Jones Lang LaSalle

*Real value in a changing world*

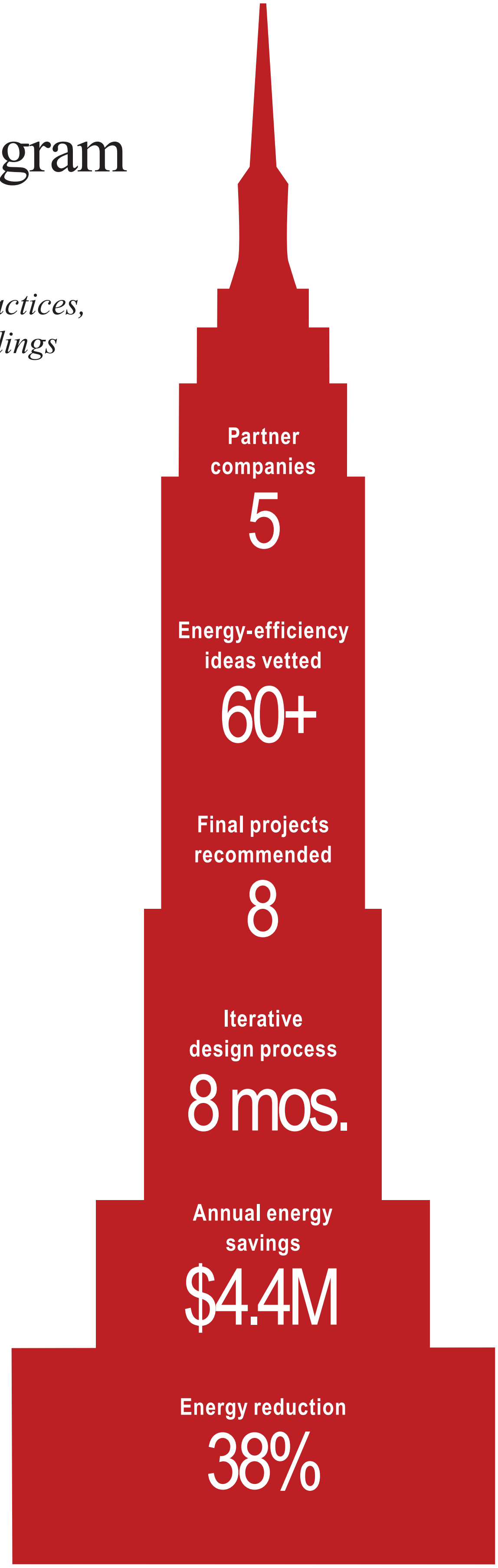
# A landmark sustainability program for the Empire State Building

*A model for optimizing energy efficiency, sustainable practices, operating expenses and long-term value in existing buildings*

Efforts to make buildings more environmentally sustainable have produced hundreds of millions of square feet of greener office space. But tens of billions of square feet remain in office buildings worldwide for which owners have made little or no progress in the area of energy and sustainability.

Owners of multi-tenant buildings, which comprise the bulk of office space, are motivated by return on investment. To justify the costs associated with retrofitting buildings to support sustainability, owners must be convinced that the investment will be repaid by some combination of higher rental rates and greater occupancy levels. The percentage of tenants willing to pay higher overall occupancy costs for green space is not large, and tenants that greatly value sustainability gravitate towards newer buildings that have been designed and built to high energy and environmental standards. In general, retrofits of older buildings are more expensive and, therefore, more difficult to justify financially.

This context underscores the extraordinary nature of the commitment that Anthony E. Malkin of Empire State Building Company has made to establish the Empire State Building as one of the most energy efficient buildings in New York City, and arguably the world's most environmentally conscious office tower built before World War II. Just as extraordinary as Malkin's commitment to making the Empire State Building sustainable was his decision to infuse the process with a high degree of transparency so that other building owners–particularly those with pre-WWII or landmark properties–would have a model to follow in pursuing their own green projects.



## Empire State Building Energy and Sustainability Team

- *The Clinton Climate Initiative*, a project of the William J. Clinton Foundation, was founded in August 2006, to create and advance solutions to the core issues driving climate change. As a part of its work in cities, CCI works with building owners to reduce greenhouse gas emissions from existing buildings. A sponsor of the project, CCI helps further develop and validate the ownership's vision, and introduce potential implementation mechanisms for the team.
- *Jones Lang LaSalle*, a global real estate services firm with the industry's leading sustainability services program, serves as the program manager and owner's representative, guiding the team through the highly collaborative process and taking the lead on areas of integrated sustainability beyond energy efficiency and the attendant reduction in greenhouse gas emissions.
- *The Rocky Mountain Institute*, a nonprofit organization recognized as a leader in energy-efficient solutions, provides vital expertise and conducts peer reviews on technical and design elements of the energy work in the building.
- *Johnson Controls Inc.*, a global Fortune 100 company focused on creating effective interior environments, performs the technical engineering work at the building as it pertains to energy efficiency.
- *Empire State Building Operations* acts as the site champion, to ensure that operations are not disrupted by the retrofit.

