Better Buildings Residential Network Peer Exchange Call Series: *Home Improvement Catalyst—Maximizing HVAC Performance Through Contractor Partnerships (201)*

September 22, 2016

Call Slides and Discussion Summary

Agenda

- Agenda Review and Ground Rules
- Opening Polls
- Brief Residential Network Overview
- Featured Speakers
  - **Steve Dunn**, U.S. DOE: Update on Home Improvement Catalyst Initiative
  - **Tom Koby**, Emerson ClimateTechnologies
  - **Will Baker**, Midwest Energy Efficiency Alliance (MEEA)
- Discussion
  - What are effective strategies to ensure that HVAC contractors do high-quality work and recommend the most appropriate systems for homeowners?
  - How can programs incentivize and support contractors to verify the performance and quality of HVAC installations?
  - What challenges have you experienced with HVAC quality installations and performance over time? What approaches have you or your partners tried to address those challenges?
  - Other questions/topics related to HVAC performance and contractor partnerships?
- Closing Poll and Upcoming Call Schedule

Better Buildings Residential Network

Better Buildings Residential Network: Connects energy efficiency programs and partners to share best practices and learn from one another to increase the number of homes that are energy efficient.

Membership: Open to organizations committed to accelerating the pace of home energy upgrades.

Benefits:

- Peer Exchange Calls 4x/month
- Tools, templates, & resources
- Recognition in media, materials
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- Residential Program Solution Center guided tours

Commitment: Provide DOE with annual number of residential upgrades, and information about associated benefits.

For more information or to join, email bbresidentialnetwork@ee.doe.gov, *or go to* energy.gov/eere/bbrn *and click Join*

Update on DOE Home Improvement Catalyst Initiative

U.S. DEPARTMENT OF ENERGY

Home Improvement Catalyst: Maximizing HVAC Performance Through Contractor Partnerships (201)

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

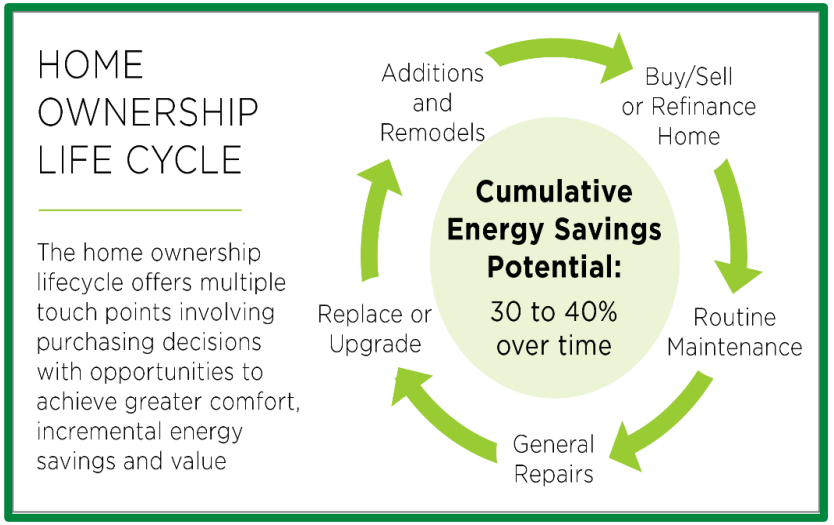
Steve Dunn
Building Technologies Office

Home Improvement Catalyst (HI Cat)

Purpose: Identify and prioritize activities where DOE can have the greatest impact in accelerating adoption of energy efficient measures at key home improvement transactions.

Objectives:

- Focus on **demonstration** of individual measures, packages or practices especially in **heating and cooling**.
- Improve decisions during **typical home improvement transactions** including higher efficiency measures and systems approach.
- Provide **support** where there are **gaps** (e.g., few utility incentives, lack of industry standards, complicated code compliance, need for handoff from Building America, installation issues).
- Expand and demonstrate Residential Building Integration (RBI) Program's impact to **reach** more partners and more homes on a national **scale** (less savings per home than other RBI activities but on a wider scale).



Home Improvement Catalyst: Activity Areas

- **Accelerate adoption and market acceptance of advanced technologies**
  - Advanced technology snapshot series to boost sales of greater energy efficiency within existing business models
    - Cold climate heat pumps, smart thermostats, other BTO-sponsored technologies
  - **Advanced HVAC system design and installation**
    - **Field implementation support: savings potential, messaging, field guidance**
- **Sequencing and packaging upgrades**
  - Recommendations on sequencing measures, measure packages based on current trade practices
  - Best practices in energy efficiency delivery models that leverage consumer home improvement transactions
- **EE Program Support Resources**
  - Test pathways that leverage HVAC and other home improvement transactions
  - Demonstration and case studies on successful mid and upstream approaches

The HVAC Replacement Market: Activities and Strategies to Address Key Barriers

Key barriers and challenges:

- Improper installations and lack of field diagnostic capabilities
- Lack of emphasis on system performance (e.g., proper sizing, ducts and airflow capacity and distribution, effect of building envelope)
- Market driven by emergency replacements, high-volume business model

