

# Setting the Pace for the Race to Zero Energy Ready Homes

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## ABSTRACT

DOE Zero Energy Ready Home works as complementary label with EPA's ENERGY STAR Certified Home's to transform the housing industry to high-performance. Within a year of the Zero Energy Ready Home launch in January 2013, there were nearly 8,000 homes committed to program certification. This level of commitment was achieved with one-fourth the budget, one-fourth the staff, and in one-fourth the time of ENERGY STAR Certified Home. Something significant is happening when a new home label demanding zero energy ready performance, in an industry profoundly slow to change, can achieve that level of traction so quickly with so little resources. This paper suggests this early success with DOE Zero Energy Ready Home was made possible by effectively applying the market deployment playbook learned from ENERGY STAR Certified Home. In other words, the cost and time savings associated with the learning-curve experience from ENERGY STAR are profoundly accelerating the race to zero energy ready homes. And an even more powerful conclusion is that this playbook can be applied to similar market deployment efforts involving other market-ready practices and technologies for maximum impact.

## Background

The U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) promulgate high-performance home labels, ENERGY STAR Certified Home and Zero Energy Ready Home, respectively. ENERGY STAR Certified Home is the symbol for energy efficient homes that exceed the 2006 International Energy Conservation Code (IECC) by 20 to 30 percent (see [www.energystar.gov/homes](http://www.energystar.gov/homes) for more information). ENERGY STAR for Homes was able to grow to over 25 percent of the housing market and more than 1.3 million homes prior to the launch of Version 3 with a very low annual budget of approximately \$1.7 million and a staff of only six.<sup>1</sup> Clearly something incredibly 'right' was involved in the implementation of ENERGY STAR Certified Home. DOE Zero Energy Ready Home takes performance to the next level where a "zero energy ready home" is defined as a high-performance home so energy efficient, most or all annual energy consumption can be offset with renewable energy (see <http://energy.gov/eere/buildings/zero-energy-ready-home> for more information). Both of these programs are having significant impact transforming the housing industry to high-performance. This paper addresses the playbook for this success and the opportunity to apply it to other market transformation programs.

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<sup>1</sup> Internal EPA ENERGY STAR for Homes tracking data

## Market Transformation Process

Before laying out the playbook that worked so well for the ENERGY STAR Certified Home program, let's examine the market transformation process. It begins by identifying and developing new opportunities for innovation, through critical research and development (see Figure 1). At the DOE's Building Technologies Office, early stage research is served by the Emerging Technologies program and applied R&D is served by the Building America program. Emerging Technologies provides contracts and grants to industry partners to develop new residential and commercial building technologies. The Building America program contracts with consortia of experts working with industry partners and with DOE national laboratories to develop technology solutions and best practices for the residential sector. Together, these programs provide a pipeline of proven innovations ready for market.

