

**ZERO ENERGY HOME PROJECT  
ZEH Market Analysis for the Dallas, TX Area**

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## 1.0 INTRODUCTION

The NAHB Research Center (NAHBRC) conducted a market research study in the Dallas, Texas area to determine homebuyers' interest in energy efficiency and specifically, Zero Energy Homes. The goals of the study were to i) to better understand consumer motivations for purchasing a ZEH and ii) to develop the basis for an approach to marketing the ZEH concept that could be used in the Dallas area, as well as other residential markets. The study included an NAHBRC survey of homeowners in Dallas as well as review of statistical data from the North Central Texas Council of Governments, the North Texas Real Estate Information Systems, the Home Builders Association of Dallas, and the National Association of Home Builders.

When discussing the concept of the Zero Energy Home (ZEH), in order to reduce any bias that might result from use of the term "Zero Energy Home", the new reference, Concept Home, was used throughout the consumer study. The Concept Home was defined as followed within the body of the consumer questionnaire:

The Concept Home uses energy sparingly thanks to improved building methods and products. A Concept Home annually produces as much energy from renewable energy sources as it uses for heating, cooling, lighting and appliances. It may use a small amount of conventional fuels such as oil or natural gas.

The Concept Home uses energy from the local utility only when the home's solar energy is not available. Whenever the home's solar energy systems produce more energy than the home needs, the excess is fed back to the utility. Any energy sent back to the utility is credited against future use.

Over the year, the Concept Home is intended to have a net-zero utility bill - meaning that the home has sent at least the same amount of electricity back to the utility as was taken from the utility. One benefit of living in a Concept Home is that your utility bills will be zero or close to zero for as long as you live there.

Due to the use of state of the art technologies and advanced construction methods, the Concept Home will be more comfortable, have better indoor air quality and be more environmentally friendly- all of which may increase the value of your home.

### Summary of the Findings

Based upon the NAHBRC 2004 consumer study of Dallas, Texas homeowners, there is very strong interest in a Concept Home if the savings on total utility bills offsets the increase in monthly mortgage payments (88% of the respondents). Furthermore:

- About 60% of the respondents would be willing to pay at least \$10/month<sup>1</sup> more on their mortgage to avoid fluctuating energy costs and/or use non-polluting sources of energy.
- Over 50% would pay more than \$20 more per month on their mortgage to avoid fluctuating energy costs and/or use of non-polluting sources of energy; and
- Over 2/3 (67%) of the respondents would pay at least \$50/month more on their mortgage for the Concept Home.

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<sup>1</sup> For every \$10/month cost, the initial investment is about \$1,500 financed over 30 years at a 7% annual interest rate.

- 50% would pay at least \$100/month more for the Concept Home.

"Drivers" that would encourage this group of survey respondents to purchase a Concept Home include some type of financial incentive. Approximately 80% of the survey group responded that the following were "important" or "very important" in deciding to buy a Concept Home:

- Government tax incentives.
- Reduced mortgage rates.
- Free 5-year annual maintenance on the heating/cooling system of the home.

Reliability and proven performance are other strong "drivers". Again, about 80% of the respondents acknowledged the high importance of utility warranties, homebuilder warranties, and proven performance over time. These also have an economic benefit for the homeowner. Energy efficiency ranked highly also with almost three quarters of the group placing it at the high end of the scale with respect to importance. More moderate importance was placed on safety and indoor air quality. Surprisingly, respondents were relatively neutral regarding physical comfort as an incentive to purchase a Concept Home.

Review of other characteristics of the Dallas market point to several additional factors that may help promote the Concept Home. Based upon the large market share represented by ENERGY STAR partners (40%), the relatively high utility rates, the existence of utility rebates and technical assistance, and the relatively ample solar resource, Dallas appears to be a prime market for energy efficient homes and including renewable energy technologies. While there remains a large gap between the purchase an ENERGY STAR-rated home and the purchase of a Concept Home, the increased focus upon energy efficiency and renewable energy resources is an important step in achieving this goal.

### **Characterization of Survey Sample**

A statistically significant sample of homeowners for the Dallas area was surveyed (424 total). At least 98% provided answers to most of the issues discussed in this report. The majority of the survey group purchased their current home in the last ten years and over 97% of these homes were single-family detached. The size and price range of the homes were moderate with over two-thirds of the homes between 1,500 and 3,000 square feet; almost 90% of the homes had a purchase price under \$200,000. This concurs with a 2004 study by the North Texas Real Estate Information Systems that found the median home sales price in Dallas to be \$147,500.

