

# Renovation of the Empire State Building

Climate Neutral Cities

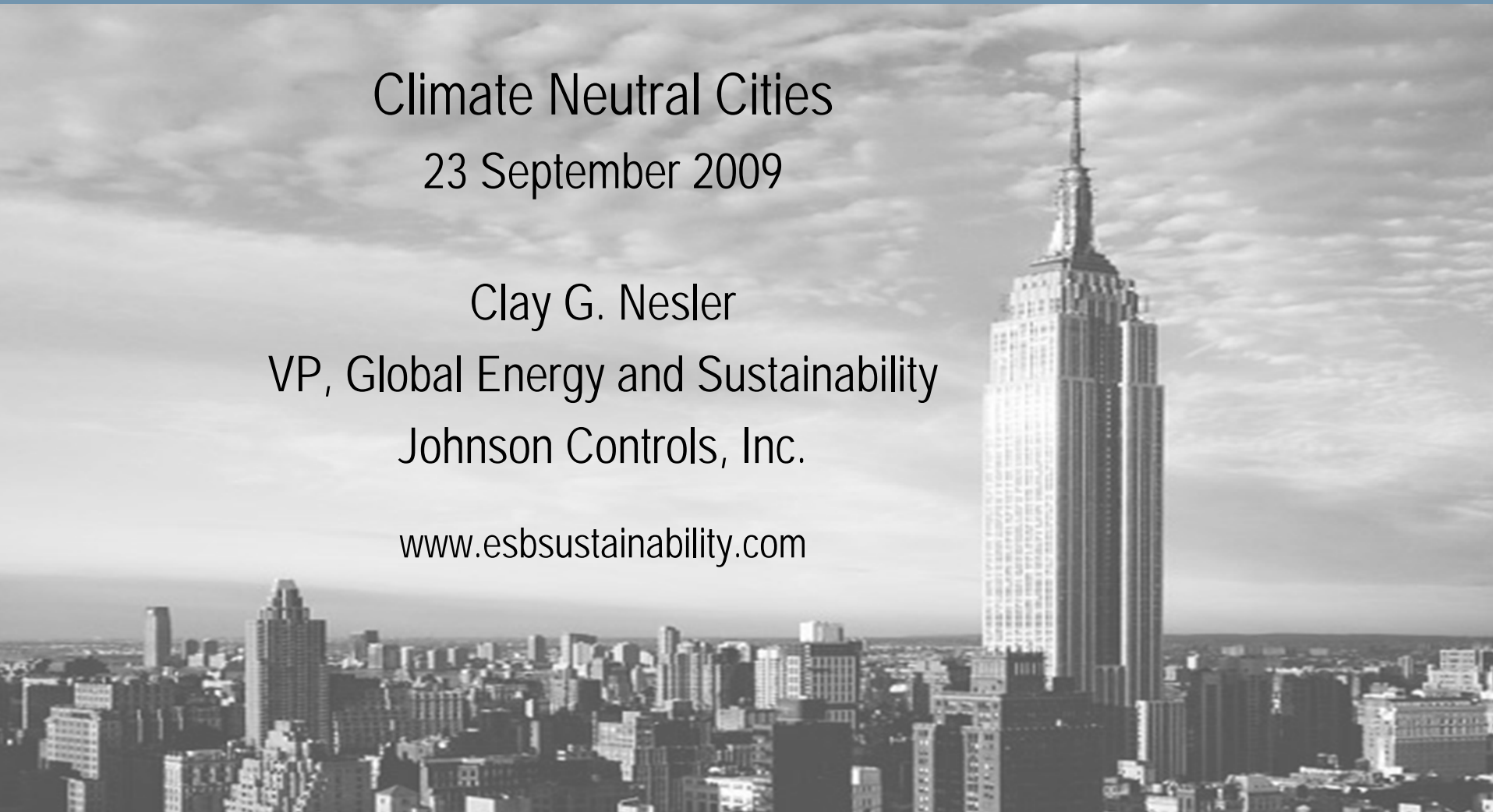
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# PROJECT TEAM

