



Optimizing the Energy Efficiency of an ICF Home

A mechanical engineer gives his top 10 strategies for achieving maximum energy savings.

By Anne Balogh, The ConcreteNetwork

Without question, using insulating concrete forms (ICFs) to build the exterior walls of a home is one of the best ways to save energy—and dramatically reduce heating and cooling costs. But builders and homeowners shouldn't become complacent. There are many other measures they can take to boost the energy performance of an ICF home. [Continue >](#)





"People think that just building a home with ICF walls covers it in terms of energy efficiency, but it doesn't. The true secret to optimum energy efficiency is to make the structure as airtight as possible while keeping the air quality very pure," says Richard Rue, CEO of EnergyWise Structures, Arlington, Texas. His mechanical engineering firm specializes in ultra-energy-efficient construction by designing the HVAC system to work in harmony with a structure's thermal envelope. Along with maximizing a home's energy performance, the company also focuses on indoor air quality to ensure a healthy, mold-free environment.

To come up with engineered solutions for obtaining superior energy efficiency, Rue uses a proprietary computer program developed after more than 15 years of experience in analyzing over 20,000 structures. He knows, probably better than anyone, the strategies that work and the mistakes to avoid. Here are his 10 tips for making ICF homes super energy efficient.

"With ICFs, you've certainly used the best wall system available. All these other strategies just complement it to complete the thermal envelope," he says.





1. Install top-quality windows and doors

When you are sizing mechanical systems for ICF structures, the load required largely depends on the windows and doors: how many, how well insulated they are, and what direction they face, Rue explains. He recommends using "thermally broken" windows, those with wood or vinyl frames as opposed to aluminum, which readily conducts heat and cold. If you plan to install sliding glass doors, also avoid aluminum frames and buy the best doors you can afford, with gaskets that seal properly to minimize air infiltration. As an alternative, Rue suggests installing French doors that swing open only on one side.

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Using double-pane low-E glass in windows and doors will also curtail heat loss in the winter and heat gain in the summer. "Look for the U-factor of the glass—anything below 0.35 is good," says Rue. The U-factor (also called the U-value) measures the conduction, radiation, and convective heat transfer from the warm side to the cold side of the window. The lower the U-factor, the better insulated the window.

2. Control interior moisture

In airtight homes, it's essential to control humidity levels to prevent mold and mildew problems. "You must address every room in the house that creates moisture, such as the kitchen, laundry room, and bathrooms," stresses Rue.





Some moisture-control remedies he recommends:

- o Install humidistatically controlled fans in the bathroom. “Once the room reaches 50 percent relative humidity, they will automatically come on to get rid of the moisture,” says Rue.
- o Don’t install vent hoods in the kitchen that just recirculate interior air. They should always vent to the outside of the home.
- o Install fresh-air venting in gas fireplaces so they’re not drawing combustion air from inside the house.

3. Use variable-speed HVAC equipment

A single-speed furnace or air conditioner comes on full-blast no matter what. That may be okay in the dead of winter or heat of summer, but in the spring or fall, when outdoor air temperatures are less extreme, a single-speed unit may heat or cool rooms too quickly.

“Variable-speed equipment can ramp down from a 5-ton unit, for example, to as little as a 1 1/2 tons,” says Rue. “This will help control moisture in an ICF house much better because the unit will operate at a lower speed and run longer to control humidity.”

Another must is a humidistat that works in conjunction with the thermostat, so the HVAC equipment will continue to run until the house reaches optimum humidity levels. “When you use these systems, not only will you have an ultra-energy-efficient home, you will also have an ultra-healthy home with dramatically better air quality. Keeping humidity levels, below 50 percent, creates an environment where even dust mites and mold spores can’t grow,” Says Rue.





4. Size HVAC equipment correctly

Seek the expertise of a professional mechanical contractor when choosing the right load capacity for the HVAC equipment in an ICF home. Oversizing can lead to higher utility bills as well as moisture and mildew problems.

