

Wisconsin ENERGY STAR® Homes Program: Providing Building Trades with Solutions to Cold Climate Building Problems and Recognition for High Performance Homes

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ABSTRACT

In planning a program to provide a unique approach to energy efficient new home construction, the Wisconsin ENERGY STAR Homes (WESH) program chose first to accept explicitly the fact that energy savings are at the bottom of the priority list for many Wisconsin residents. Thus, the WESH program strives to achieve higher home performance, combustion safety and comfort first, with energy savings following as a direct result. This paper describes Wisconsin's effort to:

- Provide the residential construction industry with building science principles to help avoid common cold-climate building problems,
- Create a feedback loop and in-field education process that builders will accept and adopt into their standard construction procedures, and
- Ultimately build more energy-efficient homes.

This is market transformation at its most obvious; a key long-term objective is to build a network of builders, trades, and home energy raters who can deliver high performance homes, with low energy intensity, to customers that will demand them. Initial results after one-and-one half years of operation suggest a promising and positive future for the program. Further, the authors conclude that this program model may be appropriate for other states if overall home performance is the goal. We also discuss the initial funding and program commitment needed to firmly establish a body of sound building science knowledge with home energy raters, builders, and trades.

Introduction

Wisconsin ENERGY STAR Homes, started in spring 1999, is a voluntary program that builds upon the brand name and logo awareness of the national ENERGY STAR Homes program developed by the Environmental Protection Agency (EPA) and the U.S. Department of Energy (Bretz et. al. 1996). The program intends to transform Wisconsin's residential new construction market into one in which customers demand, and the market delivers, homes which are more energy efficient than required by the current state energy code. Rather than focusing exclusively on energy efficiency, the program team decided the objective is to better ensure home performance by addressing combustion safety, durability, comfort, and energy efficiency. Our theory is that we can achieve greater energy efficiency in new homes if we focus on related issues of more interest to builders, trades and consumers in Wisconsin.

The program team accepts that energy efficiency is not of primary interest to the vast majority of Wisconsin building trades and consumers. Therefore, simply offering a program

focused primarily on achieving energy savings would not be well received. This is based on evaluation results, and program staff's interaction with 12 of the 23 state home building associations. When evaluators asked what is of value about the Wisconsin ENERGY STAR Homes program, participating builders indicated: (1) emphasis on comfort, safety, and durability; (2) emphasis on techniques and practices; (3) opportunity to get heat recovery and ventilation information to clientele; (4) marketing and builder recognition; (5) promoting the whole house concept; and (6) training (Cole & Winch 2000a). These opinions support the program team's contention that that energy efficiency is related, but not the primary driver for builder participation.

The program is also working to address current national media coverage of housing problems, which can cast a negative image on energy efficient homes. For example, ABC's television magazine 20/20 aired a story in January 2000 indicating that energy efficient homes were causing combustion safety problems due to backdrafting of open fireplaces, furnaces and water heaters. To quote the voiceover from this segment: "...the way their new house was built, to abide by the latest energy-efficiency standards, was not allowing enough air in." Their home was a victim of "tight house syndrome" (ABC 2000).

The 20/20 piece unfortunately only tells one half of the story, and puts airtight construction in an unfavorable light. Was it that the house was too tight, or was it the fact the builder chose to install combustion equipment that was spillage susceptible?¹ The program team believes that homes can be built to be tight, properly ventilated, and healthy and comfortable. Working to construction standards similar to those outlined by the Energy Efficient Building Association (and other well-established program such as Canada's R 2000 or the Alaska Craftsman Home program), the homes just need to be designed, built and tested to ensure this (Lstiburek 2000, Bowser et al. 1995 ; Halterman et al. 1995).²

Given that energy efficiency is not the priority, why did the program team choose to build upon the national ENERGY STAR Homes campaign? This model was chosen given: 1) limited builder awareness of ENERGY STAR in Wisconsin, 2) the link with other efforts such as Wisconsin's ENERGY STAR appliance and lighting campaign, and 3) a key objective of both efforts is to provide consumers with the ability to easily recognize a home with exceptional energy efficiency.

