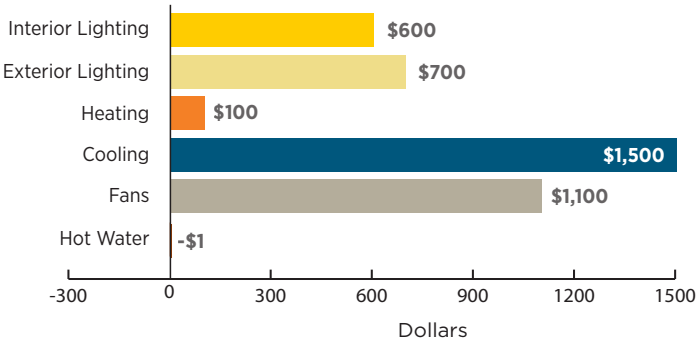
# PNC Financial Services – Maximum Efficiency Bank Branch

PNC Financial Services (PNC) 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. PNC has a portfolio covering over 30 million square feet, over 2,900 branches and 5 million customers across 19 states and Washington, D.C.

The Singer Island branch was originally constructed in 1979; PNC acquired the property in 2008 and began a major renovation in March 2011. Construction was completed in January 2012. PNNL identified upgrades to the building envelope, lighting, and mechanical units as being the most effective means to increase the energy efficiency of the building. PNC used this retrofit as a pilot for new technologies that could be applied to future branch renovation projects.

To fully explore the energy-saving opportunities, PNNL, Eaton's EMC Engineers and the PNC design team conducted onsite work that included gathering equipment and building information, speaking with site personnel, and placing data loggers to evaluate equipment performance and environmental conditions over time. Instantaneous measurements were taken for both temperatures and electrical power at the primary disconnects. Data loggers were installed to collect key information for the mechanical system and interior spaces.

## Expected Energy Cost Reductions





PNC renovated the Singer Island branch to upgrade branding, hurricane resistance, comfort issues, and energy efficiency

| | |
|---|---|
| Project Type | Bank Branch, Retrofit |
| Climate Zone | ASHRAE Zone 2A, Hot-Humid |
| Ownership | Owner Occupied |
| Barriers Addressed | Security considerations and standards for banks limit reductions to exterior lighting levels |
| Square Footage of Project | 4,612 |
| Expected Energy Savings versus Existing Operations | 40% |
| Expected Energy Savings (versus ASHRAE 90.1-2004) | 47% |
| Expected Energy Savings (to be verified) | 42,000 kilowatt-hour (kWh)/year |
| Expected Cost Reductions (versus ASHRAE 90.1-2004) | $4,000/year[2] |
| Actual Savings | Could not be confirmed because of a faulty utility meter. |
| Estimated Avoided Carbon Dioxide Emissions | Approximately 22 metric tons/year[3] |
| Construction Completion Date | January 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 a utility rate of 0.096 $/kWh supplied by PNC.

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

*(left)* Windows were replaced to improve hurricane resistance and control glare from sunlight. *(right)* Interior lighting and the ceiling were upgraded from fluorescents and light absorbing colors to reflective surfaces and light-emitting diodes.

## Decision Criteria

PNC has made energy efficiency and sustainable building practices an important part of its corporate culture. For this project, PNC took advantage of opportunities presented by a substantial building renovation.

### Economic

PNC planned the energy upgrades at the Singer Island branch as part of a major renovation to the building. Nonenergy benefits were a prime driver in selecting many of the installed energy efficiency measures (EEMs). For example, a new heating, ventilation, and air conditioning (HVAC) system was installed to provide improved comfort to employees and customers in addition to providing increased efficiency. Glazing was replaced to provide hurricane resistance as well as to improve thermal and infiltration performance and daylighting. A new lighting system helped advance the PNC brand in addition to providing a substantial increase in energy efficiency. These selected measures show the importance of upgrading energy efficiency at the same time as renovating other building features.

### Operational

Metering results showed that equipment plugged into electrical outlets accounted for 40% of total energy consumption. PNC recognized the importance of reducing plug loads in the building design and brought its Information Technology (IT) department into the design discussion.

"Our IT team was literally amazed at the monitoring study results. They had tried to look at nameplates before, but the metering results helped them see first-hand how our equipment really affects energy use," says Larry Miltenberger, Construction Manager at PNC Bank.

EEMs were carefully selected not only to consider regular operational concerns, but also security and safety concerns and overall customer and employee comfort.

### Policy

PNC is recognized as a banking industry leader in sustainable design innovation. PNC began with an aspiration to build green branches to educate and inspire customers and the banking industry by demonstrating sustainability and improving the customer experience. The PNC design team has worked together on prototype design and rollouts for over a decade. This team has built a deep trust and a collaborative approach that supports full integrated design and continuous improvement. The team opened its first Leadership in Energy and Environmental Design (LEED) certified branch in 2001 and partnered with the U.S. Green Building Council to define and pilot the volume built LEED certification process in 2004. PNC continuously seeks out new collaborative partners to develop innovative standards to systematize improvements.

