






## Deep Retrofits

December 3, 2013  
3:00-4:00 PM EDT

# Overview and Agenda

- Welcome and Overview
- Deep Energy Retrofits: An Overview
- Glenborough's Aventine Office Building Case Study
- Walmart's Supercenter Case Study
- Additional Resources
- Question & Answer Session

# Today's Presenters

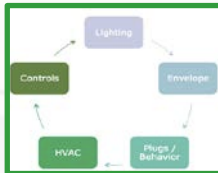
Name		Organization
Cara Carmichael		Rocky Mountain Institute
Carlos Santamaria		Glenborough, LLC
Jim McClendon		Walmart Stores, Inc.

**Cara Carmichael**  
**Senior Consultant**  
**Rocky Mountain Institute**

# Deep Energy Retrofits...



Achieve  $\geq 50\%$  energy savings



Integrative design and analysis process



Improved project economics



Provide value beyond energy cost savings (VBECS)



Positive electricity system impacts

# Not incremental, but a new class of product



# Trade Secrets for Cost Effective Deep Retrofits

1. Pursue the right steps in the right order
2. Deep Triggers
3. Focused analysis: Technical Potential and Bundle measures
4. Define business-as-usual expenditures
5. Quantify the value beyond energy cost savings



# #1: Pursue the Right Steps in the Right Order



(1) Set Quantifiable Goals

(2) Define End-User Needs

(3) Understand Existing Conditions

(4) Reduce Loads

(5) Select Appropriate & Efficient Technology

(6) Find Synergies

(7) Optimize Controls

(8) Incorporate Renewables

(9) Realize the Intended Design

Most people start here!



# #2: Deep Triggers

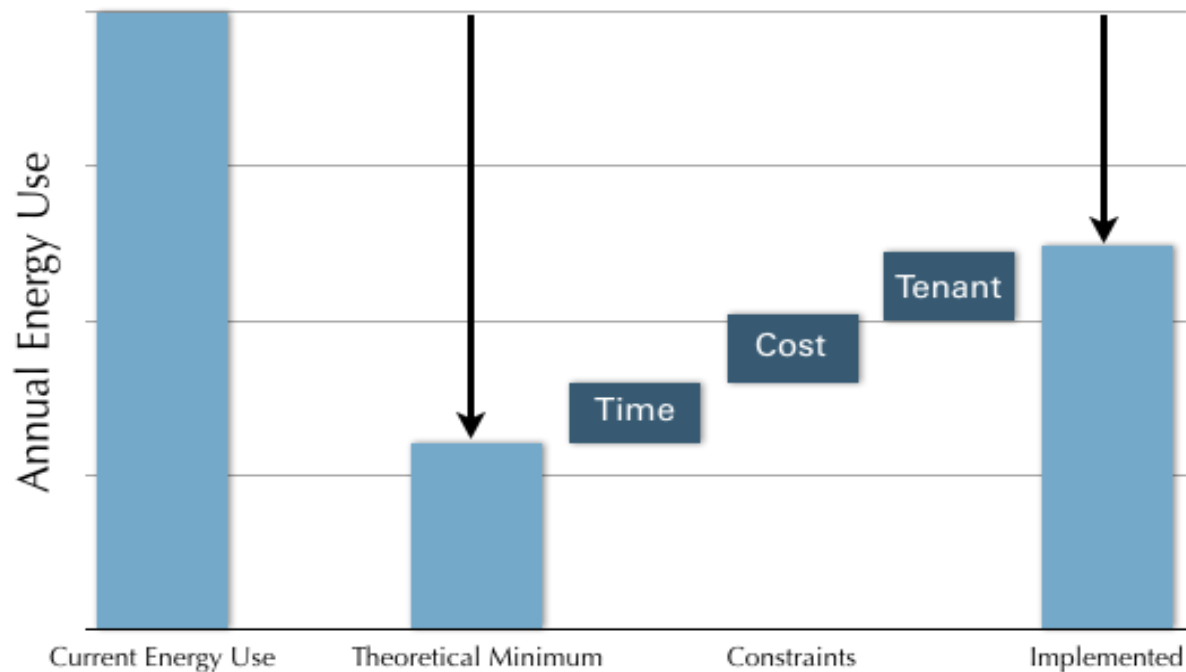


1. Planned capital improvement
2. Major system replacement
3. Code upgrades
4. New owner / refinancing
5. New use / occupancy type
6. Building greening
7. Large utility incentives
8. Mitigating an “energy hog”

# #3a: Technical Potential

Maximum level of savings possible given today's technology

## Theoretical Minimum to Inform Implementation

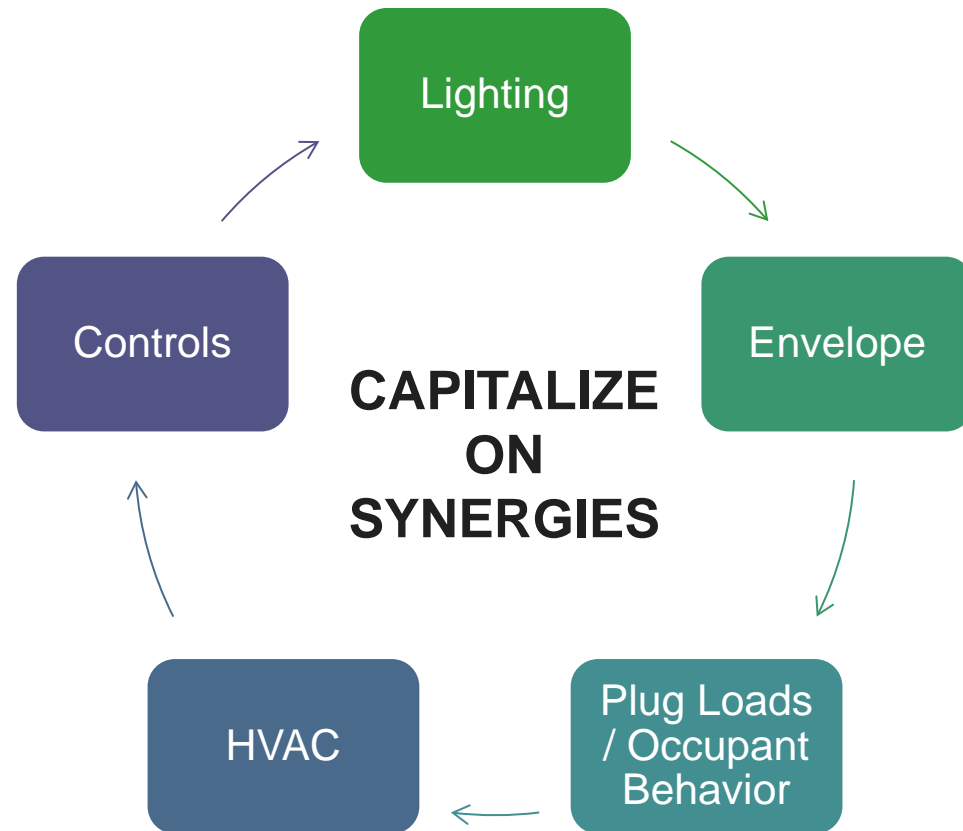


## WHY DO WE CARE?

- Challenges conventional thinking
- Not limited by industry benchmarks/norms
- Leads to more aggressive design targets
- Explicitly determines where ground has been lost



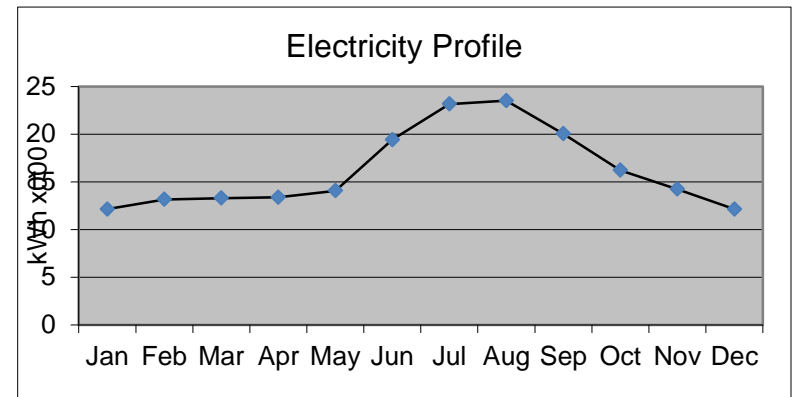
# #3b: Bundle measures



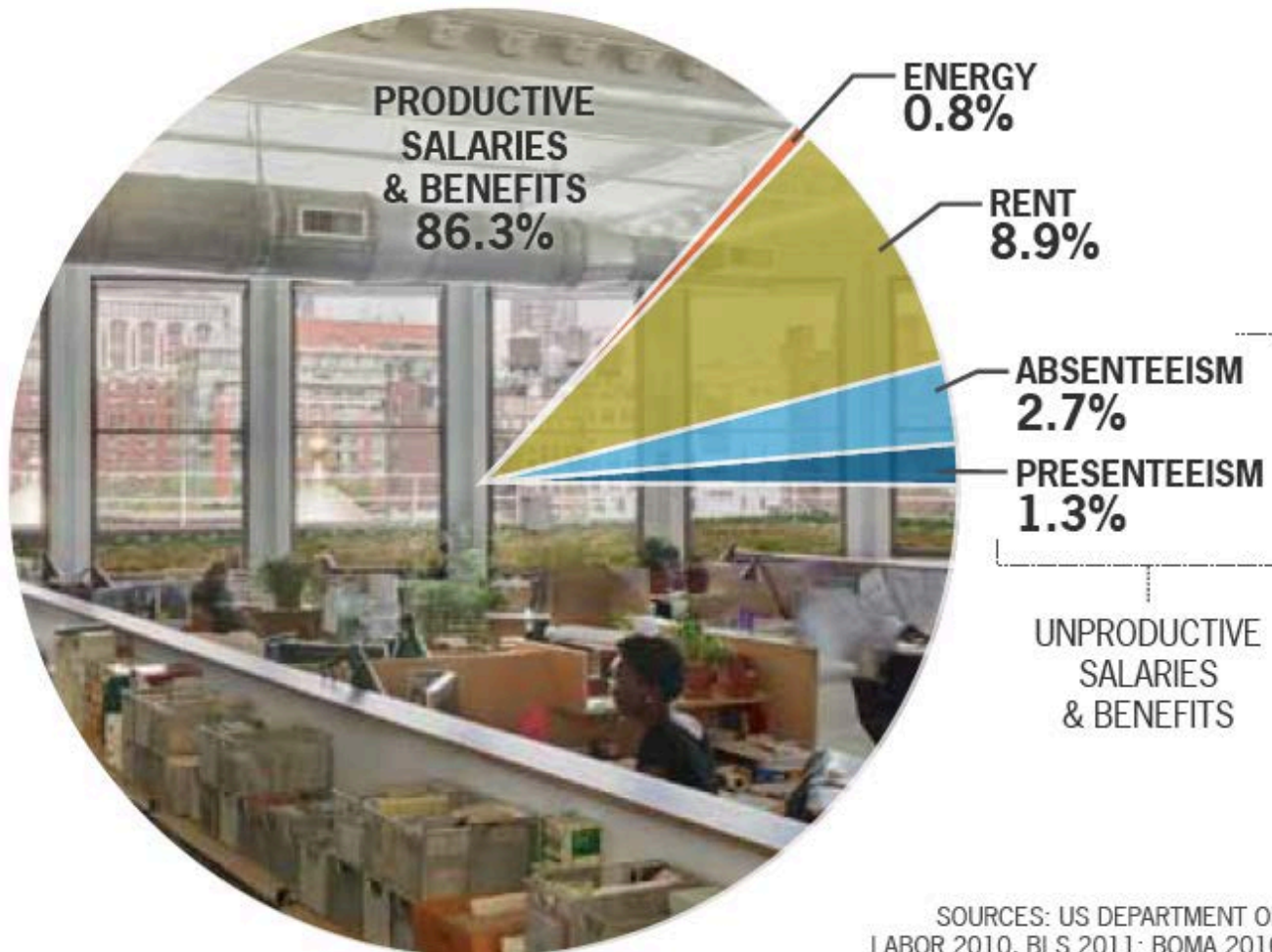
- Downsizing or eliminating mechanical and other systems - and therefore avoiding capital costs
- Adding square footage due to reduced mechanical space
- Allowing for more cost-effective measures to “finance” measures that provide value beyond energy cost savings (VBECS)

# #4: Estimate the Cost of Business as Usual

- Utility bills
- Maintenance/operation costs
- Replacements
- Incremental upgrades
- Code requirements
- Energy/carbon pricing
- Interruption



# #5: Include the Values Beyond Energy Cost Savings



SOURCES: US DEPARTMENT OF LABOR 2010, BLS 2011; BOMA 2010

# #5 The Value Framework

Value	This value is created through...
Reduction in Costs	<ul style="list-style-type: none"><li>▪ Lower costs to maintain &amp; replace equip.</li><li>▪ Lower health cost (absenteeism, health care)</li><li>▪ Lower employee recruiting and churn costs</li></ul>
Revenue Growth	<ul style="list-style-type: none"><li>▪ Higher occupancy and rent rates</li><li>▪ Increased employee productivity</li><li>▪ Improved marketing &amp; sales</li></ul>
Improved Reputation and Leadership	<ul style="list-style-type: none"><li>▪ Recruiting best employees or tenants</li><li>▪ Employee/tenant satisfaction and retention</li><li>▪ Public relations/brand management</li></ul>
Compliance with Internal & External Initiatives	<ul style="list-style-type: none"><li>▪ Meeting the needs of Corporate Social Responsibility, Carbon Disclosure Project, etc</li><li>▪ Meeting responsible investment fund requirements</li></ul>
Reduced Risk to Future Earnings	<ul style="list-style-type: none"><li>▪ Reduced risk to reputation</li><li>▪ Limit exposure to energy/water price volatility</li><li>▪ Reduced legal risks – sick building syndrome, mold claims, etc</li></ul>



# Results from 50 Deep Retrofits



**Integrated design & multiple measures** are more critical to low-energy buildings than any given technology.



**Major renovations** offer a major opportunity for deep savings. **Re-positioning existing buildings** is currently an attractive real estate move.



**Readily available technologies/strategies** were used to create these deep energy retrofits. **Performance feedback** is key.