Three key reasons why the Wisconsin program team added standards rather than just offering the national ENERGY STAR Homes program:

1. Wisconsin is characterized by a large body of small general contractors rather than a few large production builders. Approximately 60 percent of all Wisconsin building permits issued in 1999 were to businesses building 1 – 30 homes per year. Small builders often use a variety of trades, do not have the volume to support formal quality control teams, and frequently build a number of different house models. These differences present challenges to a small builder. Changing trades from house to house requires the general to continually communicate building practices required to meet program standards. For the builder, each house model can present a new

¹ Spillage susceptible is defined as a combustion appliance that is vented without a positive mechanical means. An atmospheric "B-vented" water heater is an example of a spillage susceptible appliance.

² Program team looked to well-established programs documenting the benefits of airtight construction coupled with effective ventilation. The Wisconsin ENERGY STAR Homes program team chose the Energy Efficient Builder Association's Builder Guide for Cold Climates as the program's primary technical resource.

challenge for effective air sealing and for designing and installing effective ventilation.

2. It is easy for new homes in Wisconsin to meet the 86 home energy rating score. Simply entering components, for example R-values, overall home infiltration rate, into a rating software program, without recognizing differences in installation quality could incorrectly promote a home as being exceptionally energy efficient, when the reality is the home performs poorly.
3. A common perception is that energy efficiency will result in problem homes. The program team's interaction with the building community verified builder's belief that "energy efficient homes are too tight...houses have to breathe." The program team firmly believes that recommending further air tightening--without addressing ventilation, combustion safety, and building durability--would have fallen on deaf ears. Site visits, testing, and standards that address these issues were needed to provide better assurance that ENERGY STAR Homes in Wisconsin would be exceptional and not cause other problems.

Wisconsin Energy Conservation Corporation (WECC), which manages the Wisconsin ENERGY STAR Homes program, received verbal agreement from the EPA to promote this effort in Wisconsin. The EPA's "Builder Option Package" is not promoted in Wisconsin.³ The initial program was established with pilot funding from the U.S. Department of Energy, to provide training and technical assistance to builders implementing the new Wisconsin building code. The program now continues with funds from several Wisconsin utilities.⁴

THE PROGRAM MODEL

The Wisconsin ENERGY STAR Homes program, not having code enforcement authority, provides education and technical assistance to builders on methods to meet and exceed code requirements. To build consumer demand for high performance homes, we recognize homes meeting a defined set of verifiable construction standards and a minimum home energy rating score of 86 out of 100 points⁵. The standards are designed to better ensure combustion safety, durability, comfort and energy efficiency.

The program design stems from experience implementing the Wisconsin home energy rating service since 1996⁶. Program implementers realized the relative ease for most new homes built in Wisconsin to reach the 86 home energy rating score required for certification as a national ENERGY STAR Home. A home meeting the standard insulation and

³ This offers builders a fixed set of criteria and a sampling protocol of homes tested

⁴ State of Wisconsin Department of Administration's Energy Bureau provided initial funding for this effort through the Wisconsin Focus on Energy. Alliant Utilities and Wisconsin Electric Power Company also fund the effort.

⁵ Wisconsin ENERGY STAR Homes Program Standards and Guidelines, Wisconsin Energy Conservation Corporation.

