Better Buildings
U.S. DEPARTMENT OF ENERGY

Are You Forgetting About Your Rooftop Units? Efficiency for Packaged HVAC

Better Buildings Summit
May 2016

U.S. DEPARTMENT OF ENERGY

Introductions

Jim McClendon,
Walmart Stores Inc.

Melissa Green,
Starbucks Coffee Company

Marta Schantz,
Waypoint Building Group

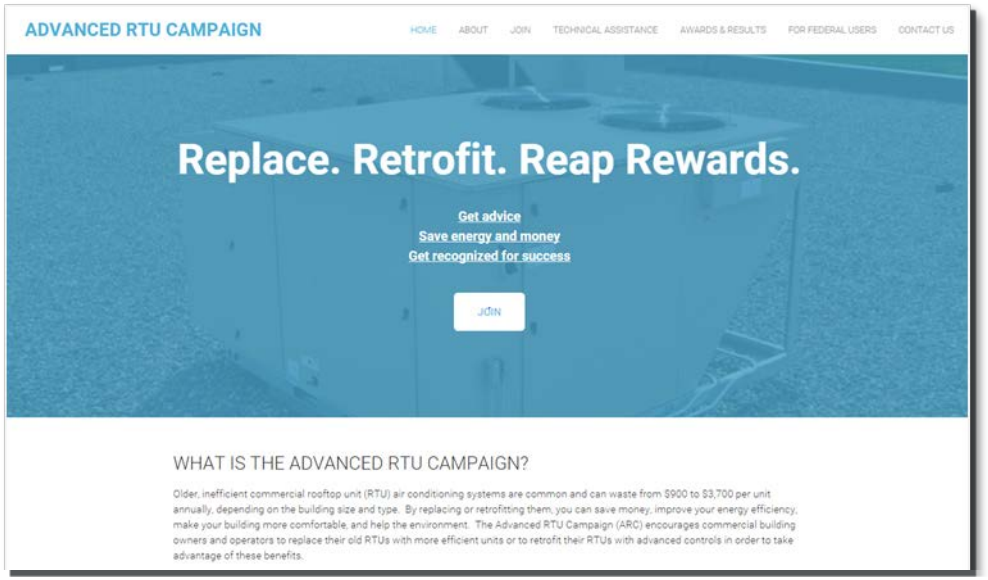
Why Rooftop Units (RTUs)?

- RTUs cool 60% of commercial building floor space nationwide
- State of the art RTUs are up to 50% more efficient than RTUs available ten years before
- RTUs can last up to 15-20 years depending on climate conditions, but lose ~1% efficiency annually

What is the Advanced RTU Campaign?

National Campaign to promote high-efficiency RTU solutions

- High-efficiency RTU replacements and new installations
- Advanced control retrofits
- Quality Installation and Quality Maintenance



www.advancedRTU.org

RILA
RETAIL INDUSTRY LEADERS ASSOCIATION
Educate.Collaborate.Advocate.

FEMP
Federal Energy Management Program

ASHRAE

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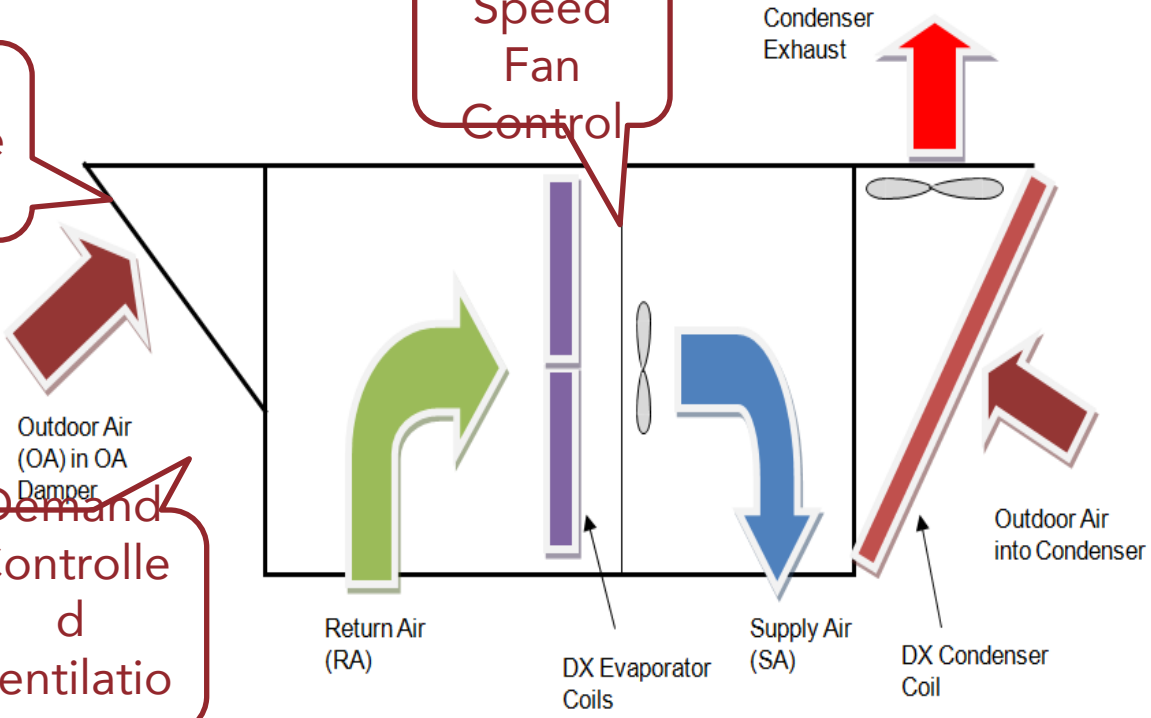
What are RTU Retrofit Controls?

Common Features

Integrated Economizer Control

Variable Speed Fan Control

Demand Controlled Ventilation



Credit: Ian Doebber

Other Potential Features

- FDD and Remote Monitoring
- Variable Speed Condenser Fan Control
- Compressor control

2015 Advanced RTU Campaign Leaders

Newest Resources

Business Case for Proactive RTU Replacement

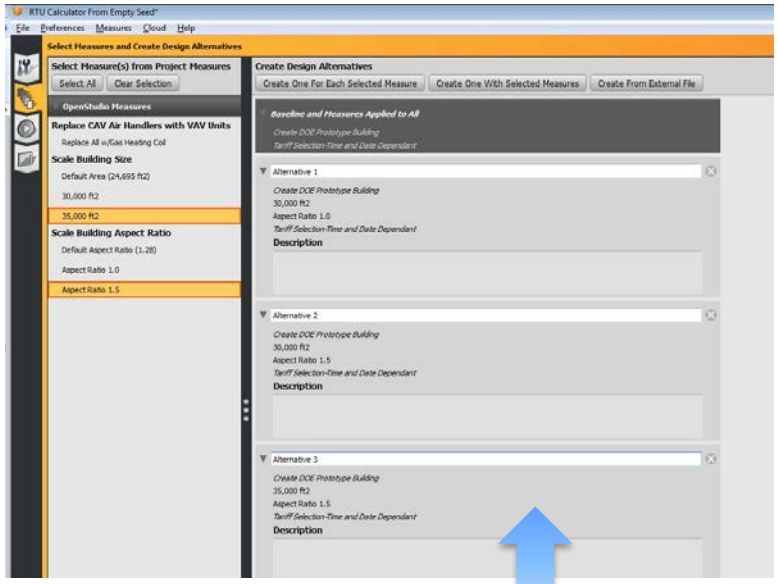
Retail Lease Language for Efficient RTUs

Efficiency Vermont RTU Replacement Case Study

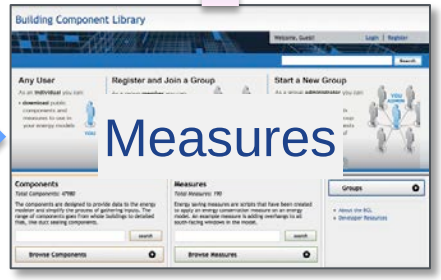
ROOFTOP UNIT PROJECT HIGHLIGHTS	
Peak electricity demand reduction	163 kW
Annual electricity savings	575,000 kWh/year
Annual gas savings	940 MCF/year
Annual utility cost savings	$93,000
Payback	3.8 years with incentives 5.9 years without incentives

Upcoming: RTU Calculator

- Simple to use
- Harness the data and power of EnergyPlus and OpenStudio
- Steps:
  - ✓ Select a building type
  - ✓ Select a location
  - ✓ Select design alternatives: RTU efficiencies and sizes, lighting, envelope, etc
  - ✓ Run
  - ✓ Review energy and economic results



Data



Measures

Jim McClendon
Walmart Stores Inc.

