

Case Study

Deep Energy Savings in Existing Buildings



Overview

Site Details

- Owner: Glenborough, LLC
- Location: La Jolla, CA
- Building Type: Medium Office
- Project Description: Renovation
- Size SF: 253,000
- Stories: 11
- Project Completion: 2010
- Year Built: 1990

Recognition:

- LEED-EB Platinum

THE AVENTINE

Built in 1990, the Aventine is a Class A office building designed by Michael Graves, one of the famous “New York Five” architects dedicated to modernism. The Aventine is located in La Jolla, California and consists of an eleven story office tower, an adjacent six-story office building, and a three-level underground parking garage.

The Aventine is certified LEED Existing Building Platinum and has an Energy Star rating of 100, the highest possible, and uses just 23 kBtus/sf, 75% less than the national average for offices. Retrofits addressed high-energy loads by replacing compressors and installing chillers, lighting and controls. The results are proof that substantial energy efficiency improvements can be made on a tight budget, especially if thermal envelope performance is already quite good. Building management and engineering staff show a continuing commitment to implementing cost-effective and new energy-saving technologies along with improving operational best practices.

“The Aventine is truly a case study worth sharing. Having an ENERGY STAR score of 100 for the last three years with just recently achieving LEED Platinum certification, this building, operation and the transformation that occurred is a great story to demonstrate to others how they can turn an average building into an ultra-high efficient building. It just takes commitment, focused effort and of course, making the right decision with capital dollars.”

- CARLOS SANTAMARIA, VICE PRESIDENT ENGINEERING SERVICES, GLENBOROUGH, LLC

Motivations

Project goals: Glenborough encountered a challenging leasing environment in the Aventine market, experiencing early lease terminations and low occupancy.

“We are constantly reinventing, capitalizing off events such as major retrofits where we learn from one project, and make it the catalyst for learning and applying lessons to our portfolio. We are proactive. We looked outside of conventional approaches and took some chances with new technologies. Even though there were some projects that didn’t have immediate payback, we grouped them with others so overall the project made financial sense.”

The goal for the project was to improve the building with an emphasis on reducing operating expenses to be more competitive.

Rationale and economic criteria: According to Vice President Carlos Santamaria, Glenborough is a dynamic company committed to constant progress, and the Aventine was treated as an opportunity to inform the company’s entire business model:

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The Aventine retrofit is an example of a wholesale commitment by an owner to the best possible outcome on a limited budget. The business case had to be made for retrofitting a building that was, at the time, only 16 years old. Glenborough conveyed the financial benefits of the retrofit internally and to the community at large to generate interest in the story of taking a good building and making it as energy efficient as possible. This proof-of-concept has led to similar approaches for other projects in the portfolio.

Barriers and resolutions: The most challenging aspect of the retrofit was preventing disruption to occupants. The Aventine was 100-percent occupied throughout the retrofit. Glenborough coordinated the work during nights and weekends and engaged tenants in the process to convey the resultant benefits.

Technologies and Design Strategies

In 2007, Glenborough focused on high energy-use loads – HVAC and lighting – and targeted aggressive improvements. The company determined that HVAC represented almost 50% of the building loads. The building had a recently installed chiller plant system, but the design team made the case that optimization of the chiller plant would be worth the investment for the projected energy savings.

HVAC: A feasibility study revealed that upgrading to an all-variable-speed chiller plant with automated controls, while keeping the existing two centrifugal chillers, would result in the greatest energy savings with minimal capital investment. With a projected payback of less than three years, the decision was made to convert the facility’s centrifugal chiller plant to a primary-only, all-variable-speed system and retrofit the two 300-ton chillers with oil-less variable frequency drive (VFD) centrifugal compressors. The work was completed in early 2008. Carbon dioxide (CO²) monitors were added to achieve optimal ventilation and to cycle down or off when occupancy was low to save energy.

