Tax Credits, Anyone?

In 2005, Congress passed, and the president signed into law, the 2005 Energy Policy Act (EPAct). One provision of this act is a $2,000 per home business tax credit for builders who build energy-efficient homes. The homes must be sold in 2006 or 2007 and must use no more than 50% of the energy used by a home built to 2004 International Energy Conservation Code (IECC) standards. To show that the home will perform to this level, it must be modeled using IRS-approved software and then inspected, tested, and approved by a certified HERS rater.

So how do you build a home 50% better than 2004 IECC? That's an excellent question. But unfortunately, there is no single answer. The answer depends on where the home is being built, and on what energy-saving features the builder is willing to put into the home. Some energy-efficient builders may find they are already building homes that qualify for the tax credit. Others may find the goal daunting, but ultimately attainable. Still others will find that the investment required to attain the 50% goal greatly exceeds the credit.

As the product manager for Architectural Energy Corporation's REM/*Rate* home energy rating software, I talk to raters from all over the country. Many of those raters are using the REM/*Rate* software to determine if their builder clients qualify for the tax credit, and if not, what they will need to do to get there. I have talked with raters whose builders' homes meet the 50% goal with little or no modification—custom and production builders in climates ranging from Wisconsin to Arizona. I have also had discussions with raters who believe they can convince their clients to make the improvements necessary to obtain the tax credit. And of course, I've heard from those who feel there is no way their builders will make the design and construction changes needed.

At the recent Residential Energy Services Network (RESNET) conference in San Antonio, Texas, I made a presentation titled "Can It Be Done? How to Meet the 50% Threshold for New Federal Energy-Efficient Homes Tax Credit." In preparation, I did some analysis using the REM/*Rate* software. The point of the analysis was to demonstrate the relative impact that some energy-saving design improvements might have on typical energy-efficient homes being built today (see Table 1). These improvements are not mandatory and costs are not considered. Working with a rater and/or software, builders can determine which improvements make sense for them.

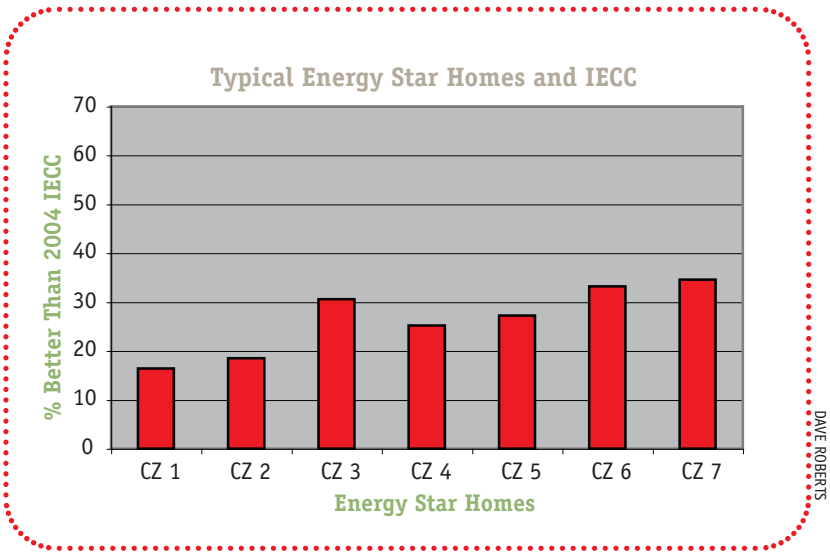

Figure 1. The graph shows how typical Energy Star Homes built in the seven IECC climate zones compare to the 50% better than IECC goal.

Figure 1 shows how seven typical homes built across the country that meet the 2006 Energy Star standards compare to the 50% goal. Why are some Energy Star homes further away from meeting this goal than others? It's because the 50% better than IECC goal covers only space heating and cooling, while Energy Star and HERS ratings cover all energy use in the home, including water heating, lighting, and appliances. So right out of the gate, you can see that it may be harder to attain the 50% goal in some climates than in others. Let's check it out.

In Figure 2, I've added a number of improvements to these homes. The improvements are added sequentially, and the results are cumulative. In other words, the bar labeled "Ducts inside" includes all the previous measures. The impact of any single improvement can be determined by comparing that bar to the one to its immediate left.

