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Case Study

Deep Energy Savings in Existing Buildings

Overview

Site Details

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

THE BEARDMORE BUILDING

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.

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.

Motivations

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.

A cost-benefit analysis was used to determine the economic impact of green building practices in terms of design, documentation, material salvage and construction.

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.

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

Technologies and Design Strategies

HVAC: Runberg installed high-efficiency, packaged rooftop heat pumps with economizers, along with demand control ventilation (DCV) with CO^2 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

All the original wood windows were removed, restored and re-glazed with low-E, argon-filled insulated glass.

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.

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.

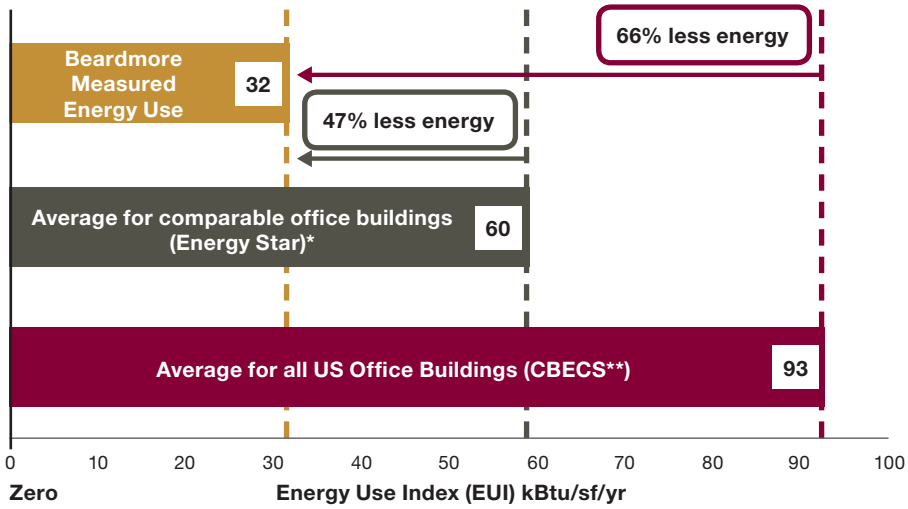
Monitoring systems: Whole-building and individual tenant electric meters are used throughout.

Efficiency Measures

- High-efficiency HVAC package units with economizer controls
- DCV with CO^2 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

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.

Energy Performance



* Comparable office average energy use from the Energy Star Portfolio Manager program based on like type, size, occupancy, hours, and climate - determined from statistical analysis of the CBECS dataset

**Average energy use for all U.S. Office buildings through the Commercial Building Energy Consumption Survey (CBECS)

The Beardmore, excluding the theater, is currently using just 32 kBtu/sf/yr (EUI[1]) – 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 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.

Energy Performance

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

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

Financial

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

1 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.

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

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

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

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

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

For more information on the Existing Building Renewal Initiative contact: Peter Wilcox pwilcox@neea.org or www.betterbricks.com

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

For more information about NBI's efforts to improve the energy performance of existing buildings, visit:
newbuildings.org/advanced-design/existing-buildings

New Buildings Institute

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