- **Clinton Climate Initiative** – Catalyst for Climate Change Action
- **Empire State Building Company LLC** – Owner
- **Johnson Controls, Inc.** – Energy Services Company
- **Jones Lang LaSalle** – Program Manager
- **Rocky Mountain Institute** – Energy Efficiency Expert



*Real value in a changing world*

# MOTIVATION

## Reduce greenhouse gases

We need to reduce greenhouse gas emissions 75% by 2050 to stabilize the climate. Today we are at 55 GtCO<sub>2</sub>e, and we need to reach 20 GtCO<sub>2</sub>e by 2050 to mitigate climate change. Business as usual will produce 85 GtCO<sub>2</sub>e by 2050. \*Source: McKinsey Analysis, IPCC, Stern Review (2006)

The building sector must be a large part of the solution as it is the largest contributor to U.S. greenhouse gas emissions. Buildings are responsible for 38% of emissions in the US. \*Source: EIA data - Table 12.2: <http://www.eia.doe.gov/emeu/aer/envir.html>

Nearly 75% of U.S. commercial buildings are over 20 years old. Retrofitting existing buildings must be part of the solution. 72% were constructed before 1990. Source: EIA data - Table 12.2: <http://www.eia.doe.gov/emeu/aer/envir.html>

# MOTIVATION

Create a replicable model for whole-building retrofits

ESB ownership wants to demonstrate how to cost-effectively retrofit a large multi-tenant office building to inspire others to embark on whole-building 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 CO<sub>2</sub> savings
- Maximize CO<sub>2</sub> savings for a zero net present value
- Maximize CO<sub>2</sub> savings

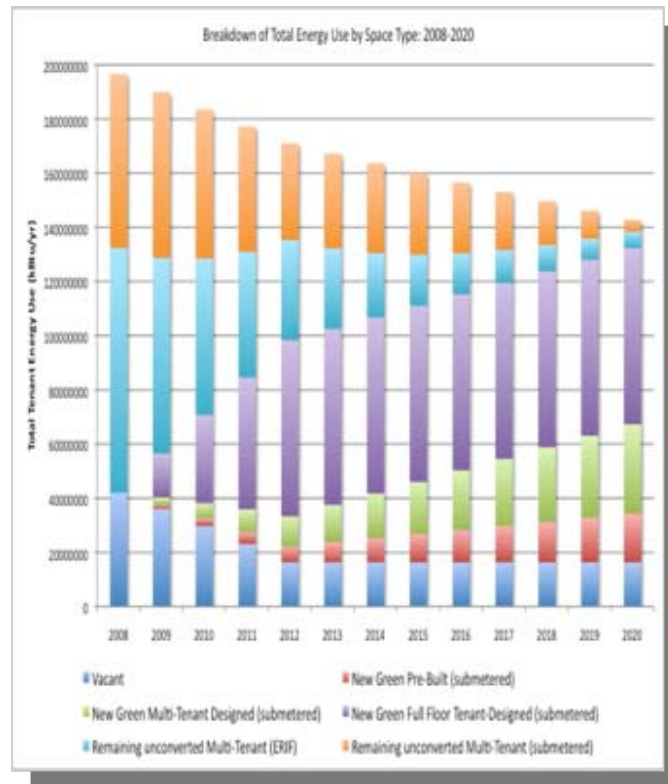
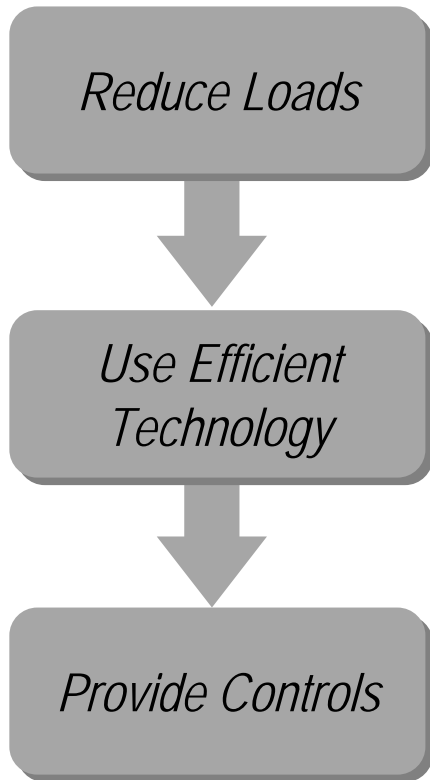
## 4 Model iteratively

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

# KEY FINDINGS

Taking the right steps in the right order ensures loads are minimized prior to investigating expensive capital upgrades

Teams must take a whole-systems, dynamic, life-cycle approach.