The improvements, in sequential order, are as follows:

- Increase the ceiling insulation to R-50.
- Install a 96 annual fuel utilization efficiency (AFUE) furnace.
- Install a 17-SEER air conditioner.
- Reduce infiltration to 1 ACH_{50} and install exhaust-only mechanical ventilation so credit can be taken for the reduced infiltration rate.
- Move all ducts inside conditioned space.

As you might expect, the impact of these improvements depends on the climate and the starting efficiency. As you can see, putting a high-efficiency furnace

Table 1. Analysis Details

IECC Climate Zone	1	2	3	4	5	6	7
Representative Climate	Miami	Houston	Charlotte	St. Louis	Indianapolis	Minneapolis	Duluth
Conditioned Floor Area Per Floor	2,000	2,000	1,000	1,000	1,000	1,000	1,000
Total Conditioned Floor Area	2,000	2,000	2,000	3,000	3,000	3,000	3,000
Number Of Stories	1	1	2	2	2	2	2
Foundation Type	Slab	Slab	Crawl	Basement	Basement	Basement	Basement
Window area, North	45	45	45	67.5	67.5	67.5	67.5
Window area, South	45	45	45	67.5	67.5	67.5	67.5
Window area, East	90	90	90	135	135	135	135
Window area, West	180	180	180	270	270	270	270
Duct Location	Attic	Attic	Attic	Attic	Attic	Attic	Attic
Supply Duct Area	540	540	540	810	810	810	810
Return Duct Area	100	100	100	150	150	150	150
Walls U-Factor	0.082	0.082	0.082	0.082	0.060	0.06	0.057
Doors U-Factor	0.65	0.55	0.4	0.4	0.35	0.35	0.35
Ceilings U-Factor	0.035	0.035	0.035	0.03	0.03	0.026	0.026
Slab R-Val, depth	0	0	0	10, 2	10, 2	10, 4	10, 4
Crawlspace ceiling U-Factor	0.064	0.064	0.047	0.047	0.033	0.033	0.033
Window U-Value U-Factor	0.65	0.55	0.4	0.4	0.35	0.35	0.35
Window SHGC SHGC 0.400	0.35	0.4	0.45	0.55	0.55	0.55	
Average infiltration ACH_{50}	7	7	6	6	5	5	5
Duct insulation R-Value	8	8	8	8	8	8	8
CoolingSEER	14	14	14	13	13	13	13
Heating (gas furnace) AFUE	80%	80%	80%	90%	90%	90%	90%
Heating (electric HP) HSPF	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Thermostat man/prog	prog	prog	prog	prog	prog	prog	prog
Duct insulation R-Value	8	8	8	8	8	8	8
Duct air leakage CFM_{25} / CFA	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Hot water (gas) EF, gas	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Hot water (electric) EF, elec	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Lighting % Fluorescent	12.1	12.1	12.1	12.1	12.1	12.1	12.1
Refrigerator kWh/yr	650	650	650	650	650	650	650
Dishwasher EF	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Ceiling Fans CFM/Watt	0	0	0	0	0	0	0

in Climate Zone 1 (Miami) makes no sense at all. And putting a high-efficiency air conditioner in Climate Zone 7 (Duluth) also makes no sense. Surprisingly, adding the high-efficiency furnace in Charlotte has a greater impact than adding it in Duluth. This is because the starting points are different—an Energy Star Home in Charlotte has an 80-AFUE furnace, while the one in Duluth has a 90-AFUE furnace.

The last two improvements warrant discussion. The 2004 IECC is the first model code to provide energy credit for homes with infiltration rates below 0.35 natural ACH. All previous codes had set this level as a floor below which no credit could be earned. To get credit for the tighter shell, the home must be tested and a mechanical ventilation system must be installed. As we all know, infiltration is one of the biggest drivers in the energy use of a home, so getting the shell tight and taking credit for it is very important. Duct leakage is another big energy hog. Moving the ducts inside the conditioned space greatly reduces, or even eliminates, duct leakage.

There's another reason why these last two improvements are important. Nearly all of the homes I've seen that qualify for the tax credit have these three things in common:

- very tight shells (1–2 ACH_{50});
- mechanical ventilation systems (to get credit for the tight shell); and
- ducts inside conditioned space.

This isn't to say that homes can't be built to meet the 50% goal without these features. But from what I've seen and heard, these features are common among homes that qualify for the tax credit today.

In Figure 2, Miami, representing Climate Zone 1, does not meet the 50% goal. So how can we get Miami to the tax credit level? Figure 3 shows two improvements that enable us to do so: adding windows with a low solar heat gain coefficient and adding fluorescent lighting. Both of these improvements reduce the solar and internal gains in the home and significantly reduce the cooling load. Note, however, that these same measures have little or negative impact in the other climate zones.

