



**Green Retrofit: What Is
Making This the Wave of the
Future?**

**Thursday,
November 5**

11:15 a.m. - 12:30 p.m.

Empire State Building

Leadership in American Progress in Sustainability

Caroline Fluhrer, Consultant, Rocky Mountain Institute
Robert C. Lieber, Deputy Mayor for Economic Dev City of NY
Anthony E. Malkin, President, Malkin Holdings
Ray Quartararo, International Director, Jones Lang LaSalle
Paul Rode, Project Executive, Solutions, Johnson Controls, Inc.



Business impact of efficient buildings

Sustainable Real Estate:

- **No longer a cost premium** to perform an energy efficient retrofit
- Achieve **operating expense savings** of 40% or greater
- **Reduce absenteeism**: 15% lower in high-performance buildings

Efficient buildings save an average:

- 30%-40% in **energy**
- 35% in **CO₂ emissions**
- 30-50% in **water use**
- 50-90% in **waste costs**



Regulation is coming

American Clean Energy and Security Act of 2009

Cap-and-trade/carbon costing = Electricity costs will be going up

Federal mandates require 20% more energy efficient by 2015, 50% by 2030 =
shape up or become obsolete

Governmental funding for energy retrofits = take advantage and upgrade
your building

Call for greater transparency = know where every building stands

Requirements for energy efficiency ratings on buildings at time of sale or
refinancing = proactively plan upgrades based on performance

“Green” vs. Energy Efficient Retrofits

Green building practices include energy efficiency.

Energy efficient retrofits focus on quantifiable energy efficiency measures.

Green Building Practices

- Renewable, recycled-content, reused and locally produced materials
- Indoor air quality (voc-free materials, DCV)
- Green cleaning
- Recycling programs
- Energy conservation
- Water reduction
- Integrated pest management



Energy Efficient Retrofits

- ✓ Reduce loads
- ✓ Reduce energy usage
- ✓ Optimize systems efficiency
- ✓ Provide controls
- ✓ Integrated, lifecycle approach
- ✓ Quantifiable metrics
- ✓ Guaranteed savings
- ✓ Measurable payback and return on investment

The market wants...

Transparency
Metrics
Results



Industry drivers for energy efficient retrofits

Converging forces

Recognition of need to develop more sustainable and efficient business practices

Acceptance of energy supply constraints and national security issues posed by energy dependence

Emerging city/state initiatives

Corporate trend toward GRI reporting, self regulation and reduction in GHG emissions

Customer, employee and shareholder pressures

Business opportunity

Growing pressure to alter appraisals, values for lending and purchasing based on sustainability

Reduced operating costs through efficiency

Increased marketability, competitiveness

Improved work environments, productivity, recruitment and retention

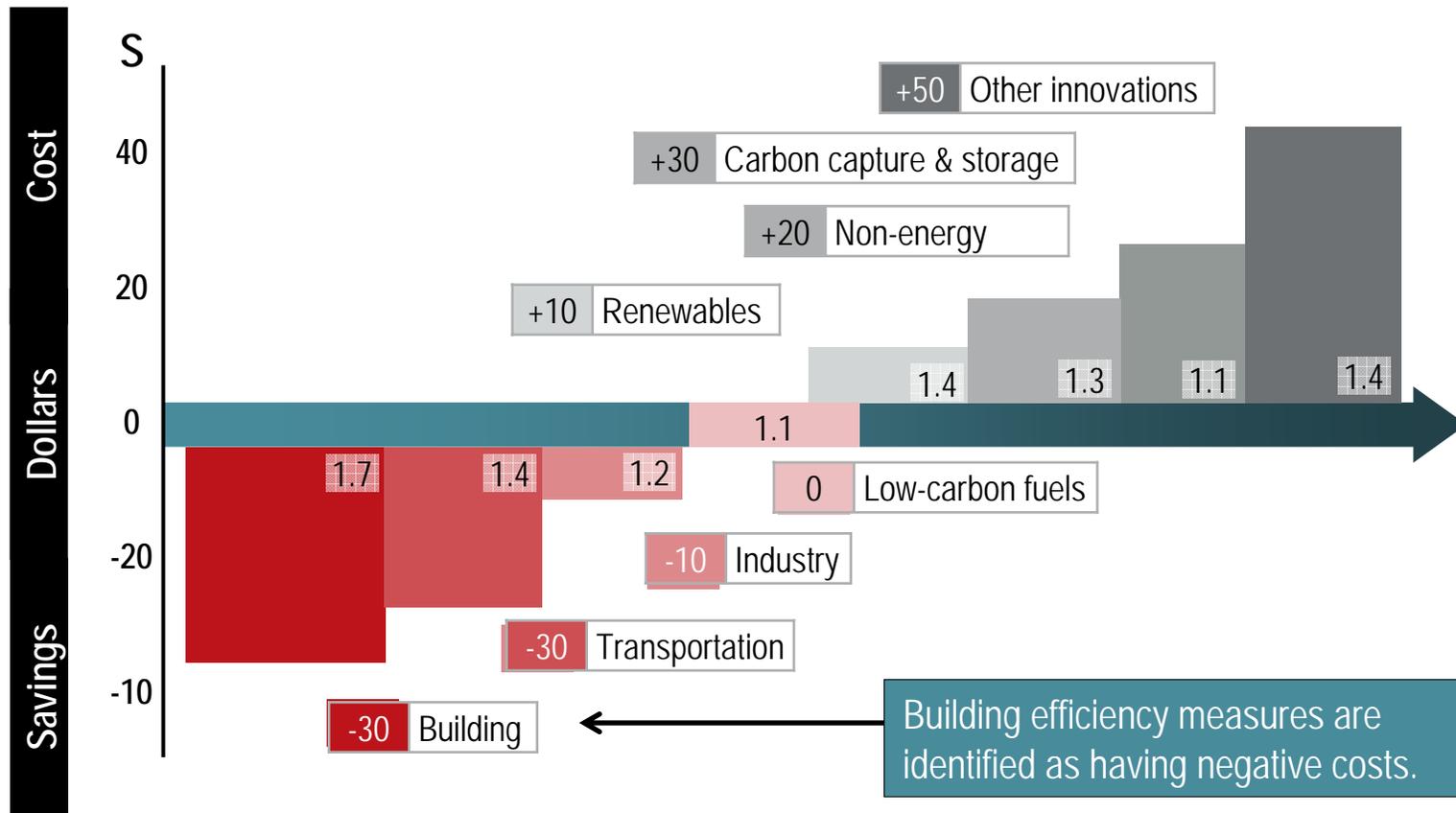
Positive NPV and ROI

Fund improvements through energy savings

Maintain value

Costs/benefits of energy efficiency

Contributions to reductions in global warming pollution



Cutting U.S. global warming pollution 80% by 2050: Cost and payoff by sector
 Source: NRDC - <http://www.nrdc.org/globalwarming/blueprint/default.asp>

Motivation

"The goal with ESB has been to define intelligent choices which will either save money, spend the same money more efficiently, or spend additional sums for which there is reasonable payback through savings. Addressing these investments correctly will create a competitive advantage for ownership through lower costs and better work environment for tenants. Succeeding in these efforts will make a replicable model real for others to follow."