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Efficiency Measures

- Replaced chiller compressors
- Automated chiller controls
- EPA cool roof
- Lighting retrofit
- Automated lighting controls
- Daylighting: 50% daylighting views
- Whole Building Control/Mgmt: Piloting integrated energy information systems program

“We addressed the chiller plant by replacing compressors with state-of-the-art turbo-core compressors, and then we installed automated controls so that chillers were talking with each other, so that adjustments were made methodically – all of the equipment was working in unison to reach a natural equipment curve.

– CARLOS SANTAMARIA, GLENBOROUGH, LLC

Lighting: A full lighting analysis and retrofit was conducted. High-pressure sodium lamps in the garage were replaced with CFLs, and stairwell occupancy sensors were added. Interior lamp wattage was reduced in existing fixtures. Highwattage exterior lighting was replaced with low-wattage bulbs with higher lighting intensity to accent the building at night. Exterior wattage decreased more than 75 percent.

Envelope: The R-value of the building envelope – only 16 years old at the time – did not warrant any upgrades. The concrete walls have excellent thermal massing properties and glazing area allows almost 50 percent daylight views. A full air leakage test ensured the air barrier was intact. Glenborough installed an EPA cool roof as a part of the integrated approach to energy efficiency, lessening the load on the HVAC system.

Controls: Automated chiller controls were installed to reduce unnecessary loads, and lighting use is reduced through occupancy sensors and time controls.

Monitoring: Glenborough analyzes several layers of data to dictate energy procurement strategies and make quick adjustments to building systems. The first layer of analysis is through Energy Star Portfolio Manager to compare against industry benchmarks.

Planned Energy Efficiency Upgrades (Current 2011 Initiatives & Beyond):

- Install (TRAV) technology.
- Install Building Optimization Program estimated to reduce an additional 10% in Energy Costs.
- Implement Daylight Cleaning to reduce night lighting use.
- Convert Cooling Tower Water From Potable Water to Reclaimed Water
- Work with San Diego Gas & Electric to incorporate a Voluntary Demand Reduction Program.
- Pilot Energy Information System towards increased energy evaluation and analysis.

Energy Performance

The Aventine energy use intensity for 2007, pre-retrofit, was 62 kBtu/sf/yr (EUI¹). After the renovation, energy use dropped by 63% to just 23 kBtu/sf/yr. The Aventine now uses 75% less energy per square foot than the average for offices

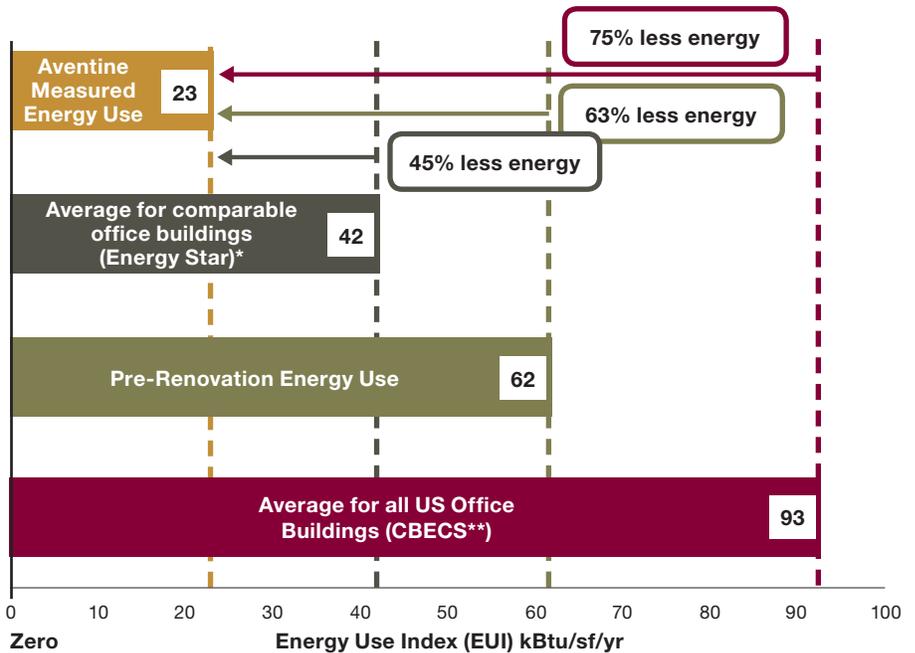
¹ An Energy Use Index (EUI) is the total energy (gas and electric) used in thousands (k) of British thermal units (Btu) divided by the square feet (sf) of the space – resulting in a commonly used metric of kBtu/sf/yr.