To ensure that this commitment was upheld, he assembled a team of best-in-class consultants in the fields of climate change, real estate sustainability, environmental design and energy services.

This report details the process for assessing, quantifying and documenting the costs and benefits of potential strategies for enhancing energy and sustainability at the Empire State Building. This process led to the adoption of a set of final strategies that, upon implementation, will reduce the Empire State Building's energy use and carbon footprint by up to 38 percent.

## Empire State Building—one of a kind

The Empire State Building is no ordinary office tower. The world's most famous office building, it draws between 3.5 million and 4 million visitors each year to the Observatory on the 86th floor. At a height of 1472 feet (449 meters), the spire is used for broadcasting by most of the region's major television and radio stations. Its 2.8 million square feet of leasable office space hold a range of large and small tenants, drawn by the building's prestige, its unmatched skyline views and its convenient location at the center of Manhattan's mass-transit system. Opened in 1931, the building has undergone recent upgrades of lobbies, hallways and other common areas including the just-completed renovation of the observation deck–restoring the building to its original grandeur.

## Vision beyond the Empire State Building

"Buildings in New York City create 65 to 70 percent of the city's entire carbon footprint," Malkin told Metro Green + Business in June 2008. "Constructing new green buildings won't move the needle in mitigating this problem. It is far more important to address the existing building stock."

About 43 percent of all the office space in New York City was built before 1945, including a majority of the 10 million-square-foot portfolio owned by partnerships affiliated with Malkin and other principals in Wien & Malkin. W&M has instituted green practices across its New York portfolio, such as using integrated pest management and green cleaning products, and using energy-efficient maintenance vehicles. The Empire State Building signed onto the Energy Star program for buildings to measure and report its energy efficiency as soon as the U.S. Environmental Protection Agency and Department of Energy expanded the program to include buildings.

The rationale for pursuing more energy efficient office buildings was driven by rising energy costs in a volatile market, coupled with widespread interest in reducing carbon emissions that result from building and vehicle energy use. As the environmental focus on buildings has intensified, it has increasingly included issues such as water conservation, recycling, reuse of building materials, reduction of chemicals and pollutants, indoor air quality and other considerations.

These changes are anticipated to enhance the Empire State Building's long-term value based on the opportunity for higher occupancy and rents over time. Green buildings have a competitive edge in attracting companies interested in reducing their own carbon footprints as well as providing work environments that promote the health and well-being of employees. Furthermore, eventually buildings could be affected directly or indirectly by sustainability-inspired regulatory changes at various levels of government.

Malkin and his team also knew what many do not: A market is emerging for financing capital improvements based on the cash flow from reduced energy costs. Developing a solid business case for these financing avenues requires a robust analytical process that produces valid data on retrofit costs and energy cost reductions. "We will be working to establish a financing format to provide the ability to otherwise indebted properties to participate in this sort of project, though the work on this project is not financing contingent and is going forward out of already available cash," Malkin said.

## A multi-phase analytical process to establish a replicable model

Between April and November 2008, the collaborative team followed a comprehensive process to determine which energy and sustainability strategies could be implemented at the building, and what costs and obstacles might arise for each strategy. The purpose was to determine where cost and benefit intersected to result in the most sustainable building possible within reasonable cost parameters.

### Expected income stream enhancements:

- Reductions in existing capital improvement program costs
- Reduced utilities budget due to greater efficiencies in energy and water usage
- Reduced building operations budget due to lower maintenance and repair costs
- Increased rent and occupancy due to enhanced value placed on updated services
- Additional income from new tenant service offerings, such as chilled water and emergency power

Initially, the team decided to consider criteria established by Leadership in Energy and Environmental Design (LEED®), established by the U.S. green Building Council, as well as Green Globes, a system administered in the U.S. by the Green Building Initiative and in Canada (under the more widely recognized name Go Green) by BOMA Canada, as points of reference rather than goals to be achieved. The comparative process of determining the building's current status along with the development of strategies that could feasibly be implemented in order to achieve increasing levels of LEED® for Existing Buildings: Operations & Maintenance (EBOM) certification was called a LEED® Gap Analysis. Eventually, the team decided to pursue the LEED® Gold building certification.