Activities to address

- Development of field diagnostic and verification software tools
  - Demonstrate, verify energy savings
- Develop technical guidance
  - Demonstrate, quantify energy savings from duct test and seal Industry adoption of ESVI
  - Advanced tech (cold climate heat pumps)
- Supply chain interventions
  - Upstream incentives
  - Selling high efficiency systems
  - HVAC installation checklists

HVAC Automated Verification Systems (AVS)

Barriers

- High program and contractor costs for verification of HVAC quality installation
- Contractor reluctance to participate in HVAC quality installation programs because of cost, technical complexity
- Lack of information to evaluate tools that field-verify quality installation of HVAC systems
- Lack of third party data on energy savings from QI

Strategies

- Collaborate with EPA and Building America to develop and implement an approach for evaluating HVAC automated verification systems (AVS)
- Engage key stakeholders, including AVS manufacturers and OEM's to advance a standard method of test

Midwest Energy Efficiency Alliance (MEEA)

Barriers

- HVAC contractor reluctance to offer duct seal/repair/upgrade services
- Lack of third party field verified data on energy savings impact of HVAC QI
- Lack of information on the business impacts for HVAC trades in providing these additional services

Strategies

- Document Iowa "HVAC Save" experience including successes, challenges, barriers, etc. when "scaling up"
- Facilitate adoption of advanced HVAC technologies (e.g. duct system repair, and cold climate heat pumps)
- Develop tools with Midwest partners to help contractors sell more duct repairs (e.g. sealing, modifications, balancing, etc.)

Northeast Energy Efficiency Partnership

Barriers

- Lack of technical understanding of appropriate applications, design, and installation of cold climate heat pumps
- Lack of accurate information on the benefits of cold climate heat pumps
- Lack of accurate information on impacts for homeowners and programs of CCHP systems and performance

Strategies

Collaborate with NEEP and CCHP stakeholders to:

- Conduct market assessment of current contractor practices
- Develop contractor guidance and checklists for CCHP applications, design, and installation
- Disseminate guidance to utility programs and trades in the NE region

Next Steps for HI Cat

Develop targeted resources for trades and programs

- Resources to support improved design, installation, operation and maintenance of HVAC systems
  - Cold Climate Heat Pump Systems (with NEEP)
  - HVAC Quality Installation with duct sealing (with EPA, MEEA)
- Checklists for trades / consumers
- HVAC Automated Verification Systems (AVS) taxonomy
- Implementation models and supply chain pathways
  - Upstream incentives, customer engagement

Obtain and incorporate feedback from key stakeholders

- Feedback on DOE technical resources and strategies
- Engagement and input DOE develops new partnerships and initiatives with the HVAC industry, utilities and program sponsors

For More Information

Questions? Contact the HI Cat Team:

Steve Dunn, Project Manager
DOE Building Technologies Office

Caroline Hazard, CSRA International

Courtney Moriarta, CSRA International

DOE Home Improvement Catalyst Initiative

- Diagnostic tools provide insight at the field level and offer opportunities to achieve greater savings within the HVAC system replacement and repair lifecycle.
  - A crucial component of understanding opportunities is partnerships with firms to identify successful field diagnostics, verifications, and correction processes on new and existing systems.
- DOE is working with the EPA to promote technical guidance and HVAC automated verification systems (AVS)

