Advanced RTU Campaign

2017 Building Technologies Office Peer Review

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Project Summary

Timeline:

Start date: 10/1/2012

Planned end date: 9/30/2018

Key Milestones

1. Impact Characterization > 1% of market; 5/15/16
2. RTU management pilot report; 7/16/16

Budget:

Total Project $ to Date: $960,000

- DOE: $960,000
- Cost Share: $0 (in-kind support from partners)

Total Project $: $1,160,000

- DOE: $1,160,000
- Cost Share: $0

Key Partners:

Waypoint Building Group	
ASHRAE	77 Building owners
RILA	9 Trade alliances
FEMP	4 Suppliers
7 RTU OEMs	20 Component mnfs
45 Utilities, REEOs, & Efficiency programs	127 Contractor/ Service providers

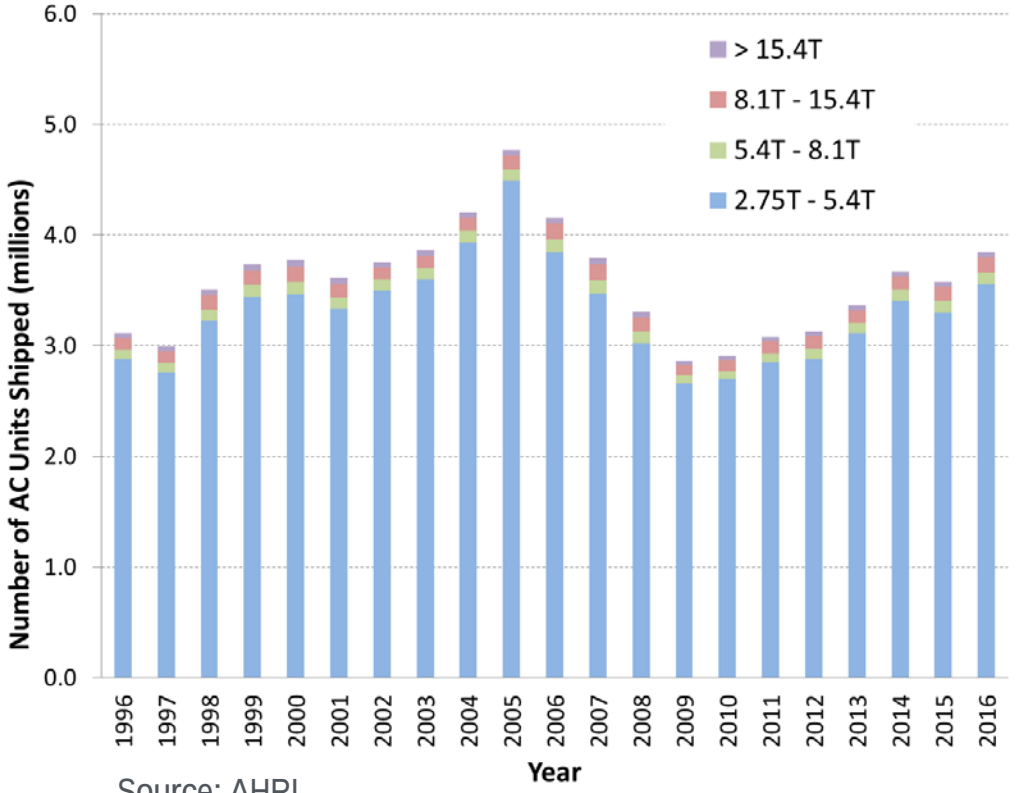
Project Outcome:

Accelerate the market adoption of high-efficiency RTU practices through demonstration of results and development of decision support resources. Partner with market leaders and market drivers to share best practices with a broad section of the RTU market.

Purpose and Objectives

Problem Statement: RTUs condition over 60% of U.S. commercial building floor area and have a typical life of 15 to 20 years and replacement is often only after failure with a new version of the old unit. High-efficiency RTUs are 20%-50% more efficient than standard efficiency RTUs, and this cycle leads to tremendous missed opportunities for energy and cost savings.

Target Market and Audience: Commercial buildings with unitary HVAC, which represents over half the commercial building market and 2.6 quads of energy consumption for cooling and ventilation. 3 to 4 million commercial unitary HVAC units are sold each year.



