Are You Forgetting About Your Rooftop Units? Efficiency for Packaged HVAC
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
What are RTU Retrofit Controls?

Common Features
- Integrated Economizer Control
- Demand Controlled Ventilation
- Variable Speed Fan Control

Variable Speed Fan Control

Other Potential Features
- FDD and Remote Monitoring
- Variable Speed Condenser Fan Control
- Compressor Control

Credit: Ian Doebber
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
Jim McClendon
Walmart Stores Inc.
Energy Efficiency thru RTU Advancements

Jim McClendon
Walmart Design

11 May 2016

Be Supplied by 100% Renewable Energy
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:

<table>
<thead>
<tr>
<th>Commitment 1: scale renewables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Goal</strong></td>
</tr>
<tr>
<td>Drive the production or procurement of 7 billion kWh of renewable energy globally by December 31, 2020—an increase of over 600% versus 2010</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commitment 2: accelerate efficiency</th>
</tr>
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<tr>
<td><strong>Public Goal</strong></td>
</tr>
<tr>
<td>By December 31, 2020, reduce the kwh/sq.ft. energy intensity required to power our buildings around the world by 20% versus 2010</td>
</tr>
</tbody>
</table>
Formats & Footprint

Quick Stats:
- 71 Banners
- >1 Billion SF
- >200 Million Cust/Wk
- >2 Million Associates
- >10,000 Stores/Clubs
- 27 Countries
Legacy Fleet
- Misc: 29%
- Lighting: 24%
- Refrigeration: 29%
- HVAC: 18%

New Store
- Misc: 31%
- Lighting: 29%
- Refrigeration: 25%
- HVAC: 15%

New Store w/LED
- Misc: 32%
- Lighting: 22%
- Refrigeration: 26%
- HVAC: 20%
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

This tab allows stores to be filtered by store type and by climate zone to show store performance and electricity end use break down for stores meeting a specific set of criteria. It also generates a list of outlier stores ranked worst to best that should be examined more closely. For store-level details, select a store from the drop down menu and click the button in the lower right corner of this dashboard.

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.

Electricity End Use Breakdown

Click the up and down arrows on the sliding bar below to change the bin sizes in the histogram.

Energy Use by Climate Type

Neighborhood Market

Sams Club

Supercenter

- Hot-humid
- Arid
- Temperate
- Cold-alpine

- Hot-humid
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- Temperate
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Electricity End Use Breakdown

Energy Use by Climate Type
Neighborhood Market
- Hot-humid: 31%
- Arid: 34%
- Temperate: 21%
- Cold-alpine: 14%

Sams Club
- Hot-humid: 29%
- Arid: 13%
- Temperate: 32%
- Cold-alpine: 26%

Supercenter
- Hot-humid: 23%
- Arid: 44%
- Temperate: 7%
- Cold-alpine: 26%
Portfolio at a Glance

Radio Brand: Sams Club

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

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Electricity End Use Breakdown

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Energy Use by Climate Type

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Footprint Opportunities

- >10 yrs: 105,000 RTUs
- <10 yrs: 45,000 RTUs
RTU Efficiency Improvements vs Volume
Approximate RTU Upgrade Savings per Year – Nominal 10 Ton RTU (Source PNNL)

RTU Upgrade Savings (wrt EER 12.1)

- kWh/yr
- $/yr

Existing EER

Dollars/yr Saved

kWh/yr Saved

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000

$0 200 400 600 800 1,000 1,200 1,400

8 9 10 11
Case Study Example; Existing RTU Replacements
Case Study Example: Existing RTU Replacements

TOTAL HVAC: Daily Data: KWH
[01/01/2010 00:00 - 04/17/2016 00:00]
/STORES/M & V PROJECT/2855 SHAWNEE, KSVIRTUAL METERS

Date

kWh
Case Study Example; Existing RTU Replacements
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

Be Supplied by
100% Renewable
Energy
Melissa Green,  
Starbuck Coffee Company
RTU BEST PRACTICES

Melissa Green
Starbucks Coffee Company
over 23,000 Stores
70 countries
90 million customers a week
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**
- **25% Reduction in Energy Use**
- **100% of Stores with Customer Recycling**
- **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
4.6% reduction in energy use in U.S. and Canada company-operated stores by since 2008

Energy Studies
LED Lighting
Energy Management Systems
Equipment Standards & Optimization
Behavioral Changes
AVERAGE STORE ENERGY USAGE*

Production 54%
HVAC 30%
Lighting 9%
Other 7%

*2015 TRENDING FROM SELECT STORES
### HVAC LIFECYCLE APPROACH

#### EQUIPMENT SPECIFICATION OPTIMIZATION
- Sizing
- Type
- Installation practices
- Controls

- Repair & Maintenance
- New Stores & Renovation
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

- Repair costs
- Ongoing maintenance costs
- Warranty
- Write-off
- Capital Investment
- Sizing
- Thermal comfort
- Utilities

Repair / Replace Decision
OTHER STRATEGIES

• Purchasing
• Systems Design
• Proactive Replacement
• Program Expansion
Thank you!

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