Emerson Climate Technologies

U.S. DEPARTMENT OF ENERGY

Tom Koby

Emerson ComfortGuard

Platform Leader

EMERSON Confidential

What We're Seeing

NEARLY **50%**

of your **home energy bill** is due to your heater and air conditioner

OVER **70%**

of home systems are **inefficient** or heading for a **breakdown**

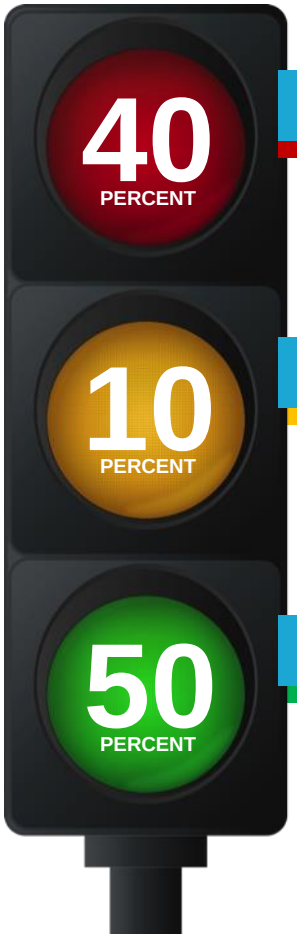
NEARLY **40%**

Of newly installed residential systems are not installed properly

UNDER **10%**

of maintenance agreement systems are properly serviced

Monitoring Helps Detect And Resolve Installation Issues To Prevent Callbacks



30% Refrigerant Loop

20% Incorrect Fan Speed

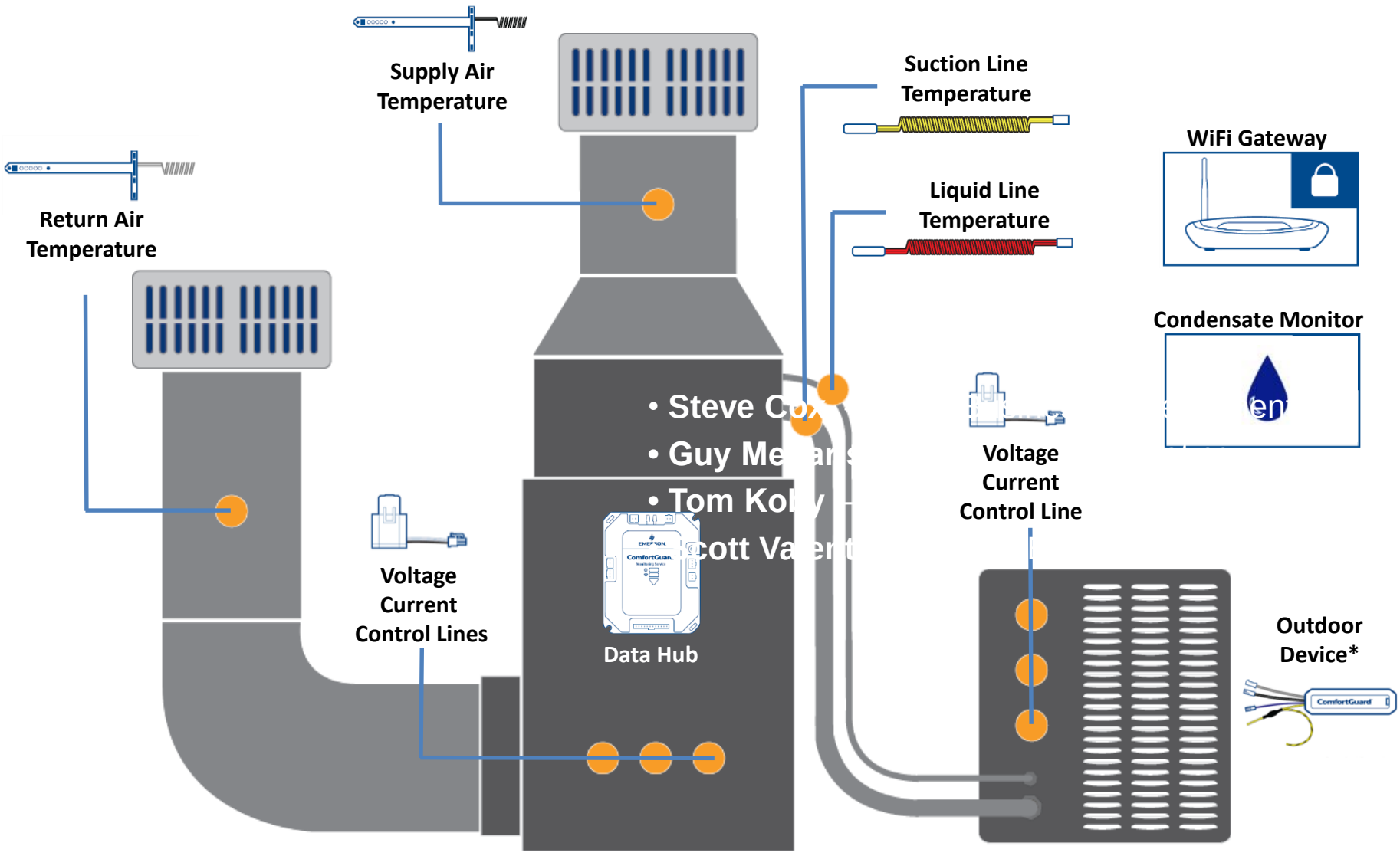
5% Wiring Issues

PROBLEM DETECTED OVER TIME

5% Refrigerant Loop Leak

5% Equipment Performance

What's Being Monitored



Monitoring Provides Visibility Into Detailed System Health and Diagnostics

	FILTER	HEATING EFFICIENCY	COOLING EFFICIENCY
GENERAL	✓ Clean or Replace	✓ Heating Output vs. Power or Gas Consumed	✓ Cooling Output vs. Power Consumed

	AIR HANDLER / FILTER	CONDENSING UNIT
COMPONENT & SUBSYSTEM	✓ Flame Sensor ✓ Hot Surface Igniters ✓ Blower Motor and Run Capacitor ✓ Expansion Device ✓ Capacitors ✓ Inducer Motor ✓ Pressure Switch ✓ Control Lines (From T-Stat) ✓ Electric Heat Sequencer ✓ Indoor Coil Effectiveness ✓ Thermal Limits	✓ Run and Start Capacitors (Compressors) ✓ Contactor ✓ Restricted Air Flow ✓ Refrigerant Charge ✓ Refrigerant Filter and Dryer ✓ Compressor ✓ Condensing Fan Motor and Capacitors ✓ Heat Pump Expansion Device ✓ Reversing Valve Relay ✓ Refrigerant Charge Compensator ✓ Outdoor Coil Effectiveness ✓ Defrost Board