Window Orientation

The models I used in the analysis for my presentation at the RESNET conference had the worst possible orientation for most climates—50% of the window area faced west, 25% east, and 12.5% each north and south. After the presentation, several folks asked about this and wondered what the impact of using better orientation might be. Figure 4 shows the impact of rotating the homes 90° so that 50% of the window area faces south, 25% faces north, and 12.5% each faces east and west. While the impact of this change is small, it is often a no-cost/low-cost improvement. Simply orienting standard homes so that most of the window area faces south will help builders meet the 50% goal. It should be noted that the windows in these models have no overhangs. Good passive design, including optimized solar control and window orientation, would further increase the savings relative to 2004 IECC.

A Tale of Two Homes

A question I often hear is What HERS Index indicates that a home will meet the 50% goal? The answer: There isn't one. Remember, only space heating and cooling are included in the tax credit analysis, while all energy is included in the HERS Index. This difference explains why the HERS Index is not a reliable indicator of tax credit status.

To demonstrate this, I modeled the Indianapolis home with two different types of improvement—those that focus on space heating and cooling, and those that focus on water heating, lighting, and appliances. Figure 5 shows how different the HERS and tax credit results can be. With the improvements, both homes ended up with a HERS Index of 71, but only the home with the space-heating and -cooling improvements meets the 50% better than IECC goal. The home with the water-heating, lighting, and appliance improvements is nowhere near qualifying for the tax credit.

Now this isn't to say that a rater working in a particular geographical area, with a particular type of home and a list of typical improvements, couldn't develop the "feel" for the HERS Index that is needed to meet the 50% goal. But nationally, it would be impossible to generalize.

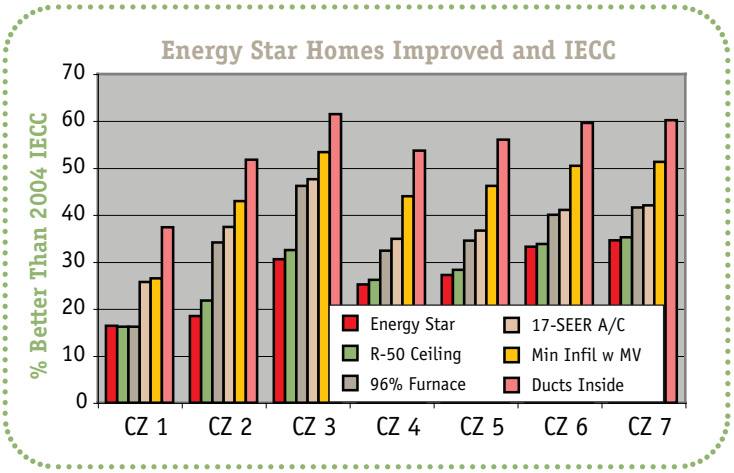

Figure 2. Adding more energy-efficient features to the homes helps move them toward meeting the 50% goal, though the effect of these measures varies by climate. The measures shown are examples, and are by no means mandatory. Using software helps the user to determine what works best for any given builder and climate.

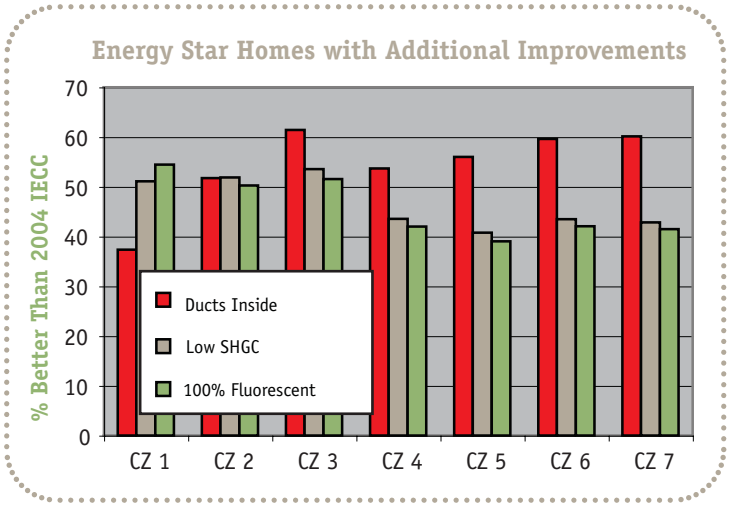

Figure 3. Additional improvements that help in Climate Zone 1 (Miami), reducing solar and internal gains, have just the opposite effect in colder climates.

