QUICK START GRANT **FINAL REPORT**

Visual Service Software

Institute of Heating and Air Conditioning Installers

Bob Wiseman and Robert Scott

IHACI

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TECH CLEAN CALIFORNIA

Executive Summary

A critical HVAC technician shortage stands in the way of California achieving its ambitious goals for heat pump installation. To overcome this challenge, the Institute of Heating and Air Conditioning Industries, Inc. (IHACI) developed a new diagnostic software tool called Visual Service. The Visual Service tool aims to expand the capacity of existing HVAC technicians and reduce the time to train new technicians in the field. Visual Service allows a single experienced employee to provide live support for multiple technicians as they service and install heat pump systems. The software provides the necessary remote monitoring, accountability, and real-time performance documentation to improve the efficiency and quality of maintenance services and installations. In addition, Visual Service can connect with digital wireless HVAC diagnostic tools and provide real-time data collection.

This Quick Start Grant project recruited 37 technicians to use Visual Service in the field. The technicians were provided tools and training on Visual Service, the proper use of digital wireless tools, and advanced diagnostic techniques. During the grant period, the software was used to document over 300 systems serviced. New technicians reported higher confidence levels when servicing and installing HVAC systems with Visual Service. The tool was improved during the grant period in response to what the team was learning, including adding the functionality to monitor refrigerant charge to further improve the quality of installations and service.

Visual Service was created to advance and support the HVAC industry, which is critical to improving the efficiency of the existing and installed HVAC equipment. Smart tools used in conjunction with Visual Service drastically increase the visibility of HVAC equipment performance and quality of service and installations. The insights gathered using digital tools and service applications are a valuable way to communicate the need for specific repairs to homeowners. Additionally, recording and reporting data at the time of equipment service ensures transparency into the completed work quality. Collecting standardized data whenever a system is installed or serviced provides contractors, utilities, and other entities with a baseline to measure actual system performance. Moreover, the HVAC industry is already facing an intense technician shortage. By reducing the time it takes to train technicians to be proficient in the field, Visual Service can be a valuable asset to contractors and the HVAC industry.

Moving forward, broad adoption of Visual Service hinges on the approval of the software for Title 24 compliance. Despite the potential benefits, contractors will be hesitant to make changes that could add time to installation and service calls without the appropriate incentive. Additionally, more must be done to address cultural barriers to training technicians. Providing trainings in multiple languages is a good first step; however, more needs to be done to improve attendance of installers. Visual Service can assist in this effort by supporting quality work without many of the challenges faced in certification programs.

Project Description

Project Team

IHACI, a 501(c)(6) non-profit, is an organization comprised of various HVAC industry stakeholders that have supported contractors since 1948. Since 2004, IHACI has implemented four major investor-owned utilities (IOUs) statewide HVAC education programs in California. For the past decade, IHACI has supported the State's initiatives for quality installations, maintenance, and compliance by working collaboratively with the California Energy Commission, Western HVAC Performance Alliance, and IOUs.

Market Barrier

Technicians require three to five years of training, yet the need to scale the number of qualified personnel to service and install HVAC equipment is immediate. In addition, quality maintenance, service, and installation have long been elusive goals in the HVAC industry. Despite considerable effort by regulators and utilities, the industry still needs to adopt quality installation and quality maintenance as standard practice.

Proposed Solution

Visual Service is a monitoring and documentation software that provides the capability for remote support from off-site technicians and records the details of system operation and performance. Through the utilization of remote monitoring tools, Visual Service effectively enables a technician with limited experience to perform standard maintenance service and installations. Further, Visual Service offers a way to address the gap in quality installation and quality maintenance by giving contractors a tool that provides real-time documentation of the status and efficiency of the equipment.