Monitoring Driving a Paradigm Shift

	PROBLEMS WITH TODAY'S MODEL	MONITORING BENEFITS CONSUMERS	MONITORING BENEFITS CONTRACTOR
QUALITY INSTALL	Difficult to validate quality of installation	Know that the new system was installed correctly	Validate quality of the installation BEFORE the tech leaves
PREDICTING PROBLEMS	No warning	Know before there is a loss of comfort or costly parts are damaged	Lowest cost of repair by eliminating most diagnostic time and eliminating callbacks
ONGOING EFFICIENCY	No way to detect remotely	Know they are saving money and prolonging the life of the system	Know they're doing the right thing for your customers

Impacts on the Industry

Send the Right Tech at the Right Time

"Even conservative estimates put the current shortage of HVAC technicians at 20,000."
Michael Cassity, ACHR News Magazine

+ Match the tech to the job – send the right skills for the work, training opportunity
+ Free up peak capacity – predictive alerts allow you to pull work into off-peak
+ Verify installation – give customers peace of mind with 3rd party verification

Know Before You Go

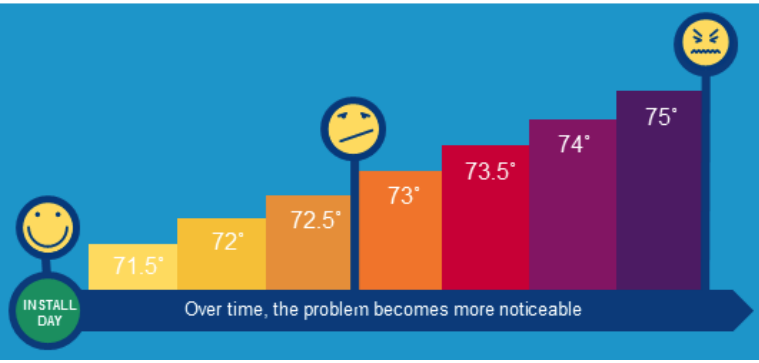
Having detailed knowledge about the nature of the issue before the truck rolls can decrease the cost of a service call significantly.

+ Shorter service calls – diagnostics already done
+ Right parts on the truck – single trip, shorter repair time
+ Customer retention – fast and accurate repair breeds trust

Make a Customer for Life

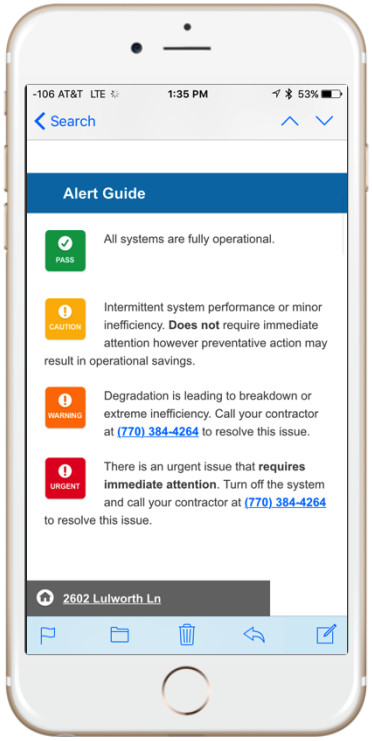
HVAC loyalty is about trust. Bad experiences are communicated in increasingly transparent ways.

+ Predictive Maintenance – Fix it before it hurts
+ 24 / 7 / 365 Monitoring – Like being there every day
+ Regular engagement – Talk to customers monthly

