

# Expand your HVAC business with home energy audits

Homeowners are looking for ways to save energy and money. Here's how HVAC professionals can help.

## Application Note

Homeowners want ways to save energy and cut costs. HVAC technicians are looking for new business opportunities. And technologies like thermal imaging enable you to see and do more than ever before. Why not bring customer needs, technology, and your skills together by offering home energy audit services? Here's how.

### What is a home energy audit?

A home energy audit includes:

1. An expert inspection and evaluation of the home and its energy-related systems, including HVAC, water heating systems, and the building envelope.
2. Analysis of the home's historical energy consumption.
3. A report to the homeowner detailing where energy is being used, where energy is being wasted, and a bottom-line recommendation on which changes and fixes will save the most.
4. Guidance on how to boost the payoff by tapping potential financial support from federal, state, local, or utility company sources.

### Why do home energy audits?

Home energy audits give you an opportunity to add a new line of business and put your HVAC expertise to work.

Studies have shown that by following energy audit recommendations, homeowners can cut utility bills by 15 percent or more, so even the most pragmatic homeowners can use an audit to put money in their pockets. For many homeowners, conserving natural resources is an additional attraction.

Even Uncle Sam has agreed, in the form of residential energy property credits.

In addition to the federal incentives, help may be available from your state or local utility or from low-income housing programs. The Database of State Incentives for Renewables & Efficiency (DSIRE, <http://www.dsireusa.org/>) has the latest information on many of these programs.



### How do you do a home energy audit?

Start with a physical inspection of the home and its energy systems.

Your HVAC expertise will help you spot issues that you can take up later with the homeowner. You'll want to examine:

#### HVAC systems

What is the age and condition of the furnace and air conditioning system, and what are their efficiency ratings? Can an older gas furnace or boiler be upgraded to a modern, high-efficiency condensing type? Does the air conditioning system meet the latest efficiency standards?

Are the systems well maintained? Check flue gasses to determine combustion efficiency. Check the condition of air filters, ducts, piping, and radiators. Are supply outlets free of blockages? Are ducts tight, or are they leaking precious heat? Is the thermostat programmed to economical heating and cooling settings—or adjusted at all?

**Lighting**

What are the light sources, and are lighting levels appropriate for the living spaces? Converting to high-efficiency lighting can save significant energy and money.

**Water heating**

How old is the water heater, and what’s the energy source? How well is the heater insulated, and what is the temperature setting? Poorly insulated older heaters that are set too hot can be energy hogs. Conversion to a modern tankless water heater could help as well.

**Indoor air quality**

You can check relative humidity, spot temperature, CO and CO<sub>2</sub> levels, and the flow of supply air with a combination tester such as the Fluke 975 AirMeter™. In areas where the ground can emit radioactive radon gas, consider including or recommending a radon test.

**Review energy bills**

You’ll also want to review historical electricity and heating fuel bills for the home. Reducing these costs is the goal of your audit and any improvement projects that may follow. Compare the home’s performance to similar size homes in the area. Look for patterns in energy consumption and opportunities to improve efficiency. Sometimes minor operating changes, like turning down the thermostat at night, can reap significant savings at zero cost.

**Building envelope**

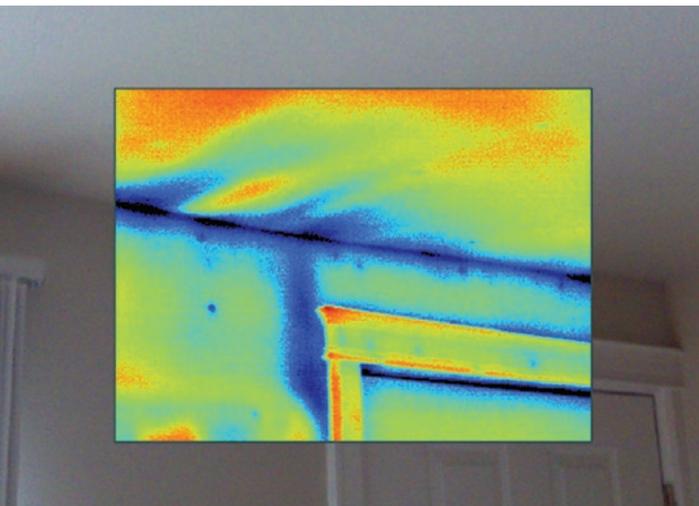
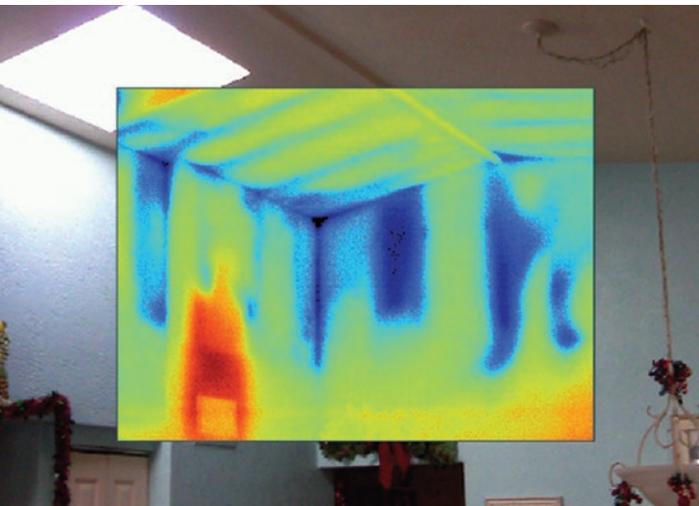
Know the age and type of construction. Are walls, ceilings, and floors well insulated, with any crawl spaces well ventilated and covered to control ground moisture? What’s the type and condition of windows and doors? Modern multi-pane windows framed with vinyl, wood, or fiberglass far outperform old metal-frame, single-pane models.

