

IT'S NOT ABOUT THE SAVINGS: ACHIEVING ENERGY EFFICIENCY IN SYSTEMS-BUILT HOMES

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Introduction

Typical energy efficient new home construction programs may overlook the systems-built housing market because programs do not recognize and address the needs of these manufacturers. The Wisconsin ENERGY STAR® Homes program, in contrast, has built effective partnerships with four large regional systems-built manufacturers. These partnerships are successful because the program helps the manufacturers achieve their core business objectives. This paper describes how Wisconsin ENERGY STAR Homes developed working partnerships with systems-built housing manufacturers and the (very minor) role energy efficiency has played in those relationships.

1. New Homes and Opportunities in Wisconsin

1.1 Wisconsin ENERGY STAR Homes

The Wisconsin ENERGY STAR Homes program works with builders and their subcontractors to increase building performance standards in Wisconsin's residential new construction market. The program accomplishes this objective by testing and certifying new homes that meet rigorous program standards for comfort, safety, durability and energy efficiency. The program aims to deliver value—in terms of technical services, problem-solving assistance, access to training sessions, a variety of incentives, and flexible participation guidelines—to participating builders.

Since its inception four years ago, Wisconsin ENERGY STAR Homes has had a significant and growing impact on Wisconsin's new construction market. More than 300 Wisconsin builders have participated in the program (that is, they have built at least one home which was tested and certified as a Wisconsin ENERGY STAR Home). The participating builders range from the state's largest production builder (who has recently committed to build all of their homes to program standards) to smaller firms that build less than five custom homes each year. In 2002-03 the program certified 883 homes. The program plans to certify at least 2,000 homes annually—about 10% of all homes built in Wisconsin—by 2005. In one Wisconsin county over 20% of the homes built in 2004 will be program certified.

Wisconsin Energy Conservation Corporation launched Wisconsin ENERGY STAR Homes in 1999. The program is currently funded by the statewide energy efficiency program, Wisconsin Focus on Energy, as well as various municipal and cooperative electric utilities across the state. (Most municipal electric and cooperative utilities in Wisconsin operate their own efficiency and conservation programs, although they may elect to join the statewide program.) Before 2001 the program was funded by both investor-owned utilities and the State of Wisconsin. Wisconsin Energy Conservation Corporation (WECC) staff is responsible for program design and implementation.

Unlike most of the ENERGY STAR Homes programs around the country, the Wisconsin program conducts performance tests on every home that is certified. Prior to the final certification test, program consultants visit each in-process home on two separate occasions—at framing and after insulation—to verify specific details of construction before those details are hidden from view. The final certification

testing (at a third site visit) includes a blower door test to verify the home's tightness, performance testing of all ventilation equipment to verify airflow requirements, and various other inspections.

The Wisconsin ENERGY STAR Homes program is delivered to builders through a network of independent consultants qualified and trained by WECC. These consultants—typically individual proprietorships where the owner/proprietor has a strong building science background—cultivate consulting relationships with builders in their geographic area. While consultants receive subsidies on each home certification as well as technical support from the program, the consultant is encouraged to see his builders—rather than the program—as his primary customer. Accordingly, the program encourages consultants to be active in local builder associations and to identify issues that matter to their builders; such activities help solidify the consultant's role as an expert in his community, thus making his business more viable. Committed to creating a self-sustaining service, the program measures success in part by the effectiveness of the consultant-builder relationships and the perceived value consultants deliver to their builders.

1.2 Systems-built Homes – A Growing Presence in Wisconsin

Wisconsin ENERGY STAR Homes became involved in the systems-built market at the request of a participating builder. After building five program-certified homes in the Milwaukee area, a builder talked with his consultant about how the program standards might be applied to modular homes. The builder explained that modular homes were a growing piece of his business and, because program certification helped him sell homes, he hoped the program could certify his systems-built homes as well. In part, the builder was interested in using the Wisconsin ENERGY STAR Homes certification to make his systems-built offerings more competitive with his custom home construction projects. The builder request prompted staff to begin exploring the potential for certifying modular or “systems-built” homes.

