



• August 15-18, 2010 • Dallas, Texas •
• Dallas Convention Center •



The Empire State Building

The Empire State Building

Repositioning an Icon as a Model of Energy Efficient Investment



JONES LANG
LASALLE®

Real value in a changing world



CLINTON
CLIMATE
INITIATIVE

Rocky Mountain Institute



Johnson
Controls



GovEnergy 2010

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 creates a competitive advantage for owners through lower costs and better work environment for tenants. Succeeding in these efforts has made a replicable model for others to follow, and a chance to inform policy with good practice.”

*- Anthony E. Malkin
Malkin Holdings*

Industry drivers

Converging forces

Mass acceptance of global warming, climate change

Rising energy prices

Widely accepted green building standards

Emerging green building regulation

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

Possible cap and trade on GHG emissions

Customer, employee and shareholder pressures

Business opportunity

Reduced operating costs

Increased market share

Improved productivity and quality

Enhanced brand

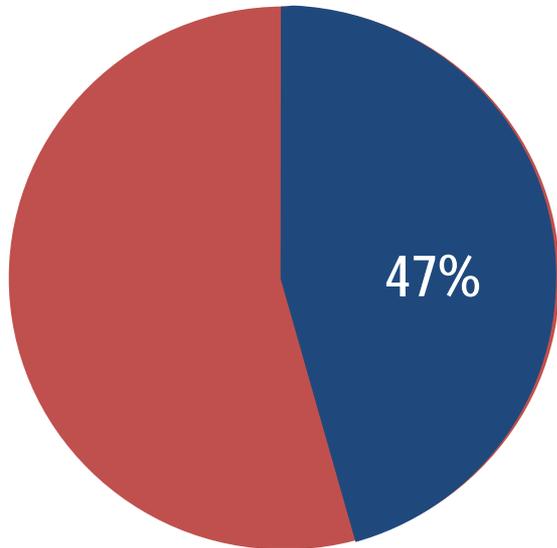
Talent recruitment and retention

Risk mitigation

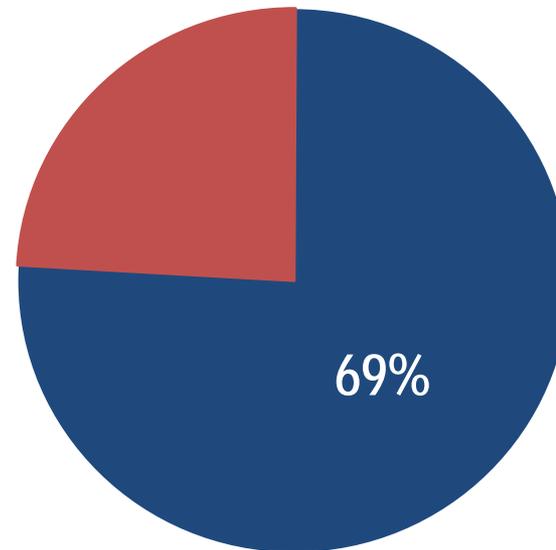
Sustainability is a growing priority

Companies that think sustainability is a critical business issue

2007



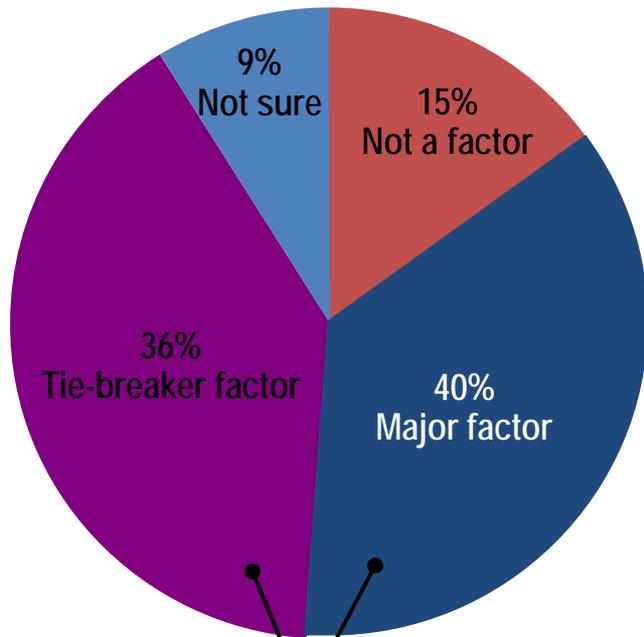
Today



* Source: CoreNet/Jones Lang LaSalle survey on sustainability, 2008

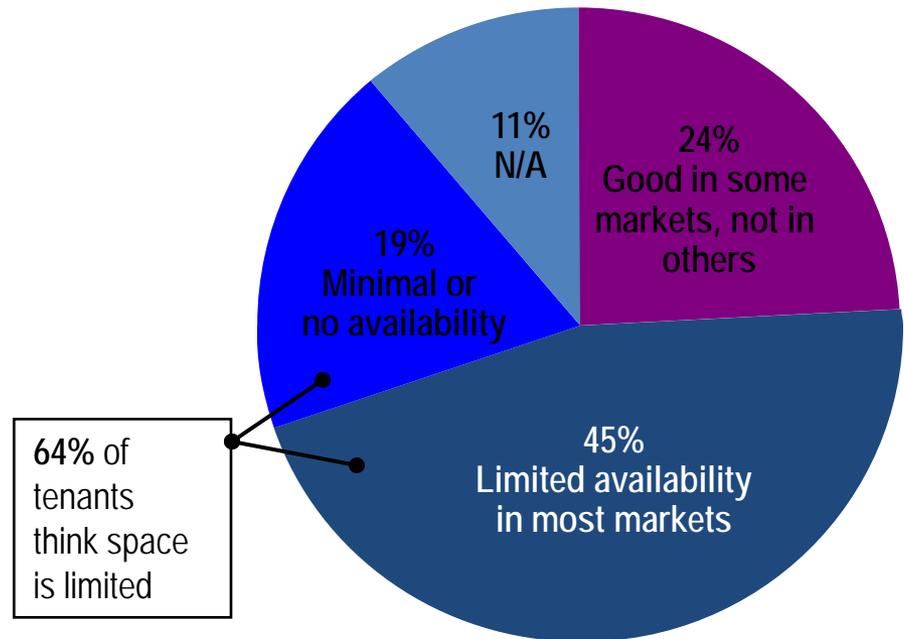
Sustainability is impacting location decisions

Q: How big a factor is energy/sustainability in your location decisions?



76% of tenants consider energy/sustainability a factor in location decisions

Q: How strong is the availability of sustainable space for lease?



64% of tenants think space is limited

* Source: CoreNet/ Jones Lang LaSalle survey on sustainability, 2008

Real Estate's impact

Sustainable Real Estate:

- No longer a cost premium to develop a green building*
- Achieve operating expense savings of up to 40%
- Reduce absenteeism: 15% lower in high-performance buildings

Green buildings save:

- 30% 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 =Electricity costs will be going up

**Federal mandates require 20% more energy efficient by 2015, 50% by 2020
= shape up or become obsolete**

**Federal funding for energy retrofits=
take advantage and upgrade your building**

Call for greater transparency=know where you stand



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

Ongoing federal, state and local legislative action

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

The market wants...

