

When a HERO Comes Along: Expanding the Market Share of ENERGY STAR® Homes

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ABSTRACT

Slow growth in the market share of ENERGY STAR®-labeled homes in Ohio precipitated the need to address the various barriers impeding the growth of energy-efficient new construction. Through the collaborative efforts of a wide range of stakeholders, a pilot effort was initiated to simultaneously increase the number of ENERGY STAR-labeled homes and reduce the cost of labeling the homes. Under the pilot, two volume builders committed to building exclusively ENERGY STAR-labeled homes, and several additional builders became ENERGY STAR partners. The number of labeled homes went from just a handful in 2000 to nearly 1,800 in 2002.

Introduction

In an effort to “jumpstart” the ENERGY STAR® homes market in Ohio, volume builders were recruited into a pilot designed to reduce the cost of verifying that homes met the ENERGY STAR standard. The pilot was based on the premise that builders are the primary decision maker as to whether or not a home would be built to the ENERGY STAR standard and that the cost, both in terms of dollars and time, was a significant impediment to builders in deciding to do so. While our primary task in evaluating the pilot was to determine if sampling is a reliable mechanism for verifying the efficiency of new homes, we felt that the pilot had a significant impact on the market presence and ultimately, market share, for ENERGY STAR homes.

To verify the reliability of the sampling process, we performed site visit audits and did extensive consumption analysis. We also conducted in-depth interviews with the various pilot stakeholders to document the market barriers and assess the effectiveness of the pilot approach in addressing them. We surveyed market actors (non-participating builders and homebuyers) to further document the obstacles they faced in building or buying an ENERGY STAR home.

We found that sampling, with some infrastructure support, can be an effective mechanism for verifying the efficiency of newly constructed homes. Further, by reducing the cost and the time required to obtain the ENERGY STAR label for a home, it also successfully addresses one of the most significant market barriers to increased market share for the program. It is our contention that the builders are the primary decision maker in determining both the expected efficiency and performance of a new home and whether an ENERGY STAR label will be sought for that home. By supporting the builders’ efforts to incorporate energy efficiency into the design of new homes, and by significantly reducing the time and money required to verify the efficiency and performance of new homes, the pilot approach supports significant increases in the number of builders participating in the ENERGY STAR program and the number of homes labeled in any given year.

Background

ENERGY STAR Homes and Home Energy Ratings

ENERGY STAR-labeled homes are designed and built to operate 30% more efficiently than homes built to the Model Energy Code (MEC).¹ These homes can achieve the targeted higher efficiency levels through:

- High efficiency heating and cooling equipment
- High efficiency water heaters
- Improved insulation
- Tight ductwork
- Reduced infiltration

These technologies and practices are designed to save the owners of labeled homes money on their utility bills and improve the comfort of the home. The ENERGY STAR label is given only after the home's energy efficiency is verified. The most common methods of verification are:

- An accredited home energy rater performs a Home Energy Rating System (HERS) rating
- Use of a Builder Option Package (BOP)

A HERS rating is an evaluation of the energy efficiency of a home, compared to a computer-simulated reference house of similar size and shape that meets minimum requirements of the MEC. The ratings are performed by an accredited home energy raters trained to perform the function of both data collection and analysis. They inspect a home to evaluate the minimum rated features and prepare an energy efficiency rating. The work of a Rater is typically overseen by a HERS Provider, a person or organization that develops, manages, and operates a home energy rating system, assuring that it complies with established national standards. Home Energy Ratings of Ohio (HERO) is a HERS Provider.

BOPs are sets of prescriptive construction specifications that dictate the characteristics of the thermal envelope, insulation, windows, orientation, HVAC system, and water heating efficiency for a specific climate zone to meet the ENERGY STAR standard. Though constructing a home to BOP specifications eliminates the need for a full home energy rating, a third-party verification that BOP requirements have been met is still necessary to label the home.