As defined by the National Association of Home Builders (NAHB), “systems-built” housing refers to a type of home construction where certain components of the home are manufactured and assembled in a factory before arriving at the home site. The intent of systems-built housing is to save costs to both the builder and homeowner by reducing onsite construction time and the associated labor costs. Systems-built manufacturing has a long (and not always glorious) history, dating back to the early twentieth century when prefabricated homes came onto the market. Since then, the terms “manufactured housing,” “mobile homes” and “modular housing” have been used to describe variations on this approach to home construction. In an effort to distance itself from lingering negative associations with words like “prefabricated” and “mobile home,” the industry has adopted the term “systems-built” as an umbrella expression to refer to both modular and panelized home products.¹

The systems-built homes market has grown steadily over the last decade, establishing itself as an important element of the new housing market in Wisconsin and the nation. According to the U.S. Census Bureau, in 2002 homes built entirely with building systems technology accounted for 6% of all single-family homes built in the US and 9% of those constructed in the Midwest. And 13% of new, single family homes built outside metropolitan areas employed systems-built construction.² While market share for systems-built housing has generally remained constant, overall modular housing

¹ The distinction between panelized and modular homes is important. While a modular home typically arrives at the construction site in two to five closed-cavity pieces (where both interior and exterior walls are finished), the panelized home components are wall sections with generally complete exterior sides and frame-only interiors. Builders using panelized products do all insulation, drywall and mechanicals at the construction site. The program was already actively working with builders who used panelized products when the Milwaukee builder raised the issue of certifying modular homes.

² *US Census Bureau, Characteristics of New One-Family Houses Completed*; US Census Bureau Website, <http://www.census.gov/const/www/charindex.html>.

production increased 27% over the last decade and 11% in 2002 alone.³ Further, industry experts assert that elements of the systems-built approach are becoming more prevalent across the new construction industry; *Automated Builder Magazine* estimates that as many as 50% of all new homes incorporate some aspect of systems-built housing.⁴

As Wisconsin ENERGY STAR Homes' staff began to explore the systems-built housing industry it became clear that the program could substantially expand its impact if staff could find an effective way to partner with systems-built manufacturers and builders.⁵

1.3 Motivations for Systems-Built Manufacturers and Builders

Wisconsin ENERGY STAR Homes program staff had long recognized that one of the primary appeals of the program for builders is the potential to reduce builder callbacks. A callback is exactly that—a situation where the owner of a new home contacts the builder to report a problem with the home, asking the builder to come back and fix the problem. Responding to callbacks can be tremendously expensive for builders in terms of time, money, and reputation. (Builders typically absorb all costs associated with these consumer complaints but in many cases, consumers' frustration over the issue remains high and can damage the builder's reputation.) In addition, as consumers become more aware of and concerned about mold and other moisture issues, the builder's liability risks associated with callbacks rise substantially. In fact, many builders are finding it increasingly difficult to get and keep liability insurance as insurance companies see more and more builders facing moisture-related claims.

The Wisconsin ENERGY STAR Homes program reduces the potential for callbacks because the certification process—essentially another set of eyes reviewing the critical details of construction and testing the installed equipment—increases the odds that the details will be done right. Additionally, when a home is certified and the consumer does have a concern, the builder knows that he can turn to program staff to help diagnose and solve the problem.⁶

In a typical stick-built home the liability associated with callbacks rests with the builder. This dynamic is altered in systems-built homes because the manufacturer is responsible for the components assembled by builder during the construction process. (In many cases the home might include some modular components from a manufacturer and some pieces—like the basement—that the builder constructs on site. Furthermore, the builder is typically responsible for heating and cooling equipment, plumbing, lighting, etc.) This means that the builder and manufacturer essentially share liability for the home.

From a practical perspective this shared liability means that manufacturers have added incentive for partnering with high-quality builders because—in addition to the general benefits of better customer satisfaction—the manufacturer faces reduced liability when working with builders who have

³ *National Association of Home Builders Fast Facts: Modular Homes Fact Sheet*; NAHB Website, 2003; “*Modular Home Sales Soar 11% in 2002*”, *Building Systems Magazine*, March/April & July/August 2003, pp 21 & 24.

⁴ *Automated Builder Magazine*, as referenced in *National Association of Home Builders Fast Facts: Systems Built Housing Fact Sheet*; NAHB Website, 2003.

⁵ Program personnel are aware of sixteen systems-built manufacturers in Wisconsin, including several manufacturers that produce product lines under multiple company names. As of October 2003 Wisconsin ENERGY STAR Homes had agreements in place with four of these manufacturers and staff was engaged in exploratory conversations with another six firms.

⁶ At this point Wisconsin ENERGY STAR Homes has certified more than 2,000 homes. In less than a handful of cases builders have asked program personnel to help them resolve consumer complaints; most of these complaints were moisture related. In response the program has typically installed moisture monitoring equipment and generally the program found that occupant behavior (e.g., not using ventilation equipment as directed, hanging laundry in the basement to dry) was the source of the problem; in these cases program staff then worked with the builder to educate the occupants about these behaviors.

significantly reduced callbacks. Similarly, manufacturers would benefit from a program intended to improve the quality of homes produced by that manufacturer's builders.