*- Anthony E. Malkin
Malkin Holdings*

I. Motivation

II. Measures

III. Key Lessons

IV. Financing

V. Next Steps

The Empire State Building

Demonstrate the business case for cost effective energy efficient retrofits through verifiable operating costs reductions and payback analysis



102 stories and **2.8 million** square feet

\$11 million in annual energy costs in 2008

Peak **electric** demand of **9.5 MW**
down from 11.6 (3.8 W/sqft, incl. HVAC)

88 kBtu per sqft per yr for the office building

CO₂ emissions of **25,000 tons** per yr
(22 lbs/sqft)

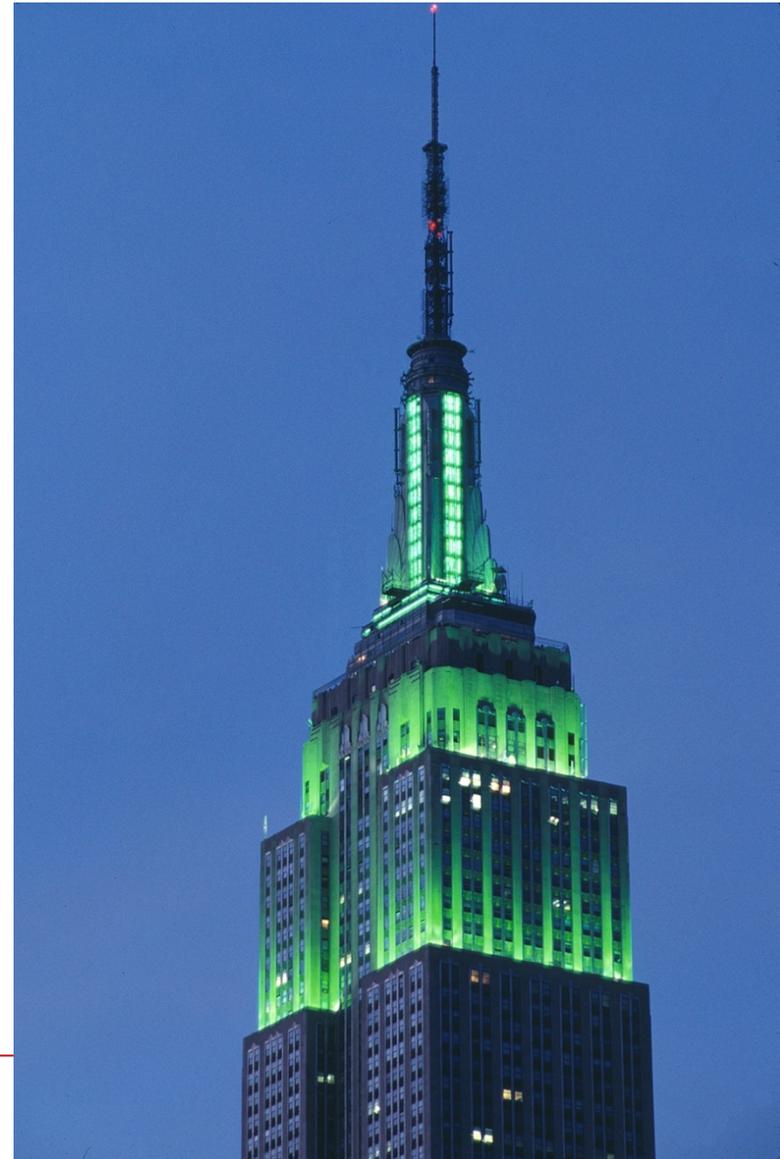
Motivation

The retrofit of the Empire State Building was motivated by the building ownership's desire to:

- 1) Reposition the world's most famous office building into a pre-war trophy
- 2) Prove or disprove energy efficiency retrofit's economic viability
- 3) Use our work to differentiate our building while attracting tenants and creating value
- 4) Produce a replicable model for energy efficiency retrofits of existing buildings – New York City's buildings today represent 85-95% of buildings projected to exist in New York City in 2030
- 5) "If the only place we succeed is ESB, the effort is a failure."

Reposition the world's most famous office building as a Class A pre-war trophy

- Part of \$550M renovation
 - 38% annual energy savings; almost double industry
 - 3.1 year payback vs 10-20
 - First multi-tenanted, integrated, energy efficient retrofit project
 - High-credit tenant occupancy
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A new approach for optimal results

- Assemble a collaborative team of world-class sustainability and energy specialists
- Develop an optimal solution through a four- phase iterative process and rigorous cost-benefit analysis
- Leverage industry leading tools and standards, and develop new ones:
 - Financial Modeling Tool
 - Energy Modeling Tool
 - Sustainability Metrics Tool (GHG/CO2)
 - eQUEST
 - Energy Star
 - Green Globes
 - LEED



Create a replicable model

Demonstrate how to cost-effectively retrofit a large multi-tenant office building to inspire others to embark on integrated energy efficiency retrofits.

