

Smart Diagnostic Tools are a “Game Changer” for HVAC Contractors

A Smart Tools for Efficient HVAC Performance Campaign Case Study

The U.S. Department of Energy (DOE) Smart Tools for Efficient HVAC Performance Campaign supports the use of wirelessly connected smart diagnostic tools—a suite of digital probes which transmit key HVAC system measurements such as refrigerant temperatures and pressures to HVAC system diagnostics smartphone applications. These tools can help determine whether air source heat pumps, central air conditioners, and other residential HVAC equipment are installed or operating correctly. This case study summarizes the business case for adopting smart diagnostic tools and the experiences of three HVAC contractors who have successfully integrated the tools into their business practices.

Contractor Quick Facts



Ack-Air Duct, LLC.

ACK-AIR DUCT, LLC is a family-owned company on Nantucket Island, Massachusetts. The company specializes in air to water, geothermal, variable refrigerant flow heat pumps, hydro, air, and radiant systems—all with an emphasis on energy efficiency.

Jeffrey Remick, Owner
Location: Nantucket, MA
Founded: 2006
Employees: 6
<http://www.ackduct.com>

TOOLS USED:

Fieldpiece, Testo, Yellow Jacket ManTooth, AccuTools BluFlame Combustion Analyzer, Appion Full Range Vacuum Gauge, Supco Redfish Meter, Smart Vacuum Gauge



Holliday Heating and Cooling

Holliday has a team of fully trained technicians that install new and repair existing HVAC, heat pump, geothermal, air purifier, and humidifier systems.

Chris Holliday, General Manager
Location: Spokane, WA
Founded: 1986
Employees: 33
<https://www.hollidayheating.com>

TOOLS USED:

Fieldpiece, Testo, measureQuick



Boucher Energy Systems, Inc.

Established in 1981, Boucher has designed and installed systems for houses ranging from 1,000 to 20,000+ square feet—for homes dating from the 18th century to the most modern colonials.

Steve Taylor, Installation Manager
Location: Mendon, MA
Founded: 1981
Employees: 17
<https://boucherenergy.com/>

TOOLS USED:

Fieldpiece Digital Manifold, Fieldpiece Job Link System Air Probes and Manometers, Testo Digital Manifold, measureQuick

How Smart Diagnostic Tools Work

Smart diagnostic tools comprise diagnostic HVAC applications and wirelessly connected digital HVAC system measuring probes that collectively enable real-time fault detection and diagnostics during installation or maintenance of residential HVAC systems. The contractor’s team of technicians and installers carry these tools with them to a job site in a compact and lightweight kit. Once there, they place smart probes on different components of HVAC systems to collect key measurements, such as air temperature and flowrates, refrigerant temperature and pressure, and electrical readings. These

measurements conveniently synchronize with the diagnostic application, which synthesizes the data to calculate system performance, run real-time diagnostics, and identify potential system faults. The smart diagnostic tools can also narrow down points of failure and recommend suggested adjustments or repairs. These tools check that the HVAC system measurements are within industry standard tolerances and that the system is performing optimally.

Once a system is verified, a technician can easily capture system data and save it to a client’s file. If there is a problem in the future, the team can more easily troubleshoot by

comparing readings. The tools make data collection easy, enabling contractors to better prepare for service needs or potential issues that may arise in the next service visit.



Figure 1. A Holliday technician secures a set of Fieldpiece JobLink probes to measure refrigerant pressure and temperature of an HVAC unit (Photo courtesy of Chris Holliday).

Good for Business, People, and Planet

DOE is committed to reducing the energy waste of HVAC systems caused by improper installation and maintenance and sees smart diagnostic tools as a viable solution. Researchers at the National Renewable Energy Laboratory estimate that energy waste from system malfunction costs equipment owners \$2.5 billion annually. More HVAC contractors using smart diagnostic tools means more efficient HVAC systems and less greenhouse gas emissions. But that's not all. The three contractors also observed other important benefits when they adopted smart diagnostic tools.

Customer Satisfaction

Smart diagnostic applications come with powerful and detailed reporting capabilities that contractors use to show proof of work to their customers. This, in turn, has improved customer satisfaction and trust in service provided.