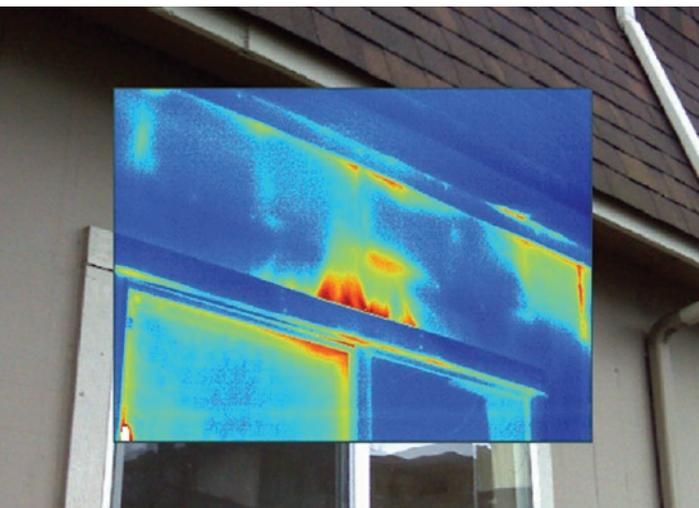
Testing with a “blower door” and a thermal imager can show you the exact location of building envelope problems. A blower door consists of a frame that seals an airtight fabric membrane into an outside doorway. Mounted in the blower door is a powerful, variable-speed fan that sucks air out of the house, creating a low-level vacuum inside. (It can also pressurize the house.) Blower door instrumentation includes gauges (manometers and anemometers) you can use to measure the flow of air through the fan at a set pressure differential—commonly 20 pascals for air infiltration and exfiltration inspections with a thermal imager, and 50 pascals for airtightness testing.

A blower door serves two functions: first, it tells you how “tight” or “leaky” a home is overall. Then, using the blower door to either draw outside air in or force air out through leak points, a thermal imager like the Fluke TiR32 makes specific leaks and other problem areas easy to spot.

**Set up for testing**

As you set up for testing, first confirm a temperature difference of approximately 18 °F (-7.7 °C) from interior surface to exterior surface for conductive inspection work, or 9 °F (-12.7 °C) for air leakage inspection work. For best results, this temperature difference should have stabilized for a period of four hours or longer. Next, as a best practice, record interior and exterior air temperature and humidity, as well as other environmental factors that may affect your results: precipitation, sun position, wind, etc. Close all outside doors, open inside doors, and make sure the HVAC system has been off at least 15 minutes.

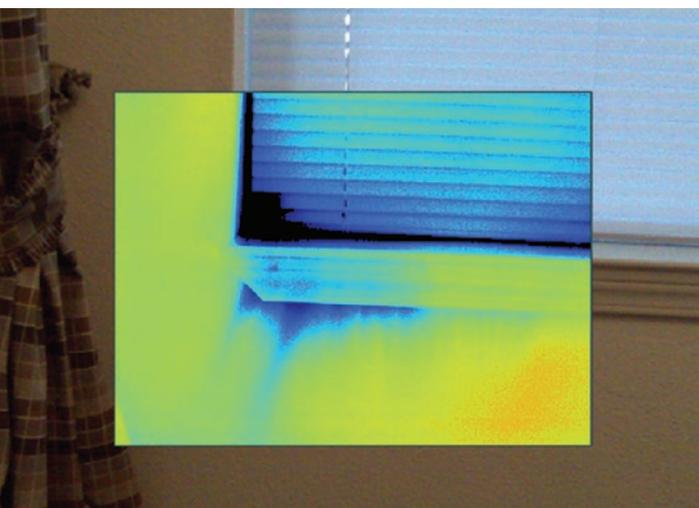




Check that your thermal imaging equipment is functioning properly, then inspect the home interior and exterior for conduction issues: insulation gaps, thermal bridging, and so on. Make a note of any issues. Next, install the blower door.