Transparency

Metrics

Results



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

4.0 million visitors per year

\$11 million in annual energy costs

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

88 kBtu per sf per yr for the office building

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

“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

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

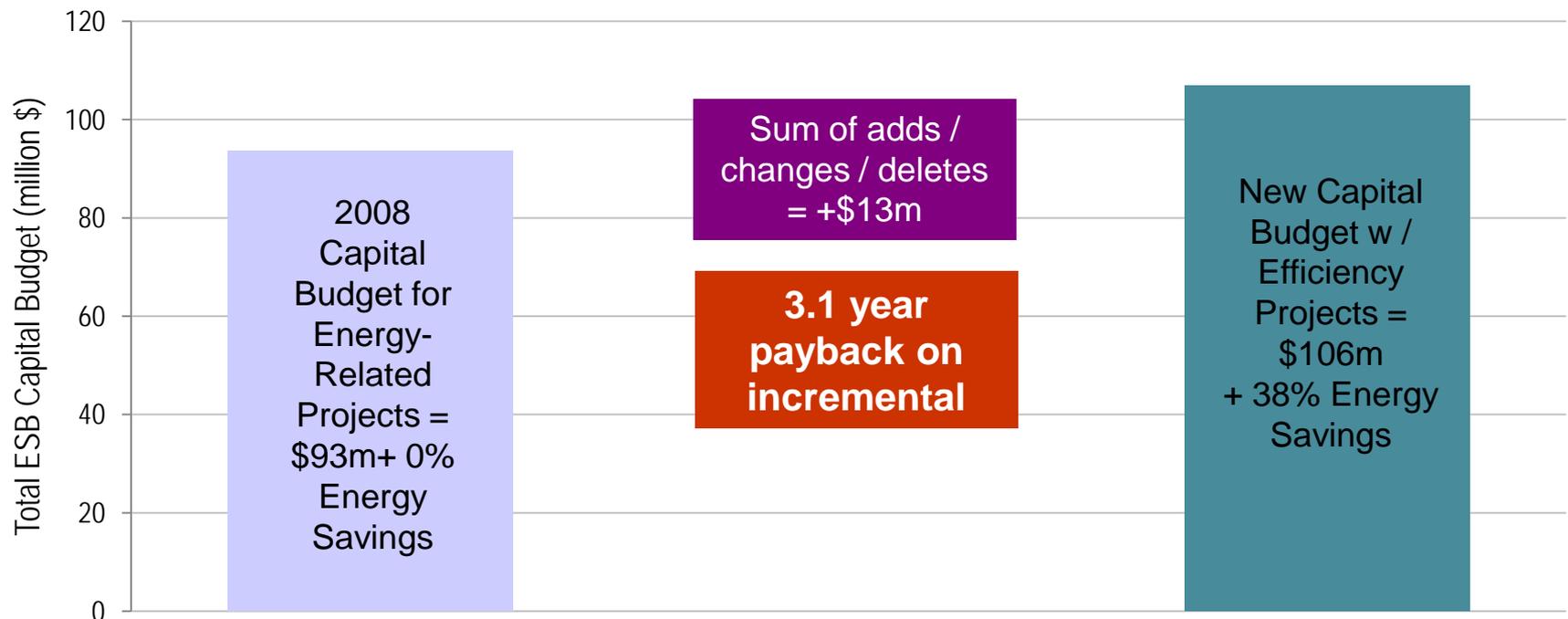
4 Model iteratively

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

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.