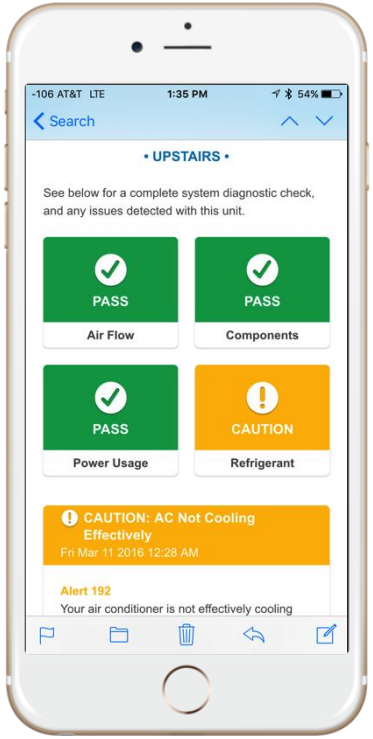


Influencing Homeowner Behavior

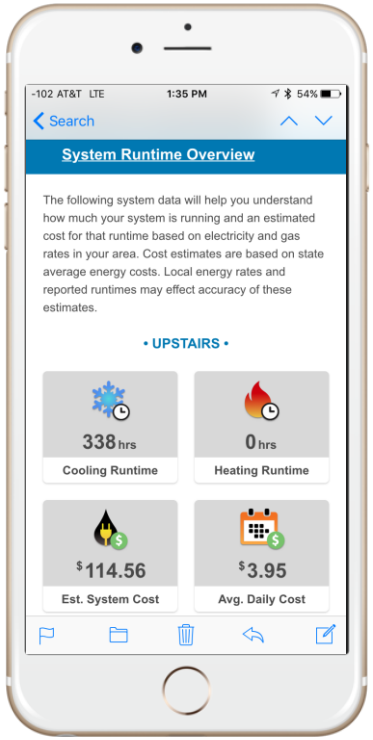
Alert Guide



Alert Details



Runtime & Cost



Emerson Climate Technologies

Low-cost sensors can take industry from a reactionary to proactive position when it comes to HVAC systems:

- **Certainty:** Data from sensors ensure proper installation when a contractor walks away from a job. This eliminates the need for troubleshooting and minimizes callbacks.
- **Competency:** Data help attract millennial technicians by reducing the long ramp-up period to competency by providing diagnostic tools rather than requiring in and out knowledge.
- **Retention:** With data, contractors can reduce service calls and send the truck out with the right parts, which leads to a better homeowner and technician experience to help retain both the workforce and clientele.
- **Insight:** Homeowners oftentimes do not have insight into how their HVAC system is working. Accessible data can help homeowners understand if there is a problem and prevent running the HVAC system until it breaks down.

Midwest Energy Efficiency Alliance (MEEA)

U.S. DEPARTMENT OF ENERGY

Ripe with Savings: How Quality Installation Programs Move Us Beyond Low-Hanging Fruit

Case Study: Transforming Iowa's Residential HVAC Market

Will Baker,
Director of Programs, MEEA

About MEEA

The Trusted Source on Energy Efficiency

MEEA
MIDWEST ENERGY EFFICIENCY ALLIANCE

Quality Installation and Verified Quality Installation

- **Quality Installation** – Focus on following specific installation standards for quality so that heating and cooling equipment is installed as intended
  - Incentivizes proper installation and installing to standard
- **Verified Quality Installation** – Combining an emphasis on increased technical skill of installation contractor with the measurement of the equipment performance
  - What the contractor has done and how it has influenced the performance

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What is HVAC SAVE?

System Adjustment and Verified Efficiency

- HVAC SAVE (System Adjustment and Verified Efficiency) is a utility program that recognizes:
  - That HVAC equipment operating performance does not equate to rated performance
  - That reasonable losses occur at the installation and in the duct system
  - That those losses can be mitigated and incremental savings captured.

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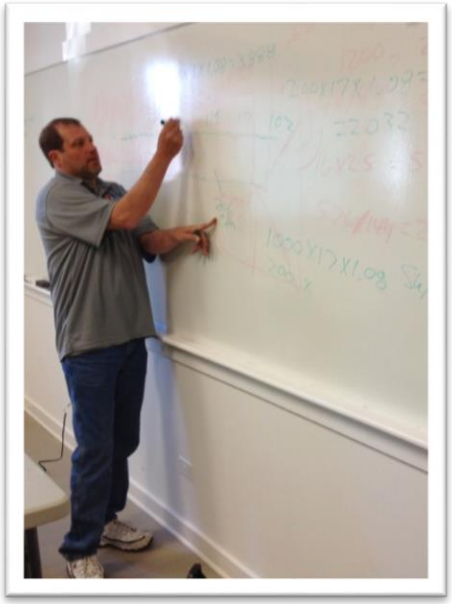
HVAC SAVE Program Elements

- Training and Certification
  - MEEA created certification and partnered with ESI
  - Develops pool of trained and certified HVAC professionals
- Field Performance Testing
  - Move classroom into the field
  - Focus on Quality Installation practices
  - Measure, adjust and verify
  - Online reporting tool
    - www.hvacsavessoftware.com



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HVAC SAVE Verified Quality Install (VQI) and Verified Quality Maintenance (VQM) Process

1. Contractors take initial measurements
2. Measurements recorded into software
3. Software provides HVAC SAVE score and performance metrics
4. Contractor makes adjustments
5. Contractor tests out work completed

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HVAC SAVE IA Program History

2010
- MidAmerican Energy, Alliant Energy, and Black Hills Energy include it in their 2014-2018 EE plans
  - Requirement for residential heating/cooling equipment rebates
  - MidAmerican introduced a Performance tune-up and duct modification rebate
- HVAC SAVE program started training Iowa contractors

2011-12
- Emphasis on training and certification
- Over 600 certified individuals
- 50% Utility Tuition Reimbursement and SESP Grant

2013
- Cedar Falls Utilities launches their program
- Participating utilities begin paying for software access

2014
- HVAC SAVE became a requirement for a furnace, AC, ASHP, GSHP rebate

2015-2016
- HVAC SAVE continues to be a requirement in IA for furnace, AC, ASHP, and HSHP rebates, and program continues to grow.