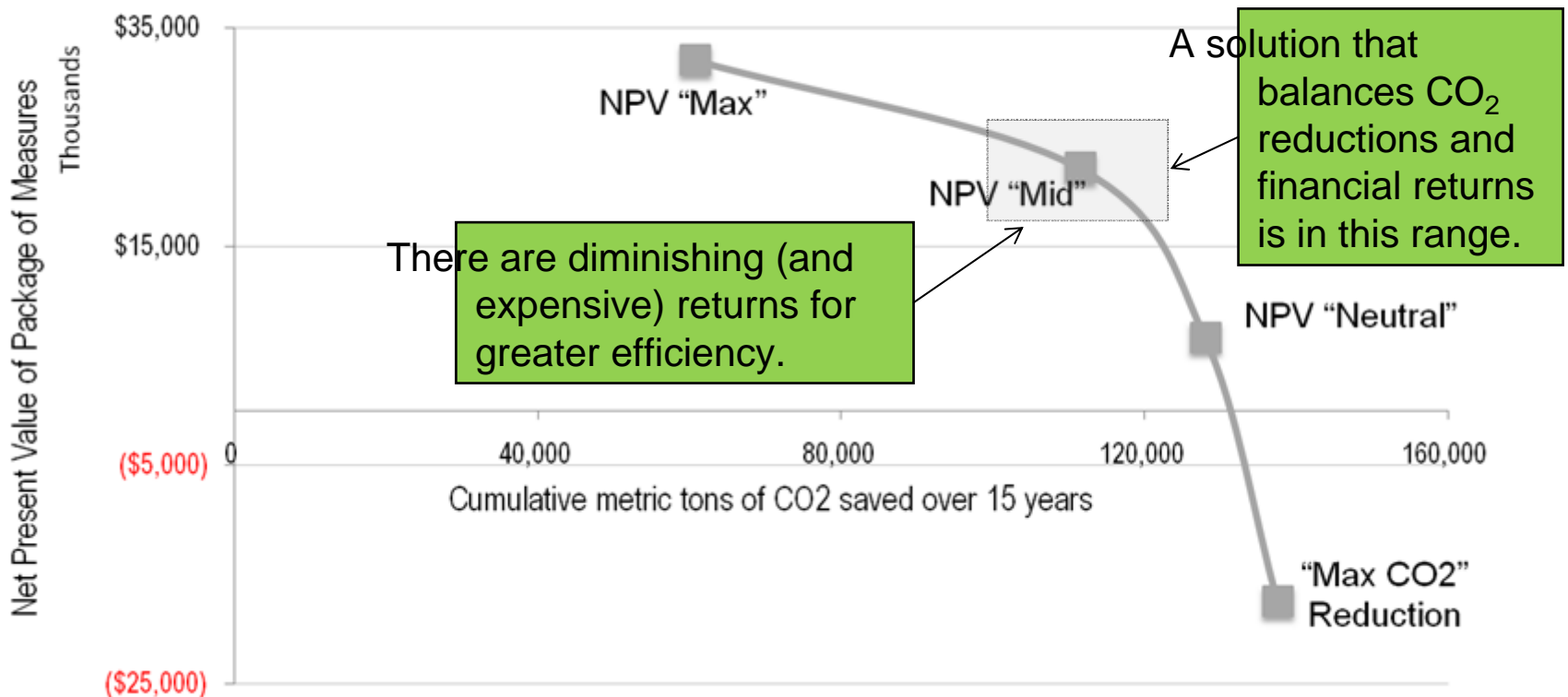
- Capital Cost
- Utility Savings
- Utility Rebates
- Tax Implications
- O&M Impacts
- Escalation Assumptions
- Discount Rate
- Future Cost of CO2
- Tenant Utility Structure