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency thru RTU Advancements

Jim McClendon
Walmart Design

11 May 2016

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

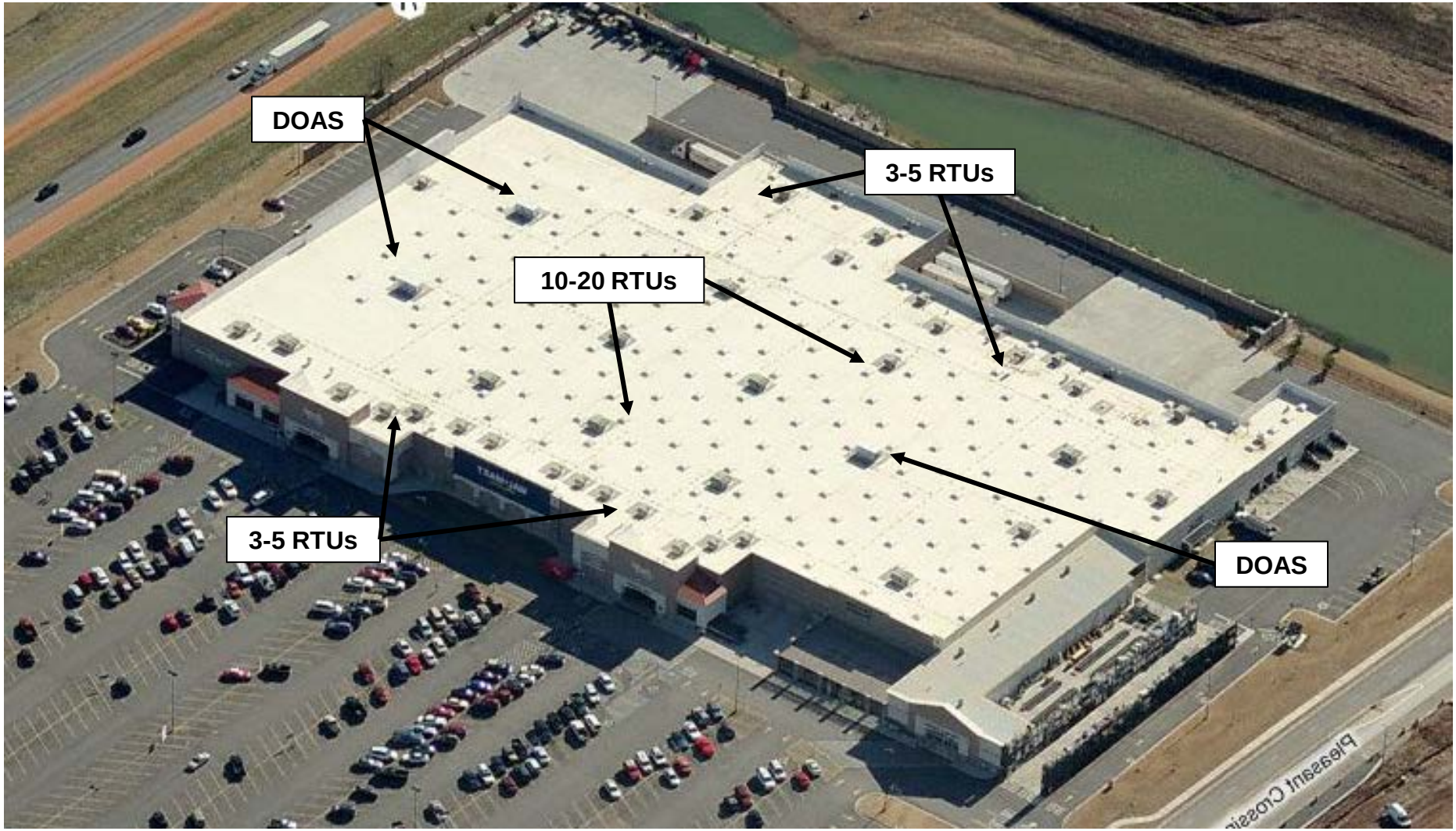
Walmart
Save money. Live better.

Formats & Footprint

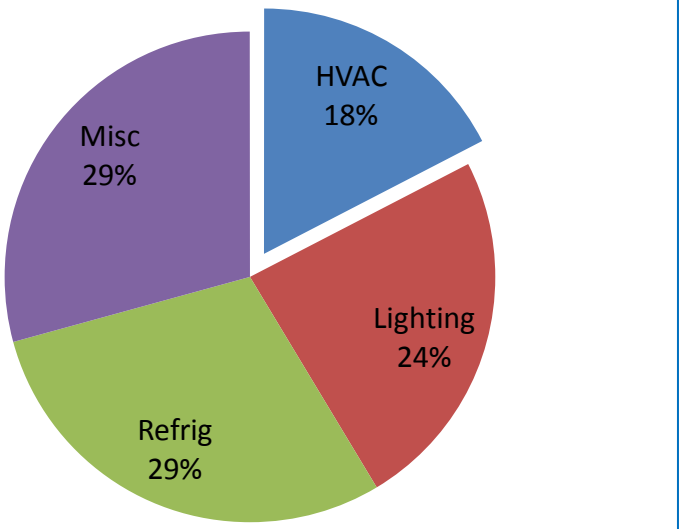
Quick Stats:
71 Banners
>1 Billion SF
>200 Million Cust/Wk
>2 Million Associates
>10,000 Stores/Clubs
27 Countries

Walmart
Save money. Live better.

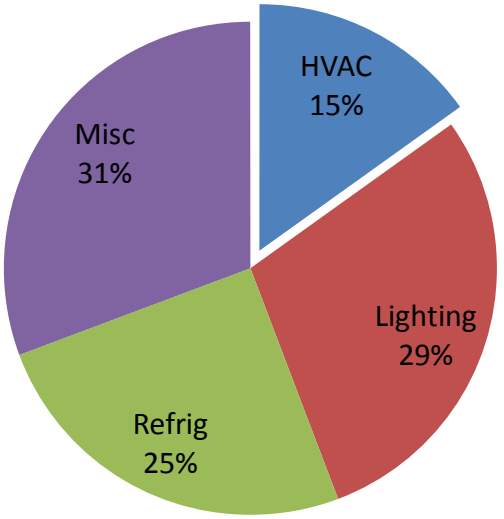
Formats & Footprint



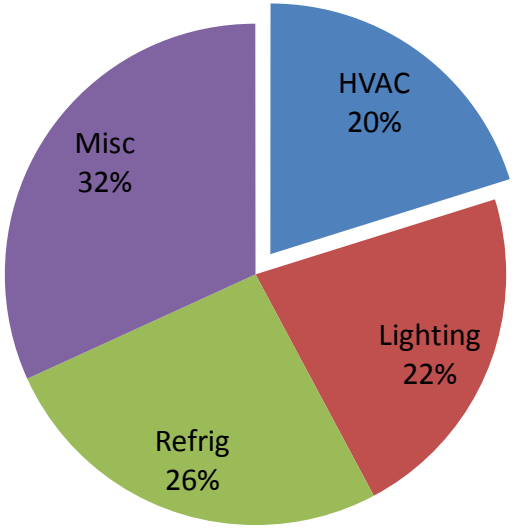
Walmart
Save money. Live better.



Legacy Fleet



New Store



New Store w/LED

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Portfolio at a Glance

Inputs

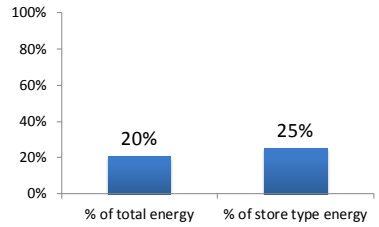
Select a store type and a climate zone from the drop-down menus above. Select " * " to include all of the categories in the analysis.

