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## 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

## 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.

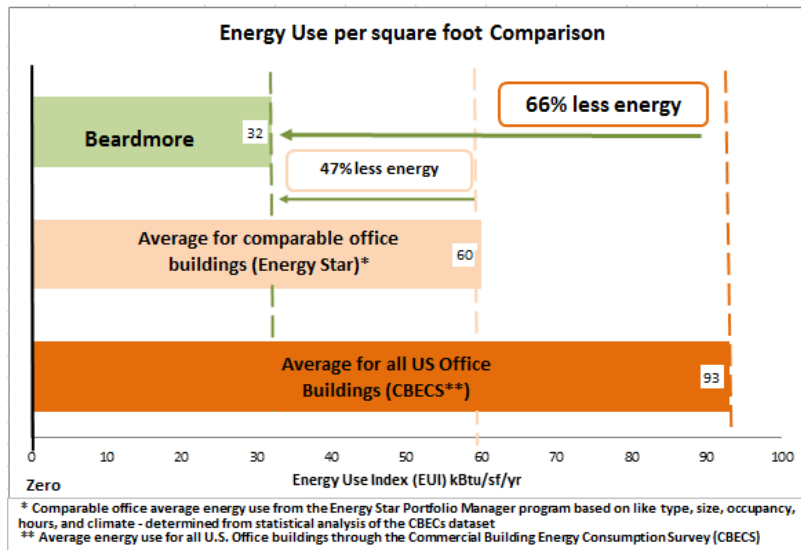
**Commissioning:** Standard commissioning prior to occupancy included testing of air infiltration, duct tightness, exhaust air flow rate and particulate and volatile organic compounds emissions.

**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:

- 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 also is supported by the Doris Duke Charitable Foundation and the Kresge Foundation

## 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)*