## Energy Efficiency Measures

Using the data collected and feedback from other team members, a list of potential EEMs was developed. *(See following page)*

# Energy Efficiency Measures

Building energy improvements at the PNC Singer Island branch included the building envelope, interior and exterior lighting, and the HVAC system. Reduced energy costs from the measures are presented in the following table. The cost of efficiency measures was not separated from the overall cost of upgrades such as hurricane-resistant glass. 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 $ | Expected Internal Rate of Return % (15 years) | Expected Cost of Conserved Energy $/kWh[1] | Expected Simple Payback yr |
|---|---|---|---|---|---|---|---|---|
| | | | kWh/yr | $/yr | | | | |
| **Envelope:** 12% of Whole Building Savings | | | | | | | | |
| Installed new Viracon hurricane, VUE1-50, insulated and laminated low-e double-pane glazing* | Yes | Yes | 13,000 | $1,200 | $22,000 | -2 | $0.13 | 18 |
| Added additional R-10 blown-in roof insulation to underside of roof deck* | Yes | Yes | 7,700 | $800 | $2,400 | 30 | $0.69 | 3 |
| **Lighting:** 22% of Whole Building Savings | | | | | | | | |
| Set lighting power density at 0.77 W per square foot and installed occupancy sensors in defined spaces | Yes | Yes | 19,000 | $1,800 | $26,000 | 1 | $0.16 | 14 |
| Installed daylighting controls – continuous dimming controls in perimeter spaces; interior walls with surface reflectance of 80% | Yes | Yes | 10,000 | $1,000 | $3,300 | 29 | $0.68 | 3 |
| Installed light-emitting diode exterior lighting for soffits and drive-through canopy; 27 W and 78 W | Yes | Yes | 9,500 | $900 | $4,000 | 22 | $0.52 | 4 |
| Installed light-emitting diode parking lot lighting | Yes | Yes | 6,800 | $600 | $16,000 | -5 | $0.09 | >20 |
| **HVAC:** 13% of Whole Building Savings | | | | | | | | |
| Replaced air-conditioning system with split system condensing unit with energy efficiency ratio of 13 | Yes | Yes | 16,000 | $1,500 | $10,000 | 12 | $0.33 | 7 |
| Installed new 5,000 cubic feet per minute interior air handling unit and carbon dioxide and humidity controls | | | 5,000 | $500 | Cost data is not yet available | | | |

* EEM is dependent on climate.

[1] 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 branch. Modeling offered a cost-effective way for PNC to evaluate the potential energy savings of the EEMs. Modeling showed that the Singer Island branch would use 46,030 kWh/year—a significant energy savings compared with the baseline energy usage of 87,838 kWh/year.

To assess whole-building savings, three energy models were created. Model 1 represented the specifications in an ASHRAE 90.1-2004 building. Model 2 represented the pre-retrofiit building, and Model 3 included the EEMs incorporated into the final design.

The Singer Island branch was occupied in January 2012. Although there was ample time to collect data on the building's performance, it turned out that the utility meter was not functional, and accurate data was not available for this case study to show comparisons with actual energy consumption.

### Model 1 – Code Baseline

The first model represented the prescriptive specifications in an ASHRAE 90.1-2004 building. The baseline had an annual energy use intensity (EUI) of about 65 kilo British thermal units (kBtu)/square foot ($ft^2$).

### Model 2 – Pre-Retrofit Building

The second model represented the EEMs included in the prototype design. This model had an annual EUI of approximately 57 kBtu/$ft^2$.

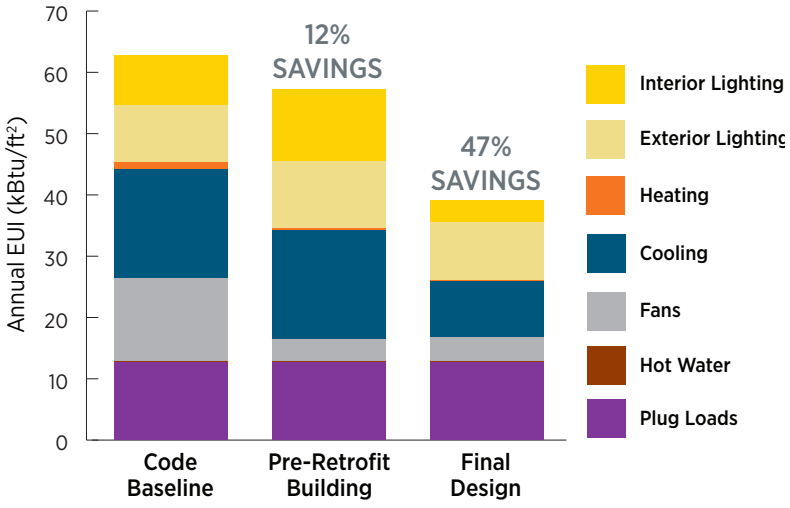
### Model 3 – Final Design

The third version included the EEMs incorporated into the design. This model had an annual EUI of about 34 kBtu/$ft^2$ and an annual energy savings of 47% over an ASHRAE 90.1-2004 building.