Only 385 of the 424 survey participants (91%) responded to questions regarding annual income. 78% of this group reported a household income of less than \$100,000 per year; an additional 11.7% reported annual household incomes between \$100,000 and \$124,000. Fifty percent of the entire group surveyed had combined monthly mortgage, homeowner insurance and taxes on their primary residence under \$1,000; for 82.5% of the 424 respondents, these monthly expenditures were less than \$1,500.

### **Characterization of Dallas, Texas New Homes Market**

According to 2000 U.S. census data, Dallas had a population of 1,188,204. 2003 census data indicates that 52,813 new housing permits were issued in that year. Although the number of residential builders who are ENERGY STAR partners is small, these builders represent just over 40% of the market share of new homes built in Dallas. The large number of housing starts per year keeps competitive pricing an important issue for new home builders. However, the strong familiarity with the

ENERGY STAR home rating among builders should increase the visibility of energy efficiency as a central consideration for homebuyers when purchasing a new home.

### **Characterization of Dallas, Texas Residential Energy Requirements and Expenditures**

With respect to space conditioning, Dallas is a cooling dominated climate with 2,725 Cooling Degree Days (CDD). However, space heating is not incidental with 2,295 Heating Degree Days (HDD). The majority of new homes use air source heat pumps to satisfy both cooling and heating requirements. Electric rates for TXU Energy, the Dallas utility, are \$0.104/kWh during the summer months and \$0.097/kWh during the winter. About 53% of the survey participants reported summer electric bills between \$100 and \$209 per month; an additional 25% said their summer bills were about \$100 per month higher or approximately \$300 per month. For the winter months, about 54% reported monthly electric bills between \$40 and \$129 per month; 25% had winter electric bills between \$130 and \$209 per month. Given the average size of the home for the group surveyed, these energy expenditures appear somewhat high and point to ample opportunities for improvement to increase energy efficiency in building shell design, appliances, and/or lighting.

The Dallas area does have several advantages with respect to energy efficiency and renewable energy. Although there currently are no incentives for renewable energy, TXU Energy, the Dallas utility, does provide incentives for ENERGY STAR homes. TXU will provide the plan review, inspection and verification, sales staff training, educational workshops, and advertising partnerships to ENERGY STAR builders. Such support should continue to increase participation by the residential market and help move towards acceptance of the ZEH concept.

With respect to climate and renewable energy, Dallas has a considerable solar resource, averaging about 5-6 kWh/square meter/day (or about 0.5 kWh/square foot/day). *PV Watts*, an online tool that estimates the amount of power produced by a photovoltaic system for various locations across the country, indicates that a 2kW (AC) PV system in Dallas would produce about 3,500 kWh per year. On average, this would be about 10 kWh per day. While this represents only about 20-30% of the summer and winter requirements for the majority of respondents, the percentage increases for the spring and fall months when average outdoor temperatures are in the mid-60's. Significant efforts are still required to bring annual energy expenditures to net-zero at a cost the Dallas residential market will bear.

### **Homebuyer Interest in a Concept Home**

Survey respondents expressed strong interest in a Concept Home if the savings on total utility bills offset the increase in monthly mortgage payments. 88% would buy a home in which new energy technologies eliminated most or all of the energy bills if these savings offset a higher monthly mortgage payment. In addition, when solicited directly on the "willingness to pay" for the Concept Home, half of the respondents indicated that they would pay at least \$100 per month more on their mortgage. This result indicates that consumers at least acknowledge an economic value to the Concept Home.

### **Drivers to Encourage Purchase of Concept Homes**

Financial incentives are the strongest drivers in encouraging homebuyers to purchase a Concept Home. Approximately 80% of the survey group responded that the following were "important" or "very important" in deciding to buy a Concept Home:

- Government tax incentives.
- Reduced mortgage rates.

- Free 5-year annual maintenance on the heating/cooling system of the home.

