System Technology Research and Development Support – Tech to Utilities

Energy Solutions

Greg Barker, Technical Director

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Project Summary

Timeline:

Start date: January 2017

Planned end date: April 2019

Key Milestones

1. Signed partnership agreements; June 2017
2. Report and scoping study; February 2018
3. Report and data specification; April 2019

Budget:

Total Project to Date: $150,000
- DOE: $150,000
- Cost Share: $0

Total Project: $405,000
- DOE: $405,000
- Cost Share: $0

Key Partners:

Energy Solutions	NREL
National Grid	ComEd
Eversource	Xcel Energy
NEEP	Efficiency Vermont

Project Outcome:

The purpose of this work effort is to speed the inclusion of promising technologies into rebate and incentive programs by improving the information available to program administrators about emerging technologies and ensuring energy savings predictions are transparent, traceable, and accurate. By improving the flow and consistency of information developed from technology demonstrations supported by federal agencies and other entities, administrators of rebate and incentive programs will be able to make better use of federal investments in technology research, development and demonstration, enabling more consistent rebates and incentives for new technologies and speeding the voluntary uptake of promising, tested energy efficient technologies.

Team

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ENERGY SOLUTIONS

Contributions:

- Engage potential partners
- Provide technical oversight
- Provide review and feedback of deliverables
- Coordinate data specification to align with BuildingSync® and BEDES

Expertise:

- Relationships with HVAC manufacturers
- HVAC technical expertise
- Extensive experience with data monitoring and analysis
- Lead Advanced RTU Campaign and BuildingSync efforts

Contributions:

- Manage outreach with working group members
- Identify needs of PAs for measure development
- Technical review of existing demonstration data
- Familiarize participants with federal demonstration data sources and help them utilize it to implement regional measures

Expertise:

- Nationwide EE program design & implementation
- Experience developing measures with utilities & PAs and navigating complex regulatory processes
- Market & technology expertise across the measure adoption curve including: Emerging Technology, Product Commercialization and Supply Chain Engagement, Mass-Market Programs, and Codes
- Company focus on quantifying energy and non-energy benefits of emerging connected devices

Challenge

Utilities spend $8 billion per year on energy efficiency and demand side management programs,[1] and they are constantly looking for new technologies to meet aggressive program goals, defer expensive system upgrades, and enable higher inclusion of renewable energy generation. New technology evaluation and deemed measure development is expensive and time-consuming. Small scale demonstrations of new technologies are often conducted in isolation from other utility activities, often resulting in an inefficient process.

[1]https://library.cee1.org/system/files/library/13561/CEE_2017_AnnualIndustryReport.pdf

Challenge

Measure Development Process
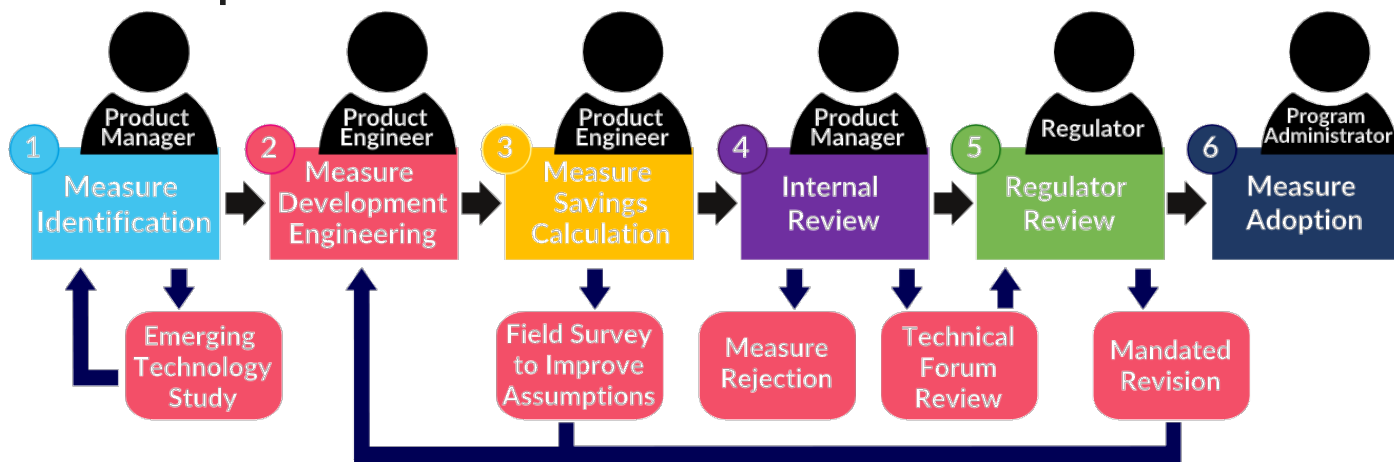
Key barriers in the measure development process include:

- Small sample sizes
- Incomplete data sets and inconsistent measurement approaches
- Lack of well-documented, comprehensive data
- Lack of clearly defined replacement scenarios
- Difficulty extrapolating to new variations: building types, climate zones

Barriers slow adoption of emerging technologies and delay achievement of measure scale. Many barriers can be addressed by drawing on existing demonstration data.

Approach

This Pilot has aimed to streamline utility measure development by identifying common inputs that can be customized by region and easily adopted by utilities nationwide.

Leveraging nationally-available data and tools enables each utility to focus their measure development efforts on their own utility-specific inputs, such as climatic variables.
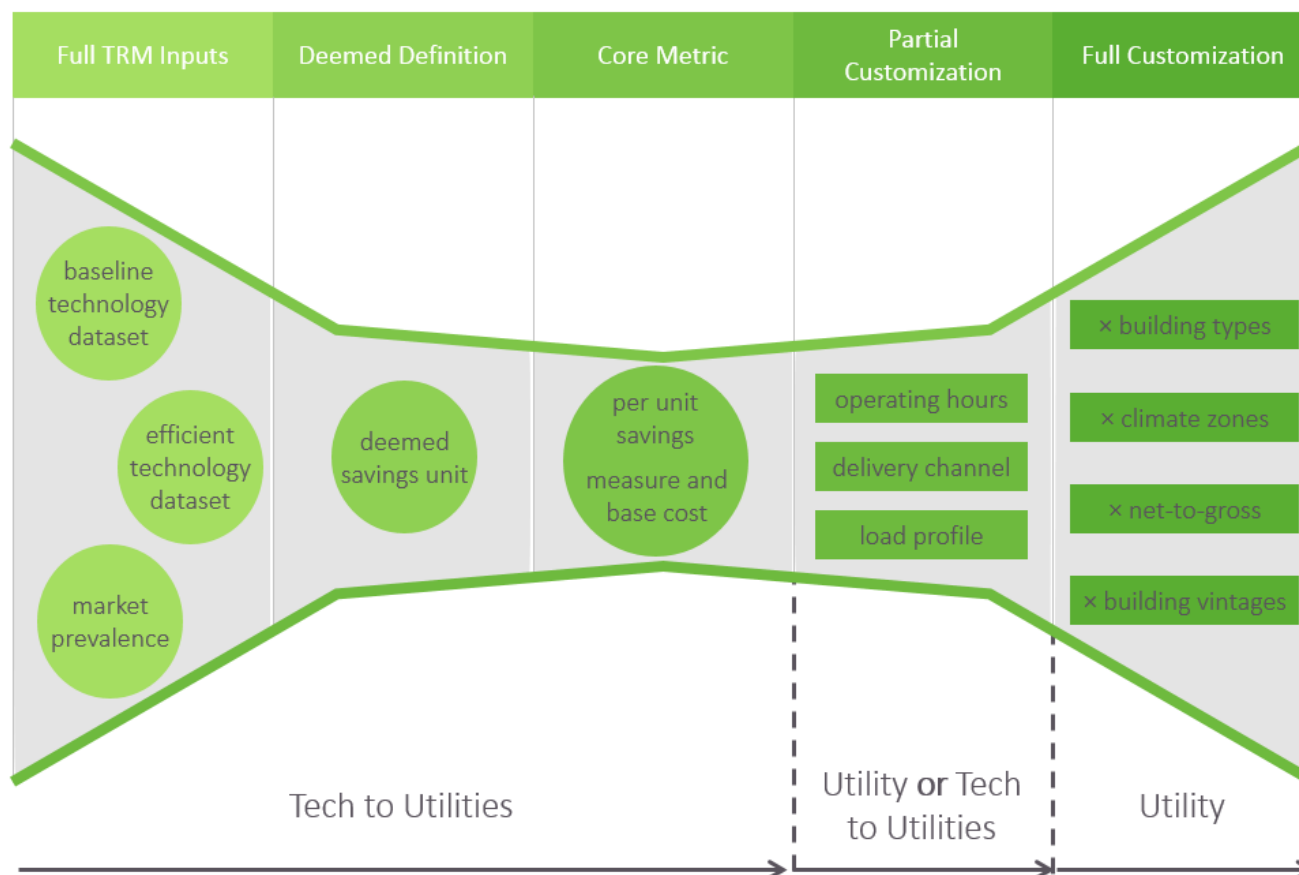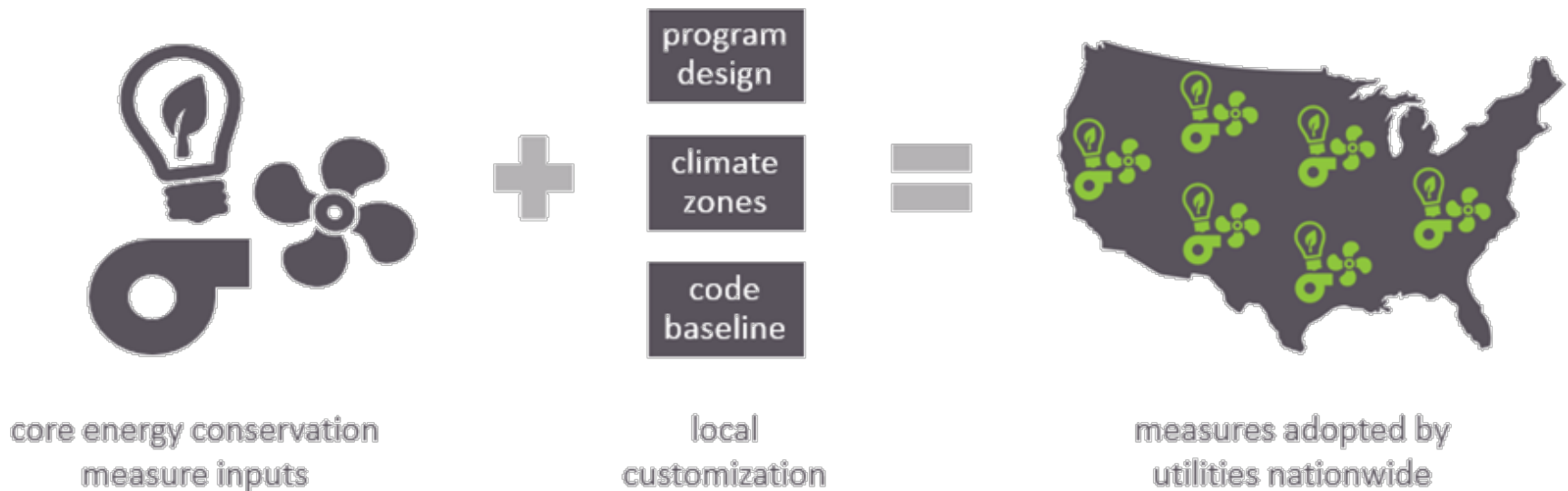
Impact