**Building ratings, labels, champions and recognition** were a strong influence on increased efficiency.

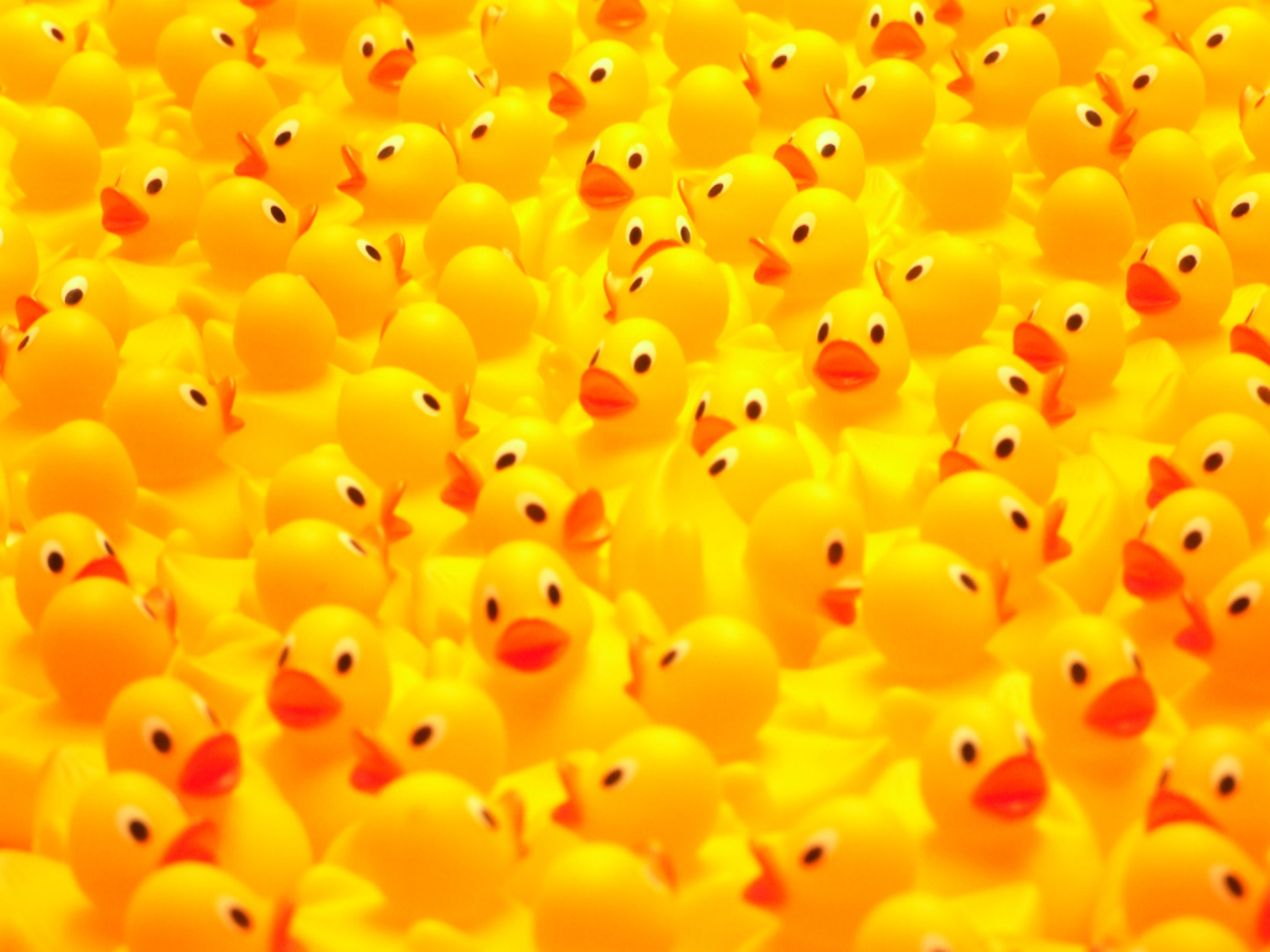
Source: NBI

© U.S. Green Building Council 2012

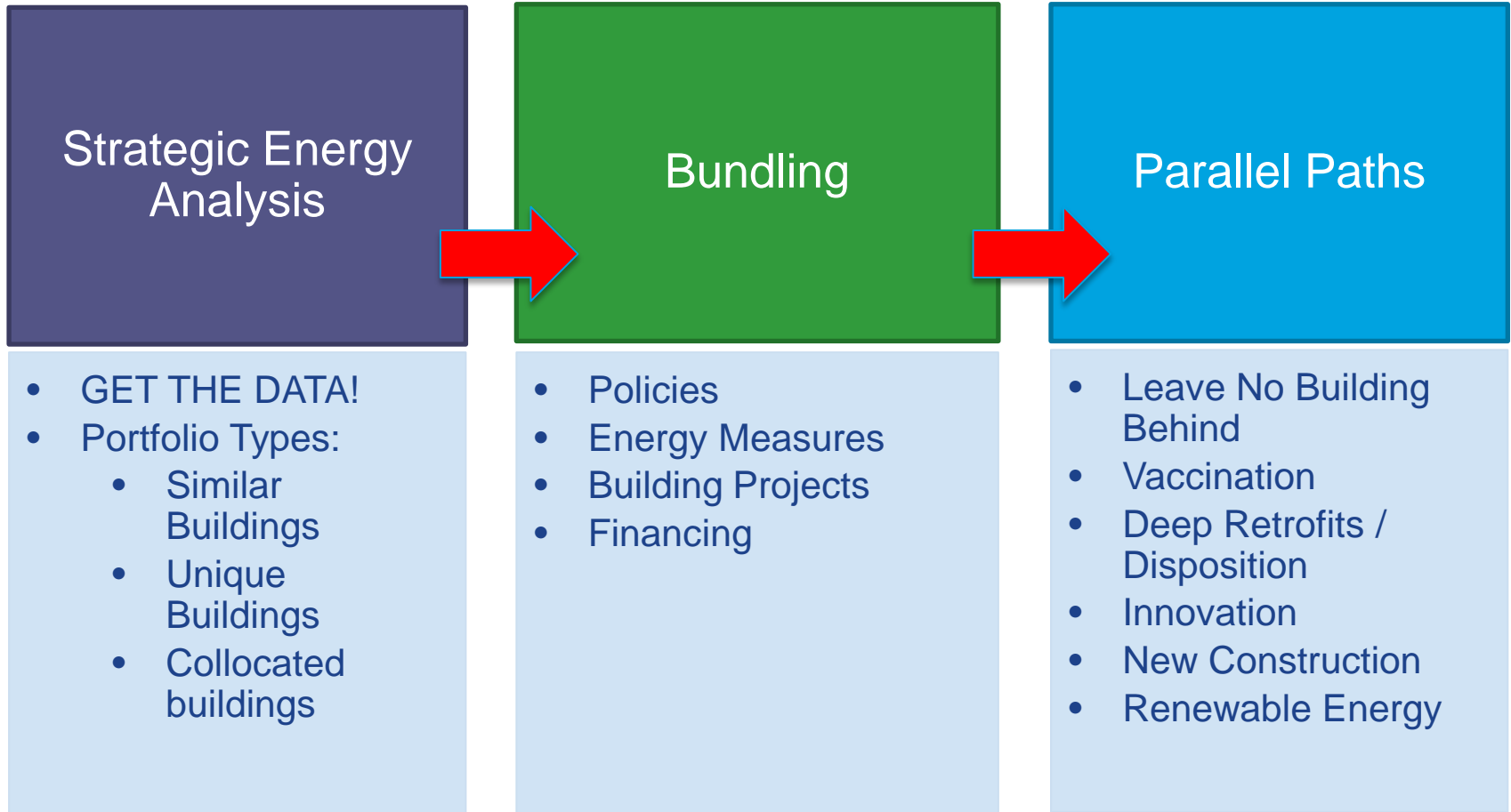
<http://newbuildings.org/meta-report-search-deep-energy-savings>







# Crafting a Building Portfolio Efficiency Strategy



*“We can do some of the measures in all of the buildings, and we can do all of the measures in some of the buildings.” – Blake Herrschaft, Engineer*

**Carlos Santamaria**  
**Vice President, Engineering Services**  
**Glenborough, LLC**

# The Aventine Office Building Deep Energy Retrofit Project Case Study



# Company Overview

**Glenborough, LLC brings over three decades of experience to the commercial real estate industry. Formerly a NYSE listed real estate investment trust, the company is a privately held full service real estate investment and management company focused on the acquisition, management, and leasing of high quality commercial properties. We invest in core and value add properties in major markets across the country including San Francisco, Southern California, and Washington DC.**



## The Aventine Case Study

This case study shows how Glenborough transformed the Aventine Office Building towards becoming one of the most energy efficient and sustainable buildings in the nation.

During 2008 - 2011, the Aventine Office Building underwent several major equipment retrofits changing its operations towards conducting the highest energy efficient best practices.

Glenborough's dedication towards Energy Efficiency & Sustainability is reflected by its company wide Commitment and Leadership.





## The Aventine Deep Energy Retrofit Project

This project started with the vision of reaching the highest level of energy efficiency and sustainability possible.

Glenborough is committed as a industry leader working towards transforming “ALL” of its office buildings across the nation.

The Aventine Deep Energy Retrofit project consisted of putting together a knowledgeable team of vendor partners interested in contributing to this one of a kind undertaking.



## The Aventine Deep Energy Retrofit Case Study

- Located in La Jolla California
- Class-A Office Building / Multi Tenant
- Built in 1990 – **23 Years Old**
- Approximately 252,000 Sq.Ft.
- 2007 EPA ENERGY STAR Rating 84
- 2007 Electrical Cost at \$2.90 \$per/Sq.Ft.



## The Aventine Deep Energy Retrofit Case Study

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# The Aventine Deep Energy Retrofit Case Study

**LEED Summary** - The Aventine Building Submitted its project to the U.S. Green Building Council in September 2009 earning "71" LEED Credits Qualifying for **Platinum Level Certification**. (*December 2010*)



**ENERGY STAR Summary** – The Aventine Building has Achieved an **ENERGY STAR Score of "100"** Rating it as One of the Most Energy Efficient Buildings in the Nation.

**Maintained a Score of "100" in 2009 – 2013  
Going on 5-years**



# The Aventine Deep Energy Retrofit Case Study

## Sustainability Overview

- Over 1,250,000 Kilowatts of Energy Saved Annually
- 725 (MtCO<sub>2</sub>e) Emissions Reduced Annually
- Over 1,000,000 Gallons of Water Saved Annually
- Over 50% Waste Diverted from Landfill to Recycling
- 100% of Energy Produced at Site Off-Set by Renewable Energy Credits - Wind Power
- “Strategic Vendor Energy Team” Created to Integrate LEED Project Resources & Expertise



# **The Aventine Deep Energy Retrofit Case Study “Strategic Vendor Team”**

- 1. ABM Engineering Services – Energy Services**
- 2. Alpha Mechanical – Engineering & Services**
- 3. Brickman Landscaping – Sustainable Landscaping**
- 4. CentiMark Roofing – Cool Roof Installation**
- 5. CleanSource – Green Cleaning Products**
- 6. Chelsea Group – LEED Consultant**
- 7. Cushman & Wakefield – Leasing Brokers**
- 8. Light Source & G.E. – Sustainable Lighting Products**
- 9. Mitsubishi Elevators – Sustainable Elevators**
- 10. Optimum Energy – Chiller Plant Optimization Software**
- 11. Stevenson Systems – Electronic Plan Mgt.**
- 12. Workspeed – Web Based Tenant Service Programs**





# The Aventine Deep Energy Retrofit Project Case Study

## “LEED Project Team”

**Project Team Administrator** - Carlos Santamaria, Vice President Engineering Services / Glenborough, LLC

**Project Team Manager** – Chris Munn, Regional Technical Manager  
Chelsea Group, Ltd.

### **Project Team Members**

Doug Eagle, Chief Engineer, ABM Eng.

Dave Munn, Chief Technical Officer, Chelsea

Travis Gorzeman, Property Manager, **Glb**

Dave Peacock, Regional Leasing Director, **Glb**

Pat Simoni, Manager Corporate Services, **Glb**

Wayne Wheeler, Building Engineer, **ABM Eng.**

Alexandra Price, Regional Leasing Assistant, **Glb**

**Kerry Jenkins, Chief Engineer, ABM Eng.**

Michelle Micciche, Property Manager, **Glb**

**Nicole Moser, Senior Project Manager, Workspeed**





# Deep Energy Retrofit The Aventine Case Study

## Started Comprehensive Energy Management Plan 3 - Phase Approach

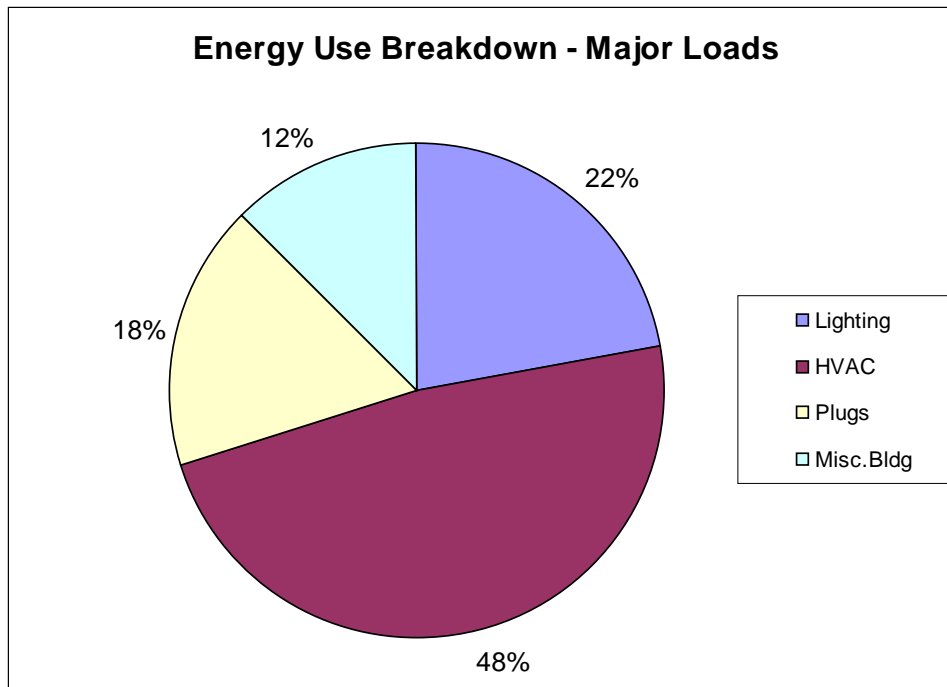
1. Energy Profile, Identify Hi Energy Uses & Users & Set-Goals
2. Evaluate & Prioritize New Technology Implementation
3. Continue Implementation of Cost Saving Opportunities with Measuring Results



# The Aventine Deep Energy Retrofit Case Study

## Energy Management Strategies

Largest Areas of Energy Consumption Identified  
& Upgraded. HVAC Systems



# The Aventine Deep Energy Retrofit Case Study

## Energy Management

- Chiller Plant Identified as Energy Load with Single Biggest Savings Opportunities

Installs **Optimum Energy's** Software Solution / "OptimumLOOP"

-Improved Plant Efficiency from a *1.4 KW/per/ton* to a **< .40 - .60** KW/per/ton Plant Efficiency



# The Aventine Deep Energy Retrofit Case Study

## Chiller Plant Performance

Using Next Generation Technologies

By using – All Drive – Algorithm Control & Monitoring:

The Aventine Reduced over 501,745  
Kilowatts of Energy Saving \$75,763 with  
this one System Upgrade!