⁶ State of Wisconsin, Department of Administration's Energy Bureau sponsors the state's home energy rating program. Wisconsin Energy Conservation Corporation implements the service.

envelope requirements of the Wisconsin Uniform Dwelling Code, when equipped with high efficiency space heating equipment, easily allows the home to make the 86 rating score.⁷

The design of the Wisconsin ENERGY STAR Homes program responds to problems raters encounter in new homes. First, raters anticipated the rating procedure was not telling the entire story; calls raters received from customers concerned with high utility bills, poor air quality, mold growth, and uneven heating of rooms suggested that there were aspects of building performance that would not be captured in the rating procedure. Wisconsin's initial design for rating new homes relied on national Home Energy Rating System (HERS) guidelines, which includes computer modeling of a home's estimated energy use, a rating score based on energy related components and estimated air infiltration rate from a final blower door test. Second, program implementers and raters were dissatisfied that homes—which raters verified as relatively “leaky”—still received rating scores of 86 or better.⁸

For example, two common problems which raters saw when completing home energy ratings included: 1) critical air sealing that is missed, creating the potential for durability, comfort and energy efficiency problems, and 2) ventilation equipment that performed poorly. When raters started testing flows from this equipment they commonly found low flows due to excessive restrictions in ductwork.

Raters also zeroed in on critical air sealing missed during construction. For example, poorly installed polyethylene vapor retarder located on an exterior allows air movement into the wall cavity, degrading the insulation's effectiveness and potentially allowing air-transported moisture to condense in cold building cavities.

Initial evaluation results from interviews with insulation subcontractors working on Wisconsin supported the program team's focus on installation problems. Insulators indicated the most common errors made in residential insulation installation were due to “poor workmanship” and “rushing the job.” Problems included; not cutting insulation to fit cavities properly, poor alignment of the insulation product with a solid air barrier, missing the thermal envelope (i.e., not keeping insulation in line with the end of the conditioned space), no foaming or caulking wire holes and penetrations, improper ventilating, and lack of sealing around box sills (Cole & Winch 2000b).

The program team was conscious that builders who address installation quality and performance might be undermined by a labeling system that is based on assumed efficiency and installation quality. It became apparent that continuing to rate homes without verification of installation quality and performance might be counter-productive, and could provide confusing consumer information. This acts only to undermine the ultimate goal: an unbiased, accurate and easy-to-identify symbol of residential energy efficiency.

Working with Advanced Energy Corporation from Raleigh, North Carolina, the program team and a small group of raters established building standards similar to other high

⁷ Wisconsin's Uniform Dwelling Code, Chapter COMM 22, nominally equivalent to Model Energy Code 95. Administered by the State of Wisconsin, Department of Commerce, division of Safety and Buildings, code effective May 1, 1999.

⁸ To provide context for this perception, the Wisconsin ENERGY STAR Home guideline for air leakage is based on the size of the home. The program guideline for air tightness is .25 [CFM@50](#) per square foot of building leakage area. For example, if all the surface area in the home (sum of all wall, ceiling, foundation area, etc.) totaled 7,500 ft², the estimated infiltration rate measured via blower door test should not be greater than 1,875 [CFM@50](#). (7500 * .25 = 1875)

performance home efforts.⁹ The program team and raters worked to establish standards that were incremental, readily achievable, and that would not force the builder to radically change building materials and practices. The program standards, rather than being prescriptive, would be based on performance. The program team has carefully reserved the opportunity to continually improve program standards based on measurement and evaluation, and feedback from builder-partners that are ready to take the next step.

Home energy raters work on-site with builders and trade contractors during at least three (3) stages of construction to ensure program standards are integrated into construction and that the home will meet quantitative standards upon completion. Raters and builders complete site visits: 1) after framing, prior to insulation installation, 2) after insulation is installed and prior to drywall, and 3) after the home is completed, to conduct performance testing

Raters play a critical role in this program model. They are responsible for delivering real-world solutions directly into the field, and working with the builder to integrate building science principles based on each specific project and the specific materials the builder uses.

Completing the various site visits and additional performance tests increased the cost of the service when compared to a base home energy rating. The program team estimated an additional eight (8) hours of time, per home, above the cost of a basic home energy rating. Market cost of a basic home energy rating in Wisconsin is approximately \$250.00.

