Is proud to reintroduce
THE EMPIRE STATE BUILDING
a Midtown Manhattan
Pre-War Trophy office building
with $500 million in capital
improvements underway.

Full floors from 25,000 - 50,000 sq. ft.
Water-leased, build-to-suit from 10,000 sq. ft.
Pre-built from 2,500 - 5,000 sq. ft.

THE EMPIRE STATE REBUILDING
Reinventing the World’s
Most Famous Urban Building
www.empirespacereimagined.com
The Empire State Building
Creating a Replicable Model for Energy Efficiency Reinvestment
BUILDINGS ACCOUNT FOR 80% OF NEW YORK CITY’S ENERGY CONSUMPTION.

Use your web-enabled phone to learn more about how the Empire State Building is transforming into a global leader in sustainability.

Go to esbtour.com
A GROUNDBREAKING RETROFIT IS REDUCING OUR ENERGY BILL BY 38.4%.

Use your web-enabled phone to learn more about how the Empire State Building is transforming into a global leader in sustainability.

Go to esbtour.com
CUT CARBON EMISSIONS BY 105,000 METRIC TONS.

Use your web-enabled phone to learn more about how the Empire State Building is transforming into a global leader in sustainability.

Go to esbtour.com
LIKE TAKING 20,000 CARS OFF THE ROAD.

Use your web-enabled phone to learn more about how the Empire State Building is transforming into a global leader in sustainability.

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The Empire State Building
Create a transparent, replicable, quantitative program for cost justified energy efficiency reinvestment with monitored and verified operating costs reductions and payback analysis

- **102 stories** and **2.95 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)
Objective and Motivation

In 2006, ownership set an upgrade program to reposition and repurpose the Empire State Building. In 2008, energy efficiency was made a priority.

1) Reposition the world's most famous office building into a Pre-War Trophy asset
2) Prove or disprove energy efficiency retrofits’ economic viability
3) Use our work to publicize and differentiate our building and attract tenants
4) Produce a replicable model for energy efficiency retrofits of existing buildings, which will make up 85% of buildings in place in New York City in 2030
5) “If the only place we succeed is ESB, the effort is a failure.”
“Green” vs. Energy Efficient Retrofits

Common definitions of “Green” buildings omit measured and verified energy efficiency. Energy efficient retrofits focus on quantifiable energy efficiency measures.

<table>
<thead>
<tr>
<th>Green Building Practices</th>
<th>Energy Efficient Retrofits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable, recycled-content, reused and locally produced materials</td>
<td>Reduce loads</td>
</tr>
<tr>
<td>Indoor air quality (voc-free materials, DCV)</td>
<td>Provide controls</td>
</tr>
<tr>
<td>Recycling programs</td>
<td>Optimize systems efficiency</td>
</tr>
<tr>
<td>Water reduction</td>
<td>Integrated, lifecycle approach</td>
</tr>
<tr>
<td>Green cleaning</td>
<td>Reduce energy usage</td>
</tr>
<tr>
<td>Green pest management</td>
<td>Quantifiable metrics</td>
</tr>
<tr>
<td></td>
<td>Guaranteed savings</td>
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<tr>
<td></td>
<td>Measurable payback and return on investment</td>
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</tbody>
</table>
## 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
Demonstrate business case through verifiable operating costs reductions and payback analysis

$550 million capital improvement program including building systems, retenanting costs, observatory and broadcasting upgrades, and historic restoration. $500 million, or $172 psf, for office building uses.
Achieve financial return & carbon output reduction

ESB can reduce energy use cost-effectively and CO2 reduction comes along for free.

![Graph showing 15-Year NPV of Package versus Cumulative CO2 Savings]

A solution that balances CO2 reductions and financial returns is in this range.