1 Identify opportunities

- 60+ energy efficiency ideas were narrowed to 17 implementable projects
- Team estimated theoretical minimum energy use
- Developed eQUEST energy model

2 Evaluate measures

- Net present value
- Greenhouse gas savings
- Dollar to metric ton of carbon reduced
- Calculated for each measure

3 Create packages

- Maximize net present value
- Balance net present value and CO₂ savings
- Maximize CO₂ savings for a zero net present value
- Maximize CO₂ savings

4 Model iteratively

- Iterative energy and financial modeling process to identify final eight recommendations

Methodology



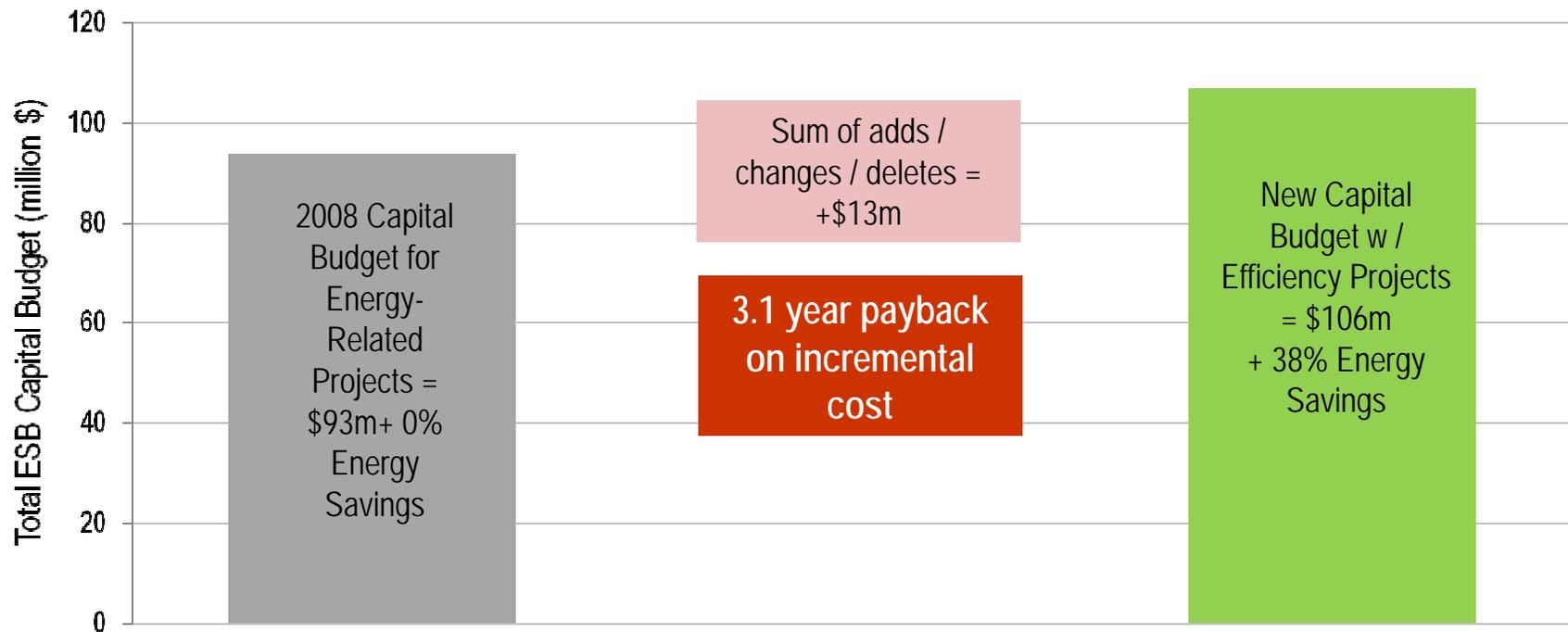
Key Outputs:

<ul style="list-style-type: none">• Baseline Capital Projects Report: \$244• Projected JCI performance contract budget: \$27m	<ul style="list-style-type: none">• Baseline Energy Benchmark Report (\$11.3m annual energy cost without broadcasting)	<ul style="list-style-type: none">• Tenant Initiatives (pre-builts, design guidelines, energy management) Report• Tuned eQUEST model	<ul style="list-style-type: none">• Model (eQUEST, financial, GHG) outputs• Integrated Sustainability Master Plan Report (including Energy Master Plan)
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Demonstrate business case through verifiable operating costs reductions and payback analysis

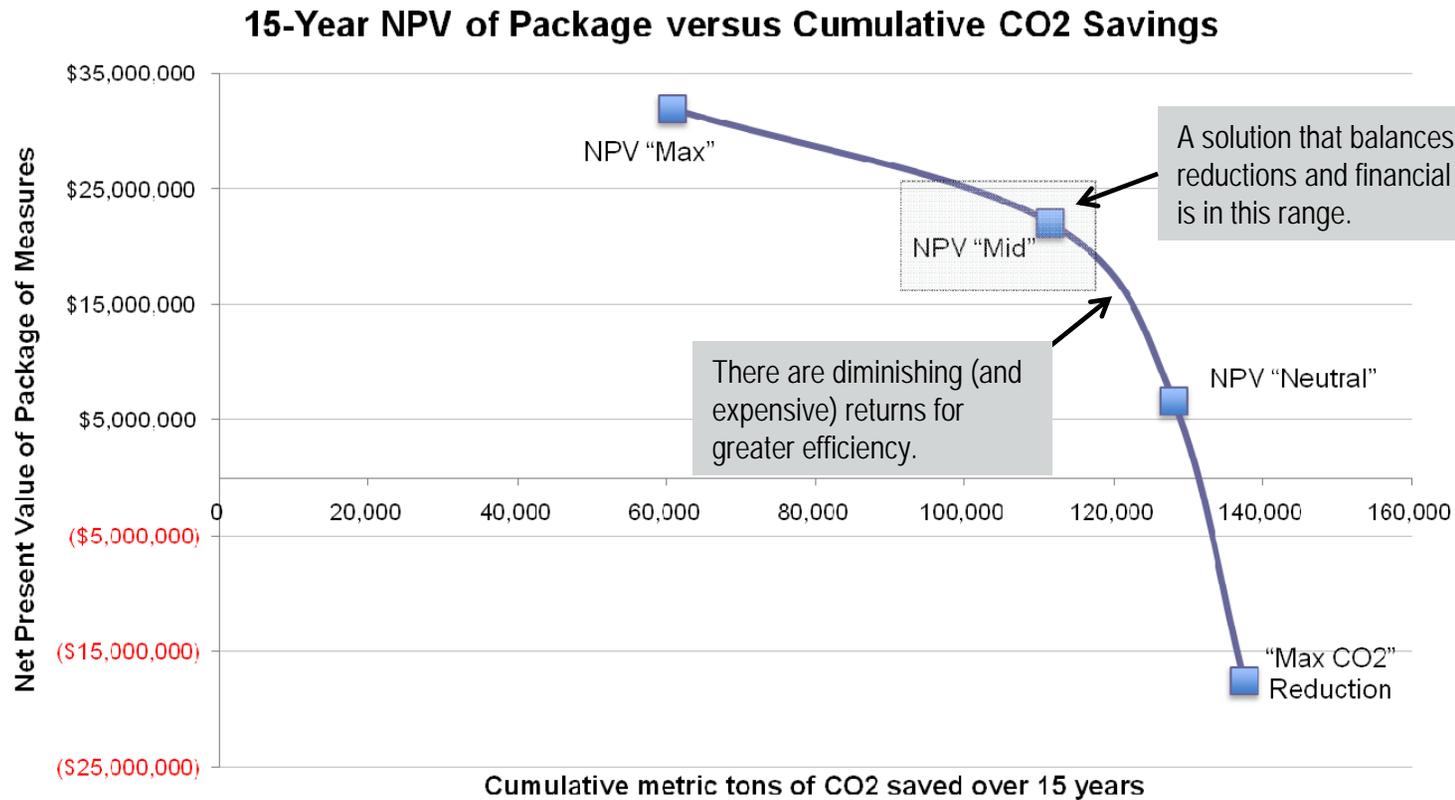
With a \$550 million capital improvement program underway, ownership decided to re-evaluate certain projects with cost-effective energy efficiency and sustainability opportunities in mind.