Based on informal conversations with builders participating in the rating program prior to the introduction of Wisconsin ENERGY STAR Homes, the program team understood that the \$250 fee was not a major obstacle to gain limited builder participation. The program team decided to leave that fee in place and subsidize the additional 8 hours of time per home. The rationale was that raters need the opportunity to begin implementing building science principles and gaining critical field experience working with builders and trades on real world problems. For the additional 8 hours of time, raters are paid \$520.00 per home.

Program staff asked builders to sign a participation agreement, committing to a minimum of three (3) homes built to the program standard per year. Raters accept that the builder may not be able to meet program standard on their first home. Continuing work on at least two more homes provides the opportunity to integrate building practices identified on the first home.

HOW IS THE PROGRAM BEING IMPLEMENTED?

A program team consisting of the State of Wisconsin's Energy Bureau, WECC, Home Building Technology Services, Conservation Services Group, Honeywell DMC and a number of private home energy raters are implementing the program in targeted regions of Wisconsin. The program team has three main implementation tasks: 1) build the skills of home energy raters, builders, and trades, 2) recruit builders to participate in the program, and 3) build consumer demand for Wisconsin ENERGY STAR Homes.

⁹ Examples of other efforts which include standards that address "whole house" performance include: the Energy Efficient Builders Association "Criteria for Energy and Resource Efficient Buildings", Greenstone's "Engineered for Life" program, the American Lung Association's "Health House Program", Tucson Electric Power Company's "Guarantee Program".

Building the Skills of Raters, Builders, Trades

The program's main objective is to establish network of builders, trades, and home energy raters who can build high performance homes. Builders and their trades physically plan and construct the home. The rater is a consultant during the design stage, provides on-site assistance during construction, and does the final performance testing.

The rater's role has been critical during the program's first year and a half of operation. A small group of experienced home energy raters received extensive training in building science principles and how homes located in a cold climate ideally should be designed, built and tested to ensure performance. The rater augments the technical capabilities of designers, builders and trade contractors.

Builders and trades need the knowledge and skills to implement building practices required by the program. For example, framers needs to take care of air sealing details prior to insulation installation, insulation contractors need to tend to vapor retarder/air barrier installation details, and the HVAC contractor needs to understand how to minimize restrictions in duct work to ensure ventilation system flows.

To meet the need of developing rater, builder, and trades skills, the program team worked with the Energy Center of Wisconsin to develop and implement a Wisconsin ENERGY STAR Homes training series. The program team selected topics relevant to program standards, and based on topics raised by builder-partners and trades. The program team hired national trainers, as well as local building science professionals to serve as instructors.¹⁰ The series included the following courses:

- Principles of Building Science
- Residential Mechanical Ventilation Design and Installation
- Troubleshooting, Diagnostics and Air Sealing
- Advanced Framing, Insulation and Air Barriers
- CO Combustion Safety, Combustion Analysis and Building Pressure Diagnostics
- Advanced Window Technology – addressing current technology, NFRC labeling, understanding performance issues
- Residential Load Calculations and HVAC System Design
- Small Business Development for Home Energy Raters

The program team, in conjunction with Affordable Comfort, Inc. and the Energy Center of Wisconsin, also conducted a conference in February 2000 to foster alliances and transfer information to the statewide building community. During this two-day conference, over 350 building industry representatives learned about the concepts, technologies, and specific products key to building high performance homes and preventing problem homes. Conference sessions were offered on advanced framing techniques, foundation insulation, air sealing techniques and materials, ventilation strategies and business development.

Getting Builders to Participate

¹⁰ Sample of trainers include Advanced Energy Corporation, Canadian Mortgage Finance and Housing Corporation (CMHC), Heating Refrigeration and Air Conditioning Institute of Canada (HRAI)

The program team's initially recruiting focused on those builders we were familiar with from the home energy rating program, and those who were already interested in high performance home construction. We also promoted the program to builders who experienced problems with excessive energy use, high moisture levels, durability and comfort problems. After the first few months of operation, the program team decided to join home building associations throughout the state to promote our services.