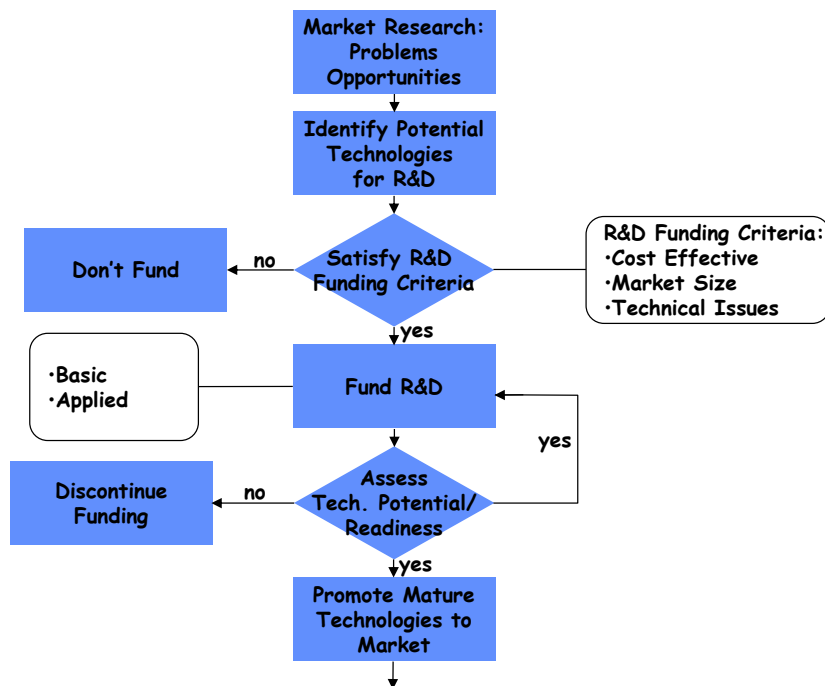


Figure 1. Innovation development flow chart.

Once innovations are ready for market, they need an effective deployment process to ensure market adoption (see Figure 2). This begins with an assessment of each new innovation relative to market readiness criteria: cost-effectiveness, performance that meets or exceeds consumer expectations, and adequate supply infrastructure. If any of these criteria are not satisfied, a Sustained Orderly Development process<sup>2 3</sup> is required to ensure industry investment in research and manufacturing capabilities required to achieve economies of scale, enhance

<sup>2</sup> Osborn, D., *Sustained Orderly Development and Commercialization of Grid-Connected Photovoltaics: SMUD as a Case Example*, *Advances in Solar Energy*, (2001)

<sup>3</sup> Aitken, Donald W., *New Economic Thinking and Approaches to Utility Scale Application of Solar Energy in the 90s*, *Advances in Solar Energy*, Vol. 11 (1997).

performance, and build an adequate supply infrastructure. Options for implementing this process include subsidies, bulk purchase agreements, golden carrot competitions, and technology incubator programs. If the new innovation meets market readiness criteria, then market-based programs can be deployed that effectively educate and promote the innovation opportunity to industry and consumers. Where there are significant resources, more expensive mass-marketing can be engaged to broadly promote the innovation. Where resources are constrained, lower cost programs can leverage large impacts including product labels, consumer education, technical support, and revenue neutral market-based incentives.

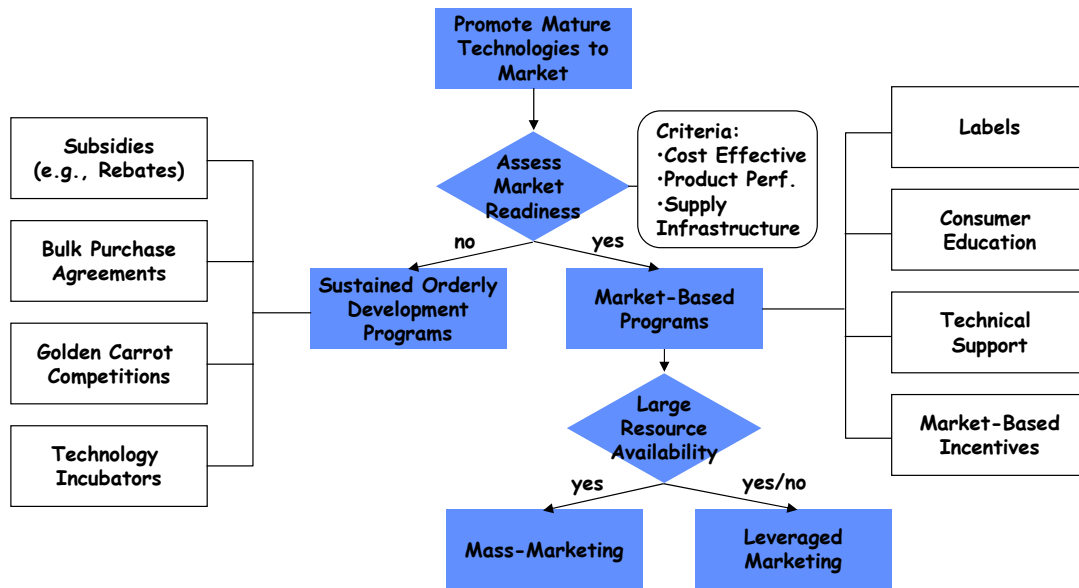


Figure 2. Market deployment flow chart.