Before the multi-phase program got under way, an initial presentation laid out program goals, the anticipated roles of each team participant and the framework for ensuring an organized, thorough process. Goals included:

- Develop a replicable model for retrofitting pre-war buildings in a cost-effective way
- Develop practices to lower energy consumption costs by as much as 20 percent
- Increase overall environmental benefits of building retrofit through an integrated sustainability approach to maximize opportunities and market advantage
- Encourage the team to be objective, creative and provocative in its approach
- Develop a model that is marketable to existing and prospective tenants
- Coordinate with the ongoing capital projects within the building
- Develop a financial structure that is efficient and achievable

As Program Manager, Jones Lang LaSalle's role was to ensure team collaboration, stakeholder communication and timely execution, as well as to drive performance measurement and documentation of the repeatable model for industry-wide use. Jones Lang LaSalle also led development of the Sustainability Metrics Model for Greenhouse Gas Emissions, using internationally-accepted, scientifically-based data and calculations to evaluate the reduced impact on global warming and local environment resulting from the implementation of sustainability measures.

Under the initial proposal delivered in April 2008, the four-phase analysis would include:

**Phase I: Inventory and Programming**

**Phase II: Design Development**

**Phase III: Design Documentation**

**Phase IV: Final Documentation**

The four phases were completed in seven months.

## Phase I: Inventory and programming

Team members conducted reviews of the building's mechanical systems and equipment, calculated tenant energy usage, and developed a baseline energy benchmark report and a preliminary system for measuring energy efficiency. A gap analysis was conducted to determine which LEED® and Green Globes criteria the building was already meeting, and which could be achieved feasibly. A plan was developed for the creation of pre-built green offices to serve tenants with an immediate need for finished space. The team steering committee met twice to discuss progress and refinements to the program, and Rocky Mountain Institute and Johnson Controls conducted a separate cross-functional workshop to look specifically at lighting strategies.

## Process of elimination

### 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 $CO_2$ savings
- Maximize $CO_2$ savings for a zero net present value
- Maximize $CO_2$ savings

### 4 Model iteratively

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

The central initiative involved in the inventory and programming phase, however, was the integration of ESSB goals with goals of a separate capital projects team already in place. When the sustainability program got under way, the Empire State Building had already embarked on a major capital program that included a combination of restoration and upgrades to lobbies, hallways, restrooms and other common areas. A key element of the capital program was to enhance the experience of the building's primary attraction, the observation decks on the 86th and 102nd floors.

The process of value-engineering existing capital projects was a high priority for the newly assembled sustainability team as a way to avoid having to make changes later.

To accomplish the process effectively, an integrated team approach was adopted to deliver building services with minimal disruption to tenants and visitors. The Empire State Building Company capital program team, led by Jones Lang LaSalle as project manager, guided work performed by TPG Architects, mechanical-electrical-plumbing (MEP) consultant Lakhani & Jordan Engineers and others. For the sustainability program, a separate project management team of Empire State Building Company and Jones Lang LaSalle interfaced with the capital program team and worked with Johnson Controls and the Rocky Mountain Institute to identify opportunities for sustainable improvements.

The integration of the capital team and the sustainability team allowed the latter to pursue a "whole-building" approach, modifying existing capital project strategies so that they conformed to higher sustainability standards. In so doing, the team could make the building more green while staying within budgetary parameters. Expertise from members of the sustainability team suggested ways to lower the cost of several capital projects while enhancing environmental factors such as energy, water and ventilation.

The integrated team started by identifying baseline budgets for 23 existing capital projects and then examined how sustainable alternatives could affect costs. In its Inventory and Programming report, the team reported that sustainable options would result in a high level of savings on six projects. The team recommended putting four of those projects on hold while they examined alternatives thoroughly, including a multi-year air conditioner replacement program, central cooling plant replacement, exterior tower lighting and mid-pressure steam riser replacement. In addition, the corridor renovation project—the largest single budget item in the capital program—was viewed as a potential opportunity for greatly reduced costs by reviewing lighting and providing an optional air handling design.

Another six projects were seen as candidates for moderate cost reductions by following sustainable strategies. Among other things, the ESSB team recommended exploring gray water sources in restroom renovations and looking at modular green roof alternatives on selected setbacks. As the capital projects team worked toward the resolution of these items, the ESSB team pursued a parallel track to identify additional opportunities not contained within the scope of the original projects.

