

A Case Study in Market Transformation for Residential Energy Efficiency Programs

This case study describes how the Midwest Energy Efficiency Alliance (MEEA) partnered with gas and electric utilities in Iowa to establish the Iowa residential heating, ventilation, and air conditioning System Adjustment and Verified Efficiency (HVAC SAVE) program, taking it to scale improving the performance and energy efficiency of HVAC systems, growing businesses, and gaining consumer trust.

HVAC systems rely on proper installation practices to deliver heating and cooling comfort to households as efficiently as possible. Installations that are tested and verified to operate within the manufacturer's performance specifications provide benefits to households through better performance, lower energy costs, and improved comfort.

These benefits translate to satisfied customers which are in-turn a benefit to contractors and utilities. Proper installation of HVAC equipment is important to achieve proper comfort and efficiency.

The Challenge

In 2010, Iowa's energy efficient HVAC equipment rebate program faced a significant hurdle for its future: federal efficiency standards were about to increase. For utility program administrators in Iowa, this meant that the incremental savings for HVAC equipment replacements was diminishing because baseline assumptions for deemed saving estimates would increase. At the same time, a growing body of evidence indicated that predicted energy savings from high efficiency HVAC equipment replacement was not being fully realized in the field primarily because common installation practices rarely include performance



HVAC SAVE Certified Contractor Measuring Airflow
Photo courtesy of the Midwest Energy Efficiency Alliance (MEEA)

testing and verification of installed systems.

This case study profiles how Iowa's utilities started HVAC SAVE as a voluntary program in 2010, followed by testing and refinement of the approach through 2013. Ultimately, it established the program in 2014 as a requirement for its HVAC equipment rebate program.

A New Approach

MEEA and its Iowa utility partners conceived of HVAC SAVE as a data-driven, performance-based, verified installation program. The concept addressed both market and participant challenges (see **Table 1: Key Attributes of the HVAC SAVE Approach**). It was designed to offer a flexible contractor-centric method, focused on verifying the HVAC system installed in Iowa homes to maximize operational performance by delivering heating and cooling at their manufacturer-rated capacity (<http://www.mwalliance.org/node/225>).

Iowa's HVAC SAVE verified installation program offers a compelling value proposition to contractors, homeowners and residential energy efficiency program administrators.

It provides HVAC installers with real-time feedback to guide adjustments to the system at the time of the installation and documentation of the system's measured performance they can share with their customers. Homeowners benefit by receiving a system that delivers greater

Project Profile

Description:

The Midwest Energy Efficiency Alliance (MEEA) and the Iowa electric and gas utilities established a new verified installation program for HVAC and took it to scale, enabling savings and a pathway to market transformation for HVAC installation. The program was established as a voluntary program in 2010, and became mandatory to receive utility rebates beginning in 2014.

Team:

- Midwest Energy Efficiency Alliance (MEEA)
- Energy Stewards International (ESI)
- Alliant Energy
- Black Hills Energy
- Cedar Falls Utilities (Municipal)
- MidAmerican Energy Company

Territory:

Iowa customers served by investor owned and municipal utilities:

- Alliant Energy: 960,000 electric customers; 410,000 gas customers
- Black Hills Energy: 154,000 gas customers
- Cedar Falls Utilities: 19,000 customers
- MidAmerican Energy Company: 760,000 electric customers; 742,000 gas customers

Program Outcomes:

- Conducted over 130 training sessions for over 2,400 contractors.
- Produced over 100,000 certified quality installations (QIs) and over 500 performance tune-ups.
- Methodologies were developed to include HVAC quality installation measures in the Iowa and Illinois Technical Reference Manuals (TRMs)

Table 1: Key Attributes of the HVAC SAVE Approach

Stakeholder	Objectives	HVAC SAVE Attributes
Utility	<ul style="list-style-type: none"> • Verified energy savings • Access to data in a timely fashion 	<ul style="list-style-type: none"> • Data driven workflow to inform field adjustments and report results • Online reporting portal for program administrators
Trade Contractor	<ul style="list-style-type: none"> • Minimal/no program paperwork • Differentiation • Minimal/no disruption to business practices 	<ul style="list-style-type: none"> • Flexibility to achieve performance metrics • Simple, field-based diagnostic tool to measure, adjust, and verify • Online reporting portal for contractors
Homeowner	<ul style="list-style-type: none"> • Identifying/selecting contractors • Obtaining comfort and performance from HVAC systems 	<ul style="list-style-type: none"> • Verified, with documented HVAC SAVE Score • Installation by a certified contractor

comfort, efficiency and reliability versus unverified systems. And the Iowa program administrators benefit from a cost-effective streamlined approach using field measurements of installed performance to justify HVAC rebates and claimed energy savings. Moreover, HVAC SAVE reduces the impact of diminishing incremental energy savings from HVAC equipment, helping the utilities meet their objective of delivering cost-effective savings through their energy efficiency portfolios.

