

Government Intervention In the Energy Efficient Home Marketplace

by

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Abstract

This paper addresses the main topic of energy efficient homes, specifically the role of government intervention in the marketplace. A number of obstacles can prohibit energy efficient homes from dominating the new home marketplace. These obstacles include higher construction costs, imperfect marketplace information, inadequate marketing techniques, and a lack of understanding of the benefits among buyers and sellers.

In order to provide a fair treatment of this topic, a number of related issues have been addressed including the public benefits of energy efficiency, economic theory and government intervention in the market, behavioral theory, and program design details for a specific energy efficient home program called Energy Star Homes. Major findings include a positive correlation with energy efficient homes and public benefit, a substantial difference in perspective from economists regarding the role of government intervention in the marketplace, social marketing conditions conducive to prompting behavior change, and conditions that contribute to strong Energy Star Home market penetration.

Government programs are found to be helpful in promoting the energy efficient home construction message. What appears to be most significant to successful energy efficient home programs is the participation of market partners committed to changing the marketplace and capitalizing on the results.

Executive Summary

This paper proposes the following hypothesis: *Without public policies that advocate energy efficient home construction as the standard for the industry, Energy Star certified homes cannot significantly penetrate the marketplace.* The implication of this premise is that without public policy advocating energy efficient home construction, energy consumption will remain high and the public good will be negatively affected as a result of increased pollution and resource depletion.

Four primary issues are explored in relation to the energy efficient home marketplace: 1) the relationship between energy efficient homes and public benefit, 2) economic theory and the role of government intervention in the marketplace, 3) behavioral theory and public information campaigns, and 4) residential energy efficiency program design, with an emphasis on the Energy Star Home program.

Numerous issues affect the energy efficient home market including:

- Consumer recognition of energy savings with energy efficient homes, including how consumers prioritize and value energy savings with new home construction;
- Consumer willingness to invest more money with home construction, with an understanding that the operational costs (including energy costs) will be reduced over time;
- Market forces and demand for energy efficient homes;
- How the market demand is often hindered by imperfect information;
- How the market demand is often hindered by suppressed information from suppliers; and

- Government's role in supporting public health and well being (reduced pollution, reduced energy security issues, etc.) in relation to promoting energy efficient homes.

Findings from the literature were presented addressing the three primary issues (energy efficiency/public good, economic theory/government intervention, and behavioral theory/public information campaigns). These findings include:

- Reduced energy consumption generally leads to improved public good;
- Some authors claim improvements in energy efficient technology can lead to increased energy use because of larger homes, more electric use, and additional energy users;
- Economic experts do not agree on the role of government intervention in the energy efficient homes marketplace; and
- Results of behavioral theory research is very relevant to public information campaigns.

Findings from anecdotal research accumulated from multiple sources involved with energy programs in a sample of eleven states revealed:

- Government programs seem to be relevant and help increase the market share of energy efficient homes;
- Strength of market partners and champions pushing the market appears to be the most important feature for areas with higher Energy Star Home market penetration; and
- Regional conditions can have an effect on successful Energy Star Home market penetration.

Recommendations for further research addressing the role of government in the energy efficient home marketplace are provided. The conclusion section summarizes the literature findings as well as the anecdotal program information findings.

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Introduction

Is there public benefit associated with energy efficient housing? What does the literature say about the role (or absence of a role) of government intervention in the energy efficient home marketplace? What are the details of the Energy Star Home program that promotes energy efficient housing? What future research could help address government intervention in the energy efficient home marketplace? The purpose of this paper is to examine these questions and explore the role of government intervention in the energy efficient home marketplace.

America's use of energy resources is a current issue of considerable magnitude. The government and the American public have expressed concerns over energy consumption and energy importation issues. Americans could reduce a considerable amount of energy use if our houses were more energy efficient. This is an important issue for the American public and government stakeholders such as the Department of Energy (DOE), the Environmental Protection Agency (EPA), state energy offices and state political leaders.

In an effort to promote energy efficiency, the DOE and EPA have partnered to create a voluntary branding program for energy efficient products called "Energy Star." There are numerous products that can earn the Energy Star label including refrigerators, washing machines, DVD players, and homes. Homes that earn the Energy Star label feature energy efficient characteristics such as increased insulation, high performance windows, fuel-efficient furnaces and better-designed air conditioners.

Energy Star certified homes simply consume less energy than traditionally built homes. Many homeowners, however, do not choose the Energy Star home option when having a home built. In order to better understand consumer behavior and why energy

efficient homes are not more prominent in the marketplace, it was important to first examine the literature addressing three important fundamental issues.

This paper begins with a literature review that examines energy efficiency and public benefit, economic theory and government intervention in the marketplace, and behavioral change theory and public information campaigns. Anecdotal information about Energy Star Home programs in eleven states is then explored. The methodology of the research is outlined next, followed by a findings section organized into the same three categories featured in the literature review section plus the Energy Star Home program information. Recommendations follow, suggesting ways to enhance the energy efficient homes marketplace and areas in need of additional research. The conclusion section provides a summary of the literature and anecdotal program information.

In sum, this document provides an analysis of program experience and important literature addressing consumer behavior in the energy efficient home marketplace, including government intervention in the marketplace. Ultimately, it should help guide the future direction of the energy efficient home marketplace by providing recommendations that could increase consumer demand for energy efficient home construction.

Literature Review

The subject of *energy efficient homes in the marketplace* is primarily focused on four issues: 1) the relationship between energy efficient homes and public benefit, 2) economic theory and the role of government in the marketplace (exploring government intervention issues), 3) behavioral theory and public information campaigns, and 4) residential energy efficiency program design. The literature review section highlights the

first three issues, while the program design issue is presented in the anecdotal program review section.

The Relationship Between Energy Efficient Homes and Public Benefit

Utilizing energy in the home provides great benefits including warmth in the winter, staying cool in the summer, and access to a multitude of electronic devices and equipment that provide function and pleasure. Residential energy consumption also creates side effects that are not beneficial to public health and well being, including increased pollution in the air and water (sulfur oxides, nitrogen oxides, carbon dioxide, mercury, and other trace elements and particulate matter), and the depletion of finite resources. Brown (2000) addresses the amount of pollution emitted from U.S. electric generators as “28 percent of all nitrous oxides (NO_x) emissions, 67 percent of all sulfur dioxide (SO₂) emissions, 36 percent of all of all carbon dioxide (CO₂) emissions (although CO₂ is not classified as a pollutant by EPA standards, it is considered a “greenhouse gas” that may contribute to climate change), and 33 percent of all mercury released into the atmosphere nationwide” (p. 1).

Other agencies address public health issues associated with increased levels of pollution from burning fossil fuels for energy. According to the National Resources Defense Council (n.d.), “America’s dependence on the polluting energy technologies of the past threatens our nation’s economy, health, and security and contributes to the most urgent environmental and public health crisis of our time: global warming” (<http://www.nrdc.org/air/energy/rep/repinx.asp>).

Pollution creates detrimental effects to the biosphere including increased asthma and respiratory problems, increased cases of lung cancer, unacceptable mercury levels in

fish, reduced water quality in lakes and streams, climate change, smog, and damage to the built environment due to acid rain. The American Lung Association (n.d.) reports on the health problems associated with coal-fired power plant emissions, and more particularly respiratory illnesses such as asthma and respiratory infections with children linked to high levels of NO_x.

The Columbia University Mailman School of Public Health (n.d.) reports on a children's health study that began in 2001. This study was conducted in China and used "the novel biomedical approach of molecular epidemiology to determine the health risks to children from environmental pollutants generated by burning coal and other fossil fuels" (<http://www.mailman.hs.columbia.edu/ccceh/research/china.html>). The school concludes "the researchers anticipate that the results of the China project will improve the health of children by providing quantitative data that can serve as a basis for preventive action and as a valuable input into decision-making on energy policy".

According to the United States Environmental Protection Agency (EPA) (2005), "energy consumed in homes accounts for nearly 17 percent of total U.S. greenhouse gas emissions and 15 percent of energy consumption nationwide" (p. 2). Prindle, Dietsch, Elliott, Kushler, Langer and Nadel (2003) state that buildings are responsible for "more than a third of U.S. energy use and carbon emissions" (p. 5).

Furthermore, the costs incurred to the public's health and well being are typically not factored into the distribution and consumption of energy fuels. When energy supplies are purchased at wholesale rates (by energy providers) and retail rates (by energy consumers), costs associated with pollution problems are generally not reflected in the energy purchase price.

There are public benefits associated with reducing energy consumption. In terms of reducing pollution externalities from electricity generation, the Energy Information Administration (n.d.) states “energy efficiency, conservation and demand-side management programs all have a role to play” (http://www.eia.doe.gov/cneaf/electricity/external/external_sum.html).

Regarding public benefits from home energy efficiency, the Environmental Protection Agency (EPA) (2005) claims Energy Star rated homes “use about 30 percent less energy than they otherwise would and are helping to prevent a significant amount of greenhouse gas emissions from entering our air” (p. 5). According to the EPA, this has resulted in saving “Americans an estimated \$200 million in energy costs and eliminated nearly 4 billion pounds of greenhouse gas emissions” (p. 5). The EPA also predicts that the continued growth in the marketplace for Energy Star qualified homes will equate to nine million metric tons of cumulative carbon emissions prevented from entering the atmosphere between 1995 and 2012.

Consumers receive better rates of return from implementing energy efficiency measures compared to increasing more supply. There are two significant ways the general public benefits with home energy efficiency: financially and environmentally. Warren (1987) makes this general premise, and advocates comprehensive energy efficiency and conservation policies as far superior practices compared to increasing energy supplies.

In terms of public good, four things can occur simultaneously when homes are energy efficient: 1) finite energy supplies are not depleted as quickly, 2) emissions are reduced (including all the corresponding benefits associated with reduced emissions), 3) consumers save money, and 4) consumers increase net disposable income. With low-to-

moderate income residents, saving money on utilities and spending those savings elsewhere can be a significant quality of life factor. David Lipke (2001) quotes builder Joseph Thompson as saying “our customers are usually most interested in the monthly utility savings in an Energy Star home” (p.52).

An additional public benefit can result from energy efficient housing. When government agencies serve as the *housing provider* for low-income residents, energy efficiency can contribute to taxpayer savings. Money can be saved when the government does not have to finance wasteful energy practices with public housing. An example of a governmental agency collaboration designed to reduce energy use in public housing is the partnership between local housing agencies (LHAs) [agencies who receive program funding from the Department of Housing and Urban Development (HUD)], and the DOE Rebuild America program (Shafer, 2003). The Shafer article cites obstacles that sometimes make it difficult to incorporate energy efficient technology and construction practices in multifamily housing, including “lack of time, understanding, and access” (p. 21). In an effort to overcome these barriers with public housing residents, Shafer writes about a Spokane, Washington public housing project where energy conservation education was provided to new tenants.

