Your New ICF Home Won't Guarantee Low Utility Bills, But EnergyWise Will

A "Systems Approach" Can Maximize Energy Savings and Provide Many Other Tangible, Healthy Benefits

The market is red-hot for foam insulated homes and likely to gain even more steam as energy prices continue to escalate with no end in sight. Many ICF manufacturers have reported a tremendous increase in sales for new single-family homes built in 2007. These trends are expected to increase as utility prices skyrocket out of sight.

This ICF/spray foam insulated home in Tennessee, the winner of a 2004 Concrete Excellence Award, used EnergyWise's "systems approach" to achieving maximum heating and cooling efficiency. Although the home is a massive 13,524 square feet, electricity for the heating, cooling and hot water costs run about $5.50 per day or $166 per month. [Credit: Photo courtesy of Eddie Burks]

Certainly, one of the main reasons for this growth is the superior energy efficiency of foam homes when compared with typically insulated wood-frame construction. Building homes using ICF's and spray-on foam insulation can potentially save hundreds of dollars annually in heating and cooling expenses. However, constructing an energy-efficient thermal envelope does not always guarantee rock-bottom utility costs, contends Richard Rue of EnergyWise Structures, McKinney, Texas.

"It is sad how many frustrated people we talk to who are not getting the energy savings they expected. They contact us and say: 'I spent all that extra money to build a foam insulated home, because I thought it would be the panacea pill and automatically ensure low utility bills.' Unfortunately, they only have part of the picture," says Rue. "One of our dealers sprayed a 4,000 square foot bank building a few months back. The builder decided not to take our dealer's advice on using our services for engineering the HVAC system, because he indicated that he had built this type of structure many times in the past with conventional insulation. His HVAC contractor installed fifteen tons of air in the bank building, and the result was a structure in which they cannot get the relative humidity below 73%." This is an example of why Rue stresses the importance of taking a "systems approach" when designing and building a foam insulated structure (see Rue's other strategies for achieving optimum energy savings). As part of a systems, or whole-house, approach, the HVAC system is engineered to work in harmony with the structure's thermal envelope and local climate conditions. This can assure the homeowner of three important benefits:

- **A well-designed HVAC system that will heat and cool efficiently, even during temperature extremes.**
- **Comfortable humidity levels in the home and a healthier living environment.**
- **An ultra-energy-efficient structure.**

According to Rue, "The 'systems approach' starts with proper engineering of the entire package: the mechanical systems, doors and windows, the insulation, and caulking to prevent air infiltration. If you take the 'systems approach' to building an ICF home, you can put your thermostat at virtually any temperature, and once the temperature and humidity stabilizes, it will take very little energy to maintain it."

Common mistakes affecting energy savings

Properly engineered ICF homes are inherently energy efficient allowing owners to easily use smaller-capacity heating and cooling equipment. However, many HVAC contractors are unfamiliar with the superior thermal qualities of foam homes and therefore end up installing oversized equipment or poorly-designed duct systems. This results in higher equipment pricing as well as higher operating costs.

Another common mistake is to mix and match heating and cooling equipment, using components made by different manufacturers. Like a precision-engineered automobile, the HVAC system will operate much more efficiently if all the equipment is compatible. Variable-speed systems also deliver better energy performance than single-speed equipment, because they automatically adjust the flow of heated or cooled air to the desired comfort level. These systems will typically run longer, but at lower speeds, providing better humidity control while reducing operating costs.

Rue frequently encounters the common mistake of installing air-to-air heat exchangers in ICF homes, based on the flawed thinking that since foam homes are more

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On the left, is a home built in 2006, conventionally insulated and highly "EnergyStar" rated. Notice the snow on the roof of the EnergyWise engineered SIP/ICF house in the middle — further evidence of foam's superior energy efficiencies. On the right, is an inefficient older home. All these homes are located in the historic district of McKinney, Texas.