Select a store type Supercenter

Select a climate type Hot-Humid

Quick Facts

Percent of portfolio-wide energy use



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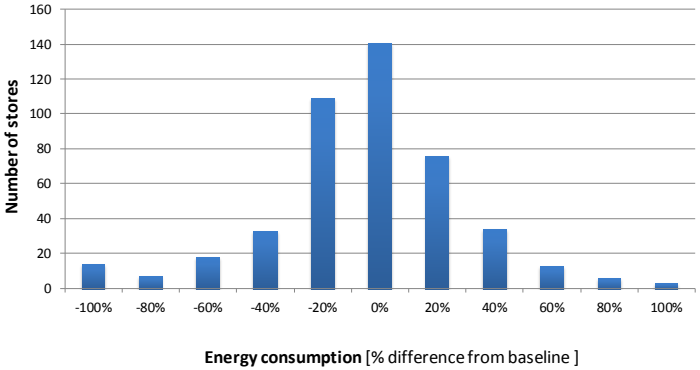
A dynamic, filterable data table is provided on the "data table" tab. This allows for the portfolio to be filtered by a number of different criteria, including store type, climate zone, prototype, protogroup, performance relative to baseline, and total energy consumption, location, and area.

Store Performance Histogram

This graph shows the number of stores with the store type and climate type selected above that fall within a certain percentage range of the baseline. Negative values indicate that the store uses that much less energy than the baseline and is thus performing better than expected. Positive values indicate that the store uses that much more energy than the baseline and is thus performing worse than expected.



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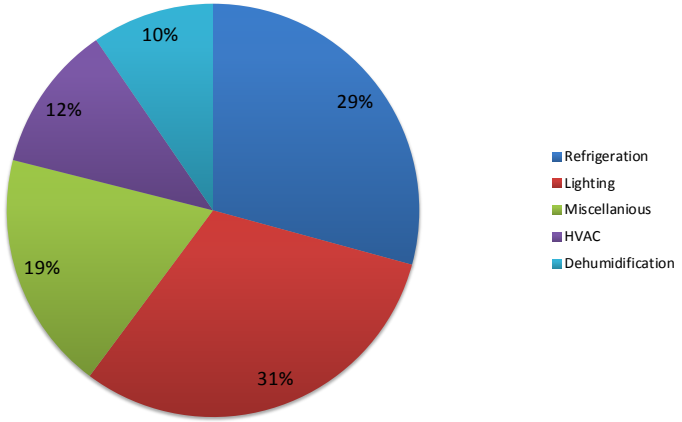
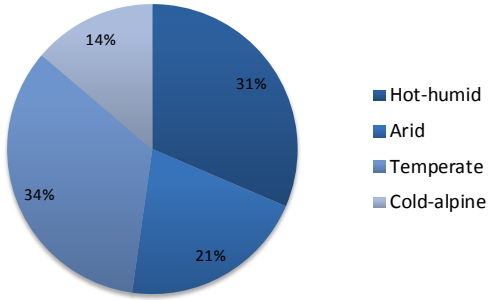
Electricity End Use Breakdown

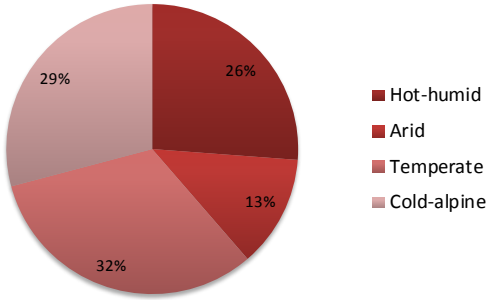


Energy Use by Climate Type

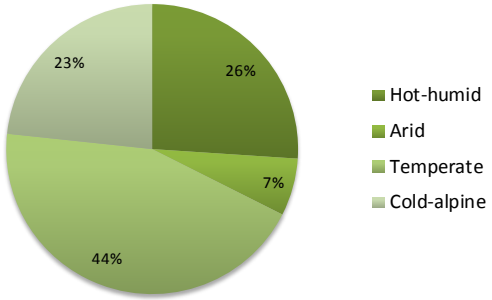
Neighborhood Market



Sams Club



Supercenter



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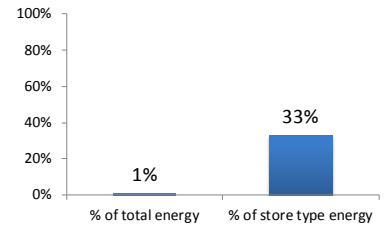

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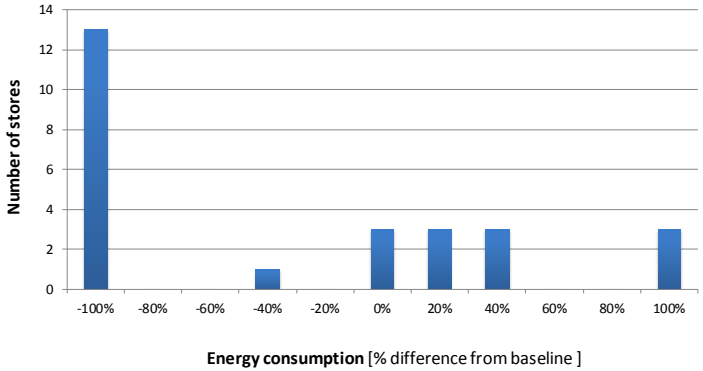

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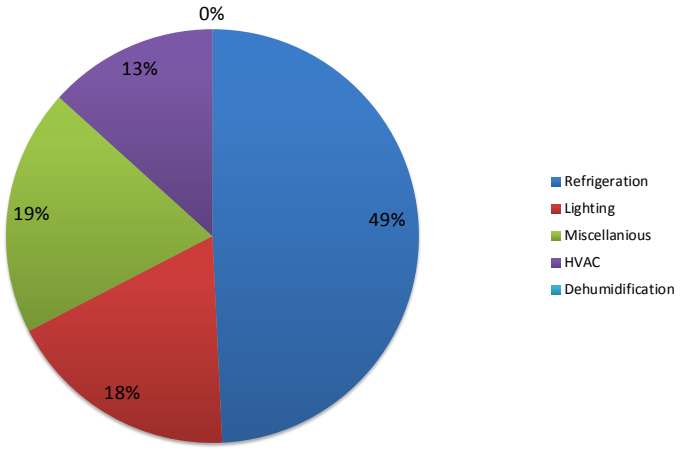

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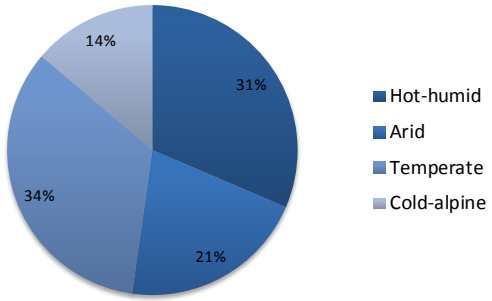

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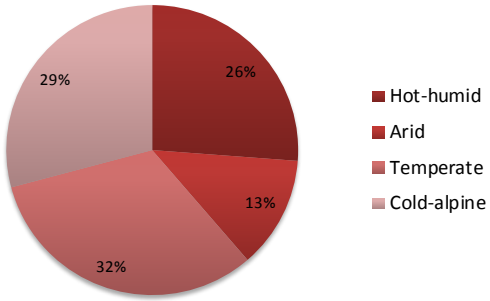

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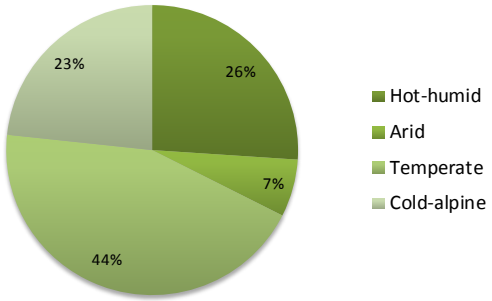

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Select a store type Sams Club

Select a climate type Arid

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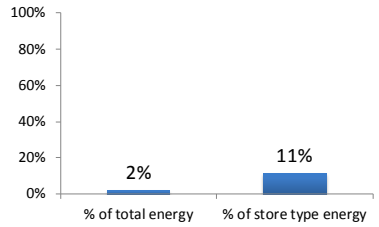

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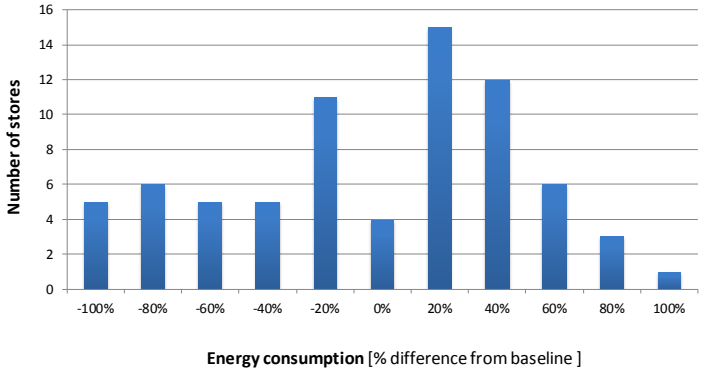