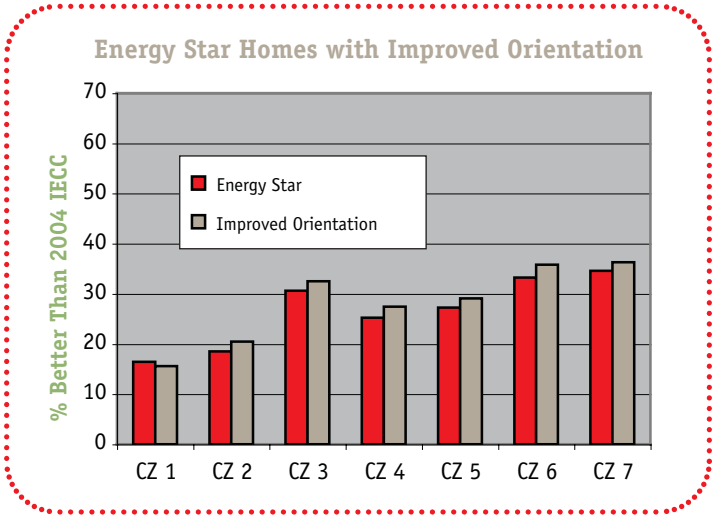

Figure 4. Simply orienting standard home designs so that most of the glazing faces south can help to achieve the 50% goal.

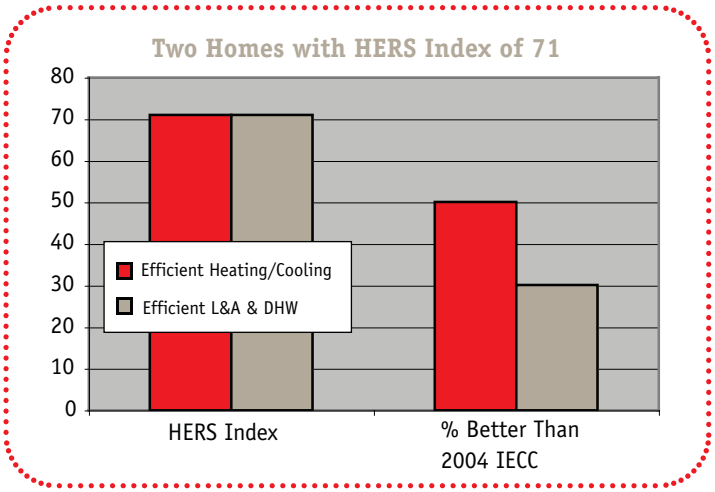

Figure 5. The same home, improved in different ways. Both improved homes have a HERS Index of 71, but only the one with improvements that affect space heating and cooling meets the 50% better than IECC goal and qualifies for the $2,000 tax credit.

Do You Qualify?

Do your homes, or those of your clients, qualify for the tax credit by meeting the 50% better than IECC goal? The only way to tell for sure is to obtain and use IRS-approved software. Or better yet, contact a local HERS rater who is trained and certified to analyze, inspect, test, and ultimately qualify homes for the tax credit.

Of course, anyone planning to take the 2005 EPAct tax credit should consult a qualified tax professional. The information in this article is not intended to be, and should not be construed as, tax advice.

—David Roberts

*David R. Roberts, P.E. works for Architectural Energy Corporation, a firm specializing in energy information products and services. He is the product manager for the REM/*Rate *home energy rating software and REM/Design home energy analysis software.*

FOR MORE INFORMATION:

IRS

- IRS Notice 2006-27 *Certification of Energy-Efficient Home Credit* can be downloaded from the IRS Web site: www.irs.gov/pub/irs-drop/n-06-27.pdf.
- IRS Form 8908 *Energy-Efficient Home Credit* can be downloaded from the IRS Web site: www.irs.gov/pub/irs-pdf/f8908.pdf.

RESNET

- Document 05-001 *Procedures for Certifying Residential Energy Efficiency Tax Credits for New Homes* can be downloaded from RESNET's Web site: www.natresnet.org/standards/tax_credits/procedures.pdf.
- A list of IRS-approved software is being maintained on RESNET's Web site: www.natresnet.org/programs/software/default.htm.

To find a certified rater working in your area, consult RESNET's list: www.natresnet.org/programs/providers/directory.htm.

www.homeenergy.org/links.html