

# **ZERO ENERGY HOMES**

CS 8803 - HAPPY HEALTHY HOMES



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## **1. PROJECT IDEA**

Zero Energy Homes is a Survey project conducted and completed as a course requirement of CS 8803 – Happy Healthy Home for the semester of Spring 2010. It analyzes the concept of a ZEH, conducts a survey to take into account people's opinion. We also include seven easy steps to convert or build a home with zero energy design. From the analysis of the survey, we draw some useful inferences that are presented in the following sections.

ZEH are said to have a considerable impact on the environment and this project survey considers people's opinion regarding the same. The concept of a zero energy home is now becoming common, and more and more people have started adapting their home amenities / utilities in a way that abide by the Zero Energy Design.

The following sections explain in detail about the ZEH with certain examples and the analysis if the survey conducted.

## **2. CONCEPT OF A ZERO ENERGY HOME**

Zero Energy Home is a general term applied to a design with a zero net energy consumption and zero carbon emissions annually. These are autonomous from the energy grid supply since energy is produced on-site. These designs are said to produce more energy than they usually consume.

Although zero energy homes are uncommon in developed countries, they are slowly gaining in popularity. The zero energy design can be measured in different ways such as cost, energy and carbon emissions.

The design provides calculations for heating, cooling, and ventilation systems and develop construction drawings for distribution systems such as ducts, etc.

The idea of a Zero Energy Home involves using renewable sources of energy, using right sized equipment that conserves energy and improves performance. The design uses zero energy modeling software that addresses energy conservation, efficient consumption, and effective production.

### **ZERO ENERGY HOME vs GREEN HOME:**

The goal of green building and sustainable architecture is to use resources more efficiently and reduce a building's negative impact on the environment. Zero energy buildings achieve one key green-building goal of completely or very significantly reducing energy use and greenhouse gas emissions for the life of the building. Zero energy buildings may or may not be considered "green" in all areas, such as reducing waste, using recycled building materials, etc.[1]

However, zero energy, or net-zero buildings do tend to have a much lower ecological impact over the life of the building compared with other 'green' buildings that require imported energy and/or fossil fuel to be habitable and meet the needs of occupants.

### **3. SEVEN STEPS TO A SUCCESSFUL ZEH**

- Decrease the energy requirements for space heating, cooling and water heating
- Increase the efficiency of the furnace (or heat pump), and the air-conditioner.
- Install a solar hot water pre-heat system, an efficient backup water heater, and an efficient distribution system.
- Install efficient lighting fixtures .
- Install efficient energy-conserving appliances.
- Install a properly sized photovoltaic (PV) system.
- Turn off lights, computers, and appliances when not in use

Following the above steps and more can lead to a successful zero design home with almost net zero energy consumption[2][4].

### **4. ADVANTAGES AND DISADVANTAGES OF A ZEH**

Zero Energy Homes provide abundant advantages to the environment, but are also accompanied by some drawbacks[1]. We summarize both of these in this section:

#### **ADVANTAGES:**

1. Improved comfort - an energy-efficient building envelope reduces temperature fluctuations
2. Reliability - a Zero Energy Home can be designed to continue functioning even during blackouts
3. Energy security - a home that produces energy protects its owner from fluctuations in energy prices
4. Environmental sustainability - a Zero Energy Home saves energy and reduces pollution

#### **DISADVANTAGES:**

1. Initial Costs are very high
2. Climate specific design may restrict the ability of responding to rising or falling ambient temperatures.
3. Solar energy Capture using the house envelope only works in locations unobstructed by the South.
4. Very few designers or builders have the necessary skills or experience to build ZEHs

While designing such a home, one can use the above points to weigh the consequences and effects of building such a home.

## 5. EXAMPLES

The following picture is a part of Ideal Homes, a zero energy design home in United States[3].



Photovoltaics are placed on the roof of this house and they capture energy from the sun to help offset consumption. This modest home produces as much energy as it consumes in a year, leading to a net zero energy consumption.