The product label option is utilized at EPA for ENERGY STAR Certified Home and at DOE for Zero Energy Ready Home. Both of these programs promote innovations that are cost-effective (i.e., monthly utility bill savings exceed incremental monthly mortgage expense of incremental improvements), exceed consumer expectations (i.e., better home for lower cost of ownership), and have an adequate supply infrastructure (i.e., all U.S. home builders). Thus, their implementation strategies are focused on engaging the housing industry and homebuyers on compelling value propositions. This is where the ENERGY STAR Certified Home playbook comes in.

## Market Deployment Playbook

What is a playbook? A simple definition is a set of actions that are likely to achieve a desired outcome with the proper balance of training, experience, and information. This term is most commonly used in sports where the desired outcome is victory. For market deployment programs, victory is defined as meaningful market transformation. Upon detailed examination of ENERGY STAR Certified Home based on seventeen-plus years' experience overseeing that program, a proven playbook critical to the program's success has been identified (see Figure 3).

This playbook includes five key components that formed the strategic framework for program implementation. A review of each critical component follows.

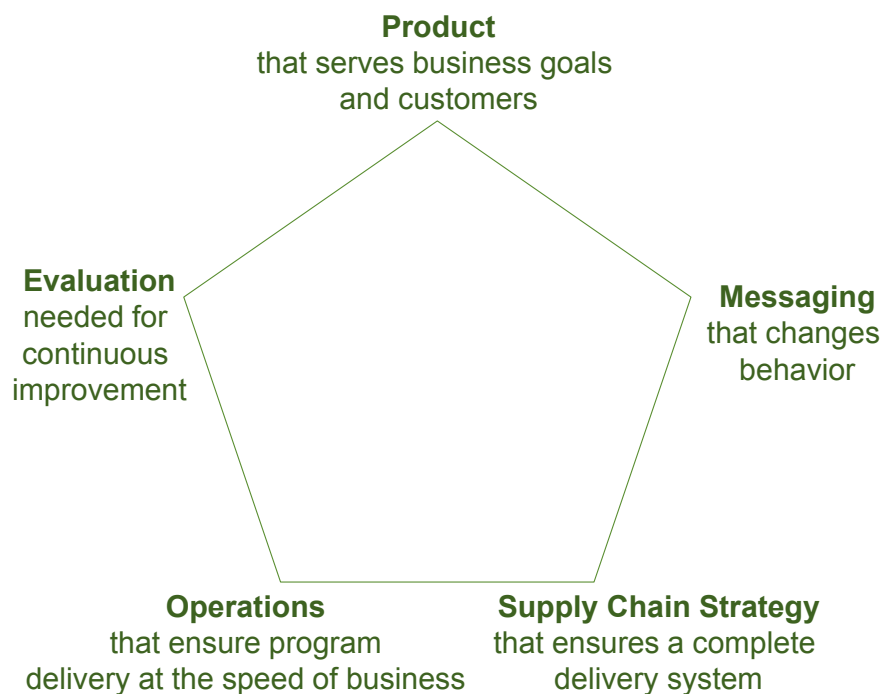


Figure 3. Market deployment playbook for innovations that are cost-effective, meet consumer performance expectations, and have an adequate supply infrastructure.