Source: AHRI

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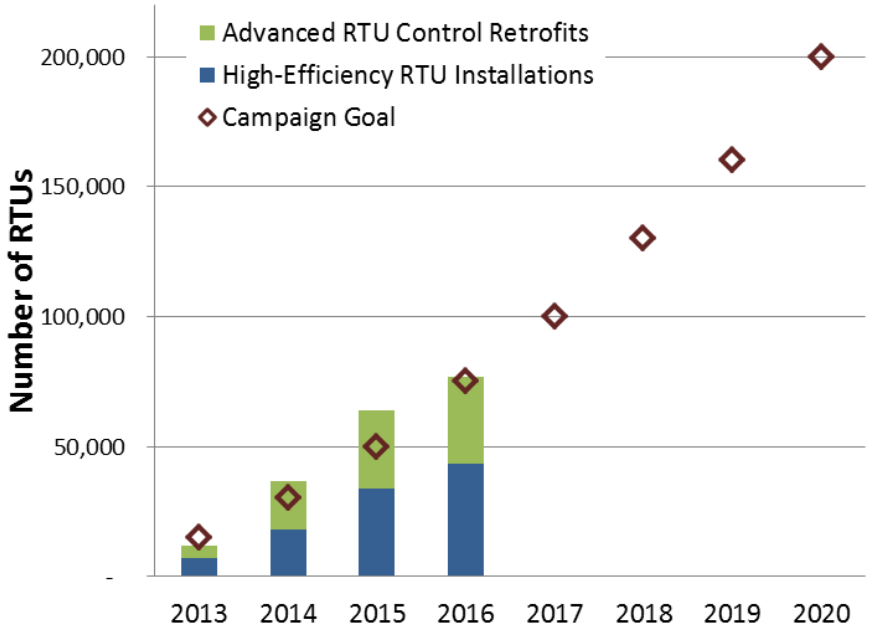
Purpose and Objectives

Impact of Project:

- Accelerate market adoption of high-efficiency RTU practices:
  - Proactive replacement with right-sized, high-efficiency RTUs
  - Advanced RTU control retrofits on constant speed RTUs
  - Persistence of performance with Quality Installation, Quality Maintenance, and automated fault detection and diagnostics
- Engage with partners across all fields affecting RTUs and develop technical and business resources to support informed decisions.
- Progress is measured by the number of RTUs impacted by Campaign partners, energy savings, the number and type of Campaign partners, and the number of resources developed.



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Approach

Approach:

- Demonstrate performance
- Recognize and promote best practices
- Develop technical and business decision resources
- Provide technical support and duplicate lessons for other users
- Coordinate across all levels of the market
- Leverage resources with large partner base

Partner Case Study on Retrofit Best Practices	
Number of stores (big box retail)	40
Average RTU cooling capacity reduction	69 tons (25%)
Highest RTU cooling capacity reduction	175 tons (41%)
Annual energy savings	13 million kWh
Annual energy cost savings	$1.3 million

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Approach

Key Issues:

- Market inertia
- Several economic, technical, and practical barriers

Partial List of Barriers and Solutions

Barrier	Solution
High initial cost	Guidance on LCC, Incentives
Split incentives between owners and tenants	Energy-aligned leases and owner/tenant negotiated upgrades
Risk of the unknown with new technologies	Education and successful demonstrations
Uncertainty/mistrust about savings claims	Demonstrations and case studies
Lack of expertise with advanced equipment/what to buy	Sample procurement specifications, standard load calculations and proper sizing, training of contractors
Difficult to quantify performance of variable speed/capacity RTUs	Improved performance calculators

Approach

Distinctive Characteristics:

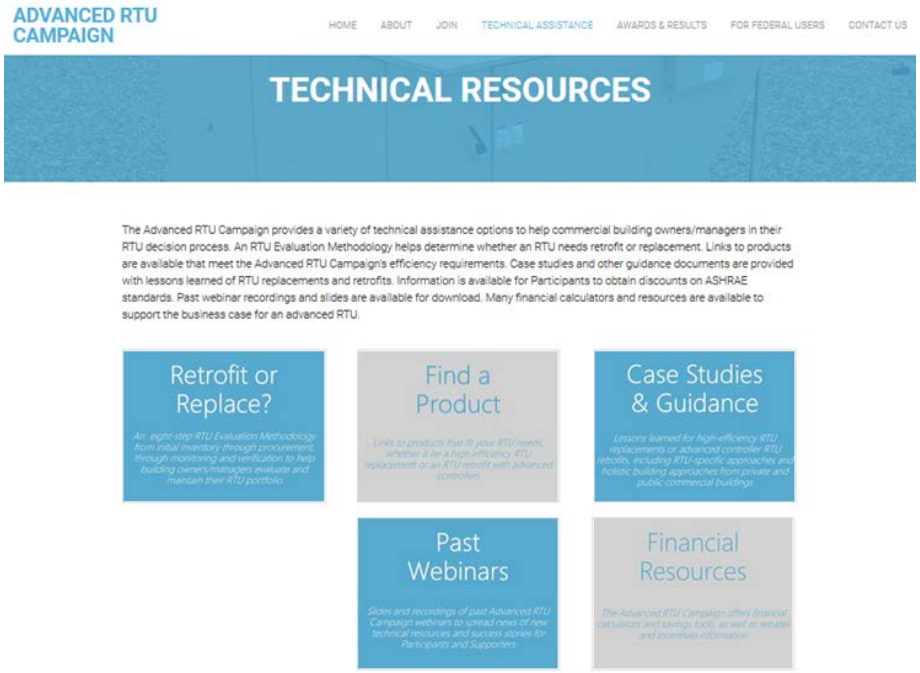
- Part of a larger DOE effort to raise the efficiency of RTUs
  RTU Challenge ➔Demonstrations ➔ Advanced RTU Campaign ➔ Raise minimum equipment efficiencies
- Integration of advanced controls for improved performance and untapped savings
- Broad market outreach beyond market leaders

Organization Type	Number of Partners
Building owners	77
Trade and Industry Organization	9
Utility and Efficiency Program	36
RTU Original Equipment Manufacturer	7
RTU Component Manufacturer	11
RTU Retrofit Controls Manufacturer	9
RTU Supplier	4
RTU Contractor/Service Provider	127
RTU Performance	9
Total	**289**

Progress and Accomplishments

Accomplishments:

- Campaign awards presented at the PRSM National conference
- Published Business Guide and Green Lease Language
- The Campaign website hosts over 33 technical and business resources. Future goals of the Campaign are to affect over 200,000 RTUs by 2020 and achieve annual savings of over 2 billion kWh.



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Progress and Accomplishments

Market Impact:

- Over 280 partners
- Almost 77,000 high-efficiency RTUs
- 6604 million kWh, $66 million, and 7 trillion Btus saved annually
- Met deployment goals every year
- Working with utilities to reach a broader market segment
  - RTU management model pilot with DNV GL and NYSERDA
  - Provided input to CEE and NYSERDA planning for RTU programs

Advanced RTU Campaign Impact Summary		
	Annual (2013-2016)	**Cumulative (2013-2016)**
High-Efficiency RTU Installations		43,556
Advanced RTU Control Retrofits		33,388
Total RTUs		76,944
Electricity savings (million kWh)	660	1,663
Energy cost savings ($million)	$66	$166
Primary energy savings (Trillion Btu)	7.0	17.8
GHG reductions (million lb CO2e)	456	1,156

Progress and Accomplishments

Awards/Recognition:

- Featured in over 65 industry news letters and blog posts
- Four journal articles about the Campaign

Lessons Learned:

- Market transformation requires a broad approach to support the diversity of market challenges, interests, and abilities.
- Challenging to get partners to share RTU numbers
- Estimating performance of variable speed systems is challenging
- Comprehensive utility RTU programs require more effort but are the most effective

Project Integration and Collaboration

Project Integration:
The Campaign team identifies and works with key industry partners and stakeholders to promote best practices and recruit more participants

- DOE oversees the Campaign and approves work items
- Campaign team (NREL and Waypoint Building Group) run the Campaign
- Organizing partners advise, promote, and contribute content
- Supporting partners promote, support participants, and recruit
- Participating partners install and maintain high-efficiency RTUs