Today, the Building Operates at 28kbtu/sf.



# The Aventine Deep Energy Retrofit Case Study

## Chiller Plant Performance

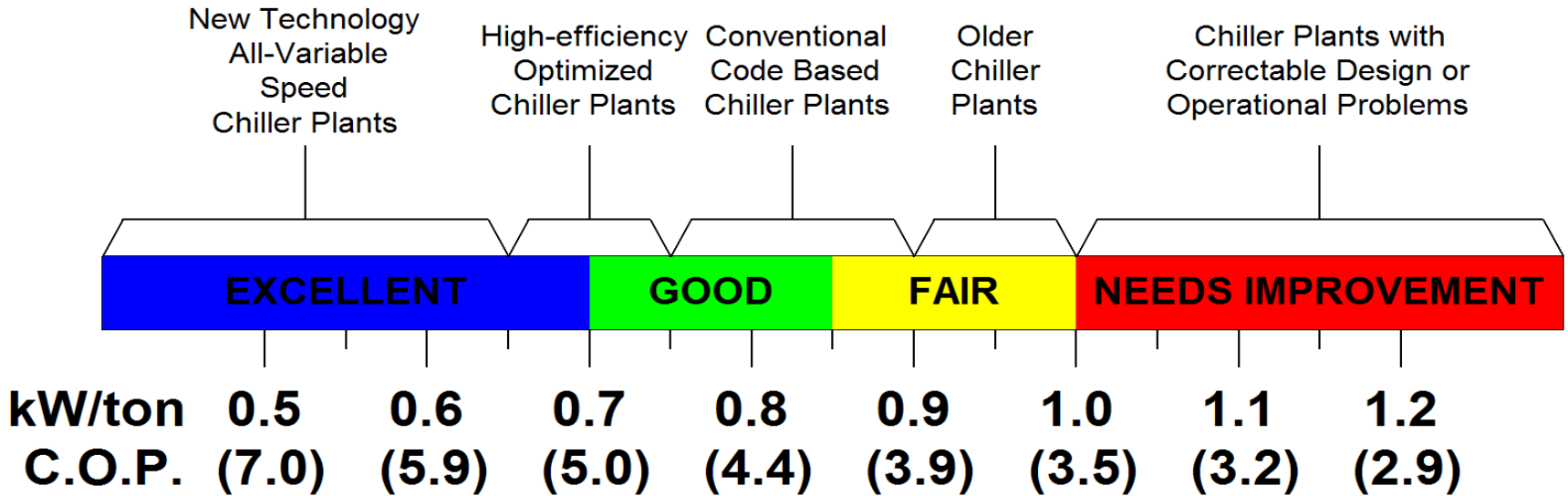
### Year 1 RESULTS

- Increased EPA ENERGY STAR score to from "84" to "**100**"
- GHG Emission Reduction From Baseline –234 (MtCO<sub>2</sub>e)
- Pre-Retrofit Electrical Cost at \$2.90 \$per/Sq.Ft.
- Post-Retrofit Electrical Cost at \$2.20 \$per/Sq.Ft. – 2013 at 1.95\$sf



# The Aventine Deep Energy Retrofit Case Study

## Chiller Plant Performance (.50 - .60/kW/ton)



**Hi-Efficiency Compressors**



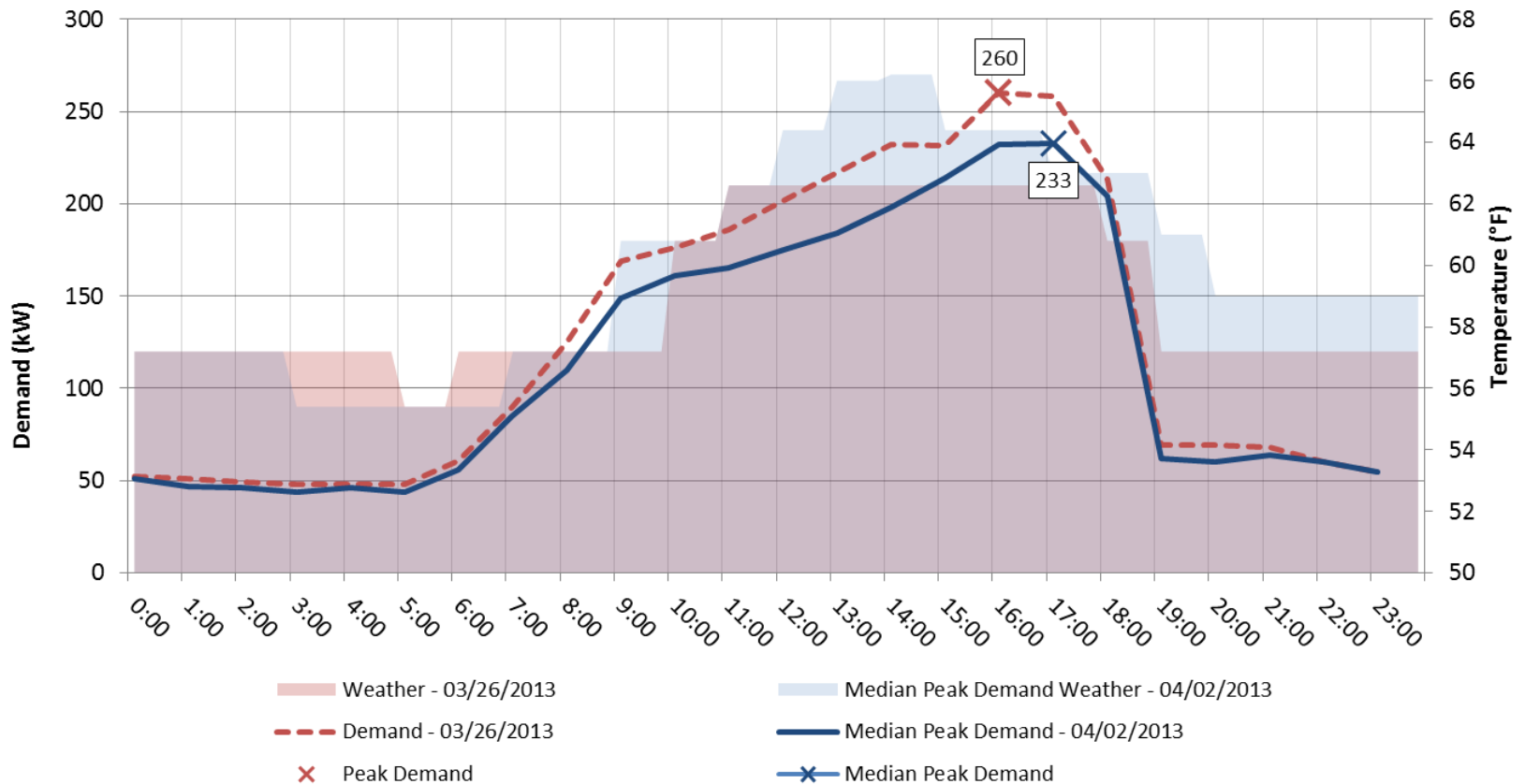
# **The Aventine Deep Energy Retrofit Case Study**

## **Real Time Energy Metering**

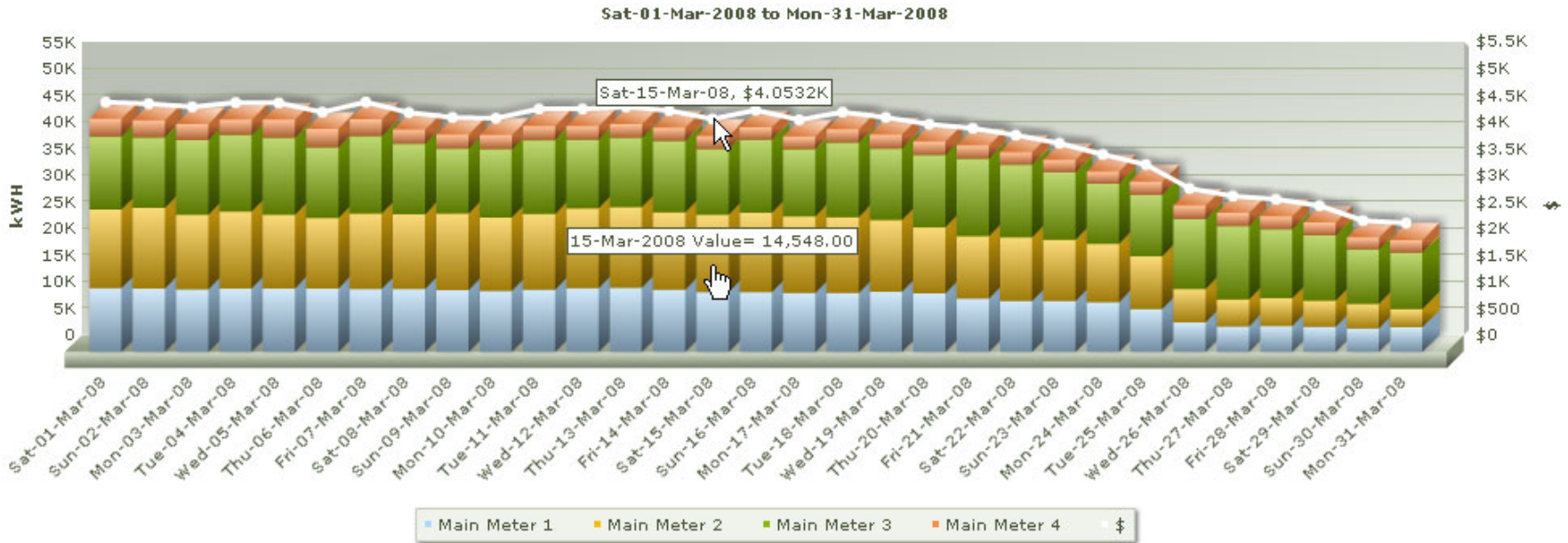
- 1. Implemented EnerNoc Insight Energy Solution**
- 2. Voluntary Peak Demand Reduction**
- 3. Ongoing – Demand Side Management**

# The Aventine Deep Energy Retrofit Case Study

735 Three Carnegie Meter - V349N-016808 - 2nd Highest Peak Demand - 03/26/2013



# The Aventine Deep Energy Retrofit Case Study – Meter Granularity



# **The Aventine Deep Energy Retrofit Case Study**

## **Whole Building Integration**

- 1. Looking at Other Systems and Practices Towards Reduction**
- 2. Addressing Water and Waste Management Best Practices Towards Energy Reduction**
- 3. Ongoing Educational Outreach & Industry Thought Leadership That Promotes Ongoing Energy Efficiency Efforts**

# The Aventine Deep Energy Retrofit Case Study

## Exterior Building Upgrades

- Installed New EPA “Cool” Roof
- Reused over Two Tons of “Old” Red Rock Ballast
- Reduced Over 45,000 Kilowatts of Energy
- Reduced Heat Island Effect



# The Aventine Deep Energy Retrofit Case Study

## Water Conservation Strategies - Building

- Water Efficient Toilets & Urinals Installed
- Hands Free Faucets Installed
- Hands Free Soap Dispensers Used





# The Aventine Deep Energy Retrofit Case Study

## Water Conservation Strategies - Landscaping

- The Aventine Uses **100% Reclaimed Water** for Irrigation
- **Smart Controls** Utilizing Drip Irrigation Used
- Drought Resistant & **Native Plants** Installed
- **Open Space** is Maintained for 25% of Project
- **Sustainable Landscape Practices** are Performed
- Environmentally **Safe Chemicals Used**
- Landscape Waste **Composted Off-Site**



# The Aventine Deep Energy Retrofit Case Study

## Waste Management Program

- Implemented Comprehensive Waste Management Program
- Current Waste Diversion Rate at 50%
- E - Recycling Conducted Throughout Year
- Tenant Education Sessions Conducted Throughout Year
- Web-Based Recycling Program Dashboard Developed
- Comprehensive Waste Audit Conducted
- Construction Recycling Program Standard Used
- Battery & Lamp Recycling Program in Place



# The Aventine LEED Platinum Case Study

## USGBC & ENERGY STAR Results



LEED Platinum Certification – Just **“One of Ten”** 20 Plus Year Old Multi-Tenant Office Buildings in **World**



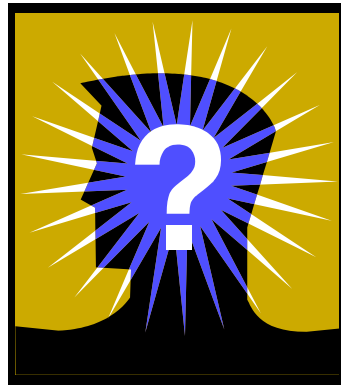
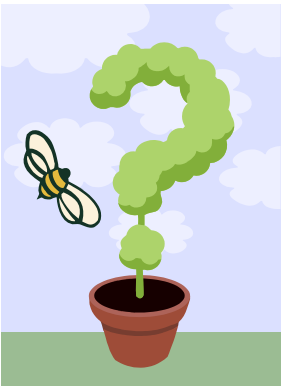
**ENERGY STAR**  
Rating of **“100”** for  
last Five Years



## Glenborough's Energy Efficiency & Sustainability Accomplishments

- NAREIT Leader in the Light “Gold” Award for Energy Efficiency - 2005
- EPA **Top Leaders Award** for Achieving a Portfolio Wide Average ENERGY STAR Score above 75 - 2008
- Flex Your Power Energy Efficiency Award - 2008
- EPA **Top Leaders Award** for Reducing Energy Across the Portfolio by over 10% - 2009
- EPA – **ENERGY STAR National Building Competition Finalist** and 4th Place Award Winner – Highest Percentage Reduction
- EPA **Top Leaders Award** for Achieving a Portfolio Wide Average ENERGY STAR Score **above 85 - 2010**

# Questions



If you would like to contact us, please feel free to send an email to Carlos Santamaria, LEED AP – Vice President – Engineering Services

[carlos.santamaria@glenborough.com](mailto:carlos.santamaria@glenborough.com)

Or call 650-343-9300x522

**Jim McClendon**  
**Director of Engineering**  
**Walmart Stores, Inc.**



# Large Scale Energy Reductions Walmart 2020 Energy Goal

Jim McClendon  
Walmart Design

04Dec2013



# Formats & Footprint

Brazil



US



Mexico



China



UK



## Quick Stats:

- >1 Billion SF
- >200 Million Cust/Wk
- >2 Million Associates
- >10,000 Stores/Clubs
- 16 Countries