Batch Test Protocol Pilot

The Batch Test Protocol (BTP) Pilot was designed to test the feasibility of using a sampling approach to verify that homes meet the ENERGY STAR standard. Under the BTP, a full HERS rating would be performed on one in five homes. If the rated home meets the ENERGY STAR standard, it and the other four homes in the batch are all labeled ENERGY STAR. The Pilot was intended to address the needs of large production builders who sought a streamlined and more cost-effective process for assessing the efficiency performance of homes built to the ENERGY STAR standard. Several organizations/individuals were party to the Memorandum of Understanding that established the Pilot initiative. The signatories included:

¹ MEC is used as the residential energy code in many states, including Ohio. Where the state energy code exceeds the MEC (e.g. California's Title 24), the ENERGY STAR standard is expressed in reference to the state energy code rather than MEC.

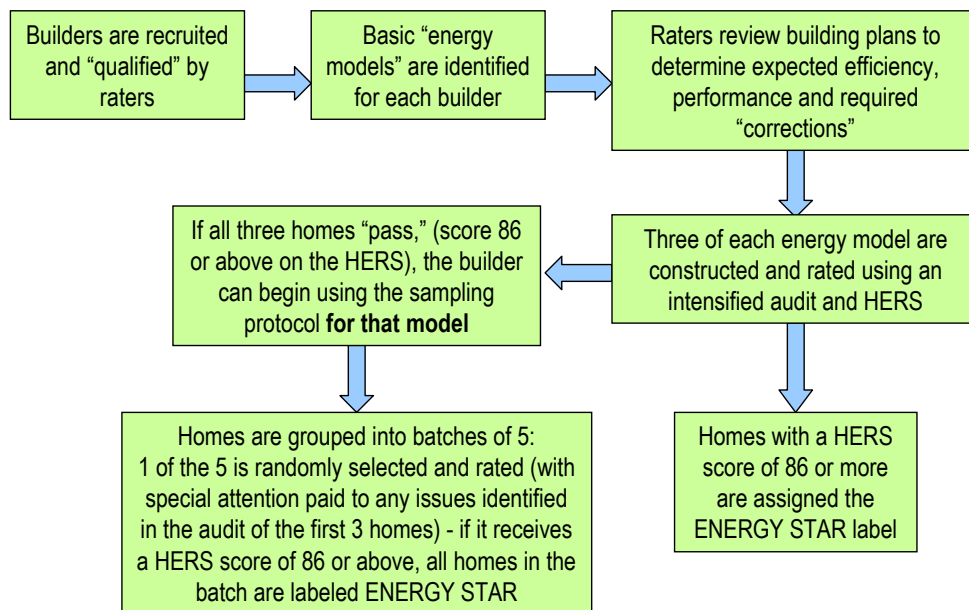
- Ohio Department of Development – Office of Energy Efficiency
- Residential Energy Services Network (RESNet)
- U.S. Environmental Protection Agency (EPA)
- Energy Design HomesSM (Senior Rater)
- Fannie Mae Columbus Partnership Office
- Builder Representatives

The variety of parties involved reflects the need to align the interests of various stakeholders in order to ensure Pilot success. The BTP, as envisioned, would be available to volume builders that demonstrate a level of consistency in home design and construction practices that support achievement of the ENERGY STAR standards.

Process Overview

Three builders were recruited for the BTP Pilot to represent the small, medium, and large production levels. The medium-sized builder opted out of the Pilot but continued to build all of their homes to the ENERGY STAR specifications. Scaletta Development Corporation, developer of Avenbury Lakes (AL), and M/I Schottenstein Homes (M/I) fully participated in the Pilot, certifying 128 and 1,685 homes, respectively. Each of the builders constructed three basic “energy models” and worked early on with the Raters to determine the necessary plan modifications to ensure that those models would meet the ENERGY STAR standard. Figure 1 provides an overview of the Pilot process.

Figure 1
Process Overview



Once three homes were rated and shown to meet or exceed the ENERGY STAR standard, the builders could use the sampling approach for that energy model. Under the sampling approach, “batches” of five homes are formed. One home, randomly selected from each batch, receives a full

HERS audit and rating. Provided that the rated home receives a HERS score of 86 or above,² all five homes in that batch are labeled ENERGY STAR. Throughout this paper, the one home of each batch that receives a full HERS rating will be referred to as a “Rated Home” and the other four will be referred to as “Sampled Homes.”