## Product

Market transformation is doomed at the start if you get the product wrong. The product must serve an organization's business goals while also being readily adopted by targeted customers. In the case of ENERGY STAR, the product is a market recognition label for achieving rigorous energy efficiency specifications. The authors observed that there was substantial criticism on both sides of each new version of the ENERGY STAR Certified Home specifications; some thought the specifications were too easy and others thought they were too rigorous. But history suggests the EPA got them right each time - ENERGY STAR Certified Home achieved substantial market penetration and continues to transform the housing industry to comprehensive building science. This was achieved by focusing product requirements on effectively staged incremental innovations that addressed the limitations of the industry and supply infrastructure. From the start, ENERGY STAR Certified Home employed thresholds that achieved critical performance objectives while being readily attainable by the homebuilding industry. Version 1 specifications established a recognition label for significantly above code performance, provided a platform for growing a viable HERS infrastructure, and initiated air and duct leakage diagnostics. Version 2 established more rigorous energy performance and ensured complete air barriers. Version 3 delivered comprehensive building science. At every step of the way, the ENERGY STAR Certified Home label delivered exceptional value.

## Messaging

A new product requires targeted customers to try something new. Thus, it is critical to develop messaging that effectively changes behavior. Where it would have been easy to oversell the power of the ENERGY STAR brand to engage home builders, program staff recognized it could not deliver customer loyalty. ENERGY STAR is one of the most successful government branding efforts, but the EPA team knew homebuyers would not be asking builders for an ENERGY STAR certified home. They weren't loyal to ENERGY STAR. The key message to builders was that certification to EPA specifications would empower them with an independent voice of authority ensuring their product met rigorous guidelines for energy efficiency excellence. That was bankable. And trust is a major issue. One recent research study suggests 1 out of 3 homebuyers do not trust home builders.<sup>4</sup> However, personal experience suggests this research overstates consumer trust in builders. The entire home buying process involves tremendous unknowns for buyers. In the case of production homes, models are luxuriously finished and decorated so they often don't accurately represent the purchased home, and buyers can feel significant pressure to pay more for very high mark-up upgrades. Introducing a substantial element of trust with an ENERGY STAR label for energy efficiency and independent verification was a big advantage for builder partners. Secondly, energy efficiency is important to homebuyers as demonstrated by numerous surveys and reports<sup>5</sup>, and thus the label also provided market differentiation on an important attribute. And lastly, a key message shifted focus away from the higher first cost to lower ownership cost where the monthly utility bill savings typically exceeded the increase in monthly mortgage attributed to ENERGY STAR improvements. Additional value propositions about comfort, health, and durability all contributed to a strong market position for the participating builders.

## Supply Chain Strategy

Understanding and building an effective supply chain is vital to success with any product. The very first ENERGY STAR for Homes Version 1 required a Home Energy Rating System (HERS) rating where there was only a nascent HERS infrastructure with just a handful of fledgling raters in a few small markets. There was nothing resembling the HERS infrastructure of today. But the EPA team clearly understood the need to protect the label with rigorous verification, as well as the reality of program resource limitations. The only way a staff of six and a small group of EPA contractors could effectively reach our nation's builders was by leveraging a sales network based on concomitant business interests. Independent verification was deemed an essential part of the product and there was no other option but to hitch the program wagon to the limited HERS industry. However, understanding the supply chain challenge informed the program implementation strategy and substantial efforts were invested to help develop a HERS infrastructure in the first years of the program. This included a major portion of the program budget and time being invested to fund the formation of the Residential Energy

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<sup>4</sup> The business of Trust – The Most Trusted Builders in America, Lifestory Research, January 2013

<sup>5</sup> Rose Quint, *What Home Buyers Really Want*, NAHB Economy & Housing Group, May 2013

Services Network (RESNET) as the industry oversight organization, cultivate utility partners who would invest in developing a local HERS infrastructure, travel extensively to meet with leading HERS raters and assist them with builder business meetings, and feature HERS raters prominently on the ENERGY STAR web site. This investment was tremendously successful as evidenced by an emerging HERS infrastructure after the first three years that enabled exponential program growth thereafter.

Once the HERS infrastructure developed and yielded an effective sales force, sustained growth demanded a significant shift of focus to a strong distribution network including utility and state programs. This led to an annual sponsor partner meeting that facilitated critical networking and sharing of lessons learned among the core distribution network. Other efforts to build distribution included coordination with DOE's Building America program, and engaging industry associations.