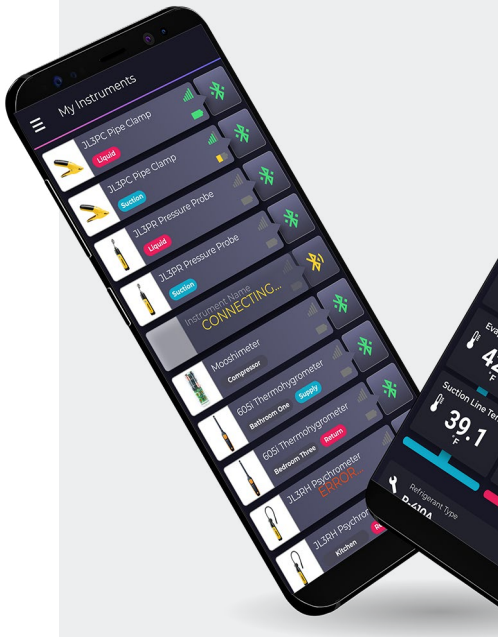
Importantly, the speed of training to use Visual Service does not come at the sake of quality. Rather, Visual Service establishes a replicable method to verify proper installation and performance of HVAC systems. Like a mechanic diagnosing issues with a vehicle through a computer, Visual Service grants homeowners clarity and insight into their system to build trust with the contractor. The data and documentation may also be used to verify energy savings for utility and state programs. As refrigerants are a critical type of emissions to address, a refrigerant tracking module was added to Visual Service during the project.

TIMELINE:
January – February 2023

HOUSING TYPE:
Single and Multifamily

TECHNOLOGY:
Heat Pump HVAC and Heat Pump Water Heaters

LOCATION:
Southern California



Proper technician support and mentoring are challenging to deliver. The live video support between experienced technicians and those in the field through Visual Service addresses much of this gap. This offers the flexibility of service managers to oversee work without attending every call on-site. Additionally, in a physically demanding trade, the longevity of careers poses a problem. Having experienced technicians monitor work through Visual Service may extend the ability for many to remain in the trade and mentor new personnel for longer.

Theory of Change and Scalability

The digital tools and documentation inherent in the Visual Service platform uncover the appropriate actions needed to restore systems' functionality and optimize performance. This pilot tested whether training on Visual Service and advanced digital tools would result in more efficient systems and quality service being performed.

With the shortage of workforce in the HVAC industry, quickly training new service technicians is crucial. The technician shortage strains the capacity to perform proper diagnostics, degrading the quality of equipment servicing and installations. Given this, the project informed how Visual Service can be adopted by new technicians to fill this gap in personnel. If adopted more broadly, the Visual Service platform could provide additional career opportunities for technicians to support field operations remotely.

Long-term, it is envisioned that this tool could lead to higher-quality installations and repairs, customer satisfaction, and contractor comfort in responding to maintenance and installation requests for heat pumps.

Program Changes and Evolution

Training was provided for the use of Visual Service and the digital monitoring tools. However, the amount of time needed to assist contractors and technicians configure their phones and tools to support Visual Service integration was undervalued. To account for this, a live, virtual session was offered to assist contractors with setup, so they can better engage in the Visual Service and diagnostic tool training.

Despite the training, IHACI noticed disparities between how technicians used the software. Each technician that participated in the training was asked to use Visual Service on one call per week. While this is sufficient to test the software, it must be used more frequently to be integrated as part of a technician's routine process. Initially, technicians followed this procedure. However, due to the lack of adoption of Visual Service into their everyday work, technicians reverted to traditional methods once the pressure of the summer workload arrived.

After this discovery, IHACI modified the training to emphasize using Visual Service on every call. Establishing Visual Service as a routine will ensure a full workload does not prevent the technician from documenting system performance. This is particularly beneficial during the busy season when documentation is most important.