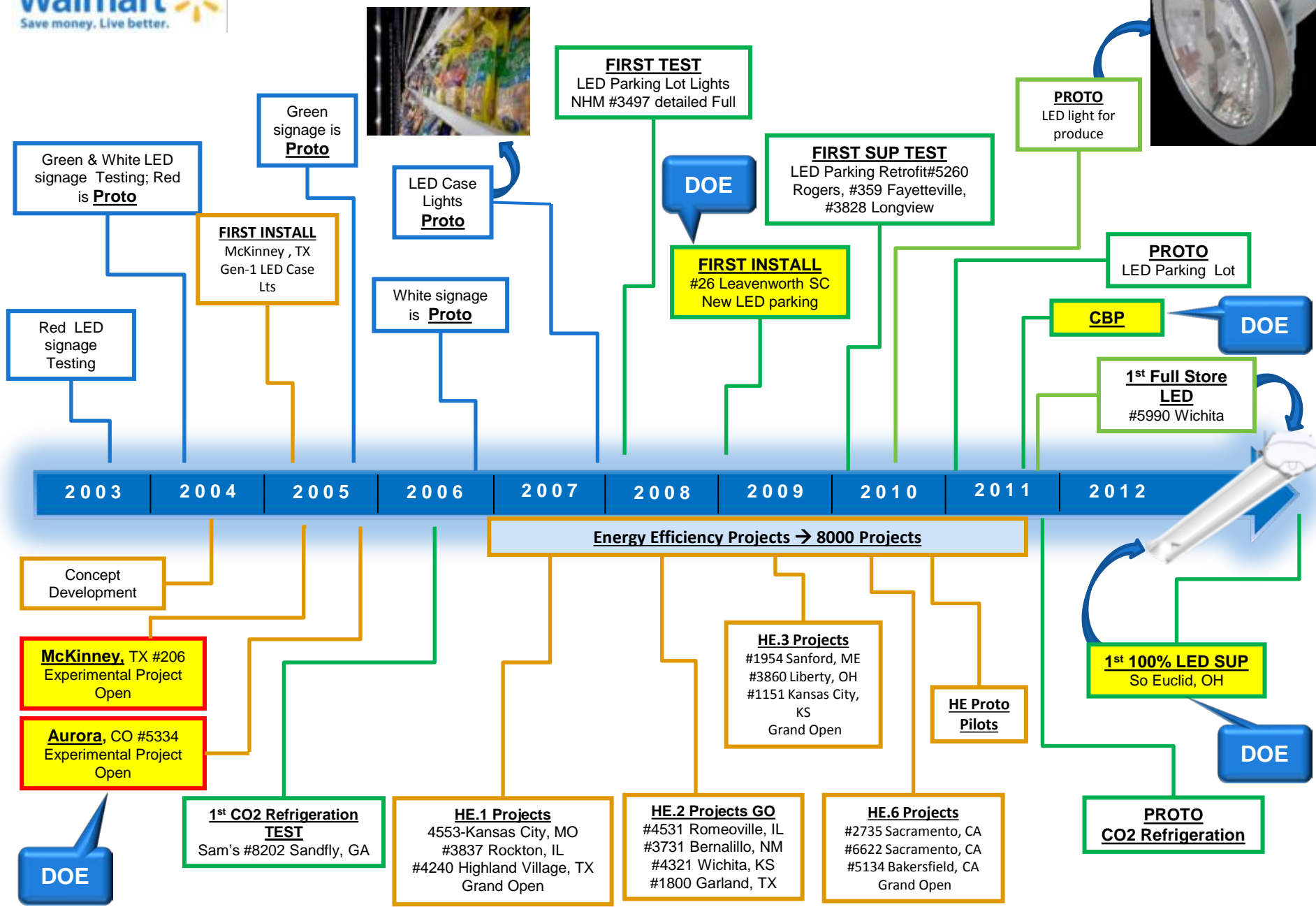
# Background Goal

## 2005 GHG Goal

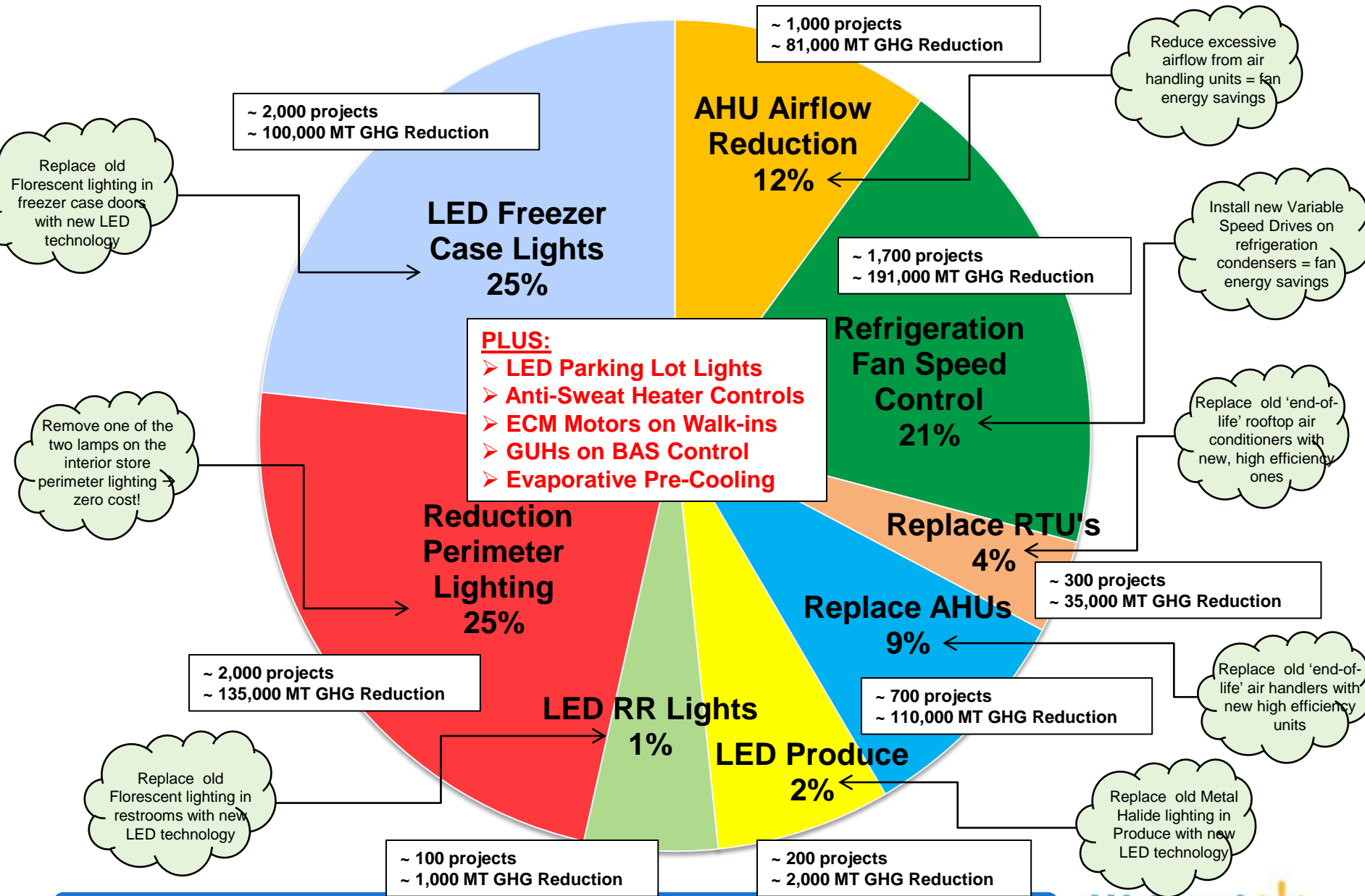
*'Reduce the greenhouse gases at our existing store, club and DC base around the world by 20% over the next 7 years'*

*Design and build a new prototype that is 20% more efficient and produces 25% fewer greenhouse gases than our 2005 prototype*

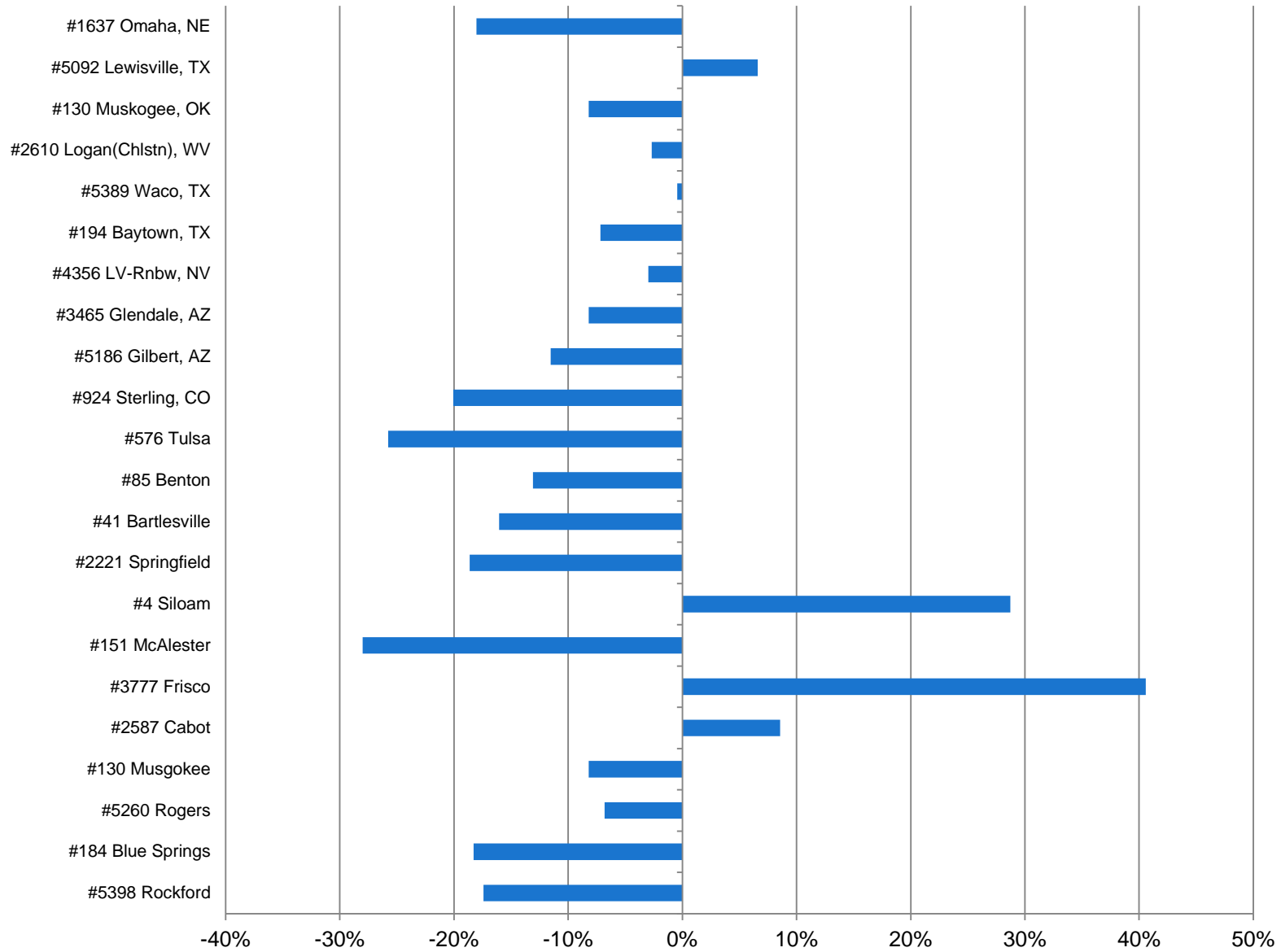
# DEVELOPMENT TIMELINE



# ~8,000 Projects Completed (2005 – 2011):

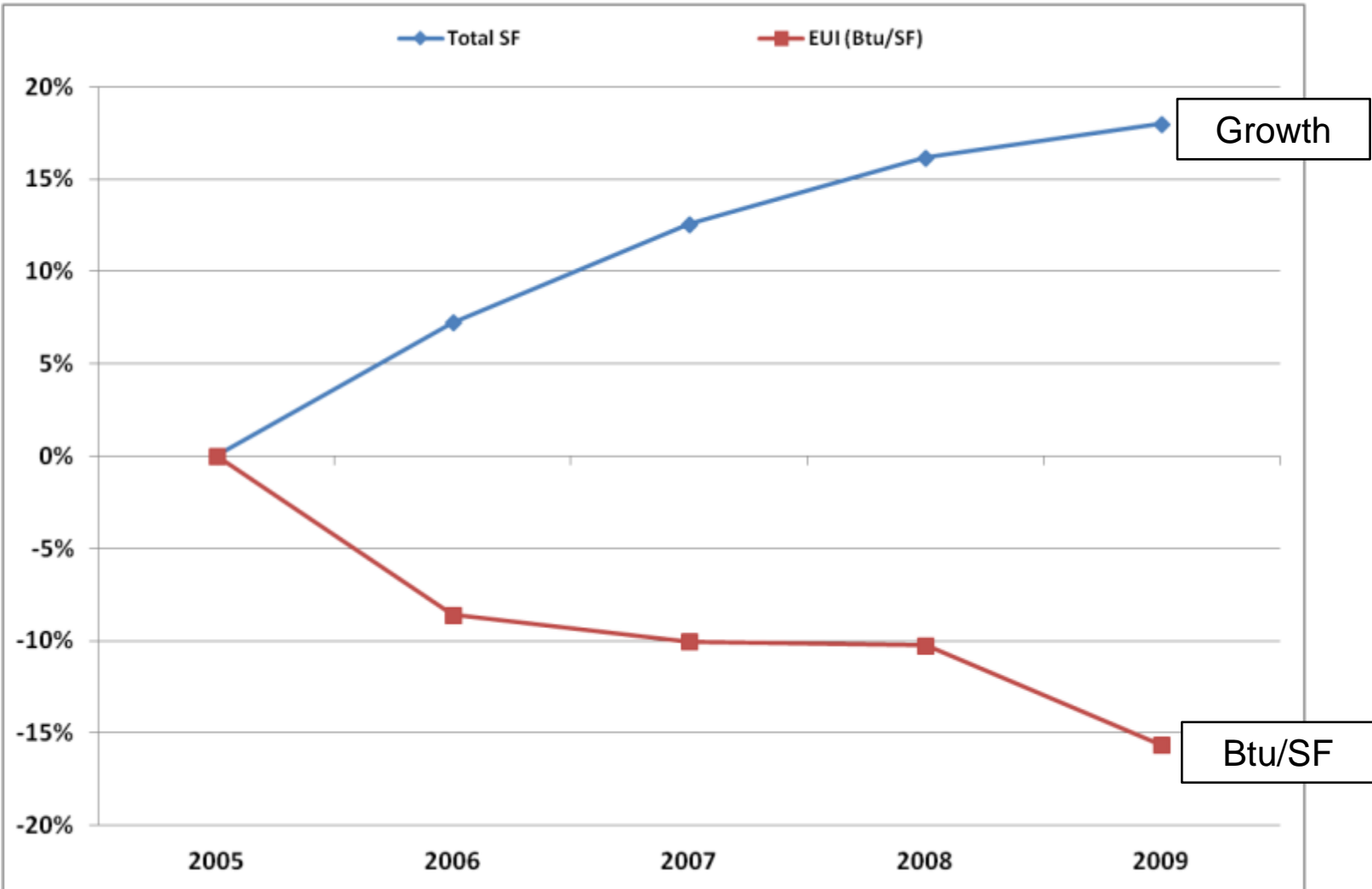


### 2006 to 2012 Change in EUI





# Energy Achievements (US Only)



# On April 15, 2013 we announced two new corporate energy goals for 2020

Walmart is on the path to being supplied by 100% renewable energy.

