:** The overall lighting power density for the building is 0.91 W/sf. Actual energy use is reduced through the lighting control system. High-

### Efficiency Measures

- Variable speed compressor heat pump condensing units
- Variable air volume (VAV) box with CO<sub>2</sub> sensors
- Increased insulation
- Motorized clerestory windows to exhaust air
- Low-e glazing
- Direct/Indirect T8 fixtures with dimmable ballasts
- Daylighting controls
- Building Management System – controls
- Commissioning

efficiency lighting includes direct/indirect T8 fixtures with automatic dimming ballasts located in the perimeter offices.

**Daylighting:** Horizontal exterior shades are located at every floor on the south-facing façade. These shades are made with sage glass that darkens as the temperature increases and provides shading for the building. Large windows with views allow natural light to penetrate into the space. Perimeter office lighting operates with daylighting controls.

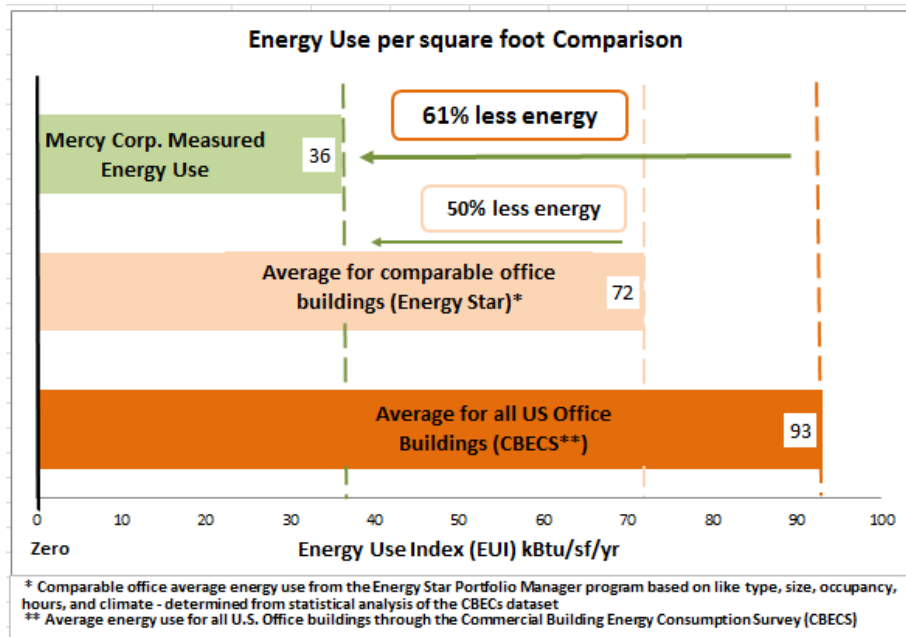
**Controls:** Building Management System (BMS), daylighting controls, occupancy sensors, motorized clerestory controls and computer sleep mode are all incorporated into the building.

**Commissioning:** Both fundamental and additional commissioning took place on the building, as required for LEED certification.

**Monitoring system:** Monitoring is conducted by means of Whole Building Management System (BMS).

**Renewables:** The building has the infrastructure for a 79kW photovoltaic array, but due to cost Mercy Corps has not purchased the panels.

## ENERGY PERFORMANCE



Actual energy use for the Mercy Corps Building in 2010 was 36 kBtu/sf/yr (EUI<sup>1</sup>) – 69% less energy per square foot than the average for offices in the U.S.<sup>2</sup>. The U.S. average for all offices 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 buildings of like type, size, hours of use and climate. In this example the Energy Star program calculated that comparable buildings would use less energy than the average for U.S. office buildings.

<sup>1</sup> 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/yr.

<sup>2</sup> CBECS – The Energy Information Agency’s Commercial Buildings Energy Consumption Survey 2003

This building, however, uses half the energy of the Energy Star estimate. The Mercy Corps building's estimated energy use after the major renovation was modeled compared to a baseline building per ASHRAE 90.1 -2004, and was estimated to use 43 kBtu/sf/yr. The actual energy use of just 36 kBtu/sf/yr (16% below the estimate) attests to the comprehensive and integrated nature of the efficiency measures selected and the continued attention to the building operations since occupancy. The building has an ENERGY STAR score of 93, placing it in the top 6% of office buildings nationally.