In the final Phase I report delivered to ownership on June 2, 2008, the ESSB team listed the following accomplishments:

- Development of a Project Charter
- Knowledge sharing within the team via: weekly team reports, bi-weekly team calls, two full-team workshops and a third workshop for lighting, and establishment of a Sharepoint site for all team members
- Feedback gained from building stakeholders, including a tenant sustainability charrette to discover green tenant needs
- Collaboration with building operations to implement immediate systems improvement measures
- Review of existing capital projects and implementation of a lobby lighting test case for energy improvement
- Measurement and verification of building equipment and conditions to establish a baseline for energy and sustainability performance
- Strategy session engaging advisory expertise, ownership and teams
- Development of a Sustainability Scorecard, LEED® EBOM Checklist and Green Globes Report

> The Project Charter stated the team's mission succinctly:
> *The retrofit of the Empire State Building into a Class A pre-war trophy building will transform the global real estate industry by transparently demonstrating how to create a competitive advantage for building owners and tenants through profitably greening existing buildings.*

Outcomes of the first phase included a cost reduction of the baseline capital project of between three and four percent based on the review and suggestions of the ESSB team and a preliminary budget for energy projects compared to projected annual energy savings. This budget indicated a payback period of 15 years for energy-related work based on current energy costs; however, when the savings from the capital projects budget was considered, the payback period eventually was reduced to about five years.

## Phase II: Design and development

By the time the Phase II kickoff meeting took place in early July, the team had already made substantial progress on several fronts: documenting tenant energy use, conducting preliminary mechanical tests, and refining criteria for measuring and benchmarking efficiency. The team was nearing completion of the LEED® gap analysis checklist for the base building, and a similar checklist for tenant spaces also was under way.

Goals of the Design and Development phase as reported to ownership on July 15 included:

- Create "360-degree" understanding of resource use at ESB (summarize in Baseline Energy Benchmark Report)
- Develop theoretical minimum energy use at ESB (identify key levers of energy reduction potential)
- Outline sustainability recommendations for pre-built spaces
- Initiate tenant engagement and design partnerships
- Begin development of energy-efficiency measures
- Continue development of project tools (Sustainability Scorecard, LEED®, Green Globes, GHG Protocol)
- Complete Phase II Deliverable Report

An important element of the design and development phase was to narrow the myriad of issues down to a manageable number of potential solutions, essentially creating order out of complexity. This winnowing process occurred throughout all four phases of the program, but it was in the second phase that consolidation of issue resolutions into a relatively small number of likely scenarios would become most prevalent.

In the Design and Development phase, Johnson Controls presented the Baseline Energy Benchmark Report in mid-July. The report examined energy usage between April 2007 and May 2008 from several perspectives:

- A month-by-month breakdown of electricity usage by kilowatt-hour, of steam usage by Mlbs, and the cost associated with each, along with a total energy cost, both with and without the broadcast towers
- Month-by-month breakdowns of electrical and steam usage showing the amount of energy expended toward lighting, ventilation, broadcast towers, main plant cooling, tenant sub-metering and other uses
- An annual breakdown showing the share of total energy expended that went to different tasks, including broadcast (23 percent), radiator heating (17 percent), lighting (16 percent), main plant cooling (15 percent), tenant sub-metering (7 percent), steam cooling (4 percent), and ventilation (5 percent), as well as the same data without including broadcast uses
- Areas of opportunity for using steam power more effectively, in particular radiator steam load (60 percent of total achievable gain), base load steam (19 percent), steam chiller (15 percent) and AHU HW HX (6 percent)

Rocky Mountain Institute also discussed its findings in examining theoretical minimum energy usage to address occupant comfort requirements, passive measures and other systems impacts, system design characteristics, technology, controls and changed operating schedules.

By raising the cooling set-point, enhancing the envelope and ventilation, reducing internal gains and improving cooling efficiency, Rocky Mountain Institute estimated that the building could reduce non-broadcast energy usage by up to 65 percent; however, the implementable minimum reduction under the existing charter was between 15 and 25 percent. Rocky Mountain Institute's analysis suggested that a reduction of 40 to 50 percent was not merely theoretical but achievable—if the cost-benefit equation did not devolve into a cost-avoidance strategy in the latter stages of the process.

Rocky Mountain Institute also discussed several issues that needed to be addressed. These included the challenge of incorporating bold concepts within conventional budget limitations, providing incentives for tenants to follow ESSB guidelines, designing more efficient HVAC systems while recognizing that loads are likely to increase over time and the challenge of achieving maximum efficiency gains by getting all parties to commit to average load reduction and life-cycle costing rather than merely efficient system design.

