Realizing HVAC Saving through Innovative Contractor Training and Incentive Programs

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ABSTRACT

Longstanding utility efficiency programs have provided customers with incentives to install new high-efficiency forced air heating and cooling equipment based solely on the equipment's nameplate efficiency. Utilities are now recognizing that expected energy savings are not being realized in the field, and the majority of this loss in savings can be attributed to improper installation of this new equipment. Iowa utilities have begun to address this issue by supporting a training and certification program that teaches contractors how to identify and repair deficiencies in systems they install or maintain in order to ensure maximum energy savings are achieved. By offering incentives for systems that meet a minimum performance threshold, utilities are motivating contractors to implement classroom lessons on the job. Since 2010, over 430 professionals have been certified and more than 550 contractor incentives for meeting the performance threshold have been processed. While the market has not been fully transformed, lasting change is already starting to take hold. Several contractors, including those who initially opposed the program, have embraced the idea and have incorporated it into their business models such that even without utility incentives it can remain sustainable indefinitely. If this program proves to be market transforming, utilities will have a new way to achieve savings from homes and businesses with new or existing HVAC systems through performance-based improvements.

Introduction

Although federal, state, and utility programs have increased the market penetration of high efficiency residential and small commercial HVAC equipment, there is evidence that the potential energy savings resulting from higher efficiency standards are not being realized in the field. Unlike many energy efficiency measures, the energy performance of residential and small commercial HVAC equipment is highly dependent on the proper installation and maintenance of the equipment as well as the individual characteristics of the distribution system in which it is installed. An improperly installed central air-conditioning system may use up to 35 percent more cooling energy than a quality-installed system in the same home (Neme et. al 1999). This additional energy usage translates to greater greenhouse gas emissions, pollution and resource consumption.

While the extent of performance problems in residential air conditioning and heating equipment is difficult to quantify, the evidence suggests that performance deficiencies are wide-spread. ENERGY STAR® estimates that nearly half of all heating and cooling equipment in the U.S. does not meet its rated performance due to suboptimal installations (EPA). A 2008 study from the Energy Center of Wisconsin (Pigg 2008) found that 75 percent of central air conditioner installations in Wisconsin were oversized by more than ½ ton of cooling capacity. Typical duct systems lose 25 to 40 percent of the heating or cooling energy put out by the central furnace, heat pump, or air conditioner (see table below). When just half of these losses are to unconditioned

space, a typical homeowner can save $160 per year off of their heating and cooling bill through duct work improvements (DOE 1999).

Table 1. Energy Savings Potential

Program Element	Energy Savings	
	Cooling	**Heating**
Refrigerant Charge	2-6%	-
Airflow	2-5%	-
Sizing	3-7%	-
Duct sealing	11-18%	11-18%
Total	**18-36%**	**11-18%**

Source: ENERGY STAR Quality Installation Sponsor Guide

The root cause of these installation problems is lack of understanding by contractors of the importance of proper HVAC installation and the persistence of outdated "rule of thumb" techniques. Common installation problems include oversized equipment, improper airflow across heat exchangers, sub-optimal refrigerant charging levels, and unmatched indoor and outdoor units. Each of these problems can negatively impact energy efficiency. Distribution system problems such as duct leakage or undersized ducts can further impact energy efficiency.

Public Utility Commissions in states with long standing energy efficiency programs are beginning to take notice of these national studies and the effect installation can have on performance. Some PUCs discount the energy savings utilities are allowed to claim on high-efficiency heating and cooling equipment, and some have questioned whether prescriptive rebate programs for these products are cost effective. This is especially true in states with longstanding efficiency programs where the market share of high efficiency equipment is significant. New York for example incorporates a discrete factor into their savings estimates to adjust for oversizing of the heating equipment as well as for losses associated with distribution system (KEMA 2010). With the reduction in savings, and concern over whether their customers are realizing the full benefits of a higher efficiency heating or cooling equipment, utilities are exploring alternate paths to meeting these needs. In Iowa, the Investor Owned Utilities with guidance from the Office of the Consumer Advocate (OCA) sought to tackle this issue through a contractor training program at a statewide level.

Program Plan & Design

In order to address this issue, the Midwest Energy Efficiency Alliance (MEEA), with its partners Energy Stewards International (ESI) and National Comfort Institute (NCI), developed the HVAC System Adjustment & Verified Efficiency (SAVE) program. The program sought to transform the residential HVAC contractor market to focus on installed performance and quality rather than a lowest bid approach.