Although most of the literature applauds home energy efficiency and associates positive public benefits with it, there are some that question the aggregate energy savings resulting from building technology improvements and programs that promote home energy efficiency. Harris, Diamond, Payne and Blumstein’s report (as cited in Anonymous, 2006) outlines increases in overall energy use despite improvements in home energy efficiency.

The Harris et al. report (as cited in Anonymous, 2006) claims a growth in aggregate energy use is partly attributed to larger homes, increased use of air conditioning, and additional appliances and home devices that use electricity. The report is critical of the Energy Star Home program because it does not discourage the construction of larger square foot homes. The authors argue that improved building technology creates more energy efficient homes, but when the homes occupy a larger footprint, the overall energy use can be higher. An appropriate analogy would be a vehicle owner feeling justified in driving more miles because they have a vehicle that obtains higher miles-per-gallon. The fuel efficiency of the vehicle is improved, but the total fuel use may have increased because of additional road trips. The Harris et al. report points out that beyond technical improvements in energy efficiency and promoting building programs like Energy Star Homes, there is a need for energy conservation and sacrifice in order to decrease residential energy consumption.

In terms of public benefit, Ayres (2002) lists implementing energy efficiency and conservation measures as the highest priority solution to reducing carbon dioxide emissions that contribute to climate warming. Contrary to the view that efficiency gains are overshadowed by increased consumption, Ayres proposes that efficiency is key to curbing climate change, and the ultimate gains in energy efficiency will occur when people begin to properly understand the laws of thermodynamics. In other words, the maximum benefit from energy efficiency has not yet been realized.

There is ample documentation about the detrimental effects of burning fossil fuels for residential energy consumption and the increase in public benefits associated with energy efficiency (Brown, 2000; National Resources Defense Council, n.d.; American Lung Association, n.d.; Columbia University Mailman School of Public Health, n.d.;

EPA, 2005; Prindle, Dietsch, Elliott, Kushler, Langer and Nadel, 2003; Energy Information Administration, n.d.; Ayres, 2002). Experts are less certain about the most desirable solutions for increasing home energy efficiency, the primary argument being over whether solutions should occur through market forces alone, or if government has a role in intervening in the marketplace.

Economic Theory / Role of Government Intervention in the Marketplace

An important economic issue in terms of energy consumption is the treatment of externalities. There are different economic schools of thought regarding externalities. Laissez-faire economists often believe that the market will self adjust to any imbalance, including imbalances caused by externalities. Public finance economists often believe government has a role and responsibility to intervene in the marketplace when externalities affect public health. Additionally, there is a wide range of government intervention methods. The following list identifies some methods of government intervention in the marketplace that address externalities resulting from economic activity:

- 1) *Regulation*: establishing policies and enforcing those policies;
- 2) *The justice system*: hearing cases about the perceived harm to individuals, the public or the environment as a result of economic activity;
- 3) *Taxation*: increased or reduced taxes, depending on the externalities created or reduced by economic activity;
- 4) *Incentives and/or subsidies*: payment from government to individuals or businesses whose practices reduce harmful externalities;

- 5) *Low interest loan programs*: loans offered for specific goods or services at low interest rates;
- 6) *Providing direct goods or services*: financially supporting particular goods or services not being provided by the marketplace but deemed necessary for public good and well-being;
- 7) *Support of research and development (R&D)*: assisting the private sector when R&D expenditures are difficult to recapture, but results of the investment provide broad social welfare; and
- 8) *Messaging/promotion*: publicly promoting messages advocating marketplace behavior change in an effort to reduce harmful externalities.

The American Council for an Energy Efficient Economy (ACEEE) (2007) outlines specific legislative methods for achieving energy efficiency goals. Some of these methods include regulatory mechanisms such as renewable portfolio standards and energy efficiency resource standards (mandating a minimal amount of renewable energy or energy efficiency in the energy source portfolios of utility companies). Other intervention activities listed include energy efficiency tax incentives, appliance and equipment efficiency standards, loans and grant programs, and legislation addressing global climate change. Another government intervention practice is implementing utility reforms including decoupling of utility revenues and profits and providing performance initiatives (creating shareholder incentives for achieving energy efficiency targets) (Kushler, York & Witte, 2007).

The Alliance to Save Energy (2005) supports federal energy efficiency programs. Their recommendations include a doubling of federal energy efficient program funding for the period of 2006-2010, which includes support for equipment standards, residential

and commercial energy codes, energy management programs for federal buildings, Energy Star program, industrial best practices programs, building technologies research and development, and government sponsored end-use surveys.

It is not unusual to see advocacy agencies suggest government funding to actively promote energy efficiency through a variety of programs and regulation. Other groups and individuals question the government's role in any kind of market intervention.

Buchholz (1989) revisits the teachings of several classic economists and comments on Adam Smith's vision for limitations on government activity. Buchholz writes, "Smith clearly defined the proper role for government: first, providing for national defense; second, administering justice through a court system; third, maintaining public institutions and resources such as roads, canals, bridges, educational systems, and dignity of the sovereign"(p.39). Buchholz comments on Smith's perspective of government having a role with a court system when injustices occur, but does not mention government intervention in the marketplace when externalities of market activity create imbalances in the biosphere.

Gordon Tullock (Tullock, Seldon and Brady, 2002) refers to Adam Smith's work as focusing on how individuals are primarily self-interested, and that self-interest dictates what happens in the economic world. Smith's book (as cited in Tullock, Seldon, and Brady, 2002) dedicates "three chapters to government, while retaining the moralistic or public interest model" (p. 4).

In his writings, Tsuru (1994) explores subjects such as Keynes versus Marx economic philosophy, the effects of technology on productivity, limitations on economic development theory and discrepancies with the gross national product (GNP) measurement system as an indicator of economic welfare. Of particular interest to

externalities related to energy consumption is Tsuro's writing on GNP, as well as his case study exploring energy policy and environmental considerations in Japan.

Tsuro (1994) observes that GNP is a numerical measurement practice that does not necessarily incorporate aspects of human welfare into the tabulation of economic welfare. Tsuro comments that in post Great Depression times, when economic thinking was greatly influenced by the Keynesian revolution, there were certain assumptions that were "of the type inherent in a mature exchange economy where practically all economic goods are priced in the market" (p. 67). The first assumption is "external effects, either positive or negative, are insignificant" (p. 67). He observes, however, that in our stage of advanced capitalism, there is a more cognizant recognition of negative externalities associated with technological progress.

Tsuro (1994) further explores components of the GNP and questions the significance of their welfare contribution, including defined categories such as "the cost of life" and "depletion of social wealth" (p.71). He mentions residential heating costs as an economic activity in the "cost of life" category. Regarding the "depletion of social wealth," Tsuro lists non-renewable resources such as mineral deposits, and renewable resources such as "clean water, natural beauty and other environmental endowments, all of which, after all, provide the source of healthy and enjoyable life. By ignoring the need for conserving such amenities, a country can raise the growth rate of GNP more rapidly than if it paid heed to them" (p. 77). Tsuro clearly recognizes the importance of factoring in external effects of economic activity when considering the confines of an economic measurement standard like the GNP.

Tsuro (1994) further elaborates on externalities by dedicating an entire chapter to the environment. Here he explores an historical background of environmental pollution

control in Japan, as well as a case study of energy policy and environmental considerations. It is interesting to observe this significant level of attention to environmental externalities from a noted twentieth century economist.

Lemieux (2004) argues that fifty years ago, the thinking of economists' on market failure validated government intervention to help maximize social welfare. Lemieux states that this position "was policy analysis before the public choice revolution" (p. 22). *Public choice* describes individuals (voters, politicians, bureaucrats) in the marketplace as self-interested and motivated by maximizing their utility. Public Choice Theory explores the inter-relationship of economics and politics, including how the self-interest of politicians and policy makers often leads to government activity that is not particularly cost effective. There are a number of modern day economists that support public choice theory and the implications that the state is incapable of correcting market failures in a cost effective manner. Public choice economists are not necessarily always in the same camp, however, and there are different perspectives that cover the spectrum from libertarian to interventionist extremes.

Public Choice Theory is sometimes generalized as an anti-government perspective. In the Tullock, Seldon and Brady book (2002), Tullock mentions "the defects of the government in a democratic process" (p. 8). However, Tullock goes on to state "this discussion does not mean that we know a better way to deal with these problems. Air pollution is normally handled ineffectively by the government, but whatever one can say about the defects of the air-quality management controls that now exist, they *may* be better than leaving air pollution to the market" (p. 8).

Brady (Tullock, Seldon and Brady, 2002) provides a public choice perspective of the Clean Air Act's attempt to protect public health. In reference to why the U.S.

Congress did not provide cost-benefit criteria for the EPA, Brady writes: “the congressional oversight committees’ interest is to make the EPA responsive to political pressures and thus make policy on the basis of political considerations, rather than on the basis of the economic benefits and costs of proposals” (p.122). This is essentially the public choice argument: government solutions are often motivated by the wrong reasons (personal, political, or special interest) and do not provide economically feasible solutions.

After exploring specific economic theories and investigating externalities related to the marketplace, it is important to take a closer look at the different types of government intervention that might take place in the energy efficient home marketplace. Prindle et al. (2003) validate government’s promotion of voluntary energy efficient home building programs (*option #8 in the beginning of this economic theory section*) because of the resulting support for another form of government intervention, energy code regulation (*option #1 in the beginning of this economic theory section*). Prindle et al. state, “voluntary programs, by bringing advanced design and building practice into the market, can open the way for future code improvements” (p. 5). This same document advocates state tax incentives applicable to buildings and equipment. The authors suggest that strong state policies such as tax incentive reward programs (*option #3 in the beginning of this economic theory section*) have the ability to drive national policies. Additionally, the authors address specific market barriers affecting the implementation of energy efficiency of home building, further suggesting the need for certain types of government intervention to help achieve public good.

Howarth and Andersson (1993) offer a different perspective than public choice theory. In their work examining market barriers to energy efficiency, they advocate a

much more contemplative look at the “shortcomings and limitations of the market mechanism” (p.271). Although Howarth and Andersson primarily address energy efficient equipment, their arguments are relevant to the housing industry as well. They consider the much over-looked situation of consumer decisions that are affected by “incomplete or imprecise information, biasing the market against investments in energy efficiency that would be made under perfect information” (p. 271).

Howarth and Andersson (1993) also suggest that there has not been an adequate attempt to analyze market barriers that impede the implementation of energy efficient technologies that use “formal models rooted in economic theory” (p. 264). “Frictionless models of competitive equilibrium are an incomplete and potentially misleading guide to energy policy,” (p. 264) they write. “Good policy arguably involves more than simply ‘getting prices right’. A potential role exists for governments to intercede when the vagaries of market institutions lead to lags in the development and adoption of energy efficient technologies” (p. 264). Preferred government intervention, according to Howarth and Andersson, involves establishing policies that support utility demand side management practices that advocate load reduction, rather than using tax instruments.