Building Consumer Demand

Consumers are critical to the ongoing success of the effort. Consumer demand is needed to maintain a supplier's interest in any service or product. Given a very limited number of participating builders during 1999, the program team was careful to send a very positive image about this program and not disparage any builder not participating. This is important in Wisconsin. The program team believed a negative campaign would alienate builders from joining the program in the future. Working with two advertising agencies, the program team agreed on a campaign that educated consumers regarding the details of high performance construction. The message was that tending to these details can make the difference between a good home and a great home. We are not necessarily asking the builder to upgrade insulation values, types of windows, or the efficiency of furnace. The program recognizes that installation quality allows those components to perform.

The initial campaign included television, radio, and newsprint advertising. The program team provided participating builders with consumer brochures, showroom and trade show displays, and metal yard signs. Members of the program team and raters continue to volunteer time to staff parade of home events, explaining features of a Wisconsin ENERGY STAR Home.

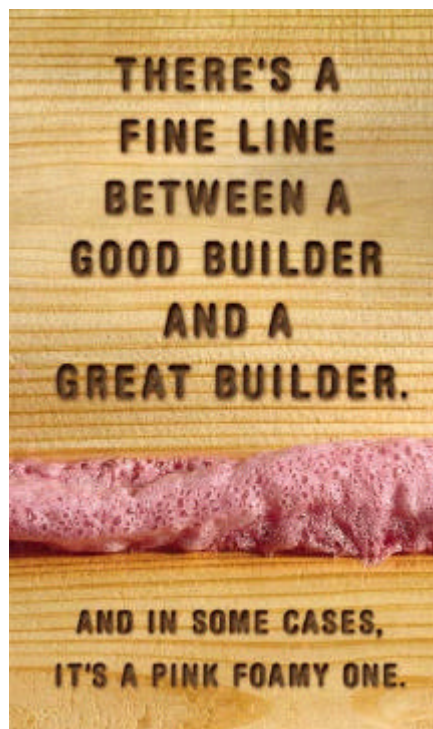


Figure 1. Front cover of Wisconsin ENERGY STAR Homes consumer brochure, emphasizing installation quality. This message is carried through all program marketing.

WHAT IS BEING LEARNED?

The lessons learned are organized according to the implementation tasks. That is,

- Are the skills of raters, builders and trades improving?
- What are the best ways to recruit builders?
- Are consumers demanding Wisconsin ENERGY STAR Homes?

Note that the evaluation references for this section only address the program's activity in one region of Wisconsin. Evaluation activities in other areas of the state will be implemented during late 2000.

Are the Skills of Raters, Builders, and Trades Improving?

The program continues to make efforts to establish raters as a resource to builders and other trades. The combination of classroom training and on-site review during construction is improving rater's skills in building science and in apply these principles in real-world situations with contractors and trades. Evaluation interviews found that raters believe the Wisconsin training series has been very beneficial to understanding "whole house" concepts, ventilation techniques, and insulation practices (Cole & Winch 2000c).

While participating builders noted the difficulty of taking time off from work to attend training, two-thirds of the builders interviewed have attended one of the sessions. Builders verified that the program increased their knowledge of "whole house concepts," better ventilation practices, suggestions for dealing with moisture problems, and improved insulation techniques. Over half of the participating builders want additional training in areas such as space heating, windows, framing, avoiding carbon monoxide risks, insulation, indoor air quality, and condensation problems (Cole & Winch 2000a). Interim builder evaluation results indicate that the greatest gains were increased knowledge "about blower door testing and pressure balance testing". Contractors and builders attributed a higher percentage of their knowledge to the Principles of Building Science workshop than did home energy raters. This early result supports the finding that the training session was an especially good introduction to the principles of home building for contractors and builders.