We will take a two tiered approach by both increasing renewable energy usage and increasing energy efficiency with the following commitments:

## Commitment 1: scale renewables



### Public Goal

Drive the production or procurement of 7 billion kWh of renewable energy globally by December 31, 2020—an increase of over 600% versus 2010

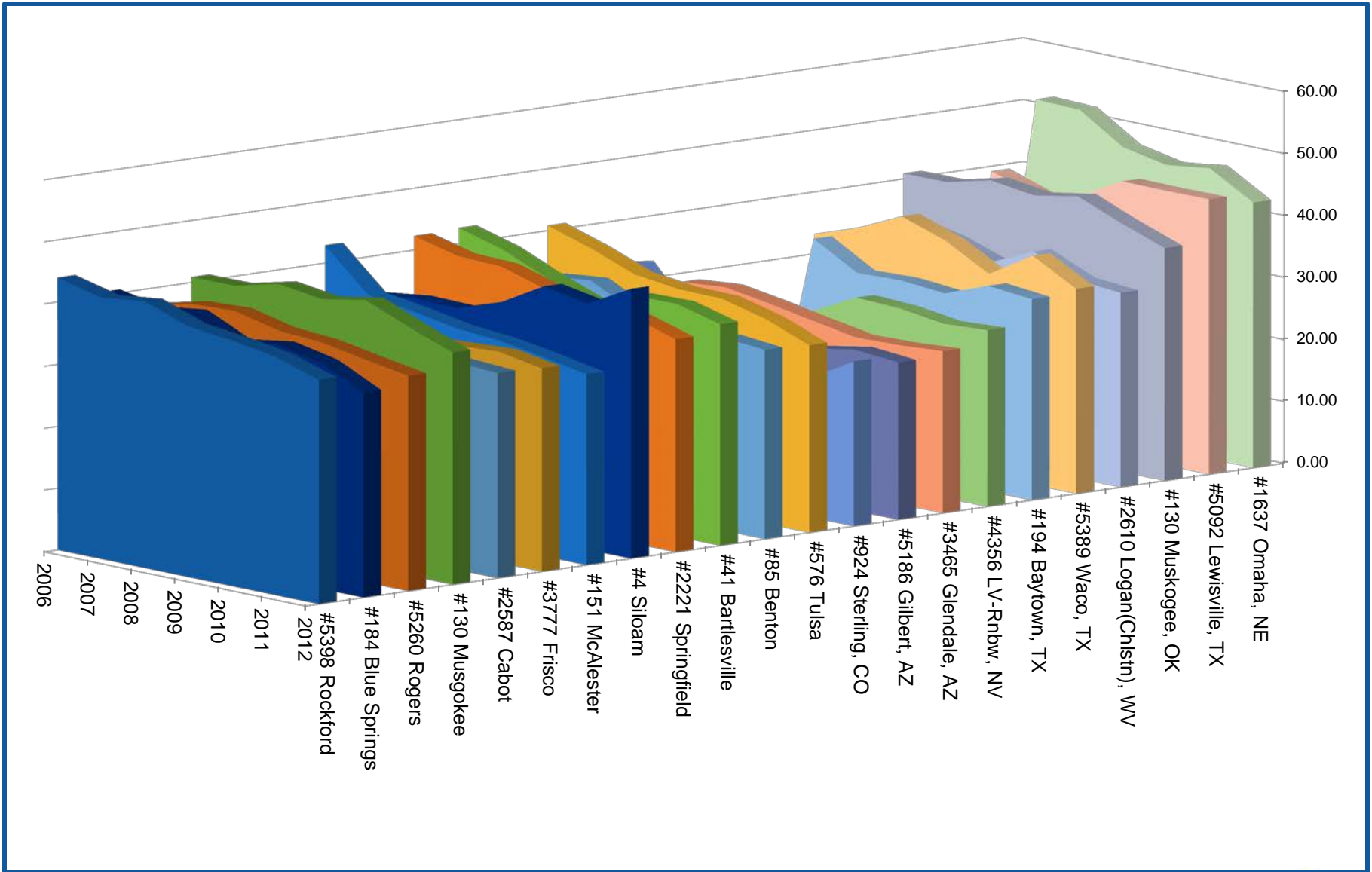
## Commitment 2: accelerate efficiency



### Public Goal

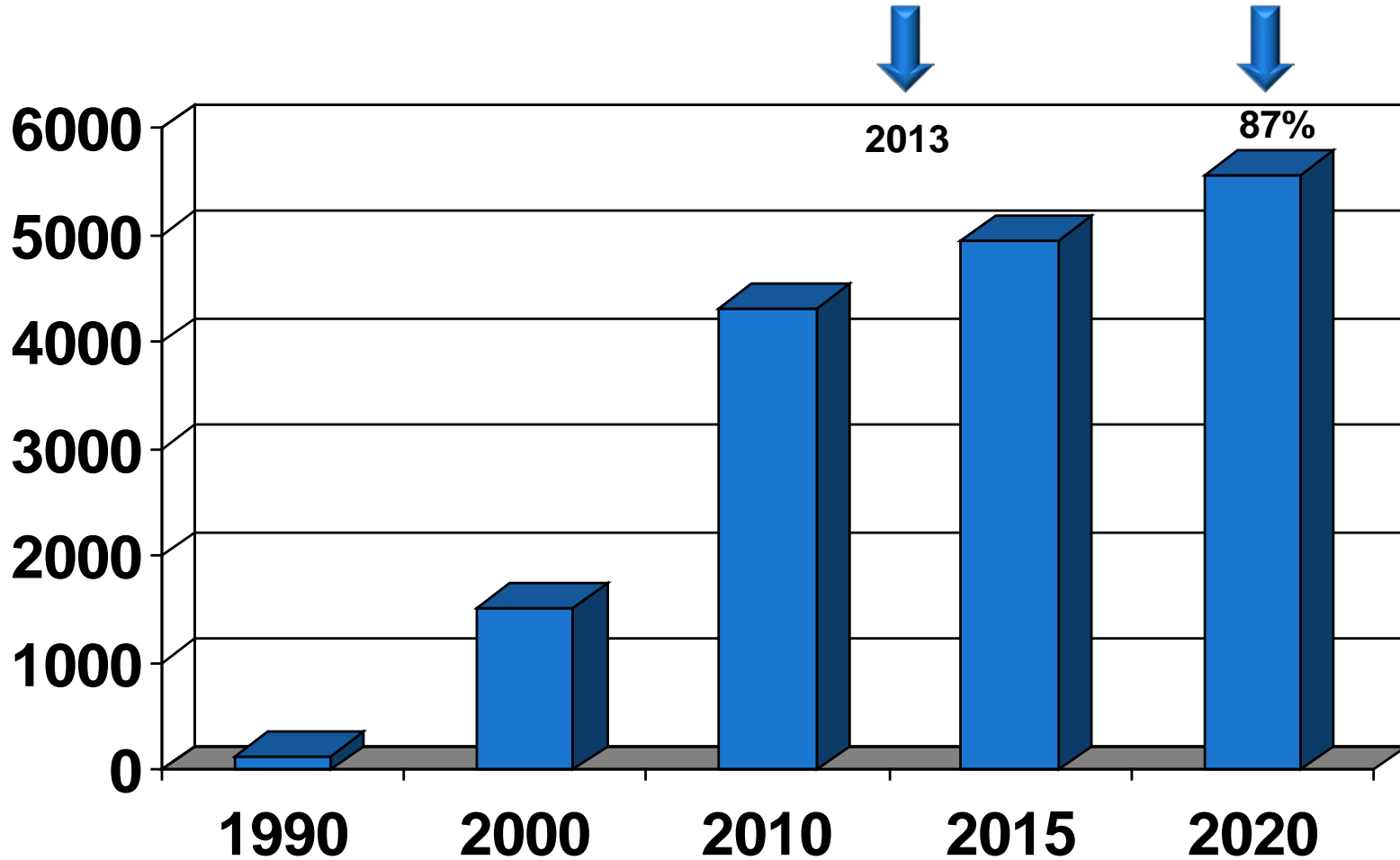
By December 31, 2020, reduce the kwh/sq.ft. energy intensity required to power our buildings around the world by 20% versus 2010

# 2020 Energy Goal → Starting Where We Left Off



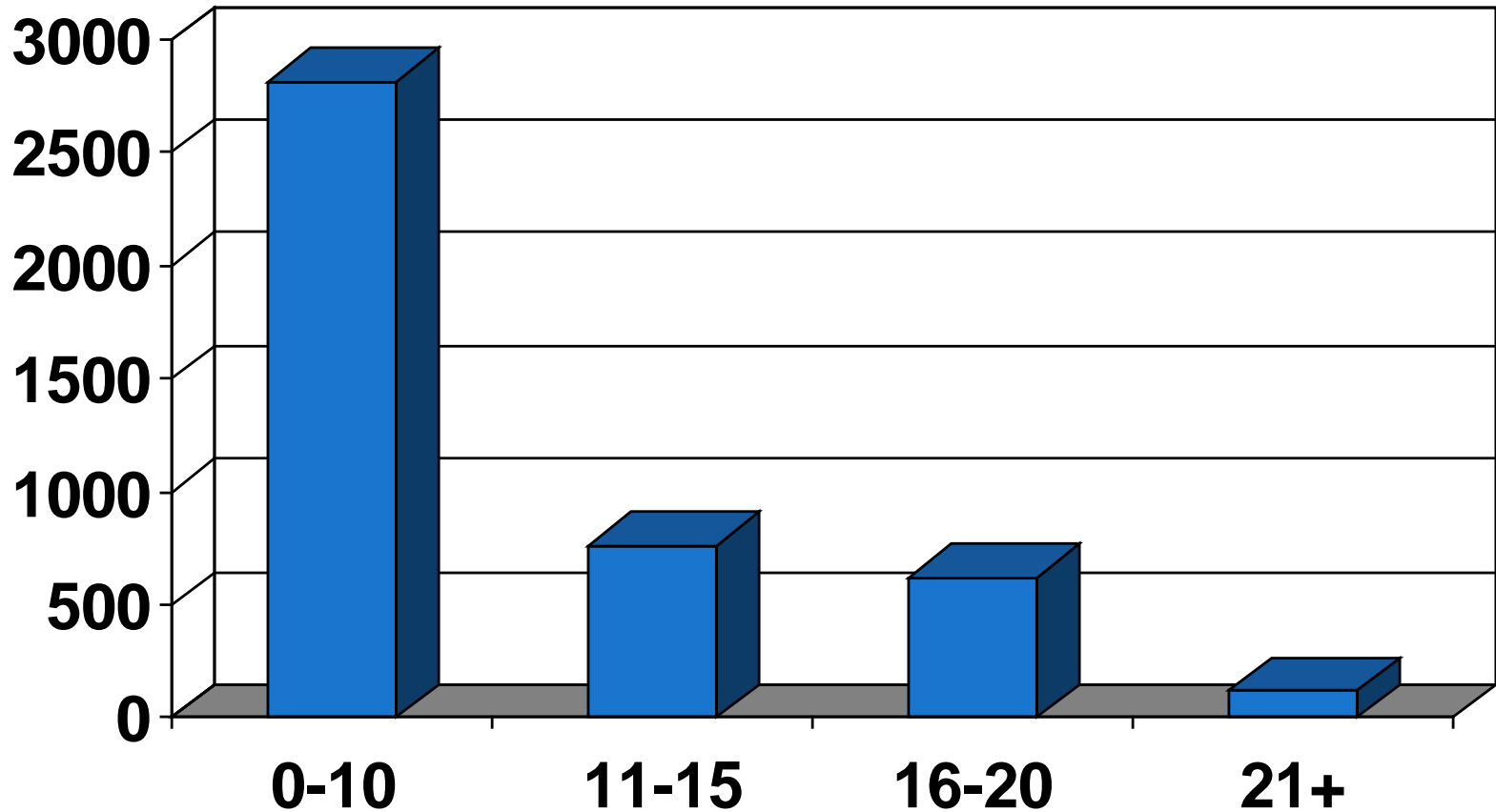
# Goal is Based in the Existing Footprint

## Existing Building Stock<sub>US</sub>



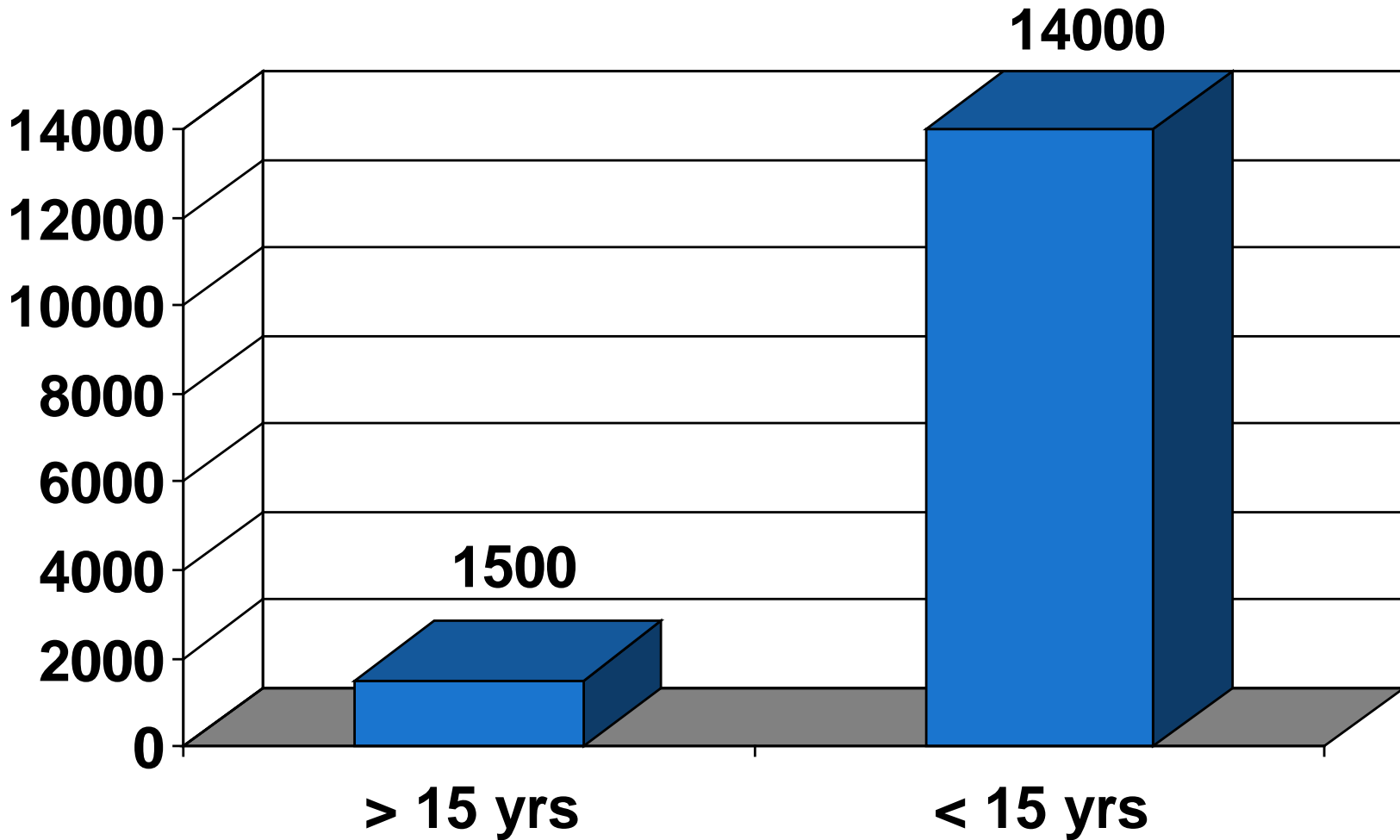
# Goal is Based in the Existing Footprint