Capital Budget Adjustments for Energy Efficiency Projects



Balance financial return & carbon reduction

ESB can achieve a high level of CO₂ and energy reduction cost-effectively

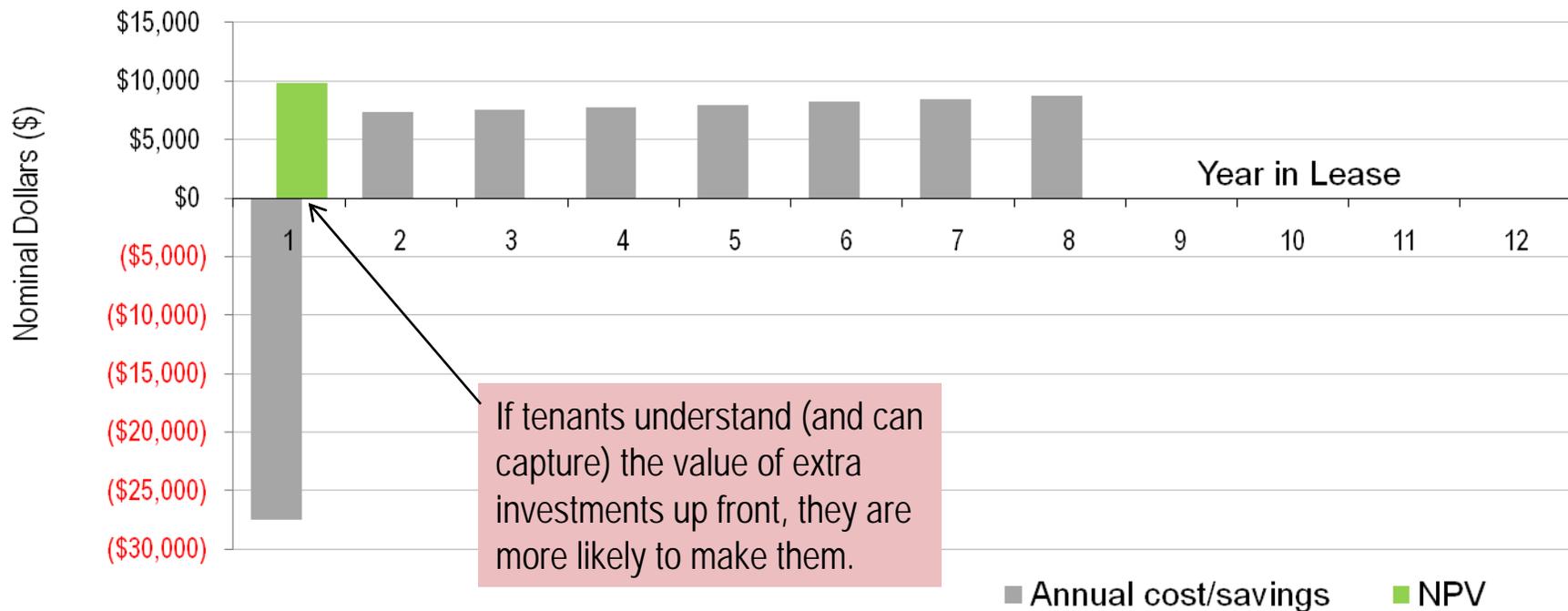


Tenant utility cash flow

Demonstrate the business case through verifiable operating costs reductions and payback analysis