“HVAC contractors often think more is better. It’s not—even for heating,” says Rue. A well-built ICF home, for example, may need only 30,000 BTUs of heating capacity. But the smallest single-speed gas furnace available puts out about 60,000 BTUs, more than double the capacity the home needs. This excess heat can be a problem, according to Rue. “The second year the owner is in the home, everything that has moisture in it, like the caulking for the molding and cabinetry, will start to dry out and crack because there’s way too much heat in the house,” he says, noting that viable solutions are to switch to a heat pump or install a two-speed furnace that can operate at a lower capacity.

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5. Insulate the attic with sprayed foam

A 6-inch-thick application of sprayed foam—applied to the underside of the roof, with no attic venting—will keep the temperature of the attic in an ICF home within 10° F of the temperature of the living space year-round, claims Rue.





“If you spend the money to build with ICFs, it would be foolish not to spend the extra money (about \$2 per square foot) to insulate the attic with sprayed foam,” he says. Another benefit: Applying the foam to the underside of the roof rather than to the attic floor makes the space entirely usable for storage.

Rue is not a fan of using fiberglass insulation, because it won't completely block air infiltration. “If you build an ICF house and put fiberglass in the attic, it's like building a Ferrari chassis and dropping in a Yugo engine,” he contends.

6. Locate all ductwork in insulated space

Ironically, the ducts that distribute conditioned air throughout the home are often the most poorly insulated elements of the thermal envelope. Adjustments in construction that locate the ductwork in insulated space will be rewarded with a sizeable reduction in monthly heating and cooling bills, and sometimes a drop in HVAC system requirements. “For a 3,000-square-foot house, on average, you can reduce the tonnage requirements by at least 1/2 ton because you don't have duct heat loss or gain,” says Rue.

If the ductwork runs through the attic, insulate the space with sprayed foam (as noted above). Poorly insulated attics can reach temperatures exceeding 135° F. Other options include installing the ductwork in furr-downs, crawl spaces, or basements (in one-story homes) or laying the ducts on the rafters and covering them with foam or cellulose insulation.



On the interior of an ICF home, pay close attention to details such as placing ductwork in insulated space, and blocking areas where outside air can penetrate such as around doors and window.





7. Caulk every spot where air could enter

Building with airtight ICF walls doesn't make caulking obsolete. There are plenty of penetrations in the building framework where air can enter, such as around window and door frames, sill plates, and entry points for plumbing and electrical systems.

The true secret to optimum energy efficiency is to make the structure as airtight as possible while keeping the air quality very pure.

"You can't overcaulk. The rule of thumb: If it looks like it could leak air, caulk it," says Rue. He advises paying special attention to windows and doors, caulking them thoroughly with a 35-year siliconized material. On the interior, he says to caulk any penetrations into the attic.

8. Avoid the use of recessed can lights

Recessed lights that penetrate into the attic space can be the "kiss of death," unless you've insulated the attic with sprayed foam, says Rue. "One of these seemingly innocuous little lights represents 1 square foot of uninsulated attic space, and 20 of them is equivalent to having a door open in the attic at all times."





When a homeowner insists on recessed lights, he recommends paying a few extra dollars for an insulated brand with airtight seals.

9. Install compatible HVAC systems

Only use HVAC equipment from the same manufacturer to optimize operating efficiency, advises Rue. “Air conditioning contractors are notorious for mixing and matching equipment to save money. But the system will run more efficiently if all the components—including the condensers, furnace, and coils—are from the same manufacturer,” he says.

10. Provide “ventilation on demand”

ICF homeowners are sometimes concerned that their homes are too airtight and will permit the buildup of dangerous carbon monoxide levels. For peace of mind, Rue recommends the installation of a “ventilation on demand” (VOD) system—a CO2 sensor that automatically monitors the air quality of the house.