Howarth and Andersson (1993) present economic models that outline how competitive markets fail to include desirable levels of energy efficiency when structural characteristics either convey imperfect information to consumers or actually impede information. The results of their modeling are consistent with the arguments that government has a role for delivering information when the marketplace fails to deliver needed information or delivers incorrect or misleading information.

Warren (1987) also comments on the imperfect nature of the energy supply side of the marketplace. He specifically cites the presence of imperfect information, but also

mentions other marketplace complications such as institutional limits of competition and contrasting industry structures. Warren claims that these combined features of the energy supply side marketplace insure “significant impediments to the free interplay of market forces in the energy sector” (p. 523). Warren’s conclusion is supportive of government involvement in creating demand side management utility policies that target energy efficiency, instead of increasing energy supplies over time.

In terms of government regulation as an intervention method, Lin (2006) addresses regulatory federalism. Lin’s work explores regulatory authority issues with central and local governments. A key finding of Lin’s study is the inefficiency of the typical U.S. regulatory structure where the central government sets the standard and the local government meets the standard. The reverse situation (where local governments choose their own standards and the central government decides how to meet those standards) proves to be more efficient. Lin’s work has some relevance to the energy efficient home marketplace, however, Lin’s study is most relevant to developing an understanding of the federal regulatory process, which is outside of the scope of this paper.

Behavioral Theory and Public Information Campaigns

The Energy Star Homes program is a government sponsored *public information campaign*. Before exploring the literature and anecdotal information about the Energy Star Homes program, it is important to look at the literature addressing behavioral theory related to public information campaigns.

Bender, Moezzi, Hill-Gossard and Lutzenhiser (2002) analyze the *Flex Your Power* campaign that took place in California in 2001. *Flex Your Power* was a public

information campaign that addressed energy consumption behavior in response to the California energy crisis.

The goal of this campaign was to reduce immediate and long-term energy demand. The circumstances behind the need for this program (the California energy crisis) differ from circumstances driving energy efficient home public information campaigns, however, the desired goal is the same for both types of public messaging programs: influence energy consumption behavior.

Weiss and Tschirhart's article (as cited in Bender et al., 2002) suggests four essential factors to successful public information campaigns: "1) targeting the right audience, 2) delivering a credible, understandable message, 3) delivering a message that influences audience beliefs, and 4) creating a social context that leads to the desired outcome" (p.18). Bender et al. indicate the *Flex Your Power* public information campaign helped California achieve positive results. In 2001, peak energy demand was reduced by 8.9% and energy consumption was reduced by 6.7%.

Bender et al. (2002) suggest that the *Flex Your Power* campaign may have successfully appealed to consumers on an individual level, but did not effectively appeal to people on a social institutional level. Reaching consumers at the social institutional level implies people realize how reduced energy consumption benefits their family, friends, extended community and others. Bender et al. attribute the campaign's lack of appeal at the social institutional level as a result of the focus on "simple, emergency-type demand reduction behaviors" (p.23), and they associate this program approach with the *Theory of Planned Behavior*.

Ajzen's study (as cited in Bender et al., 2002) addresses the Theory of Planned Behavior, where three concepts help "to predict or understand an individual's intention to

behave in a specific way” (p.23). These three concepts are “the individual’s personal attitude towards the behavior, the influence of others on the individual relative to the behavior, and the perceived degree of control by the individual over the behavior” (p.23).

Bandura’s book (as cited in Bender et al., 2002) and Peters & Feldman’s report (2001) both include additional research on energy consuming behavior referencing the term *self-efficacy* to describe an “*I can do it*” (p. 24) message that “may be more effective at achieving energy efficient behavior than cost savings or non-energy benefit advertising” (p. 24).

When the energy efficiency message is marketed, it competes with all the other commercial messages that saturate the airwaves and print media. Peters & Feldman (2001) examined three different studies “that demonstrate the importance of self-efficacy as a determinant of customer response to advertising for support of energy efficiency and renewables” (p. 479). Self-efficacy is described by Peters & Feldman as “the perception by an individual that he or she has control over performing a behavior effectively” (p. 479). In terms of behavior theory, Peters & Feldman reference self-efficacy along with response efficacy, “the perception that the behavior will have predictable and desirable outcomes” (p. 479), as part of Ajzen’s Theory of Planned Behavior where “self-efficacy predicts adoption of the promoted behavior” (p. 479).

The three studies that Peters & Feldman (2001) examined were: 1) a 1998 series of focus groups with residential and commercial customers of a California utility company, 2) survey research for the Tennessee Valley Authority, and 3) a series of surveys that evaluated advertising in Wisconsin. Peters & Feldman state, “a detailed regression analysis indicated that attitudinal measures of self-efficacy are among the few – and strongest – predictors of respondent recall of advertising on behalf of renewables”

(p. 480). Peters & Feldman conclude that the assumed messages of *saving money* and *non-energy benefits* are proving to be ineffective motivators for energy efficiency behavior change. They suggest that the message may be the problem, and the shift should be to an *I can* message – the principles of self-efficacy.

Bandura’s writings on Social Learning Theory (as cited by Andreason,1995) address how people learn new skills from observing other people. According to Andreason, “social learning theory proposes learning of specific new behaviors and takes place both directly and indirectly. For major changes in behavior or lifestyle, direct learning involves three major components: sequential approximation, repetition, and reinforcement” (p.266).

Andreason (1995) addresses the subject of social marketing, and describes social marketing as “the application of marketing technologies developed in the commercial sector to the solution of social problems where the bottom line is behavior change” (p. 3). Andreason claims that commercial sector marketing has had some positive results with social problems, although it has not been the primary intent of the marketing efforts. He states, “what is largely untapped is the immense potential to massively improve the quality of people’s lives that this approach would have if it were put in the hands of government agencies and a wide variety of nongovernmental organizations and private voluntary organizations around the world” (p. 4). Andreason describes four conditions of social marketing:

- “ • The final objection is to influence the behavior of a target market.
- The target behaviors compete with comfortable alternatives.
- Community pressures make it difficult to bring about change even if the target market finds it attractive.

- Critical support agencies must help out if the behavior change program is to be successful” (p.5).

Andreason (1995) sees social marketing practices increasing with government agencies. He mentions multiple written references that explore the teaching of social marketing, review the accomplishments of social marketing, and provide criticisms of the practice. Andreason’s work includes references to social psychology and marketing fields of study.

Burke (2006) has provided research that addresses behavioral change in relation to *system building*. Burke investigates why energy efficiency advocacy groups have been “unable to significantly influence technological change” (p.11). Burke suggests that what is missing from those who advocate technological solutions are a “hands-on theory on how to influence sociotechnical change” (p. 2). In his dissertation, Burke presents a new organization based theory of system building that builds on “existing theories of sociotechnical systems and of society and technology in general” (p.14). In the development of his organization based theory, Burke explores successful examples of implementing sociotechnical change from the corporate world.

Burke’s new theory of system building focuses on the capacities of organizations and not individuals to effectively introduce new technologies. Burke’s statement that “advocates of alternative technology have lacked the organizational capacities for effective system building” (p. iv) is in reference to case studies of the Home Energy Rating System (HERS) and Energy Efficient Mortgages. Burke states, “research findings mostly support this thesis” (p. v).

Burke’s research is relevant for a few reasons: he explores the role of a key stakeholder group to the Energy Star Home program (HERS professionals); he

emphasizes the role of organizations effectively introducing energy efficiency technology; and his emphasis on systems building adds to the body of knowledge that focuses on behavioral change achieved through individual appeals. Burke's conclusions suggest that small scale, consensus based organizations may *advocate* change, but they are not necessarily effective with *implementing* sociotechnical change. Burke's analysis of corporate structures, analysis of the HERS and Energy Efficient Mortgages business models, and development of his system building theory suggest that larger, more hierarchical organizations are more successful at implementing sociotechnical change.

Program Design Review / Energy Star Home Program

As previously stated, the Energy Star Homes program is considered a public information campaign. Energy Star Homes is a federal government program that advocates energy efficiency through voluntary participation. In reference to the eight categories of potential government market intervention methods listed previously in this paper, a public information campaign falls into the eighth category called *messaging/promoting*. Inherent to the messaging and promoting role, the federal government's activities with the Energy Star Homes program include establishing performance standards, collaborating with market partners to verify performance standards, subcontracting with private consultants, and providing funds to state government for on-going program related functions.

According to the Energy Star, History of Energy Star web page (n.d.), the EPA began the Energy Star program in 1992, and the Department of Energy (DOE) joined forces in 1995. The Energy Star program is a third party voluntary labeling program that

identifies and promotes numerous energy efficient products. The EPA (2005) expanded the Energy Star Program in 1995 to include whole house construction.

According to the EPA (2005), the voluntary participation rate of the Energy Star Homes program is rising with more than 2,500 builders participating nationwide. More than 360,000 Energy Star certified homes have been built in the United States, approaching 10 percent market penetration annually for new homes built throughout the nation. The web source entitled Energy Star Qualified New Homes Market Indices for States (n.d.) features more recent data and identifies more than 525,000 Energy Star homes nationally, with the market penetration rate still near 10 percent. The number of certified Energy Star homes built annually varies by region and state, therefore the market penetration rate of the regions and states vary.

Within the United States there are varying degrees of market penetration with Energy Star certified homes ranging from strong to weak. In some states, municipal or regional markets are strongest and account for the state's higher percentage of national market share (J. Otto, personal communication, February 13, 2007).

The following is a description of The Energy Star Qualified New Homes Market Indices for States (n.d.): "The Energy Star Qualified New Homes Market Indices for States compares the number of Energy Star qualified new homes built to the number of privately owned housing units permitted in each state and the District of Columbia. Each state's index is a measurement of Energy Star's presence in the site-built, single-family new homes market for that state. It does not measure other energy efficiency efforts within the state"

(<http://www.energystar.gov/index.cfm?fuseaction=qhmi.showHomesMarketIndex>). The web site features a U.S. map and identifies the market share of Energy Star Homes in all

states, identifying the strong, growing and weak market areas. The Energy Star Qualified New Homes Market Indices for States is the resource used to reference the market penetration of Energy Star Homes in eleven states featured in this paper.

Another web based reference source is the Energy Star New Homes Partner Locator (n.d.). This site provides contact information for site-built home builders and developers that have become voluntary partners in the Energy Star program. The details for Energy Star Home partnership are presented on the web page entitled EPA's Energy Star for New Homes Outreach Partnership – Updated Guidelines for 2007 (n.d.).

The Energy Star Home program includes networks, partnerships, and promotional activities. According to the Cadmus Group (J. Otto, personal communications, January 25, 2007), the EPA contracted with private consultants to manage the Energy Star Homes marketing and media efforts starting in 2001. Consultants initially worked with local markets identified as potentially strong market areas and pooled resources with key partners for marketing activities. These initial market areas included Houston, Indianapolis, Las Vegas and Phoenix.