Pilot Evaluation Objectives

The Ohio Department of Energy Efficiency (OEE) operates the Home Energy Rating of Ohio (HERO) Program. HERO encourages and promotes good building practices and advancements in residential energy efficiency throughout Ohio. As part of its mission, OEE sponsored a comprehensive evaluation of the BTP Pilot. The short-term objectives of the evaluation were to:

- Determine the reliability of sampling as a method to verify performance of homes constructed by volume builders
- Identify infrastructure characteristics that support use of a sampling approach

Broader objectives of the pilot shared by most of the stakeholders included:

- Determination of the impact of the Pilot on reducing barriers to increased market share of ENERGY STAR homes
- Assessment of potential cost savings of verifying the efficiency levels of newly constructed homes through sampling
- Assessment of the impact of the pilot on customer awareness of ENERGY STAR homes and the associated benefits of owning a labeled home

Research Design, Methodology and Findings

Overall Approach

Several evaluation activities were conducted to support the achievement of the above objectives, including:

- Site visit audits of 80 homes built by the participating builders
- Energy consumption analysis of Rated and Sampled homes
- Review of available documents, Program history, and related information
- In-depth interviews with Program staff and stakeholders
- Participating (on-site) and non-participating builders (via phone) interviews
- Phone surveys of owners of ENERGY STAR labeled homes

Below we discuss how each of the activities supported the various evaluation objectives and some of the associated findings.

Determining the Reliability of Sampling

HERS Ratings. Site-visit audits and consumption analysis were conducted to assess the integrity of the sampling protocol. A total of 1,813 homes obtained the ENERGY STAR label through the Pilot. Of those,

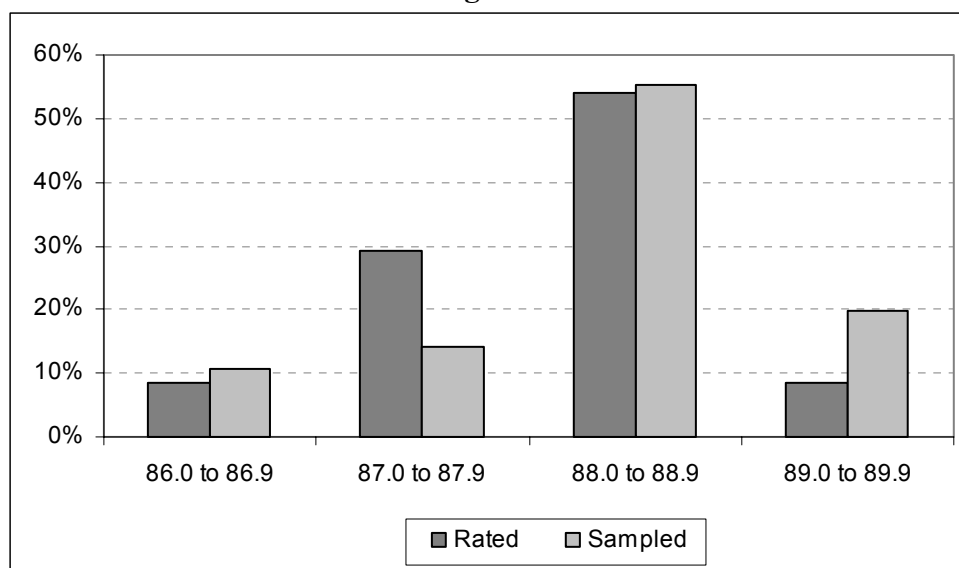
² 95 MEC, which is the energy standard for state of Ohio, scores a Home Energy Rating of approx 82. The HERS reference home used in ESH comparisons is an 80.0 score. For each point above 80, the home is expected to be 5% more efficient, e.g., a home with a HERS score of 86 would be 30% more efficient than a standard home.

approximately 300 received a full HERS rating. A total of 80 homes (24 Rated and 56 Sampled) that were labeled as ENERGY STAR through the Pilot were randomly selected to receive a site visit as part of our evaluation. These site visit audits were performed for two primary purposes:

- 1) To verify efficiency levels of the Rated homes and assure the integrity of the rating process
- 2) To determine the comparability of the Rated and Sampled groups

The homes were inspected, blower door and duct leakage tests were performed, and the data collected were analyzed using REM/Rate software.³ All of the homes audited scored an 86.0 or higher – meeting or exceeding the ENERGY STAR standard. The audits yielded similar HERS ratings for homes rated through the pilot. In addition, the average rating calculated through the audit was 88.3 for Sampled homes and 88.1 for Rated homes. There was no statistically significant difference between Sampled and Rated homes. Figure 2 shows the distribution of HERS scores for Rated and Sampled homes.