## FINANCIAL

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**Total project cost:** \$37,000,000 \$445/sf (new and renovation)

**Funding and Incentives:** The majority of capital for the building came from a private fundraising campaign. Mercy Corps received grants to incorporate efficiency measures into the project. The Lemelson Foundation owns 9% of the building. Scheduling and cost control were very important to the owners, who hired a construction manager to ensure the project remained on budget.

**Estimated annual cost savings:** Per ASHRAE 90.1 – 2004, the building is estimated to save \$37,624 annually, a 35% savings over a baseline building.

## PROJECT RESULTS

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**User Satisfaction and Innovation:** According to Hugh Donnelly, Manager of Administration and Facilities for Mercy Corps, user satisfaction for the building

*“...has been net positive all around. The goal of creating a community was absolutely achieved.”*

Employees enjoy working in the building and are adjusting to the open office environment, which is a change from their previous location. Donnelly believes the most innovative aspects of the building are the Building Management System and the method by which the clerestory windows exhaust air naturally.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner Representative: Mercy Corps
- Architect: THA Architecture
- Mechanical Engineer: Glumac Engineering
- General Contractor: Walsh Construction

### Sources:

- Mercy Corps: Hugh Donnelly, Manager Administration + Facilities
- Green Building Services: Ralph DiNola
- Glumac: Dana Troy
- Green Building Services: Historic Buildings – A survey of project profiles
- Historic Portland Building Revamped into LEED Platinum Mercy Corps Headquarters: by Yuka Yoneda 3/4/11 – *inhabitat*
- Mercy Corps, Center for Change - Portland Development Commission
- [www.mercycorps.org](http://www.mercycorps.org)
- US Green Building Council president visits Mercy Corps for LEED Platinum ceremony – Portland Architecture blog: Brian Libby 12/7/09

**Photos:** Courtesy of THA Architecture

### Research and Development:

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

### Funding:

- 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

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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 net-zero-energy use by commercial buildings.

*For more information on the Existing Building Renewal Initiative contact: Peter Wilcox [pwilcox@neea.org](mailto:pwilcox@neea.org) or [www.betterbricks.com](http://www.betterbricks.com)*

## THE JOSEPH VANCE BUILDING

Owner	Location	Building Type	Project Description	Size SF	Stories	Project Completion	Year Built
Rose Smart Growth Investment Fund	Seattle, WA	Office	Deep Retrofit/ Historic	134,000	14	2007	1929

### OVERVIEW

In 2006, the Rose Smart Growth Investment Fund I, L.P., acquired the historic Joseph Vance Building in downtown Seattle with the purpose of transforming it into “the leading green and historic class B”



building in the marketplace. The terra cotta Vance Building was constructed in 1929 and has 14 floors – 13 floors of offices over ground-floor retail with a basement for mechanical equipment and storage.

Since acquisition, the Rose Fund has made significant investments in renovating the building to improve energy efficiency and environmental performance, as well as tenant experience. The owner’s strategic investments included roof replacement with a LEED-approved, light-colored membrane; lighting retrofit; water fixture replacement; steam system retro-commissioning; window restoration; shading and light shelves; natural ventilation; and bike storage and shower facilities.

Additionally, the owner professionalized leasing and management practices, including green cleaning and integrated pest management, and created a green tenant improvement and operations manual to guide tenant behavior and tenant improvement work. These initiatives have led tenants to call the building “ground zero of the green movement” in Seattle. As a result, the owner has increased occupancy from 68% to 96% and has seen increased rents, tenant retention and net operating income, thus enhancing long-term value. In 2009 the U.S. Green Building Council (USGBC) awarded the Vance Building LEED for Existing Buildings (EB) Gold certification.