The manufacturer-builder relationship is complicated by basic economics. While the consumer purchasing the home is the builder's customer, the manufacturer's customer is the builder, not the consumer. Manufacturers invest considerable effort in recruiting and retaining builders; like any supplier, the manufacturer benefits from repeat business from its established clientele.

The manufacturer, then, is left in a difficult position. Although it is in the manufacturer's interest to improve the building techniques of its builders, as a supplier, the manufacturer has limited ability to suggest (much less enforce) increased standards for aspects of the home that are typically the builder's purview. Ideally, the manufacturer would like to focus on producing modules and be assured that someone else is educating their builder-customers. Furthermore, as liability issues arise and any questions of blame begin to circulate, both the manufacturer and the builder could benefit from an unbiased expert investigating the situation. Once program staff understood this situation they recognized that the Wisconsin ENERGY STAR Homes program could provide significant value to systems-built manufacturers.

2. Challenges in Reaching Systems-Built Housing

As described above, the manufacturer's need to address shared liability issues without compromising their standing with the builder created an opportunity for the Wisconsin ENERGY STAR Homes program to approach manufacturers and talk about the benefits of partnering with the program. In speaking with manufacturers, program staff explained that Wisconsin ENERGY STAR Homes already provides participating builders with a kind of quality control process. As an unbiased third party, the program helps builders verify that certain building performance standards are met. And, as is the case with stick-built builders, the program could provide ongoing education and training to the systems-built builders, enabling them to continuously improve their building practices. While these ideas had immediate appeal to several systems-built manufacturers, the program still had to overcome significant programmatic challenges to make the Wisconsin ENERGY STAR Homes model work in the factory.

2.1 The Big Challenge: Fitting the Certification Model to Systems-Built Housing

Initiated as a program serving stick-built housing, the Wisconsin ENERGY STAR Homes certification model is premised on the fairly standard way most homes are built in Wisconsin. Insofar as the process is considerably different for systems-built housing, the program had to devise modifications to the certification model that accommodated the differences in the building process (i.e., that modules are produced and sealed at a factory rather than at the home site, making it impossible to verify certain details of framing and insulation at the construction site). The program also had to maintain its rigorous standards. While it was relatively easy for staff to identify what needed to happen to certify systems-built housing, developing a process associated with those requirements was much more difficult.

Staff recognized that, in order to certify a systems-built home, certain features would need to be verified at the factory. Once these features were verified, the modules were essentially "certification ready." Utilizing "certification ready" modules, a builder—who followed other program standards on site—could deliver a certified Wisconsin ENERGY STAR Home to his customer.

Factory-level verification was, however, complicated by manufacturers' desire to offer Wisconsin ENERGY STAR Homes certification as an option rather than a standard feature. Had manufacturers adopted the changes required to meet program standards system-wide, the program could have verified those changes up front and perhaps conducted some sort of periodic check in to assure that the

modifications were still in place. Instead, the program had to figure out a way to accommodate a process where manufacturers would make one module “certification ready” while the next module might be “standard.”

From the program’s perspective, accommodating manufacturers on this point was vital. The Wisconsin ENERGY STAR Homes program had long emphasized its voluntary nature with participating builders. The program does not require participating stick-built builders to enroll all of their homes. Indeed, one of the things consultants emphasize to builders is the program flexibility—the builder can access the program when he sees value in doing so. (The program intends, of course, that builders will see value and increasingly enroll more of their homes, ultimately making the commitment to build only homes that meet program certification standards. However, it is clear that builders are not going to make a commitment to the program until they have seen first-hand evidence of its benefits.) As staff began talking with manufacturers, they understood that these manufacturers wanted a similar level of flexibility so that they too could offer Wisconsin ENERGY STAR Homes certification as an option, effectively testing the market without making fundamental adjustments to production or pricing.

Having manufacturers produce certification ready homes on an intermittent basis was much more complicated than a stick-built builder building non-program homes. On the stick-built side the program consultant is simply involved in the homes that the builder identifies to the consultant as candidates for certification. On the systems-built side, though, it seemed that the program would need to have a consultant standing by to inspect modules at intermittent and irregular schedules. Program staff knew that this model would quickly become time and cost intensive, effectively making the costs associated with certification unreasonable.

