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Shrink Your Energy Bills

Making your home more energy efficient isn't rocket science

by Fran J. Donegan

Nearly 30 years have passed since the first oil crisis gave Americans an indelible lesson in energy deprivation. Yet many homeowners still don't realize how much energy seeps out of their houses every day despite the steps they might have taken. According to experts, many homes — including new ones — act more like sieves than like sealed buildings.

"What we've learned about basic energy efficiency isn't readily available to homeowners, builders and contractors," says Dave Brook, an extension agent specializing in energy for Oregon State University.

The reason is clear enough: Because much of that knowledge was developed for low-income housing as part of the federal Weatherization Assistance Program, it hasn't yet reached the mainstream housing industry. Nevertheless, it includes a number of findings that affect all homes.

For example, because hot air rises, most heat lost in a building goes right through the roof. What causes that heat loss? Leaks in attic floors are the culprit, lowering the R-value of attic insulation and draining 30 to 50 percent of a home's heating energy. And while leaks around windows and doors let out far less energy than you probably thought, gaps in forced-air ducts can cut home heating and cooling efficiency 40 percent.

Fortunately, making your home more energy efficient isn't rocket science. A couple of weekends sealing the attic and furnace ducting using materials that cost less than $50 on average will slash up to 30 percent off your energy bill. (See "Other Ways to Save," below.)

SEALING THE ATTIC

To save energy immediately, begin by sealing the gaps that lead from your living areas to the attic. Some of these gaps accommodate wiring and pipes, while others result from poor craftsmanship and the normal settling of the building. But all of them serve as passageways for heated air to escape.

That's because houses act like big chimneys. Warm air rises to top of the building, increas-

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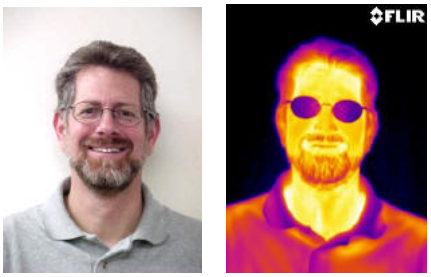
INFRARED THERMOGRAPHY

The new energy auditing tool.

By James Quarello

Thermography is the use of an infrared imaging and measurement camera to "see" and "measure" thermal energy emitted from an object. Thermal, or infrared energy, is light that is not visible because its wavelength is too long to be detected by the human eye; it's the part of the electromagnetic spectrum that we perceive as heat. Infrared thermography cameras produce images of invisible infrared or "heat" radiation and provide precise non-contact, non-invasive temperature measurement capabilities.

Today infrared thermography is becoming a more common place tool for building diagnostics. This is not because infrared is a new technology, it has been around since the 1950s, but until recently the equipment has been extremely expensive and cumbersome to operate.



Visible photograph and an infrared thermogram in an ironbow palette.

Newer cameras are portable, hand held devices that are easily operated. Prices have also come down, cameras are still many *thousands* of dollars, to where more companies are finding they can invest in a unit.

One major area where infrared thermography is growing as the tool of choice is energy auditing. Because infrared cameras are heat sensitive, their use for locating heat and energy loss in buildings is a natural progression. Missing or incorrectly installed insulation, inefficiency of warm air furnace ducts,

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ENERGY AUDITS, RATERS AND INSPECTORS.

What's the difference?

By James Quarello

These days with the rising costs for keeping our homes warm and appliances humming, we are increasingly looking for ways to save on our home energy bills. The question on most peoples minds is; how and where do I need to change or upgrade my home to save money? Enter the energy "expert".

These individuals have training or experience in energy efficiency techniques and building science. They are commonly referred to as Auditors, Raters, or Inspectors. But what is the difference between these experts?

The one major difference is the cost of service and amount of time each will spend evaluating your home. For example, auditor or rater evaluations most often involve two visits to the home. The first is to assess the home and the total energy cost and usage over the past year by auditing the energy bills. The second to re-evaluate the home after upgrades have been made and quantify the results. This of course adds time and cost onto the service.

The energy inspection on the other hand entails one trip to the home. No "audit" is conducted of the homeowners energy bills, but simply an assessment of the home for energy inefficiency. The owner is presented with a report that details the recommended upgrades, estimates the costs of the enhancements, and the energy savings related to each upgrade. It is a streamlined process that most people appreciate because; A) it is less involved and time consuming, and B) less costly.

One word of caution when choosing an energy expert. Some contractors or companies offer "free" energy audits. The problem with this quite simply is conflict of interest. A window replacement contractor conducting audits and then selling replacement windows is not an unbiased assessor. In fact he may be a shady contractor.