#### Recognitions:

- LEED-EB Gold
- 2009 Regional Top 10 Awards – AIA Seattle

#### Energy Performance:

% Better than Baseline	Baseline	Measured Energy Use (KBtu/SF/yr)	Energy Star Score
58%	Average for U.S. Offices*	39	98

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

## MOTIVATIONS

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### Project goals:

The owner's goal is *"upgrading the structure to be green, healthy, and attractive to current and future tenants who share a commitment to preservation, stewardship of the natural environment, and healthy indoor environments."*

*"The Vance Building presented a terrific opportunity to fulfill the investment mission of our firm—to acquire assets in walkable, mass-transit accessible locations that are ripe for repositioning and green retrofit. Vance's original, historic design attributes, such as terrazzo floors, high ceilings, operable windows and floor plans designed to maximize natural light, not only have great character but also have inherent environmentally sensitive qualities. We sought to uncover and restore these attributes while incorporating modern, energy-efficient green improvements. Our repositioning of the building has attracted a rich mix of tenants who love the building. We have also installed real-time energy monitoring that is getting tenants excited about energy conservation. The building has been dubbed in the press as 'ground-zero for the green movement in Seattle,' and overall, I think we have rekindled the dynamism that the original designers intended when the building was built in 1929." - Nathan Taft, Jonathan Rose Companies*

*"The approach was generally to try and take the building back to its roots – architecturally by strategies such as exposing the terrazzo floor, and the same principle for building systems, such as restoring natural ventilation. We started to pull back to the original systems, and then analyzed how we could incrementally apply modern technologies to get best performance. Simplification was the general philosophy." - Peter Alspach, Arup, Project Engineer*

### Rationale and economic criteria of selecting energy efficiency options:

The approach for the Vance retrofit was based on a goal of achieving LEED for Existing Buildings certification and evolved during an iterative design and costing exercise in late spring and summer of 2006. Even prior to acquiring the property, Rose had worked with an interdisciplinary team of architects and engineers to identify a range of potential renovation strategies and verify its acquisition budget.

After taking ownership, Rose engaged ZGF Architects; Arup; Magnusson Klemencic Associates; and Turner Construction to work collaboratively on devising a comprehensive renovation plan addressing both deferred maintenance items as well energy efficiency and aesthetic measures. Based on study, analysis and targeted energy modeling, the team made trade-off decisions to maximize the impact of



the funds invested in the renovation.

For example, architect ZGF approached interior renovations with a focus on simplicity, stressing open floor plan layouts and restoring high ceilings and operable windows. With assistance from Arup, ZGF and the project team conceptualized a natural ventilation strategy to meet tenant thermal comfort needs in the summer time. The strategy, which was quite simple, reductive and dependent on uncovering and restoring some of the building’s best original features, was the result of quantitative analysis, temperature monitoring and targeted façade solar gain studies. The team exposed floor and ceiling slabs, removed drop ceilings, and installed light shelves and MechoShade window shading systems along with ceiling fans—all in lieu of mechanical air conditioning. As another part of the renovation, the team devised an ongoing operations and maintenance plan to decommission cooling units at the end of their useful lives, transitioning office suites to natural ventilation over time.

**Barriers and resolutions to energy efficiency measures:** As with any renovation, unforeseen conditions led to adjustments. The process of pursuing LEED EB forced the team to consider the most cost-effective and practical solutions for required retrofit measures that had not come to light during initial due diligence. For example, compliance with ANSI/ASHRAE 62.1-2004 required additional fresh air in upper corridors and common basement spaces and improved air quality to tenant spaces based on site surveys and engineering evaluations, and also helped to balance the systems.

Finally, the fact that the building was occupied during the renovation added complexity, presenting coordination challenges that factored into balancing costs and benefits of green investments.

## TECHNOLOGIES AND DESIGN STRATEGIES

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The owner considered a full range of retrofit strategies such as total glazing replacement and HVAC replacement to address problems with original windows and an inefficient steam heating system; however, the design team soon recognized that substantial energy efficiency improvements could be made by thoughtfully optimizing the existing building features.

**HVAC:** The design team chose to retrofit the existing steam heating system, connected to the Seattle Steam downtown grid, rather than to replace the system, which would have been expensive and would have required significant invasions of the existing structure. Arup replaced the global thermal control with local controls so that the steam system is now regulated with thermostatic valves at individual radiator units, allowing individual zone comfort control and improved energy efficiency.