Design and Implementation: Contractor Centric Solutions

By teaming up with Energy Stewards International (ESI), MEEA developed the technical training, certification, and field performance testing methodology. Together, they designed a simple, flexible, in-field process, providing a strong contractor friendly foundation for HVAC SAVE.

Specifically, the HVAC SAVE process

uses measurement and interpretation of static pressure, and a series of temperature measurements to diagnose and fix issues that might otherwise compromise the field performance of the installed system compared to manufacturer-rated performance, which is rated under controlled laboratory testing conditions. Additionally, HVAC contractors are trained to use the HVAC SAVE software tool that calculates efficiency at both the equipment and system level. The tool provides a corresponding HVAC SAVE score for each level based on a simple metric of delivered capacity compared to input energy (see **Figure 1: The HVAC SAVE Process and Workflow**).

Equipped with technical skills and a simple field measurement tool, HVAC contractors can apply their certified skills to install high performing equipment and achieve energy savings. The field testing generally can be completed in 30-60 minutes (allowing for 5-8 homes tested per day) and is recorded in equipment performance in real time. The output of the analysis tool arms the technician with the information necessary to make

Figure 1: The HVAC SAVE Process and Workflow



adjustments that optimize system performance without adding undue burden to the installation process. The HVAC SAVE approach appeals to contractors because it allows flexibility their choice of tools to analyze HVAC system efficiency.

Taking It to Scale

Making it Stick: Gaining Contractor Buy-In

Initially, the HVAC SAVE Program successfully delivered projects with efficiency gains and financial savings on an individual system-by-system basis. HVAC SAVE, however, faced challenges in gaining widespread adoption by contractors who were concerned about reputation, competition, and the cost of software licensing. As a voluntary program, the number of projects completed in the first two years of production was less than 1,500 households annually. MEEA and its partners recognized that without active contractor participation and buy-in, HVAC SAVE would not successfully reach a large volume of households. MEEA, ESI and the Iowa utilities hosted a series of round-table meetings seeking HVAC contractor input, identifying software cost concerns as an area to address. As a result, in 2013, the utilities bought software access for the participating contractors. And, seeing the value of the program, contractors began paying for their own training costs.

Once introduced to the HVAC SAVE process, many contractors find the data-driven, real-time feedback provided by ESI's software-based field tool, coupled with the program's technical training (which the contractors pay for themselves) to be a powerful combination (see **Figure 2: HVAC SAVE from the Contractor Perspective**). Many participating contractors report using the software's output as both a customer engagement tool during the sales process and a technical assistance tool for installing technicians. The performance verified approach helped move them past the mindset of "Why would I want to know that?" to using the software and its outputs to effectively boost productivity and sales.

To further encourage contractor acceptance, the utilities employed an upstream market strategy by engaging distributors

in promoting the training and HVAC SAVE process to their contractor networks. Motivated by the prospect of selling more high efficiency equipment, and winning over the loyalty of their contractor customers, the distributors played a vital role in helping the program grow rapidly. Training (paid for by the contractors) class sizes were increased due to the distributors' marketing involvement, which in-turn increased the number of HVAC SAVE certified contractors.

Achieving Energy Savings with a Regulatory Buy-In

Participation and results from the 2010 voluntary program were encouraging to the Iowa utilities, building their confidence in contractor-centric verified installation practices. Additionally, in 2013, two U.S. Department of Energy studies by Building America research teams confirmed the energy savings potential of proper HVAC installation with the HVAC SAVE method (https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/improving-gas-furnace-performance.pdf & <https://basc.pnnl.gov/resources/energy-savings-system-efficiency-improvements-iowas-hvac-save-program>). As the concern of diminishing available energy savings loomed, the Iowa utilities embraced verified installation through the HVAC SAVE approach in their 2014-2017 Energy Efficiency Plans. Effective January 1, 2014, in order for a customer to be eligible for a rebate, HVAC installations would be required to achieve a target range HVAC SAVE equipment score 85-110 for furnaces and 85-120 for air conditioning units.

To effectively lock in the energy savings potential of verified quality installation, a cost-effectiveness rationale needed to be established. To accomplish this, MEEA contributed to the 2016 Iowa Technical Reference Manual (TRM) stakeholder input process, suggesting a de-rating of 6.4% to the assumed installed efficiency for furnaces, and 10.5% on central air conditioners that do not include HVAC

Figure 2: HVAC SAVE from the Contractor Perspective

Delivering Greater Performance and Value for Customers

"As a company we have had access to many training opportunities for our people to get trained and SAVE Certified. The trainers were professional and proficient. The SAVE Certification process for equipment is a great selling tool for our customers due to the rebate programs the utilities offer. But for the service side of our business, the SAVE Certification allows us the opportunity to "dial in" the equipment to its optimum performance and specs. In doing that we ensure the equipment has been run through all its paces and operating properly. For our company, which focuses on new construction, this process significantly cuts down and eliminates warranty service calls. That savings to us makes this process very valuable."

