

Yes You Can!

Achieving Quantity and Quality with Commercial HVAC Programs

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ABSTRACT

There are over nine million commercial packaged rooftop units (RTUs) in the United States. It is estimated that 75 percent of these units are not running efficiently. Although the savings per unit are small, they represent a large energy savings potential when aggregated. The challenge in capturing savings from the small commercial HVAC market is cost-effectively combining programmatic quality control, advanced technical diagnostics, and a multi-dimensional market penetration approach.

This paper discusses the critical program components of an established HVAC initiative that has grown from a small regional pilot in 2002, to today achieving over 46 million kWh in savings and servicing over 20,000 rooftop units. Realizing this level of program success requires designing quality controls into every program component, as well as establishing a sustainable model for long term contractor involvement. This paper further outlines the importance of effective enrollment, comprehensive training, and automated diagnostic tools.

Introduction

Realizing cost-effective, persistent energy savings has proven challenging for commercial HVAC energy-efficiency programs. Despite the complexity of properly sizing, installing, and maintaining HVAC systems, from our experience much of the HVAC industry is dominated by vendors and service entities that recognize that within the HVAC market, buyers' primary decision criterion is often based upon "lowest initial cost". With commoditized installation and maintenance, little investment is made in technician training and tooling, let alone implementing energy-efficiency measures.

These market dynamics are further exacerbated as economic conditions increasingly squeeze facility managers to "run to failure"—often a direct result of disconnecting ownership of operations and maintenance budgets from capital budgets, resulting in a failure to optimize total cost of ownership across the asset lifecycle (HVAC Industry Exclusive 2009).

Portland Energy Conservation, Inc. (PECI) is an energy-efficiency consulting group that conducts third-party administration of various energy-efficiency programs, including commercial HVAC. Over the past thirty years, PECI has developed, implemented and maintained various HVAC energy-efficiency programs to address the difficulties of finding substantial and real energy savings. This paper focuses on the real-world lessons learned in addressing these market conditions to engage and train HVAC contractors on energy-efficiency and achieve success with commercial HVAC programs. This paper will detail seven fundamental steps to achieving success in HVAC energy-efficiency programs including how they are applied to current PECI HVAC programs.

Background

PECI developed its first HVAC tune-up program in 2002 called AirCare Plus™. Initially piloted in the Pacific Northwest and California in several utility groups including Avista Utilities, Northwest Energy Efficiency Alliance, Clark Public Utilities, Bonneville Power Administration, Pacific Gas & Electric and Southern California Edison, it is now an active program in the Pacific Gas & Electric (PG&E) territory. At the end of 2009, the AirCare Plus Program has achieved over 46 million kWh through approximately 20,000 HVAC units.

Table 1. AirCare Plus Overview of Participation and Energy Savings

CLIENT	Date	HVAC Units Serviced	kWh	# of Contractors
Northwest Energy Efficiency Alliance (NEEA)	2002-2004*	79	78,842	10
Avista Utilities	2003-2004	149	127,061	3
Avista Utilities	2005	307	246,807	3
Avista Utilities	2006	682	1,136,621	6
Avista Utilities	2007	1560	2,972,277	6
Avista Utilities	2008	1377	3,035,366	7
Bonneville Power Admin. (BPA)	2008**	61	174,527	1
Clark Public Utilities	2004*	16	-	
Pacific Gas and Electric (PG&E)	2006-2008	8468	19,853,767	34
Pacific Gas and Electric (PG&E)	2009	6040	13,548,724	36
Southern California Edison (SCE)	2004-2005	3703	5,351,565	11
TOTAL		22,442	46,525,557	

*Pilot Program **Measurement and Test Program Data as of December 16, 2009

Source: PECI internal data

AirCare Plus is a comprehensive HVAC program tailored to clients, contractors and customers. The Program is designed to optimize the performance of all major energy-consuming components of HVAC unitary packaged units and split systems. The state-of-the-art diagnostic tools and technology used by the Program set it apart from other HVAC tune-up efforts. These tools allow contractors enrolled in AirCare Plus to precisely evaluate eligible commercial HVAC units, and subsequently improve unit performance and capacity, thereby realizing energy savings.