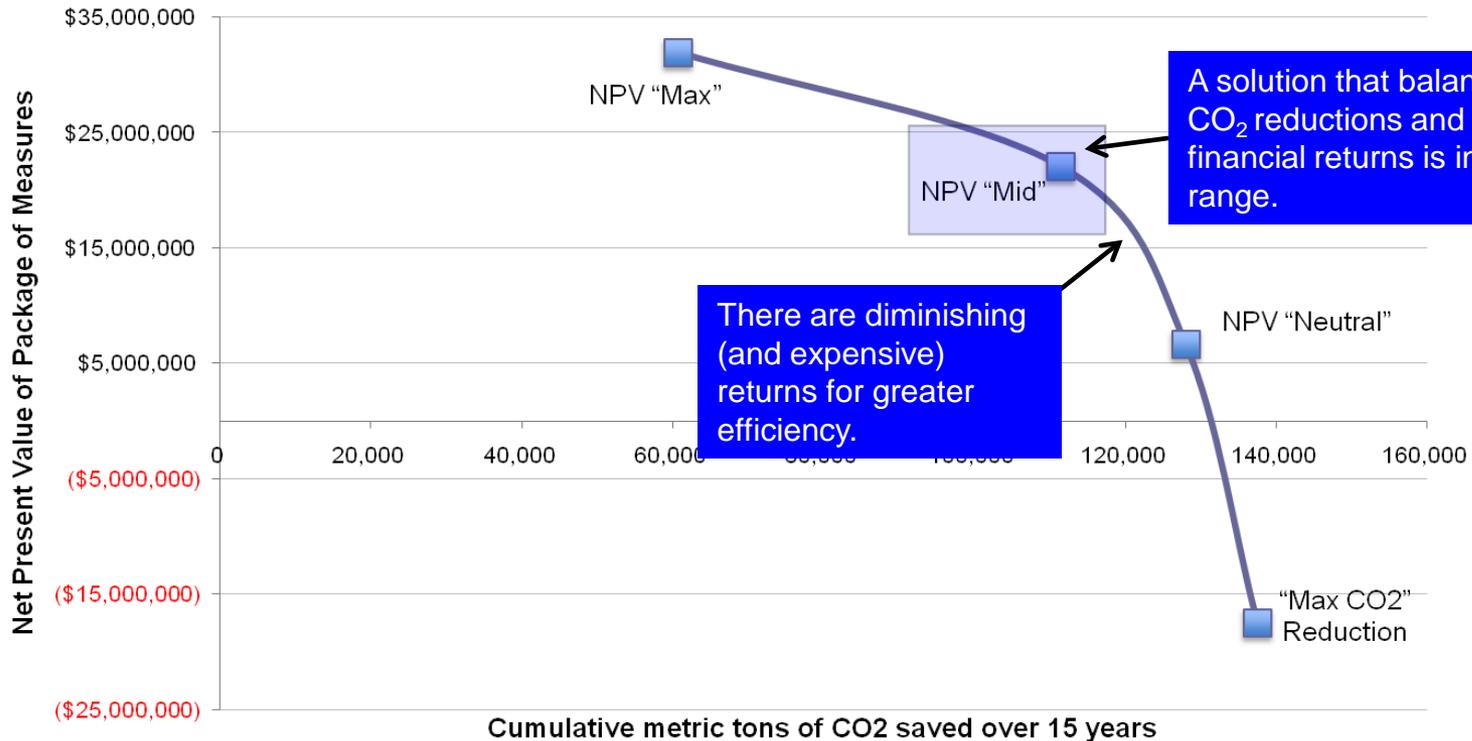
Capital Budget Adjustments for Energy Efficiency Projects



Balance financial return & carbon reduction