Two key partners that the consultants worked with in the pilot market areas included utility companies such as Southwest Gas and homebuilders. An important aspect of a strong market area was the presence of HERS professionals including Home Energy Raters (home performance analysts), trainers for the raters, and providers that validate the home energy ratings as well as provide quality control for the profession (J. Otto, personal communications, January 25, 2007).

Breakdown of Regional and State Activity

Nevada

Nevada is considered a strong Energy Star Homes market state (Energy Star Qualified New Homes Market Indices for States, n.d.). According to the Cadmus Group (J. Otto, personal communication, January 25, 2007), the California energy crisis served as a catalyst for change in the Las Vegas home building market, and also a reason for the utility companies to become involved in the home energy efficiency effort. Nevada was able to aggregate partners and funding to promote the home energy efficiency message, with the EPA acting as a support partner. Nevada is an example of a strong Energy Star home market area that has been promoted largely by champions (S. Rashkin, personal communications, March 5, 2007).

Las Vegas established an Energy Star partner group, which included builders who were committed to building beyond minimal code standards. The Energy Star Partner Group also features HERS raters and local home building marketing professionals. Together, the Energy Star Partner Group has effectively implemented outreach campaigns advertising the benefits of Energy Star Homes, disseminated on-site marketing materials, and provided technical and marketing training to the industry at large at local conferences. As a result, nearly 60 percent of all homes in Las Vegas are Energy Star certified. This has been accomplished without any monetary incentives (M. Kushler, personal communication, January 25, 2007).

The bulk of the Energy Star programs in Nevada are administered through the utility companies through a Public Utilities Commission approved process (L. Walser,

personal communication, February 22, 2007). Participating utility companies include Sierra Pacific Power Company and their affiliate in the Southern Nevada, Nevada Power.

Austin, Texas

In a web posting from ACEEE (2003), the Austin, Texas home building market is identified as the earliest Energy Star Home program. The Austin program was initiated in 1985, and has served as the predecessor to a more expansive *green building* market that thrives today in Austin. A feature of the Austin energy efficient and green building home program effort is the participation of the municipally owned utility company, Austin Energy. ACEEE (2003) states “program managers are able to document sufficient peak load reductions to justify continued budget support from Austin Energy” (p. 1).

Tinker (2003) writes about Austin’s Green Building Program with the primary focus of her research highlighting the results of water consumption. Tinker’s findings reveal various green features were “effective in reducing water consumption for different builders, and in many cases, water conserving features actually led to increased use” (p. iv). These findings support the Harris et al. report (as cited in Anonymous, 2006) in which the authors suggest efficiency measures may lead to increased aggregate consumption.

Although Tinker’s research is more water consumption focused than energy consumption focused, her work does provide some comprehensive justifications for sustainable development and historical information pertaining to the Austin Green Building Program. She reinforces the acknowledgement of Austin’s leadership in the energy efficient and green building marketplace, and draws attention to how improved technology can lead to increased resource consumption.

Texas

Texas is considered a strong Energy Star Home market state (Energy Star qualified new homes market indices for states, n.d.) that uses a marketing focused model (S. Rashkin, personal communication, March 5). Texas has a unique story, including a relationship with energy efficient home building activity and the state energy code (F. Lopez, personal communication, February 12, 2007).

In Texas, homebuilder training related to the state energy code is made available. Other factors that seem to encourage Energy Star Home construction in Texas include active participation with ICF consultants, billboards used for public messaging, utility company partnerships, legislation addressing emissions reduction, relationship with the Home Builders Association since the introduction of emissions reduction legislation, and a general building trades awareness of building science principles that is leading to homes that exceed Energy Star standards (F. Lopez, personal communication, February 12, 2007).

The Texas utility companies Centerpointe Energy and TXU have joined forces in Houston and Dallas where large production builders have dominated the building market. Both utility companies have worked on expanding the HERS verification infrastructure and have actively marketed the benefits of energy efficiency to consumers. Minimal rebates to builders have been issued. The combination of building the HERS infrastructure, providing minimal rebates to builders, and strong public messaging targeting local home buyers has resulted in a 35 percent Energy Star Home market share in Houston, and a 45 percent market share in Dallas (M. Kushler, personal communication, January 25, 2007).

Southwest Region

The Southwest region is a strong Energy Star Home regional market area (Energy Star Qualified New Homes Market Indices for States, n.d.). This region features a warmer average climate than that of the Northern regions, with significant cooling loads. Electricity for cooling is typically provided by coal-fired plants, and to some extent nuclear plants. The coal-fired plants present issues with emissions that contribute to climate change and public health issues.

The Southwest Energy Efficiency Project (SWEET) (n.d.) states that Arizona is the United States leader in the number of Energy Star homes. Of particular interest from the SWEET web site is a statistic from 2001 stating that 7,000 Energy Star certified homes built in Arizona represented 26% of the national market of all Energy Star certified homes. SWEET attributes the high market penetration to the participation of utility companies with their promotion efforts.

Arizona

Arizona is considered a strong Energy Star Home market state (Energy Star Qualified New Homes Market Indices for States, n.d.). Arizona's State Energy Office features a training program for the trades people involved in energy efficient housing construction (J. Westberg, personal communication, February 13, 2007). Trades people include homebuilders, heating, ventilation and air conditioning specialists, framers, insulation contractors and others. Arizona contracts with the building science consulting company, Advanced Energy for this training. A portion of the training focuses on production builders. Advanced Energy encourages builders to increase their bottom line

and reduce call-back and litigation costs by emphasizing building envelope improvements and sound building science principles with home construction. The utility companies provide most of the funding for the training program (C. Gohman, personal communication, February 14, 2007). Arizona also features a web site at which practitioners can view on-line training videos (Arizona Department of Commerce On-Line Training Center, n.d.).

Savage (2005) reinforces the concept that building science principles is key to the success of the home building market. Savage states, “by incorporating building science into their homebuilding process, builders have been able to dramatically improve their public image, reduce their operating costs (reducing call-backs), and increase customer satisfaction” (p.24).

Through Advanced Energy, Colby Swanson authored a Phoenix Home Energy Efficiency Study (2005). This study explored the results of new home energy efficiency programs that fell into three broad categories: baseline homes (the current building code), Energy Star certified homes, and guaranteed performance homes. Swanson reports, “this study showed that the bar has been raised for home energy performance in the Phoenix area as a result of U.S. EPA’s Energy Star and various Guaranteed Performance home programs. These programs have been instrumental in the education and training of consumers, builders, and contractors about the benefits and construction of higher performing homes” (p. 3).

Swanson’s report (2005) identifies the methodology of the study, sample size used, and data gathered on the specifics of the homes cited in the study (square footage, number of stories etc.). The results indicate Energy Star certified homes require 16 percent less cooling than baseline homes. The average annual electric consumption for

Energy Star Homes was higher than the baseline homes, however, due to the fact that Energy Star Homes were larger than baseline homes. Swanson indicates that Energy Star homes can “yield improvements in the overall energy efficiency of new homes, as compared to homes built to standard practices” (p. 4), but also adds that “the trend to build larger homes must also be addressed” (p.4).

Kentucky

Kentucky is considered a weak Energy Star Home market state (Energy Star Qualified New Homes Market Indices for States, n.d.). Kentucky has relied on the strength of their partnership with the University of Kentucky’s Cooperative Extension program, especially since their state does not feature a strong and established HERS network (G. Guess, personal communication, February 12, 2007). Some of the funding of the Governor’s Office of Energy Policy is directed toward other organizations such as the Cooperative Extension Agency and the National Energy Education Development program (NEED) in an effort to deliver the energy efficiency message statewide (G. Guess, personal communication, February 12, 2007).

Some of Kentucky’s circumstances that likely affect their weaker market position include fewer production builders, fewer HERS accredited home energy raters, lower rates for electricity because of proximity to regional coal supplies, and competitive natural gas rates (G. Guess, personal communication, February 12, 2007).

Iowa

Iowa features a strong Energy Star Home market share (Energy Star Qualified New Homes Market Indices for States, n.d.), with minimal market involvement from

State Government (D. Dilks, personal communication, February 7, 2007). The strength of the Iowa Energy Star Homes program appears to be from the involvement of other strong partners such as consultants, utility companies, HERS certified home energy raters and homebuilders (D. Dilks, personal communication, February 7, 2007).

Iowa features the Iowa Energy Center, which is administered by Iowa State University (Iowa Energy Center, n.d.). The Iowa Energy Center is funded by an annual assessment of revenues from gas and utility companies throughout the state. Some of their energy efficiency research and educational efforts are directed toward the residential sector.

Indiana

Indiana features a low-to-medium market penetration (Energy Star Qualified New Homes Market Indices for States, n.d.). In Indiana, the participation rate of utility partners is not at the same level as the Southwest territories (M. Jansen, personal communication, February 12, 2007). Indiana's State residential energy code is not particularly demanding (Building Codes Assistance Project Codes Status, n.d.). There is some activity in Indiana with EPA's New Homes Outreach Partnership program in terms of pooled funding from participating Energy Star Home partners for aggregate marketing. This effort appears to be providing a mixed degree of success (M. Jansen, personal communication, February 12, 2007).

The Energy Division of the Office of Energy and Defense Development operates the State Energy Plan (SEP). Through the SEP, some resources are dedicated to grant programs that promote home energy efficiency.

Wisconsin

Wisconsin also features a low-to-medium market penetration (Energy Star Qualified New Homes Market Indices for States, n.d.), however, the State is considerably active in the marketplace. Wisconsin's State Division of Energy worked with consultants to produce an evaluation report exploring the level of Energy Star label awareness with Wisconsin and Iowa residents as a result of Wisconsin's *Focus on Energy* program (Wisconsin Department of Administration, Division of Energy, 2005). The survey results of 402 randomly selected Wisconsin households and 410 randomly selected Iowa households showed 31.8 percent of Wisconsin respondents "recalls or recognizes Energy Star and associates meaningful information with the name or label" (p. 1-1). The Iowa respondents indicated a 24.6 percent response for label recognition.

The survey results show responses that demonstrate both *awareness* and *understanding* of the Energy Star label. The evaluation report indicates "the Wisconsin program does not appear to have made any significant change in the percentage of Energy Star *aware* residents who are able to demonstrate an *understanding* of the name or label" (emphasis added) (p. 1-1). The authors conclude that "it would appear that with respect to Energy Star awareness and understanding, the primary accomplishment of the Wisconsin program has been to push awareness to a level roughly seven percentage points higher than one might have expected in the absence of the program" (p.1-1).

Wisconsin features two major nonprofit agencies advocating energy efficiency: Energy Center of Wisconsin (ECW) and the Wisconsin Energy Conservation Corporation (WECC). Both agencies receive government funding for statewide energy efficiency related programming. ECW is generally more research focused and has utility industry

origins. WECC is more program focused (administering the state's *Focus On Energy* program), and their experience originated with low-income weatherization programs (M. Meunier, personal communication, March 1, 2007).