## **Operations**

The first three components are critical for program lift-off. These last two components are essential to sustain program growth. Effective operations must always be looking ahead and anticipate systems and services needed to ensure the program works at the speed of business and that exponential growth could be managed with the limited resources allocated to the program. Business partner loyalty is fragile, making it critical to minimize burdens and make services easily accessible. This objective was achieved with ENERGY STAR Certified Home by quickly applying information technology to enable online access to partnership agreements, reporting of certified homes, and access to marketing and technical resources. Additional processes were set up for ensuring quick responses to all inquiries and keeping all partners informed.

## **Evaluation**

The last critical component is to effectively evaluate program performance to support continuous improvement. Staying put is not an option. With resource-constrained programs like ENERGY STAR, this demanded the discipline to focus only on data needed for continuous improvement. As a result, the criteria for collecting data was based on whether it could be converted into information and then knowledge needed to assess the effectiveness of the other four components and guide efforts to make them better. Towards that end, ENERGY STAR had continuous tracking data on the number of labeled homes that enabled assessment of growth in different markets and strategic planning for different distribution solutions. As an example, early data revealed there was no correlation between the rate of growth and the amount of incentives offered by utility and state programs.<sup>6</sup> For instance, markets like Las Vegas and Phoenix were leading ENERGY STAR Certified Home growth with no incentives and soon after that Texas had become the state with the largest number of ENERGY STAR certified homes even with a utility incentive much smaller than most other states. Active evaluation of all presentations,

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<sup>6</sup> ENERGY STAR for New Homes Sponsor and Utility Partner Guide, EPA ENERGY STAR Web Site, October, 2007

training, and webinars enabled staff to continually improve messaging. The bottom-line is with very limited resources, disciplined evaluation enabled critical improvements to ENERGY STAR Certified Home.

## **Applying Market Deployment Playbook to DOE Zero Energy Ready Home**

DOE Zero Energy Ready Home serves an important role supporting market deployment of proven innovations from DOE's Building America Program. This program builds upon its predecessor, Builders Challenge, but was completely reinvented. This was necessary to fully align Zero Energy Ready Home with ENERGY STAR Certified Home and to establish much more aggressive program requirements serving the zero energy ready goal. The following sections demonstrate how Zero Energy Ready Home applied each component from the ENERGY STAR Certified Home market deployment playbook.

### **Product**

As a market deployment solution for Building America, a critical business objective for Zero Energy Ready Home was to ensure targeted innovations would be included in every certified home. However, product design also worked in parallel with 'Marketing' component efforts to ensure value propositions necessary for a compelling consumer message. This was accomplished by specifying complete systems that locked in both superior energy efficiency and home performance. A solid foundation for energy efficiency and building science was achieved by requiring ENERGY STAR Certified Home Version 3 as a prerequisite, optimized thermal enclosure and efficient heating/cooling system innovations from Building America, and ENERGY STAR certified components throughout the home. This level of rigor was based on DOE tracking data from the prior Builders Challenge program demonstrating builders were ready for a much more aggressive HERS Index Score than required by ENERGY STAR Certified Home. A year after establishing a rigorous HERS Target Score requirement, this decision was validated with data reported by RESNET that nearly 220,000 homes were HERS rated in 2013 with an average HERS Index Score of 64.<sup>7</sup> If we assume a reasonable distribution of HERS Index Scores, it is estimated that tens of thousands of single-family homes constructed last year can be expected to have met or exceeded the threshold HERS Index Score for DOE Zero Energy Ready Home ranging from 50 to 60. Thus, we estimate that nearly 10 percent of the approximately 600,000 single-family homes constructed in 2013 are already meeting or approaching the Zero Energy Ready Home performance threshold.<sup>8</sup> The Zero Energy Ready Home product can add substantial additional value by reducing risk and improving home performance. That is first achieved by requiring EPA Indoor airPLUS certification to ensure comprehensive indoor air quality (IAQ). This is critical because IAQ is no longer extra credit in high-performance homes that are well insulated and air-tight. In addition, homes this efficient