Reliability and proven performance are other strong "drivers" when considering the purchase of a Concept Home. Again, about 80% of the respondents acknowledged the high importance of utility warranties, homebuilder warranties, and proven performance over time. Although 75% of the group indicated that they did not want to pay extra to avoid fluctuating energy bills in an earlier question, over 80% of the group said predictability of future bills (utility and mortgage) was either "important" or very important in deciding whether to buy a Concept Home. Energy efficiency also ranked fairly high in importance with about 70% of the group placing it on the high end of the scale.

More moderate importance was placed upon safety and indoor air quality. About 50% ranked safety and indoor air quality at this level with safety having a slightly higher percentage of favorable responses than indoor air quality. Surprisingly, respondents appeared relatively neutral on physical comfort as an incentive to purchase a Concept Home. Respondents were also split fairly when asked about the importance of resale value as it relates to the decision to purchase a Concept Home. About 15% fell into each of seven categories ranging from least to most important. The least important drivers with respect to the purchase of an energy-efficient home are:

- State-of-the-art technology,
- Environmental friendliness, and
- Friends or neighbors own a concept home.

### **Conclusions and Marketing Approach for the Concept Home**

Based upon the 2004 NAHBRC consumer questionnaire and review of other energy and home building data pertinent to the Dallas, Texas residential building market, there is a tangible and valued homeowner interest in energy efficiency as evident in the support for programs that promote energy efficiency such as ENERGY STAR. The willingness of the consumers to recognize the value to the Concept Home adds credence to this result. The awareness of the value of energy efficiency is a helpful step in moving towards acceptance of a Concept Home in the Dallas marketplace.

The cost of the Concept Home is of course one of the primary concerns. When the Concept Home performance is described as offsetting the utility bills, the interest increases. Separate motivators such as reduced pollution, utility price stability or even comfort, appear to be less valued economically. To increase the attractiveness to the buyer, direct financial incentives were cited as the most important "driver" in encouraging the purchase of a Concept Home. In essence, net-zero energy expenditures are most desirable if the installed cost/purchase price of the home is also "net-zero" (or close) relative to "the same" non-Concept Home. Although energy efficiency and predictability of monthly energy bills were generally viewed as "important" or "very important" by at least 70% of the respondents, this was not something for which they were willing to pay higher first costs. In addition to the financial incentives, other strong drivers that encourage the purchase of a Concept Home are reliability and proven performance. However, it should be noted that the indicators of reliability and proven performance over time (warranties and longevity) also have a financial base as an incentive.

With respect to a viable economic market and climate, Dallas is both a challenging and a prime region to implement a multi-faceted approach towards achieving net-zero energy use in new homes. The volume of new homes built in the metropolitan area reinforces the need to ensure that prices remain affordable. Furthermore, the reported average annual income of \$57,577 and median home sales

price of \$147,500<sup>2</sup> also indicate the need to remain within a moderate price range. Achieving net-zero energy expenditures is a challenge given that the current cost of small-scale renewable energy technologies remains quite high.

Climate, however, is an advantage for Dallas, as well as the entire north central Texas region. Balanced space heating and cooling requirements coupled with moderate swing seasons and good solar access throughout the year are a strong benefit. Improvements to the building envelope and provisions for shading can contribute to reduction in space conditioning requirements. Solar availability will also be advantageous in offsetting domestic water heating loads - typically, the largest energy use in homes after space conditioning. With the cost of electricity in Dallas at approximately \$0.10 per kWh - higher than the national average - conservation and renewable energy sources should be attractive to this market due to the faster payback period.

On the basis of the NAHBRC internet study, the most advantageous marketing efforts<sup>3</sup> for the Zero Energy Home (Concept Home) appear to be the financial benefits of purchasing such a home and/or the reliability, long-lived performance, and durability features of the home. Wherever possible, it is important to highlight economic advantages that might otherwise be overlooked, for instance, reduced monthly expenditures with more efficient equipment, income tax advantages with respect to interest that are not applicable to monthly payments on utility bills. Energy efficiency, safety, and indoor air quality should be underscored in support of these central features. In addition to homeowners/buyers, other audiences that are important to target include lenders, appraisers, and the local utilities. Benefits that these groups derive from a Zero Energy Home should be reflected in financial incentives for the homebuyer.

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<sup>2</sup> North Central Texas Real Estate Information Administration, 2004

<sup>3</sup> Marketing efforts may be from the builder, the state energy office, or even the federal government.