Staff found the solution to this obstacle rather unexpectedly, through contacts made as part of a separate effort. In 2001 the State of Wisconsin received a U.S. Department of Energy grant for a Building America project to investigate and improve the efficiency of production-scale housing in the state. As part of WECC’s efforts delivering Wisconsin ENERGY STAR Homes under the state’s Focus on Energy program, WECC staff participated in the state’s Building America initiative. This effort funded several in-depth technical assessments of existing production-level building practices in the state. (In addition to working with a systems-built manufacturer, the effort involved analysis of the construction practices of a large production builder.) The grant enabled the program to convene the key players in the systems-built housing industry and to initiate conversations about how Wisconsin ENERGY STAR Homes and systems-built manufacturers could work together.

As part of these conversations program staff were introduced to representatives from PFS Corporation, a state-approved housing code-compliance firm based in Madison. PFS works with systems-built manufacturers and their in-house quality control staff to provide in-factory code compliance. The PFS process involves detailed review of quality control documentation recorded on the factory floor, as well as random sampling of home products as they are completed. If compliance is not met PFS has the authority to shut down production lines until the problem is corrected systemically.

Already in the factory, PFS provided the critical link to Wisconsin ENERGY STAR Homes certification during the manufacturing process. PFS recognized the value of Wisconsin ENERGY STAR Homes’ certification to their clients (the manufacturers) and the benefit of working with the program to provide that certification. Accordingly, PFS volunteered to supplement their existing evaluation by verifying additional features of the modules intended to be “certification ready.” With PFS offering to perform these verification services at no additional cost to the program or the manufacturer, the program could devote its energies to identifying the measures each interested manufacturer needed to incorporate to meet program requirements and then working with PFS to make sure those measures were verifiable in the factory.

The partnership with PFS had significant implications for the program's viability in the systems-built marketplace in terms of cost effectiveness. By agreeing to provide the additional review at no cost to the program, PFS enabled Wisconsin ENERGY STAR Homes to certify systems-built homes at a lower cost (because two site visits are effectively eliminated). The program has some new costs, of course, associated with providing training to PFS personnel but these training expenses are relatively minor compared to the eliminated site visit costs, especially as the number of systems-built homes enrolled in the program increases over time.

The benefits of the program's partnership with PFS extend well beyond the program's financial savings on site visits. This partnership enables the Wisconsin ENERGY STAR Homes certification to be fully integrated into a manufacturer's process; as an example, a builder is able to verify that components are "certification ready" based on information PFS has added to the standard code compliance plates that are affixed to each component before shipping. In addition, as this effort evolves and PFS staff comes to appreciate the benefits the program delivers to manufacturers and builders, the PFS staff is starting to refer additional manufacturers to the program.

2.2 *Other Programmatic Challenges*

Staff had to overcome a variety of smaller challenges once the big hurdle regarding in-factory verification was resolved. Some systems-built housing models, for example, feature components that are framed on site such as dormers on Cape Code homes. Under the Wisconsin ENERGY STAR Homes model these homes require both in-factory verification of the modules and site visits to verify details associated with the on-site framing components. Staff had to develop a model that was flexible enough to allow consultants to accommodate these complications.

Other ongoing challenges include efforts to collaborate with manufacturers to sell the benefits of Wisconsin ENERGY STAR Homes certification to systems-built builders. As was the case in the stick-built industry, the program's strategy is to identify and recruit opinion leaders first. In the case of systems-built housing, program staff must work closely with manufacturers to identify these leaders.

3. Measuring Success

Successful energy efficiency programs are ones that benefit all stakeholders. WECC believes that the best models are those that enable private industry to realize real benefits from delivering energy efficient goods and services while simultaneously delivering the public benefits associated with energy efficiency (ideally in an increasingly cost-effective manner). Considered in this context, the Wisconsin ENERGY STAR Homes partnership with the systems-built housing industry looks very promising.

3.1. Benefits for Manufacturers and Builders

Wisconsin ENERGY STAR Homes provides critical quality assurance services to both manufacturers and builders in the systems-built marketplace. On the factory floor, the certification requirements are an assurance for the *builder* that the product the builder requested is the product delivered. Thanks to the PFS verification process, the builder and his customer can be more confident that they are receiving product that, correctly assembled, will perform to some of the highest building standards in the nation. Similarly, at the home site, certification standards are an assurance for the *manufacturer* that the assembly of the systems-built home components was performed in a manner consistent with the manufacturer's intent, building science principles and construction best practices.