The July presentation also provided Jones Lang LaSalle and Johnson Controls the opportunity to make recommendations on sustainable tenant pre-built spaces, comparing two potential options to standard pre-built spaces from an architectural, mechanical and lighting standpoint. Recommendations included reducing the number of interior wall enclosures to enhance natural light and views, selecting interior finishes to support sustainable goals and using task lighting to complement higher efficiency overhead lighting.

At the closing of Phase II, the team also set forth the goals for Design Documentation in Phase III:

- Complete Tenant Energy Management Report (guidelines for existing tenants)
- Complete Pre-Built Space Design Report (design for new pre-built spaces)
- Complete 90 percent of eQUEST model (test and understand key hypotheses)
- Begin financial modeling of synergistic combinations of measures, not isolated measures
- Begin in-depth lease review and tenant surveys
- Develop LEED® EB and CI Feasibility Report
- Complete Phase III Deliverable Report

## Phase III: Design documentation

Phase III of the ESSB analytical process centered on two major deliverables: a final report assessing the tenant energy usage and the impact of pre-built spaces; and the development and refinement of the eQuest Energy Model.

The tenant energy program had four basic components:

1. Establish electric sub-metering for each tenant so that energy used by the tenant can be displayed and compared to industry norms via a dashboard linked to the building web page.
2. Identify key building personnel to be the face of the program, suggest each tenant designate a point of contact. Provide training to the contact so they understand the basics.
3. Provide education through online training, and seasonally-specific recommendations and best practices for tenants to reduce their carbon footprint.
4. Report on progress.

Tenant energy usage had been documented over a period of months ending in mid-August. The ESSB team had discussed ways for the building's facility management staff to easily monitor energy usage of each floor and each tenant on that floor. The proposed plan was to create a computer "dashboard" that would automatically translate numeric data into visual data such as charts and graphs so that managers could more easily spot trends and act on them. A typical tenant's data might show month-to-date and year-to-date energy usage in terms of kWh and cost, as well as high, low and average usage per square foot and a month-by-month breakdown of actual and ideal usage.

The plan as proposed to ownership on August 27 was to optimize energy systems floor by floor as spaces became available through vacancy or restacking tenants within the building. Following the building's existing restacking plan, 14 floors could immediately be made available for optimization, with up to 33 floors available for optimization by the end of 2011.

At this phase of the analysis, the team also had final plans in place for pre-built tenant spaces and had started the vendor bid process. Different pre-built layouts had different sustainability impacts, and the team developed multiple scenarios to achieve different levels of energy efficiency within these spaces. The cost of the different scenarios exceeded the cost of non-sustainable pre-built spaces by 6.5 percent to 12 percent.

The most sophisticated element of the Design Documentation phase was the development of the eQuest Energy Model. Drawing on a program developed by the U.S. Department of Energy, the model was designed to be used for cost / benefit analysis for future improvements, modifications and operational changes. The purpose of the eQuest Energy Model was to compare the energy consumption baseline to various facility improvement measures in order to calculate energy savings of these measures on a stand-alone basis and in combinations with other measures. The ESSB team created a matrix that analyzed the costs and financial benefits of facility improvements and other potential green strategies, and integrated the data with sustainability ratings, architectural programming and operational best practices, creating a comprehensive sustainability scorecard. The result was a sophisticated understanding of how different strategies, implemented individually or in various combinations, would affect project cost and building performance.

Johnson Controls and Rocky Mountain Institute conducted parametric runs on strategies relating to chillers, heating units, water pumping equipment, air handling units, controls, co-generators, lighting, plug loads and the building envelope. These exercises helped identify scenarios that would provide the most value, taking into account life-cycle costs and benefits, economics and logistics of implementation. For each scenario, the team needed to document variables that could affect the results. For example, if tenant engagement and adoption rates were higher or lower than anticipated, or if more of the building was used for broadcast than anticipated, there could be an impact on the estimated results. Recognizing these variables and attempting to quantify their impact was a significant element of the analysis.

## Phase IV: Final documentation

The final phase of the analytical process was to create an Integrated Sustainability Master Plan Report, synthesizing data from all available standards and measurement tools, including ENERGY STAR, LEED®, Green Globes, eQUEST Energy Modeling Tool, the Sustainability Metrics Tool and Financial Modeling Tool.

