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Case Study

Deep Energy Savings in Existing Buildings

Overview

Site Details

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

Recognitions:

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

THE JOSEPH VANCE BUILDING

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.

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.

- Nathan Taft, Jonathan Rose Companies

Motivations

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

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.

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

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

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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 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^2 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

Efficiency Measures

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

The building's Energy Star rating of 98 (out of 100) places it in the top two percent of office buildings nationally.

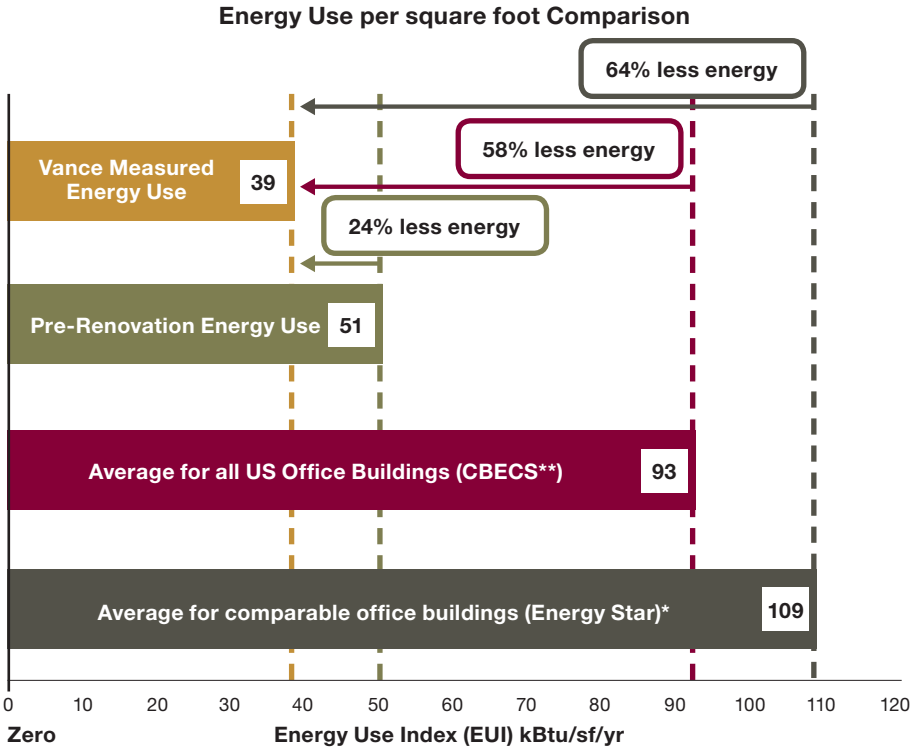
west exposures reflect sunlight to light-colored ceilings, reducing the need for overhead lights. The team established design guidelines to ensure future tenants meet ASHRAE requirements for natural ventilation.

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



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

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

Energy Performance

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

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

Energy performance/savings: The Vance Building energy use intensity for 2005, pre-retrofit, was 51 kBtu/sf/yr (EUI[1]). 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.[2] 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.

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

2 CBECS – The Energy Information Agency's Commercial Buildings Energy Consumption Survey 2003.

Project Results

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

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-josephvance-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

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:
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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.