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Contractor Reaction

- Market Transformation takes time…
  - Initial reaction was very vocal and negative
  - Timing was difficult; followed new State of Iowa contractor licensing requirements
  - Software licensing
  - 'We already do a quality installation, but the other guys cut corners'
  - Training essential to obtain buy in of concept
  - Slow adoption of program following initial training due to fear of competitive disadvantage.
  - 'Wait until we have to.'

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Contractor Reaction

- Reputation building
- Utility promotion
- Rebate income
- Enables a system-level 'whole house' look

- "When we started it was an eye opening experience. Now we have performance information that tells us when our installation process is truly complete."

- "We perform these tests for our new homes programs anyway. The software makes it a lot more convenient and the rebate income is gravy."

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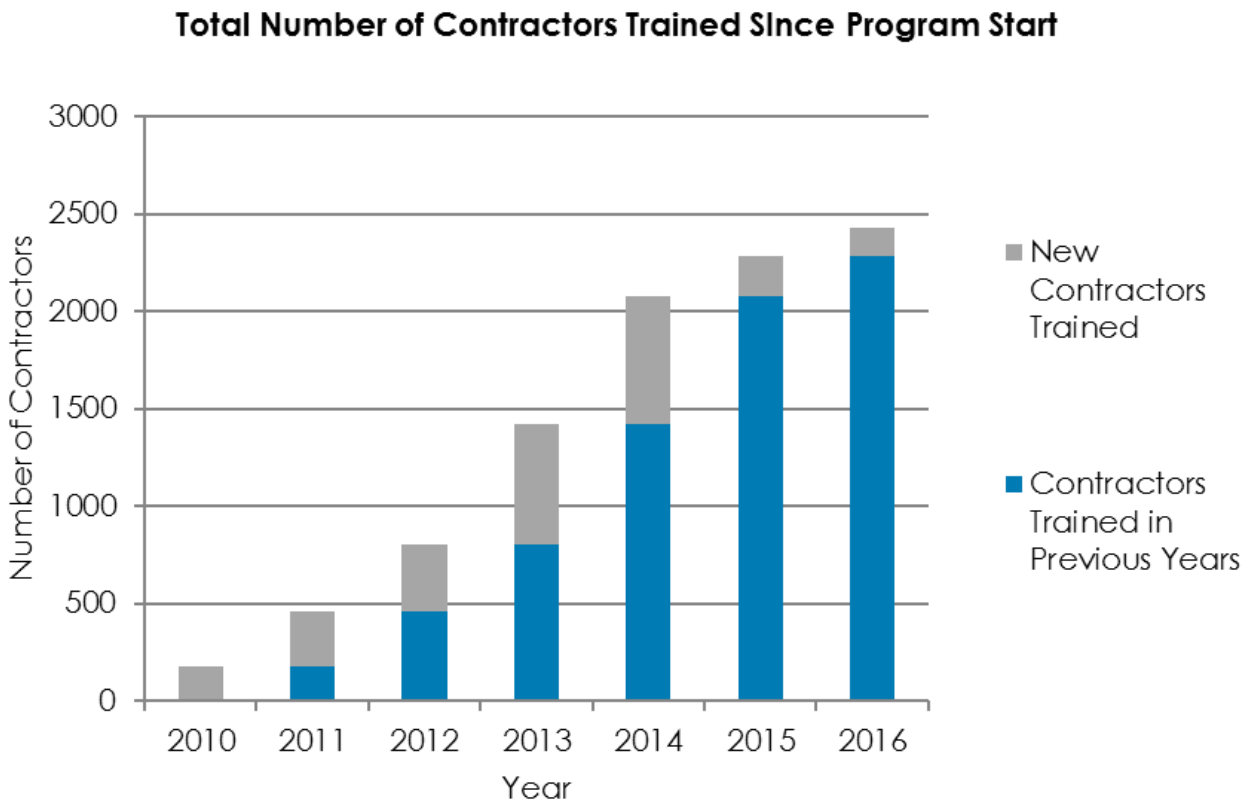
Program Outcomes