# KEY FINDINGS

Maximizing business value leaves considerable CO<sub>2</sub> on the table

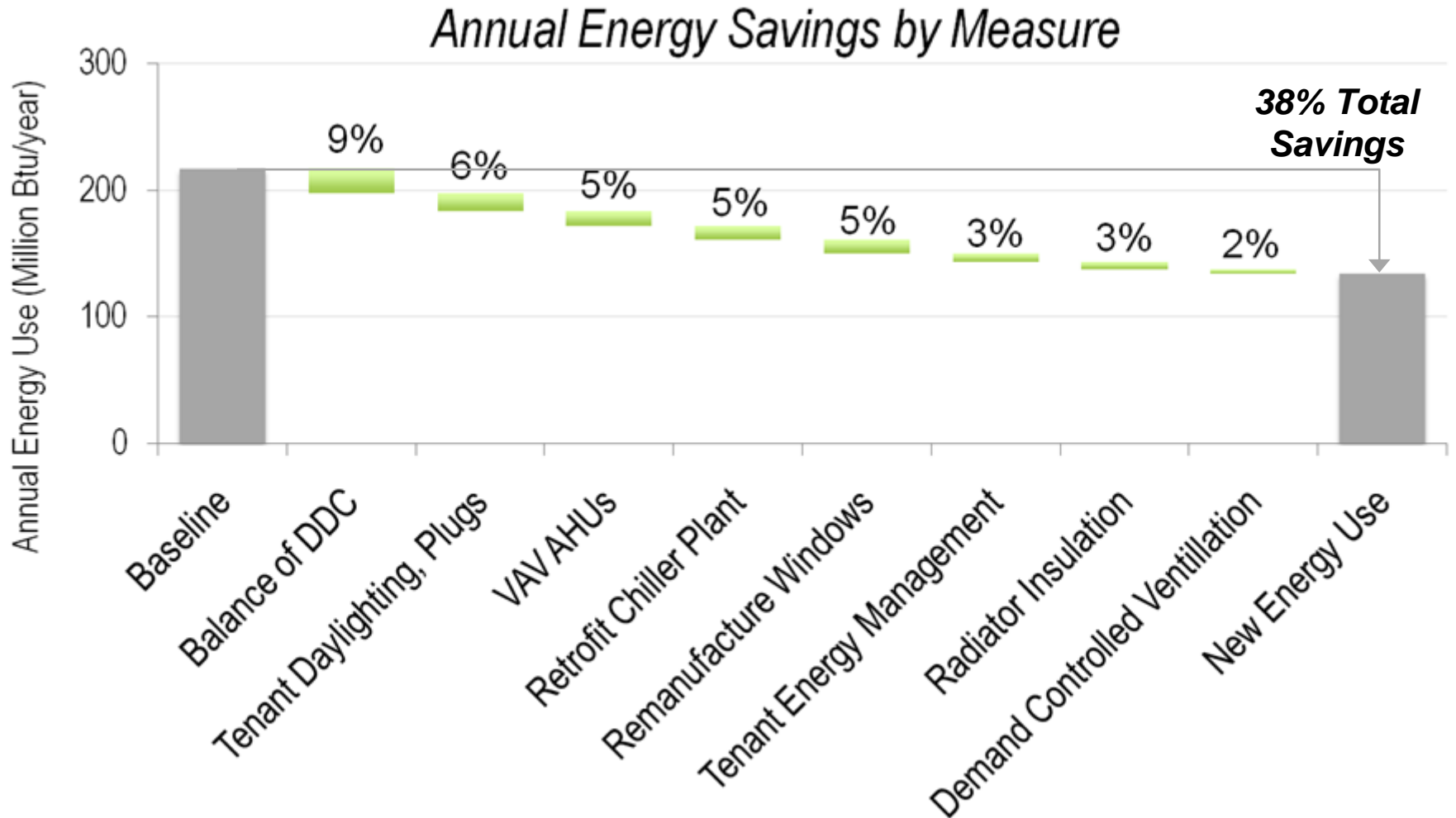
The Empire State Building can achieve a high level of energy and CO<sub>2</sub> reduction cost-effectively.