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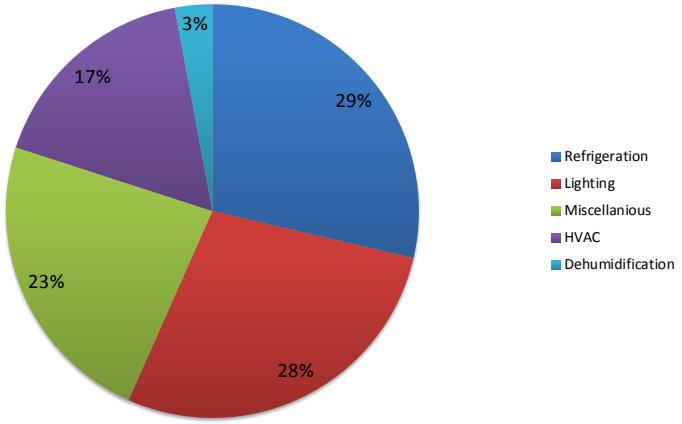

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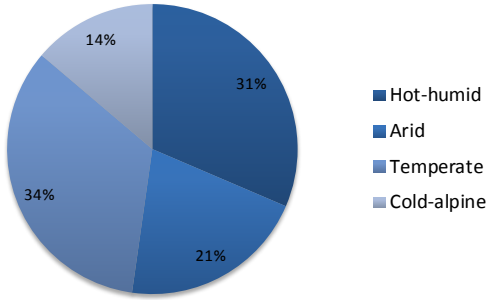

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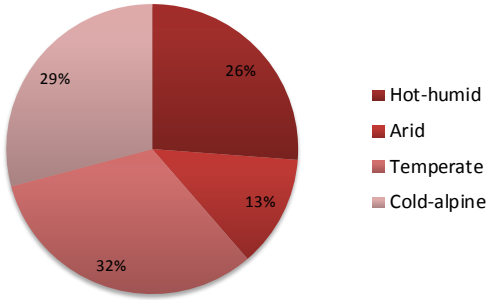

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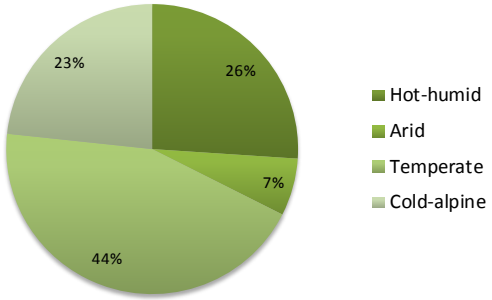
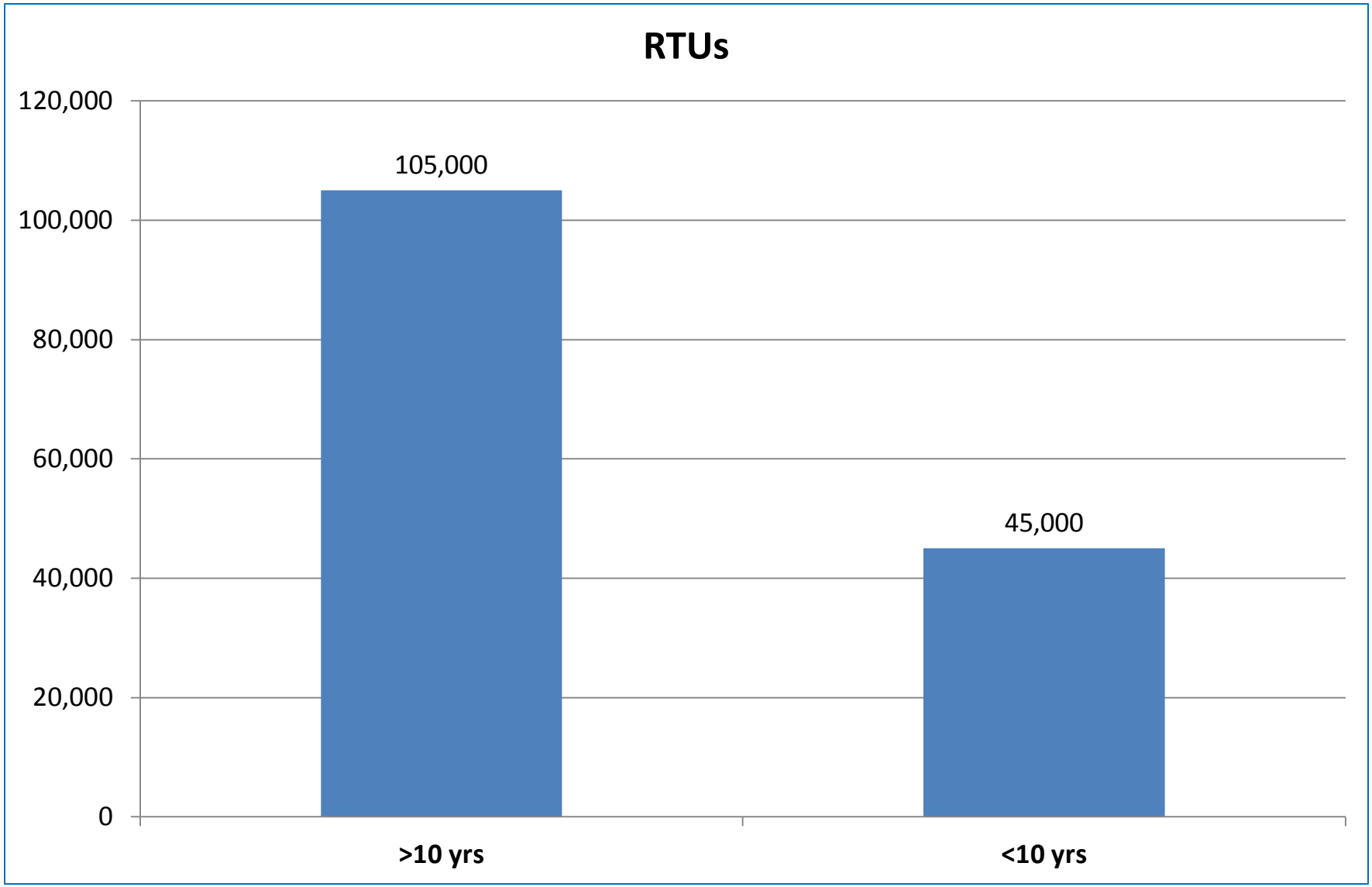