Googleplex, Google's headquarters in Mountain View, California, completed a 1.6 megawatt photovoltaic campus-wide renewable power generation system[1]. Google (and others) have developed advanced technology for major reductions in computer-server energy consumption (which is becoming a major portion of modern zero-energy commercial building design, along with daylighting and efficient electrical lighting systems).

Palo Alto Net Zero Energy House - The Palo Alto Net Zero House is the green renovation of a home in Palo Alto, California. Completed

in June 2009, the house is net zero energy.

## 6. SURVEY ANALYSIS

The survey conducted on Zoomerang helped us to collect opinion of the general public regarding their idea of a Zero Energy home, what do they fear the most, how comfortable are people in transitioning their home design to that of a ZEH.

The following are two screenshots of the survey conducted:

The screenshot shows the Zoomerang web interface for a survey titled "Zero Energy Homes". The survey is active and was launched on 4/22/2010 at 11:22 AM. It has 168 email invites, 26 visits, and 13 completed responses. The survey questions are:

- Name: [View 13 Responses](#)
- Email ID: [View 13 Responses](#)
- Profession: [View 13 Responses](#)

On the left sidebar, there are sections for "Results Overview", "Report", "Filter", "Statistics", and "Responses". The "Responses" section has checkboxes for "Completed", "Partial", "Screen Out", and "Over Quota".

The screenshot shows the Zoomerang web interface for the "Zero Energy Homes" survey, displaying questions 4 through 7. Question 4 asks for the first thought when hearing "Eco-Friendly Homes?". Question 5 asks for thoughts on Zero Energy Homes. Question 6 asks for main concerns when refurbishing a home into a Zero Energy House. Question 7 is a multiple-choice question about energy-saving measures.

Measure	Count	Percentage
Decrease the energy requirements for space heating, cooling and water heating.	7	56%
Increase the efficiency of the furnace (or heat pump), and the air-conditioner.	2	17%
Install a solar hot water pre-heat system, an efficient backup water heater, and an efficient distribution system.	4	33%
Install efficient lighting fixtures.	7	50%
Install efficient appliances.	5	42%
Install a properly sized photovoltaic (PV) system.	0	0%
Turn off lights, computers, and appliances when not in use.	12	100%

We enumerate the questions included in the survey:

decrease the energy requirements for space heating, cooling and water heating.

Demographic information such as Name, Profession and Email ID

## **7. CONCLUSION**

1. What is the first thought that comes to your mind when you hear 'Eco-friendly homes'?
2. What do you think about zero energy homes?
3. What are your 3 main concerns when it comes to refurbishing an existing home into a Zero Energy Home?
4. Which of the following do you follow? (The options given can be seen in the snapshot provided above)

Based on the survey conducted, we have analyzed the responses collected. We have successfully studied the concept of a Zero Energy Home / Design and how it can prove to be beneficial in these times of environmental crisis.

Many people seem to be open with the idea of a zero energy home design. However, given the concerns that they carry at the moment, it may take a while before everyone can smoothly transition to such homes, thereby causing a huge environmental benefit.

## **ANALYSIS:**

The sample space is around 15, with almost 170 email invites.

Based on the responses collected, we conclude that most of the people are aware of the idea of a Zero Energy Home.

People relates Zero Energy homes to words like 'energy-conserving', 'closer to nature', etc.

Cost, quality, maintenance and reliability seem to be the major concerns of people when it comes to refurbishing their houses in order to adapt a zero energy design.

The easiest step that the people are willing to take is to switch off all the electrical appliances such as computers, fans, light bulbs, etc when not in use.

People are also comfortable in installing efficient light fixtures and appliances, and



## 8. REFERENCES

[1]  
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[http://www.energysavers.gov/your\\_home/designing\\_remodeling/index.cfm/mytopic=10360](http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10360)

[3]  
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[4]  
<http://www.toolbase.org/Home-Building-Topics/zero-energy-homes/tucson-zeh>