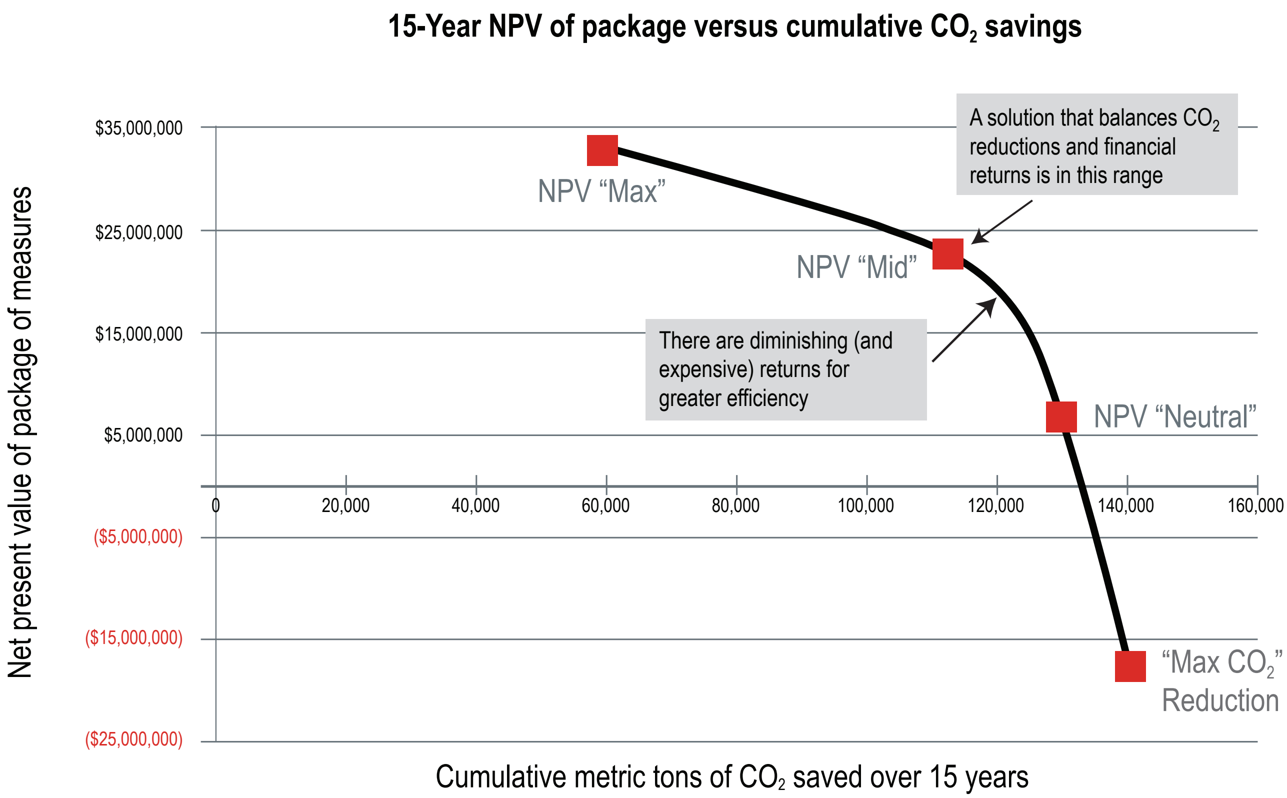
Modeling to pull the project together via iterations between the energy (eQUEST) and financial (spreadsheet) models included several global energy and financial assumptions:

- Base case fuel escalation = 1%
- Base case construction escalation = 2.5%
- Base case inflation = 2%
- Base case real discount rate = 8%
- Base case green rent premium = 1%
- 15-year time horizon

The recommended strategy was called the "net present value midpoint" because it considered strategies based on a balance of NPV with the amount of carbon dioxide avoided. The NPV midpoint was compared with other options, including one that would maximize NPV, and another that would maximize carbon dioxide reductions regardless of NPV. Comparing the midpoint option to the two extremes would help identify best-case scenarios.

The results pointed to a clear solution: The team should pursue a program that would reduce energy use and greenhouse gas emissions by 38 percent, saving 105,000 metric tons of carbon dioxide over the next 15 years.

## Empire State Building can achieve a high level of $CO_2$ and energy reduction cost-effectively




"Achieving an energy reduction greater than 38 percent appears to be cost-prohibitive," the team noted in its final report to ownership. The analysis had examined strategies that could have reduced emissions by nearly 45 percent, out of a theoretical maximum of 55 percent. A total of 40 energy-efficiency ideas were narrowed down to 17 implementable strategies that were analyzed in depth. Of these, the first 90 percent of reduced carbon dioxide would also save costs over time by an average $200 per ton of carbon saved. The last 10 percent, by contrast, would carry a life cycle cost of more than $300 per ton of carbon saved.