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

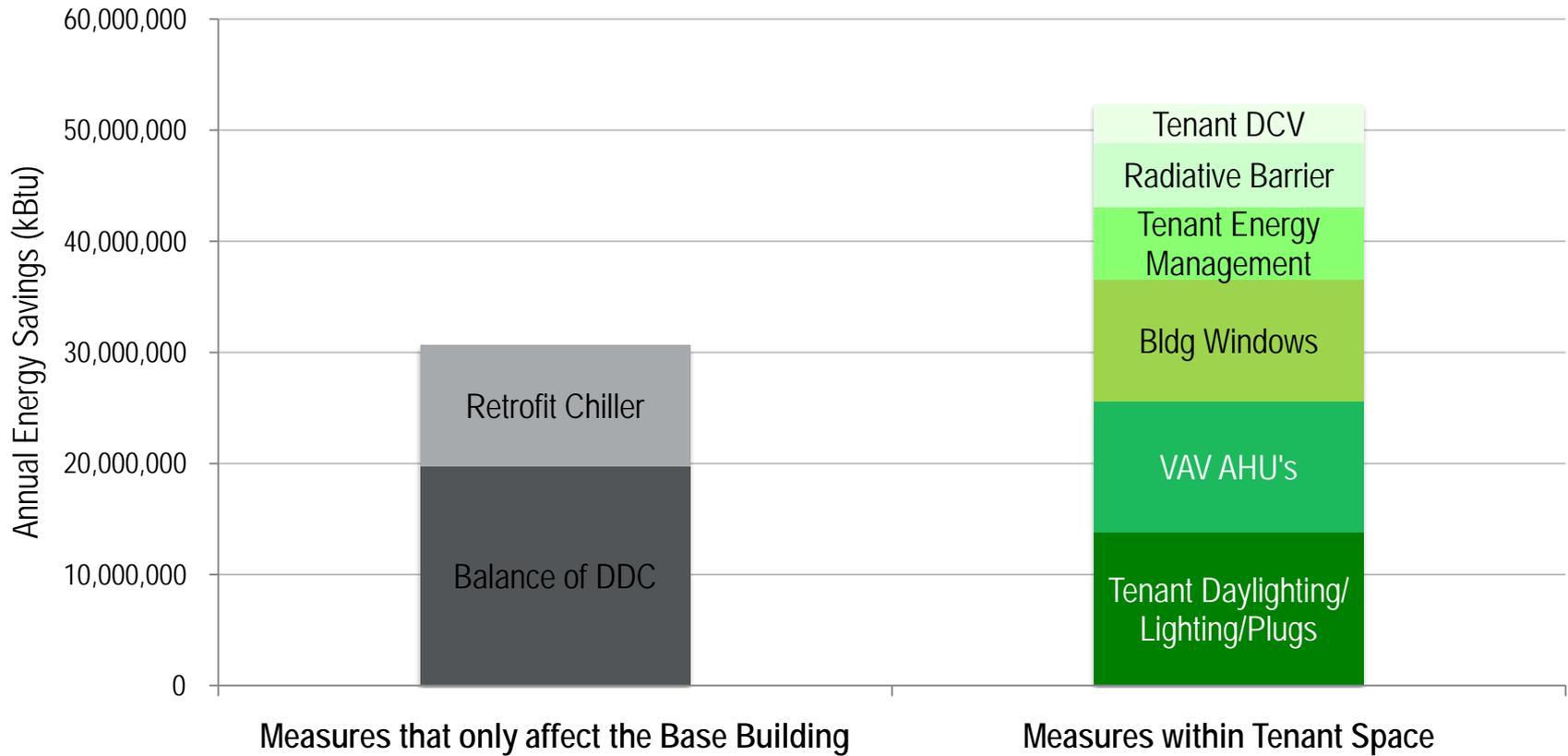
15-Year NPV of Package versus Cumulative CO2 Savings