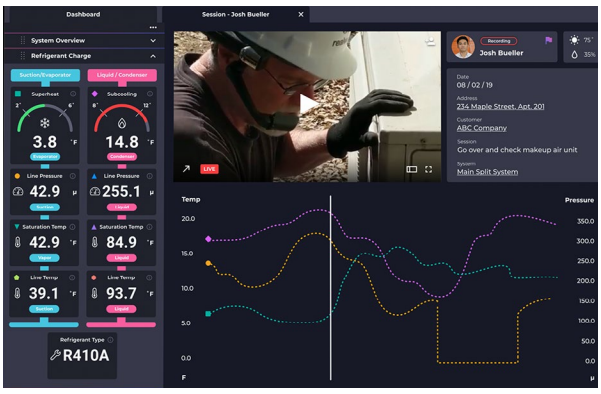
Project Goals and Achievements

Summary of Project Goals and Achievements

KPI/Goal	Metric	Data Source	Project Results
Triage evaluations	Number of service calls	Existing systems evaluations	300
Certification evaluations	Total installations evaluated	New installation evaluations	6
Customer satisfaction	Customer satisfaction of system performance utilizing Visual Service during installation	Customer satisfaction survey	N/A
New system installations resulting from triage evaluations	Total number of systems installed	Contractor reporting of Visual Service to initiate system upgrades	14
Contractor evaluation of Visual Service	Contractor rating of Visual Service	Contractor evaluation survey	9.2/10

New technicians come from various backgrounds with limited opportunities to unify training experience. A primary goal of the project was to assess how Visual Service could help technicians from all backgrounds become effective in the field over a short timeframe. There were several key outcomes of the project to evaluate Visual Service. Due to the issues with the lack of consistent reporting of the necessary data, the project regrettably did not have supporting documentation or findings for the customers' satisfaction key performance indicators.

Triage Evaluations



Triage evaluations, performed on all service or maintenance calls, were a significant success for the project. Participating contractors logged over 300 triage evaluations using Visual Service throughout the project. This type of service call also accounts for most interactions a contractor will have with a customer. Interestingly, new technicians were more likely to use Visual Service in triage evaluations than experienced technicians. Technicians early in their careers found the software useful in communicating with homeowners and verifying that their work was quality and complete. While more experienced technicians also valued the communication aspect, the additional time spent on documentation was perceived as a hassle during busier seasons.

Installation EER and HERS Data

Despite the numerous triage evaluations, only six systems were evaluated for total system performance. This number is significantly lower than anticipated because of reporting issues from participating installation technicians. Installation EERs could not be evaluated due to a lack of manufacturer data for the specified condenser, furnace, and coil combinations from the installing contractor. Additionally, HERS data was not available for the six systems tested for performance and, therefore, could not be used as a point of comparison. Further, contractors did not provide customer contact information to measure customer satisfaction.

New System Installations

The use of Visual Service directly resulted in 14 new system installations. As reported by contractors, the detailed system performance data was instrumental in communicating the need to replace poorly performing existing systems to customers, particularly for newer technicians. The data provided clarity to homeowners on how their system was performing, how it could be improved, and built trust with the contractor. Communicating this demonstrated that services were not unnecessarily added.

Contractor Evaluation of Visual Service

Participating technicians ranged from personnel with less than six months of experience to veterans in the field. New service technicians responded the most positively to the training, mentoring, and use of Visual Service. These technicians adapted to the process quickly and found the software helpful in explaining problems to the homeowner. At the same time, service managers could verify how systems were operating when the technicians left the customer.

Likewise, experienced service technicians also reported a positive experience with Visual Service and the data it provides. However, the additional time commitment from documentation was a burden to those with more experience. Generally, these technicians stopped participating once workloads increased during the summer months.

Installers had a very different response. While they expressed appreciation for the training, very few of the systems tested in the program were full installations. Broadly speaking, there appeared to be an evident technical skill gap between installers and service technicians. Installers struggled to leverage the app to document system performance successfully. Moreover, participating contractors tended to focus on construction during system start-ups rather than fine-tuning systems. This further limited the usefulness of Visual Service to installers specifically.