Footprint Opportunities



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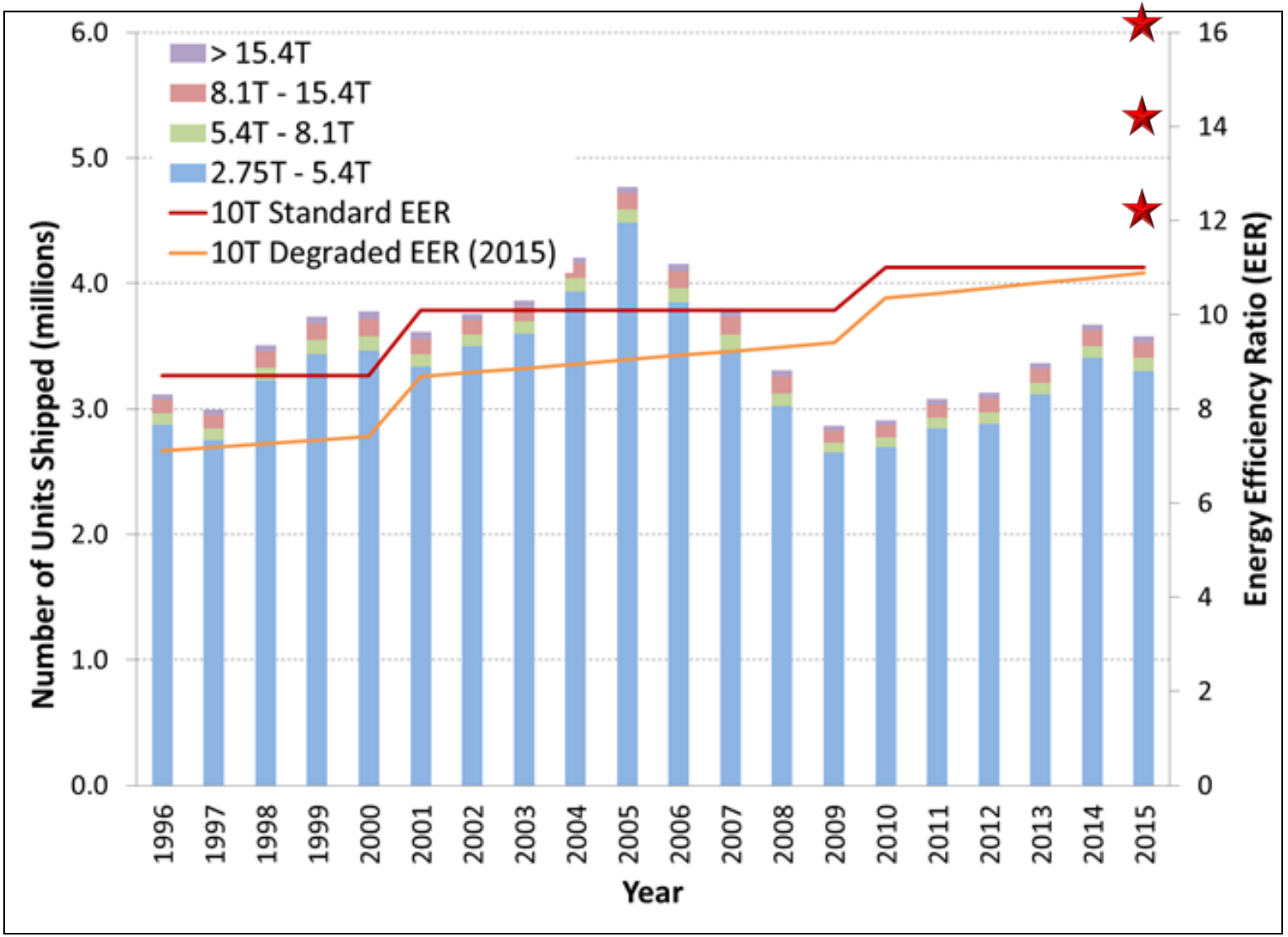
RTU Efficiency Improvements vs Volume



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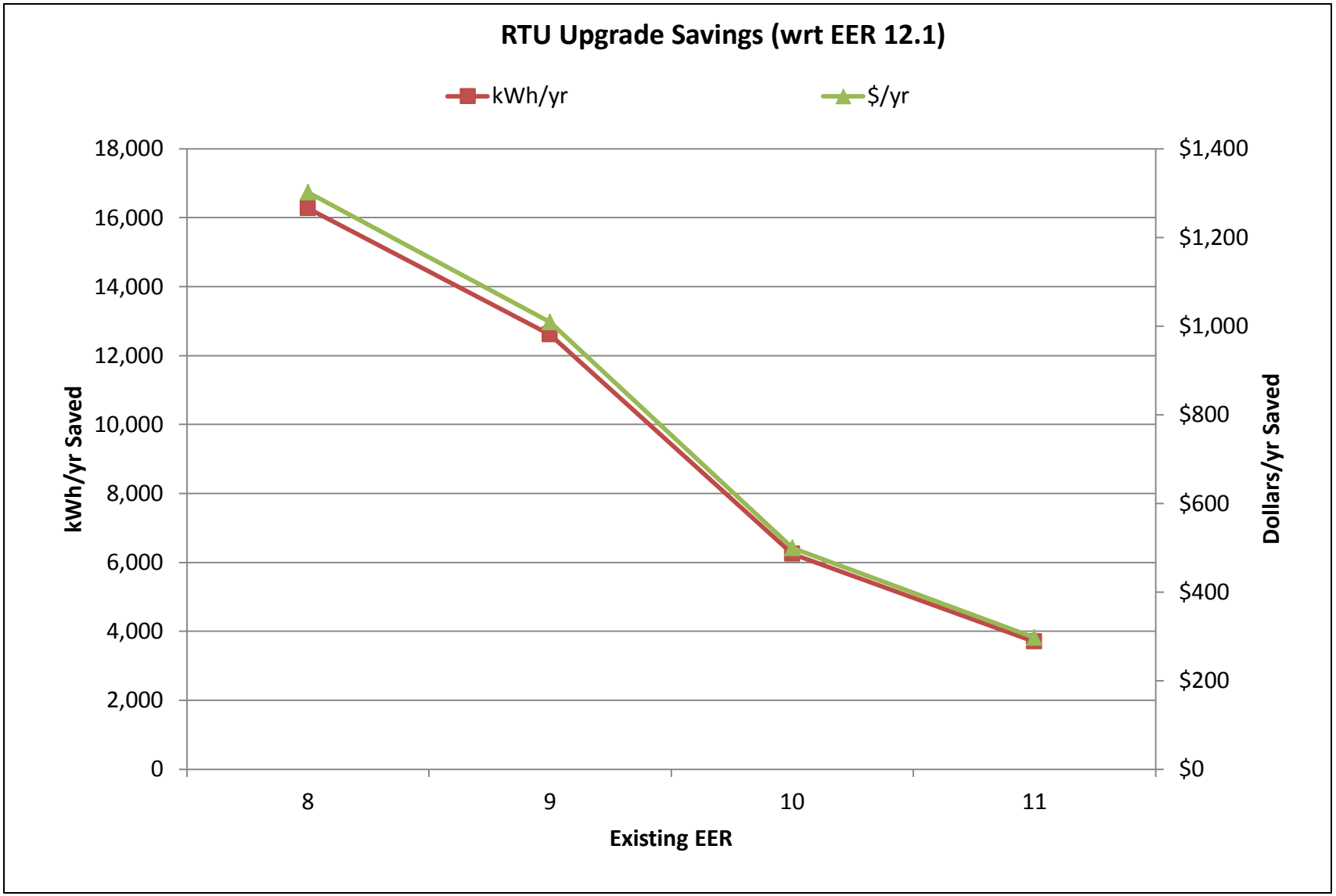
Approximate RTU Upgrade Savings per Year – Nominal 10 Ton RTU (Source PNNL)



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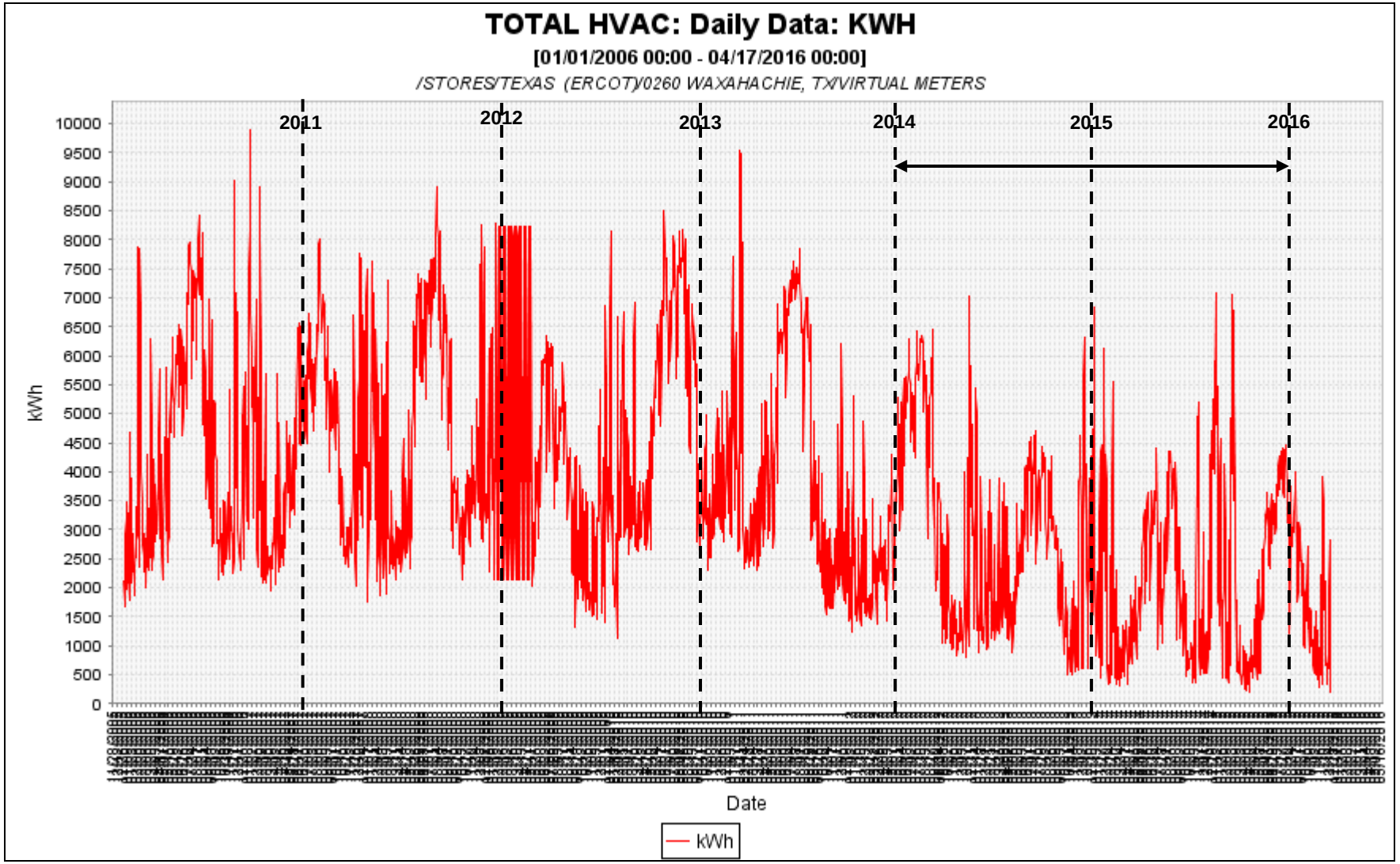
Case Study Example; Existing RTU Replacements