To achieve this, the HVAC SAVE program initially focused on developing a workforce that could properly install and verify the performance of high efficiency equipment. This was done by delivering a 2-day class that trains contractors on proper installation and adjustment of HVAC systems. At the core of this training is the ability to properly diagnose the performance and identify deficiencies in any residential forced air heating and cooling system. It shows contractors how simple measurements such as static pressures, temperature rises, and airflows

can be used to provide a snapshot into a system's performance and locate where repairs or adjustments are needed. The measurements discussed in the training are bundled in a way that allows contractors to see the benefits of the performance approach and provides recommendations for how they can establish a sustainable business model. Attending the training and seeing the long term benefits for their business provides contractors additional motivation to move to the performance based approach. As this training seeks to address efficiency issues related to HVAC installation practices, contractors who attend need to have a basic understanding of HVAC systems and experience installing equipment in the field. In Iowa a license is required to legally install HVAC equipment, so some of the concerns over unqualified contractors enrolling in the training are reduced.

To help drive participation in the class, utilities in Iowa offered a 50% tuition rebate for any contractor who took the training and earned the associated certification. Utilities also made it clear up front that they were going to require this certification in the future to participate in any of their HVAC rebate programs. Continuing education credits towards the renewal of their state licenses as well as for several other industry certifications could also be earned through the training. These rebates and the continuing education credits helped jump start the program and build up an initial base of contractors who had the knowledge to move to a performance based approach. Training was offered at multiple locations across the state to give as many contractors as possible the opportunity to attend.

Consistency across participating utilities was also an important consideration during the program design. In Iowa the three main investor owned utilities (IOUs) have interwoven service territories that can add a level of confusion for participating trade allies and homeowners when several energy efficiency programs with the same goals are offered in a single area. To help combat this MEEA, the IOUs, and other stakeholders in the state met early on to unify around the requirements of the HVAC SAVE program. This consistent design provided an additional level of assurance to HVAC contractors as a single set of requirements would qualify them to take advantage of the majority of the utility incentives across the state.

Since this was such an established market, the program determined that training alone would not prompt contractors to change installation practices. Translating lessons learned in the classroom to the field required extra motivation from the program. Once the trained workforce was in place all 3 participating utilities began offering incentives to contractors who verified the performance of their installations. The incentive could be obtained on any installation that met a minimum performance threshold set by the utility. Although the incentive was small (up to $100 per installation), it helped defer some of the initial costs associated with conducting the additional testing. For the contractors more familiar with utility incentive programs, this was sufficient to motivate them to participate in the program. For others, the financial incentive alone was not enough to encourage them to move from the training to implementation in the field. For these contractors, additional mentoring opportunities were offered to help guide them through the process. Contractors were eligible to receive additional support either in person or over the phone from the training provider when they were ready to take the next steps. With this in place, the program was able to mold champions in several communities who went above and beyond the requirements to participate and who turned it into an opportunity to develop new long term strategies for their business. One example of how a long term business strategy was implemented came from a contractor who was initially skeptical of the program. This particular contractor, who serves the Quad Cities and is one of the largest dealers in the state, saw the benefits of the performance based model after attending the training offered through the program. After he

earned his certification he sent the majority of his staff through the training and required them to conduct performance testing on all service calls and seasonal tune-ups. This not only allowed him to show his customers the improvement in performance they were getting with a system tune-up, but also provided him with a record of his customers' system performance that he could use to follow-up with them during off peak times and recommend additional work, such as duct work repairs or additional insulation.