The business case – integrated approach

More than half the savings exist within tenant spaces

Energy Savings: Base Building vs. within Tenant Space



Savings in Tenant Spaces

Investments based on incremental cost and projected savings

	Total Project Cost	Total Cost (\$/rsf)	Construction Cost (\$/rsf)
Class 'A' Office Budget	\$4,413,404	\$180.88	\$121.45
Actual Costs	\$4,624,262	\$189.52	\$132.95
LEED Premium*	\$210,858	\$8.64	\$11.50
*Total LEED Premium – 4.7%			
Energy Saving (NPV for 15 Yrs)	\$593,496		
NYSERDA Grant (Approx.)	\$22,802		
Net Positive**	\$405,440		
**Total Savings – 9.2%			



Data provided by Skanska based on performance of their 32nd floor office at the ESB, 2009

Measured and Verified Energy Savings

Utility Consumption Comparison

136 Madison Avenue
(Class "A" Office)

	2008					Total Annual Actual
	JAN Actual	FEB Actual	MAR Actual	APR Actual	MAY Actual	
Cost	\$3,677	\$3,921	\$4,209	\$3,721	\$4,905	\$57,506
Consumption (KWH)	13,760	15,520	17,920	14,880	19,893	220,853
Avg. Cost per KWH	0.27	0.25	0.23	0.25	0.25	0.26
Energy Cost (Per Rentable Square Feet)	0.22	0.24	0.26	0.23	0.30	3.49

Comparison Annual Adjusted*

\$85,039

326,595

0.26

3.49

*Adjust Class "A" office to the same RSF as ESB

Empire State Building
(LEED Platinum)

	2009					Total Annual Projected
	JAN Actual	FEB Actual	MAR Actual	APR Actual	MAY Actual	
Cost	\$1,989	\$1,987	\$2,500	\$2,151	\$2,525	\$32,015
Consumption (KWH)	10,516	10,506	11,686	10,523	12,220	165,764
Avg. Cost per KWH	0.19	0.19	0.21	0.20	0.21	0.19
Energy Cost (Per Rentable Square Feet)	0.08	0.08	0.10	0.09	0.10	1.31