When an AirCare Plus certified technician performs tune-up services on eligible HVAC equipment, all major components are thoroughly inspected and adjusted for optimal performance and energy-efficiency. All measures are completed based on established program protocol. Even if the unit has received quality preventive maintenance, an AirCare Plus certified technician can identify and resolve problems in the following HVAC components:

- **Thermostat.** Thermostat controls are verified to ensure proper settings based on the occupancy schedule, guaranteeing that the unit is running only when it needs to be. Manual thermostats are replaced with programmable thermostats.
- **Economizer.** Working with the AirCare Plus tools, the certified technician can diagnose the current operating condition of the economizer and, in most cases, repair or adjust it to provide as much “free cooling” as possible, resulting in lower energy bills.
- **Refrigerant.** Our automated tools evaluate the refrigerant charge and perform an analysis to identify problems. Proper charge will extend the compressor’s life and reduce energy consumption.
- **Airflow.** Depending on the as-found conditions of the HVAC unit, the certified technician may clean the evaporator coils, adjust the belts, and adjust the fan speeds, resulting in improved building occupant comfort and lower energy usage.

The AirCare Plus Program is primarily contractor-driven, incorporating training, tools, marketing and incentives to help contractors understand and communicate the value of HVAC energy-efficiency to their customers. Leveraging contractors’ existing maintenance contracts and relationships with building owners is a critical program success element and a key factor for increasing participation. In 2009, the Program started working with utility representatives to complete AirCare Plus services with their referred customers. Partnering with utility representatives proved to be a highly successful strategic initiative for the Program.

PECI has also created a program called the HVAC National Accounts Initiative, which has generated an additional 20 million kWh across 200 U.S. utilities for a single national account. This Program started in 2008 and is scheduled to ramp down in 2010.

Expanding on successes, PECI is currently working with Southern California Edison, who in turn is working collaboratively with the Pacific Gas & Electric, San Diego Gas & Electric and various municipalities to create a state-wide quality maintenance program that includes integrating energy-efficiency. PECI is designing a program that blends industry standards from Air Conditioning Contractors of America and input from the Western HVAC Alliance. Program design is further influenced through structured field studies and focus groups, consolidated best practices, and advanced diagnostics tools.

Approach

In order to achieve successful HVAC program results, PECI has identified the following seven program essentials; components derived from a broad range of experiences in program design, consultation and administration:

1. **Pervasive Quality.** Every aspect of the program design and administration must reinforce quality results.
2. **Market Driven.** Programs must be designed around a clear understanding of market dynamics for the primary stakeholders (customers, contractors, and utilities).
3. **Contractor Driven.** HVAC service contractors serve as the primary liaison between customers, and program administrators.
4. **Stakeholder Value.** Program objectives must derive from a meaningful value proposition for each of the primary stakeholders. Without taking into account who is

- invested, who is interested and who is getting paid, an HVAC energy-efficiency program will not succeed long-term.
5. **Comprehensive HVAC.** True market transformation and program success cannot occur with discrete components in isolation of the total HVAC “ecosystem”. All major energy-using components of an HVAC system must be taken into account to achieve sustained energy savings.
 6. **Evaluation, Measurement & Verification (EM&V)** Cost-effective, conclusive, ongoing monitoring of program impact is critical for ongoing credibility, coupled with sufficient understanding of the baseline conditions.
 7. **Program Longevity.** Consistency in approach, funding, and training are essential to recoup high up-front program costs while maintaining credibility with participating contractors.