The formal training, combined with on-site technical assistance, appears to be a model to establish formal change among builders and trade contractors. Initial results suggest that some lasting behavior changes have come from the training session.¹¹ Given that the program is new, the program team agrees that additional evaluation must be completed to make a definite conclusion that builders will continue to implement information learned from the classroom training sessions and on-site technical assistance provided by the rater.

The program team also looks at the results of performance tests completed on Wisconsin ENERGY STAR Homes as a gauge for whether we are building skills. Two quantitative tests performed on all homes include 1) air tightness tests and 2) ventilation

¹¹ Wisconsin Focus on Energy First Interim Report - Final, May 17, 2000, Chapter 9

system flow tests using a flow hood. Gains in air tightness are clear, but equally clear is that there are much greater gains to be made in the area of ventilation effectiveness.

Air tightness. Consistent with other members of the Energy Efficient Building Association, the program team’s motto is to “build the house tight and ventilate it right”. So is that happening? Table 1 compares whole house infiltration rates for 54 new homes certified as Wisconsin ENERGY STAR Homes versus 249 new homes that were rated without construction site visit assistance—from 1997 to date. The findings in Table 1 illustrate that the average whole house infiltration for the Wisconsin ENERGY STAR Homes is 354 [CFM@50](#) (23 percent) lower compared to homes outside the program.

Table 1: Comparison of Infiltration Rates

Type of Homes and Sample Number	Average whole house infiltration rate
249 Wisconsin homes built in 1997 or later	1,545 CFM@50
54 Wisconsin ENERGY STAR Homes	1,191 CFM@50

Wisconsin ENERGY STAR Home builders are achieving air tightness gains due to better air barrier/vapor retarder detailing, sealing recessed lights, and attending to critical leakage areas at floor joists and bath/shower enclosures.

Ventilation strategies. Program raters focus on testing to continually improve ventilation in program homes. This is an area with significant room for improvement. As listed in Table 2, raters continue to find lower than desired flows from bath fans and range hoods:

Table 2: Average exhaust fan flow results from 32 Wisconsin ENERGY STAR Home

Fan Location	Rated Flow (CFM)	Tested Flow (CFM)	% of Rated Flow
Bath Fans	70	44	63%
Kitchen Fans	100	66	66%

Raters will continue to work with builders and trades to upgrade bath fans, install less restrictive ducting, and employ simple control strategies. These controls give the owner better control over moisture conditions while eliminating a common reason for callbacks.

Success Getting Builders to Participate

As of May 2000, 120 builders have signed a Wisconsin ENERGY STAR Homes partnership agreement. Collectively, these builders have committed to build 376 homes to program standards. Of those homes completed to date, 54 have been certified, and 17 have not passed.¹²

Evaluation results from builders and subcontractors support the program team’s theory that energy efficiency is not the primary driver for participation in this program. Participating builders said they joined the program because they are “interested in building a better home” (Cole & Winch 2000a). Subcontractors said the most valuable components of

¹² Data queried on May 22, 2000 from Wisconsin ENERGY STAR Homes database managed by Wisconsin Energy Conservation Corporation.

the program include the blower door test; emphasis on safety, efficiency, air quality, and creating awareness among contractors and homeowners (Cole & Winch 2000b).

The most successful way to recruit builders is probably the simplest: join the area's home building association, show your willingness to participate in their environment, and become active in the associations' committees and special events. Program staff is active with 12 of the 23 state home building associations. This involvement immediately provided a vehicle to talk directly with builders and trades. As a member, program staff perceived they were immediately viewed as part of that region's trade market. Executive directors from the local home building associations welcomed what the program offered and have asked program staff to give presentations during the association's monthly meetings.

