

Residential HVAC Smart Diagnostic Tools Campaign

The U.S. Department of Energy (DOE) is working with partners on new collaborative initiatives to support the development and adoption of high-performance heat pumps that operate efficiently and maintain optimal performance over time, delivering comfort, energy savings, and low carbon heating to U.S. homeowners. To that end, DOE is launching a new Technology Campaign that promotes the use of smart diagnostic tools that allow HVAC contractors to quickly and easily commission new HVAC systems and identify faults in existing systems. Although Automatic Fault Detection and Diagnostics (AFDD) equipment is available today, it is offered only in a limited number of high-end products that aren't yet cost-effective for most homeowners. Smart Diagnostic Tools address the system performance issue at a much lower cost.

The Residential HVAC Smart Diagnostic Tools Campaign (Campaign) will serve as a national platform for sharing information and recognizing successes with key stakeholders, including HVAC contractors and installers, energy-efficiency programs, equipment developers, trainers, and others.

Space heating and cooling systems account for 44% of energy consumption in U.S. residences. (Energy Information Administration. 2020. Residential Energy Consumption Survey, 2015) Improper installation and maintenance of HVAC systems leads to increased energy use, unnecessary repairs, and occupant comfort issues. Researchers at the National Renewable Energy Laboratory (NREL) estimate that central air conditioners (CACs) and air-source heat pumps (ASHPs) in the United States



An example of HVAC Smart Diagnostic Tools

Photo courtesy of Walt Hunt, Pacific Northwest National Laboratory

waste 20.7 terawatt hours (TWh) of energy per year due to equipment faults. (Winkler et al. 2020. Impact of installation faults in air conditioners and heat pumps in single-family homes on U.S. energy usage. Applied Energy, Volume 278.) That's **9%** of national CAC/ASHP energy consumption, costing equipment owners **\$2.5 billion** annually. To provide the high quality comfort that occupants expect, these units will need to be installed correctly from the start.

What are Smart Diagnostic Tools?

Smart diagnostic tools determine faults in ASHPs and CACs by pairing a suite of digital gauges with a smart phone. Many brands of tools for residential HVAC diagnostics emerged in the last decade as a response to the need for more accurate and efficient ways to measure critical aspects of equipment performance, such as superheat and subcooling, while allowing for remote data collection for fault detection. Existing "smart" diagnostic tools on the market today utilize Wi-Fi or Bluetooth® enabled devices to monitor temperature, pressure, refrigerant charge, airflow, and other equipment performance metrics and transmit that data from equipment in the field to a central data logger or a mobile application, such as MeasureQuick (either Apple or Android-based).

HVAC Smart Diagnostic Tools Campaign

The Campaign is sponsored by DOE and implemented by the Pacific Northwest National Laboratory (PNNL). The Campaign aims to accelerate the adoption of HVAC smart diagnostic tools

by providing a platform for technical assistance and access to key resources such as guidance on implementation best practices for contractors and installers, independent testing of available smart diagnostic tools, utility incentive programs, case studies, and lessons learned.

The campaign will also recognize contractors and installers who have achieved success with adopting HVAC smart diagnostic tools in their business, and campaign supporters who have demonstrated impactful support to the campaign promoting and sharing key resources. ■

Interested in participating? Please let us know!

We need help identifying existing case studies, best practices, and lessons learned related to smart diagnostic tools. We will be seeking feedback on design components of the Campaign, including participation requirements, success metrics, and evaluation criteria for recognizing exemplary performance.

A series of virtual workshops will be scheduled to discuss potential challenges and solutions for smart diagnostic tool deployment, and how to meet market needs.

To participate or learn more, please email us at techchallenge@pnnl.gov or provide additional information here: <https://bit.ly/3pGhGSQ>