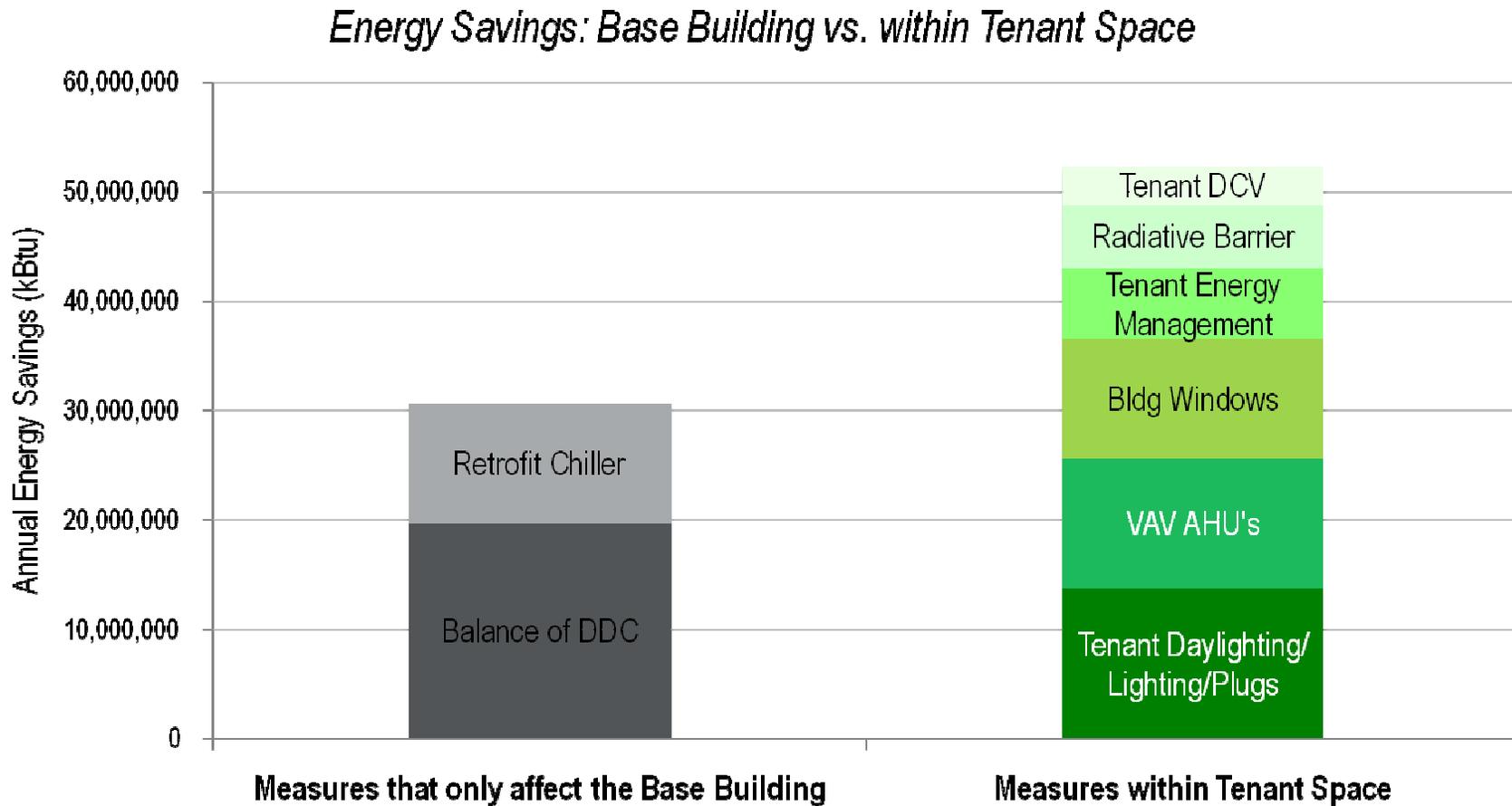
Energy efficiency and sustainability provide amenities (lower energy costs, easier carbon reporting, daylighting, etc.) that set the building apart from surrounding tenant space.

Illustrative: Tenant Utility Cash Flow



The business case – integrated approach

More than half the savings exist within tenant spaces



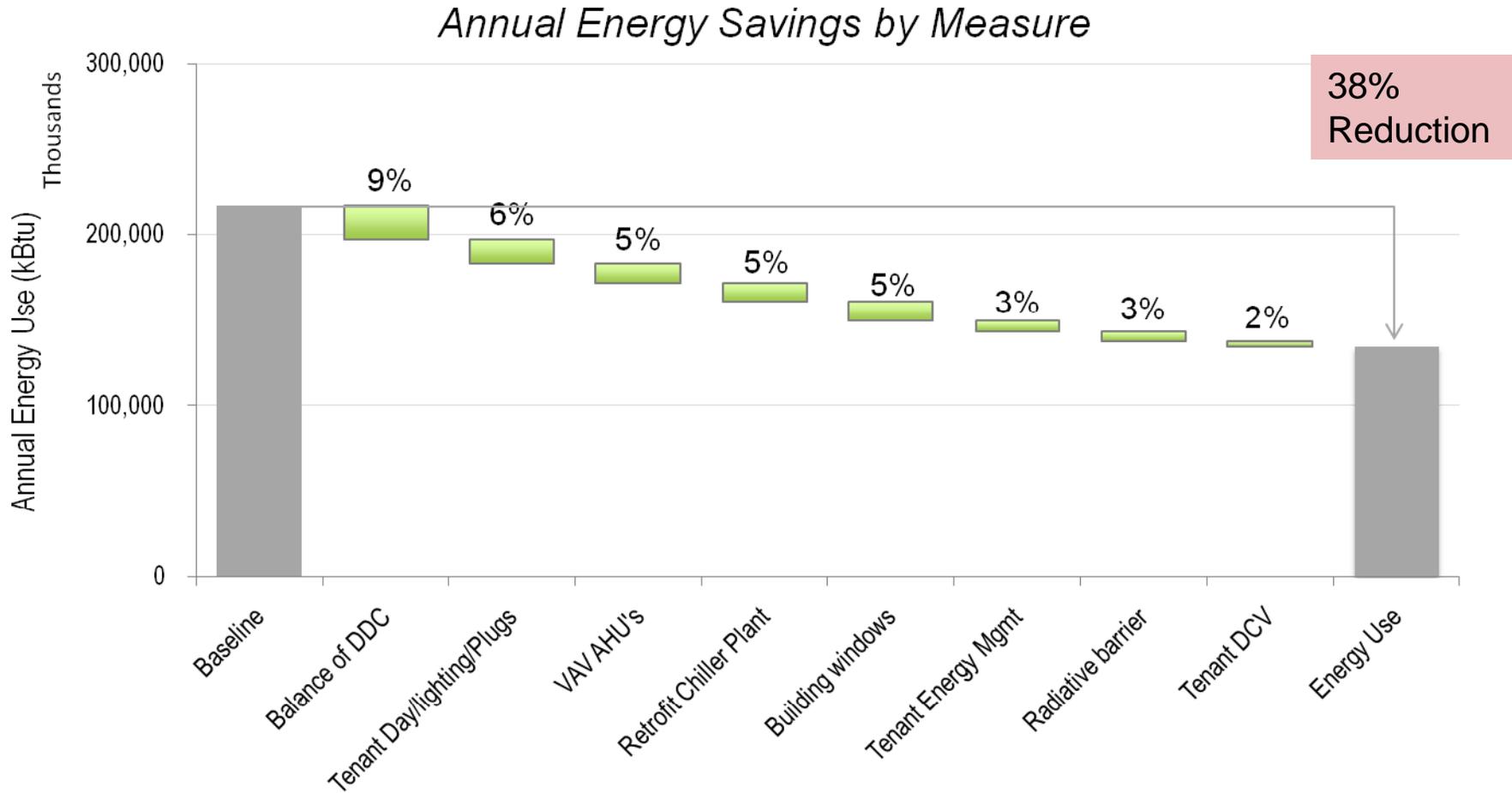
Tenant space

Programs that will help to reduce and manage tenant energy use

1. **Tenant pre-built program:** The sustainably designed, energy efficient pre-built prototype will save \$0.70 - \$0.90/sqft in operating costs annually for an additional cost of \$6/sqft and help ESB demonstrate design principles for all tenants to endorse.
 2. **Tenant design guidelines:** Design guidelines, based on the pre-built program, will provide green, energy-efficient ESB standards. Tenants can verify the economic validity of the recommendations by accessing the eQUEST model or tenant financial tool.
 3. **Tenant energy management program:** ESB will sub-meter all tenant spaces and manage a feedback/reporting tool to inform tenants about their energy use. This program will also assist tenants with their own carbon reporting efforts.
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Measures