This 2,542 square foot EnergyWise engineered SIP/ICF home is GUARANTEED not to exceed $38 per month for the heating, cooling and hot water bills.
[Credit: Photo courtesy of Joyce Camp]

airtight, bringing in outdoor air is necessary to maintain good indoor air quality. "If you install an air-to-air heat exchanger, especially in hot and humid or polluted climates, you are just asking for trouble," says Rue. "Why bring in additional outside moisture or polluted air? There is no need. Although foam homes may be more airtight, the average house will have at least a 10% to 30% window-to-wall ratio. There is enough leakage through windows alone to make up for any air exhausted through bathroom or kitchen venting." ICF homeowners are sometimes concerned that their homes are too air-tight and will permit the buildup of dangerous carbon monoxide levels. For peace of mind, Rue recommends the installation of a "ventilation on demand" system — a CO2 sensor that automatically monitors the air quality of the home.

"With the 'ventilation on demand' system, if the air quality reaches an unacceptable level, the sensor will send a signal to open up a motorized damper that brings in outside air to improve the indoor air quality," he explains. "It is a very inexpensive system (the cost is about $400) that provides assurance that you have high-quality air in the house."

Using the "systems approach" to building an ICF home allows you to put your thermostat at virtually any setting, and once the temperature and humidity stabilize, it will take very little energy to maintain it.

"Ventilation on demand" also eliminates the need for a separate system to continually bring in outside air. "Manufacturers of air-to-air heat exchangers claim they bring in 'fresh' air, but they are also bringing in humidity and pollution," notes Rue. "Therefore, you are better off spending your money on a good air-filtration system."

Choosing the correct method to properly insulate the attic with foam insulation is another key factor in the energy performance of an ICF home—and in reducing the overall operating costs of HVAC equipment. Unfortunately, most builders subscribe to the "R-value myth" and do not always make the best choice, says Rue. Comparing the R-values, which are determined under laboratory conditions, can be deceiving, he explains. These values are based primarily on the ability of a material to resist the conduction of heat and do not fully account for air infiltration through the insulation system. Controlling this air movement is vital to ensuring thermal comfort and minimizing energy use. Spun fiberglass is an example of an insulation material that boasts high R-values, but has poor air-infiltration control properties. Instead, Rue recommends the use of sprayed-foam insulation on the attic roof deck, because it is an excellent infiltration barrier, and it puts your HVAC system into conditioned space.

The symptoms of improperly sized HVAC systems

If you are living in a foam home and are not enjoying the lower utility bills you expected, chances are the problem originates with poor engineering of the HVAC system. The following are some symptoms of an improperly sized system and what they might mean.

1. Short-cycling.

One of the easiest symptoms to recognize is short-cycling of the central air conditioner. If the unit is turning on and off four to five times per hour in the heat of summer, it is not operating efficiently. Instead, the unit should run continuously for 40 to 50 minutes out of every hour to maintain consistent room temperatures and to achieve more comfortable humidity levels. "What most homeowners do not realize is that when the AC unit first turns on, it goes through a start-up process that will make the unit very inefficient," says Rue. "If a unit short-cycles four times an hour, it is using as much energy as if it were running for two hours continuously." The problem is usually due to oversizing. A 2,000 square-foot EnergyWise-certified foam insulated house located in a Sun Belt state may need only 1-1/2 tons of cooling capacity, compared with 4 tons for a conventionally insulated wood-frame structure of equal size.

2. Uncomfortable humidity levels.

One of the consequences of short-cycling is uncomfortable humidity levels which compound the problem by compelling homeowners to turn the thermostat even lower, because they feel clammy. "In an ICF house that is properly engineered, you will feel cool even when the thermostat is set as high as 76 degrees, because the humidity levels are low. The house should not be above 50% humidity in the summer," says Rue. Too much humidity can also be caused by the use of an air-to-air heat exchanger, which may be ushering in moist outside air. The simple solution is to turn

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it off, says Rue.