“You need to prove your work and show exactly what you’re doing. That’s a lot easier to do with a report from measureQuick on your iPad. Not only does it separate us from the pack, but the customer sees value in that and would be willing to pay more for that kind of service,” **said Jeffrey Remick, Ack-Air Duct LLC.**

Improved Productivity, Lower Costs

The tools make it faster and easier to troubleshoot and diagnose certain issues, shortening call times, and saving the companies money. The tools also allow technicians to work smarter. They no longer need to spend precious time documenting system performance because the application does it for them. They can focus on providing quality service to their customers while the application is running diagnostics.

“My technicians tell me all the time how these tools have made it easier to do their jobs. They don’t have to fumble around trying to document information, they take less time at each job site, and they can use data to justify recommendations to customers,” **said Chris Holliday, Holliday Heating and Cooling.**

Additionally, contractors noticed a steady decrease in truck rolls—or number of times a technician needs to be dispatched to a customer’s location for service or troubleshooting.

Better Installations, Better Performance

Smart diagnostic tools provide verification that a system was installed properly. For Steve Taylor of Boucher Energy Systems, this means his technicians can provide maximum comfort and cost savings to homeowners while improving home energy efficiency.

“Making homes energy efficient is as important as properly installing HVAC systems,” **said Steve Taylor, Boucher Energy Systems.**

Additional Service Offering

For some contractors, smart diagnostic tools can signal a new business opportunity. For example, smart diagnostic tools allowed Ack-Air Duct to turn their seasonal business into a year-round operation. As they built the maintenance side of their business, Ack-Air Duct invested in other Bluetooth-enabled tools—such as flue gas combustion analyzers, and dual port manometer probes—that were paired with measureQuick, so they maintained different types of heating equipment other than central air conditioners and heat pumps. This allowed them to respond to a variety of service requests outside of the main heating season.

“These tools are a game changer! As a small business, this technology will help us grow, scale our operation, and offer a new service missing in Nantucket—I’m excited for additional opportunities with this technology!” **said Remick.**

Overcoming Barriers to Adoption

As with new technology, the contractors faced some initial hurdles in adopting and deploying smart diagnostic tools. One of the greatest challenges, across the board, was training technicians on how to properly use the tools. Holliday explained that training can incur additional overhead costs and be time intensive. Moreover, newer smart diagnostic tools can have a steep learning curve. While some technicians may be quick to understand the tools, others may need more time.

Holliday's advice? Train early and provide incentives to technicians. To reduce barriers to adoption and bring the whole team on board, the firm subsidized the cost of the

new tools. Although not an industry-wide practice, Holliday wanted to get the smart diagnostic tools in the hands of their technicians as quickly as possible.

Some local utilities offer free training or scholarships for continuing education. Remick took advantage of the free, in-person training offered by Mass Save. In lieu of a formal training course, technicians can access a complete library of free, on-demand training videos offered by manufacturers like measureQuick. This allows technicians to quickly replay segments in the field when they run into any problems. Remick recommends having technicians test and apply what they've learned during routine preventative maintenance checks.

Holliday continues to advocate for more training with these tools to ensure technicians are ready to use them from the start of their careers.



"If we can get local schools to embrace this technology, or technology to be donated to schools to help with training costs, technicians will be ready to hit the ground running with smart diagnostic tools," said Holliday.

Conclusion

Equipping HVAC industry professionals with the modern tools to do their job better and smarter has a big ripple effect. It leads to better installations, more efficient homes, and a healthier planet. Holliday strongly believes the HVAC industry is heading in a tech-centric direction. Although there are startup costs and learning curves to overcome, the benefits of adopting this new technology far outweigh the challenges. With smart diagnostic tools, Holliday, Remick, and Taylor believe they are better positioned to meet the demands of the future.

To Learn More, Visit the Smart Tools for Efficient HVAC Performance Campaign

The Smart Tools for Efficient HVAC Performance Campaign serves as a national platform for sharing information and resources, and recognizing successes of key stakeholders, including HVAC contractors and installers, energy efficiency programs, equipment developers, trainers, and others.

Interested in participating? Please let us know!

The Smart Tools for Efficient HVAC Performance Campaign wants you to participate, and provide feedback on design components, including participation requirements, success metrics, and evaluation criteria for recognizing exemplary performance.

To participate please email us at

techchallenge@pnnl.gov

To provide additional information, visit:

<https://bit.ly/3I8sRMo>

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<https://bit.ly/3HdAUWR>

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