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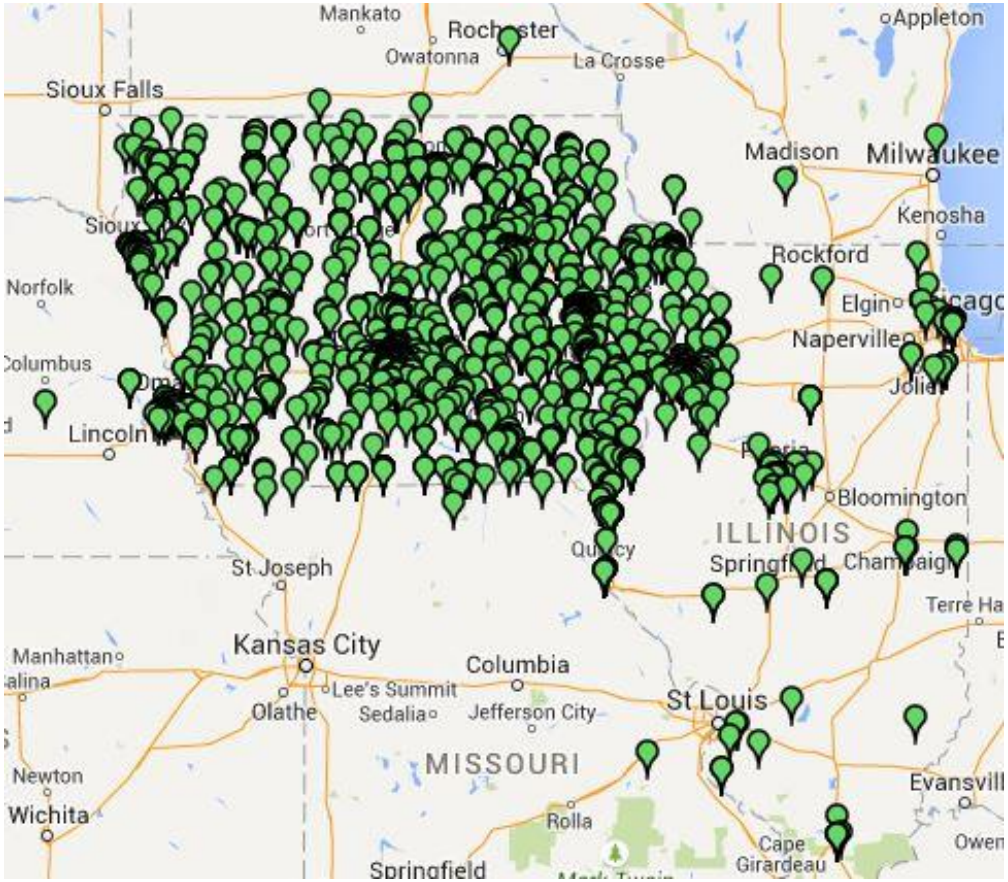
Total Trained HVAC Save Contractors



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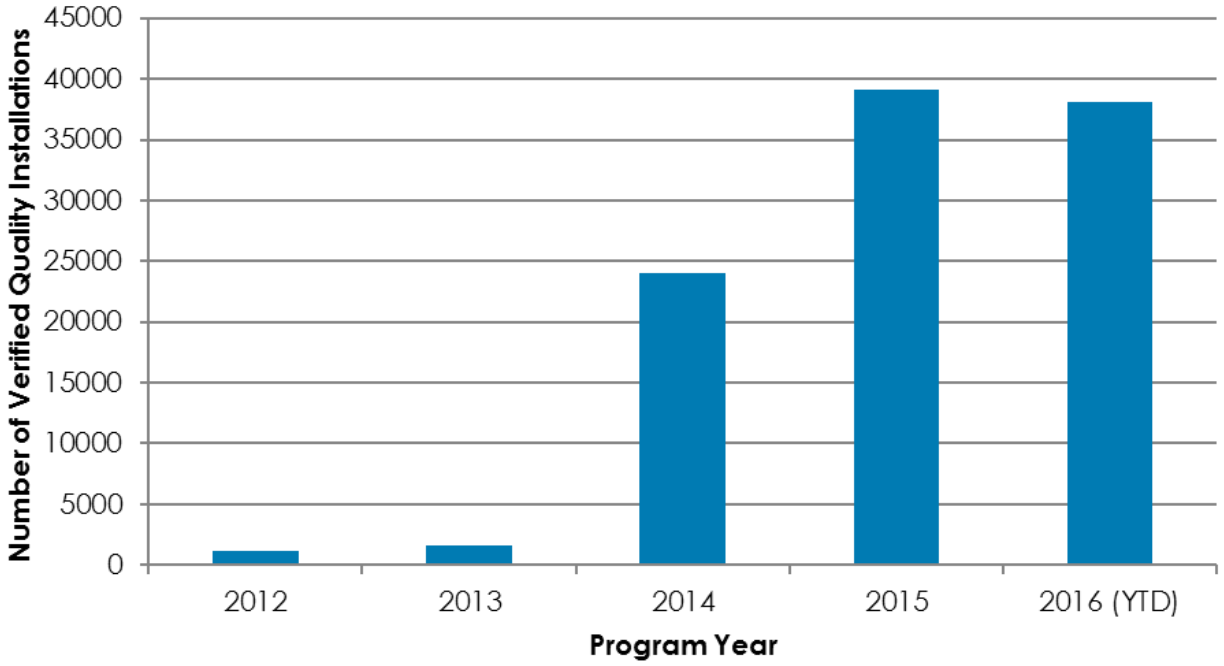
Program Outcomes (Cont.)

Total Number of Verified Quality Installations by Year



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Lessons Learned

Early contractor involvement is key to program buy-in and success

Group payment for software is a watershed moment

Statewide quality assurance plan is essential

Consistent marketing throughout program regions

Market transformation of technical skills of Iowan HVAC contractors throughout the state

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Thank you!

