

Residential Air Conditioner Charge and Air Flow Verification Study

HYPOTHESIS:

PG&E assumed viable technologies existed that would verify whether residential air conditioners were properly charged and if they were able to maintain total system air flow within acceptable manufacturers' recommendations. In order to test this assumption, a study was conducted to evaluate Verification Service Providers' (VSP) ability to apply specific technologies for verifying residential air conditioning systems' charge and air flow, and to provide feedback to the technician in the field when corrections are required.

The scope of the study involved the VSPs ability to: **1)** apply diagnostic methodologies in the field; **2)** recruit and train Heating Ventilation and Air Conditioning Contractors (HVAC) to verify charge and air flow using the VSPs methodologies; **3)** upload verification data on a per unit basis to an incentive program manager; and **4)** provide a quality assurance program that would ensure the validity of the data collected in the field.

SUMMARY:

PG&E commissioned Architectural Energy Corporation to conduct the study to gain a better understanding of the capabilities and market readiness of existing Verification Service Providers. The scope of the study included:

- a discovery of existing VSPs and their corresponding technologies
- data collection on the associated costs to HVAC contractors participating in a verification service program and to the utility when using a VSP
- interviews with upper management of the verification service companies
- in-field observations and technical evaluations of the actual charge and air flow verification work performed by HVAC contractors of each existing VSP doing work within PG&E's service territory
- in-field observations and technical evaluations of service calls performed by HVAC contractors who were not participating in a verification service program.
- development of technical specifications and a "best practices" document for charge and air flow VSPs

FINDINGS:

Four VSPs and one verification tool were part of the study. Only three of the VSPs were found to be market ready within PG&E's service territory. The VSPs were: CheckMe, Enalays and RCA Verification. Each VSP possessed the viable technology needed to deliver charge and air flow verification services and upload the verification data to PG&E.

Adding refrigerant to an undercharged unit and increasing air flow actually increases an individual air conditioning unit's demand. At the same time, the efficiency increase causes the unit to cycle less often during peak periods. To estimate the savings from a population of units that have had a charge and/or air flow correction, it is appropriate to evaluate the savings on an aggregate basis because when a population of units runs for a shorter period of time, the aggregate demand will decrease.

Aggregate peak demand reduction and Energy Efficiency Ratio (EER) improvements for residential air conditioners were calculated by Architectural Energy Corporation for each VSP. Depending on the existing condition of the air conditioners serviced during the study, the estimated aggregate peak demand reduction at 95 degrees outside in kilowatts per ton ranged from .058 to .14, and the estimated improvement in EER ranged from 3% to 14%.

CONCLUSION:

The study determined the charge and air flow verification technology is viable. Based on observed costs, energy and peak demand reduction savings, and overall market readiness, PG&E Customer Energy Efficiency program managers demonstrated a strong willingness to build an energy efficiency program using this technology to serve its residential customers.

VARIOUS COSTS INFORMATION CHARGED BY THE VSPs TO THEIR MEMBER HVAC CONTRACTORS IS OUTLINED BELOW.

Equipment costs ranged from \$950 - \$7,000. Financing was available in some cases for the more advanced diagnostic equipment. Equipment costs do not include equipment normally owned by the HVAC contractors such as digital thermometers, gauges and scales.

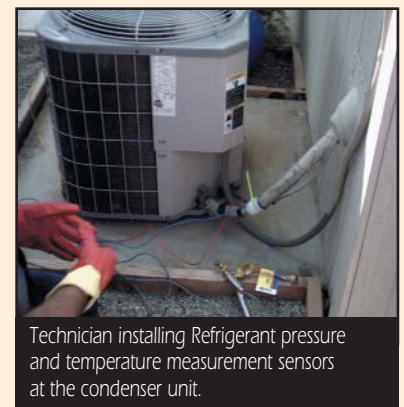
Training costs were determined by the number of technicians needing training and ranged from \$500 per technician to \$995 per technician.

The VSPs' **Certification Costs** were based on individual criteria and included a one-time charge per technician, an annual fee per technician and the number of Personal Desktop Assistants (PDAs) utilized by the HVAC contractors. Certification costs per technician ranged from an annual fee of \$50 to a one-time (lifetime) fee of \$1,300.

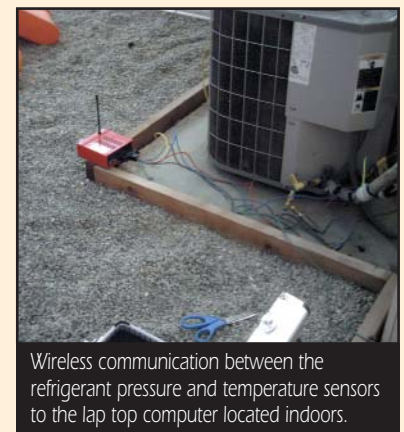
Per site costs represented the major cost difference for participating HVAC contractors between VSP and non-VSP service calls. Per site costs were dependent on various factors including data upload costs, inspection costs and actual bid costs per job. These costs ranged from \$37.60 to \$250 flat fee per site.



Condenser unit prior to capacity measurement showing an outdoor flow hood.



Technician installing Refrigerant pressure and temperature measurement sensors at the condenser unit.



Wireless communication between the refrigerant pressure and temperature sensors to the lap top computer located indoors.



Capacity measurement using an outdoor flow hood with wireless communication to the lap top computer located indoors.