### Estimated Annual Energy Use and Percentage Savings by End Use

| End Use Category | Code Baseline Annual EUI (kBtu/$ft^2$) | Pre-Retrofit Building Annual EUI (kBtu/$ft^2$) | Final Design Annual EUI (kBtu/$ft^2$) | Final Design Percent Savings Over Baseline |
|---|---|---|---|---|
| Interior Lighting | 8.2 | 11.9 | 3.7 | 55 |
| Exterior Lighting | 9.2 | 10.8 | 4.2 | 54 |
| Heating | 1.1 | 0.3 | 0.2 | 87 |
| Cooling | 20.9 | 17.9 | 9.2 | 56 |
| Fans | 12.6 | 3.5 | 3.8 | 70 |
| Hot Water | 0.3 | 0.3 | 0.3 | 0 |
| Plug Loads | 12.6 | 12.6 | 12.6 | 0 |
| **Total** | **64.9** | **57.2** | **34.1** | **47** |

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




### Expected Building Energy Savings from Implemented EEMs by End Use versus Code Baseline

| Electricity End Use Category | |
|---|---|
| Interior Lighting | 6,100 kWh |
| Exterior Lighting | 6,800 kWh |
| Heating | 1,200 kWh |
| Cooling | 16,000 kWh |
| Fans | 12,000 kWh |
| Pumps & Aux. | -1 kWh |
| Hot Water | -10 kWh |
| **Electricity Total** | **42,000 kWh** |

# Lessons Learned

Throughout this retrofit project, several lessons were learned that can help guide future commercial building projects.

## Consider Nonenergy Benefits

Nonenergy benefits and timing were critical factors in the Singer Island branch energy upgrades. Most improvements were made to enhance the branch for hurricane resistance, comfort, and branding. However, the upgrades provided an opportunity to include or enhance energy efficiency features well beyond what would have been possible otherwise. The economic calculations for the EEMs do not appear to be cost effective. However, the costs of energy improvements could not be separated from the broader costs of installing measures for other reasons. In many instances, the full cost of a measure was charged against energy efficiency, although installation costs and perhaps even material costs were paid to achieve other benefits, such as reduced glare and hurricane resistance.

## Expert Help Can Expedite a Project

PNC needed to move quickly in renovating the Singer Island branch. To accommodate the fast-paced schedule, PNNL brought in Eaton's EMC Engineering to assist with site assessment and modeling. Companies that renovate a lot of buildings and must meet demanding schedules should consider establishing relationships with consulting engineers to bolster their design team staff during critical schedule periods.

## Set Energy Efficient, Internal Standards

In addition to the Singer Island branch renovation, PNC worked with CBP on a new bank building. As part of that energy analysis study, many features were identified too late to include in the Singer Island branch study. PNC created a small team that met every week and metered actual performance of different hardware and software combinations, from computers and monitors to routers, switches, counter equipment and automated teller machines (ATMs). This team worked with vendors to test upcoming technology before it was released. PNC tested the equipment and metered performance under real bank operating conditions. Through this effort, PNC set more energy efficient, internal standards and provided feedback to manufacturers for developing the next generation of equipment that will be more energy efficient, saving energy and reducing costs for PNC and other businesses. These measures include centrally controlled night shutdown for computing equipment, better control options for office equipment, and LED lighting options for ATMs and signage. For more information on these activities and measures, see the Fort Lauderdale PNC case study, "PNC Financial Services – Net-Zero Energy Bank Branch."

## Monitor Energy Performance

The CBP team worked with PNC to monitor energy loads in an existing branch. Results from this limited study had profound effects on the work for the net-zero energy branch and PNC's entire portfolio of buildings. Owners of prototypical building portfolios should consider similar studies to gain insights into how their buildings actually perform and where to focus their energy efficiency investments.

## Confirm Utility Meter Operation

All too often energy performance is thwarted by malfunctioning utility meters. All building operators should regularly check their meters and utility bills for proper operation and confirm that the proper tariffs are applied. An improperly operating utility meter will slow the verification of energy performance at Singer Island until the summer of 2014.

## References and Additional Information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