Common, consistent inputs can be developed from regional or national demonstration data, enabling utilities to minimize duplicative tasks and focus on regional customization.

Nationwide measure frameworks can be updated more regularly from new studies or from connected device data as connectivity and reporting features advance.

Streamlining the measure development process allows program administrators to bring new deemed measures into portfolios more quickly, propelling the adoption of promising new technologies at the scale needed to support innovation.
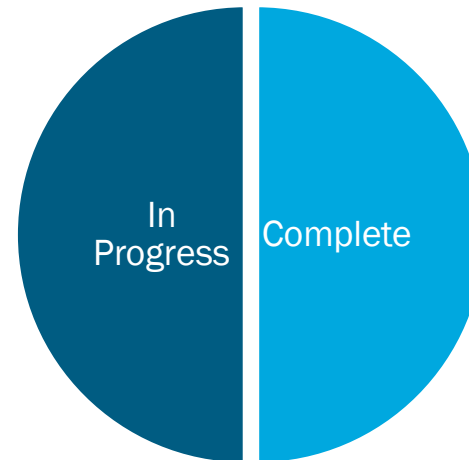
core energy conservation measure inputs

+

program design

climate zones

code baseline

local customization

=

measures adopted by utilities nationwide

Progress

Phase 1 of the project has been completed. In the course of Phase 1, the team undertook the following activities:

recruited **participants** from over 10 regions

identified technology candidates based on field data and group interest

administered survey for **technology selection**

selected **LED 4-Pin** and **ARC** retrofit measures

facilitated participant agreement on TRM inputs and data formats

created **measure development templates** for participant adoption

The project is currently about 50% complete.