Which ever expert you hire, Auditor, Rater, or Inspector, be sure your energy assessor is an independent contractor not connected with any company selling energy efficiency upgrades. This will assure you receive an accurate evaluation which will guide you to the most sensible upgrades for your particular home.

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ing air pressure near the ceiling. The difference between that pressure and the lower pressure outside on a cold day drives the warm air through any crack, crevice or gap it can find. The high pressure at the top also creates low pressure near the bottom of the house, which pulls cold air in through openings around the foundation or slab.

Energy experts call this the stack effect. The larger the spread between inside and outside temperatures, the greater the pressure differences and the stronger its pull. However, if you have mold or condensation problems in your home during winter, don't do any sealing until you've tackled the moisture situation.

What insulation can't do. An insulated attic isn't necessarily a sealed attic. Insulating materials are designed to slow down heat loss through solid materials rather than to stop airflow. Insulation works with weatherizing to create a thermal boundary between the inside and outside of your home. Unfortunately, most homeowners pay attention solely to the insulation part of the equation. "Half the money people pay for insulation is often lost due to leaks," says Michael Lamb, a home-energy specialist for the Energy Efficiency and Renewable Energy Clearinghouse, a McLean, Virginia-based information network sponsored by the U.S. Department of Energy (DOE). "If homeowners sealed the attic floor before insulating, they would save a lot more energy."

Filling the gaps. Spotting the holes and gaps you need to seal is easy in an uninsulated attic. Lay planks across joists and stay on them so you don't step through the ceiling. Then check for gaps around anything that comes through the floor. Examples include the tops of light fixtures, pipes, wiring, the chimney and heating and cooling ducts. Also check for gaps around the top plates of interior partitions.

If your attic is insulated, you'll need to roll back batts to get at the gaps. Wear pants and long sleeves, gloves, eye protection, and a dust mask. Gray or black smudges in the insulation signal air leaks. If your attic is insulated with loose-fill insulation, which can't be peeled back, you might want to call a professional weatherization contractor to locate the leaks. Then seal as many of them as possible.

Instead of insulation, use latex caulk to fill gaps up to about 3/8 inch wide. For holes up to about 1 inch wide, use expanding urethane foam (it comes in a can). Be careful — the foam is hard to get off of clothes and hands. A new latex sealant from DAP ($3.50 per 12-oz. can) cleans up with soap and water.

- For larger holes, create a plug from a piece of drywall. Cut it to fill the hole, push it into place and then seal the edges with urethane foam. Or, use fiberglass insulation stuffed into plastic bags.
- Seal gaps around chimneys and stove flues with a sheet-metal collar and caulk.
- Insulate and apply weather stripping around the edges of the hatch or door that leads to the attic.
- On cathedral ceilings, apply caulk in spots where drywall meets exposed beams.

WHERE TO ADD INSULATION

Once you've air-sealed the attic, be sure insulation meets DOE standard. The standard for most of the U.S. is R-38. Call the Energy Efficiency and Renewable Energy clearinghouse (800-363-3732) for the recommendation for your area.

If you need to add more insulation on top of the old, use unfaced batts or loose fill. Owens Corning and Johns Manville make a batt encased in plastic for easy handling.

You can also reduce heat loss by insulating over light fixtures in the rooms below your attic — provided you replace the standard recessed versions with fixtures rated "IC," for insulated ceiling. To prevent airflow, buy IC fixtures that also have an air- and moisture-tight housing. They're available from most major lighting companies. Halo also offers an airtight retrofit collar for its IC fixtures.

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DETECTING DUCT LEAKS

Leaky ductwork in a forced-air heating and cooling system creates several problems. A supply duct that leaks into an attic or crawl space pours cooled or heated air — and the money you paid for it — into the void. Leaky return ducts pull hot or cold attic or crawl space air into the system. Indeed, a duct that runs through the attic can pull in 140°F air in summer, making the cooling system work that much harder. It also pulls in dust, moisture, mold, and other contaminates.

Start by reconnecting any ducts that have fallen apart. Then hunt for holes in supply ducts by feeling for the air as it leaks out and seeing if a tissue clings to return ducts as air is sucked in. Use duct mastic (available in cans or caulking tubes) to seal small gaps. For larger ones, reinforce the mastic with fiberglass mesh tape. You can also use UL-181 aluminum tape — essentially professional duct tape. Just don't use the cloth variety labeled duct tape, which really isn't for ducts.