Involvement with associations also provided access to the local building leaders. Many of these leaders took advantage of the program's promotion by becoming partners and committing homes to meet the program standards. The added program recognition, complemented with construction site yard signs, prompted other builders to inquire about the program. The program team perceived the second group of builders had the notion "I know how that guy builds...if he can meet Wisconsin ENERGY STAR standards so can I." The program's marketing recognition, and the reputation of the "early adopter" group of builders is effectively driving the process of securing more builder interest.

A major barrier to recruiting builders is widespread misinterpretation regarding program standards. Program staff find themselves constantly explaining that duct sealing, blown in blanket insulation, and a heat recovery ventilator are not requirements of the program, but rather options that may be included in the home. With limited time to describe the program, program staff notes that some builders perceive that certain equipment and products are program standards. Being active with local building associations gives the program team a way to both understand these misperceptions and an opportunity to fully explain the actual program standards in a more informal context rather than during a structured presentation. Many builders are hesitant to ask questions in front of their colleagues. One-on-one time between a program staff member and a builder is essential to provide a more comfortable environment in which builders are more likely to ask detailed questions.

Building Consumer Demand

A fundamental problem in new home construction programs is the issue of "split incentives." That is, the builder makes many fundamental decisions about construction methods, work standards, and component specifications. That process demands great sensitivity to first cost issues and labor cost control. The homeowner, however, lives with the consequences of all those decisions. In most cases, the largest incentives for a builder to meet or attain a standard are general fear of liability and their "reputation" to uphold.

The Wisconsin ENERGY STAR Home model is designed to transform the new construction market to one where the consumer can identify homes that are more comfortable, (and more energy efficient). Consumers are then likely to demand a home, which is more energy efficient, and require that the market become capable of delivering these homes.

During the first quarter of 2000, the program team worked with two advertising agencies to promote Wisconsin ENERGY STAR Homes directly to consumers, as well as

recognize builders who have built to program standards. The program aired television, radio and newsprint advertisements during January through April 2000. WECC's call center, which handles program calls, averaged 38 consumer calls per month during this four-month period. Overall, the mass media promotions have been successful getting the attention of the consumer. However, the mass media model for ongoing promotion is a costly, though effective, entrée' into the local consumer market.

One can only expect builders to participate as long as there is credible information on why these homes are performing so well and that consumers demand them and are willing to pay for the increased benefits. Ongoing consumer education and highly visible marketing are needed for the program to ensure that participating builders have a market for their homes. Evaluators found that participating builders—located in the target promotion area—do not believe consumers are fully aware of the Wisconsin ENERGY STAR Home Program. Builders noted that the January through April 2000 advertising had increased consumer awareness, but more marketing is needed for effectiveness. Builders said additional information regarding ENERGY STAR appliances and energy efficiency mortgages is necessary to boost consumer awareness.

There is growth in consumer demand for the Wisconsin ENERGY STAR Home label. Raters are working with more consumers who serve as general contractor for the home they are building and will live in. Based on consumer presentations and program booths at various trade shows, program staff developed leads and currently work with 35 consumers serving as their own general contractor. This appears to be a large market in Wisconsin. Based on building permit applications, approximately 30 percent of the homes have a permit taken by the eventual homeowner.¹³

Additionally, program staff offered a consumer session during the February 2000 conference. Of the 60 participants attending this session, 12 have committed their home to be built as a Wisconsin ENERGY STAR Home.

Conclusion

Based on both formal interim evaluation results, and informal feedback from participating builders, the program team believes the model is appropriate to achieve greater energy efficiency in new homes built in Wisconsin. The model appears to be appropriate given Wisconsin's building practices, the manner that area builders structure their work, typical building components, and common cold climate problems that affect builders and consumers.