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<sup>7</sup> "Number of Homes Rated and Average HERS Index Score in 2013," RESNET, <http://www.resnet.us/blog/wp-content/uploads/2014/01/Number-of-Homes-Rated-and-Average-HERS-Index-Score-in-2013-1.pdf>

<sup>8</sup> "Housing Starts in 2013: 18% Annual Increase, Still Sixth Lowest Level on Record," Calculated RISK Finance & Economics, January 17, 2014

can save thousands of dollars in the future installing solar systems to achieve zero energy performance if simple low- and no-cost measures are included during construction. As a result, Zero Energy Ready Home requires solar ready details in locations with a significant solar resource. Looking ahead at hard trends confronting the housing industry relative to water resource constraints, greater exposure to disasters, and an accelerating pace of innovation, DOE Zero Energy Ready Home also encourages and provides extra recognition for builders meeting requirements of EPA WaterSense, the Institute for Business and Home Safety (IBHS) Fortified Home, and DOE quality management system guidance. Zero Energy Ready Home offers builders substantial market differentiation along with significant risk reduction. More importantly, it is easily achievable by mainstream builders all across the country. DOE is confident this is a great product.

## Messaging

ENERGY STAR certified homes are assured of 20 to 30 percent greater efficiency than a minimum code home. However, a typical mortgage principal and interest payment typically dwarfs the resulting utility savings, so it is not always perceived as significant. On the other hand, zero energy and zero energy ready performance are emotional. Now a homeowner can own a home that can be untethered to meaningful utility bills. It's equivalent to a car that gets over a hundred miles per gallon performance. The incremental energy savings above ENERGY STAR may not be huge, but zero energy ready performance takes homebuyers to an emotional place that is compelling. Consider the billboard by Garbett Homes in Salt Lake City shown in Figure 4. The power of that message allows it to grab homebuyers' attention.



Figure 4. Garbett homes billboard.

Another power message addresses exclusivity. If you're an ENERGY STAR Certified Home builder, you're in the top 10 to 20 percent of builders in the country for meeting rigorous performance guidelines. With Zero Energy Ready Home, builders are in the top 1 percent of



builders meeting rigorous guidelines for excellence. This is a messaging advantage for the upstart program that has nothing to do with energy or home performance, and everything about the added confidence a buyer can have with this builder. Another key message is about the visionary choice with Zero Energy Ready Home. A home built to minimum ENERGY STAR Certified Home requirements will be illegal to construct in just a few years as states ramp up from 2009 to 2012 IECC. However, each Zero Energy Ready Home is built to the forthcoming 2012 IECC code and will not be obsolete. Again, this is a powerful message to any homebuyer making what is often the largest purchase of a lifetime. Along with these core messages are powerful messages about comprehensive IAQ protection, enhanced comfort, added quality assurance, advanced technology, and improved durability.

The next step is to make this message as simple as possible. Towards that objective, the Zero Energy Ready Home brochure demonstrates the consequences of each consumer’s home buying choice with simple bar graphs depicting the relative value propositions (see Figure 5). The green bar represents Zero Energy Ready Home, the blue bar represents ENERGY STAR Certified Home, and the grey bar represents a typical existing home based on MEC 93 home specifications. Here is how simple and effective the message becomes in the sales process using the ‘Healthful Environment’ comparison bars as an example:

“Mr. and Mrs. Jones, as you can see from the U.S. Department of Energy information, every one of our homes have all the U.S. Environmental Protection Agency recommendations for good indoor air quality to protect you and your family, while ENERGY STAR has about half of them, and they are substantially missing in an existing home. Wouldn’t you agree you and your family would benefit from this enhanced health protection?”



Figure 5. DOE zero energy ready home brochure.