-Dirk Thierer, Wyckoff Heating and Cooling

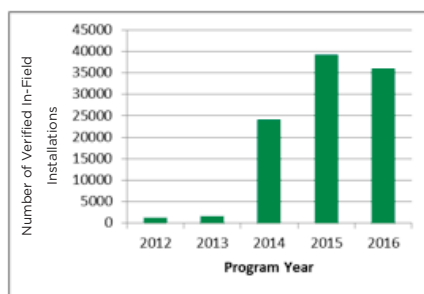
SAVE verification (<https://basc.pnnl.gov/resources/energy-savings-system-efficiency-improvements-iowas-hvac-save-program>). The innovation of this approach is that it effectively flips the script for determining the cost effectiveness of HVAC quality installations. Instead of using quality installation practices as a means to optionally claim "additional" energy savings for HVAC replacements, Iowa regulators agreed that unverified installations are more likely to under-perform. By adopting a reduced baseline efficiency in savings calculations used for HVAC SAVE verified installations, they effectively eliminated the need for the program to justify verified installation as a standalone measure as well as the need to upsell the service to customers.

Garnering Results

The collaborative nature of the HVAC SAVE team—the utilities, MEEA, ESI, and the contractor network—enabled a successful ramp up from the voluntary launch in 2010 to the rollout of the 2014-2017 Energy Efficiency Plans. As of February 2017, 67% of the HVAC companies within the Iowa HVAC SAVE market are participating in the program and have an HVAC SAVE certified contractor on staff demonstrating both delivery at scale and market transformation. As shown in **Figure 3: Verified (In-Field) Installations by Year**, verified quality installations scaled rapidly.

Making HVAC SAVE mandatory for access to rebates loosened the market forces that were restricting the voluntary program from gaining greater traction. At the same time, the TRM modification has been crucial to underlining the importance of HVAC SAVE because it clears a path for wide-scale deployment of quality installation and verified performance practices. It is no longer necessary for contractors to sell “additional energy savings” associated with HVAC SAVE because HVAC SAVE has become the expected standard of care when up-selling higher efficiency equipment.

Figure 3: Verified In-Field Installations by Year



Responding to an Evolving Market

Two constants throughout the seven years of HVAC SAVE’s existence have been the focus on contractor training and commitment to in-field performance verification. While the program has evolved since inception, it persists by maintaining focus on those two core priorities. In addition, remaining agile enough to make mid-course corrections has enabled this program to continue to innovate.

Some examples of HVAC SAVE’s evolution are below, followed by key metrics in Table 2.

- Incorporating lessons learned from voluntary program (2010) to more effectively roll out a mandatory program requirement (2014).
- Changing from a two-day building science oriented class (2010) to a more streamlined one-day intensive class (2013) focused on how to most accurately test the operating capacity of the HVAC equipment.
- Shifting to a standardized QA process based on technician qualification and data monitoring.

Table 2: Key Metrics of the HVAC SAVE Program

Average HVAC SAVE system installation cost	• \$6,500
Seasonal Energy Efficiency Ratio (SEER) rating A measure of air conditioner efficiency	• 14.5 - 16 SEER
Annual Fuel Utilization Efficiency (AFUE) rating A measure of furnace efficiency	• 94% and higher AFUE
Homeowner rebate	• \$350-\$750 (depending on efficiency) for Air Conditioners • \$400 - \$700 (depending on efficiency) for Furnaces
Cost-effectiveness	• -90 minutes for tier 3 field QA visits
# of HVAC SAVE certified technicians	• -1,460 active technicians • -2,488 active & inactive technicians
# of HVAC SAVE certified installations / % of total	• -24.5 jobs/contractor in 2016 (35,887 jobs in 2016)

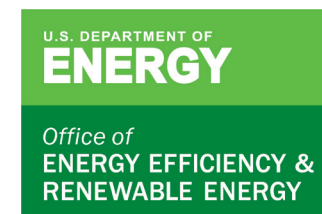
Expanding and Looking Forward

The HVAC SAVE program has promise. Evaluation, measurement, and verification (EM&V) to quantify the savings, benefits and effectiveness of the HVAC SAVE program is on-going, including an impact evaluation to evaluate the energy savings from HVAC SAVE. MEEA, their utility partners and participating contractors are prepared to make adjustments based on any findings. Additionally, MEEA continues to hold contractor meetings to fine tune their approach.

Regionally, MEEA is building off the momentum they have achieved with the Iowa utilities and expanding the HVAC SAVE approach in three distinct ways:

1. The software tool: As part of an on-going and planned expansion of HVAC Save, MEEA is working to expand the testing and verification process to include a more complete system score, which would include duct leakage testing and overall system performance.
2. Contractor business models: Working with the Iowa utilities, MEEA is exploring opportunities for additional energy saving through duct repair and HVAC tune-up services. In collaboration with contractors, MEEA is exploring how to promote tune-up offerings that fit with their service agreements.

3. Expanded territory: MEEA is taking their lessons learned and best practices from the experience with Iowan utilities to the Illinois and Minnesota utilities to promote tune-up offerings that fit with their service agreements.



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DOE/EE-1639 • September 2017