The PA Consulting Group completed a report presenting the metrics results of WECC's contract for residential program delivery (2005). The report shows that the Energy Star Homes program met the goal of increasing "the frequency and quality of the interaction that participant builders have with consultants on the use of program practices (goal: 20% increase in the number of new builders entering the program)" (p. 2). The report also showed mixed results with the program goal to decrease builders in the consultant stage (builders requiring less consulting over time after being involved with the Energy Star program).

Wisconsin is a state that utilizes systems benefits funding to provide programs aimed at decreasing energy consumption, increasing energy efficiency, and increasing the use of renewable energy. Wisconsin features significant partners including statewide nonprofit agencies involved with energy efficiency programs (including Energy Star Homes), growing homebuilder participation, and a growing HERS partnership with WECC.

Illinois

Illinois is considered a weak Energy Star Homes market area (Energy Star Qualified New Homes Market Indices for States, n.d.). Illinois does not feature a formal system benefits funding mechanism, but does feature an Energy Efficiency Trust Fund that helps support some programs. There is no state residential energy code in Illinois. In general, the Illinois homebuilders and home rule jurisdictions are not supportive of a

more restrictive statewide energy code (B. Haas, personal communication, February 13, 2007). Since Illinois is a home rule state, local jurisdictions are able to establish their own energy code criteria if they choose. The Illinois Department of Commerce and Economic Opportunity is considering offering a beyond-building-code pilot home construction program, featuring grant funding for one to five structures to help serve as model building examples (B. Haas, personal communication, February 13, 2007).

Alabama

Alabama is also considered a weak Energy Star Homes market state (Energy Star Qualified New Homes Market Indices for States, n.d.). Alabama features a non-mandatory statewide residential energy code, and local jurisdictions have the option to adopt their own energy codes. In Alabama, the Homebuilders Association and the utility companies are not involved in strong Energy Star Home promotion partnerships compared to some of the Southwestern market areas. Similar to Kentucky, Alabama features relatively low electric rates.

The HERS presence in Alabama is significantly less prominent than other regions, and only a few certified energy raters provide services in the state. In the absence of home energy rating services, The Alabama Department of Economic and Community Affairs has provided the Homebuilders Association with a blower door unit (home energy diagnostic equipment) to help analyze heating and cooling performance for homes. A state sponsored energy performance home building program is currently being developed with training assistance from the Southface Institute in Atlanta, Georgia. The Homebuilders Association will be the facilitating agency for this “beyond-code” building performance program. Alabama is another state that emphasizes energy efficiency

messaging through a partnership with the Cooperative Extension Agencies (K. Clifton, personal communication, February 20, 2007).

Michigan

Michigan is another state that is categorized as a weak Energy Star Homes market area (Energy Star Qualified New Homes Market Indices for States, n.d.). Some production builders are active in Michigan, and they are responsible for the majority of the Energy Star certified homes in the state. The State Energy Office allocates a minimal amount of funding to promote the Energy Star Home building message. Michigan does not feature Energy Star market partners participating in EPA's New Home Outreach Partnership program, indicating pooled funds for joint marketing is not taking place. The state residential code is one of the nation's least stringent, and recent attempts to update the code have been met with litigation from the Michigan Homebuilders Association.

Some grant money has been allocated to nonprofit agencies for programs that attempt to reach builders, consumers, and real estate professionals with the Energy Star Home message. These programs could be considered short-term attempts to promote energy efficiency in the marketplace, and have not been particularly successful with increasing the market share of Energy Star Homes in Michigan. For several years, the State Energy Office has offered five incentive grants a year to homebuilders who build an Energy Star showcase home. These incentive grants help cover the costs of marketing and construction for a single Energy Star certified home.

Michigan features a systems benefit funding system that is mostly used for delinquent utility bill payments from low-income residents. A small portion of the

systems benefit funding is allocated towards promoting energy efficiency (J. Sarver, personal communication, February 26, 2007).

New Jersey

New Jersey is considered a state with a strong Energy Star Home market (Energy Star Qualified New Homes Market Indices for States, n.d.). New Jersey features a substantial public benefits funding system that funds their statewide energy efficiency programs. New Jersey uses an incentive based model, which is the opposite of the Texas marketing based model (S. Rashkin, personal communication, March 5, 2007).

New Jersey's Board of Public Utilities (state utility regulatory agency) operates a statewide clean energy initiative called the Clean Energy for New Jersey program (New Jersey's Clean Energy Program, n.d.). The State's Energy Star Homes program is part of the Clean Energy for New Jersey initiative. This is a comprehensive program that offers builder incentives, involves on-site audits, provides design assistance, and includes training for people in the building trades (New Jersey Board of Public Utilities, n.d.).

The division of the Board of Public Utilities that manages the State Energy Program (SEP) from the EPA is the Bureau of Conservation and Renewable Energy. The Bureau of Conservation and Renewable Energy works with some residential energy efficiency programs, including public awareness programs (New Jersey Board of Public Utilities Energy Description, n.d.). Most of the Energy Star Home partners in New Jersey would be considered strong (HERS raters, utility companies, homebuilders etc.). It remains to be seen if these partners would continue to actively promote the Energy Star Home concept if the incentive funding in the State was no longer available.

Other Key Program Elements

Cooperative Extension Agency Partnerships

A partnership with the EPA and the Department of Agriculture's Cooperative State Research, Education and Extension Service (CSREES) was formed in 2002 to promote Energy Star with consumers. According to Atilas, Wysocki and Tremblay (2003), "the objective of the EPA and CSREES Energy Star partnership is to educate consumers through Cooperative Extension to conserve energy, save money in the home, and create consumer demand for Energy Star homes and products" (p. 61). In 2003, seventeen states were participating with the Cooperative Extension program.

EPA's New Home Outreach Partnership Program

In 2002, the Energy Star Homes target markets expanded. Currently, there are 28 markets working with the EPA's New Home Outreach Partnership program (J. Otto, personal communication, January 25, 2007). This is a program that aggregates partners and financial contributions for pooled marketing efforts. Typical partners include homebuilders, HERS raters, utility companies and the EPA (Energy Star for New Homes Outreach Partnership – Updated Guidelines for 2007, n.d.).

Table A lists the dependant variable and independent variables for eleven states.

Table A - Variables for Energy Star Homes Market

State	Market Share	Energy Star Home Program Support	Significant Municipal Markets	State Legislation	Public Benefit Funding	Utility Partners		Homebuilder Partners	Production Builders	HERS Partners	Other Partners	Marketing Finance Pool	Status of State Energy Code	Utility Rates	Energy Crisis
Nevada	43% (Strong)	Minimal	Yes	AB3 permits utilities to use energy efficiency measures and renewable sources of energy to meet NV's clean energy portfolio requirement	Yes - money used for energy efficiency for low-income residents	Strong		Strong	Significant	Strong	Home building marketing professionals	Yes	2003 IECC mandatory for all jurisdictions that have not adopted an energy code	NG: medium 12.46 Electricity: medium 8.56	California energy - catalyst for change
Texas	31% (Strong)	Moderate	Yes	1999: the Texas Legislature adopted electricity restructuring legislation targeting energy efficiency, renewable energy, and air pollution reduction	Yes - a small system benefits charge helps finance low-income assistance and consumer education programs	Strong		Strong	Significant	Strong	Advertising agencies	Yes	2000 IECC w/ 2001 supplement, jurisdictions may adopt a more recent code	NG: medium 12.49 Electricity: medium 7.95	Emissions concerns
Iowa	42% (Strong)	Minimal	No		No	Strong		Strong	Significant	Strong	Iowa Energy Center	No	2006 IECC mandatory statewide	NG: medium 12.29 Electricity: low 6.40	
New Jersey	36% (Strong)	Strong	Yes	2005: legislation established energy efficiency standards on eight appliances	Yes - substantial fund that supports energy efficiency and renewable energy, and energy assistance for low-income residents	Strong		Limited	Significant	Strong	Marketing reps & implementation contractors	Limited	2006 IECC w/ state amendments, mandatory statewide	NG: medium 13.44 Electricity: high 10.29	
Arizona	21% (Strong)	Moderate	Yes	2005: Energy efficiency standards established for twelve appliances and supplies (effective 1/1/08)	No	Strong		Strong	Significant	Minimal		Yes	2000 IECC is voluntary	NG: medium 13.54 Electricity: low 7.45	
Indiana	3%-10% (Growing)	Minimal	Yes	2006: water, wastewater & energy bill that may be used by local units of government to reduce consumption and usage costs or to provide billable revenue increases	No	Moderate		Moderate	Significant	Strong		Yes	State developed code (1992 MEC w/ amendments)	NG: medium 12.11 Electricity: low 5.58	
Wisconsin	3%-10% (Growing)	Strong	Yes	Recent legislation switched the public benefit fund management from the Division of Energy to the Public Service Commission	Yes - substantial fund that supports energy efficiency and renewable energy, and energy assistance for low-income residents	Moderate		Strong (widely dispersed)	Limited	Moderate	Wisconsin Energy Center Corp. & Energy Center of Wisconsin		State developed code (meets or exceeds 1995 MEC)	NG: low 11.93 Electricity: low 5.58	
Illinois	<3% (Weak)	Minimal	No	2006: law requires Dept. of Commerce & Economic Opportunity to establish & maintain a program to certify energy efficient appliances	Yes - small fund allocated to low income residential energy efficiency and other energy efficiency programs	Limited		Limited	Significant	Minimal		No	IECC 2000 w/ 2001 supplement, mandatory statewide	NG: low 11.62 Electricity: low 6.80	
Alabama	<3% (Weak)	Minimal	No		No	Limited		Limited	Limited	Minimal	Cooperative Extension Agency	No	Voluntary state code equivalent to 2000 IECC minus SHGC 0.40 requirement	NG: medium 15.82 Electricity: low 6.08	
Kentucky	<3% (Weak)	Minimal	No		No	Limited		Limited	Limited	Minimal	Cooperative Extension Agency	No	2002 state code w/ 2000 IECC external envelope requirements, mandatory statewide	NG: medium 13.09 Electricity: low 4.63	
Michigan	<3% (Weak)	Minimal	No		Yes - mostly directed to utility payment recovery, minimal amount directed to energy efficiency	Limited		Limited	Limited	Moderate		No	State code less stringent than 1992 MEC, mandatory statewide	NG: low 10.55 Electricity: low 6.94	