In Progress | Complete

Project Findings: Common Data Inputs Needed

Participating utilities and efficiency organizations agreed on a common set of key data inputs for measure development that can be drawn from energy efficiency technology demonstrations and that are consistent across most organizations:

1. Measure Energy Consumption and/or Demand
2. Baseline Energy Consumption and/or Demand
3. Measure Cost
4. Labor Cost
5. Baseline Cost
6. Performance characteristics used to match measure case to baseline case
7. Effective Useful Life
8. Hours of Operation
9. Load Shape: 8760-hour breakdown of savings, and peak-period load factor

Recommendations for Technology Demonstrations

1. Engage efficiency program administrators **at the start** of the field study process

2. Clearly document and report on **key measure development inputs** where possible. The following are necessary regardless of technology or region:
    *   baseline and measure cost
    *   hours of use
    *   expected useful life
    *   energy and peak demand savings (including definition of peak) for both electricity and heating fuels
    *   baseline conditions

3. Provide information on the **statistical significance** or applicability of results, including:
    *   sample size and diversity
    *   site selection criteria and representativeness
    *   consistency or variability of results

Recommendations for Technology Demonstrations

4. Publish complete data on conditions and statistical characterization of **base case conditions**
   - Characterize the base case with information on the existing conditions of all units replaced or retrofitted (such as existing lighting fixture wattage or pre-retrofit HVAC RTU maintenance conditions)

5. Provide information on **non-energy benefits**
   - Program administrators want to increase the cost-effectiveness and consumer benefit of energy efficiency programs. Collect and publish information on non-energy benefits such as: maintenance savings, increased productivity, improved indoor air quality, or promotion of occupant health.

6. Select technologies to fill out the **next decade's prescriptive portfolio**
   - Technologies that address issues such as beneficial fuel switching or that have grid-level benefits
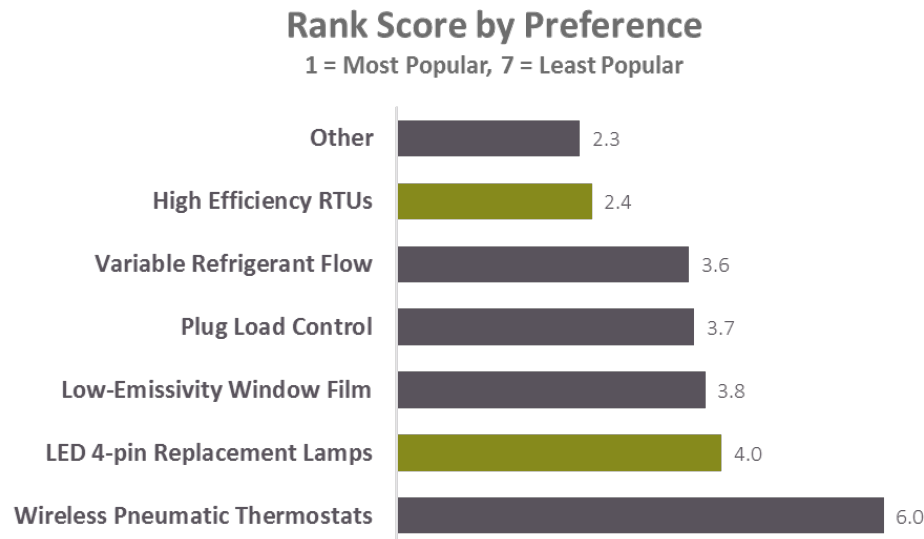   - Controls-based technologies that allow for deeper and more targeted energy savings

Stakeholder Engagement

For Phase 1, Energy Solutions held a recruitment webinar to present the goals of the program and to highlight the program's benefits for participating organizations

- Prioritized organizations that expressed a commitment to active engagement
- Looked for regional diversity and a mix of public and private utilities, regional efficiency organizations, and single-state and multi-state entities

Recruited 12 participants (program managers and engineers) from 8 organizations across over 10 states for participation in the working group

Focus measures were chosen based on working group interest, data availability, diversity of end-uses, and wide national deployment potential

Rank Score by Preference
1 = Most Popular, 7 = Least Popular

Measure	Score
Other	2.3
High Efficiency RTUs	2.4
Variable Refrigerant Flow	3.6
Plug Load Control	3.7
Low-Emissivity Window Film	3.8
LED 4-pin Replacement Lamps	4.0
Wireless Pneumatic Thermostats	6.0

Stakeholder Engagement

Results have been shared with national labs and other organizations publishing reports on technology demonstrations so that published reports support measure development needs.