“When the air quality gets to an unacceptable level, it will send a signal to the furnace to open up a motorized damper that brings in outside air to improve the indoor air quality,” he explains. “It’s a very inexpensive piece of assurance (the cost is about \$300) that you have high-quality air in the house.”





VOD also eliminates the need for a separate system to continually bring in outside air. “Manufacturers of these systems claim they bring in ‘fresh’ air, but you’re also bringing in humidity and pollution,” notes Rue. “You’re better off spending your money on a good air-infiltration system.”

FOR MORE INFORMATION

EnergyWise Structures (www.energywisestructures.com)

More wall insulation? No need with ICFs

Because ICFs completely encapsulate concrete in two layers of polystyrene foam insulation—the same material used for foam coffee cups—they provide a nearly continuous barrier against air infiltration. “About 70% of all air leakage through a house is through the walls, and ICFs eliminate that leakage,” says Rue. The polystyrene foam used with ICF systems outperforms all other types of insulation, including rock wool, fiberglass, and cellulose, he adds. “With most ICF systems, you’ll get 2 1/4 to 2 1/2 inches of foam on each side of the concrete wall, which is more wall insulation than you’ll ever need.”

Concrete walls also have a high thermal mass, which shields the home interior from outdoor temperature extremes, reducing peak and total heating and cooling needs. “You can heat and cool three ICF houses for every one house that’s typical 2x4 wood-frame construction with fiberglass insulation,” Rue says.

Several types of ICF systems are available, including block, panel, and plank types, but all offer similar benefits. ICF homes also are less drafty and maintain more even temperatures than a typical wood-framed home.





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NAVIGATION & USER TIPS

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ABOUT THE CONCRETE SHERPA

The Concrete Sherpa is a team of people that represent the experience, teaching and learning of our team members and other industry leaders *on a mission to make life better for the concrete contractor*. We are an idea center striving to deliver thought provoking ideas based on “Concrete Advice for Business and Life” to stimulate you to reach new heights. As a user, you should remember to consider all information you receive, here at the Concrete Sherpa or elsewhere, not as a *cast in concrete* recommendation, but rather as an idea for you to consider and ponder.



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THE JOURNEY LEADING TO THE CONCRETE SHERPA PROJECT

The Concrete Sherpa Project (A [Sherpa](#) is a “guide”) was born at The Concrete Network in mid 2004. Here is how it happened:

The biggest surprise, or gift, since starting The Concrete Network in 1999 has been the concrete contractor friends from around the country we’ve made and witnessing the passion they have for what they do. These people include Dave Pettigrew, up in the San Francisco Bay Area, or the Verlennich brothers in Minnesota, or Bob Harris in Georgia, the list goes on and on. It’s quite inspiring.

We were once asked, “How are you so excited every day about concrete?” Well the answer is simple, it is impossible to not be excited about concrete when you have the job we do—interacting with hundreds of concrete contractors from every state in the country.

The thing we’ve learned about concrete contractors is that most are passionate *craftsmen*—they are often less passionate and experienced in the “office stuff”. Human nature channels us to do what we are most comfortable with; learning how to use a new saw-cutting tool is comfortable; learning and implementing a new estimating strategy, or job management tool, is not so comfortable.





Sherpa info

THE JOURNEY CONTINUES...

So Sherpa was born to provide FREE and easy to use information on topics many contractors are not too comfortable with.

- Concrete Sherpa is here to provide help to contractors who are often 'Lone Rangers' and don't have anyone to get solid business advice from.
- Concrete Sherpa is here to provide help for contractors who have to work too hard and too many hours in their business, and one day realize they need to work *on their business, not in their business*.
- Have fun with Concrete Sherpa and go faster towards reaching success than you might have on your own.
- To skeptics who think something free can't be valuable, or there must be a trick- visit Concrete Sherpa and decide for yourself.

We hope you make great use of the Concrete Sherpa and it helps you to become an awesome success for yourself, your family, your church, and your community.

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