There are diminishing (and expensive) returns for greater efficiency.
The business case – integrated approach

More than half the savings exist within tenant spaces
Tenant Spaces

Enhanced work environments are created

- 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.
- Positive ROI
- Tenant Prebuilt Program and Design Guidelines
Savings in Tenant Spaces

Skanska studied their own installation costs to project costs and savings

<table>
<thead>
<tr>
<th></th>
<th>Total Project Cost</th>
<th>Total Cost ($/rsf)</th>
<th>Construction Cost ($/rsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 'A' Office Budget</td>
<td>$4,413,404</td>
<td>$180.88</td>
<td>$121.45</td>
</tr>
<tr>
<td>Actual Costs</td>
<td>$4,624,262</td>
<td>$189.52</td>
<td>$132.95</td>
</tr>
<tr>
<td>LEED Premium &amp; Energy Efficiency*</td>
<td><strong>$210,858</strong></td>
<td><strong>$8.64</strong></td>
<td><strong>$11.50</strong></td>
</tr>
</tbody>
</table>

*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
Integration of efficiency measures

The key to the ESB process is integrating the right steps in the right order. Eight interactive steps were chosen out of more than 60 considered... no “Silver Bullet”.

Annual Energy Savings by Measure

- Baseline
- Balance of DDC
- Tenant Daylighting/Plugs
- VAV AHU’s
- Retrofit Chiller Plant
- Building windows
- Tenant Energy Mgmt
- Radiative barrier
- Tenant DCV
- Energy Use

38% Reduction
STEP ONE
TRANSFORMING THE EMPIRE STATE BUILDING

Small changes, big impact. Simple changes to the outer shell make the whole building more efficient. Saving money without sacrificing comfort or performance.

OUR SOLUTION

- WINDOW REFURBISHMENT
  We’re removing, improving and reinstalling all 6,514 windows to make them more energy efficient.

- RADIATOR INSULATION
  We’re installing 6,514 heat-reflective shields behind all radiators to prevent heat from escaping through the walls.

- REUSING MATERIALS
  Windows are refurbished on site, eliminating emissions from manufacturing and transportation — keeping them out of landfills.

STEP ONE RESULTS

-22,000
Reduce CO₂ emissions by 22,000 metric tons over 15 years

$1,000,000
Save $1 million a year

x 4,000
That’s like taking 4,000 cars off the road!
Measures

**WINDOWS:** Refurbishment of existing 6,514 duo-pane in an on site facility increased insulation from R-2 to R-8. Process included the addition of suspended, coated film and new krypton/argon gas fill. 96% of original glass and frames were reused.
Measures

**RADIATIVE BARRIER:** Installed more than six-thousand insulated reflective barriers behind radiator units located on the perimeter of the building. Virtually no building has this insulation.
STEP ONE
TRANSFORMING OUR CITY

We can’t do it alone. To truly change New York City, we need to transform many more buildings. The Empire State Building is providing a blueprint, sharing the knowledge we’ve gained to enable others to become more energy efficient.

What if all buildings in New York City reduced their energy usage by 7.9%?

Simple steps such as improving windows, insulating radiators and reusing materials can add up to significant savings.

RESULTS OF A 7.9% ENERGY REDUCTION IN NEW YORK CITY
Save enough energy to shut down New York’s largest power plant

-60,000,000
Reduce CO² emissions by 60 million metric tons over 15 years

x 11,000,000
That’s like taking 11,000,000 cars off the road!
STEP TWO
A SMARTER BUILDING, A
MORE EFFICIENT BUILDING

Thousands of miles of pipes, wires and ducts form a massive circulatory system that heats, cools and ventilates the building. These systems waste a huge amount of energy by operating when they don’t have to.

OUR SOLUTION

UPDATE THE CHILLER PLANT
4 electric chillers were retrofitted to create a highly-efficient cooling plant.

NEW AIR HANDLERS
Smart air circulation machines monitor air quality and run only as hard as they need to.

WIRELESS CONTROL NETWORK
Every piece of heating, cooling and ventilation machinery is connected to a massive wireless control network.