Table B - Description of Variables

State	Representative State with either a strong, growing, or weak Energy Star Home market
Market Share	<i>Dependent variable</i> . As indicated by EPA's Qualified New Homes Market Endices for States
Energy Star Home Program Support	<i>Independent variable</i> . Three categories of state funding allocated to the Energy Star Home effort
Significant Municipal Markets	<i>Independent variable</i> . "Yes" indicates at least one primary municipal market responsible for increasing the State's market share
State Legislation	<i>Independent variable</i> . Relevant state energy legislation addressing energy issues. <i>Source: ase.org</i>
Public Benefit Funding	<i>Independent variable</i> . Notes indicate type of public benefit funding and if funds are available for energy efficiency. <i>Source: disireusa.org & ase.org</i>
Utility Partners	<i>Independent variable</i> . Level of utility company participation with Energy Star Home programs
Homebuilder Partners	<i>Independent variable</i> . Level of homebuilder participation with Energy Star Home programs
Production Builders	<i>Independent variable</i> . Indication of production builder presence in the State. NAHB definition of production builder: more than 25 homes built annually
HERS Partners	<i>Independent variable</i> . Level of Home Energy Rating System professionals participating with Energy Star Home programs
Other Partners	<i>Independent variable</i> . Notes regarding any unique State partners
Marketing Finance Pool	<i>Independent variable</i> . Participation with EPA's Outreach Partnership pooled resources program
Status of State Energy Code	<i>Independent variable</i> . Indication of the presence or level of State's residential energy code. <i>Source: bcap-energy.org</i>
Utility Rates	<i>Independent variable</i> - Retail rates for residential customers - NG=Natural Gas - Prices obtained from Energy Information Administration
Energy Crisis	<i>Independent variable</i> . Urgent energy supply or reliability issues

Methodology

The following list represents secondary data analysis methods used in this paper:

- Anecdotal information was gathered from program professionals in situations where program results are not published (phone conversations, emails, written correspondence);
- Relevant web sites were accessed regarding home energy efficiency program information;
- Published literature was analyzed addressing public benefits of energy efficiency, economic theory specific to government intervention in the marketplace, behavioral change theory and, specific program design for energy efficient residential construction;
- Strong, growing and weak Energy Star Home program markets were analyzed; and
- State building codes were analyzed in relation to other state efforts to promote energy efficient home construction.

The purpose of Table A is to describe multiple independent variables and determine their relationship to the dependent variable *market share*. The market share of Energy Star homes was determined by referencing the web site Energy Star Qualified New Homes Market Indices for States (n.d.). A sample of states was chosen to represent strong, growing, or weak Energy Star Homes markets (Energy Star Qualified New Homes Market Indices for States, n.d.). Table B provides descriptions for the variables.

The dependent variable *state Energy Star Home program support* was listed as strong, moderate or minimal (J. Westberg, personal communication, February 13, 2007; C. Gohman, personal communication, February 14, 2007; G. Guess, personal

communication, February 12, 2007; M. Kushler, personal communication, January 25, 2007; J. Otto, personal communication, February 13, 2007; L. Walser, personal communication, February 22, 2007; F. Lopez, personal communication, February 12, 2007; D. Dilks, personal communication, February 7, 2007; M. Jansen, personal communication, February 12, 2007; M. Meunier, personal communication, March 1, 2007; B. Haas, personal communication, February 13, 2007; K. Clifton, personal communication, February 20, 2007; J. Sarver, personal communication, February 26, 2007; S. Rashkin, personal communication, March 5, 2007).

The same resources listed above for *state Energy Star Home program support* were referenced for the following other independent variables: *significant municipal markets, utility partners, home builder partners, production builders, HERS partners, other partners, marketing finance pool, and energy crisis*.

Information addressing state legislation effecting residential energy efficiency was examined (Alliance to Save Energy, State Energy Efficiency Index, n.d.). Public benefit funding for the states was researched and described in relation to residential energy efficiency (Alliance to Save Energy, State Energy Efficiency Index, n.d.; Database of State Incentives for Renewables & Efficiency (DSIRE), n.d.). The different state energy codes were listed in reference to national energy codes (Building Codes Assistance Project Codes Status, n.d.). Utility rates for natural gas and electricity were mathematically divided into high, medium and low categories and listed for the sample states (Energy Information Administration, Average Price of Natural Gas, n.d.; Energy Information Administration, State Electricity Profiles, n.d.). Finally, Table A was analyzed to determine if any trends or combinations of independent variables seemed likely to affect the dependent variable *market share*.

No regression analysis or contingency tables were utilized with this analysis (O'Sullivan, Rassel and Berner, 2003) because much of the ordinal data listed was very general, and very little interval data was available (Meier, Brudney and Bohte, 2006). Condensing available data into simple tables is considered a reasonable analysis method (Meier, Brudney and Bohte, 2006). Table A is considered a simple table.

Findings

Findings: Relationship Between Energy Efficient Homes and Public Good

The literature presents a nearly unanimous conclusion that a reduction in residential energy results in an increase in public benefits. The literature generally indicates support for technological advances that reduce energy consumption. Some experts, however, are concerned about increasing aggregate energy use. Additional appliances, an increase in larger square footage homes, and an increase in energy users cause these increases. Although this is a separate problem, it is a related problem that warrants further consideration.

Several sources outlined in the literature review section of this paper support the concept that *reduced home energy use equals improved public benefits* (Brown, 2000; National Resources Defense Council, n.d.; American Lung Association, n.d.; Columbia University Mailman School of Public Health, n.d.; EPA, 2005; Prindle et al., 2003; Energy Information Administration, n.d.; Warren, 1987; Lipke, 2001; Shafer, 2003; ACEEE, 2007; Kushler, York & Witte, 2007; Prindle et al., 2003; Alliance to Save Energy, 2005; Ayres, 2002). The literature collectively defines public good associated with reduced home energy consumption as reduced health problems (including respiratory complications and lung disease), lower levels of air and water pollution,

reduced mercury in fish, reduced real property damage from acid rain, reduced energy distribution failures that cause black-outs and brown-outs, reduced dependence on the importation of energy supplies from unstable portions of the world, and the increased ability for people to reallocate money typically spent on utility bills to either savings or other goods and services.

The argument in the Harris et al. report (as cited in Anonymous, 2006) is relevant to the public good issue. Although technological advances with building materials, appliances and electronic devices have allowed people to reduce home energy consumption, we still need to be concerned with aggregate energy increases. If homes continue to be larger, appliances and electronic devices continue to be used more, and more people engage in home energy use activity, it is possible that progress with reducing energy consumption is off-set by increased aggregate energy use. Other sources recognize the problems identified in the Harris et al. report (as cited in Anonymous, 2006) regarding increased aggregate energy use in the wake of improved technology (Tinker, 2003; Swanson, 2005; G. Guess, personal communication, February 12, 2007).

As stated previously in this paper, the literature is clear about the detrimental effects of burning fossil fuels for residential energy consumption. The literature is mostly unanimous about the public benefits that occur when energy efficiency is increased in residential homes.

Findings: Economic Theory / Role of Government Intervention in the Marketplace

The literature is limited in terms of addressing one of government's least intrusive methods of market intervention: *marketing and promoting*. The economic theory and energy policy literature covers numerous aspects of government intervention including

regulation, tax structure, providing incentives and subsidies, providing grants and loans, providing goods and services that the marketplace does not address, and assisting with research and development.

The literature is not unanimous regarding the government's role with market intervention. Economic perspectives range from advocating zero-to-minimum government intervention, to advocating significant government intervention including strong regulations, tax incentive policies, research and design funding, and voluntary energy efficiency program funding. One study (Lin, 2006) assumes government regulation is a given and explores the dynamics of the federal government regulatory process.

Some of the literature supports public choice theory where the self-interest of politicians and policy makers often leads to government activity that is not particularly cost effective (Tullock et al., 2002; Lemieux, 2004). Some of the literature supports government intervention (by way of advocating energy efficiency, not by the use of tax instruments) because of market barriers and imperfect information prevalent in the energy efficiency marketplace (Howarth and Andersson, 1993). Some writers support the role of government assistance with utility demand side management approaches to energy efficiency (Howarth and Andersson, 1993; Warren, 1987; Prindle et al., 2003; Kushler et al., 2007).

Other economic perspectives include a general acknowledgement of the failures of the GNP as a measurement of economic health (Tsuru, 1994), and historical recognition of the decline of environmental health due to economic activity (Tsuru, 1994). Research and economic experts from energy efficiency advocacy organizations conclude that many forms of government intervention in the energy efficiency marketplace are

necessary (ACEEE, 2007; Kushler, et al., 2007; Prindle et al., 2003; Alliance to Save Energy, 2005).

The literature review section of this paper is by no means a comprehensive review of all the economic positions addressing government intervention in the energy efficient marketplace. It is reasonable to say, however, that in summary the literature referenced in this paper establishes a wide range of perspectives on government intervention from ‘hands-off’ to ‘full-steam-ahead’. It is also reasonable to conclude that the written literature recognizes externalities related to energy consumption such as air and water pollution. The literature, does not, however, present uniform conclusions as to how to deal with those externalities.

Findings: Behavioral Theory and Public Information Campaigns

It is interesting to insert the social marketing conditions listed previously in this paper as described by Andreason (1995) into an energy efficient homes marketplace situation:

“The final objection is to influence the behavior of a target market” (p. 5). The primary target market in this case is purchasers and potential purchasers of new homes. There are other target markets or stakeholders involved, however, and the buy-in from other stakeholders is necessary to effectively increase the market share of energy efficient homes. Secondary target markets include homebuilders, HERS raters, utility companies, legislators and others. In the case of energy efficient homes, the behavior of all stakeholders in the target markets is important to the success of the program(s).

“The target behaviors compete with comfortable alternatives” (p. 5). This is especially true with the building trades stakeholders. Change is often threatening.

Change in the home marketplace requires everyone in the chain (HVAC contractors, finished carpenters, framers, window installers, plumbers, electricians, and all other sub-contractors) to be willing to let go of comfortable routines and embrace new methods and technologies.

“Community pressures make it difficult to bring about change even if the target market finds it attractive” (p. 5). This is applicable to the building trades people. The primary market (new home purchasers) may find energy efficient homes attractive, but other stakeholders (building trades people) may feel that the construction methods and materials necessary for an energy efficient home are too cumbersome or costly to include, or their peers and trade organization leaders may send them messages that discourage embracing new building practices.

“Critical support agencies must help out if the behavior change program is to be successful” (p. 5). This is where the support of government messaging agencies as well as other major stakeholders (utility companies, consultants, possibly trade associations) play an important role in the energy efficient home marketplace when the goal is to transform information received by the target audience to behavior change. In summary, the social marketing conditions described by Andreason appear to be very applicable to the energy efficient home marketplace.

Burke (2006) emphasizes organizational based theory that reinforces the need for system building in order to effectively make sociotechnical change occur in the energy efficient homes marketplace. Burke’s core message is about analyzing ways to effectively make behavior changes happen. He elaborately explores two fledgling energy efficient market components (HERS system and Energy Efficient Mortgages), and suggests *system building* will increase the ability for the HERS and Energy Efficient

Mortgage agents to encourage behavior change and make their markets flourish. Burke's work appears to be reasonable, well researched, and applicable to the energy efficient home marketplace.

