

# Top home energy efficiency choices

## *Build it right from the foundation up*

The average American home uses 1,400 kilowatt-hours of electricity a month. But energy-tight houses are being built in Missouri right now that average about 100 kilowatt-hours for a 3,400 square foot home! And that's without any solar collectors generating electricity.

So how low can you go in your existing home or one you hope to build? Here are 10 smart building and renovation tips to achieve a highly energy-efficient home:

### **#1: Build or upgrade the most efficient building envelope you can afford**

— That means using heat wrap on new construction. It's inexpensive and may even replace some of the insulation you otherwise would use. Still, insulation is the low-hanging fruit of energy efficiency so insulate to the max, exceeding Missouri's minimum standards if you can.

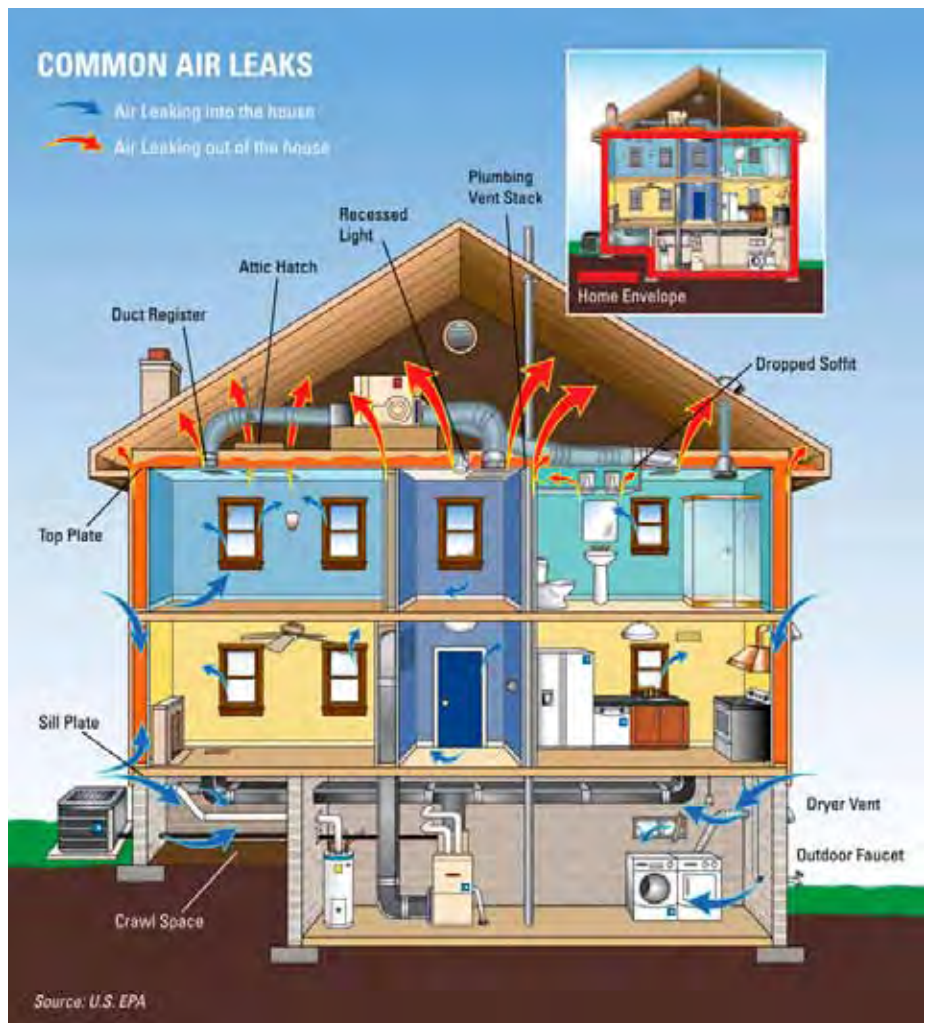
The U.S. Department of Energy (DOE) reports air leaks account for as much as 40 percent of electricity use. While insulation will take care of major leaks and drafts, don't forget caulking and weatherstripping around windows and doors and where plumbing, ducting or wiring penetrates walls, floors, ceilings and soffits. Install foam gaskets behind outlet and switch plates on outer walls. For doors, replace bottoms and thresholds with ones with pliable sealing gaskets. Also keep the fireplace damper tightly closed when not in use.