DOE is completely transparent with how the bars were calculated in a detailed analysis report posted on the program web site.<sup>9</sup> This is intended to provide powerful market differentiation for builders who do the easy jump from ENERGY STAR Certified Home to Zero Energy Ready Home. And this message has been extensively evaluated for effectiveness. Over 30 training classes with industry professionals teaching the business case for zero energy ready homes continues to earn on average a score of 4.7 out of 5.

## **Supply Chain Strategy**

An effective supply chain solution is the most significant challenge facing DOE Zero Energy Ready Home. Once the HERS rating infrastructure emerged, ENERGY STAR Certified Home had a dedicated sales force with very little distraction up to recent years. This was because all or most revenue for HERS raters was derived providing verification services to builders earning ENERGY STAR. Thus, the strategy to require HERS verification resulted in a national sales force working 24/7 to sell that program. Things have dramatically changed. HERS has grown so well under RESNET that the rating business is substantially diversified. In addition to ENERGY STAR Certified Home, raters provide verification for a number of green labels and for just the HERS rating without a program label. In addition, the latest 2015 IECC establishes a code compliance path using HERS certification. And increasingly HERS raters will be embracing opportunities to work with existing homes. This is a dramatically different landscape for developing a Zero Energy Ready Home supply chain. DOE is focusing on nurturing a cadre of leading builders and HERS rater, facilitating their collaboration, and promoting their success. Thus, DOE Zero Energy Ready Home staff work hard to find the most innovative raters and demonstrate the strong business case for upselling ENERGY STAR builders to Zero Energy Ready Home. As mentioned earlier, RESNET data suggests at least 50,000 homes are meeting or exceeding the average DOE Zero Energy Ready Home HERS Index target score in the low to high 50's. In other words, a very large share of home builders is already within shooting distance of zero energy ready performance. The resulting strategy for DOE is to educate raters and builders of the business opportunity to substantially increase market differentiation while reducing risk with readily achievable Zero Energy Ready Home certification. Additionally DOE is working to develop a distribution network by working with more progressive utilities to offer an upper-tier new home program, joining forces with a new zero energy home association called the Net-Zero Energy Home Coalition, and collaborating with manufacturers vested in the transition to zero energy ready performance.

## **Operations**

With much less resources than even the small amount allocated to ENERGY STAR Certified Home, efficient operations has been a live-or-die proposition from the beginning for DOE Zero Energy Ready Home. Every single step of implementation had to be optimized or

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<sup>9</sup> DOE Challenge Home Label Methodology, October 2012, [http://energy.gov/sites/prod/files/2013/11/f5/ch\\_label\\_methodology\\_1012.pdf](http://energy.gov/sites/prod/files/2013/11/f5/ch_label_methodology_1012.pdf)

leveraged. First, program reporting of certified homes is accommodated with a simple manual system while gaining traction, but in the near future looks to leverage the RESNET Registry. This will be substantially less cost than experienced by ENERGY STAR's internal on-line reporting system and should yield the same level of accuracy with substantially more data. Almost from the start, the largest RESNET-approved HERS software providers (Architectural Energy Corporation and EnergyGauge) were leveraged to provide Zero Energy Ready Home target home energy simulations built into the software. All partner resources have been developed for on-line distribution and lower distribution cost. This includes extensive marketing and technical resources. As one example, Zero Energy Ready Home switched from the bronze plaque used for ENERGY STAR Certified Home to a window sticker that is a small fraction of the cost and will hopefully be applied more extensively since it is so much easier to use. A large investment has been made providing zero energy ready home training across the country, but this is a critical early activity for establishing the program message and leveraging an army of HERS raters and other consultants who can deliver the same training as the program grows. Key technical training is also provided with low-cost webinars that are posted on-line for 24/7 availability. Additionally, Zero Energy Ready Home leverages the Building America Solution Center, a new on-line tool, as a major resource for providing expert guidance on all of the program's technical specifications. Without going into further detail, Zero Energy Ready Home has to do better with less.