Figure 2



Consumption Analysis. The ratings give a prospective indication of the homes’ performance. We conducted consumption analysis to compare the expected home performance (in terms of projected energy costs) to actual performance and to again compare the performance of Rated and Sampled homes. While we found that homes used somewhat more energy (about 14% more when normalized for weather) than projected through the REM/Rate model, we felt that the homes performed as expected and savings were significant compared to what they otherwise would have been. REM/Rate bases its estimates of energy consumption on assumptions of optimal household behavior (e.g., thermostat settings at 68°F in winter and 76°F in summer and use of setback and setups during nighttime and unoccupied hours) and efficient energy usage. It is our opinion that REM/Rate produces an accurate projection of energy consumption under ideal conditions, which are rarely observed in actual households.

We further analyzed consumption data to compare the Rated and Sampled homes. We began our analysis with homes for which we had a full year of consumption data, and then progressively relaxed the data availability requirements to increase our sample size. Consumption analysis compared full year

³ REM/Rate is a residential energy analysis, code compliance and rating software designed for use by HERS providers.

(n=167), full heating season (n=444), and peak month consumption (n=787) of Rated and Sampled homes. Again, no statistically significant difference was found between Rated and Sampled homes. Table 1 compares the average energy consumption between the two groups of homes over each period.

Table 1

	Rated Homes ccf/sq.ft.	Sampled Homes ccf/sq.ft.
12 Months of Consumption Data (August 2001 - July 2002)	0.3400	0.3598
Full Heating Season Consumption Data (October 2001 - April 2002)	0.2566	0.2634
Peak Month Consumption Data (January 2002)	0.0633	0.0625

Based on our findings, our conclusion was that Sampling can provide reliable verification of home efficiency and performance. Rated and Sampled homes performed similarly under both the prospective and retrospective measures.

Infrastructure Requirements to Support Sampling

While we found that sampling could provide a reliable method for assessing the efficiency of newly constructed homes, our assessment contends that sampling alone is not enough. In the interviews with stakeholders (that included the participating builders) and the non-participating builders, it was clear that some processes need to be in place to support the use of sampling, including:

- Builder and Rater screening and training
- Quality control as part of the building process
- Oversight of sampling process
- Process for corrective action
- Quality assurance for the rating process

These processes are important to provide builders with the knowledge and tools required to build homes that will meet the ENERGY STAR standard in the most cost-effective manner. They are also necessary to give the various stakeholders (i.e., lenders, state energy officials, ENERGY STAR program managers) confidence in the sampling process. These processes not only support sampling, but they can also contribute to the success of the ENERGY STAR program in a particular market. As more builders become ENERGY STAR partners, sampling provides a potential platform for orientating builders at the state level and providing them with additional tools and techniques to assist them in making incorporating energy efficiency into their regular building practices.

Assessing Potential Cost Savings of Sampling

It was anticipated that the sampling protocol would significantly reduce the cost of verifying home efficiency and expected performance. Original savings estimates considered the cost of the rating spread over all homes in a group or batch. It was anticipated that sampling would bring that cost from \$200 - \$300 per home to \$40 - \$60 per labeled home.