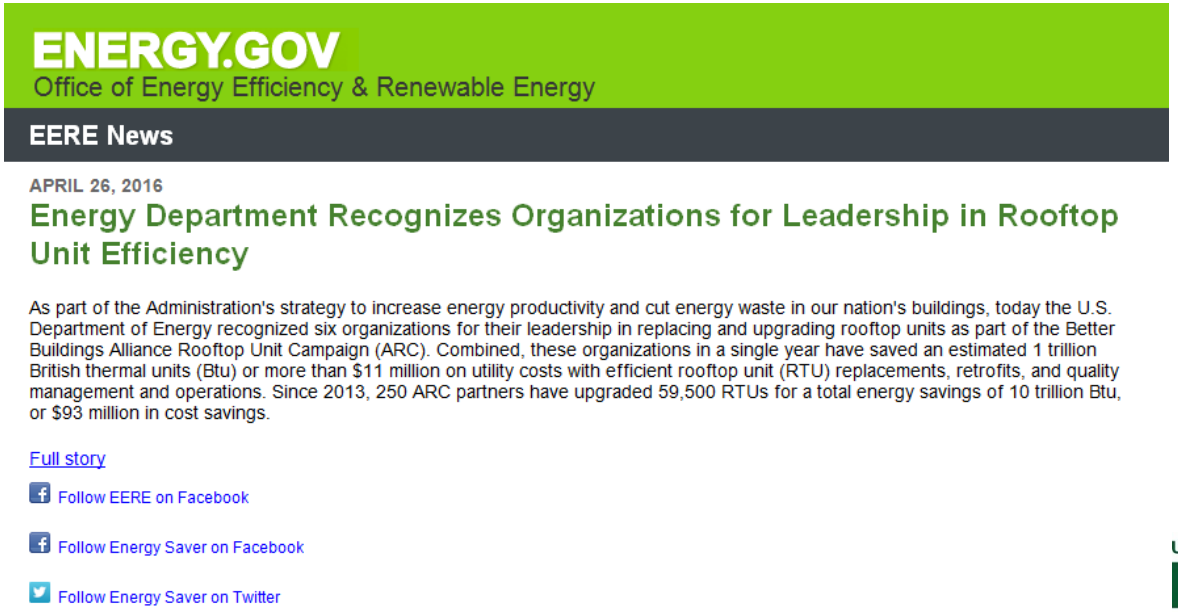
Partners, Subcontractors, and Collaborators:
Waypoint Building Group – subcontractor and project communications lead
ASHRAE, RILA, and FEMP – Organizing partners and advisors
212 Supporting partners – Promote best practices and recruit new partners
77 Participating partners – Install and maintain high-efficiency RTUs

Project Integration and Collaboration

Communications:

Objectives: Education, engage industry, communicate successes

- Multiple DOE Blogs, tweets, and posts
- 2016 DOE Awards notice was reposted 9 by different media outlets
- 2 stories in industry journals in 2016
- 2016 & 2017 PRSM National Conference Awards and technical session
- Presented at three national conferences
- 13 webinars with partners (since 2013) with over 1,000 viewers



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EERE News

APRIL 26, 2016

Energy Department Recognizes Organizations for Leadership in Rooftop Unit Efficiency

As part of the Administration's strategy to increase energy productivity and cut energy waste in our nation's buildings, today the U.S. Department of Energy recognized six organizations for their leadership in replacing and upgrading rooftop units as part of the Better Buildings Alliance Rooftop Unit Campaign (ARC). Combined, these organizations in a single year have saved an estimated 1 trillion British thermal units (Btu) or more than $11 million on utility costs with efficient rooftop unit (RTU) replacements, retrofits, and quality management and operations. Since 2013, 250 ARC partners have upgraded 59,500 RTUs for a total energy savings of 10 trillion Btu, or $93 million in cost savings.

Full story

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Next Steps and Future Plans

Next Steps and Future Plans:

- Study and document how RTU AFDD promotes persistence of savings
- Promote broad implementation of RTU AFDD
- Continue to develop and promote RTU calculations with OpenStudio
- Support comprehensive utility RTU programs
- Transition resources to the market

REFERENCE SLIDES

Project Budget

Project Budget: $200,000 with $55,000 subcontract
Variances: None
Cost to Date: $92,000
Additional Funding: No direct funding, but partners contribute time and resources. The partner contributions are not tracked.

Budget History					
FY 2013– FY 2016 (past)		FY 2017 (current)		FY 2018 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$760,000	$0	$200,000	$0	$200,000	$0

Project Plan and Schedule