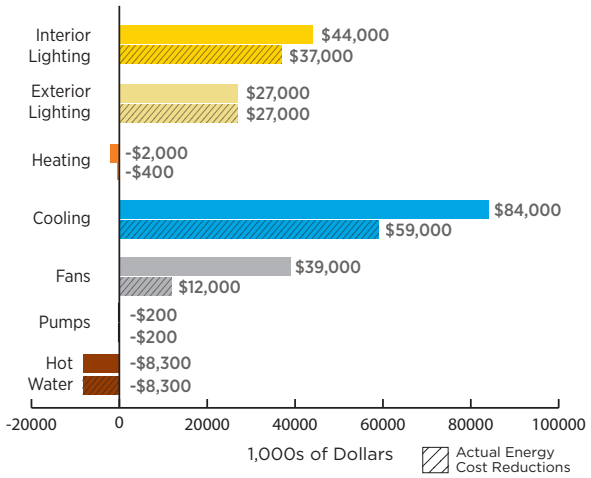
Regency Centers Develops Leadership in Energy-Efficient Renovations

Regency Centers (Regency) partnered with the Department of Energy (DOE) to develop and implement solutions to retrofit existing buildings to reduce energy consumption by at least 30% versus requirements set by Standard 90.1-2004 of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the American National Standards Institute (ANSI), and the Illuminating Engineering Society of North America (IESNA) as part of DOE's Commercial Building Partnerships (CBP) Program.[1] Pacific Northwest National Laboratory provided technical expertise in support of this DOE program.

Regency is a national shopping center company with a total portfolio of 364 properties and over 45 million square feet. Regency is an industry leader in responsible building development and is committed to adopting all practical energy efficiency measures (EEMs) to reduce the environmental impact in developing and operating its shopping centers portfolio. Regency believes this commitment leads to better risk management and cost reductions, improves the communities where it operates, encourages innovation, and is in the best interest of its shareholders. As part of its commitment to sustainability, the Granada Village project in Granada Hills, California, is a showcase of many other green building strategies, including an underground storm water management system, water efficient landscaping and smart irrigation, and electric vehicle charging stations.

Estimated Actual Energy Cost Reductions



Regency updated this mall to improve both aesthetics and energy efficiency. Building enclosure performance was enhanced with added insulation and upgraded windows. Exterior upgrades included new parking lot and architectural lighting. The renovated mall has earned a Gold certification from the U.S. Green Building Council.

Project Type	Retail Shopping Center, Retrofit
Climate Zone	ASHRAE Zone 3B, Hot-Dry
Ownership	Leased Space
Barriers Addressed	• Energy measures must be balanced with changing tenants over time, which may include diverse space use • Split incentives between tenants and the developer
Square Footage of Project	125,416
Expected/Estimated Actual Energy Savings (versus Historic Operations)	28%/20%
Expected Energy Savings (versus ASHRAE 90.1-2004)	14%
Expected Energy Savings	1,084,000 kilowatt-hour (kWh)/year
Verified Energy Savings	757,000 kWh/year
Expected/Estimated Actual Cost Reductions (versus Historic Operations)	$183,000/year[2]/$126,000/year
Project Simple Payback	Approximately 5 years
Estimated Avoided Carbon Dioxide Emissions	Approximately 522 metric tons/year[3]
Construction Completion Date	October 2012

[1] The Commercial Building Partnerships (CBP) Program is a public/private, cost-shared initiative that demonstrates cost-effective, replicable ways to achieve dramatic energy savings in commercial buildings. Through the program, companies and organizations, selected through a competitive process, team with U.S. Department of Energy (DOE) and national laboratory staff who provide technical expertise to explore energy-saving ideas and strategies that are applied to specific building project(s) and that can be replicated across the market.

[2] Based on an average blended utility rate of $0.169/kWh provided by the local utility.

[3] Greenhouse Gas Equivalencies Calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html.

Regency chose the Granada Village shopping center for participation in the CBP Program after considering several other new construction and redevelopment opportunities. The Granada Village was a favorable candidate for the energy efficiency upgrades because the existing buildings had undergone very few upgrades to the building envelope; or to the heating, ventilation, and air-conditioning (HVAC) and lighting systems since the project was constructed in the 1960s and 1970s. The Granada Village includes eight buildings—six buildings received upgrades and two buildings were not included in this retrofit, and approximately 30 retail tenants total.