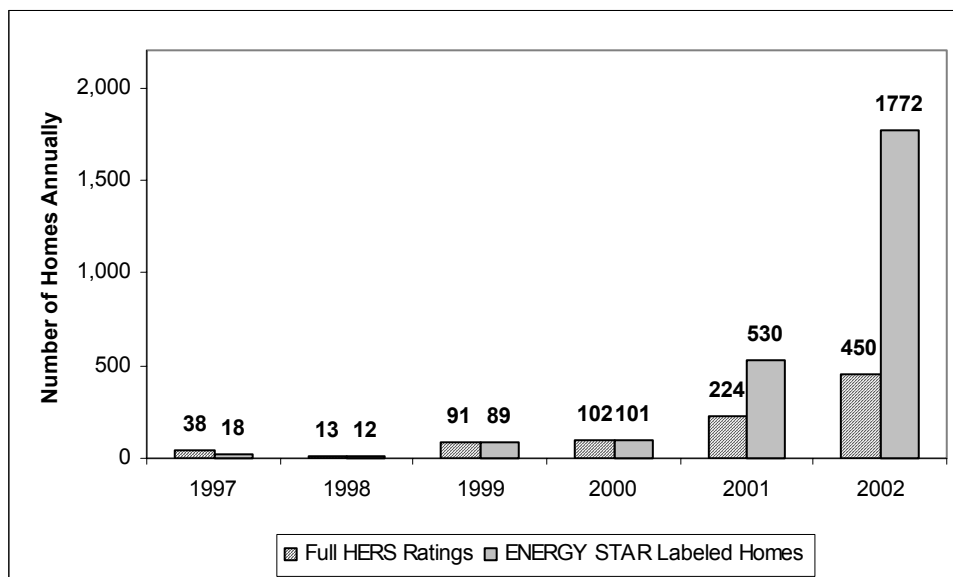
However, in the course of the evaluation, we found several programmatic or infrastructure requirements necessary to support sampling. Those costs may add an additional cost of up to \$40 per home depending on the size of the program or market. Still, including those costs, significant savings are expected. Further, the savings from sampling can provide a source of funding for these programmatic

processes important for supporting success of ENERGY STAR. The projected cost of \$100 per home was within the cost threshold given by non-participating builders where they would pursue an ENERGY STAR label for all or most of the homes they built.

Impact of the Pilot on Reducing Barriers and Increasing Market Share of ENERGY STAR Homes

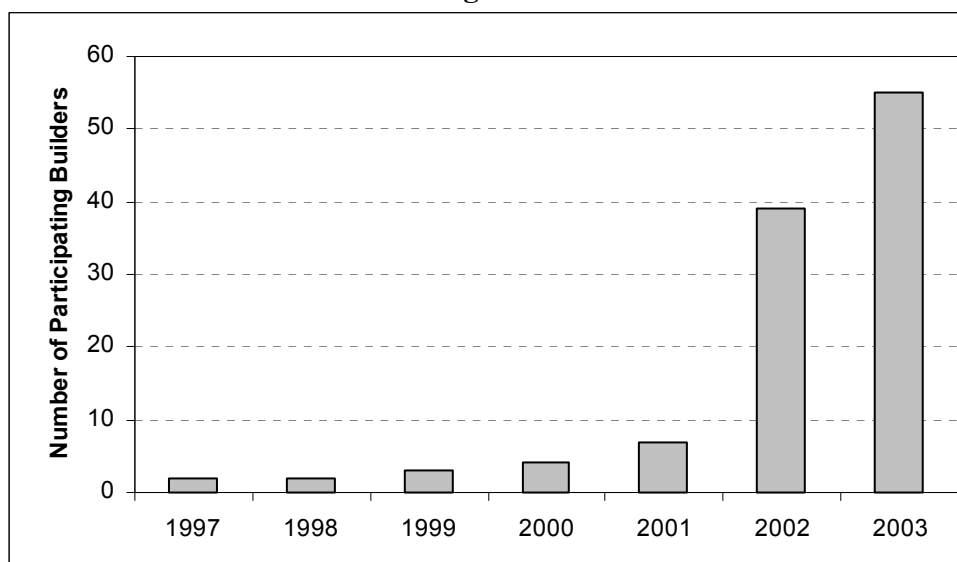
The impact of the Batch Test Protocol Pilot in jump-starting the market for ENERGY STAR homes has been substantial. Figure 3 shows the increase in the number of home energy ratings performed and the number of labeled homes constructed over the past several years. In 2002, 450 HERS audits were performed and 1,772 homes were labeled ENERGY STAR through the HERO program. The 1,772 labeled homes represent about 5% of the new home market in Ohio.