Application of Program Essentials

The primary objective of the AirCare Plus Program is to capture energy savings in the notoriously difficult small commercial HVAC market. This challenging market is dealt with successfully by the Program by highlighting not only the importance of engaging and enrolling the right contractors, providing comprehensive training and diagnostic tools, but the by application of these seven program essentials detailed below.

Pervasive Quality

Pervasive quality control must be designed into every facet of the program, from initial enrollment and participation requirements to comprehensive training and field audits. The potential for data errors, fraud, gaming, and rebate chasing can undermine both the public trust and the potential for long-term market transformation.

Quality. We broadly define program quality as those factors that 1) eliminate errors, gaming, and fraud, 2) optimize the performance objectives of indoor air quality, thermal comfort, and cost of ownership (as measured over the asset life cycle - including capital acquisition, operations and maintenance costs), and 3) enable market transformation.

While effective training and enrollment help ensure participation of quality contractors, effective error checking and data analysis are necessary to further reduce fraud, data entry errors and gaming. In our experience, utilization of our hand-held diagnostic tool that allows a technician to wirelessly upload equipment parameters while being guided through the HVAC measures protocol eliminates data entry errors and greatly reduces fraud. Automated error-checking that compares values within anticipated parameters allow technicians to correct errors while still on the roof-top – avoiding the need for costly returns.

The AirCare Plus Program applies an advanced Quality Control Plan into all components of the Program. For example, each and every measure completed is checked for accuracy within program parameters. This level of quality control greatly supports not only the reputation of the program, contractors and utility involved, but helps substantiate energy savings.

Market Driven

HVAC energy-efficiency programs are most effective when tailored to the market segments they serve. Customer and utility requirements may differ substantially between a sophisticated national account heavily invested in energy-efficiency when compared to a triple-net leaseholder who may have no interest in improvements beyond reduction of short-term operation and maintenance expenses. As HVAC energy-efficiency programs become increasingly sophisticated, incentive structures and other program protocols can be tailored not only to utility requirements, but also to the various contractor business models that have evolved to serve them.

Effective market penetration. Identifying and understanding each stakeholder in the marketplace is essential to program success. Customers need to understand how participation in the program will reduce their operation and maintenance costs while maintaining indoor air quality and thermal comfort. Contractors need to see how program enrollment supports their business objectives and may generate additional revenue opportunities for new and existing customers. Utilities need to ensure that their portfolio of programs meet regulatory thresholds for program cost effectiveness; total resource cost (TRC), and achieved energy savings. Unlocking the value in HVAC programs requires approaching each market segment with a broad toolset applied to the specific combination of conditions found on a particular rooftop – effectively targeting best-fit incentives to maximize impact.

The AirCare Plus Program is highly attuned to the needs of the customer, contractor and utility. For example, the market dynamics shift throughout PG&E's California territory. The Program takes these dynamics into account and designs the program with the goal of flexibility within each identified market.

In our recent experience, due to the current economic conditions, business owners (customers) are highly motivated to cut costs. These conditions have conflicting impacts on AirCare Plus - one of the first services they are cutting is HVAC maintenance programs. Quality HVAC maintenance programs are an integral step to maintaining energy-efficiency. Lack of standard maintenance creates an environment where AirCare Plus encounters poorly maintained HVAC equipment, needing substantial repair or replacement before any energy-efficiency measures can be implemented. On the other hand, since AirCare Plus is a no-cost service for commercial customers in PG&E territory, customers sign up quickly to garner potential free energy savings. One market dynamic the Program has responded to is that customers are wary of no-cost programs. The Program has combated this by creating educational materials that demonstrate to the customer the benefits of AirCare Plus. The combined market penetration approach of a no-cost service and educational outreach has allowed the Program to be successful in reaching customers.

Contractor Driven

The HVAC contractor serves as the catalyst for achieving energy savings, as they are the primary liaison between customers and program administrators. They must have the technical ability to assess how to achieve thermal comfort and indoor air quality while optimizing energy-efficiency and cost effectiveness. AirCare Plus enables them to do so.