ESB LEED® Office Annual Adjusted**

\$43,099

165,764

0.26

1.77

**Madison rate utilized

49%
Energy Savings

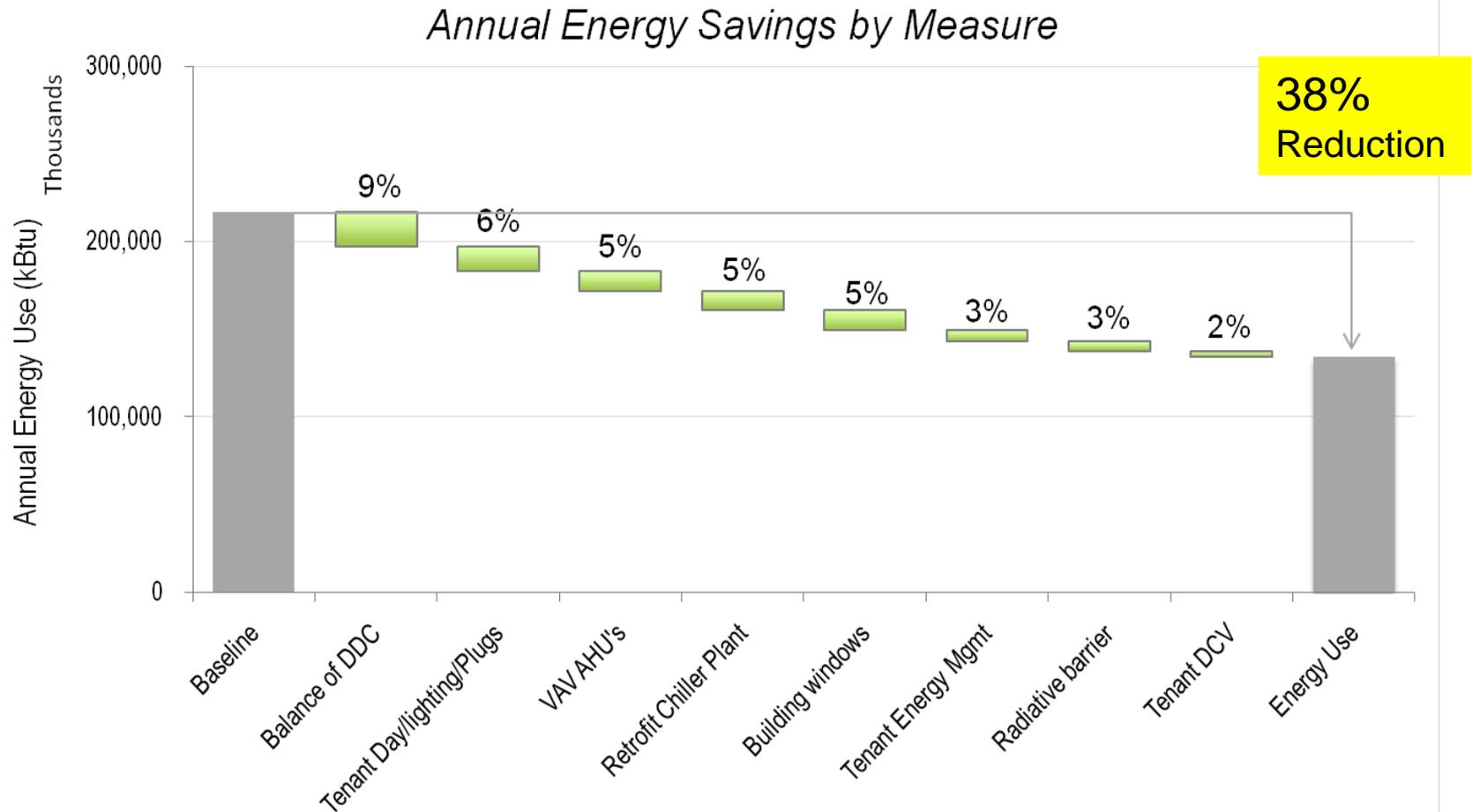
Data provided by Skanska based on performance of their 32nd floor office at the ESB, 2009



GovEnergy 2010

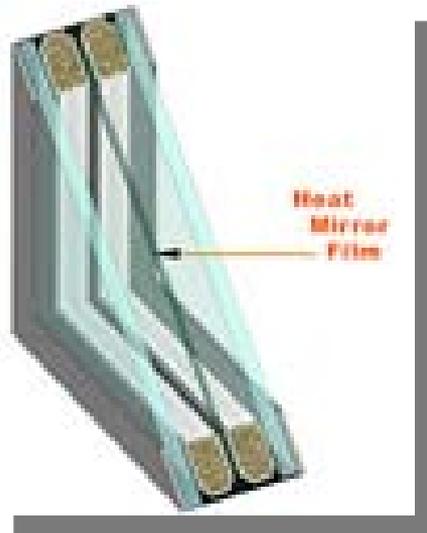
Implementing recommended measures

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



Measures

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.