STEP TWO RESULTS

-50,000
Reduce CO₂ emissions by over 50,000 metric tons over 15 years

$2,200,000
Save over $2.2 million a year

x 119,000
That’s like not burning 119,000 barrels of crude oil!
Measures

**CHILLER PLANT RETROFIT:** The chiller plant retrofit project included 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:** Replacing 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). Units are replaced as tenant spaces are rebuilt.
Measures

**DDC CONTROLS:** The measure involved upgrading the existing control systems at the Empire State Building with *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.
STEP TWO
SMARTER BUILDINGS, MORE EFFICIENT BUILDINGS

You wouldn’t drive a car that only ran at full power or not at all. Large buildings run their systems harder and more often than they need to—wasting energy. The Empire State Building is installing new equipment that allows us to monitor these machines, turning them down or off when they aren’t needed, using 19.1% less energy throughout the building.

What if all buildings in New York City reduced their energy usage by 19.1% simply by making their equipment smarter and more efficient?

RESULTS OF A 19.1% ENERGY REDUCTION IN NEW YORK CITY

The equivalent of permanently closing 2 coal power plants a year

-135,000,000

Reduce CO₂ emissions by 135 million metric tons over 15 years

x 323,000,000

That’s like not burning 323,000,000 barrels of crude oil!
STEP THREE
MULTIPLYING THE POWER OF CHANGE

We’re working with all of our tenants to help them increase their energy savings, giving them tools to track and reduce their energy consumption, and helping them design and build more sustainable office spaces.

OUR SOLUTION

- **ENERGY EFFICIENT LIGHTING & PLUGS**
  Energy efficient CFL bulbs and smart plugs sense when a person leaves their desk and power down when not needed.

- **DAY-LIGHTING**
  We’re engineering ways to take advantage of abundant natural sunlight and save energy.

- **TENANT ENERGY MANAGEMENT**
  A live online dashboard lets tenants monitor their energy use and helps them find ways to reduce their power consumption.

STEP THREE RESULTS

- **-31,000**
  Reduce CO₂ emissions by 31,000 metric tons over 15 years

- **$1,300,000**
  Save over $1.3 million a year

\[ \times 1,340,000 \]

That’s more CO₂ than 1,340,000 adult trees can filter in a year!
Measures

**TENANT ENERGY MANAGEMENT:** This measure provides tenants with access to online energy consumption and benchmarking information as well as sustainability tips and updates.
STEP THREE
MULTIPLYING THE POWER OF CHANGE

It starts with the right tools, but real change requires all of us. We can all make choices that reduce our energy consumption and use of fossil fuels. These changes don’t have to be sacrifices: They can save us money and make our world cleaner and brighter.

The people of New York City could reduce their energy consumption by 11.4% just by monitoring and being more responsible about the energy they use.

RESULTS OF AN 11.4% ENERGY REDUCTION IN NEW YORK CITY

Dramatically improve air quality

\[-81,000,000\]

Reduce CO₂ emissions by 81 million metric tons over 15 years

\[\times 240,000,000\]

That’s more CO₂ than 240 million trees could filter in that time!
THE WORLD

The environment is not a place we visit; it’s where we live and work. This is about reducing the impact of economic growth and creating the opportunity for growth with reduced impact around the world.

8,000,000,000 acres of trees

If every country in the world became 10% more energy efficient, we would cut our CO2 emissions by 3 billion metric tons, more carbon than a forest 3 times the size of the United States could filter in a year.

THE CITY

Over 90% of the today’s buildings in New York City will still be here in 25 years. To change our energy consumption, we must address the existing built environment.

43,000,000 barrels of oil saved

Energy efficiency is the least expensive source of alternative energy. Why not encourage energy efficiency with tax credits, incentives, and other benefits, just like wind, solar, and other alternatives? In the process, save 43,000,000 barrels of oil each year.

THE BUILDING

The Empire State Building leads the movement towards energy efficient buildings. We prove that sustainability retrofits are smart investments and provide a template for others to replicate.

20,000 cars off the road

This project reduces the Empire State Building’s carbon footprint by 100,000 metric tons over the next 15 years, equivalent to taking 20,000 cars off the road.

The EMPIRE STATE BUILDING is a proud partner and certified building of EPA’s ENERGY STAR program.
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 and maintain performance

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
CHANGE THE EMPIRE STATE BUILDING, CHANGE THE WORLD.

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Go to esbtour.com
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SUSTAINABILITY: SPREAD THE WORD, TRANSFORM THE WORLD.

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