When considering building materials, look at insulated concrete forms (ICF), possibly the most energy-efficient building material available. It costs about 15 percent more than conventional materials but creates such a tight house that an air exchanger may be needed.

**#2: Buy the most efficient windows you can afford, place them wisely, then shade them** — When you consider that as much as one third of heating losses occur through windows and doors, it pays to buy the most efficient windows you can afford. Look for ENERGY STAR windows with low thermal emissivity (low-e) coatings, low overall heat transfer coefficient (U-factors) and low solar heat gain coefficient. Minimize glass on the north of your house, maximize it on the south with overhangs, awnings and deciduous trees for shade.

**#3: Consider a ground-source heat pump** — Air-to-air heat pumps aren't very effective in Missouri, according to energy consultant Doug Rye, but ground-source heat pumps are extremely effective, with efficiency above 400 percent. They're expensive but qualify for a 30 percent federal tax credit.

**#4: Add solar for hot water** — In some parts of the world, virtually all housing uses some form of solar water heater. As solar panels continue to drop in price, solar water



HouseLeaks.jpg

heaters are more affordable with shorter payback periods. They also qualify for a 30 percent federal tax credit.

**#5: Install an attic fan and ceiling fans** — Particularly in existing homes where efficiency options may be more limited than when building new, attic and ceiling fans are good choices for cross ventilation. Even a small draft will cool you down 4 to 5 degrees. Remember with attic fans, though, to seal and insulate against winter heat loss.

**#6: Light efficiently** — In another decade LED lighting may be as affordable as compact fluorescent lighting has become. Until then, CFLs are the way to go. According to ENERGY STAR, they use about 75 percent less electricity than standard lighting, produce 75 percent less heat and last 10 times longer. Some suppliers, such as Lowe's, will recycle used bulbs for you.

**#7: Incorporate solar mass** — You don't have to install expensive photovoltaic cells to enjoy the benefits of solar. Look for ways to add solar mass to your existing or future home. Stone, tile and brick walls and floors, preferably dark

in color, in combination with south-facing windows can serve as heat sinks that absorb heat during the day and release it at night. Place the mass where sunshine from the south can reach it.

**#8: Insulate to the max** — ENERGY STAR reports that only 20 percent of houses built before 1980 are well insulated. While the University of Missouri Extension Service recommends at least R-49 insulation in the attic, DOE recommends up to R-60 for wood-framed houses in Missouri. Insulating your attic, including knee walls in finished attics; exterior walls; cathedral ceilings; crawl spaces; and floors above unconditioned basements is probably the single most important cost-effective efficiency improvement you can make.

Other R-values recommended by Extension are R-18 for walls, R-25 for floors over crawl spaces, R-19 for crawl space walls, R-8 for slab edges and R-11 for basement walls. These are minimum values.

**#9: Buy ENERGY STAR appliances** — According to ENERGY STAR, 17 percent of the energy consumed in your home comes from appliances, particularly the refrigerator, clothes washer and clothes dryer. An ENERGY STAR clothes washer uses 50 percent less energy than conventional models; a refrigerator 20 percent less energy than required by federal standards and 40 percent less than conventional models sold in 2001; and a dishwasher 41 percent less energy. Clothes dryers aren't rated by ENERGY STAR, though they use a lot of electricity. Use a solar dryer instead: hang your clothes outside in summer and inside in winter to air dry for free.

**#10: Take care of your ducts** — ENERGY STAR says 20 percent of the air that moves through ductwork leaks out through loose connections, holes and cracks. When building a new home, energy consultant Doug Rye recommends placing ductwork in conditioned space, a basement or crawl space. Avoid placing in the attic, which can reach 140 degrees in summer. For existing ducts, seal leaks with mastic if you're a do-it-yourselfer; otherwise, hire a professional.

## Build or renovate for efficiency

Whether you're planning to build a new home, renovating or repairing what you've got, there are "smart" building materials that will save energy and may earn a federal tax credit.