The AirCare Plus Program has not only found success in providing incentives to contractors for completing established energy-efficiency measures, but the Program also provides (no cost) comprehensive diagnostic tools and robust, frequent training to enrolled contractors. From enrollment to completion of measures, the Program is a constant resource for the contractor.

Success begins with quality contractors. As such, program enrollment targets HVAC contractors and technicians that demonstrate internal business controls and training consistent with industry standards and a predisposition towards energy-efficiency principles. In the AirCare Plus Program a “certified technician” includes only those contractor employees that meet or exceed the following requirements: 1. At least two years Heating, Ventilation & Air Conditioning service experience and an HVAC Technician Certificate aligned with ARI, NATE or ACCA standards. 2. Compliance with any and all required License or Code requirements as specified by the governing jurisdictions where work will be performed. 3. Refrigerant Transition and Recovery Certification, Class II or Universal, as required by 40 CFR Part 82, Subpart F, and issued under a Program approved by the U.S. Environmental Protection Agency.

HVAC contractors come in all shapes and sizes and the AirCare Plus program seeks to accommodate all of them. The strategy of enrolling contractors based on their number of customers does not necessarily produce quality results. The key for enrollment and engagement into an HVAC energy-efficiency program is finding a contractor that can understand and integrate AirCare Plus into their business model. Other variables to consider include geographic location (to provide sufficient aggregate coverage of utility territories), number of eligible customers, and total number of qualified HVAC technicians.

Training

When enrolling contractors, it is critical to establish clear up-front expectations regarding expected activity levels, energy savings objectives and minimum technician tool utilization. For example, AirCare Plus contractors need to complete a minimum of 16 measures per month per program-provided in the toolkit. In addition, an effective program should be structured around what we recognize as the four phases of program adoption: *learning the ropes, adjusting expectations, increased efficiency, and leverage*. Program administration provides focused training and support tailored to each phase of program adoption. Proper contractor and technician training are essential to effectively garnering energy-savings in the hard-to-reach small commercial HVAC market.

Phase 1: Learning the Ropes.

In the first phase, the Program trains participating technicians and works closely with administrative staff, with training curriculum tailored to each audience. In this “learning the ropes” phase of the program, contractor management, field technicians and back office support experience the program through different filters, evaluating the program by different criteria. Contractor management often needs to understand the financial impact of participating in the program: investment in training, tools and marketing; revenue impact of expanded service contracts and equipment installation.

The contractor wants to minimize administrative overhead associated with program reporting and compliance. They are also concerned with utilization impact, labor burn rate and effective allocation of technicians across a given geographical region. The AirCare Plus

operational training addresses these concerns that can become roadblocks to participating. This type of operational training happens from initial enrollment, on an annual basis after that and as needed. The training is generally a mix of in-field visits and conference calls. In person training produces better results.

Phase 2: Adjusting Expectations

During the second phase, our Program anticipates low level frustration as the contractor absorbs the administrative overhead of learning a new program, prior to realizing the program upside. At this phase, the novelty of new technologies and protocols has worn off for technicians. While technicians struggle to master new technical ideas and information, contractor administrator staff continues to learn how to incorporate the web-based reporting and scheduling into their daily business practices. Contractors may begin to feel impatient about seeing a return on their company's investment in the program. Administrative staff may view the new program as a disruption of their regular work. This is a key phase of the program for increased program support at all levels, including regular communication, access to training materials and reiteration of overall soundness of the program model. This generally includes consistent phone check-ins, follow-up field training for technicians and any other support deemed necessary by the contractor or the Program.