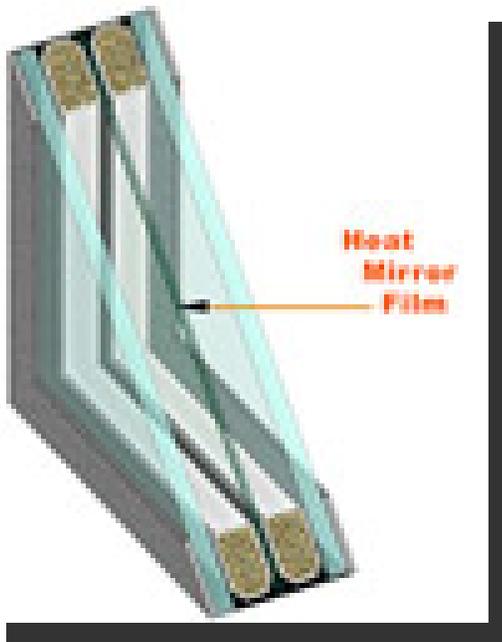
Eight interactive levers ranging from base building measures to tenant engagement deliver these results



Implementing recommended measures

Eight interactive levers ranging from base building measures to tenant engagement deliver these results

WINDOWS: Remanufacture existing insulated glass units (IGU) within the Empire State Building's approximately 6,500 double-hung windows to include suspended coated film and gas fill.



Measures

Eight interactive levers ranging from base building measures to tenant engagement deliver these results

RADIATIVE BARRIER: Install more than six-thousand insulated reflective barriers behind radiator units located on the perimeter of the building.



Measures

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TENANT DAYLIGHTING / LIGHTING / PLUGS: This measure involves reducing lighting power density in tenant spaces, installing dimmable ballasts and photosensors for perimeter spaces, and providing occupants with a plug load occupancy sensor for their personal workstation.



Measures

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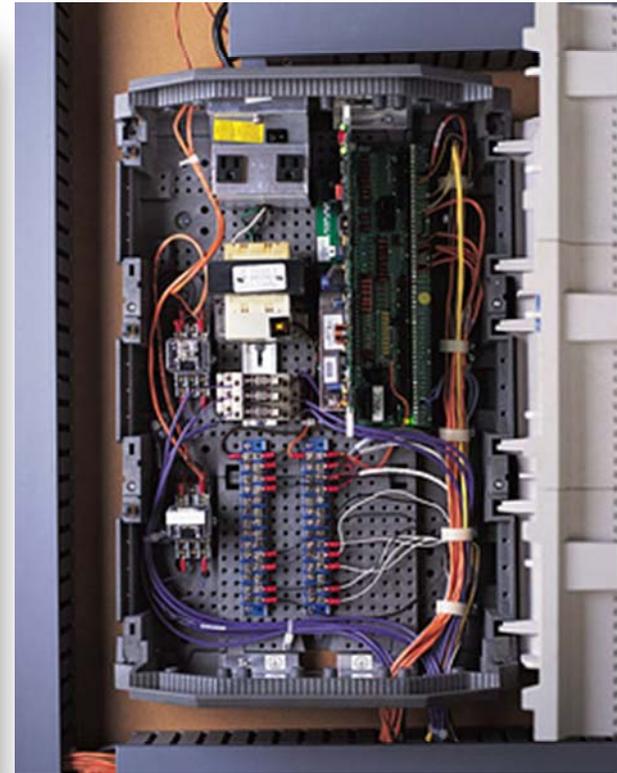
CHILLER PLANT RETROFIT: The chiller plant retrofit project includes the retrofit of four industrial electric chillers in addition to upgrades to controls, variable speed drives, and primary loop bypasses.



Measures

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VAV AIR HANDLING UNITS: Replace existing constant volume units with variable air volume units using a new air handling layout (two floor-mounted units per floor instead of four ceiling-

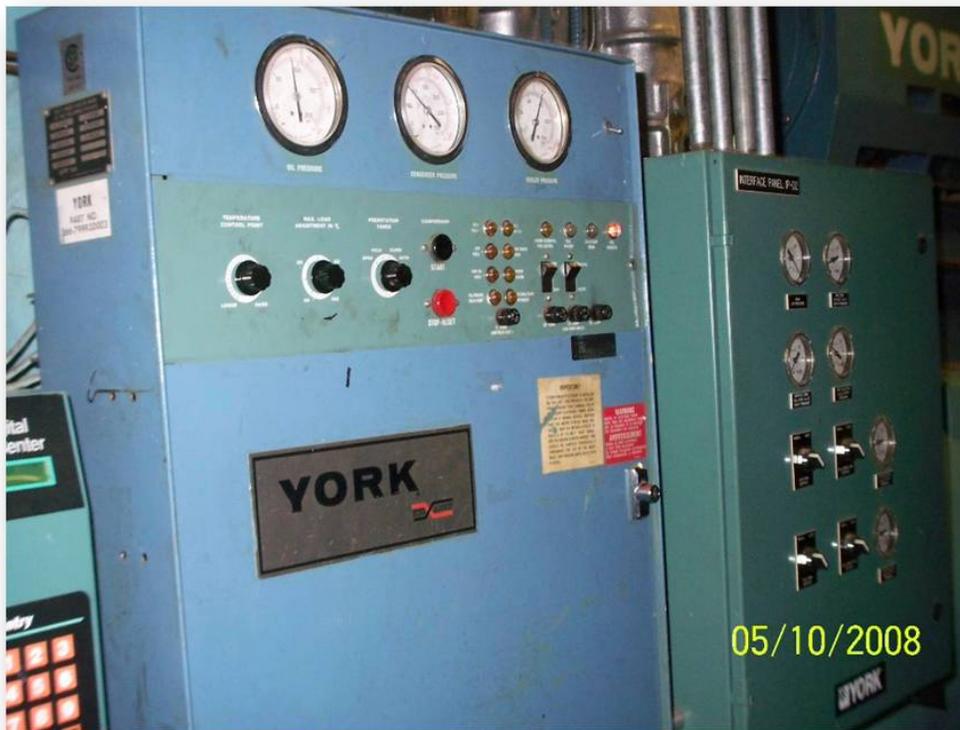


Measures

Eight interactive levers ranging from base building measures to tenant engagement deliver these results

DDC CONTROLS: The measure involves upgrading the existing control systems at the Empire State Building becoming *one of the largest wireless networks ever installed*.