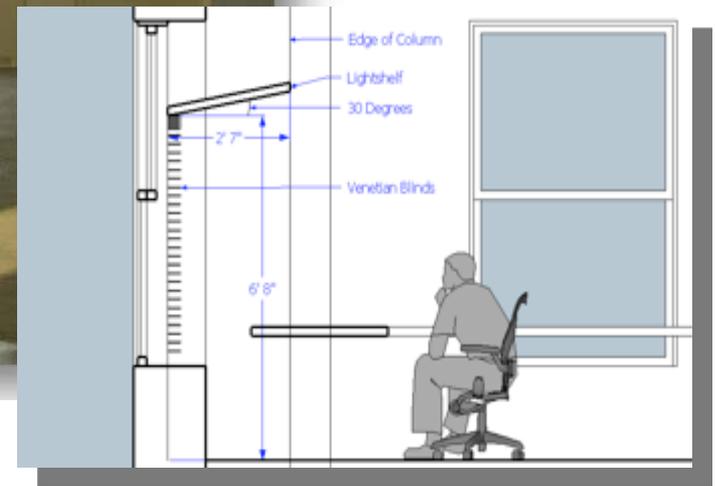
Measures

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



Measures

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

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.



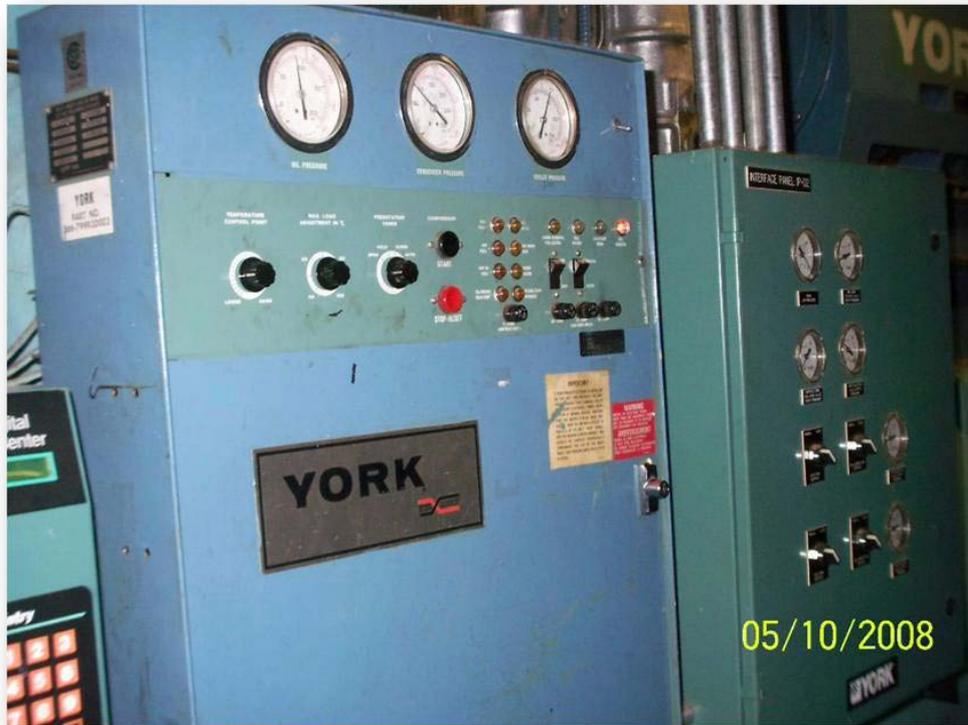
Measures

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-hung units).



Measures

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.