Phase 3: Increased Efficiency

During the third phase of program adoption, technicians, managers, and administrators develop competence with the Program tools and structure, and the energy savings from program efforts begin to show. This phase of the Program delivers increased efficiency—both in terms of energy saved from rooftop service visits, and in terms of efficient business practices. During this phase, contractors begin to take advantage of weekly program reports that show opportunities for energy-efficiency service in their contract buildings. The Program becomes an essential component of their business, rather than a distraction from it. During the third phase, the Program has now established relationships with the key stakeholders, additional targeted training is available at no cost to the contractor and expectations are clear across the board.

In general, we find the third phase can take up to a year from initial enrollment. Additionally, available reports inform contractors about issues detected through automated data checking and field audits. Monthly newsletters are also sent out to participating contractors to further reinforce key program elements.

Phase 4: Leverage

During the final phase of the Program, participating technicians, service managers, and administrative staff all understand and have developed competence using program protocols and tools. In this phase, contractors are able to leverage this level of knowledge and skill to produce significant savings. Because most contractors need to see the program work before they feel confident selling it to their customers, it is during this phase that most contractors begin to take advantage of the program's marketing materials and engage on a higher level with the Program. In this phase contractors begin to see increased business demand from their current and new

customers because of the program's service offerings. The Program spends more time collaborating with contractors at this point and introducing co-op marketing opportunities and referral opportunities.

Stakeholder Value

The AirCare Plus Program is a comprehensive HVAC program tailored to clients, contractors and customers which provides ongoing support and training, robust quality control, thorough data collection, and responsible relationship management. A successful HVAC energy-efficiency program needs to have a value proposition that effectively engages each stakeholder.

Successful program design requires all program elements to reinforce behaviors and decisions of HVAC contractors, customers, the utility and their utility representatives. Establishing stakeholder value can be reinforced with reporting tools, effective marketing collateral, and well-designed training curriculum that covers business, technical and financial elements.

When well understood, program designers can identify complementary values across multiple stakeholders. As an example, the AirCare Plus Program instituted a referral system that benefitted both enrolled HVAC contractors and PG&E's Sales and Service Representatives. In order to create greater program awareness the program sought to leverage the existing utility representatives' customer relationships. In 2009, customer referrals constituted approximately half of the entire Program's energy savings, which totaled 13.5 million kWh. Since 2009, the AirCare Plus Program has serviced almost 1,000 customer referrals, and an estimated 2,500 expected by the end of 2010. Referrals are of great value to the participating utilities, as the utility representatives get "credit" from customers for providing the energy-saving service given that they originally presented the idea to the customer. This demonstrates full circle value to the utility.

Program literature and marketing material outline the benefits for utility representatives to enroll new customers into the program as a means of meeting their aggregate energy-efficiency targets. These referrals are then allocated to contractors who regard the referrals as an opportunity to expand sales to new clients. When the contractor's dispatcher schedules the referrals so as to cover labor costs within a given geographical area, sales costs are greatly reduced. This offsets the fact that the contractor does have an existing contract with the customer; thereby offsetting the maintenance costs.

The AirCare Plus Program facilitates training and educational sessions for the utility's sales representatives throughout the year to demonstrate how to effectively enroll customers by articulating the benefits defined for the given market segment. A key to the success of the referral program is the education and ultimate understanding of the program benefits to the representatives. They serve as the primary communication channel to the customer.

When effectively integrated across all facets of the utility and contractor business models, participant acquisition costs are greatly reduced. AirCare Plus historical data indicates that on average, commercial customers save \$340 per HVAC unit serviced by AirCare Plus. Sustained savings like the above effectively demonstrate the strong value proposition to stakeholders.

Comprehensive HVAC

Each energy using component of an HVAC system must be taken into account to achieve system-level energy savings. The AirCare Plus Program addresses the refrigerant cycle, installation and/or adjustment of programmable thermostats and optimization of economizer controls and sensors. Economies are created by implementing energy-savings measures for all available HVAC unit components (versus programs that focus on a singular measure).