**Carbon dioxide reduction**

The greatest reduction in carbon dioxide from the baseline would come from completing the task of installing digital demand controls that had been started in the capital projects. This strategy alone would reduce energy use by nine percent from the baseline. Tenant daylighting—working with tenants to ensure that layouts maximize the use of natural light—would save six percent from the baseline. Three other strategies would save five percent each: installing air handling units with variable air volume controls, retrofitting the chiller plant and addressing window glazing. Other strategies contributing to the 38-percent reduction included tenant energy management (three percent), radiative barrier (two percent) and tenant demand-controlled ventilation (two percent).

**Chiller plant retrofit**

The greatest cost savings came from the ability to retrofit the chiller plant rather than replace it. This was made possible by the reduction of the cooling load by 1,600 tons. The load reduction resulting from the sustainability program's demand control ventilation project, which reduces outside air infiltration, and the window light retrofit, which reduces solar heat gain, would allow the chiller plant to be updated rather than replaced entirely.

**Peak electrical usage reduction**

Under the proposed plan, peak electrical usage would also be reduced by 3.5 megawatts, from its current peak and capacity of 9.6 megawatts to just over six megawatts. At the same time, the team looked at several options for additional capacity, including co-generation, gas-fired generation, fuel cells, renewable energy and purchasing capacity. After analyzing all options, the team recommended a two-megawatt gas-fired generator to power variable chiller-plant loads, thereby increasing capacity to 11.6 megawatts.

**Enhanced tenant environment**

In addition to reducing energy and carbon dioxide emissions, the proposed sustainability program would deliver an enhanced environment for tenants including improved air quality resulting from tenant demand-controlled ventilation; better lighting conditions that coordinate ambient and task lighting; and improved thermal comfort resulting from better windows, the radiative barrier and better controls.

> The net present value of the midpoint option was estimated at $22 million over 15 years, compared with $32 million if NPV was maximized and negative $17 million if carbon dioxide reduced as much as possible regardless of NPV.

A key variable in the NPV calculation was the rent premium that could be gained from establishing the Empire State Building as a green building. The baseline calculation assumed that sustainable features would allow the building to gain rents one percent higher than if no such program were implemented. If in fact the sustainability program did not result in higher rent, the NPV over 15 years would be cut in half, to about $11 million. In its due diligence for making the calculation, the team identified key studies from CoStar Group, University of California-Berkeley and the University of Reading, which estimated the rent premium for green buildings between three and nine percent compared with similar buildings without those features. If the Empire State Building were to achieve the low end of this estimated spectrum by gaining a three-percent average rent premium, the 15-year NPV would be greater than $40 million.

Rocky Mountain Institute examined the impacts of potential miscalculation of energy savings, and found that the impact on NPV was fairly small. If energy savings were to fall short of the estimate by 20 percent, or exceed the estimate by 20 percent, the impact on NPV would be less than $3 million over 15 years. The impact of energy variance on $CO_2$ emissions, however, could be substantial. If the baseline estimate were to be met, the proposed initiative would save about 115,000 metric tons of $CO_2$ emissions over 15 years. If performance fell short of the estimate by 20 percent, $CO_2$ emissions would be less than 95,000 metric tons; if performance exceeded the estimate by 20 percent, more than 135,000 metric tons of $CO_2$ would be saved.

The team looked at anticipated near-term changes in U.S. $CO_2$ costs and concluded that legislation likely would not significantly change $CO_2$ calculations. In addition to recommendations on which strategies to implement, the ESSB team had also examined the length of time it would take to implement various strategies. This was a significant consideration, because a key metric of each strategy was the payback period for capital invested. If a strategy with a relatively short payback period required a long period of time to implement, that would affect the cost-benefit equation for that strategy. Under the proposed plan, 61 percent of the energy savings were part of a program that Johnson Controls would implement quickly. Another 22 percent of the savings would come from two projects that the Empire State Building Company would implement over several years: the tenant energy management program, and the installation of two variable air volume air handling units on each floor. The other 17 percent of energy savings would depend on tenant actions that would not be fully complete for 12 years as leases rolled over, a front-loaded process given that 40 percent of leases are set to expire over the next four years.