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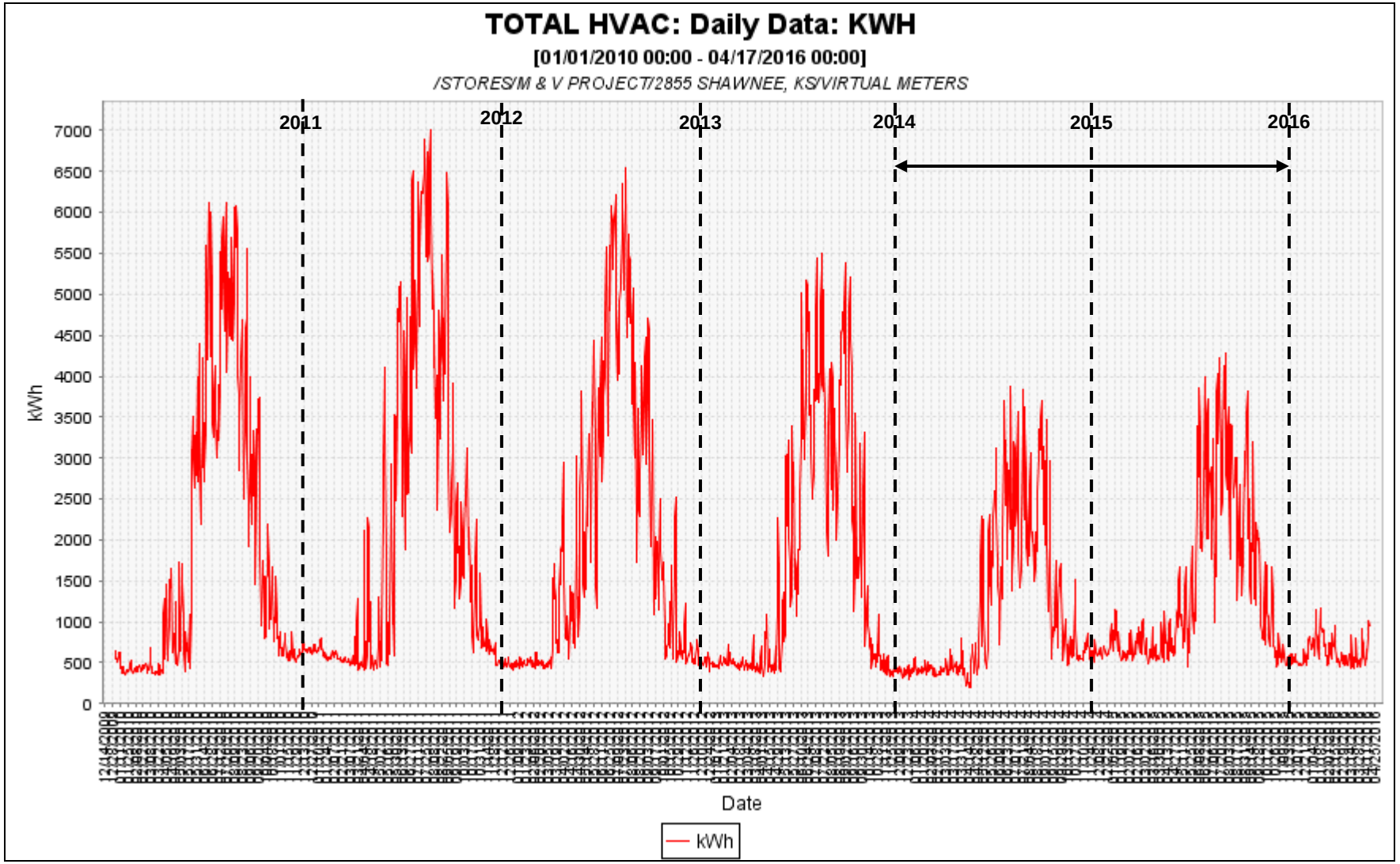

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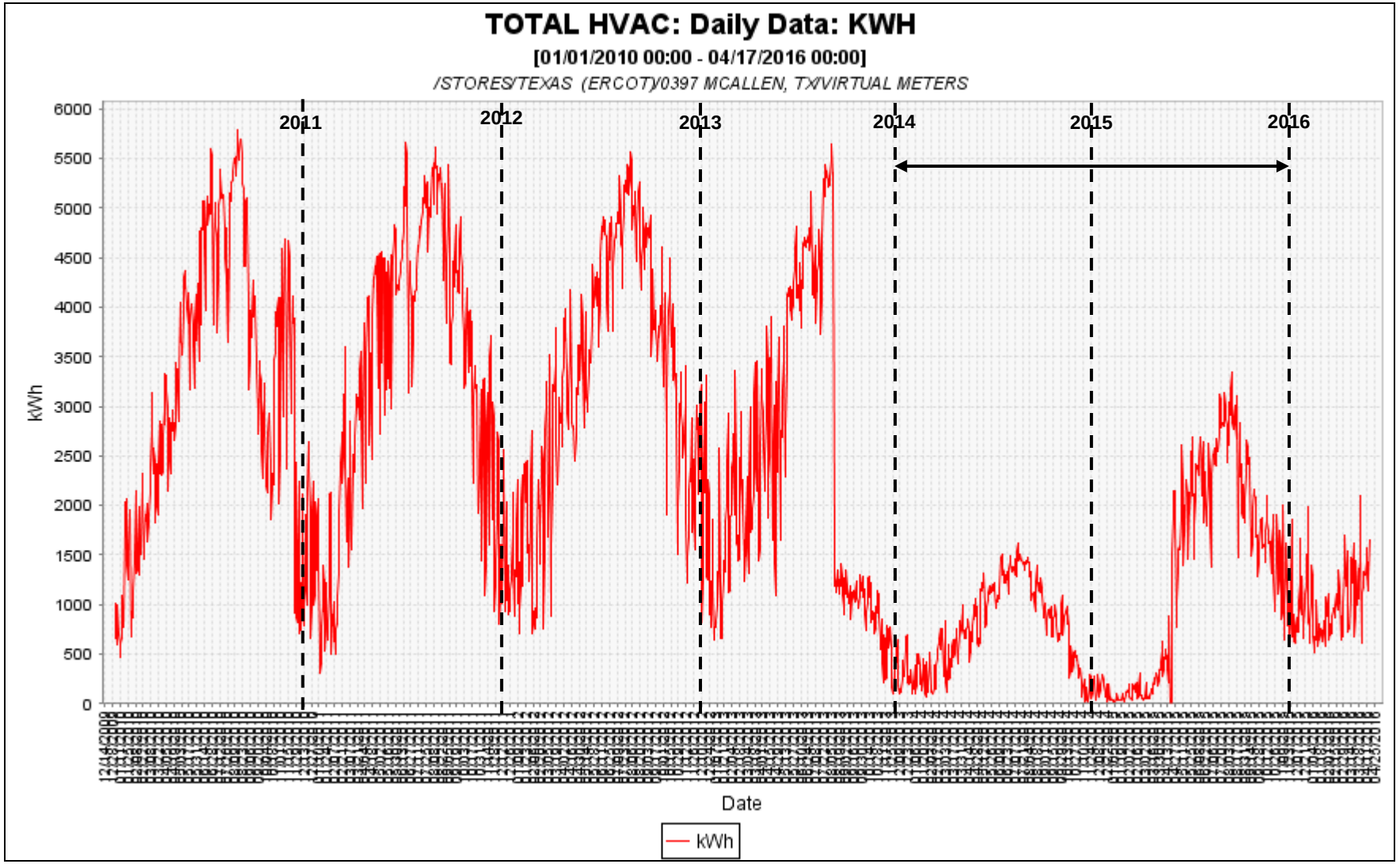