Real-time facilities performance index monitoring used for *continuous commissioning* of HVAC systems.



Measures

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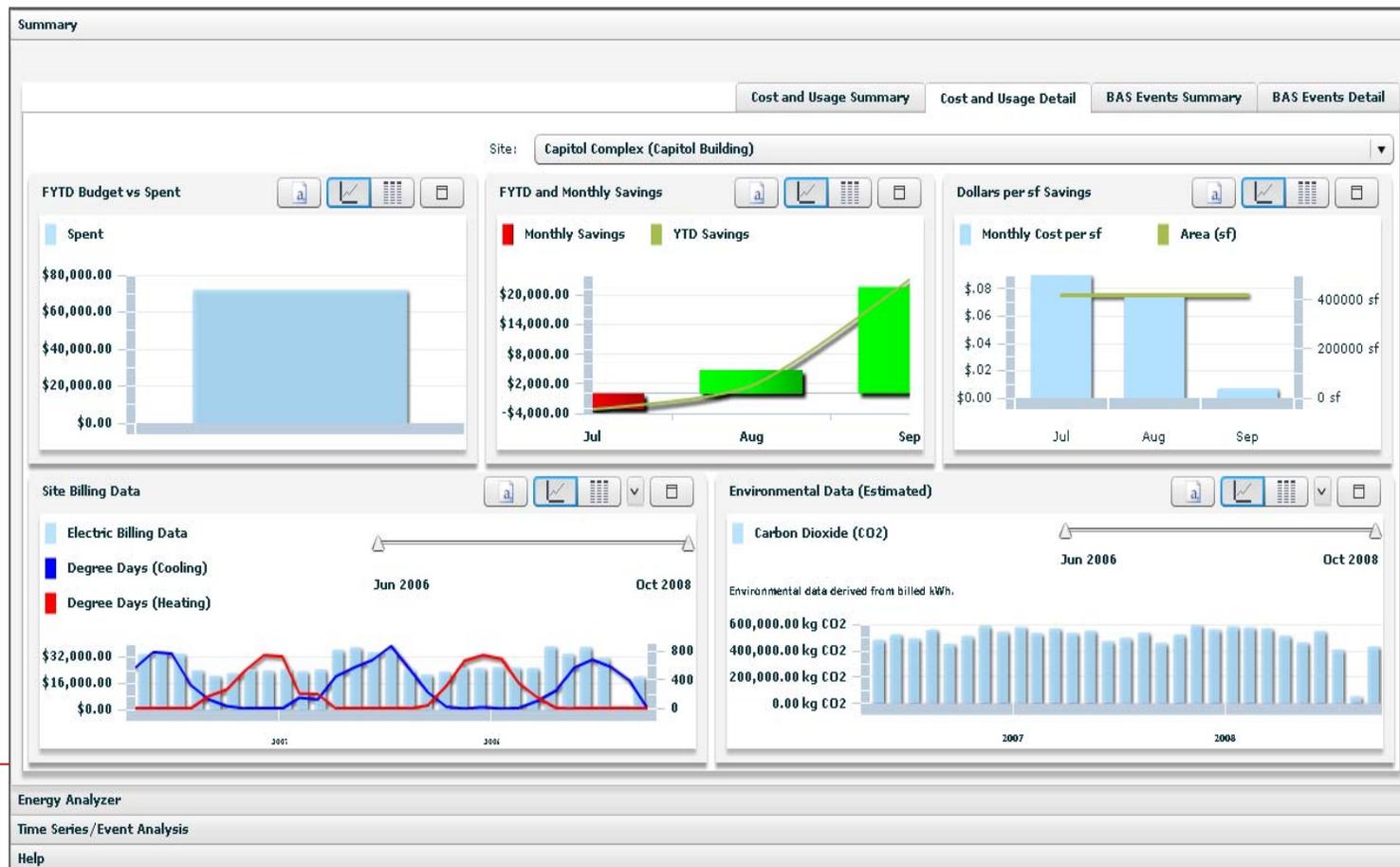
DEMAND CONTROL VENTILATION: This project involves the installation of CO2 sensors for control of outside air introduction to chiller water and DX Air Handling Units.



Measures

Eight interactive levers ranging from base building measures to tenant engagement deliver these results

TENANT ENERGY MANAGEMENT: This project will provide tenants with access to online energy consumption and benchmarking information as well as sustainability tips and updates.

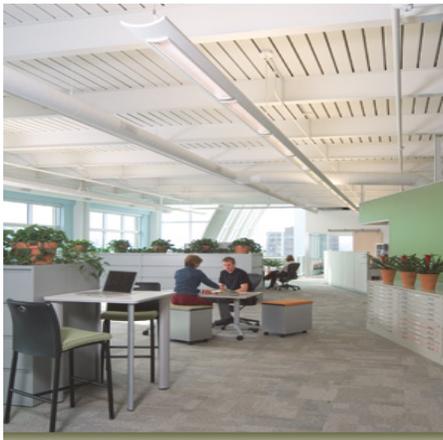


Tenant Results

Enhanced work environments are created

This package of measures also results in enhanced indoor environmental quality and additional amenities for tenants:

- *Better thermal comfort resulting from better windows, radiative barrier, and better controls;*
- *Improved indoor air quality resulting from DCV; and*
- *Better lighting conditions that coordinate ambient and task lighting.*