Arup and property manager Kidder Matthews completed a survey of the existing air conditioning equipment at the building and catalogued key data on each unit, screened them for harmful

### Efficiency Measures

- Removed ducted heating systems
- Recalibrated steam heating system
- Localized thermostats
- Operable windows
- Automated sunshades
- Lighting retrofit with automated controls
- Light shelves
- CO<sub>2</sub> sensors
- Re-commissioning

refrigerants, and decommissioned and recycled all inefficient units. The owner removed inefficient and unnecessary split and packaged direct-expansion (DX) equipment. Combined, these strategies resulted in a 56% decrease in energy used for heating.

As tenant leases expire, cooling units nearing the end of their useful lives are decommissioned and recycled.

The owner focused on the implementation of a building-wide natural ventilation strategy. The design team added mechanical ventilation systems in corridors and common areas to comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.1-2004, consistent with LEED requirements; the combination of operable windows and enhanced ventilation to corridors and basement has resulted in improved air quality and controllability. CO<sub>2</sub> monitors will eventually be automated and will cycle on and off as necessary.

Optimization of existing systems kept the project below the minimum requirements of Seattle energy code that are triggered by substantial alterations (such as replacement of systems), saving money both in capital costs and in design and construction time.

**Envelope:** The original, single-pane windows had broken hardware or were painted shut. The team restored operability with new and refurbished hardware, thereby allowing natural ventilation, which reduces HVAC demands and improves indoor environmental quality.

Simultaneously, performance of the windows was enhanced with the addition of weather stripping, which brought performance to an acceptable level and avoided the need for total glazing replacement. Window coverings were installed to improve occupant comfort.

**Lighting:** A lighting retrofit completed the energy efficiency equipment upgrade. Inefficient fixtures were replaced with T8 and T5 fixtures.

**Daylighting:** The 45-foot building width (the recommended width for passive design) allows natural lighting and ventilation. Light shelves on the south and west exposures reflect sunlight to light-colored ceilings, reducing the need for overhead lights. The team established design guidelines to ensure future tenants meet ASHRAE requirements for natural ventilation.

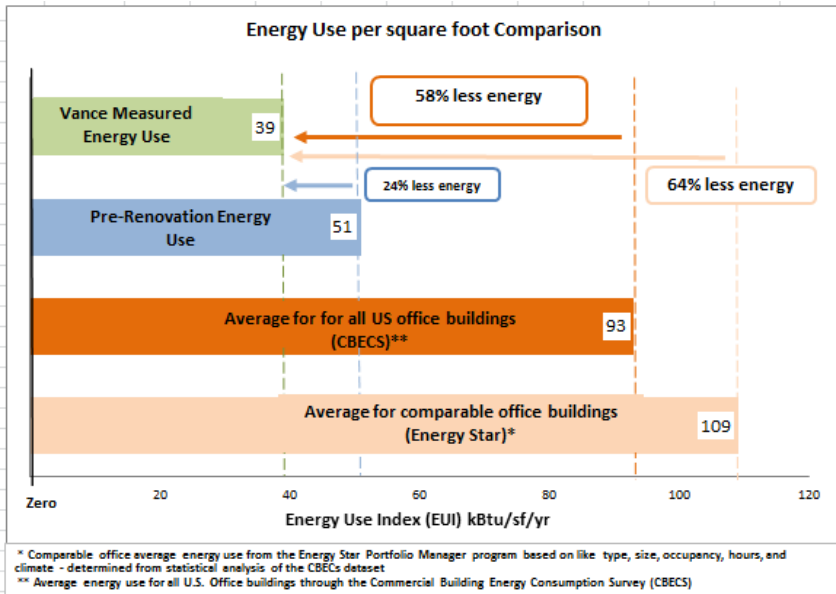
**Controls:** The building's original steam system was made more efficient by overriding the existing thermostats (one per façade) and installing localized thermostats on each floor. Lighting efficiency is achieved via occupancy sensors in all common areas and most tenant spaces.

**Commissioning:** Re-commissioning and ongoing commissioning of all HVAC, lighting and domestic water systems ensure that all systems operate as designed and are continually fine-tuned.