Start with your building shell or building envelope, which is the barrier between air conditioned or heated space and unconditioned space, including the outdoors. Tighten with efficient windows and storm windows, extra insulation in the attic and walls, light-colored roofs or metal roofs and building materials such as insulating concrete forms or structurally insulated panels.

If adding a room or building all new, take advantage of passive solar design. That means designing with south-facing windows that provide good daylighting. Adding awnings, porches, shades and trees allows solar gain in the winter but blocks light and heat in the summer. Passive solar also may incorporate large masses of stone, concrete, brick or tile, known as "heat sinks," that can absorb heat during the day, then radiate it at night.

Solar water heaters are more affordable these days as the price of photovoltaic panels has dropped. You'll see an immediate reduction in electricity use. Traditional tank-type water

heaters typically use 12 percent of a home's electricity, according to Michael Bluejay, energy consultant.

For a cooler roof in summer, use light-colored shingles or metal sheets to improve efficiency by reflecting radiant heat. Darker colors absorb heat. The U.S. Department of Energy (DOE) says changing to a light-colored roof can reduce electricity use by up to 15 percent. Metal roofs have been shown to absorb 34 percent less heat than asphalt shingles and can reduce energy use by 20 percent.

Another cooling option, reflective coatings, are best for areas with hot, sunny weather much of the year. The Lawrence Berkeley Laboratory in California estimates coatings can save at least 25 percent in energy usage.

A table at <http://www.solar-estimate.org/index.php?verifycookie=1&page=white-roof&subpage> compares the reflectance of various roofing materials and shows that a bright white coating has 80 percent solar reflectance with roof temperatures of 15 degrees above the air temperature compared to black shingles that have 5 percent solar reflectance, with roof temperatures of 90 degrees above the air temperature. Go light!

Check out ENERGY STAR's Roof Products Program at [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=RO](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=RO) and comparisons of roofing products at [http://downloads.energystar.gov/bi/qplist/roofs\\_prod\\_list.pdf](http://downloads.energystar.gov/bi/qplist/roofs_prod_list.pdf).

## Create snug walls

For snug walls, add dense-packed cellulose or fiberglass or inject water-based, low-expansion foam insulation into existing walls. Spray polyurethane foams are best applied by professionals but do a better job of eliminating air leaks than other types of insulation. DOE reports that air leaks are responsible for as much as 40 percent of electricity use.

For additions, new wall options include aerated concrete, insulating concrete forms or structural insulated panels. Also consider 2x6 stud construction instead of the traditional 2x4 and 2x5. According to the Energy Efficient Network, 2x6 uses fewer studs on the exterior, thus conducting less heat through the wall.

If you're building from scratch, consider advanced house framing techniques, which according to DOE, replaces some lumber with additional insulation, thereby reducing waste and tightening the thermal efficiency of the house. Look for framing diagrams at [www.energysavers.gov](http://www.energysavers.gov).

For warm floors in winter, insulating floors above a crawl space, slab or unconditioned basement to R-25 is a good place to start.

Radiant floor heating is another option that if properly sized and installed can be 25 to 40 percent more efficient than forced air, according to experts. Electric resistance mats are one type of radiant flooring, ideal for placing under a tiled floor in a bathroom or kitchen. The heat is electric, though, so your utility bill will reflect that. Another type is hydronic tubing, which can be installed in floors above unfinished areas like basements and crawl spaces. Keep in mind, though, that hydronic tubing doesn't replace the ducts you'll still need for air conditioning.

Finally, inefficient windows lose as much as 25 percent of a home's heat, according to DOE. For tight windows, replace single-pane windows with more efficient ones. Look for low AL (air leakage) ratings on new windows; 0.1 to 0.3 is the typi-

cal range. Also important are the “U-value” (1/R) and the shading co-efficient. Buy windows whose frames include thermal breaks that interrupt heat flow and loss.

Add window overhangs, awnings and deciduous trees outside and insulating drapes and blinds inside. According to the University of Missouri Extension, window coverings such as these with an R-4 value are cost effective because they block about 75 percent of heat loss.