15-Year NPV of Package versus Cumulative CO<sub>2</sub> Savings



# KEY FINDINGS

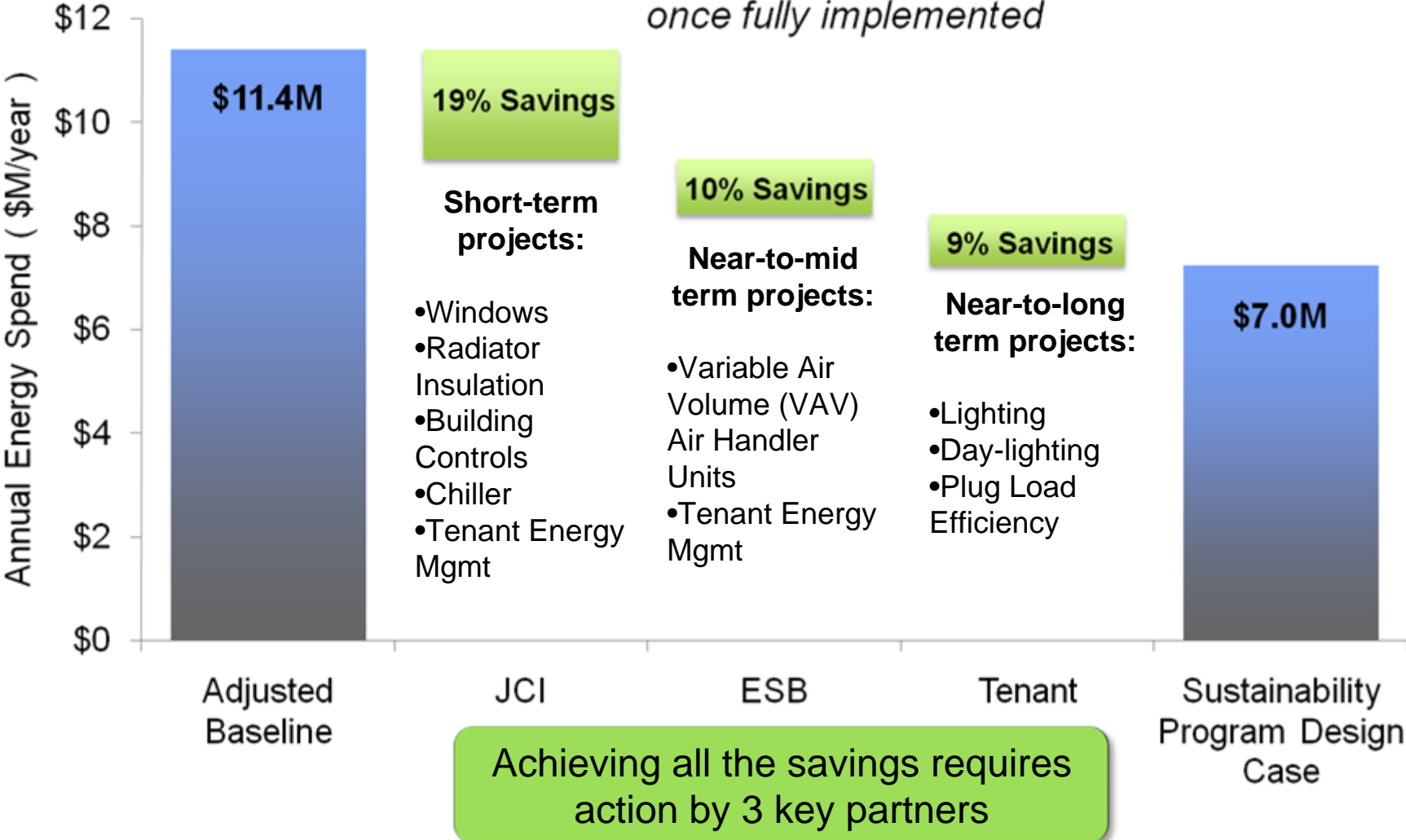
Eight interactive levers ranging from base building measures to tenant engagement deliver the results