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RTU Upgrade Advantages

Value Proposition:

- Annual Energy Savings → Immediate VOE Reduction on P&L
- LCC Savings that Exceeds the Asset Investment
- Reset Depreciation Schedule
- Lifetime Energy Costs are 6 ~ 8 Times Initial Capital → OpX vs CapX

Replacement Approach:

- RTU age (>10yrs), M&R spend and energy cost
- Upgrade entire roof, not unit by unit …replace vs retrofit…
- Plan into annual capital budget cycle (financials + impacts…downtown, etc)
- Lower energy forecast accordingly
- Coordinate with Remodel where possible

Added Value:

- Comfort & Controls…connectivity / IoT…'intel ready' = > savings
- 5 yr warranty = M&R → VOE protected for ~½ the book life…
- Leverage your footprint thru proactive program …pros/cons of scale

Thank You

Melissa Green,
Starbuck Coffee Company

U.S. DEPARTMENT OF
ENERGY

RTU BEST PRACTICES

Melissa Green
Starbucks Coffee Company

over 23,000 Stores

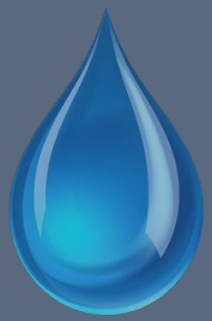
70 countries

90 million customers a week

VISION, GOALS & TARGETS

*In 2008 amidst a shifting business landscape, we set out to use our **scale for good**, establishing bold ambitious goals to **reduce our impact on the environment***

25%
REDUCTION IN WATER USE



100%
OF STORES WITH CUSTOMER RECYCLING

25%
REDUCTION IN ENERGY USE

100%
RENEWABLE ENERGY COVERAGE

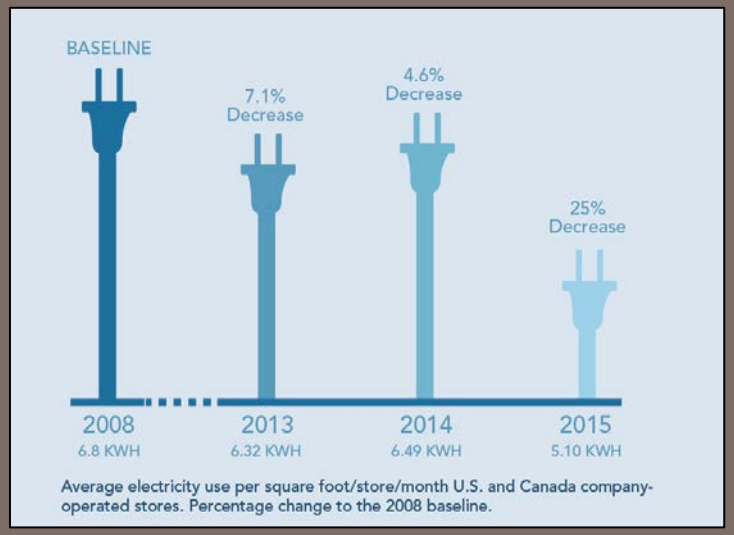
VISION, GOALS & TARGETS

*In 2008 we also began work with the USGBC to develop a **volume based certification for retail.** In 2010 we launched our **Green Building Goal.***

GOAL:
100% OF NEW STORES BUILT TO MEET LEED CERTIFICATION

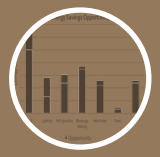
ENERGY PERFORMANCE

4.6% reduction in energy use in U.S. and Canada company-operated stores by since 2008



Average electricity use per square foot/store/month U.S. and Canada company-operated stores. Percentage change to the 2008 baseline.