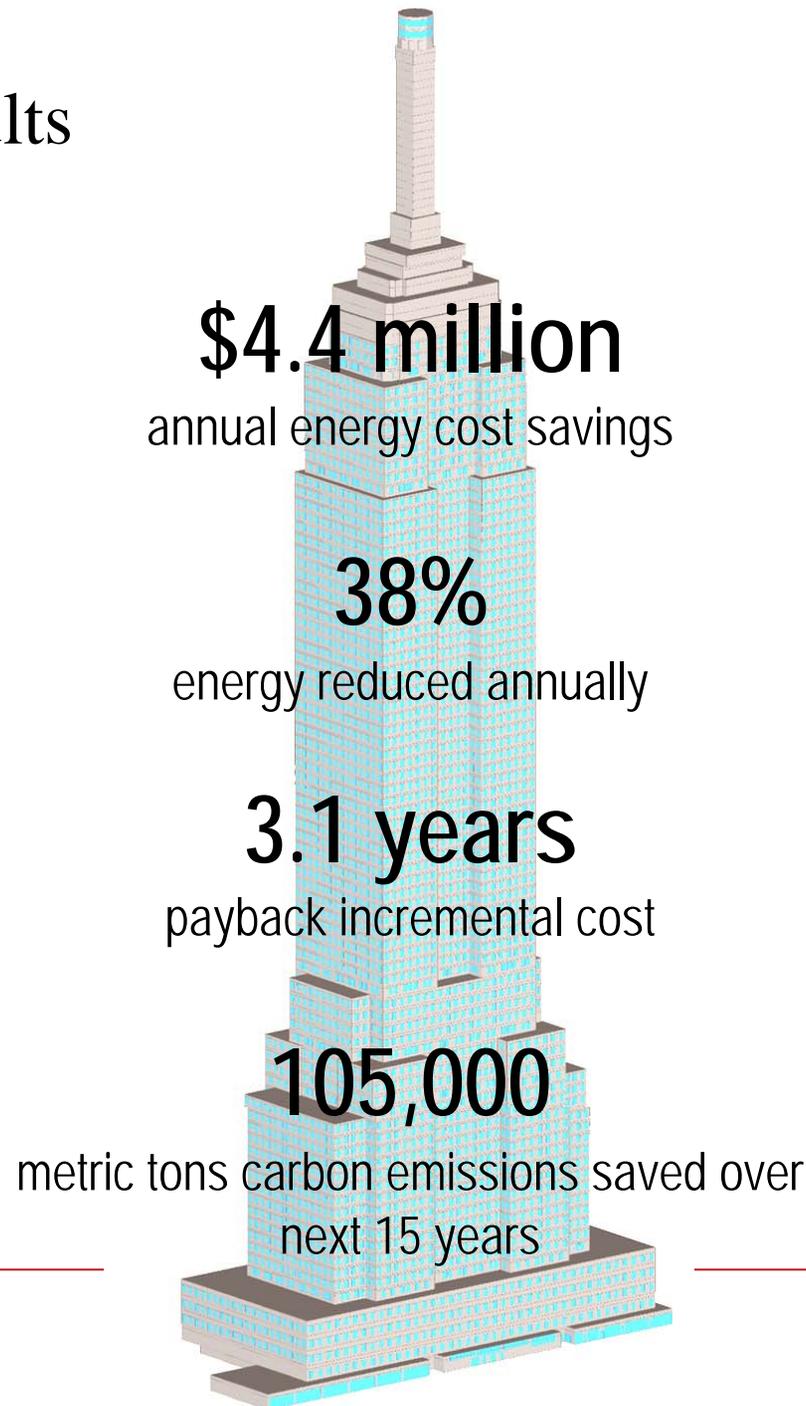


Expected results

- \$550M renovation program
- \$120M expenditures altered, \$20M new expenditures
- \$7M savings, \$13M net new expenditures
- Funded through energy and operational savings
- Serve as model for owners of existing buildings
- Open source, not proprietary, replicable
- Focus on local and national activities and ongoing new contracts and education



Expected results



Outcomes



- *Right steps in the right order* – integrated approach to all building systems
 - Utilize existing tools and create new ones
 - Demonstrate how retrofit can cost-effectively achieve 35%+ energy savings and serve as model for existing buildings
 - Guaranteed savings supported by M&V and real-time commissioning
 - Tenant design guidelines, model pre-built office suite to showcase link between base-building and tenant space improvements in accelerating building's progress toward sustainability goals and energy efficiency
 - Transparent, web-based resources
-

HOME FEATURE STORIES PROCESS PROJECT TOOLS PARTNERS PRESS



EMPIRE STATE BUILDING
Leadership in American Progress in Sustainability

A project of this scale might seem far removed from your small office or home - but there are opportunities to save energy in any situation.
[Read more](#)

Built during the Great Depression, the Empire State Building symbolizes America's limitless potential. Today the building is undergoing a major sustainability retrofit to become a leading example of economic and environmental revitalization.

Consulting, design, and construction partners Clinton Climate Initiative (CCI), Johnson Controls Inc. (JCI), Jones Lang LaSalle (JLL), and Rocky Mountain Institute (RMI), recently completed an 8 month modeling and analysis project which will save 38 percent of the building's energy and \$4.4 million annually.

This website provides detailed information on the building's transformation.
[Read the white paper.](#)

SOLVE THE RETROFIT PUZZLE

See how taking the right steps, in the right order, makes all the difference.

This website aims to provide complete and transparent information on the Empire State Building's sustainability retrofit. We hope to set a new standard for thinking about large commercial retrofits: a standard that owners, designers, engineers, and tenants around the world can easily adopt.

[Download the full white paper](#)

Click the building to download quick facts about the Empire State Building Program

Watch the video on YouTube

Creating a leading example for the design of commercial retrofits was at heart a learning experience for the team. In the process of developing specific project recommendations, the team uncovered several key lessons for the retrofit of large multi-tenant commercial office buildings. Read more "Lessons Learned"

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Financing options

Several innovative financing options exist or are under development to help you access capital with attractive rates and terms for deep energy retrofits in commercial real estate:

- 1) Performance contracting
- 2) On-bill financing
- 3) Tax-lien financing

Innovative solutions for buildings large and small, private and public, owner-occupied and tenant-occupied



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Next steps

What you can do to take action?

- 1) Triage your building portfolio based on renovation cycle
- 2) Create a sustainability master plan including retrofit projects, design standards, lease structure changes, tenant energy management programs, and marketing initiatives
- 3) Commit to an integrated, whole-building retrofit approach: Conduct whole-building audits rather than single measure projects
- 4) Require performance guarantees with ongoing measurement and verification of savings to reduce risk
- 5) Engage tenants, employees, and building occupants in energy savings efforts through training, tools, technology

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