## Tenant participation to drive energy savings

In order to capture the 17 percent of energy savings involving tenant spaces, the Empire State Building team was given the responsibility for a program that would include both aggressive guidelines and incentives for tenants to achieve energy savings of about six percent. Since nearly 40 percent of the building's leased space was due to turn over within four years, the team emphasized immediate adoption of guidelines for tenant improvements. The proposed green pre-built design would help the team establish design principles for all tenant spaces. Tenants could review the experience of the pre-built spaces and access the eQUEST model and tenant financial tool to verify the economic validity of the guidelines in terms of cost (estimated at $6 per square foot) and operational cost savings to the tenant ($0.70 to $0.90 per square foot annually).

A program of sub-metering all tenant spaces and management of a reporting tool to inform tenants of their energy use was considered essential both to drive tenant focus on energy efficiency within their own space and to assist tenants in calculating their carbon footprints. Sub-metering would encourage tenants to follow the building guidelines on recommended strategies such as daylighting (creating space plans that maximize the use of natural light), and use of efficient lighting techniques such as task lighting.

The ESSB team also recommended exploration of tenant incentive programs such as a "feebate" plan wherein tenants that missed sustainability targets would pay fees that might be redistributed to those that exceeded sustainability targets.

## Key lessons learned

In summary, the final presentation to management reviewed some key lessons from the team's collective experience:

**Developing robust solutions requires dynamic, multi-year models and collaborative efforts.** The implementation team would need to anticipate and address changes in tenant profiles, vacancy rates and technology as well as building renovations and the possibility of tenant disruptions. Maintaining flexibility and collaboration in the team would ensure the success of the program.

**Delivering the maximum cost-effective $CO_2$ reduction requires a whole-system and life-cycle view.** A proactive, long-term plan is required to maximize $CO_2$ and financial benefits. One reason is that the most cost-effective efficiency upgrades would have to be linked to major capital upgrade projects. In addition, the team's assessment showed that rapid acceleration of efficiency implementation produced significant extra cost without providing a similarly large benefit.

**The results reinforce the need to address the natural tension between business value and $CO_2$ reductions.** The scenario that maximized business value would avoid more than half of the $CO_2$ reduction opportunity. Even the recommended program merely balanced cost and benefit at a point where the greatest benefit could be achieved for the lowest cost, rather than pursuing every viable $CO_2$ reduction measure without regard to cost. In order to make the business case, perceived needs and industry norms needed to align with energy-efficiency levers.

**Rapid dissemination and adoption of the results requires development of an efficient process to reduce time and costs.** To drive speed and effectiveness, the team recommended development and use of tools to diagnose and categorize a portfolio of buildings; to rapidly develop a "first cut" answer; and to navigate through the iterative process between energy and financial modeling at the project level.

Empire State Building Company accepted the team's proposed solution in its entirety (final project scope TBD), allowing the team to move forward immediately on implementation. The thorough and collaborative process had resulted in a strong consensus backed by transparent information. Tools were developed to measure and give feedback on building-wide and tenant improvements. The team now had a mandate and a plan to move forward swiftly and with confidence that the framework for decisions would continue to yield positive results, ultimately serving the goals of the Empire State Building owners and tenants as well as overall environmental goals.

## A look forward

The analytical process was merely the first step toward achieving an optimal energy and sustainability profile at the Empire State Building, but it was of critical importance to the ultimate success of the program. The strategies selected from this process will not only have a significant impact on the building's carbon footprint but will open doors to additional cost-effective avenues of financing the project.

The Empire State Building is just one drop in an ocean of commercial buildings that must undergo some form of rational energy and sustainability retrofit in the next several years if we as a society are committed to reducing the impact of buildings on the environment. It is hoped that by making available documentation and information such as this report, the Empire State Building sustainability team can clear a path for thousands of other buildings to follow.

## Jones Lang LaSalle Energy and Sustainability Services

Jones Lang LaSalle offers a range of services to help you develop and implement a sustainability strategy that aligns with your business objectives. Our services include:

- Consulting services
- Energy services:
  - Energy audits
  - Energy baselining
  - Portfolio energy management services
- Retrocommissioning
- LEED® services:
  - LEED® gap assessments
  - LEED® design charrets
  - LEED® certification management
- Strategic program development and management
- Sustainability training
- Sustainability property and portfolio baselining

## Additional Jones Lang LaSalle Insights:

*Green Office Toolkit*

*Lean and Mean Means Green*

*Marketing green buildings to drive competitive advantage*

*Outsourcing in a strategic future: A study of eight top-performing CRE organizations*

*Property sustainability key to economic stimulus*

*135 Cost Saving Ideas*

**To learn more, please visit:**
http://www.us.joneslanglasalle.com/sustainability

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