The CBP project included 125,416 square feet of the shopping center, including tenant spaces and all of the exterior common area lighting (some buildings were excluded because they were not part of the redevelopment). In addition to the CBP goal, Regency set a goal of at least 20% reduced energy costs below ASHRAE 90.1-2004 as part of its broader goal to achieve Leadership in Energy and Environmental Design Gold certification. The original annual utility cost reduction for the design was estimated at $183,000 when compared to existing operations. Preliminary building energy modeling estimated the project will achieve approximately 28% energy savings compared to the existing buildings' annual energy use.

The available data show a savings level of about 20% in comparison to historic operations. The project team believes building performance is likely to continue to improve. A portion of the data was collected soon after construction completion and not all systems had adequate time to stabilize. Two other factors may be influencing the outcome. First, energy savings in retail are highly dependent on sales cycles and actual business operation. The more cyclical a tenant's business, the more variation that tenant will have in energy use. Second, this study was conducted while tenants were transitioning between spaces because of ongoing retrofit construction. This case study is based on completion of the first phase of the renovation. Ongoing energy savings will likely improve as new spaces are updated and as tenants' schedules and operations are less disrupted.

The Granada Village buildings were built at different times and some of the oldest parts of the shopping center had little or no envelope insulation. The shopping center was dramatically renovated with energy saving strategies that included roof insulation, high performance windows, high efficiency HVAC equipment, exterior lighting and controls, and daylighting and efficient interior lighting in some tenant spaces.

"The CBP partnership helped us solidify our understanding of what energy efficiency measures were technically and financially feasible, and practical, given the building type and scope of control as a landlord."

— Mark Peternell, Vice President of Sustainability, Regency Centers

Original storefront windows with no thermal breaks (left) were replaced with new glazing providing thermal breaks and control of solar heat gain (right)

Decision Criteria

Economic

Regency strives for a simple payback of less than 5 years for its energy efficiency projects, but also realizes the many soft benefits associated with its commitment to sustainability:

- Decreases in operating expenses and increases in net operating income (NOI)
- Increases value, as seen by many institutional investors
- Solidifies new development opportunities
- Strengthens relationships with key tenants
- Improves employee engagement.

Operational

Many of the direct energy costs to Regency occur in lighting for common spaces including the parking lot. In addition, the CBP team expects high performance lighting will significantly reduce the lifetime maintenance costs as lights require less frequent visits from a maintenance crew to replace the fixtures.

Policy

Several energy measures in the Granada Hills shopping center provided benefits beyond energy performance. High performance windows were chosen to support the energy goals of the project, but also to enhance the shopping experience of those visiting the retail tenants. Improvements to parking lot lighting reduced energy needs but also enhanced security of the shopping center at night.

Energy Efficiency Measures

The following energy efficiency measures (EEMs) were recommended, and some were included by Regency when the design was being finalized. Energy savings from the measures are presented in the following table, which were used to estimate the initial design costs. While some of the envelope EEMs have relatively long simple paybacks, the simple payback of the total project was close to 5 years due to the total package of energy improvements made at the site. Many of the EEMs were pursued in this project because it was a major renovation and the building envelope was modified which made many additional features feasible. The EEMs are presented ranked by expected annual savings.

EEM	Implemented in This Project	Will Consider for Future Projects	Expected Annual Saving		Expected Improvement Cost $[1]	Expected Cost of Conserved Energy $/kWh[2]	Expected Simple Payback yr
			kWh/yr	$/yr			
Envelope: 5% of Whole Building Savings							
Increased roof insulation to R-30*	Yes	Yes	185,000	$31,000	$61,000	$0.08	2
Upgraded storefront window glazing to an assembly U-factor of 0.54 and solar heat gain coefficient of 0.426*	Yes	Yes	26,000	$4,400	$151,000	$0.92	> 20
Increased wall insulation in some sections to R-19*	Yes	Yes					
Lighting: 14% of Whole Building Savings							
Upgraded interior lighting to Title 24-2008 minimum for retail spaces with a lighting power density specified to be 1.6 W/ft^2	Yes	Yes	385,000	$65,000	$127,000	$0.02	< 1
Upgraded exterior lighting, including low wattage recessed can lights in the common canopy area	Yes	Yes	102,000	$17,000	$76,000	$0.14	4
Installed new exterior lighting controls, including photo sensors and clocks to shut off part of the parking lot lighting from 11p.m. to 6 a.m.	Yes	Yes	59,000	$10,000	$12,000	$0.04	1
HVAC: 9% of Whole Building Savings							
Installed high efficiency 5-ton heat pump units*	Yes	Yes	376,000	$64,000	$142,000	$0.10	3
Installed high efficiency 12.5-ton packaged air conditioner units with natural gas furnaces*	Yes	Yes			$105,000		

*EEM is dependent on climate.