## Existing Building Stock<sub>US</sub>



# Footprint Opportunities

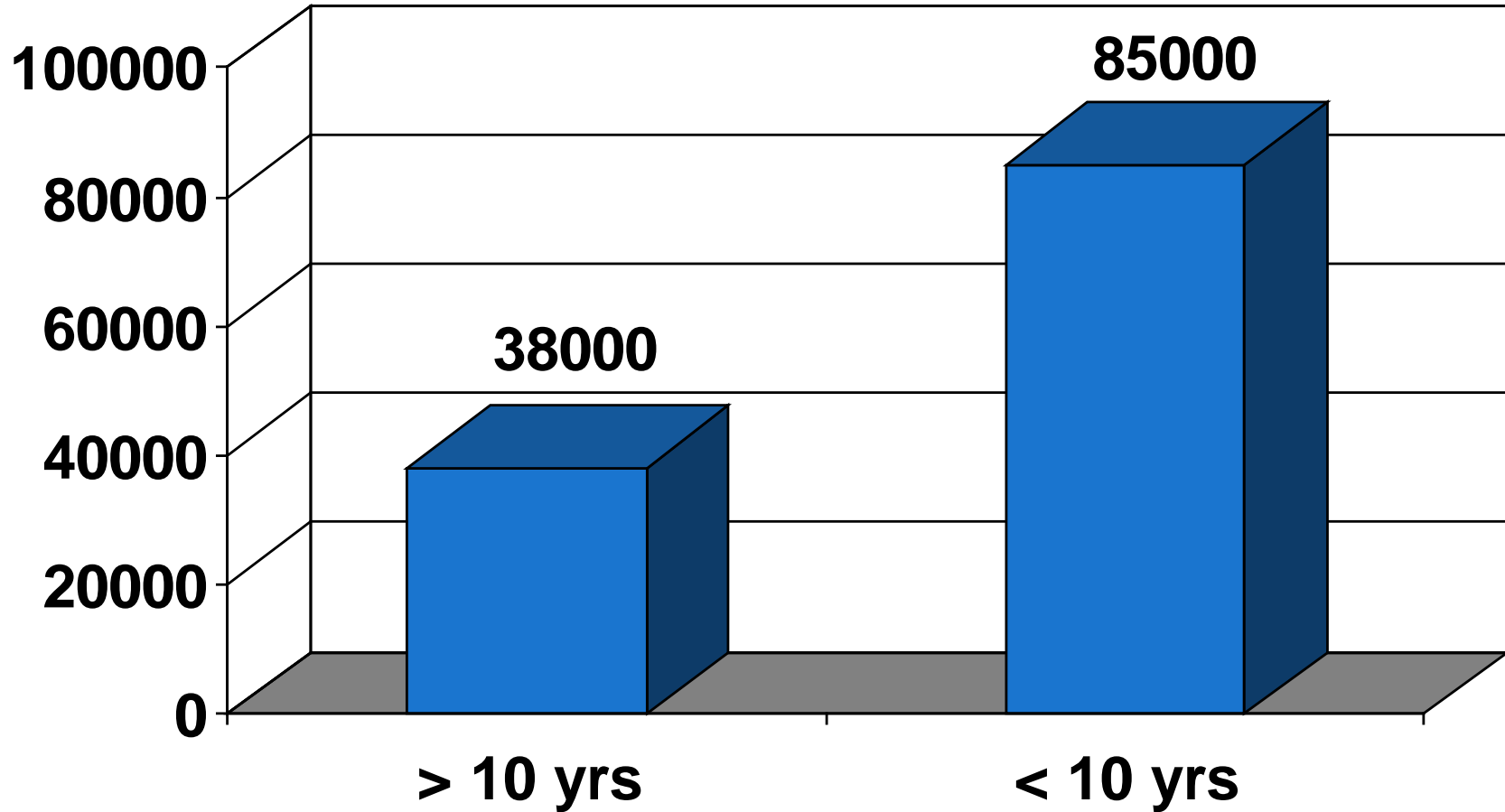
## Racks



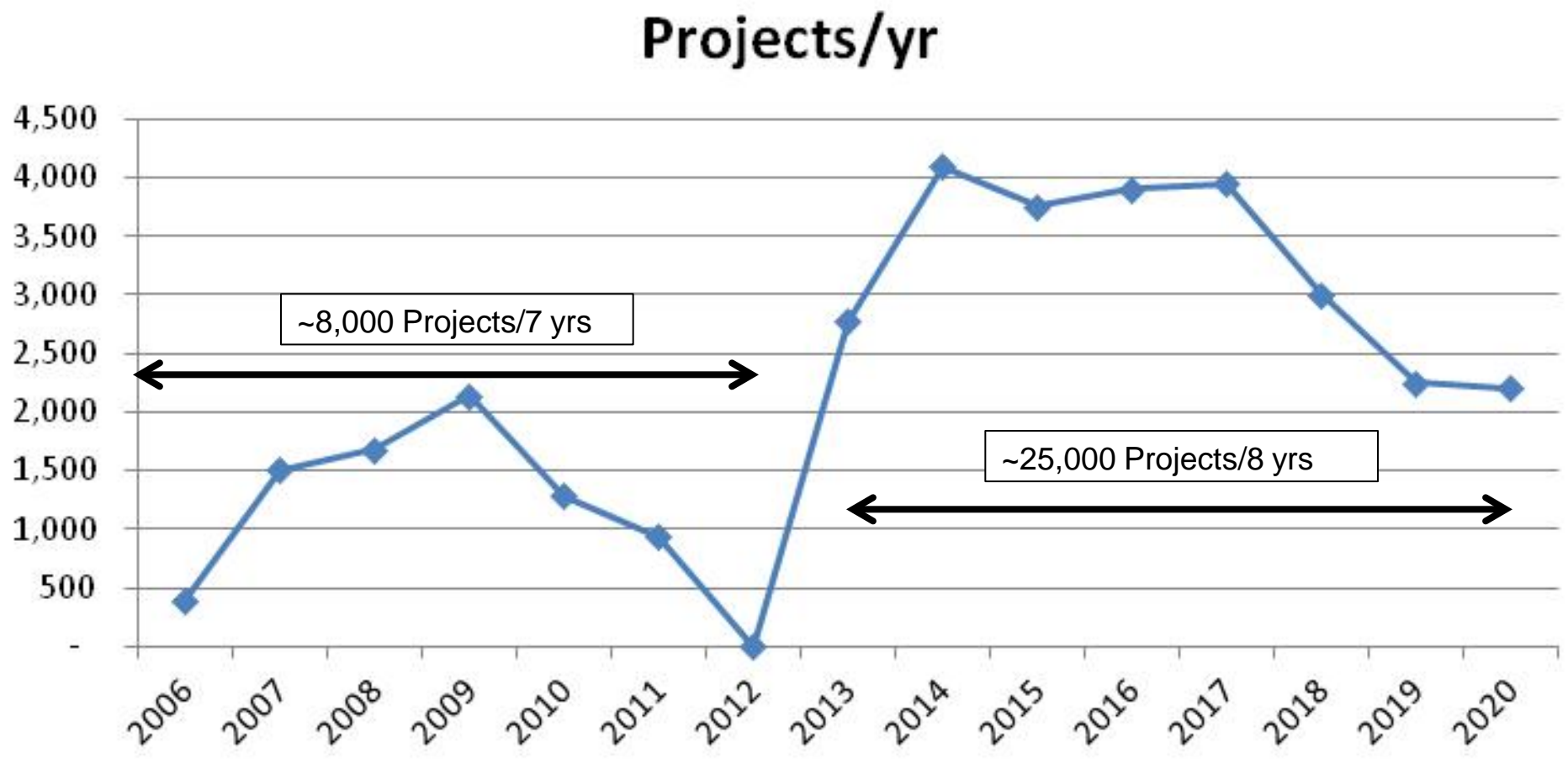


# Footprint Opportunities

## RTUs

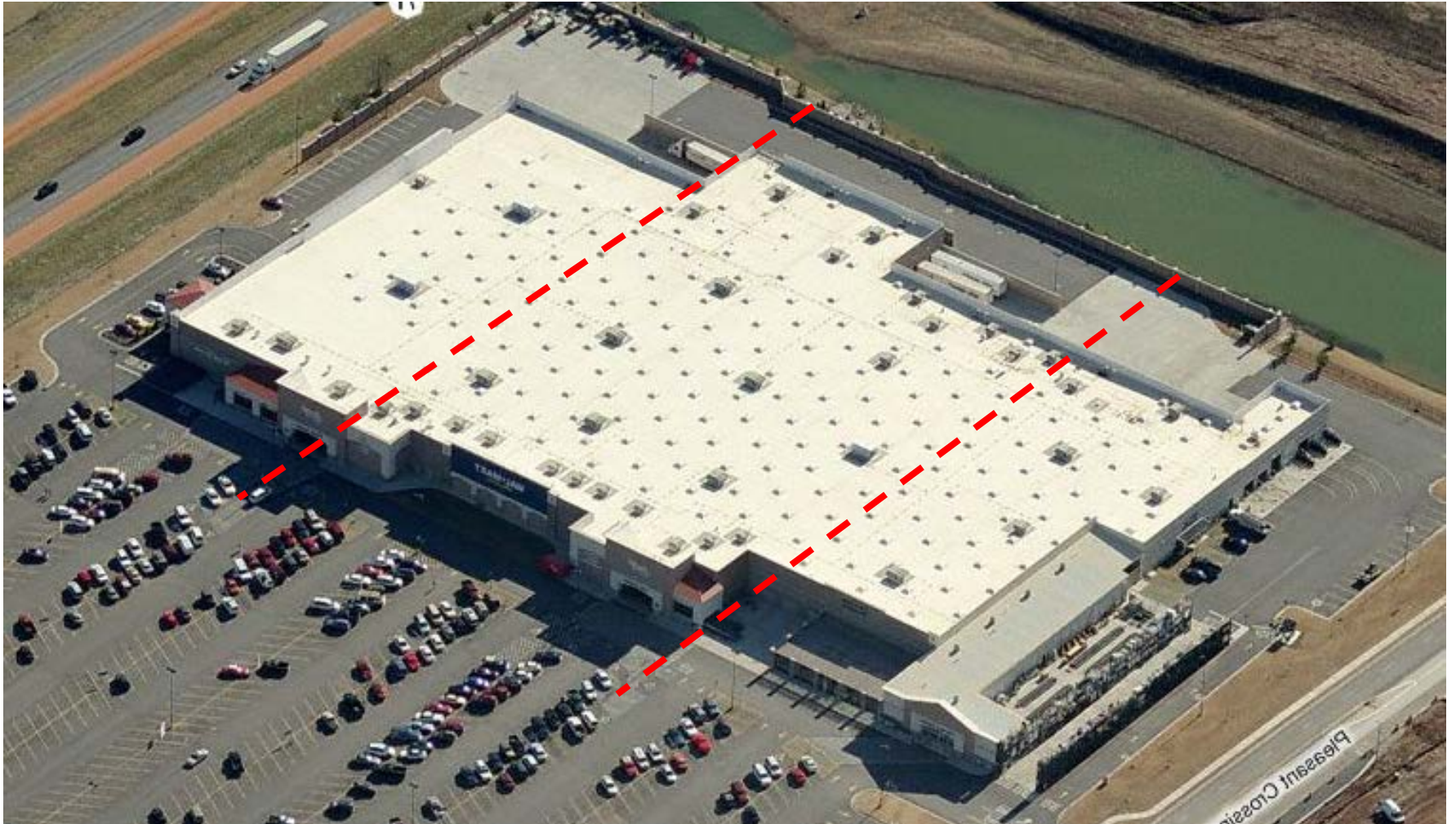


# EE Projects Opportunities Example → 2005 Goal vs 2020 Goal



# APPROACH

# Walmart Supercenter



# 2020 Energy Goal Strategy

*Large scale, portfolio wide energy efficiency project identification;*

➤ *Understand the footprint*

- Monthly Utility data at minimum / submeter data is better*
- All energy forms; electric, gas, other*
- Sort by format, region, operation*