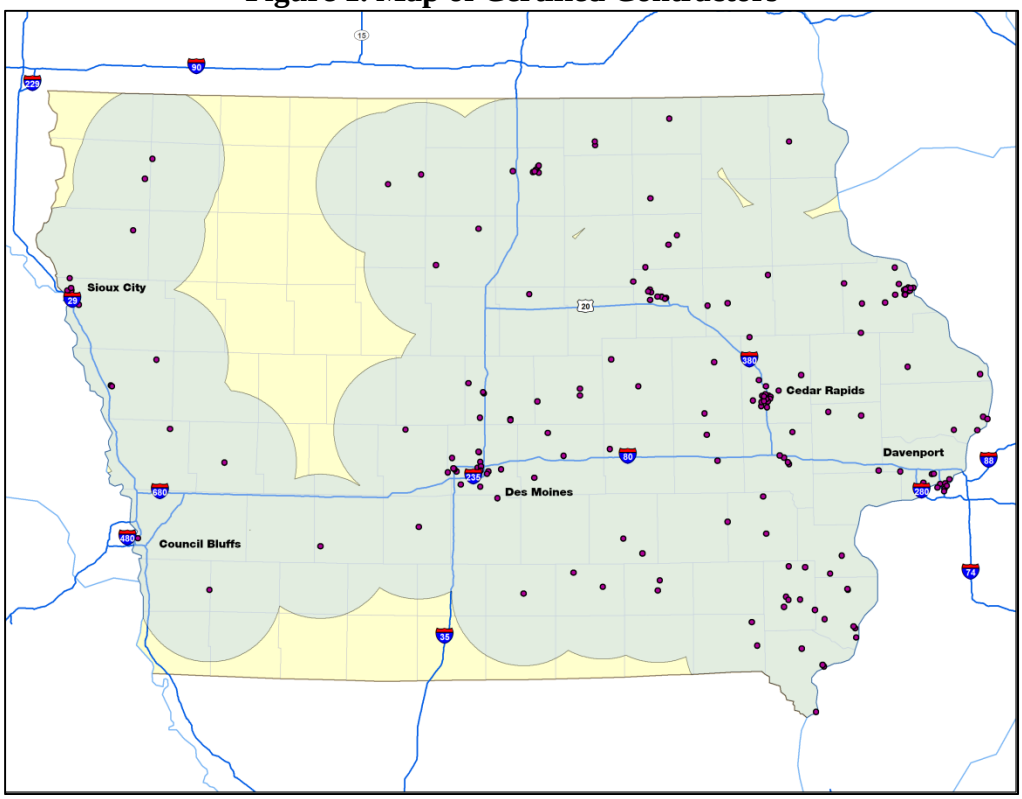
Additionally, on site quality assurance is administered by a 3rd party to contractors new to the program. This extra step is not only used to verify that contractors were correctly reporting the measurements they were taking, it also gave the program the opportunity to provide participating contractors with additional field training. Initially contractors may be hesitant to conduct testing on their own due to unfamiliarity with the tools required to conduct the testing. These hands-on learning opportunities helped mitigate the insecurities that were felt by some contractors and empowered them to fully engage in the program.

While incentives are helping jump start the transformation of the market, long term sustainability is driven by the contractor's ability to develop a successful business model around performance testing. Incentives will not always be available to support the additional time invested into each job versus the standard approach. In order to ensure that the market is transformed in a sustainable manner, the HVAC SAVE program educated contractors on how they can incorporate a performance-based model into their business that allows them to sell the quality of their work rather than just the brand of equipment. For example, when providing a quote for a new furnace or air conditioner, the contractor can provide the homeowner with information on how their current unit is performing based on airflows, temperature rises and static pressure drops, giving them more credibility and setting them apart from their competitors who offer just a new equipment quote.

Results

MEEA, in partnership with Iowa's major investor owned utilities, began holding training in the fall of 2010. Since then, the program has completed trainings and certified approximately 435 individuals. The training was provided at several locations across the state, allowing for contractors from many communities to attend. Figure 1 shows the locations of each trained contractor throughout the state with the green areas of the map showing the approximate territory they cover.

Figure 1. Map of Certified Contractors



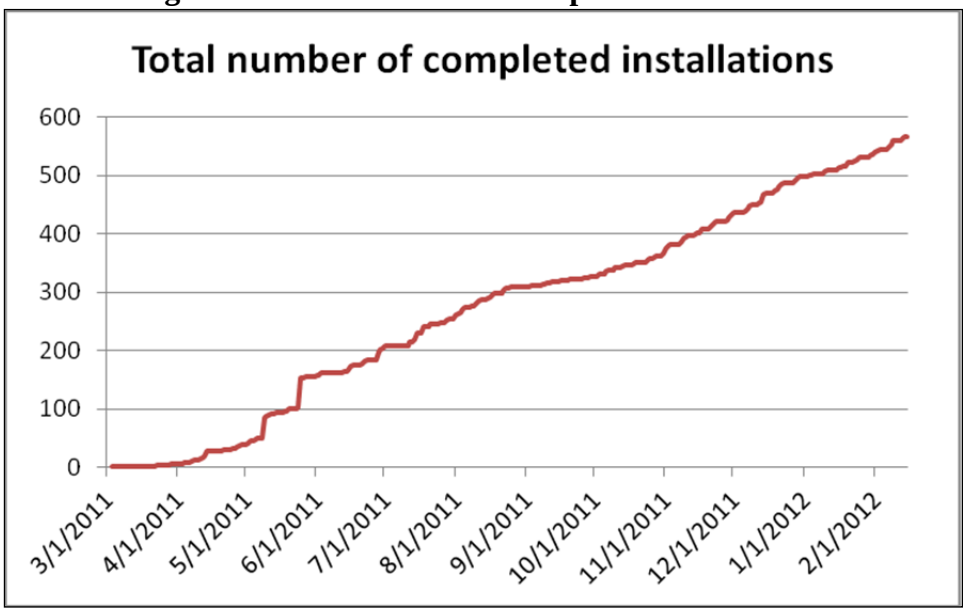
Source: Midwest Energy Efficiency Alliance