3. Mold, mildew, and warping.

In addition to making homes uncomfortable, high humidity can encourage the growth of mold and mildew. You may notice mold growth in bathrooms and on interior walls or ceilings. Another sign of too much humidity is warping of wood floors and wood-framed windows.

4. A home that is too dry.

Over-sizing of the furnace is just as bad as over-sizing of the AC system. "More is not better, even though a mechanical contractor might tell you so. You end up drying out the house to the point that interior caulking will actually crack and peel. The humidity level should not drop below 30%," says Rue. Static electricity is another sure sign that the humidity level is too low. Rue recommends buying an inexpensive desktop humidistat to monitor humidity readings year-round.

Who to turn to for help

Whether you are a builder or homeowner, you should always seek the services of a mechanical engineer or licensed HVAC professional that specializes in foam-insulated structures when sizing and designing the duct layout for the heating and cooling system. It is important to select a professional who will take a whole-house approach, accounting for such factors as the square footage of the space, insulation of the thermal envelope, the number of windows and doors, and the climate. EnergyWise, for example, uses a proprietary computer program generated from experience derived from NASA thermal consultants for the Mercury, Gemini and Apollo space programs to perform a detailed energy analysis of each house. Included are energy-consumption comparisons of different heating and cooling systems. It then matches the HVAC system to the thermal envelope, with consideration for healthy indoor air quality. Then, an EnergyWise engineer designs the HVAC duct system which is critical to proper air distribution. The company even offers a monthly average utility cost guarantee if the builder or homeowner follows the EnergyWise plan. Rue says that an EnergyWise-certified foam home will use less than a third of the energy for heating and cooling than a typically insulated structure constructed to current code.

EnergyWise uses a proprietary computer program generated from experience derived from NASA thermal consultants to perform a detailed energy analysis of each home plan.

"When you use a licensed mechanical engineer, you have someone to turn to who is responsible for the correct sizing and layout of the ducts for the HVAC system. The engineer should get involved from day one."

How do you find a qualified mechanical engineer, particularly one that specializes in ICF/foam-insulated home systems? Rue recommends asking the manufacturer or distributor of the ICF products. "People who are selling you ultra-energy-efficient products should take responsibility for giving you the resources you need to achieve successful results," he says.

You should also insist on an inspection of the home to ensure that the design and engineering are done properly. EnergyWise has developed procedures to videotape inspections of every job and plans to send copies to the homeowner and builder as a visual record.

"We can do all this – the engineering and inspection – for about 35 cents per square foot of heated and cooled area. If you are building a 3,000 square-foot house, you can get a mechanical system that is professionally designed, engineered and inspected – along with a guarantee of lower utility costs – for about $1050," says Rue.

A wise investment indeed in this age of soaring energy costs!

About Richard Rue and Energy Efficient Construction Methods

Richard Rue, CEO of EnergyWise, is a recognized industry spokesman and mechanical/thermal consultant with over 30 years in HVAC, insulation, energy consumption and conservation. His time-tested expertise highlights the critical nature of properly engineering HVAC systems to avoid frequent post-construction problems and complaints.

From manufacturing to geo-thermal, laboratory testing to engineering over 40,000 structures, Mr. Rue has real-world performance statistics that support his assertions.

For more information, visit online at www.energywisestructures.com and www.energywisefoam.com.

Saving Energy Can Earn Mortgage Credit

Homeowners who live in energy-efficient foam homes not only enjoy dramatically lower utility bills and better air-quality, they can also qualify for larger mortgages.

Some mortgage lenders are now offering Energy Efficient Mortgages (EEMs), which increase the purchasing power of buyers who build homes that conserve energy or who make energy-saving improvements to existing homes. An EEM recognizes that energy-efficient homes cost less to operate than standard homes. The estimated energy savings are added to the borrower's income to allow the buyer to qualify for a larger loan amount.

For more information, visit Residential Energy Services Network at www.natresnet.org and Indigo Financial Group at www.energyefficient-mortgages.com.

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