Figure 3



Another measure of the reduction in barriers is the number of builders participating as ENERGY STAR partners. Builders identified the cost, both in terms of dollars and time, of obtaining a home energy rating or a builder option package inspection as a significant barrier to having a home labeled ENERGY STAR. The pilot specifically addressed this by reducing both the time and cost of verifying the energy efficiency of new homes. Figure 4 shows the number of ENERGY STAR building partners in Ohio. Currently, 55 builders have signed on to the program. Additionally, seven have made the commitment to build 100 percent of their new homes to the ENERGY STAR standard.

Figure 4



Some of the growth in labeled homes and participation by builders would have occurred naturally with the overall growth in the ENERGY STAR program, however much of the exponential leap can be attributed to the pilot program. In particular, the convergence of the various stakeholders around this issue created opportunities for rapid expansion of the ENERGY STAR-labeled homes program in Ohio. Ohio counts itself among the most active states for the program.

Impact of the Pilot on Customer Awareness of ENERGY STAR Homes

National surveys were conducted in 2000 and 2001 to determine the awareness and recognition of the ENERGY STAR label. In 2000, 41 percent of general consumer respondents indicated they had seen or heard of the ENERGY STAR label, and in 2001, awareness was relatively the same. Significantly more respondents exposed to a high level of publicity recognized the label than those exposed to little ENERGY STAR advertising (53 percent vs. 31 percent).

For our evaluation, we surveyed 100 of the 1,800 homebuyers to assess:

- Awareness of the ENERGY STAR label
- Awareness of energy efficient mortgages (EEMs)
- Comfort and energy savings expectations
- The need for additional information to understand the benefits of their new ENERGY STAR home

We found the impact of the pilot to have a disappointing impact on the awareness of these homebuyers regarding the ENERGY STAR brand. Key findings from the survey included:

- Eighty-six percent of survey respondents were aware that their home was ENERGY STAR labeled
- Only 29% of those surveyed were aware of other ENERGY STAR-labeled products, such as appliances or lighting

- Very few (6%) of the survey respondents were aware of the existence or benefits of EEMs
- Sixty-eight percent claimed to have a good understanding of the benefits and savings of their ENERGY STAR-labeled home

Over 85% of the respondents indicated that the energy cost savings that they have realized were greater than or as expected, but many of the respondents expressed an interest in additional information regarding:

- More information on ENERGY STAR, including specifics about the advantages of ENERGY STAR ratings, criteria for labeling, and a list of other qualifying products
- More information on energy efficiency/savings in their recently purchased homes
- More information on the Furnaces/Heating/AC/Thermostats including how to use programmable thermostats and general operating and maintenance guidelines

Conclusions

The Pilot program had a significant impact on the number of homes built to the ENERGY STAR standard in Ohio, though that impact came from the commitment of builders to supply the higher efficiency homes rather than from the increased demand. Through discussions with both participating and non-participating builders, we found builders view the potential to use the ENERGY STAR label as a way to promote the homes or achieve market differentiation as limited. We would attribute that perception (or reality as it may be) to three areas:

- While ENERGY STAR uses energy efficiency, quality construction and comfort in their consumer-targeted materials, purchasers assume they are (or should be) getting all three when they purchase a new home
- When selecting a new home, energy efficiency ranks lower on the list of homebuyer considerations than location, price, or style and features of the home
- Lack of a full understanding of the meaning of the ENERGY STAR label and associated benefits (e.g., what does the ENERGY STAR label mean in monthly dollar savings?)

While the various stakeholders hoped to see a significant increase in the demand for ENERGY STAR homes and other ENERGY STAR products as a result of the Pilot, that objective doesn't appear to have been fully achieved. However the primary goal of increasing the market share of ENERGY STAR homes has been accomplished, and all signs point to continued growth in the number of labeled homes. What this may mean is that builders will continue to be the most productive market actors to focus on in promoting the ENERGY STAR program and in development regional or state efforts to support the program. They are going to be the primary decision maker in determining whether a new home will be built to the ENERGY STAR standard or not for some time – until a certain level of market saturation is attained and consumers begin to demand ENERGY STAR homes. In the near term, reducing the market barriers faced by builders will result in the greatest payoff in terms of expanded ENERGY STAR home market share.

References

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