

Cutting energy use

Prioritizing cost-effective weatherization for existing homes

□ BY BRIAN KNIGHT □

It can be tough to get excited about invisible influences that affect our homes, but one of the most important is proper weatherization of existing homes and buildings. The best way to improve one's environmental impact is to spend less money on monthly energy costs. Weatherizing existing homes is an incredible opportunity to accomplish this while also increasing the dwelling's health and comfort.

In a recent blog post at the wildly popular WNC Green Blog collective, I claim that the most important priority for green homes is to reduce monthly energy costs as much as possible. Despite all the pretty finishes and exciting technologies, the most important thing to do is keep un-renewable energy use to a minimum if not be a net producer of renewable energy. This is true for new and existing construction. It's possible for an existing home with low energy costs to be more sustainable than a new green home built in a more rural setting. Personally, I think it's the monthly, energy cost number that defines it.

The best way to figure out a particular home's deficiencies is to hire a professional energy auditor to evaluate the best places for improvement. In most existing homes there are three particular projects that can have fast financial and environmental payback and will make homes more comfortable.

Air seal, air seal, air seal!

Nothing is more invisible than air movement, and few things are more important. One can expect to save 5-30 percent of their monthly energy costs by sealing air leaks. For most homes, the best way to increase comfort, improve the environment and save money is by reducing uncontrolled air infiltration and exfiltration.

One of my favorite things about new construction is that it's so easy to create an airtight dwelling. Existing homes are much more chal-

lenging. Even the newest homes built today are, in my opinion, too leaky. But the improvement needed for existing homes is often immense, as is the level of cost effectiveness associated with access.

Where to start an air-sealing or insulation project?

Most energy auditors and home performance contractors will begin an air-sealing project by measuring

the leakiness of a building envelope with a blower door test. This is the ultimate diagnostic test that puts a number on how well a building envelope performs. Generally, the results from a blower door test are much more accurate and revealing than the R-values of building components. I repeat: Blower door numbers before R-value!

By testing at the beginning of a project, we can measure the success of improvements and often times

the blower door can reveal hidden sources of air leaks.

Blower doors are extremely helpful but not mandatory, and people can improve their existing homes without them. Air movement in homes can be complex and dynamic. Generally, air enters (infiltrates) the lower areas of a home and exits (exfiltrates) the upper areas. Even a mild breeze can change the physics as can exhaust fans and different temperatures.



Conducting a blower-door test is essential to creating an airtight living space. Duncan Mcpherson, Samsel Architects photo

The most cost-effective places to start are the areas that are most accessible at the bottom and top of a home. In the basement, masonry to wood and other transitions and penetrations are good places to focus efforts. Replacing weather stripping is more important on basement doors, as is sealing windows and other possible cracks in the wall planes of lower levels. A simple strategy is to look for daylight coming into pitch black spaces. Vented crawlspaces should strongly consider being sealed, insulated and possibly conditioned.

Air-seal the ceiling before adding insulation!

Most existing homes have flat ceilings with attic insulation on the floor of the attic/flat ceiling plane of the top level. This is probably the most overlooked area to focus air-sealing efforts, even for professional home energy auditors. It can be a pain to work in an attic but it's more accessible than leaky walls, and the walls are usually trying to leak air through the attic. There is usually a strong air and vapor pressure at the ceiling plane which makes it a very effective and important place to air seal.

In order to perform this work, its necessary to peel back or push aside any insulation that is blocking the penetration or transition needing to be air sealed. Even a small, ceiling mounted light fixture can leak enormous amounts of air (and moisture) through the electrical junction box and gaps between the junction box and finished ceiling.

Recessed cans (micro chimneys) are one of the worst offenders. Even for the newest "airtight" recessed cans, its necessary to build a box or cap around them to properly seal them off. Pay very close attention to areas around upper cabinets, interior walls and dropped ceilings. Dirty colored insulation and spider webs are visual clues of air leaks. Cold, windy days are good times to feel for leaks with your hand, a surprisingly effective tool for locating them.

Perhaps the biggest leak and challenge involves the attic access door. Fold down stairs are a pain to fix and air seal but should have a very fast payback if done well. An increasingly popular method for efficient homes with vented attics is to put the access door on an exterior wall of a gable end. I think this is good strategy for existing homes when also dealing with exterior siding renovations.