**Monitoring systems:** The Vance uses an energy dashboard tool to track real-time energy and water consumption for individual floors. Next steps include real-time energy metering at the tenant level, adopting "green lease" conditions and creating incentives for conservation.

## ENERGY PERFORMANCE

**Energy performance/savings:** The Vance Building energy use intensity for 2005, pre-retrofit, was 51 kBtu/sf/yr (EUI<sup>1</sup>). After the renovation, energy use dropped by 24% to just 39 kBtu/sf/yr. The Vance now uses 58% less energy per square foot than the average for offices in the U.S.<sup>2</sup> The U.S. average for all



offices 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 calculation showed that comparable buildings would use more energy than the average for U.S. office buildings. The Vance

outperforms this reference set, using 64% less energy than the Energy Star estimate.

The building's Energy Star rating of 98 (out of 100) places it in the top two percent of office buildings nationally. The building's pre-retrofit Energy Star rating of 93 is indicative of the fact that some older buildings perform better than anticipated due to less mechanical equipment, such as, in this example, a simpler HVAC system that does not require fan power and incorporates natural ventilation.

## FINANCIAL

**Acquisition Cost:** \$23.5 million (\$176/sf)

**Building Improvement Cost:** \$3.5 million (\$26/sf)

**Tenant Improvements & Leasing Commissions:** \$2.26 million (\$17/sf)

**Funding:** The project is owned by the Rose Smart Growth Investment Fund, an affiliate of Jonathan Rose Companies. Local utility incentives were used to help defray the costs of particular investments.

<sup>1</sup> 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/yr.

<sup>2</sup> CBECS – The Energy Information Agency's Commercial Buildings Energy Consumption Survey 2003

## PROJECT RESULTS

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**Competitive positioning in market:** The owner's retrofit strategies go beyond the building envelope and systems to include operations and maintenance.

The Rose Fund believes the proof of concept is self-evident: Since completion of the renovation, occupancy increased from 68% to more than 96% (currently 90% occupied).

*"Greening alone did not take the project from 68% to 96% leased, but marrying a green vision with an assiduous attention to real estate investment, development and operating fundamentals has attracted a dynamic tenant mix, increasing top-line revenues, net operating income and value."* –

Nathan Taft, Jonathan Rose Companies



**Tenant Requirements:** The owner and engineer worked with architect ZGF to create guidelines for tenant retrofits to guide design decisions for daylighting, ventilation, and finishes. Strategies include light shelves, MechoShades and high-level transom vents where interior, enclosed offices are required. These strategies are the responsibility of tenants and were not implemented throughout the building during the initial retrofit.

**User Satisfaction:** A 2010 Occupant Survey Report conducted by the University of California, Berkeley Center for the Built Environment shows that 77% of building occupants are satisfied with lighting levels. 85% of occupants indicated general satisfaction with the overall building and individual work spaces. Thermal comfort and acoustic environment were rated less highly, but still positively overall, and are specifically related to energy efficiency strategies such as operable windows and open floor plans, respectively.

**Innovation:** The project team continues to examine and fine-tune building performance through energy monitoring, post-occupancy surveys and a re-greening effort.

## ACKNOWLEDGEMENTS AND SOURCES

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### Project Team:

- Owner: Rose Smart Growth Investment Fund I, L.P., an affiliate of Jonathan Rose Companies
- Architect: Zimmer Gunsul Frasca Partnership
- General Contractor: Turner Construction Company
- Mechanical Engineer: Arup
- Structural Engineer: Magnusson Klemencic Associates
- Property Manager: GVA Kidder Matthews

### Sources:

- Nathan Taft, Jonathan Rose Companies; Peter Alspach, Arup
- Jonathan Rose Companies website: <http://www.rose-network.com/all-projects/the-joseph-vance-and-sterling-buildings-green-historic-office-and-retail-property>
- Energy Star Portfolio Manager Statement of Energy Performance

**Photos:** William Wright Photography (Page 1), Lara Swimmer (Page 2), Jeff Youngstrom (Page 6)

### Research and Development:

- Preservation Green Lab: Ric Cochrane
- New Buildings Institute (NBI): Liz Whitmore, Cathy Higgins, Mark Lyles

### 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

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