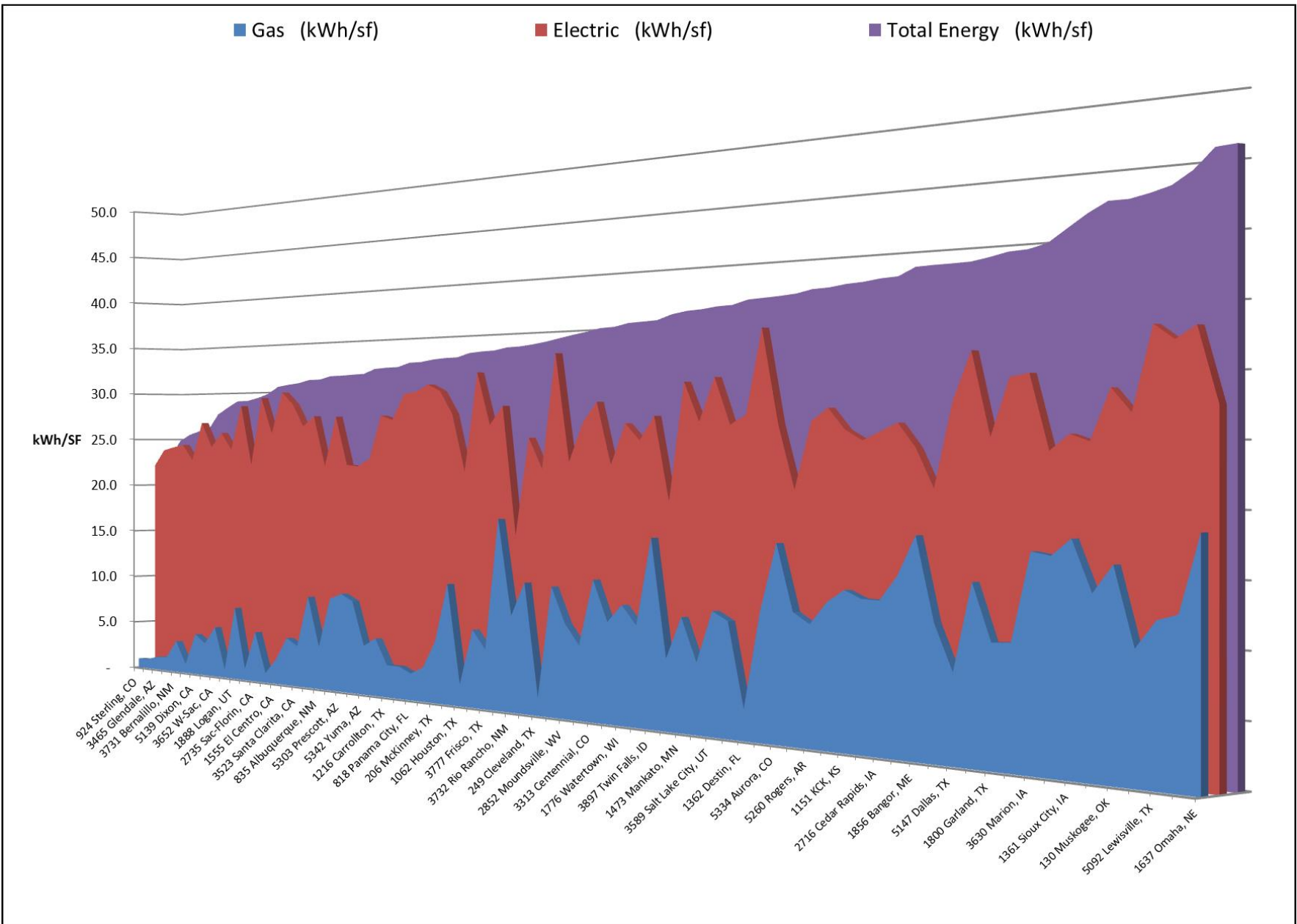
➤ *Look for patterns & trends → establish 'normal' and identify the outliers*

- Range of deviations*
- Best / worst performers*
- What's right – what's wrong*

➤ *Initiative Ideation*

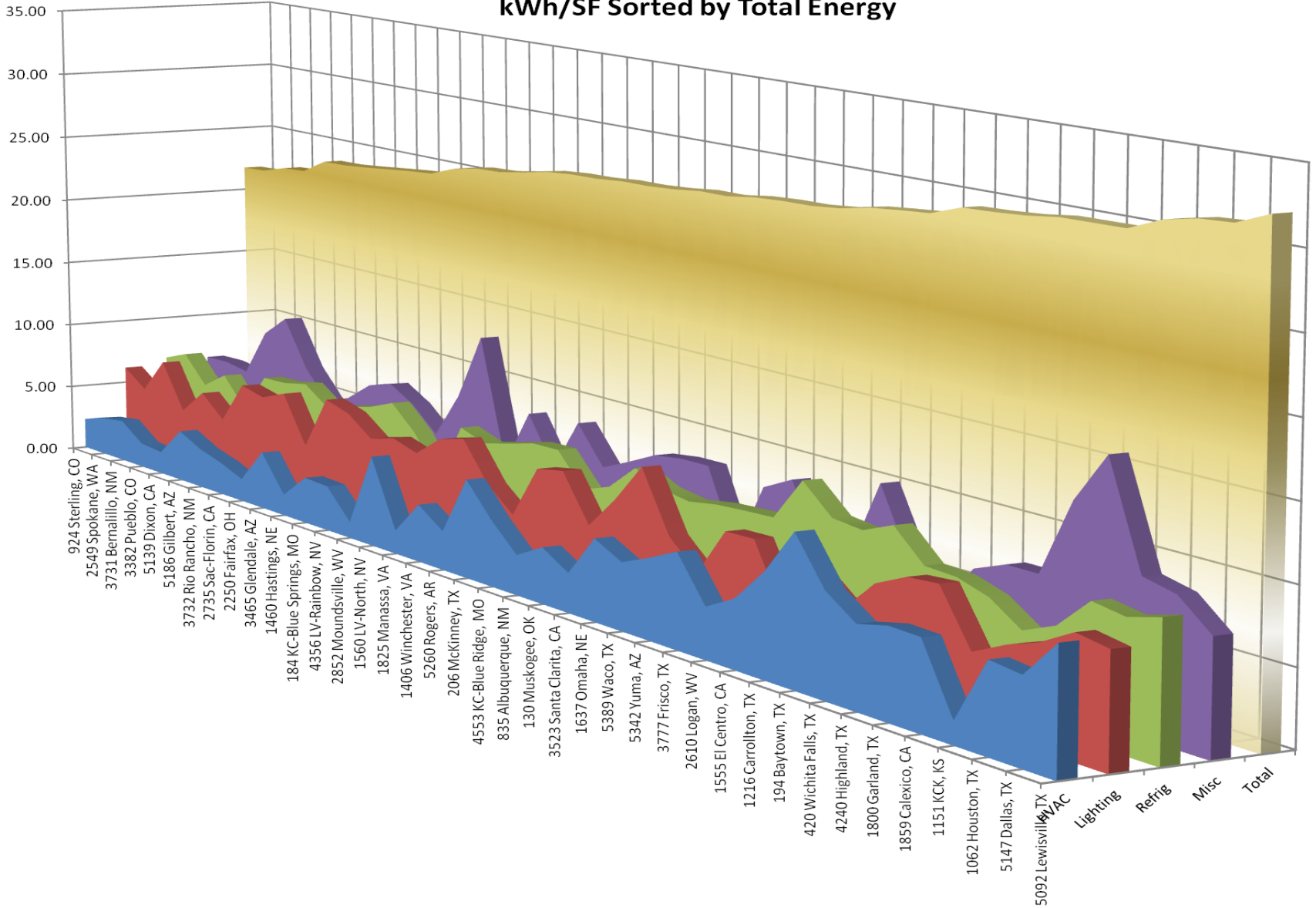
- Int/Ext SMEs, Utilities, NGOs, GO's, Formal/Informal...*
- Sort by; 1) Load Reduction, 2) Free Energy, 3) Efficiency*
- Filter by; 1) OTS-ROTS-NT, 2) Return on Investment, 3) Resources*







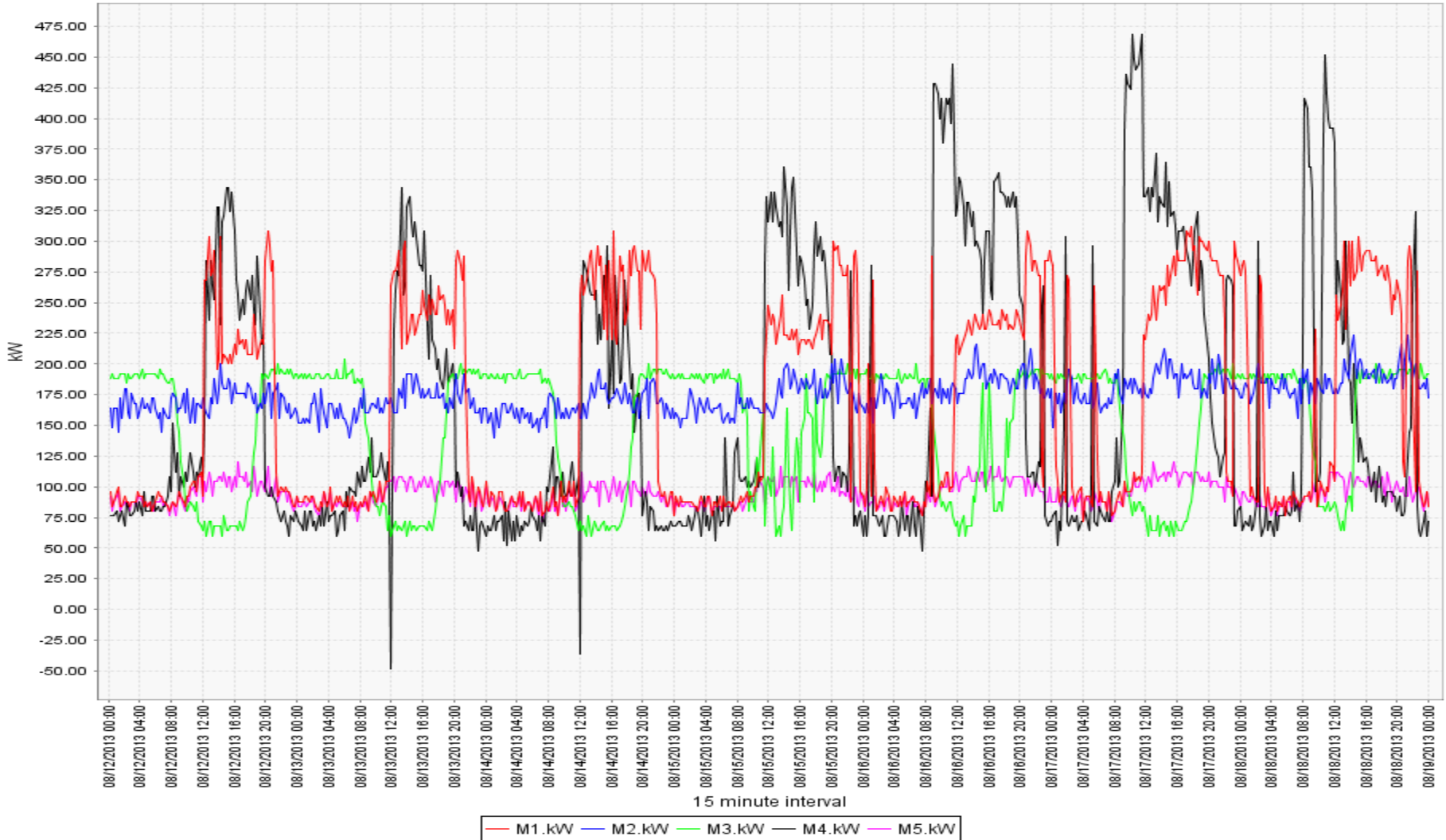
# kWh/SF Sorted by Total Energy



# 4356, Las Vegas, NV Previous Week (kW), 15min interval Reading

[08/12/2013 00:00 - 08/19/2013 00:00]

M1: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL HVAC  
M2: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL REFRIG  
M3: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL LIGHTING  
M4: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/15 TOTAL SITE MISC  
M5: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/04 TOTAL DEHUMID

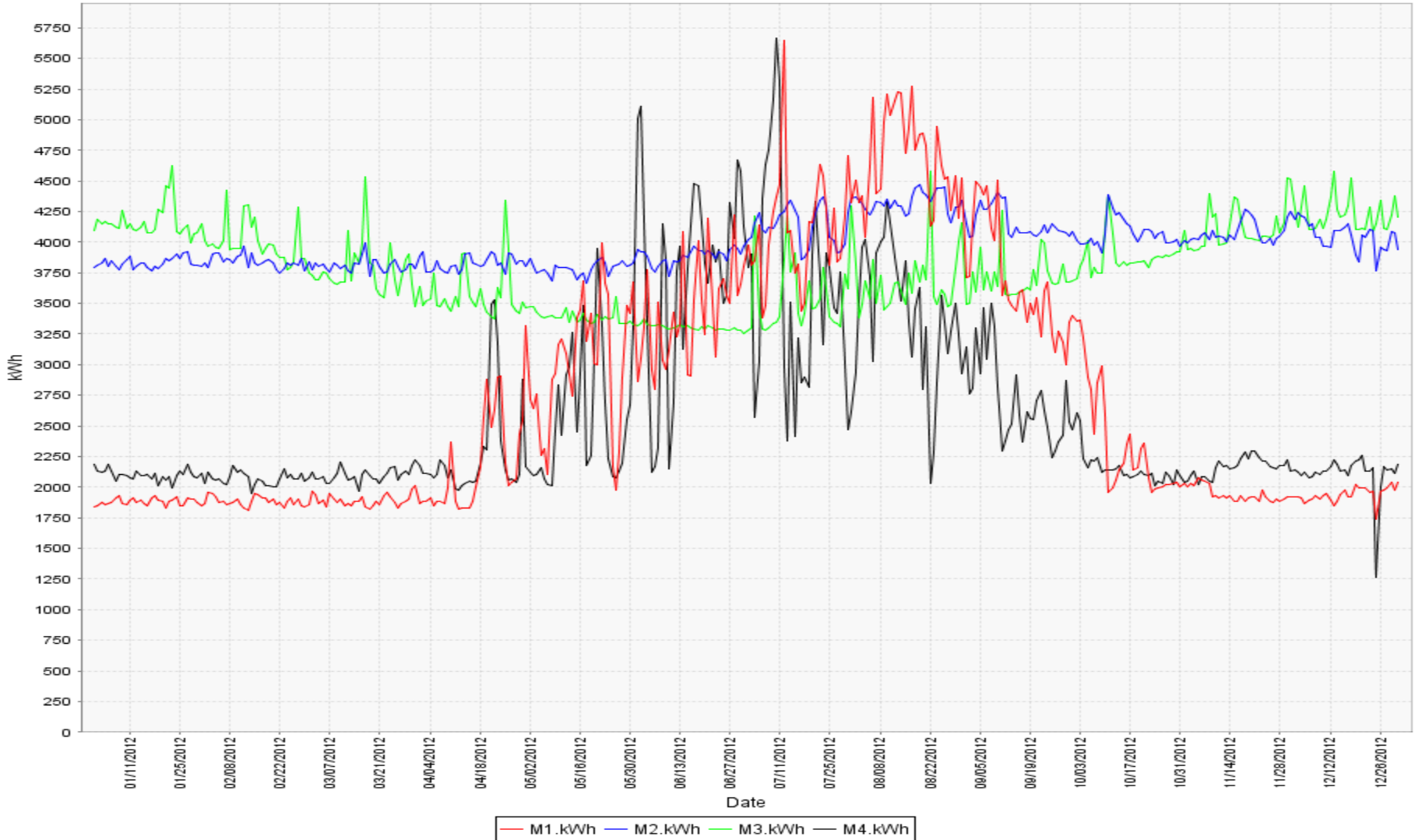


# 4356, Las Vegas, NV

## Previous Year (kWh), 24hr interval reading (bad dehumid reading)

[01/01/2012 00:00 - 01/01/2013 00:00]