Storm windows, either interior or exterior, can reduce heat loss by a whopping 25 to 50 percent, according to DOE, with payback as short as 5 years, according to the Missouri Department of Natural Resources. Plastic sheeting works if you can’t afford storm windows, and simple caulking around windows will save energy.

If you’re building a new house, keep the glass area at 10 to 12 percent of the floor area.

Some of these efficiency improvements qualify for federal tax credits through 2016, and some electric cooperatives offer rebates. Go to [www.energystar.gov/index.cfm?c=tax\\_credits.tx\\_index](http://www.energystar.gov/index.cfm?c=tax_credits.tx_index) or [www.takecontrol&save.coop](http://www.takecontrol&save.coop) for details.

## The alphabet soup of building efficiently: AACs, ICFs and SIPs

If you’re adding a room, retrofitting an entire house or building from scratch, consider using autoclaved aerated concrete (AAC), insulating concrete forms (ICFs) and structural insulated panels (SIPs).

AAC, a foam-like material made of lime, cement, gypsum, water, sand and aluminum powder poured into panel molds, was developed in Sweden. It is more efficient than conventional concrete blocks and porous concrete but does not perform as well as SIPs, ICFs or even well-insulated wood-framed walls, according to [www.house-energy.com](http://www.house-energy.com).

If you’re planning to build a storm room for protection during high winds and tornadoes, heavy, ICF-built walls are extremely strong. ICFs are stackable foam concrete forms with a steel-reinforced concrete center sandwiched between two extruded foamboards. They typically have R-values from R-18 to R-35, based on the thickness of the wall, according to University of Missouri Extension, making them an excellent energy-efficient material. In contrast, 2 x 4 wood-framed walls

### Standard Framing Versus Advanced Framing Cross-section

Standard corner: Extra exterior corner studs

Standard T-wall intersection: Insulation void, Extra studs for attaching drywall

Advanced corner: 2x4 turned sideways serves as nailer, Drywall clip to hold drywall in place

Advanced ladder T-wall intersection: Drywall and interior walls are attached to "ladder," which spans between studs

Standard methods use unnecessary studs

Comparison	Standard	Advanced
Insulation Voids	3%	0%
Framing factor	15-25%	10-15%
Batt R-value	R-13	R-13
Sheathing R-value	R-0.5 to 2.0	R-2.5
Effective Average R-value	R-11.1	R-14.6 (30% higher)

[advancedframing.eps](http://advancedframing.eps)

are usually R-13 to R-18, and 2 x 6 wood-framed walls are around R-24.

ICFs also create a large concrete mass that can store and release energy, greatly adding to the thermal efficiency of the building.

SIPs are a third building option. They consist of plywood sheets laminated to a core of foamboard (up to 8 inches thick) that can be used for walls, ceilings, floors and roofs, offering energy savings of 12 to 14 percent, according to DOE. Construction is fast and may be so tight that fresh-air ventilation may be required.

## How to evaluate efficient building materials

How can you evaluate product claims? How can you be assured that the insulation or insulated concrete forms you may buy for their efficiency really do perform? While there are always product exceptions, the occasional lemon, you can buy smart by following these suggestions:

- 1. Read consumer reviews** – You can search for reviews online, but one website used by many is [www.consumerreview.com](http://www.consumerreview.com) where you can read about product comparisons and reviews by actual users.
- 2. Check ENERGY STAR** – Many appliances and home improvement products are rated by ENERGY STAR at [www.energystar.com](http://www.energystar.com). Before you buy, see if the products you are considering are ENERGY STAR rated.
- 3. Talk to local buyers and users** – The vendor should be happy to supply customer references whom you can contact for recommendations and personal experiences.
- 4. Look for certifications** – The product may have a third-party certification, sort of a Good Housekeeping Seal of Approval — such as ENERGY STAR — that gives you confidence in the product. Also find out if your vendor and installer are certified or have other credentials to qualify them to sell or install the product.
- 5. Ask for a demo** – Perhaps the vendor or installer can actually demonstrate the product’s efficiency or reference a study or test that documents results.



window.jpg



midnight.jpg



Happy NY.jpg

 **Energy Efficiency**  
*Tip of the Month*

To determine if a door leading out of your house needs new weatherstripping, look for daylight on a sunny day. If even a sliver of daylight remains visible between the door and its frame or the floor, add weatherstripping.