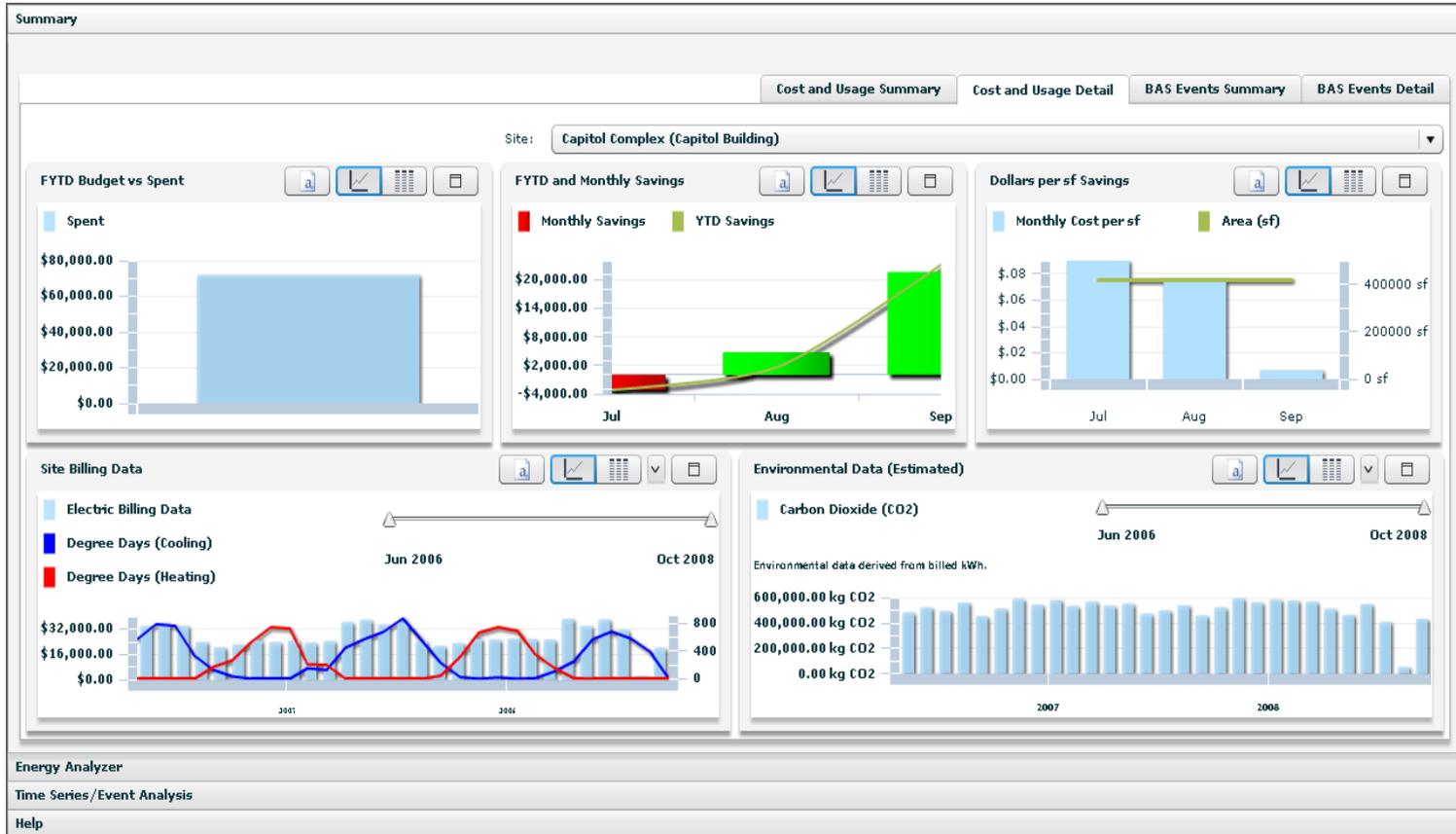
Measures

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

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



Challenges



- Full exploration of all energy efficiency measure can be time consuming and resource intensive
- Realizing maximum impact requires the engagement and participation of all of the building stakeholders and skilled execution
- Important energy efficiency measures are not economically viable and therefore limit the total reductions possible
- Mechanisms for financing these projects need to be standardized and supported by the appropriate financial institutions
- Many buildings are subscale for large ESCO programs
- Resource limitations are a governor of speed and breadth

Practical 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
- 6) Create concrete successes at the building and pre-built level to build momentum and enthusiasm

www.esbsustainability.com

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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.](#)



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"](#)

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

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