# KEY FINDINGS

More than half of the savings exists within the tenant spaces

**38% Annual Energy Cost Savings**  
*once fully implemented*



# KEY FINDINGS

In addition to energy reductions, enhanced work environments are created

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

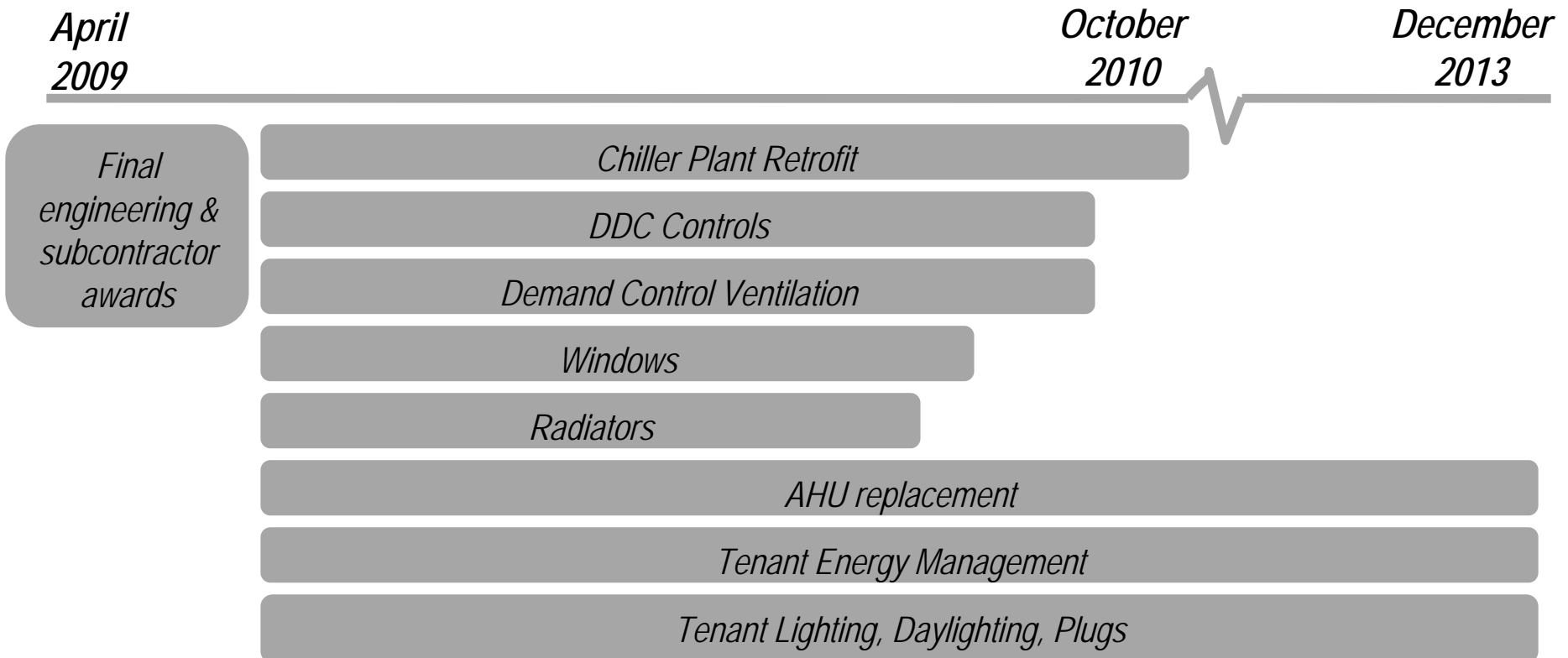
- *Better thermal comfort resulting from better windows, radiative barrier, and better controls;*
- *Improved indoor air quality resulting from DCV; and*
- *Better lighting conditions that coordinate ambient and task lighting.*



# IMPLEMENTATION

Work has already started and will be complete by 2013

The projects to be implemented via the Johnson Controls performance contract will be complete by October 2010. The remaining projects will be complete by December 2013.



# EXPECTED RESULTS

- 38% overall energy use reduction
- \$4.4M annual energy spend savings
- 33% cooling load reduction
- \$13.2M incremental cost and 3.1 year payback
- 105,000 metric tons GHG reduction over 15 years
- Energy Star 90 rating (90% percentile)
- LEED "Gold" certification target





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