These 435 individuals represent approximately 300 of the 2100 contracting companies that have participated in one of the Iowa utility rebate programs in the past. While this is roughly 14% of all participants, the number of installations completed is not evenly distributed among the 2100 contracting companies. Contractors that are more active in utility incentive programs are typically more engaged and informed of new initiatives as a greater percentage of their business is tied to these programs. Additionally, not every licensed contractor has taken advantage of utility programs in the past. There are roughly 8000 licensed HVAC contractors in the state, while the program seeks to train each of these individuals this is not a realistic in the near term. The short term goal for the program is to have at least one individual from each contracting company who participates in utility incentive programs certified, The most difficult segment of the market to reach are the contractors who only participated in a previous incentive program on a one time or infrequent basis. These contractors have little incentive to participate as it makes up only a small percentage of their overall business. We expect that targeting frequent participants in utility incentive programs and building up a market for system improvements will drive demand for the training and certification among the remainder of the contractor market.

In April 2011, additional incentive opportunities were made available to contractors who reported the installed performance of any new high efficiency piece of equipment. Since that time, the program has seen roughly 550 installations rebated. It took a few months after the initial launch of the incentives to see much uptake, but since that time they have been coming in at a steady pace. This increase can be accredited to certified contractors becoming more

comfortable with the testing and reporting procedures as well as the increase in trained contractors. Figure 2 shows the total number of completed installations.

Figure 2. Total Number of Completed Installations



Source: Midwest Energy Efficiency Alliance

Since the performance testing and reporting is currently an optional process and is not tied to the homeowner receiving their prescriptive incentive, there is significant room for growth in this area. In 2010 roughly 29,000 high efficiency HVAC equipment rebates were processed by the Iowa Investor Owned Utilities. The goal is for the number of installations that undergo performance testing to slowly ramp up over time as contractors become more familiar with the process so as not to negatively affect the number of equipment incentives processed through the utility programs. By 2014 the hope is to have the majority of the contracting companies conducting performance testing on a voluntary basis so that requiring the testing on all equipment rebates can be examined.

In order to evaluate the energy savings associated with the system improvements conducted by certified contractors the program plans to collect information on how well the existing equipment is performing by measuring common system metrics, such as airflows and temperatures prior to any work being done to determine a baseline efficiency of the system. This information will then be compared with system performance information collected after the recommended system repairs are conducted to estimate the energy savings. While some of this work has already been completed a larger sample set is needed before any estimates can be made. This information is expected to be collected over the next several months as the program grows.

Early on in the program it was determined that contractor input into the process was valuable to its long term success. After several months of running the trainings, a group of contractors who were involved in the program were gathered to discuss how future installation incentives should be structured. This open dialogue reassured the contractors that the program was designed to meet their needs and gave useful insights to utilities on how to make the program a success. Information on the learning curve associated with implementing the

performance testing into their business as well as some of the issues contractors were seeing in the field were gathered as a result of these meetings. One key issue the program attempts to avoid is designing a model that is too complicated to be implemented in the mass market. In these meeting contractors regularly indicated that the extra time they needed to invest in each job should be initially offset by incentives or participation would suffer. Since the initial meeting, the program has expanded the group to include contractors of varying sizes and specialties to get the most diverse opinions into how the program should be structured.