Sharing the results from Phase 1 with energy efficiency program administrators has led to follow-up activity by these stakeholders:

- Influence on design of a field study on energy savings from HVAC monitoring controls
- Interest from participants in further NREL HVAC performance mapping
- Impacting the prioritization and design of a lighting ET field study

In addition, multiple stakeholder utilities are using the latest template to inform TRM updates:

- Efficiency Vermont and NEEP moving forward with using LED 4-Pin template data to support measure development

Future engagement includes recruitment of new participants including HVAC manufacturers and representatives to provide data and input for Phase 2.

Remaining Project Work

Looking ahead in Phase 2, the team will focus on creating more robust data streams for measure development.

In 2018, we aim to pilot the use of energy monitoring data to support efficiency program measure development.

We will work with the utility and efficiency organization partners to:
- document data reporting and verification **requirements for utility programs**
- review, document, and analyze existing data and measurement and verification processes to **assess alignment with utility needs**
- draft a **standardized data specification** with necessary fields that manufacturers can use to provide monitoring data to program administrators for measure development
- review opportunities for **alignment and integration with DOE tools**

Remaining Project Work

The team will develop a **data specification** for HVAC energy monitoring data to be used in measure development, with a focus on advanced rooftop unit control (ARC) retrofit technology. NREL will utilize its expertise in standardized data fields from its work on the BuildingSync® audit data schema to inform this work and also to coordinate the specification with **BuildingSync** and **BEDES** terms.

The data specification will include a definitional document outlining reporting guidelines for ARC/HVAC data elements and standard naming conventions for these elements to facilitate analysis and sharing by users.

Thank You

Energy Solutions

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REFERENCE SLIDES

Project Budget

Project Budget: Phase 1 cost $150k from FY17 funds and has been completed. Phase 2 costs $255k from FY18 funds and has just begun in April 2018. It is estimated to be completed in April 2019, which occurs during FY19; however, all costs will be covered with the $255k in FY18 funds.
Variances: None.
Cost to Date: As of March 2018, costs incurred include all of the $150k for Phase 1 and $10k of the Phase 2 budget. The total costs incurred as of March 2018 are $160k.
Additional Funding: None.

Budget History					
January 2017 – FY 2017 (past)		FY 2018 (current)		FY 2019 – April 2019 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$150,000	$0	$255,000	$0	$0	$0

Project Plan and Schedule

Project Schedule		
Project Start: January 2017	⬛ (blue)	Completed Work
Projected End: April 2019	⬛ (dark)	Active Task (in progress work)
	🔴	Milestone/Deliverable (Originally planned, but missed)
	◆	Milestone/Deliverable (Actual)

Task	FY2017				FY2018				FY2019			
	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Past Work (Phase 1)												
Q2 Milestone: Draft workplan		◆										
Q2 Milestone: Final workplan		◆										
Q2 Milestone: Draft explanation of approval practices		◆										
Q2 Milestone: Partnership agreements for NREL/DOE review		◆										
Q3 Milestone: Final explanation of approval practices			◆									
Q3 Milestone: 3-10 signed partnership agreements			◆									
Q4 Milestone: Identify 1-3 technologies				◆								
Q4 Milestone: 1-3 draft templates				◆								
Q1 Milestone: 1-3 final templates					◆							
Q1 Milestone: Partner reviews of templates					◆							
Q2 Milestone: Final report and scoping study						🔴◆						

Project Plan and Schedule

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Task	FY2017				FY2018				FY2019			
	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Current/Future Work (Phase 2)												
Q3 Milestone: Draft revised work plan							◆					
Q4 Milestone: Final revised work plan								◆				
Q4 Milestone: Partnership agreements for NREL/DOE review								◆				
Q1 Milestone: Partnership agreements signed									◆			
Q1 Milestone: Memo summarizing participants									◆			
Q1 Milestone: Draft data specification									◆			
Q2 Milestone: Summary of data and process										◆		
Q2 Milestone: Revised draft data specification										◆		
Q3 Milestone: Revised final report											◆	