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# Doug Rye says . . .

## A comforting thought

No, it can't be. It can't possibly be time to write a column for a new year. It seems like I just wrote one for 2011 a few weeks ago. Unless you are a teenager, you know exactly what I am talking about. Well, time really flies when you are having fun. Of course, the frog says that time is really fun when you are having flies. Please smile.

As I think of a new year, I also think of the past. I just love it when you tell me that you were helped by something that you read in this column. I just got a call a while ago from a fellow who told me that he had just finished reading the December column and wanted to order the attic radiant barrier so that he could install it before his attic gets hot. He is a smart fellow. I hope to continue helping you for a long time, so write my phone number down — 501-653-7931 — and just file it under energy nut and continue reading these columns.

I have received a lot of calls lately from folks with comfort problems in their homes. Some have older houses, and others have fairly new ones. It really doesn't matter, because if you are not comfortable, you are not happy.

I can tell you that the subject of comfort has changed over the years. My first bedroom as a youngster was 6 feet by 9 feet. I had my own bunk bed, a place for my electric train, and I didn't have to share it with three older sisters. The problem was that I had to go through their room to get to my room. And my room had no source of heat whatsoever, except what seeped into my room through the curtain (door) from the big non-vented gas heater in the girls' room, and they didn't have to share the heat with me. On many cold mornings, I would draw pictures in the frost on the window before I would jump out of bed and run through their bedroom to get to the non-vented gas heater in the living room. Think of it. My room was freezing; their room was smothering hot; the temperatures of the other rooms were anybody's guess, and basically we were all thankful and happy just to have a house with heat.

What a difference a few years can make. Now we expect every room in our house to be the same comfortable temperature. I know of a case this past year where the homeowner threatened to file suit against the builder of his new house because upstairs was always a few degrees hotter than downstairs in the summer. We have proven many thousands of times that there is no excuse for a new house not to have affordable comfort. It is not always possible that every room will have the exact same temperature 24/7, but it

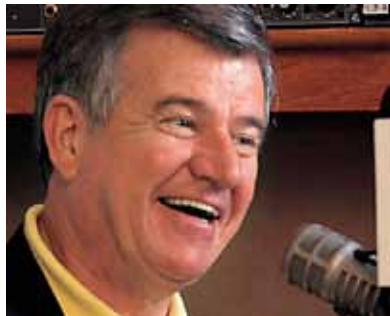
can be very close. All you have to do is build it like the electric cooperatives and I have been teaching you to do for the last 20 years. It is easy and affordable, and IT WORKS EVERY SINGLE TIME. Just ask us for help.

I recently received a call from a lady in Illinois who said that she and her family had been in their new house for seven months and the house was cold. I said, "I assume that you meant cold in the winter." She said, "Yes, it was just great in the summer." I said, "You should have built the house to my standards." She replied, "We did." My heart skipped a beat and I asked her every question I could think of. Did you caulk; did you use cellulose; did you use good windows, etc.? And yes, they even installed geothermal. I couldn't imagine what the problem might be, so I asked the age-old question. "What is the thermostat setting right now?"

Her answer was 60 degrees. I told her to turn it up to 75 degrees. She said that if she did, her husband would come through and turn it back down to 60 degrees. I told her to go whack her husband upside the head and tell him who was boss, and if that didn't work, stop cooking his meals. She laughed and said that might work. This is a true story, and it has what appears to be an easy solution. Some problems don't have such easy solutions, but I am confident I can help all of you. See you next month when I will give you more ways to make your house more comfortable.

In the meantime, Happy New Year!

*Doug Rye, a licensed architect living in Saline County, Ark., and the popular host of the "Home Remedies" radio show, works as a consultant for the Electric Cooperatives of Arkansas to promote energy efficiency to cooperative members. To order Doug's video or ask energy efficiency-related questions, call Doug at 501-653-7931. More energy-efficiency tips, as well as Doug's columns, can also be found at [www.ecark.org](http://www.ecark.org).*



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