The extra time dedicated by the program initially to move contractors in the right direction has resulted in several "champion" contractors across the state. These contractors realized the benefits early on, sought additional advice from the program, and have fully incorporated the performance based model into their business. Outside of the new installation market, these contractors are integrating this model into their annual maintenance programs. When coupled in this manner, these contractors use the techniques and tools from the training to generate additional business leads during the slower times of the shoulder seasons. Other contractors in these areas are starting to take notice of this approach and have begun investigating the program themselves. It is this type of growth that will allow the program to remain sustainable over time.

Challenges and lessons learned

The HVAC SAVE program faced several challenges during its development and implementation. Initially, some contractors resisted the idea that additional education would benefit their business. They contended that this program was an additional hurdle to receiving incentives on high efficiency equipment installations forced upon them by utilities. Direct communication with these contractors regarding the program's desire to realize installed efficiencies served to quell some of this unrest. The most effective solution to their resistance, however, proved to be the training itself. After sitting through the two day training, even the most hesitant contractors saw the business case for providing their customers with additional value through the performance based approach described in the training.

Another initial challenge was ensuring lessons learned in the classroom were implemented in the field. The training did a good job exposing contractors to performance testing, and making the business case for it, but because of the historical legacy of selling homeowners on the equipment only and not the quality of the installation, contractors were hesitant to adopt these new methods. In order to address this gap, HVAC SAVE provided dedicated staff people that were available over the phone to answer both process (reporting) and technical questions, and conducted site visits to assist contractors through the process as needed. This hands-on approach developed contractor confidence in offering performance installations as part of their regular business practice.

Additionally, once the program began holding regular contractor meetings it was realized that a "one size fits all" approach would not work for all contractors. Larger contractors that focus on volume and throughput have vastly different needs than those of smaller rural contractors where HVAC is part of a one man shop that practices many trades. The program needed to make several adjustments in the methods of reporting performance metrics to utilities in order to meet the needs of both groups. While the larger contractors valued simplicity and an automated approach to reporting, smaller contractors with less volume found that standard paper reporting was best.

One challenge that continues to be an issue for HVAC programs is consumer education around the importance of installation on the performance of high efficiency HVAC equipment. When raising awareness among consumers a balance needs to be struck between the demand and the availability of contractors to perform these services. The HVAC SAVE program has reached a point where the base of quality trained contractors is large enough that we can begin to focus on driving demand for performance testing through homeowner education.

Future Direction

Currently, the HVAC SAVE approach of training, field support, and contractor incentives is effectively transforming the new install market. This combination could also be successfully utilized in the retrofit or replacement of distribution systems in existing homes. As it stands now, distribution systems are rarely addressed in equipment replacement situations or as a standalone opportunity to improve occupant comfort and efficiency. As the installation market matures, the program will seek to increase the demand for this type of retrofit by looking into providing incentives to contractors or homeowners.

Additionally one area that the program would like to address in the future is the whole home retrofit market. The success of these programs hinge on the availability and willingness of an advanced contractor market to promote the idea of whole home upgrades to homeowners. Since space conditioning accounts for the majority of home energy use, HVAC contractors can play a crucial role in achieving the large energy savings homeowners are expecting when they go though one of these programs. Home retrofit contractors can work closely with properly educated HVAC professionals to ensure the equipment is performing as expected and delivering the desired amount of conditioned air to each location in the home. When these two trades work together, the effects of air sealing, insulation, and internal loads can be incorporated into the design of the heating and cooling systems, allowing for more accurate sizing and distribution system layout.

Conclusions

A trained and willing HVAC workforce intent on delivering quality installed equipment is paramount to achieving potential energy savings. MEEA, with the help of investor owned utilities, addressed this issue in Iowa by offering a model that includes a mix of trainings, incentives, and field support that has made significant progress in the first two years, and will continue to allow the market to adapt over the next several years.

While the market has not been fully transformed, the approach developed by the HVAC SAVE program is well on its way. Based on our experience working with this program, setting long term goals and being forthright regarding the program's intentions helps ease initial reservations associated with change. While a good initial design is important, gathering input from contractors at various stages allows for the program to make adjustments along the way and maximize the benefits to all program participants.

The key to the success of the program rests on its capacity to provide HVAC contractors with not only the skills necessary to address energy efficiency, but to develop a business model around performance based testing that can remain successful beyond the availability of incentives. Once a contractor in a given community becomes fully engaged with this approach,

their competitors take notice and begin to adjust their business models as well, further engraining the desired approach into the marketplace.

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