The literature exploring the Flex Your Power public messaging campaign in California is primarily focused on effectively producing behavior changes. The authors (Bender et al., 2002) have significantly referenced other literature (Ajzen, Bandura, Peters & Feldman, Andreason, Weiss & Tschirhart and others) while addressing behavior change theory and targeting actual behavior changes. Applying behavior change theory and targeting behavior changes goes beyond sending out awareness messages. Social Marketing, Social Learning Theory, and the Theory of Planned Behavior all provide significant perspectives into human behavior relevant to the energy efficient homes marketplace.

Peters and Feldman (2001) reinforce the significance of self-efficacy, while referencing other literature in support of their argument (Ajzen, Bandura and others). In terms of creating behavior change with marketing messages, Peters and Feldman suggest that self-efficacy approaches (*I can* messages) should replace other approaches (*save money* and other *non-energy benefit* messages). Peters and Feldman's use of multiple regression analysis to illustrate the relationship of "renewables advertising recall to renewables energy efficacy and information seeking/processing" (p. 484) is a comprehensive approach that explores more than one cause for the dependant variable (Meier, Brudney, and Bohte, J., 2006).

The collective behavior change literature reinforces the conclusion that programs that produce effective behavior change are not simply the result of the implementer's version of *what is a good idea*, or an opinion of *what is the right thing to do*. Instead,

significant consideration of behavior-based theory should be considered and incorporated or the well-intended program implementer may find their program fails to create desirable behavior changes with the target audiences.

Findings: Program Design Review / Energy Star Home Program

As previously described, there are numerous ways government might intervene in the energy efficient home marketplace. The following list represents additional highlights from the literature addressing government intervention in the marketplace:

- There is a range of implementation costs associated with the different forms of government intervention;
- Different social and economic philosophies either support or condemn marketplace intervention; and
- At times, different forms of government intervention work in tandem with other market mechanisms

The range of government intervention in the marketplace is immense. This paper narrowed down the intervention mechanisms to one category, *messaging/promotion*, and one particular government sponsored energy efficient program design, Energy Star Homes.

The choice to concentrate on the Energy Star Homes literature and anecdotal program information was influenced by the following factors; 1) market intervention by way of *messaging/promotion* is one of the least intrusive forms of government intervention in the marketplace, and 2) the Energy Star Home program has a history of consumer recognition and establishing partnerships with other economic actors in the marketplace.

Market growth factors are examined in the Table A. A sample of eleven states representing strong, growing, and weak Energy Star Home markets are listed in Table A. This table shows a more in depth look at several independent variables and their possible relationship to the dependant variable labeled *market share*. Five states are categorized as “strong markets”, two states as “growing markets”, and four states as “weak markets”. Table B provides descriptive information for the variables.

One potential independent variable, *consultant partners*, was not included in Table A because it represented a response to market growth rather than explanation as to why the market growth may have occurred in the first place (S. Rashkin, personal communication, March 7, 2007). All other independent variables in Table A represent potential market growth factors.

Observations from Table A

The five states with a strong Energy Star Home marketplace share the following features:

- Significant municipal markets (4 out of 5)
- Enactment of some form of legislation that addresses energy efficiency (4 out of 5)
- Strong utility partner activity (5 out of 5)
- Strong homebuilder partners (4 out of 5)
- Strong production builder presence (5 out of 5)
- Strong HERS partners (4 out of 5, with the fifth showing strong participation with a low number of raters)
- Some form of “other” partners (4 out of 5)

- Mandatory state energy code aligns with relatively current national code (4 out of 5)
- Medium to low natural gas and electricity rates (4 out of 5)

The two states with a growing Energy Star Home marketplace share the following features:

- Significant municipal markets
- Enactment of some form of legislation that addresses energy efficiency
- Moderate utility partner activity
- Low natural gas and electricity rates

The four States with a weak Energy Star Home marketplace share the following features:

- Minimal strength with the states' Energy Star Home Program support
- Minimal strength with municipal markets
- Little to no legislation activity addressing energy efficiency (3 out of 4 featuring no significant legislative activity)
- Limited utility partner activity
- Limited homebuilder partners
- Limited HERS partners
- No significant marketing finance pool activity
- Medium to low natural gas and electricity rates

Observations 1 – 6 pertain to variable indicators for the five strong market states.

Observation #1: Government activity in the marketplace may be relevant, but there is more to the story than government sponsored programs, funding, & regulation.

Five of the thirteen independent variables represent some form of government activity (*Energy Star home program support, state legislation, public benefits funding, marketing finance pool, and status of state energy code*). There is not a defining pattern with the five strong market states regarding government activity. State assisted *Energy Star Home programs* range from strong to minimal, suggesting that these state funded programs have a role in the Energy Star Home marketplace, but not necessarily the most important role.

Strong market states may or may not be participating with EPA's New Home Outreach Partnership in which the federal government helps fund a *marketing finance pool* for participating Energy Star Homes partners. *State legislation* addressing energy efficiency varied in content (less significant legislation to significant legislation). An established *public benefits program* (where money is generated to sustain statewide programs) may or may not be featured in these five states. The one government related variable, *status of state energy code*, did reveal a pattern. Four out of five strong market states feature a mandatory code that aligns with a relatively recent version of the International Energy Conservation Code.

The information describing the five government related independent variables suggests there is support for the hypothesis that without government assistance, the Energy Star Home marketplace would not be as strong. The pattern, however, is not consistent, suggesting other variables play a role with successful market areas.

Observation #2: Successful Energy Star Home markets appear to be correlated with other independent variables such as strong utility partners, strong homebuilder partners, strong production builder activity and strong HERS partners - highlighting the importance of partner participation and the presence of market champions.

This discovery is equally important as observation #1. Government support may be helpful, but the market partners serving as champions seem to be more responsible for invigorating the marketplace.

Observation #3: The presence of strong production builders is a common trait with the strong market states.

All five of the strong market states indicate significant activity with production builders. This is logical, because production builders produce more homes than smaller builders. If more production builders are producing Energy Star Homes, then Energy Star Home aggregate numbers will increase.

Observation #4: The five strong market states feature a solid HERS infrastructure.

Home energy raters verify Energy Star homes. Four of the five strong market states indicate a relatively robust HERS presence. The fifth state features fewer raters, but they comprehensively take care of the market. HERS raters are the cornerstone of the Energy Star Homes program, providing expertise to the builders and validity of the finished product. Strength with HERS partners is an important aspect of the successful market areas.

Observation #5: Four of the five strong market states feature at least one strong municipal market.

It is logical that even a single progressive municipal market can increase the market share of a state, especially if production builders are active and the area is experiencing significant population growth and new building construction.

Observation #6: The five strong market states do not feature the highest utility rates in the country.

It is difficult to assess the significance of this finding. This is an observation that raises questions about the quality of the variable *utility rates*. A utility rate that is considered “low” or “medium” by the scale used in this paper may not feel “low” or “medium” to the utility ratepayer of a particular state. This variable is somewhat vague, so the quality of the variable comes into question.

Observations 7– 10 pertain to variable indicators for the two growing market states.

Observation #7: Strong partnerships and champions are not as prevalent in the growing market states as with the strong market states.

In the case of Wisconsin, there is a substantial amount of public benefit funding which appears to be a factor in this growing market. Homebuilders seem to be significant partners in Wisconsin, but utility partners and production builders do not seem to have the same strength of presence as with stronger market states. Indiana’s pattern shows strength in production builders and HERS partners, but not as much strength with utility partners and homebuilder partners. These results suggest that a number of important

strong market partners together can create synergy and establish more effective market penetration (compared to only having one or two strong market partners).

Observation #8: The two growing market states feature moderate strength with the Home Energy Rater System (HERS) infrastructure.

Indiana's HERS activity is considered strong, and Wisconsin's HERS activity is considered more moderate by numbers, but strong in terms of effective delivery of service. As with the five strong market states, this is an important aspect for the states where the market is growing.

Observation #9: The two growing market states do not feature significant municipal markets.

As stated with observation #5, thriving municipal markets can elevate the state's total market share. The absence of thriving municipal markets can reduce a state's total market share.

Observation #10: The two growing market states do not feature the highest utility rates in the country.

The same comment applies here as with observation #6. The quality of the variable is questionable in terms of providing useful information to the energy efficiency motivation of the residents and partners of these two states.

Observations 11– 14 pertain to variable indicators for the four weak market states.

Observation #11: Most of the factors that are evident in strong Energy Star Homes market states are missing in weak market states.

This general statement applies to the significant partners and champions who are prominent in the strong market states and seem to be missing in the weak market states. The four weak market states feature a mix of government activity, i.e. minimal *State Energy Star Home program*, *minimal legislation*, two states with *public benefit funding* and two states without, no *marketing finance pool* activity, two states with mandatory local *energy codes* reflective of the IECC code, one state with a voluntary energy code, and one state with a very weak mandatory energy code. Government activity is mixed, but prominent market partner activity is consistently weak.

Observation #12: The four weak market states feature minimal to moderate strength with the HERS infrastructure.

This observation supports the argument that a substantial HERS presence is an important aspect to a successful Energy Star Home marketplace.

Observation #13: The four weak market states do not feature significant municipal markets.

Comments for observation #9 apply here as well.

Observation #14: The four weak market states do not feature the highest utility rates in the country.

This observation may be significant for Kentucky, which features low electric rates due to their regional access to coal. This may have a relationship with consumer buy-in for energy efficient homes.

Implications from Observations 1 – 14

- 1) Several variables co-exist with the strong market states indicating that important ingredients combine to produce a more successful end product.
- 2) Growing market states share some similarity with variables; however, the significant market partners and champions are not as prevalent in growing market states as they are in the stronger market states.
- 3) Weak market states show inconsistent patterns of mixed variables, which do not amount to significant market penetration.
- 4) Weak market states primarily show that market partner leadership is weak, municipal markets are weak, and legislation supporting energy efficiency measures is absent.

Additional Considerations

The literature and accumulated anecdotal program information suggest that regional circumstances play a role with effective Energy Star Home program design. Additionally, participation with program partners is often determined by regional circumstances. There does not appear to be a one-size-fits-all remedy for successful programs.

The Southwest region, for example, features higher year round temperatures, a greater emphasis on air conditioning loads, and a more substantial focus on air quality

issues. These conditions affect state and/or federal regulatory requirements for air emissions. Given these regional circumstances, it is not unusual to see utility companies actively participating with demand side management programs that reduce electric loads, maintain energy supplies, and emit fewer pollutants from coal fired electric generating plants. Considering the combined regional factors, it stands to reason that utility companies would play a more significant role in implementing Energy Star Home programs in the Southwest.

It appears as if successful Energy Star Market penetration does not have to be tied to rebate or incentive based programs. With strong partner building networks, incentives or rebates may not be necessary. This is shown in the Las Vegas market with the Energy Star Partners Group (60 percent market share), and Phoenix (more than 30 percent market share), and Indianapolis (nearly 20 percent market share). In these three market areas, strong champion groups or individuals effectively promoted Energy Star Homes (M. Kushler, personal communication, January 25, 2007). Texas is a good example of a marketing driven model (in comparison to an incentive driven model) (S. Rashkin, personal communication, March 5, 2007).