KEY INITIATIVES & OPPORTUNITIES


Energy Studies

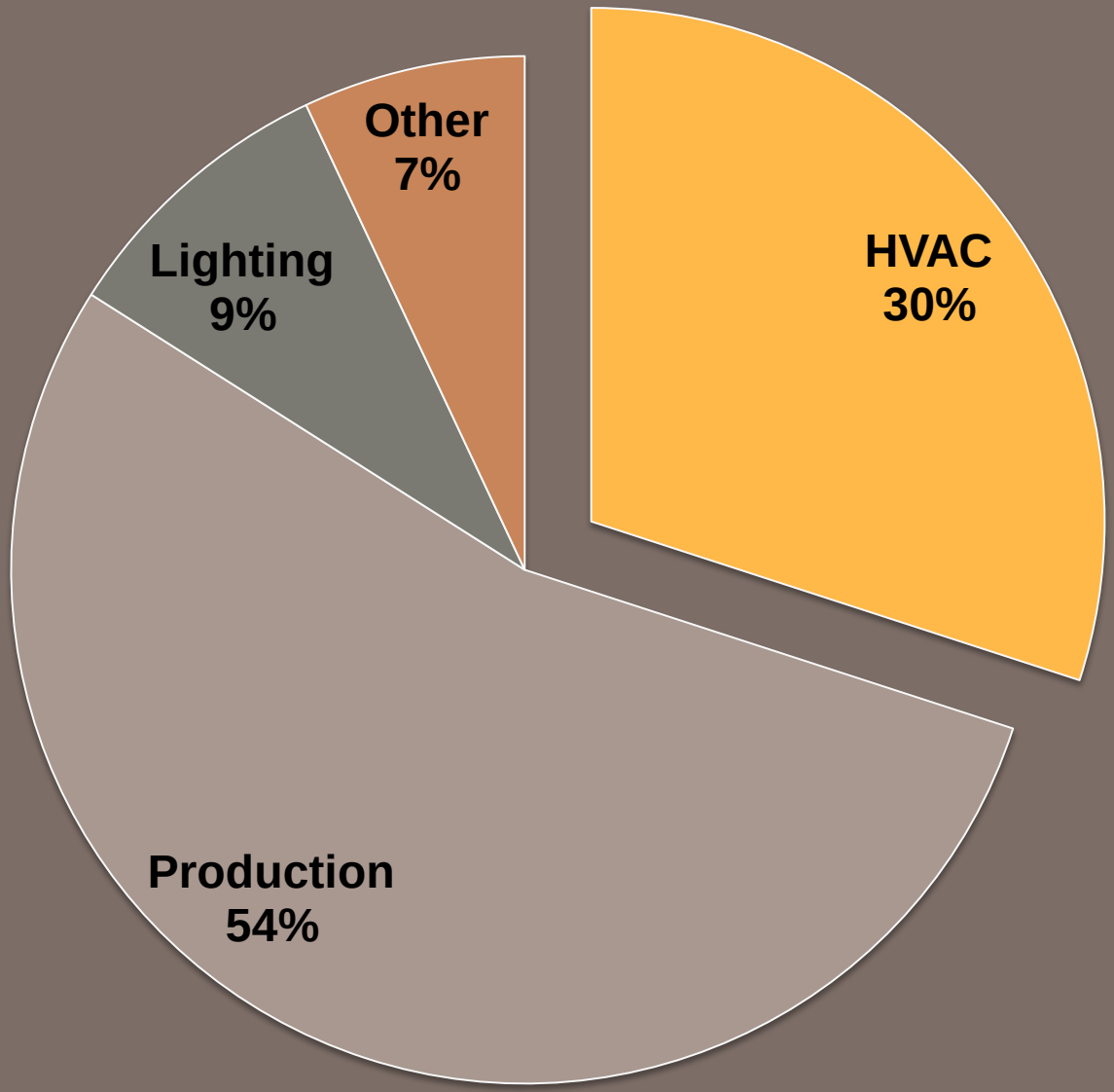

LED Lighting


Energy Management Systems


Equipment Standards & Optimization


Behavioral Changes

AVERAGE STORE ENERGY USAGE*

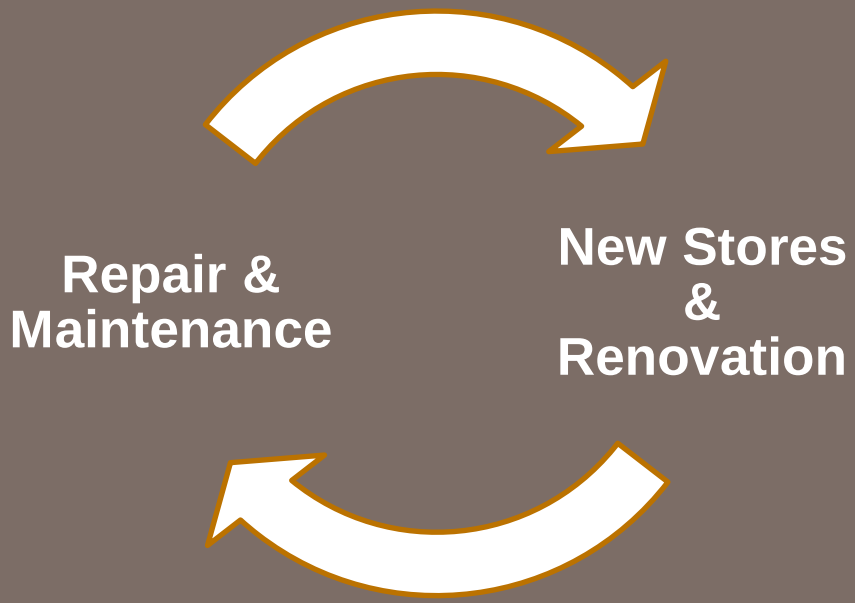


*2015 TRENDING FROM SELECT STORES

HVAC LIFECYCLE APPROACH

EQUIPMENT SPECIFICATION OPTIMIZATION

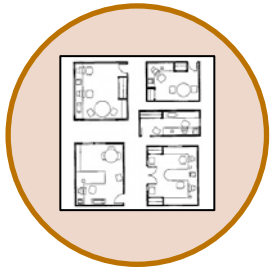
Sizing | Type | Installation practices | Controls



NEW STORE & RENOVATIONS

Landlord Negotiations

- Landlord Workletter
- Tenant design package



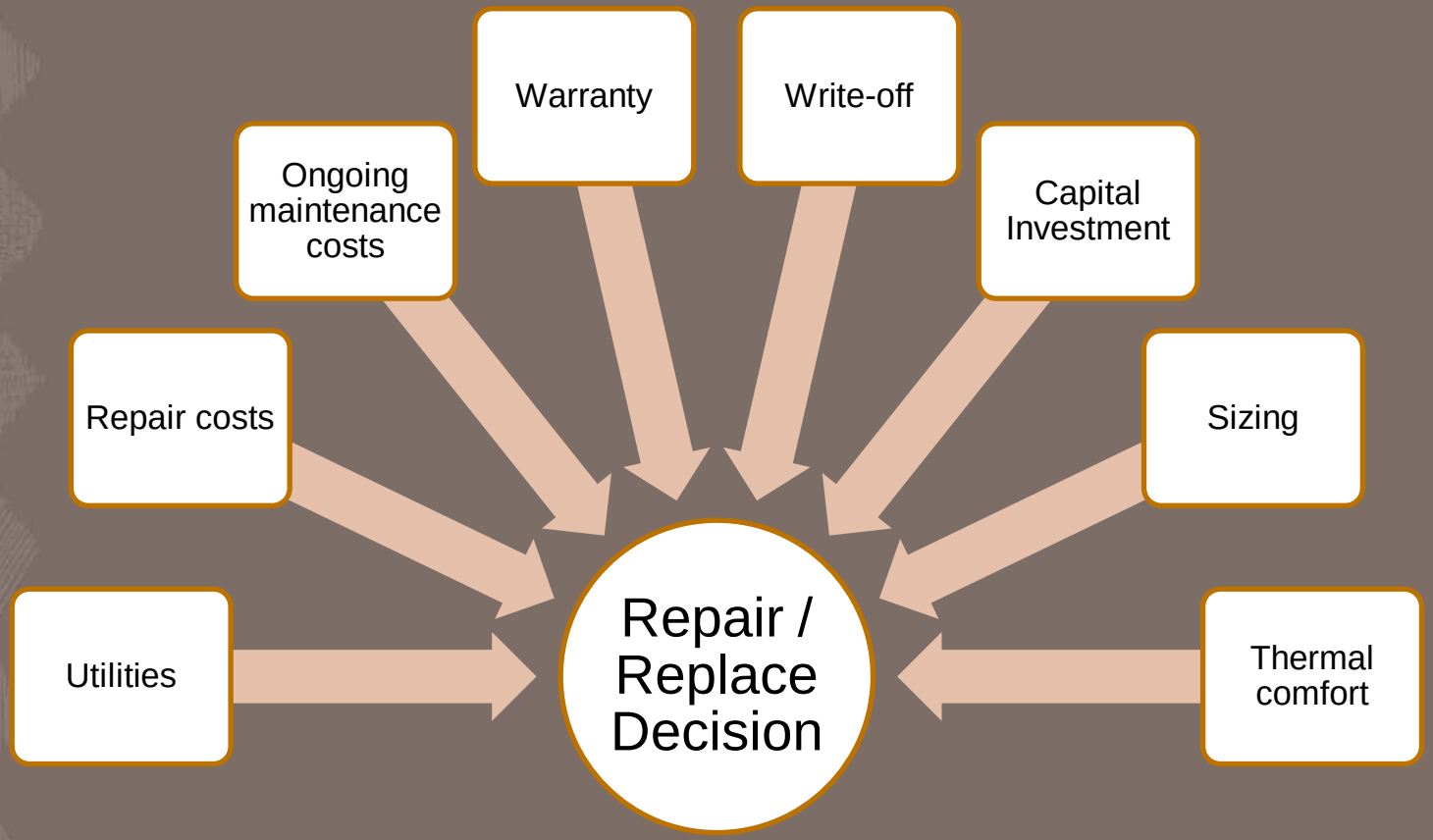
New Stores

- Equipment load worksheet
- Starbucks Mechanical Guidelines
- Commissioning

Renovations

- Store Condition Assessment
- Repair History
- Lease life

REPAIR & MAINTENANCE



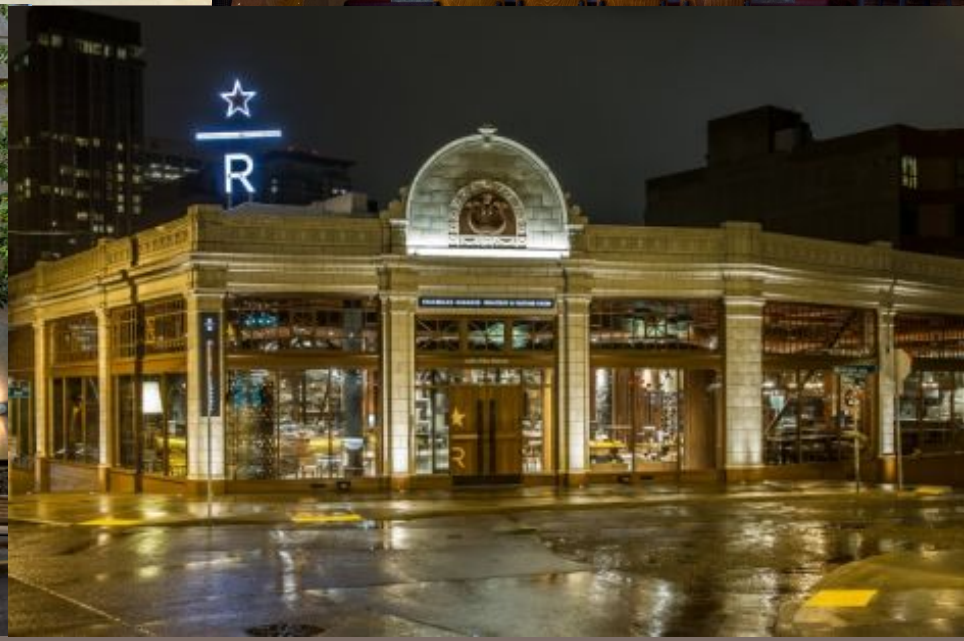
OTHER STRATEGIES

- Purchasing
- Systems Design
- Proactive Replacement Program Expansion





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Thank you!

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Marta Schantz, Waypoint Building Group
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Michael Deru, National Renewable Energy Laboratory
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