Energy Performance

% Better than Baseline	75%
Baseline	Average for U.S. Offices*
Measured Energy Use (KBtu/SF/yr)	23
Energy Star Score	100

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

Energy Use per square foot Comparison



* 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)

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, occupancy, 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 Aventine outperforms this reference set, using 45% less energy than the Energy Star estimate. The Aventine’s Energy Star rating of 100 is the best possible, and is a 15-point increase from the building’s 2007 rating of 85.

Financial

Improvement Cost: \$801,540 before rebates (approximately \$3.20/sf). Additional costs for internal maintenance staff implementation of lighting improvements not available.

Incentives: \$175,000 in utility incentives for central plant upgrades and lighting retrofits. Using a detailed in-house financial modeling tool, Glenborough made a convincing business case for the Aventine retrofit. This tool has been instrumental in securing financing and has also helped transform Glenborough’s overall

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

business practices. In 2004, the owner established investment criteria that targeted payback of 2-3 years. By 2008, the perspective had changed – retrofit strategies became more aggressive and payback was extended to 3 to 4 years, on condition of added long-term asset value. Glenborough now will consider 4- to 6-year returns and/or paybacks with major upgrades if strategies add asset value and contribute to occupancy. The project was funded through private capital.

The owner employed a unique model to help with LEED Certification, creating a “Strategic Vendor” project team that provided technical resources and sponsorship in the way of cash donations, off-setting the consulting costs for LEED Certification. This was a mutually beneficial project – vendors use the Aventine success as a proof-of-concept marketing tool.

Project Results

Glenborough Vice President Carlos Santamaria says the Aventine retrofit has exceeded the company’s objective of positioning the building at the top of the Class A office market.

User Satisfaction: “Without a doubt, productivity has increased with our tenants and the work that they provide only from the standpoint that we now have less heating, ventilation and airconditioning complaints and our tenants can concentrate more on their core business rather than having to be inconvenienced by poor indoor air quality or other building related failures. High-efficiency, sustainable buildings run more reliably more of the time with fewer failures.”

Tenant Education: “Many times each year, we conducted outreach programs where we talked to different tenants about ways they could reduce impacts operationally. We conducted educational event that were fun, and gave tangible examples of what could be different, and that they could take home to save energy and resources.”

Competitive positioning in the market: “The Aventine is truly the poster child for ultra-efficient and sustainable buildings. Tenants are proud to be in a building that is so sustainable and energy efficient. They are provided with a number of value added features that many other buildings just do not have.”

Reasons for the building’s competitive advantage include:

- Lower operating costs for tenants.
- Operations and maintenance program results in fewer equipment failures, and lower operating and replacement costs.
- Better indoor air quality from systems and controls using state of the art and/or next-generation technology.

In the first year of operations post-retrofit, the Aventine:

- Saved over 2 million kWhs of electricity.
- Cut energy and operating expenses by more than \$116,000.
- Decreased carbon emissions by 600,000 lbs.
- Received a utility rebate of \$175,000.

Acknowledgements and Sources

Project Team:

- Owner: Glenborough, LLC www.glenborough.com
- Architect: Michael Graves Architects
- Mechanical Engineer: Glenborough, LLC
- Property Manager: Glenborough, LLC

Sources:

- Carlos Santamaria, Glenborough, LLC
- Aventine Office Building – LEED Platinum Certification Project - Fact Sheet
- Energy Star Portfolio Manager Statement of Energy Performance

Photos: Glenborough, LLC

Research and Development:

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

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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.