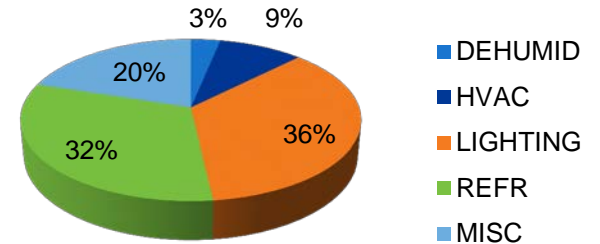
M1: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL HVAC  
M2: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL REFRIG  
M3: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/TOTAL LIGHTING  
M4: /STORES/HE STORES/4356 LAS VEGAS, NV, HE5/VIRTUAL METERS/15 TOTAL SITE MISC



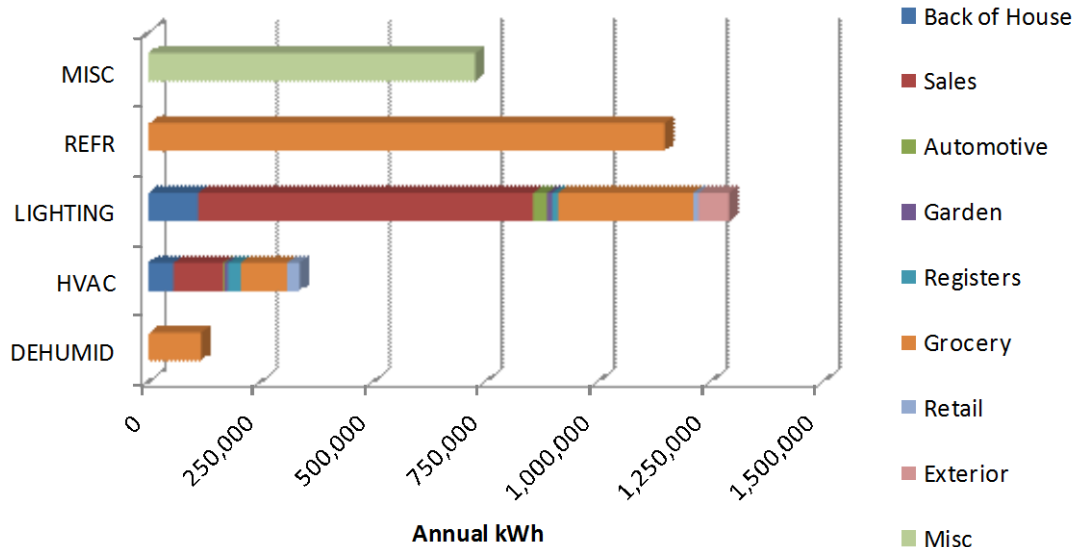
### #924 Sterling Super Center kWh/Year Breakdown by Store Area

	DEHUMID	HVAC	LIGHTING	REFR	MISC	TOTAL
Back of House		55,624	110,177			165,800
Sales		110,536	745,664			856,200
Automotive		3,487	31,098			34,585
Garden		6,928	10,732			17,660
Registers		28,750	13,642			42,392
Grocery	117,667	103,510	300,359	1,148,693		1,670,229
Retail		27,421	11,520			38,941
Exterior			68,039			68,039
Misc					727,055	727,055
Total	117,667	336,256	1,291,231	1,148,693	727,055	3,620,901
Gas (Therms)						79,800

### Breakdown by End Use

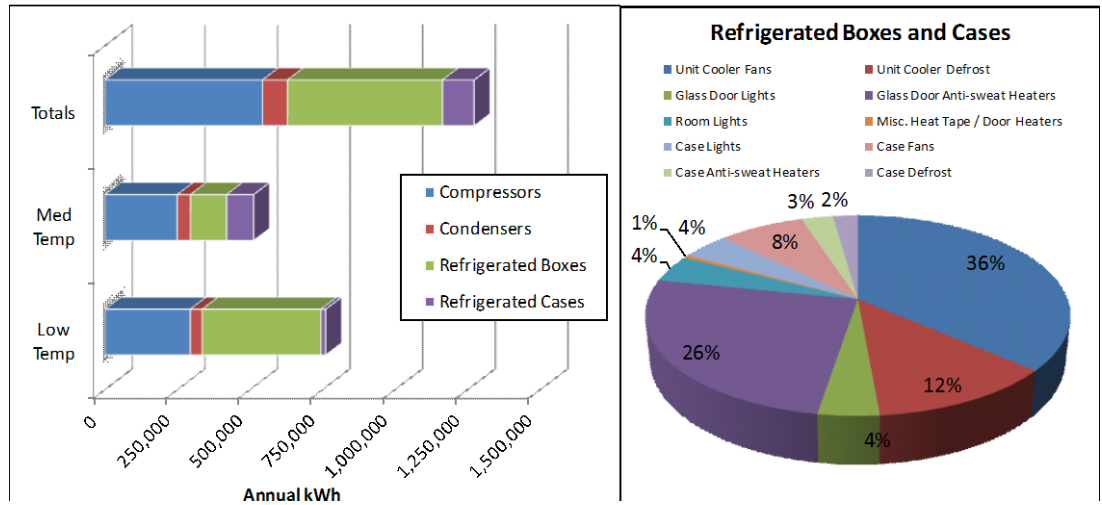


### Energy Distribution by Area and End Use



Sam's Club #6549 Pueblo, Colorado

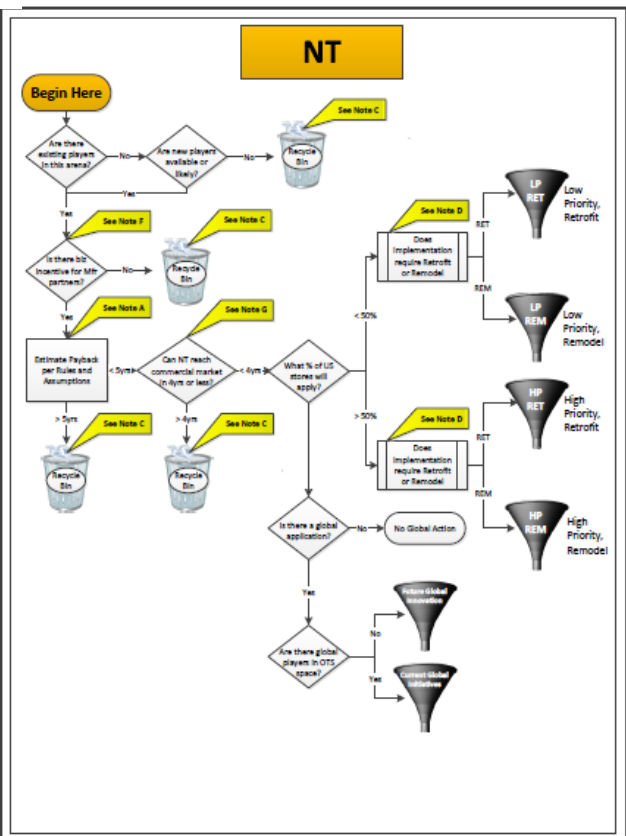
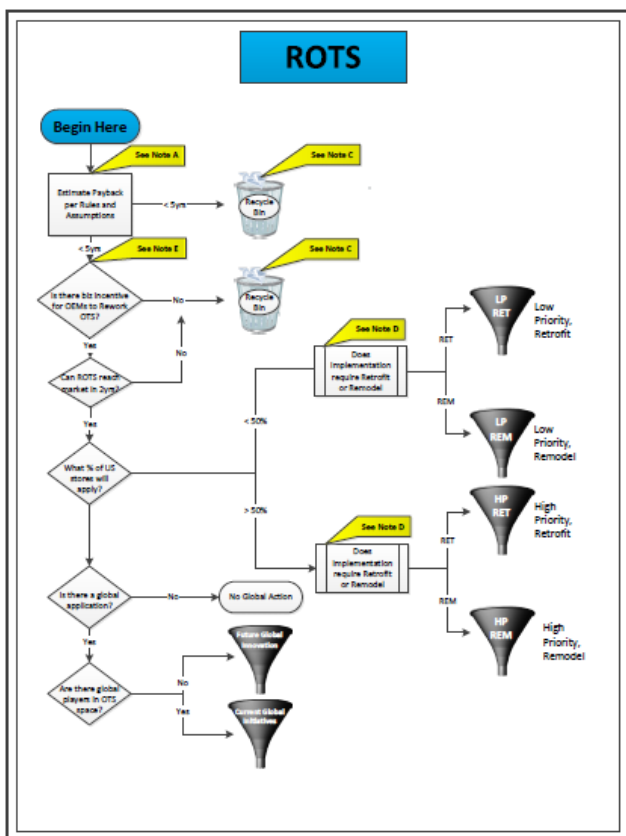
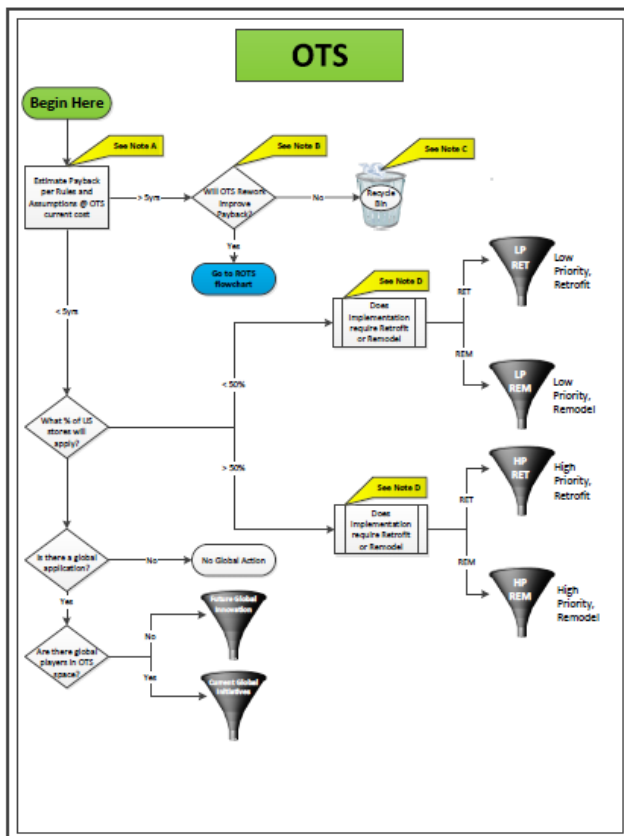
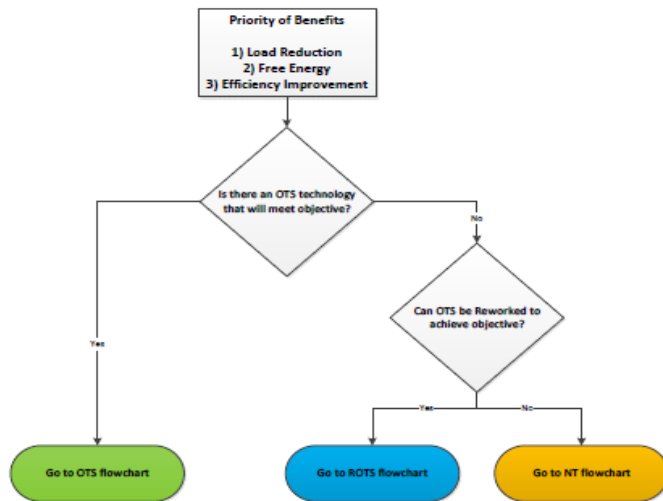
End Use		Annual kWh Consumption		
		Low Temperature	Medium Temperature	Totals
<b>Compressors</b>	Compressors	293,556	249,057	542,613
<b>Condensers</b>	Condenser Fans	40,849	45,279	86,128
<b>Refrigerated Boxes</b>	<b>Unit Cooler Fans</b>	<b>166,871</b>	<b>67,117</b>	<b>233,988</b>
	Unit Cooler Defrost	72,898	5,612	78,510
	<b>Glass Door Lights</b>	<b>13,937</b>	<b>11,818</b>	<b>25,755</b>
	Glass Door Anti-sweat Heaters	145,324	19,248	164,572
	<b>Room Lights</b>	<b>7,353</b>	<b>20,760</b>	<b>28,113</b>
	Misc. Heat Tape / Door Heaters	3,223	0	3,223
	<b>Walk-In Box Subtotal</b>	<b>409,606</b>	<b>124,555</b>	<b>534,161</b>
<b>Refrigerated Cases</b>	Case Lights	1,429	26,118	27,547
	<b>Case Fans</b>	<b>2,557</b>	<b>46,504</b>	<b>49,061</b>
	Case Anti-sweat Heaters	11,022	7,147	18,169
	<b>Case Defrost</b>	<b>891</b>	<b>13,342</b>	<b>14,233</b>
	<b>Case Subtotal</b>	<b>15,899</b>	<b>93,111</b>	<b>109,010</b>
<b>All Total</b>		<b>759,910</b>	<b>512,002</b>	<b>1,271,912</b>



## Objective :

- Define the Objective; ‘Reduce the kWh/sf 20% by 2020’
- Need to ‘Fill the Funnel’...with EE projects that make economic sense → FOCUS ON EXISTING BUILDINGS
- Basic Concept;
  - *Assemble a diverse group of Subject Matter Experts (SMEs), explain the objectives, outline the limits & boundaries, provide them the tools they need...and let them go.*
- Know your SME’s;
  - Internal, Consultants, Utilities, DOE, Universities

# Strategy Discussion Path





**Thank You**



# Additional Resources

# For More Information

- Rocky Mountain Institute
  - [Retrofit Depot](#)
  - [Rocky Mountain Institute](#)
- Glenborough, LLC
  - [The Aventine Chiller Plant Optimization](#)
  - [A Search of Deep Savings in Existing Buildings](#)
  - [Building Performance Tracking: Aventine Success Story](#)
- Walmart Stores, Inc.
  - [Walmart Energy](#)

# Question & Answer Session

# Join Us for the Next Better Buildings Webinar

## U.S. Department of Energy Better Buildings Webinar Series

### Kick-starting Your Energy Management Program

Tuesday, January 7, 2014  
3:00-4:00 PM EST

Jaxon Love, Shorenstein  
Kelly Boulton, Allegheny College

Time, money, and expertise are often barriers to a robust energy management program. Join Better Buildings Challenge Partners Shorenstein and Allegheny College as they describe solutions that have helped them jump these hurdles to develop a culture of sustainability within their organizations – and a track record of successful energy efficiency projects. Jaxon Love details Shorenstein’s experience bringing on energy management fellows for summer appointments, which built the case for a full-time sustainability position at the company. Kelly Boulton outlines how she and campus professors have worked together, engaging students to develop and present the business case for campus energy efficiency projects to administrators.

[Register](#)

# Additional Questions? Feel Free to Contact Us

[betterbuildingswebinars@ee.doe.gov](mailto:betterbuildingswebinars@ee.doe.gov)

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