As described previously in this paper, the variable *utility rates* may be of questionable quality. It is noteworthy to point out that there are unknowns about the quality level of other independent variables as well. In general, the independent variables were ordinal in nature, not interval. This implies that the variables were vague with imprecise parameters. An example of this is the ordinal variable *HERS partners*. There is a clear order of the status of the variables i.e. strong, moderate, or minimal, however, the spacing between the values may not be the same across the levels of the variables (the range between strong and moderate, or moderate to minimal is undefined). This situation

implies that the quality factor of some of the variables is questionable because of the undefined spacing between the values across the levels of the variables.

Another example of this is the variable *utility partners*. How does one assess the “value” of this variable? What are the factors that actually determine the categories “strong”, “moderate” and “limited”? Is it the degree of the financial support the utility companies provide to the Energy Star Homes programs? Is it the degree of their philosophical support of energy efficiency principles? Is it the degree of their response to regulatory mandates? Is it the degree of their response to dwindling energy supplies? Is it the degree of their concern for environmental quality? Is it related to their need to appear “green” to green-sensitive ratepayers? Is it some combination of these conditions or concerns? Does it vary from utility company to utility company depending on their service territory?

Without answers to these questions, the independent variables are destined to remain vague, and the quality of the variables will remain questionable. It is still possible to observe trends or patterns based on the information that is available, but it is important to note the concerns for quality regarding the variables.

Regarding the evaluation studies of energy efficiency related programs cited in the literature, it is noteworthy to comment on the evaluation methodology used. The metrics study (PA Consulting Group, 2005) represents a thorough approach to collecting secondary market share data and “identifying appropriate sources of information” (Fitzpatrick, Sanders and Worthen, 2004, p.264).

The awareness and understanding study (Wisconsin Department of Administration, Division of Energy, 2005) represents a comprehensive attempt to measure attitudes, opinions and behaviors of a larger group. The intent of this evaluation

was to review the *Focus On Energy* program, a program designed to help the public, and paid for by the public through Wisconsin's public benefits fund. This evaluation study fits Henry's point (as cited in Fitzpatrick, Sanders and Worthen, 2004) that surveys should be used more frequently in evaluations involving larger audiences representing the general public "to involve the public further in policy issues and improve democratic discourse" (p.341).

Recommendations

Recommendations: Relationship Between Energy Efficient Homes and Public Benefit

The literature comprehensively addresses public benefits associated with reduced energy consumption. It seems wise and in the public's best interest for business and government to continue to focus on ways to reduce energy consumption from fossil fuel sources and correspondingly improve public good. From a strictly anthropocentric perspective, this path is appropriate for the health and well being of the human population. From a biocentrism perspective, this path benefits all other living organisms.

The important concerns cited in this paper about how energy efficient technology may be leading to increased aggregate energy use (Anonymous, 2006; Tinker, 2003; Swanson, 2005; G. Guess, personal communication, February 12, 2007) are valid and should be considered as we continue to make technological advances to increase energy efficiency.

The relationship between reduced energy use and improved public health is a scientific issue. There could always be further research addressing cause and effect relationships with pollution and health such as the Columbia University Mailman School

of Public Health study (n.d.). If, however, society could agree that increased pollution decreases public health, it seems the best focus for additional research would be on the motivational factors necessary to create behavior change with energy consumers.

Recommendations: Economic Theory and the Role of Government in the Marketplace

Howarth and Andersson (1993) present compelling findings that indicate buyers do not have enough information (or the correct information) about the benefits of energy efficiency equipment to enable them to make educated purchase decisions that result in aggregate energy savings. Although these findings correlate with energy efficient home purchasing decisions, there is an added level of complexity with the energy efficient home market. Energy efficient components of a house are more misunderstood by consumers.

Although there is a general familiarity with energy consuming equipment such as refrigerators, washers, dryers, televisions, DVD players and other consumer electronics, the actual structural components of the house are less understood by consumers. These components include raised heel trusses, various forms of insulation, heat recovery units, framing materials, windows featuring different energy performance attributes, ventilation systems, structural insulated panels, insulated concrete forms and renewable energy systems.

From an economic perspective, buyer information (including imperfect, impeded or suppressed information) is a problem in the energy efficient home marketplace. When consumers do not understand the value, costs, and returned investment associated with structural components of a home, it translates to market barrier complications. Buyers

are generally less familiar with structural home components than they are with energy consuming equipment such as appliances and vehicles. The literature explores how buyers make decisions based on available information. The infrequent nature of home purchase decisions further complicates the ability of buyers to make the best decisions.

Further research should be conducted that addresses consumer knowledge specific to energy efficiency related home components. This research should offer remedies for the most effective way to include necessary information into the marketplace with an understanding that homes feature complex components that are not always understood by the consumer.

As previously discussed, a limitation with the literature is the absence of a substantial exploration into government's role as minimal interventionists. There does not appear to be adequate literature exploring government's role with messaging, marketing and promoting energy efficient residential housing. It is an issue that is at times hotly debated in Congress when the Department of Energy's budget and subsequent allocation to State Energy Offices is being considered. Often, the opinions expressed during these deliberations are not backed with data and research that supports or discourages government sponsored marketing and promotion activities.

Public choice theory provides some perspective into the nature of policy decisions, and how those decisions create policies that are not always the best use of public funds. Additional research should correlate public choice theory with specific *marketing/promotion* government intervention activities and policies. It would be interesting to see how public choice theory addresses specific, least-intrusive government intervention in the energy efficient home marketplace.

Recommendations: Behavioral Theory and Public Information Campaigns

There is some consensus regarding the relationship between reduced energy consumption and public good. There is much debate about whether government should intervene in the energy efficient home marketplace. If there were agreement that government should intervene in the energy efficient home marketplace, the questions remaining would be: to what extent, and which form of intervention is considered reasonable? Economic scholars and social scientists will no doubt continue this debate and provide mixed conclusions. Possibly the most important research aspect of this entire energy efficient home marketplace issue is a further exploration into the motivations that lead to behavior change.

This paper will not solve the debate about the role of government in the energy efficient marketplace. Assuming that the government will continue to intervene in the energy efficient marketplace at different levels (regulation, providing incentives, providing tax breaks and/or tax penalties, assisting with R&D, providing a justice system for externality related cases, providing direct goods and services, providing low-interest loans, or supporting messaging/promoting programs), further research will be best directed toward *understanding human behavior and how best to encourage behavior changes that result in reducing energy consumption*.

Every stakeholder in the energy efficient home marketplace can benefit from the applied principles of behavior change research. Stakeholders range from program champions (market actors promoting, constructing, and selling energy efficient homes) to homebuyers. All these stakeholders either deliver or receive messages. Behavior change

research addresses message crafting, creating awareness and understanding, and effectively motivating people toward action.

Further research is warranted in the areas of Self-Efficacy, Social Marketing, Social Learning Theory, and the Theory of Planned Behavior with a specific emphasis on the energy efficient home marketplace. More specifically, additional research should focus on the relationship between these four theories and government sponsored *marketing/promotion* oriented programs.

Recommendations: Residential Energy Efficiency Program Design

It is helpful to first review certain assumptions about the energy efficient home marketplace before providing recommendations for residential energy efficiency program design. As previously stated, there is the assumption that:

- Reduced energy consumption translates to improved public good;
- Economists and social scientists will continue to debate the role of government intervention in the energy efficient homes marketplace, and government intervention will continue to take place at different levels and imply different costs;
- Future programs addressing energy efficient behavior would benefit from an expanded knowledge and application of behavior theory; and
- Government intervention improves the energy efficient home marketplace, but success is more likely associated with program design and the strength and commitment from the participating market partners.

Now that these assumptions have been identified, the discussion can shift to program design and the Energy Star Homes Program.

The Energy Star Homes program represents an obvious choice for program design examination. It is an established program. Research supports its national brand recognition. It is a program that was initially piloted in market areas expected to show promise for expansion. It is a program that can provide improved energy efficiency results under different regional conditions.

Anecdotal information gathered for this paper that explores eleven different state Energy Star Home markets reveals some patterns relevant to successful market penetration. Future research, however, should address variables related to successful Energy Star Home market penetration. Weak and growing market areas implementing the Energy Star Home program could benefit from studying existing market areas that have been experiencing success. Some of the factors present in successful markets are:

- Strong partners champion the program that can be more important than government assistance, although government assistance appears to play a positive role;
- A strong HERS presence as the foundation to a successful Energy Star Home program;
- Strong Energy Star Home municipal markets which are likely to contribute to strong state markets;
- Programs that are market driven, requiring fewer subsidies and likely to be more effective and durable over time compared to programs that are incentive driven; and
- Consideration of regional circumstances as important to program success.

There are many other home energy efficiency program designs available for states and regions to adopt. It is likely that the anecdotal lessons learned and revealed in Table

A and briefly summarized above are applicable to alternative program designs such as the National Association of Home Builders Green Built program, Environments for Living program, Leadership In Energy and Environmental Design for Homes program, and other regional homebuilder association and utility company sponsored programs.

Conclusions

In the beginning of this document, the following initial hypothesis is proposed: *Without public policies that advocate energy efficient home construction as the standard for the industry, Energy Star certified homes cannot significantly penetrate the marketplace.* This hypothesis appears to be supported by the literature, web based materials, and anecdotal program information that was reviewed for this paper.

Perhaps a more significant finding was the importance of other factors that contribute to the successful market penetration for the Energy Star Home program. Those factors include the inclusion of strong market partners that serve as committed program champions, a strong presence with the HERS energy rating professionals, a predominant marketing driven component to the program, strong municipal markets, and attention to regional circumstances that are important to the specific market areas.

There are imperfections with the independent variables used in Table A. Table A, however, does reveal findings that help describe strong, growing and weak Energy Star Home market areas.

Before exploring energy efficient home construction program design (and more specifically, the Energy Star Home program), it was necessary to first examine the literature addressing the relationship between energy efficiency and public benefit, economic theory relative to government intervention, and behavioral change theory

relative to energy efficiency. By addressing these three subjects first in the literature review section of this paper, a foundation was created for a closer look at energy efficiency home construction program design. The literature revealed that a future emphasis on applied behavior theory could benefit all the stakeholders in the energy efficient home marketplace.

Finally, the literature revealed some weaknesses. Future research should investigate specific government intervention mechanisms for the energy efficient home marketplace. More specifically, research should be conducted that explores the details of the *messaging/promotion* role that government provides with energy efficiency advocacy programs. Additional research should be conducted regarding behavioral theories in relation to the energy efficiency home construction message.

Specific home energy efficiency program designs such as the Energy Star Home program have helped reduce energy consumption. The logical next step for the future of this program is to incorporate best practices from states and regions that operate with a minimal amount of government program investment and a maximum amount of market partner commitment to make the biggest market penetration possible. This type of marketing driven approach can provide multiple benefits including profitable market partners, improved air and water quality, and improved public benefit.

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