Return and supply ducts should also be pressure-balanced for forced-air systems to work efficiently. Leaks upset that balance, and can drive heated or cooled air out of the house or pull outside air in. Unfortunately, sealing only some of the leaks can do the same thing. Have the system inspected by a pro when you're done to be sure you didn't miss any.

After the ducts are sealed, be sure any that run through unconditioned crawl spaces, basements, or attics also are insulated. Insulating long runs of ductwork is best left to a contractor. But you can handle short runs yourself with foil-faced fiberglass duct insulation. Cover all sides and secure the insulation with a cable tie.

GETTING AUDITED

If your energy bill still seems too high, get a professional energy audit. Be sure it includes a blower-door test. Without it, the contractor can only guess at your energy problems. Essentially a large fan, a blower door pulls most of the air out of the house to pinpoint outside air leaking through holes and cracks. The technician locates the gaps, measures their size, and provides options for sealing them.

A blower-door test costs about $100, though some contractors will do it for free if you ultimately choose them to do the sealing work. *(Editors note: This cost is very low, generally audits cost between $200-$400. Also you should hire an auditor unaffiliated with contracting companies to avoid any conflict of interest.)* But it's hard to find a company that performs this type of test. Contact your local utility, state energy office, weatherization contractors, and home inspectors for leads on finding someone in your area.

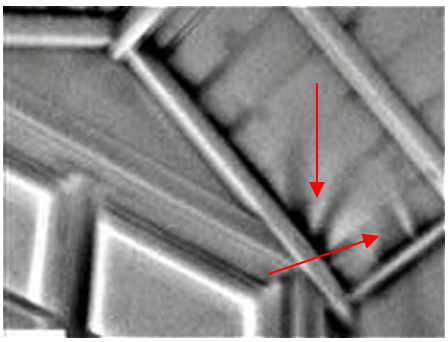
Finally, don't seal the foundation completely. A good weatherization contractor will seal it just enough to stop serious leaks without cutting off the air needed for combustion appliances, like furnaces, water heaters, fireplaces, ranges, and dryers. **Other Ways to Save** Once you've sealed the yawning chasms throughout your home, go after the details.

- Replace single-pane windows with low-e units rated R-3 (also listed as U.40) or higher, says Michael Lamb, a specialist for the Energy Efficiency and Renewable Energy Clearinghouse, an information network sponsored by the U.S. Department of Energy. "You'll cut 20 percent or more off your heating or cooling bills," Lamb explains.
- While leaks around windows bleed relatively little energy (except in exposed, windy areas), seal any obvious gaps. You'll find the largest ones between the window frame and the rough opening in the framing of your home. Use **low**-expanding foam for windows and doors (sold in cans) for best results.
- Invest in a set-back thermostat. You can slice your energy bill up to 15 percent simply by setting the temperature back 10°F for an eight-hour period.
- Install wall insulation. When properly installed, cellulose and lightweight foam products reduce heat loss and air leaks.

Thermography *continued from page 1*

and air gaps in the building shell can all be quickly detected without any invasive techniques.

Normally during an energy audit air leaks in the home are located through the use of a blower door fan and smoke pencil. This is an imprecise and time consuming method. Using the fan in unison with an infrared camera will allow the technician to quickly and accurately locate the problem areas. The door fan accentuates the air leaks, making them readily apparent to the camera. The infrared camera can also be used without a door fan to locate air gaps in a home.



Air leaks, arrows, are plainly visible in this infrared photo of a cathedral ceiling.

Another aspect of infrared diagnostics is locating forced air heating and central air conditioning ductwork leaks. Once again traditional methods are time consuming and imprecise. Duct leakage tests involve the use of a calibrated fan, a smaller version of the blower door fan, forcing air into the ductwork. First the heating and cooling registers are sealed closed. Then the fan is turned on and the speed increased until a specific pressure is attained. A leakage measurement is then made using an airflow and pressure gauge connected to the duct testing system. Estimates of efficiency losses from duct leakage can then be made from the leakage measurements. A non-toxic fog can be inject into the duct system to visually demonstrate the location and extent of leakage in the ductwork.

An infrared camera can once again be used along with the fan system to scan the duct work in the entire house. And in just a few minutes detect exactly where the duct work is leaking, including inside the walls! Knowing the location of as many leaks as possible will allow for more thorough sealing of the system which means greater efficiency and savings.

An infrared thermographic inspection should be a must for any energy efficiency assessment. If your looking for a energy expert to help lower your monthly energy bills, be sure they posses the ability to conduct this service. Remember infrared cameras precisely detect heat variations which will show exactly where money is “leaking” out of your home.