The program is making solid progress. However the program team recognizes continual program improvement is needed to better ensure the performance of homes, motivate builders and trades to participate, and increase consumer demand. Some specific future directions:

Roles of raters. Program staff and trainers have increased the building science knowledge and trouble shooting skills of the initial group of home energy raters. Raters require continual training and the ability to continually apply building science theory via site visits and performance testing to firmly establish themselves as professionals which builders and

¹³ Information from MSB Energy Associates, based on Ameri-Fax data service, which compiles building permit data from the State of Wisconsin, Department of Commerce, Division of Safety and Buildings

consumers can rely on. Most raters indicate it takes time to develop a relationship built on trust and respect before the builder is comfortable to use the rater as a credible source of information (Cole & Winch 2000c pg 15).

Role of trades. Feedback from trades working suggest the need for better communication between the rater and trades, whose work is most impacted by the program. Trades and builders indicate the program needs to do a better job at providing training information at the installer level, and not just the owners of HVAC and insulation companies.

Customer feedback. The program team realizes the importance of consumer and feedback to help improve our efforts. As the program matures, we plan to document occupant feedback through follow-up surveys. Information from homeowners about durability, air quality and energy savings will provide the formal feedback to our builders and trades that they need to continually improve their practices.

Performance feedback. Measurement and verification of WESH homes, through metering, data loggers and utility bill analysis, is critical to the ongoing success of the program. Also, additional information is needed to determine the effectiveness of the standards and how the standards may be modified and improved over time. At the start of the program it was anticipated that the standards would increase as builders and subcontractors move up the learning curve. As more homes are certified under the program we will have a larger sample size to conduct further evaluation on all aspects of the program.

Service cost. As a history is acquired on a volume of homes, program staff seek to determine the appropriate level of service and site visits necessary to ensure performance. The cost of providing the service continues to be a concern. Currently the subsidy for the rater to conduct site visits and the presence of a cash reward to the homebuyer allow the program to make strides. Initial evaluation results suggest builders "are uncertain whether they will participate in the program if they have to pay the full cost of the program" (Cole & Winch 2000a). The program team envisions that the cost per home could go down over time, assuming the builder takes a responsible role, and identifies an in-house quality control person, for ensuring quality installation for certain aspects that do not require diagnostic tools. The program will also start to integrate the ENERGY STAR Mortgage product. This may provide further homeowner incentives toward participation, which would help buy down the cost of the service.

Relevance to other states. The program team believes the model is relevant to other states, assuming the goal is to promote a whole house new home program that addresses comfort, durability, combustion safety, adequate ventilation and energy efficiency. The key is determining what will motivate builders to participate and what will motivate consumers to purchase these homes. Each state will have different factors to consider: consumer demand, energy prices, current construction practices, and the size and organizational characteristics of area builders. We understand large production builders may balk at the level of involvement outlined under the Wisconsin program on all homes. However, after preliminary training, construction of a prototype house, and performance testing, production builders could integrate quality control procedures, performance testing and standards necessary to

ensure homes will perform and callbacks are minimal. This approach appears to be the case in the “Build America” program that targets production builders across the country. (http://www.eren.doe.gov/buildings/building_america/system.shtml.)

The program team recognizes that it is currently not plausible in Wisconsin to promote only the home energy rating score as a method of distinguishing between the energy efficiency of new homes when the infrastructure is not prepared to build such homes. Additional building science training and performance testing are necessary until consumers begin to demand high performance homes from their builders and the builder can deliver these types of homes. The Wisconsin ENERGY STAR Homes program is designed to make it compelling for a builder to participate because the program provides information on preventing problems and callbacks that affects their profit and reputation.

Acknowledgements

The authors of this paper would like to acknowledge that the work presented in this paper is the combined efforts of Opinion Dynamics Corporation and MSB Energy Associates for gathering evaluation results and baseline information; the Energy Center of Wisconsin for the training series development and coordination; and Knupp and Watson, Inc. and Lindsay Stone and Briggs Advertising, Inc. for marketing and media relations. The authors would also like to thank Angela Hahn with Wisconsin Energy Conservation Corporation and Don Hynek with the Wisconsin Energy Bureau for their editorial assistance of this paper.

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