Will Baker

Midwest Energy Efficiency Alliance

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MEEA

- **Opportunity:** Quality inspections help identify underperforming equipment, but it can oftentimes be overly prescriptive and difficult for contractors.
  - Software that can diagnose inefficiencies can help eliminate this lengthy and unclear process.
- **Lessons Learned:**
  - Contractors expressed concern that the verification software would put them at a disadvantage. They felt they already had quality installations. HVAC SAVE changed marketing to communicate the benefits: verification can build contractor reputation by proving quality and mitigate callbacks.
  - HVAC SAVE covered the cost of software to remove the initial cost barrier for skeptical contractors.

Discussion Highlights

- **Diagnostic tools can change the game for contractors** in a number of ways:
  - **Differentiator:** Verification tools are a great way for contractors to differentiate themselves at the kitchen table when a competitive, comparable bid comes in.
  - **Time-Saver:** Contractors can identify the problem easily without relying on prescriptive, time-intensive repair visits as well as prevent repeat repair calls.
- **Diagnostic tools can also change the game for homeowners:**
  - **Insight:** Homeowners often don't understand their equipment beyond whether or not it is blowing cold air. Diagnostic tools can help them understand if and how their equipment is working.
  - **Integration:** Smart product manufacturers are building platforms that will allow homeowners to use a single app to monitor their home systems.

1st Ever Energy Efficiency Day Is Oct. 5th

- *Promote the benefits of energy efficiency for the first-ever, nationwide Energy Efficiency Day!*
- *Digital media toolkit includes: Logos, hashtags, pictures, and messages to boost the visibility and benefits of energy efficiency*
- *Use hashtag **#EEDay2016** on social media Oct. 5*

Better Buildings Summit

Peer Exchange Call Series

We hold one Peer Exchange call the first four Thursdays of each month from 1:00-2:30 pm ET

Calls cover a range of topics, including financing & revenue, data & evaluation, business partners, multifamily housing, and marketing & outreach for all stages of program development and implementation

Upcoming calls:

- September 29: Highlights from ACEEE Summer Study Sessions (201)
- October 6: Secret Sauce: Recruiting and Retaining Qualified Contractors (101)
- October 13: Moving Beyond Split-Incentives: Engaging Rental Property Tenants and Owners in Energy Efficiency (301)
- October 20: Here Comes the Sun: Advances in Residential Solar (301)

Send call topic ideas to peerexchange@rossstrategic.com

See the Better Buildings Residential Network Program website to register

Addenda: Attendee Information and Poll Results

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Call Registrant Locations

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Call Attendees: Network Members

- Alaska Housing Finance Corporation
- Center for Energy and Environment (CEE)
- Center for Sustainable Energy
- CLEAResult
- Columbia Water & Light
- Ecolighten Energy Solutions Ltd.
- Focus on Energy
- Honeywell International, Inc.
- Midwest Energy Efficiency Alliance (MEEA)
- Northeast Energy Efficiency Partnerships (NEEP)
- Research Into Action, Inc.
- Seventhwave

Call Attendees: Non-Members (1 of 2)

- Air Conditioning Contractors of America
- ASC Energy
- Association for Energy Affordability
- BC Housing
- BPI
- Building Services Controls Ltd
- Clallam County PUD
- Community Housing Partners
- ecobeco
- Emerson Climate Technologies
- Energy Design Update
- Energy Gas & Industries Association
- Environmental Design / Build
- Fox Energy Specialists
- Franklin Energy
- Health & Energy Co.
- ICAST
- ICF
- Idaho Division of Building Safety
- Knauf Insulation
- Mark Dyen Consulting, LLC
- Michaels Energy
- MN Center for Energy and Environment
- National Renewable Energy Laboratory

Call Attendees: Non-Members (2 of 2)

- Navigant
- New York State Energy Research and Development Authority
- Parker Interests Unlimited
- Rocky Mountain Institute
- Sustainable Connections
- Therma-Stor LLC
- University Kuala Lumpur
- Valent Air (Unison Comfort Technologies)
- VHR+a
- WSU Energy Program

Opening Poll #1

- Which of the following best describes your organization's experience working with HVAC contractors?
  - Very experienced/familiar **– *63%***
  - Some experience/familiarity **– *17%***
  - Limited experience/familiarity **– *10%***
  - No experience/familiarity **– *7%***
  - Not applicable **– *3%***

Opening Poll #2

- Which of the following best describes your organization's affiliation?
  - Non-Profit **– *37%***
  - Other (please chat in) **– *28%***
  - Contractor **– *16%***
  - State/Local Government **– *13%***
  - Utility **– *6%***

Closing Poll

- After today's call, what will you do?
  - Seek out additional information on one or more of the ideas **– *76%***
  - Consider implementing one or more of the ideas discussed **– *19%***
  - Other (please explain) **– *5%***
  - Make no changes to your current approach **– *0%***