Customers' and Partners' Experiences

Contractors expressed satisfaction with Visual Service. They were impressed with how the software supported their job functions and facilitated customer conversations. IHACI received the following feedback on the tool:

> *"Visual Service gives our customers insight into how their system is really performing. I love it!"*
>
> **Eddie Perez –** *Operations Manager,* CPHAC

> *"My guys love it!"*
>
> **Dean Gilford –** *President*, Kilowatt Electric and HVAC

> *"It makes my job easier!"*
>
> **Ernie –** *Service Technician*, Kilowatt Electric and HVAC

> *"I would love to see a way to test capacitors in the Visual Service process."*
>
> **Tyler Miner –** *President*, Redlands Heating and Air

> *"I want to use Visual Service to rate my jobs in place of a HERS rater."*
>
> **Mark Ramirez –** *President*, Comfort Control

Key Learnings

Service technicians responded well to the trainings and had the technical competency to utilize Visual Service. In response to a satisfaction survey, contractors rated Visual Service as extremely helpful in explaining system deficiencies to customers, giving the tool an average rating of 9.1 out of 10, and extremely helpful in giving them a good view of how the system is operating, rating the tool on average 9.2 out of 10.

To establish Visual Service or similar tools as part of a technician's routine, trainings must emphasize both frequent use of the tool and the benefits of holistic system assessment for both customer and contractor. IHACI requested that technicians use Visual Service on one call per week. Still, this level of engagement proved insufficient to engrain the software as part of their usual routine. As workload increases seasonally or with weather changes, contractors place a priority on the number of customers seen in a day and are unlikely to take extra time per call to thoroughly diagnose efficiency and performance issues with the Virtual Service system, forgoing energy savings for the customer and the grid. The propensity to forgo using Visual Service in times of high demand was especially true for experienced technicians who have learned how to diagnose and troubleshoot problems following a different process than what Visual Service provides. An experienced technician may check the system one part at a time to assess a problem. Comparatively, Visual Service looks

at the problem holistically. Checking the entire system allows for better energy efficiency and reliability. Future trainings will better characterize the benefits of additional revenue, fewer callbacks, and improved customer satisfaction that result from routine utilization of Visual Service.

Enhancing the training with a focus on support and mentorship, as well as providing trainings in Spanish, may support further usage in the field. IHACI did not anticipate that the use of Visual Service for new installation system performance testing would be as low as was seen in this pilot phase. The low usage rate is attributed to installers often having less formal HVAC education that would allow them to understand the Visual Service tool quickly and because the app was inaccessible to installers who primarily speak Spanish. Further developing the trainings and app in Spanish, as well as live mentoring to walk technicians through the process, may help installers better understand technical details. A demonstration of Visual Service on at least one project benefits installers and technicians regardless of their experience level in the industry.

In-person trainings were more effective, but many contractors reported that they were hesitant to send their staff to trainings attended by competitors. Though online training can reach a broad audience, in-person trainings were found to be much more effective at educating technicians and received higher satisfaction ratings. However, the in-person were sparsely attended, even though many were provided in Spanish. Contractors stated that they were hesitant to send their staff to trainings fearing that doing so would result in opportunities for competitors to interact with their staff. In-house trainings provided to one contractor firm at a time would address this concern.

Service technicians often did not recommend repairs for systems that are not operating at maximum efficiency, despite these repairs being flagged by Visual Service. Customer satisfaction is a top priority for contractors, and suggesting repairs that improve performance but are not critical to functionality may be negatively interpreted by homeowners as upselling. Put simply, if cold air is blowing it is difficult to convince a customer to make further investments. Additionally, repairs on a recently installed system may reflect poorly on the competence of a contractor, while issues found too late may be viewed as negligence. Visual Service can bridge the communication gap between customers and contractors, especially if the value of savings from repairs can be easily quantified.

Refrigerant reclamation and monitoring have become prominent areas of focus for the HVAC industry, and tools to track refrigerants in the field are needed. Between rising costs and new legislation, how much refrigerants are used and where is crucial for contractors to understand. Recognizing this, a refrigerant tracking module was added to Visual Service that aligns with coming refrigerant tracking legislation, such as the AIM Act. Further, this ensures significant costs are not incurred from errors in the installation process. In practice, Visual Service identified refrigerant charge problems on 62 percent of systems. However, a large percentage of these were not repaired, and this lapse warrants further investigation.