Furthermore, both the builder and manufacturer benefit from the program's commitment to provide homeowners with comfortable, safe, durable, and energy efficient homes. The most obvious benefit for both builders and manufacturers is the reduction in potential callbacks that typically results from the added attention to the details of construction required by the program's certification process. In addition, there is a significant potential for increased customer satisfaction associated with the certification process. As part of the program's communication strategy, the new owner of every Wisconsin ENERGY STAR Home receives a homeowner's manual and a report that describes the tested performance of their home; survey data associated with this mailing indicates that homeowners are very pleased with their homes and that they value the Wisconsin ENERGY STAR Homes designation.

The certification itself benefits this industry because it is an objective assessment of home quality. For the systems-built industry communicating the quality of their products to homebuyers is paramount. Given the industry's checkered history, they are very attuned to finding and exploiting opportunities to compare their current line of products to stick-built alternatives. Wisconsin ENERGY STAR Homes certification has come to represent quality and performance in the Wisconsin home market, and some manufacturers see tremendous benefit in having this label apply to their products.

Finally, manufacturers who participate in the program have more access to innovation than their peers. In many ways Wisconsin ENERGY STAR Homes functions as a kind of research and development service for these manufacturers, helping them to identify possible innovations that merit further analysis.

It is worthy of note here that the program's list of benefits for manufacturers and builders does not include energy savings for the homeowners. Consumers typically assume (and often with good justification) that their newly constructed home will be more energy efficient than their previous dwelling. In Wisconsin the difference between the new home and the old home is usually much greater than the difference between the average new home and a higher performance new home. Further, staff acknowledge, based on past research as well as discussions with builders, that energy savings is simply not a big customer motivator. There is no good reason for staff to assert otherwise with builders and manufacturers.

3.2 Program Benefits

From the program's perspective, developing a partnership with systems-built manufacturers gives the program access to an important piece of the new construction market. Insofar as the program aims to affect 10% of Wisconsin's new construction market by 2005, reaching the systems-built industry makes that goal more attainable.

Wisconsin ENERGY STAR Homes aims to permanently change the way homes are built in Wisconsin, making the sustainability of various program impacts very important. Early indications are that the program can affect permanent change with systems-built manufacturers. One way to measure this

potential is to look at how widely manufacturers are implementing the in-factory recommendations they receive from the program. One Wisconsin manufacturer, Wausau Homes, has decided to implement some recommendations associated with insulation and window installation in all new homes produced in both their Wisconsin facility and their facilities in other parts of the country, even though the company has no “program” incentive to do so in other areas. This broad adoption of Wisconsin ENERGY STAR Homes’ recommendations indicates that Wausau Homes does truly see the program as a trusted and valuable technical resource.

More generally the program—along with other WECC and Focus on Energy programs—benefits from having and sustaining an effective partnership where staff was pushed to modify program protocols to fit a different set of needs. As programs become successful it is very easy for rules to become institutionalized to the point that staff miss opportunities because those opportunities do not fit into existing models. In addition to serving as a vital reminder that “it’s not about energy,” this partnership also serves to remind staff that they have the ability to transform challenges into growth opportunities.

The final metric of success from the program’s perspective is, of course, energy savings. Wisconsin has strong building codes and most new homes are built sufficiently above code that they would meet the national ENERGY STAR Homes standards, which is what prompted more rigorous state-level standards initially. Past evaluations indicate that a certified home saves 100 therms annually over a typical new home. The 30 systems-built homes certified so far, then, account for 3,000 therms of savings annually.⁷ While this number is relatively small, staff is optimistic that it will grow substantially over time.

4. Conclusions: It’s Not About the Energy Savings

This partnership with the systems-built housing industry works because the Wisconsin ENERGY STAR Homes program staff remains committed to two fundamental premises. First, they ensure that the program is responsive to the needs of the marketplace; this effort began, after all, with a request from a participating builder. And the partnership model evolved as staff recognized the needs and motivations of the systems-built manufacturers. Program staff was prepared to be flexible on various issues of implementation while also protecting overall program effectiveness. The commitment to responsiveness enabled a flexibility that yielded a creative new approach.

Equally significant was staff’s recognition that, for our private industry partners, it is not about the energy savings. Energy issues are a minor consideration in the new home construction process. Significant and sustainable opportunities for energy savings are seized most cost-effectively when programs address issues more central to the concerns of the other stakeholders. In this case, the manufacturer and builder concerns about liability and the reputation of their industry provided an opportunity to build a partnership that does, in the end, generate energy savings for the program. Being responsive to the needs and priorities of the marketplace ensured that the program was relevant and, ultimately, that partnership opportunities could be realized.

⁷ The program measures electrical savings based on specific installed technologies (e.g., ENERGY STAR qualified appliances, high SEER central air conditioners, etc.).