[1] Improvement costs have been estimated by the team and may not reflect actual costs observed by Regency.

[2] Meier 1984.

Energy Use Intensities By End Use

The design team used eQuest—a sophisticated but easy-to-use energy analysis tool—to develop a full energy model for the Granada Village project. Because tenants pay the utility bills, the range of tenant types, tenant privacy agreements, and number of tenants involved, actual energy consumption data for the existing facility was not available. To verify the performance of the existing facility, monitoring at the electrical panel was installed on eight active retail units within the existing strip mall. The eight units selected spanned the range of uses represented at Granada Village and were believed to be representative of units not explicitly metered.

The baseline model was calibrated using the detailed metering data, which was important for accurately modeling this complex Granada Village shopping center.

Some variables are listed below this paragraph that may have greatly influenced energy consumption at Granada Village. However, these variables are difficult to capture in whole-building energy simulation:

- Occupancy schedules and energy use intensity varied among many tenants and significantly affected energy consumption. To account for this, custom occupancy schedules were developed based on metered data to reflect operations at each tenant site. Where tenants had similar operations and loads, occupancy and use schedules representing multiple, similar tenants were created.
- Existing HVAC units were monitored, and available performance characteristics (seasonal energy efficiency ratio, heating seasonal performance factor, kilowatt/cubic feet per minute) were researched.
- Infiltration was much higher than normal for modern construction and Granada Village was in significant disrepair—window seals were missing, there were large voids in insulation and interior finishes, and daylight was seeping through cracks in the ceiling. Renovating the roof and windows alleviated these problems and reduced infiltration.

To assess whole-building savings, three energy models were created. Model 1 was the baseline model based on the existing building operations. Model 2 represented the prescriptive specifications of an ASHRAE 90.1-2004 baseline. Model 3 represented the final design based on the energy measures planned for the project.

Model 1 – Pre-Retrofit

The first model was the baseline of the current building, which was calibrated with metered data from several tenants. The baseline had an annual energy use intensity (EUI) of about 104 kilo British thermal units (kBtu)/square foot (ft^2).

Model 2 – Code Baseline

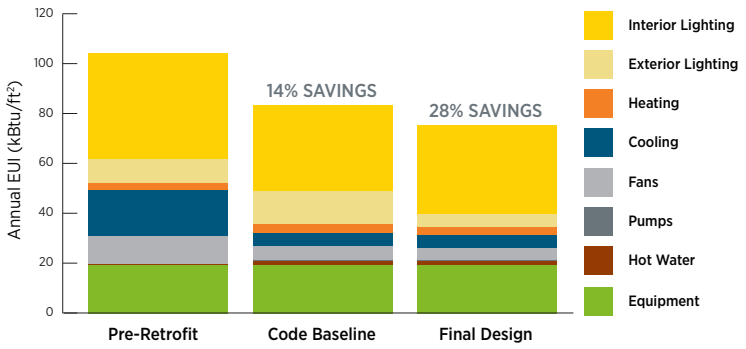
The code baseline building was modeled to support Leadership in Energy and Environmental Design documentation and to understand how the original building might compare to modern code requirements. This model had an annual EUI of about 83 kBtu/ft^2.

Model 3 – Final Design

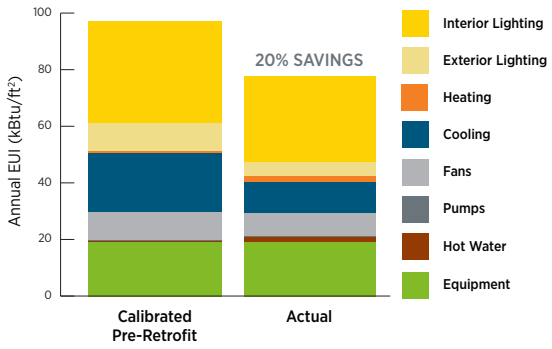
The final design version included the EEMs incorporated into the design. This model had an annual EUI of about 75 kBtu/ ft^2, 28% lower than the original building before the renovation.