Recommended Next Steps

Visual Service can serve as a critical facilitator of workforce development and quality assurance for the HVAC industry. The software allows contractors to effectively train technicians in a much shorter timeframe. This gets more personnel active in the field while supporting the sustainability of operations despite staff turnover. Further, it is essential to measure system performance following installation and servicing. Visual Service serves as an intelligible way for the HVAC industry to provide contractors, homeowners, program implementors, and regulators insights into actual system performance. The use of this software is a tremendous opportunity to improve the efficiency of equipment through the workforce in conjunction with technological improvements, and as such can serve a prominent role in achieving climate goals. The team foresees a number of critical next steps to support the deployment of Visual Service and support the HVAC industry as described in further detail below.

More research needs to be done to ascertain the monetary value the software provides and communicate that to contractors. Contractors will not adopt new processes without enough incentive to do so. While the wireless tools utilized by Visual Service are already commonly purchased by contractors, they do not typically invest additional time per call to perform the documentation. Uncovering the complete picture of upgrades needed to a system could generate additional revenue for contractors. At the same time, properly functioning systems save homeowners money. Calculating the mutual benefits is critical in a market-based pathway to adoption.

From a regulatory perspective, there is an immediate need to collaborate with the California Energy Commission to recognize Visual Service as a pathway for Title 24 compliance. Streamlining the inspection process without sacrificing quality is critical in supporting the rapid growth of the heat pump market. Visual Service accomplishes this through remote diagnostic testing, documentation, and real-time data collection that provides accurate information at the time of installation. The viability of this strategy may be further tested through opportunities such as the investor-owned utilities' CASE research projects specifically focused on compliance improvement.[1] Beyond building code compliance, Visual Service presents an opportunity to verify energy savings and quality installation verification for state and utility programs, including TECH Clean California. Rather than simply having insight into if a system is working, Visual Service can uncover validated efficiency improvements that can be achieved through servicing.

Visual Service and associated trainings should be made more accessible to technicians and installers by being available in Spanish and by being offered as in-house trainings. Notably, though online training can reach a broad audience, in-person trainings were found to be much more effective and valued in this project. However, the events were sparsely

1 The CASE Team presents recommendations to support the Energy Commission's efforts to update Title 24, Part 6 (Energy Code) requirements. Read more at title24stakeholders.com.

attended due to contractor hesitancy around external trainings. Addressing such barriers is another opportunity to scale the use of Visual Service. Furthermore, the lack of Spanish translation in the software's app interface created a barrier for Spanish speakers. Translating the app to multiple languages is a primary goal to grow the software's usability. Additionally, offering in-person, in-house trainings to one contractor firm at a time will address contractors' concerns about their staff attending public trainings where competitor contractor firms may be present.

Installer trainings focused specifically on system start-up and providing the knowledge necessary to perform quality work while remaining accessible to installers of all backgrounds should be offered. The project found a significant skill gap between technicians who received formal HVAC education and those who have not. Start-ups completed entirely by installers, who have usually not received this education, were found to suffer in quality and system performance. Many installers completing system start-ups did not have the technical competency to use Visual Service as part of the installation. A multi-day training course focused specifically on start-up procedures that are accessible to those without formal HVAC training would be helpful. This approach circumvents many of the barriers presented by formal certification programs to grow the base of qualified installers. IHACI will explore training options to support installers, which would incorporate Visual Service as part of the routine start-up process.

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This program is part of the TECH Quick Start Grants (QSG) program, designed to fund targeted, innovative projects that test approaches to overcoming market barriers to heat pump space and water heating adoption.

If you have questions about this report's findings or seek additional support assessing lessons learned for scaling project concepts, please contact the TECH Clean California Team at tech.info@energy-solution.com.