What about walls?

Walls are usually the least cost-effective areas to air-seal. For one thing, walls are at the average neutral pressure plane of a house but mainly they are only accessible during exterior or interior finish renovations. I think one of the more cost-effective methods of air sealing walls is to remove the window trim and window frame. It's possible that replacing weather stripping on windows is a wise investment too. On the exterior, be careful about caulking the bottom window trim as you could be trapping a bulk water escape pathway.

Materials

I recommend the best air-sealing materials available. High quality tapes like 3M's 8067 or the vapor permeable Euro tapes are my first choices when appropriate. Quality urethane caulks are a good choice for most caulk jobs especially for anything involving masonry and exterior exposure. We've also started using acoustical sealant available in big cartridges from drywall suppliers for some locations that will stay dry yet have lots of expansion and contraction.

Spray foam is a nice tool for gaps larger than one-quarter inch, and I tend to prefer the window and door versions as they seem to stay more flexible over time. I do not recommend any water based spray foams as the ones I have tried quickly turn to dust. A light mist of water to the substrate will do wonders to a polyurethane spray foam can application. Still, I think most locations where people reach for the spray foam would be better served with high quality flashing tape.

Add insulation in the attic

If you skipped any of the above about air sealing the ceiling plane, go back. NEVER add insulation to an attic floor without air-sealing it first!

Adding fluffy types of insulation to the floor of a vented attic is a very cost-effective weatherization upgrade, sometimes even for new homes. Cellulose is my first choice followed by blown fiberglass. I do not recommend fiberglass batts but am OK with leaving existing batts in place and blowing over the top – as long as they were peeled back to do the air-sealing first! Remember that blown insulation can settle 10-30 percent after the initial installation.



A well-insulated attic door and attic insulation can cut heating costs by half.

The lowest level of insulation allowed by prescriptive law in WNC for attic floors is currently R38. This means anything less than 11 inches of fluffy insulation does not readily meet code. The 2012 international energy code requires R49, which is 14 inches of typical fluffy insulation. What exactly is cost-effective depends on many variables and is up for debate, but I am of the opinion that people should not have less than what current international law requires and represents a very cost effective level of insulation. Translation: your ceiling should have 14 inches or more of settled fluffy insulation on the attic floor.

Insulation performance drops dramatically with weak links and thermal bridging. The attic door or hatchway should be as close as possible to the level of insulation on the attic floor. Building a dam around the attic access is usually necessary to achieve the thicknesses needed for good, thick R-value performance.

My personal home's attic insulation upgrade has dramatically cut my heating costs. Here's what I did: ■ Two-inch XPS foam separates the 2-by-10 and 2-by-6 framing from the ceiling joists and acts as a dam to hold back the thick levels of fluffy insulation about to be added. The door is 3 pieces of 2-inch XPS foam taped together and rabbeted for a tight friction fit. While not quite R 50, it's a solid improvement over the loose piece of drywall it replaced and is very airtight. I waited 4 energy intensive years before deciding to take a peak into my attic's insulation condition. I cut my home heating oil consumption in half and dramatically reduced the number of summer days needing to turn on my AC.

Seal accessible ductwork

Most existing homes have ductwork in the basement, crawlspace or attic. If any of these ducts are accessible and have not already been sealed, this can be seriously easy money and increased comfort. Hire someone or get a large bucket of HVAC mastic and seal every possible metal joint or transition. Pay particularly close attention to the main air handler. Every accessible metal seam should be meticulously sealed with nickel thick layers of mastic.

Ductwork with air conditioning will probably be insulated. Depending on how accessible and leaky the ductwork is, it can make sense to pull back the insulation to seal the transitions and connections to the main trunk lines, air handler plenums and registers. This is another area where an energy audit professional can offer expertise and measure performance improvements with a duct blaster test. Sealing ductwork is most important in vented crawlspaces, vented attics and unfinished basements. If you are building new or adding on, never put ductwork in unconditioned spaces.

Every home is different and will likely have differing weatherization needs. There are several important areas of concern avoided by this article. We talk about some of them in the WNC Green Blog Collective. Don't spend any more money on wasted energy! Weatherize your home as soon as possible and enjoy the comfort, environmental and monetary benefits.

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