## **Evaluation**

The Zero Energy Ready Home program employs proven evaluation techniques to measure growth, message effectiveness, web site use, training effectiveness and partner satisfaction. Early evaluation results indicate that the sweet spot for participation is the regional builder looking for a competitive edge with large production builders. These smaller regional builders tend to be more nimble making changes including integrating new technical and marketing solutions. The results of this evaluation will inform further efforts working with HERS raters to engage builders. And DOE will be confident of the messaging used in this effort based on evaluation results of extensive training seminars and presentations. DOE will also continue to organize leading builder round-table meetings engaging presidents and senior managers of the most active Zero Energy Ready Home partners to share lessons learned and identify areas for program improvement.

## **Applying Market Deployment Playbook to Other Programs**

This paper suggests that the ENERGY STAR Certified Home playbook can effectively help other market transformation programs targeting market-ready innovations with an adequate supply infrastructure. When starting a new program, it is recommended to plan and implement the program around the five key components. When applying the playbook to an existing program, the first step would be to benchmark the current implementation plan. The authors suggest a simple spider diagram tool shown in Figure 6. A '0' indicates the component is barely or not addressed and a score of '5' indicates the component is fully addressed. Simple internal or

external assessments are fine for identifying important areas for improvement. Figure 6 includes an example of the spider diagram applied to a hypothetical program that is only excellent at evaluating results of an otherwise very weak implementation strategy. Assessment efforts like this are needed early in a program development phase to best optimize results. The important recommendation is to consider leveraging the lessons learned from proven market transformation efforts by employing this playbook.

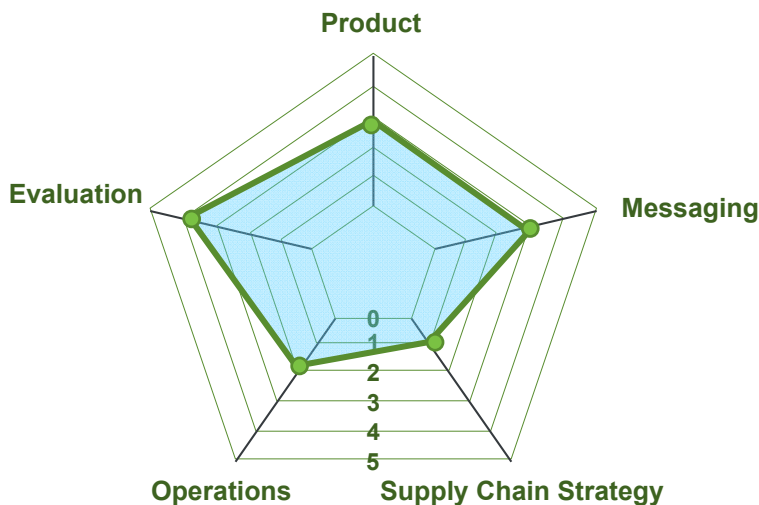


Figure 6. Market development program benchmarking tool with hypothetical program.

## Conclusion

To appreciate the ambitious performance target for DOE Zero Energy Ready Home, consider analysis by the National Association of Home Builders indicating it takes up to 25 years for new technologies to be adopted by the industry.<sup>10</sup> Following the successful ENERGY STAR Certified Home program playbook, DOE Zero Energy Ready Home is making an impressive entry into the housing market. Within a year of the Zero Energy Ready Home launch in January 2013, there were nearly 8,000 homes committed by builder partners. This level of commitment was achieved with one-fourth the budget, one-fourth the staff, and in one-fourth the time compared to the ENERGY STAR Certified Home program. Based on this success, other initiatives promoting market-ready practices and technologies should consider benchmarking their program to the Market Development Playbook developed from ENERGY STAR Certified Home experience to identify areas for improvement.

<sup>10</sup> C. Theodore Koebel, Maria Papadakis, Ed Hudson, and Marilyn Cavell, “The Diffusion of Innovation in the Residential Building Industry,” U.S. Department of Housing and Urban Development; prepared by Center for Housing Research, Virginia Polytechnic Institute and State University and NAHB Research Center, January, 2004.