**Spot leak points**

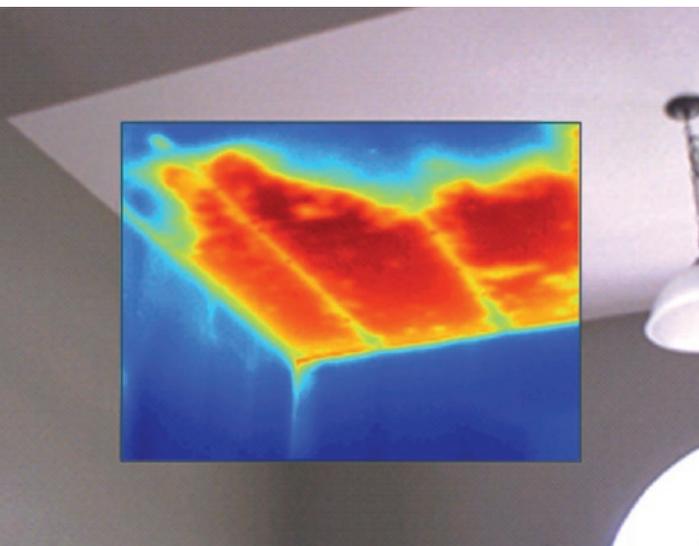
With the blower door pulling outside air through every crack and orifice, it's prime time to spot those leak points on the interior of a building envelope using the thermal imager, the ultimate "power tool" for energy audits. The imager can't "see" the incoming air, but it can detect the cool or warm surfaces created as air leaks across window sills, out of electric fixtures, and through wall and roof penetrations. A smoke stick can also be helpful in spotting air movement, but the imager works fast—and it enables you to record the thermal images for future reference.



Leak points often occur at wall, ceiling, or floor penetrations (for plumbing, lighting, and electric outlets); windows and doors; in joints between walls, ceilings and floors (top plates and sill plates), and joints around chimneys. With a thermal imager, you can capture images that document the problem spots—to include in your audit, and to serve as a guide when you return to fix the problems. You can also use a thermal imager and blower door to pressurize a house so you can study air as it "exfiltrates" from the home. (Sometimes air doesn't exit from the same places where it enters.)

**Test for airtightness**

Finally, you're ready for an airtightness test. It takes a certain amount of airflow to maintain a constant vacuum. By comparing that flow with the volume of air in the building, you can calculate how many air changes per hour occur at 50 pascals (ACH @ 50 pascals), a standard indication of how well the structure is sealed. Older, leaky houses can test at 20 ACH @ 50, or higher. Current building codes specify a maximum reading of 7 ACH @ 50. The standard for an Energy Star-rated dwelling is 4 ACH @ 50.



**Report your findings**

Prepare a written report for the homeowner, detailing what you have observed about how much energy is used, where energy is lost or wasted, how to fix any problems you have discovered, and where to find any tax help, grants, and rebates that may help cover the costs. Thermal images of problem areas are as useful as they are impressive to homeowners.

**How do I get started?**

As an HVAC pro, you are far ahead of the competition in the knowledge you bring to the energy audit process. You already understand the mechanical systems involved. You know how electricity, fuels, and combustion figure into the equation. You've already got the hard part nailed.

One way to get started in the home energy audit business is to offer free seminars at schools and libraries about how to save energy and money. When homeowners understand what they can gain from an audit, they may want to sign up. For those who want to learn more, make your energy audit services available.

### Beyond the basics

There is extensive information on home energy audits, training, and professional certification available on the Internet. Here are some recommended sources, including organizations responsible for training and certification:

U.S. Department of Housing and Urban Development

U.S. Department of Energy – Building America Residential Energy Services Network (RESNET)  
The Energy & Environmental Building Alliance (EEBA)

Building Performance Institute, Inc.  
Efficiency First

### Tools of the trade

Among the tools used for energy audits are:

- Your brain (and your experience)—the most important tool of all
- Thermal Imager
- Infrared Analysis and Reporting Software
- “Blower door” to measure building tightness and enhance thermal imager results
- Infrared thermometer for quick checks of spot surface temperature
- Smoke sticks
- Laser-distance meters for quickly measuring room size and calculating area and volume
- Past utility bills
- Digital multimeter and power meters for monitoring and analyzing energy used by appliances, lights, entertainment equipment, and other household devices
- Flue-gas analysis meters (such as the Fluke CO-220)
- Indoor Air Quality meter (such as the Fluke 922, 971, or 975)

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Printed in U.S.A. 1/2014 6001410\_EN

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