Two additional models were created soon after Granada Village was occupied to evaluate actual energy savings. One model was developed to represent energy consumption after the building renovation was complete. This Actual model was calibrated based on a year of energy consumption from utility bills. The calibrated model was then used to recalibrate the Pre-Retrofit model for an apples-to-apples comparison. The results are shown in the graph entitled Comparing EUI of Calibrated Pre-Retrofit and Actual Energy Performance Models. The recalibrated Pre-Retrofit model predicts less energy consumption than the original version. Part of the difference is from changes in equipment set points, temperature settings, and reduced operating hours. Some of these changes may have resulted from the retrofit, but the model cannot capture these improvements, making the resulting 20% estimate of savings a conservative estimate. These models are not directly comparable to the design models because of the changes in building operation assumptions.

Comparing Estimated EUI of Pre-Retrofit, Code Baseline, and Final Design Models



Comparing EUI of Calibrated Pre-Retrofit and Actual Energy Performance Models



Annual Energy Use and Percentage Savings by End Use versus Pre-Retrofit Operations Based on Design Models

End Use Category	Pre-Retrofit Annual EUI (kBtu/ft²)	Code Baseline Annual EUI (kBtu/ft²)	Final Design Annual EUI (kBtu/ft²)	Final Design Percent Savings Over Pre-Retrofit
Interior Lighting	42.5	34.8	35.5	16
Exterior Lighting	9.5	12.9	5.3	44
Heating	2.9	3.7	3.2	-11
Cooling	18.5	5.3	5.2	72
Fans	10.9	5.5	4.8	56
Pumps	0.1	0.1	0.1	-50
Hot Water	0.3	1.7	1.7	-382
Equipment	19.4	19.4	19.4	0
Total	**104.0**	**83.3**	**75.2**	**28%**

Annual Energy Use and Percentage Savings by End Use versus Pre-Retrofit Operations Based on Actual Energy Performance Models

End Use Category	Pre-Retrofit Adjusted Annual EUI (kBtu/ft²)	Actual Annual EUI (kBtu/ft²)	Actual Percent Savings Over Pre-Retrofit
Interior Lighting	36.1	30.2	16
Exterior Lighting	9.7	5.3	44
Heating	0.9	1.9	-123
Cooling	20.7	11.2	46
Fans	9.9	7.9	20
Pumps	0.1	0.1	-50
Hot Water	0.3	1.7	-382
Equipment	19.4	19.4	0
Total	**97.1**	**77.7**	**20%**

Lessons Learned

The Granada Village project provided several lessons learned that may benefit other shopping center owners as they undertake energy efficient building projects.

Savings Likely to Settle Up

Current findings suggest that Granada Village is achieving about 20% of savings in comparison to historic energy consumption. However, building performance is likely to improve over time. The data for the analysis was collected immediately after the mall was occupied. Equipment operations had not yet stabilized. Further, many tenants were still in transition because of the renovation. The actual savings will continue to vary, but will likely improve as new tenants settle into new spaces.

Creative Partnership with Tenants

Like many leased properties, the Granada Hills shopping center had a challenge in the split-incentive arrangement between tenants and landlords. Creative partnerships with tenants are key to overcoming the split incentive. Improvements may be funded by the building owner or tenant, but the results benefit the owner through longer tenant leases and lower operation costs, while the tenant benefits from an improved customer experience and lower utility bills. With leased properties and the uncertainty of who future tenants will be, design the space and energy package to maintain as much flexibility as possible.

Tenants Appreciate Upgrades

A post renovation survey found that tenants were pleased with energy upgrades. Tenants reported being more comfortable, noticed no changes in lighting quality, and believed that comfort and safety had been maintained or improved. These perceptions are important to the building owners because their business is dependent on tenant satisfaction. It is not enough that retail customers and the public approve of the building's green label. Tenant perceptions of building performance and their retail customers' acceptance are important to the economic performance of the building as an asset.

Older Structures Represent Challenges and Opportunitites

While renovating an older building can bring unique EEM challenges, there are often additional energy savings with low additional costs. At Granada Hills, the older buildings provided challenges because structural enhancements were required to support the heavier rooftop HVAC systems. Updating the older buildings provided opportunity as well because it allowed the leaky and uncomfortable tenant spaces to receive air sealing and become much more comfortable and reduce tenant utility bills.

Funding for Energy Features

Funding for innovative measures like electric vehicle charging stations, lighting improvements, and HVAC upgrades may be available from national programs or local utilities. The Granada Village project was able to leverage cost incentives for many of the energy features.

References and Additional Information

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