The AirCare Plus Program performs HVAC tune-up measures as guided by a proprietary protocols and diagnostic tools. The proprietary information is substantiated by verified work papers, measurement and evaluation, and constant quality control by the Program. Current program development follows Air Conditioning Contractors of America-based maintenance standards integrated with program protocols. Incorporating ACCA standards will provide consistency of approach using an industry vetted approach.

The proprietary Program tools have been established by PECCI through various technology partnerships. The tools are continually modified and upgraded to ensure they are ahead of the technology curve. The measures completed by the tools are vetted through an extensive engineering process, rigorous quality assurance and field testing.

The tools for the AirCare Plus Program are provided at no cost to enrolled contractors to each of their certified technicians. The tools are a comprehensive package of sophisticated diagnostic software paired with computer technology allowing Wi-Fi connectivity, step-by-step measure completion, self-auditing ability and automated error elimination protocols. The goal of the AirCare Plus tools is to make it as easy as possible for the certified technicians to complete the energy-savings measures in a timely, accurate and quality manner.

Future consideration. Future generations of PECCI HVAC energy-efficiency programs are anticipated to integrate industry guidelines for improved unit sizing and quality installation – both of which offer significant leverage in advancing energy-efficiency objectives.

Evaluation, Measurement & Verification

Recent evaluation and impact studies have underscored with troubling consistency the difficulty in measuring and attributing energy savings associated with specific HVAC tune-up measures. Inability to isolate specific variables, inadequate baseline and controls, and insufficient data points combine to yield inconclusive results. Addressing these challenges is at the forefront of PECCI's future program development activities.

Evaluation, measurement & verification as reinforcing mechanism. One significant challenge that we have observed in HVAC energy-efficiency programs is the often inconclusive results from evaluation and monitoring studies. Program results structured around deemed energy conservation measures are often difficult to substantiate due to inconsistent modeling methodologies and insufficient data sets. This risks creating an adversarial conflict between implementers, evaluators and the administrators of public funds, resulting in a greater expenditure of resources on after-the-fact validation and challenges.

Future consideration. Current program design activities underway recognize that measurement and verification should be given a preeminent position in program design to assure that

conclusive results can be demonstrated at regular and early intervals throughout the program's existence. Conclusive results provide rate payer and regulatory confidence in the expenditure of incentives, enabling greater cost-effectiveness as the program achieves economies of scale and greater market penetration.

Program Longevity

Program cost-effectiveness and market penetration are expected to continually improve over time. Application of the seven program approaches including contractor participation, training, skilled tool-use and market awareness require multi-year consistency to yield results. PECI has experienced frustrating results with short-run programs (less than two years) from all stakeholders involved. Robust HVAC energy-efficiency programs need a minimum of three years to recoup initial investment, and achieve economies of scale and effective market penetration.

PECI has observed that introduction of a new HVAC energy-efficiency program will often follow a 'typical' adoption curve. During the first year, participants are identified, contractors are enrolled, toolsets are allocated and training is provided.

In the second year, contractors and technicians gain field experience with the diagnostic tools and PECI reinforces field training and insights for integrating the Program into contractor's business model. In parallel, PECI works to establish credible relationships with the utility sales and service representatives as the basis for the referral program. By the third year, both contractors and utility representatives have experienced program success and actively engage with PECI to identify further program enhancements.

Conclusion

Commercial HVAC energy-efficiency programs are notably difficult to garner sustainable, cost-effective energy savings. There are many variables that make this process challenging such as lack of energy awareness during the time of installation, the cutting of customer HVAC maintenance programs and business owner short-term decision-making driven by current economic conditions.

As evidenced by the successes of AirCare Plus, effective application of the program essentials to HVAC energy-efficiency programs including cost-effectively combining programmatic quality control, advanced technical diagnostics, employing a multi-dimensional market penetration approach, effective enrollment, comprehensive training, and automated diagnostic tools will enable the capture of energy-saving from the vast majority inefficient of commercial HVAC units.

References

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