

A New Generation Energy Efficient Homes



Engineering

KEYWORDS : Energy Efficient Homes, Renewable Energy Sources, Human Barrier

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ABSTRACT

This paper is dedicated to a comprehensive study and analyzes the potential effectiveness and benefits of Energy-Efficient Homes. A 25% reduction of foreign oil imports would cause the price of oil to increase. This in turn would cause the cost of heating a home (that uses oil for its heat) to increase. Also, the price of gas at the pumps would increase, creating greater monthly expenses for all who drive. Energy efficient homes create other benefits not related to oil. Energy efficient homes can dramatically decrease the cost of maintaining the average home. Energy efficient homes also have the benefit of using renewable energy sources, which conserves existing energy resources.

❖ INTRODUCTION

Industries aside, our homes are the chief consumers of many energy sources. The amount of energy wasted just through poorly insulated windows and doors is about as much energy as we get from the Alaskan Pipeline each year. The amount of electricity generated by fossil fuels for a single home puts more carbon dioxide into the air than two average cars. Almost every home in the United States could be powered by renewable energy of some kind to a greater or lesser extent. Converting existing homes to energy-efficient homes, and building only new homes which are energy-efficient, would result in a myriad of benefits, both long term and short.

❖ EXISTING HOMES

Improvements to an existing home, to make it an energy efficient home, focuses chiefly on ensuring that every aspect is properly installed, insulated, and all equipment is energy efficient. The major areas of concern are:

- Building Envelope
- Space Heating and Cooling
- Water heating and supply
- Waste water
- Appliances
- Garbage
- Lighting

❖ NEW HOMES

Construction of a new home can take advantage of a concept known as “Whole Building Design.” “Whole Building Design” takes an integrative approach to building design so that all elements of the building help achieve an optimal energy performance. The building has to interact effectively with the outdoor environment — a concept known as climate-responsive architecture. “Whole Building Design” combines Energy-Efficiency with Solar Technologies to boost energy savings, and it reduces the amount of energy required to operate a home compared to conventional houses. The “Energy Efficiency” aspect of “Whole Building Design” is concerned with the same areas as mentioned with Existing Homes. The “Solar Technologies” incorporated into the “Whole Building Design” involves the use of Passive Solar Design and Solar Thermal Technology.

❖ Passive Solar Design

It is the technology of heating, cooling, and lighting a building naturally with sunlight rather than with mechanical systems. Some design features include large south-facing windows and building materials that absorb and slowly release the sun’s heat. It can also involve the use of Photovoltaic (PV) technology. PV is basically “solar electricity” that results from converting sunlight into energy. PV systems help preserve the Earth’s finite fossil-fuel resources such as coal, oil, and natural gas. It also helps reduce

air and water pollution associated with these energy sources. Incorporating passive solar designs can reduce heating bills as much as 50%.

❖ Solar Thermal Technology

It is the use of solar water-heating systems. Solar water-heating systems use collectors generally mounted on a south facing roof. These collectors heat water either passively or actively (Active being the most energy efficient).



Fig - 1 External whole building design features



Fig - 2 Internal whole building design features

Relatively few homes (existing & new construction) across the U.S. are energy-efficient homes. Considering the environmental benefits that an energy-efficient home creates, why haven’t more people chosen to make their homes an energy-efficient home?

❖ The Human Barrier

Reluctance on the part of consumers to undertake the conversion of their homes to energy-efficient homes can be summed up in one word:

❖ MONEY

The upfront costs that are required to make the conversion are often too great a barrier for the average consumer to overcome. Some energy efficiency improvements involve little or no implementation cost. However, there are also improvements that can cost a great deal of money. Replacing a heating system can cost up to \$5,000 in a large house or even more if you are converting from electricity to another energy source. Installing new windows, while very beneficial to your home and the environment, can be a financial strain to implement.

❖ **Overcoming human barriers**

Knowledge of the long-term benefits and monthly utility savings that an Energy-Efficient Home can provide. Knowledge about Energy-Efficient Home financing programs (government backed & conventional loan programs). But an energy-efficient home—with such features as proper insulation, high efficiency heating and cooling systems, and energy-efficient windows—can lower utility bills by 10 to 50 percent. This would all be reflected in a myriad of benefits, both long term and short.

❖ **ENERGY EFFICIENT FINANCING PROGRAMS**

❖ **U.S. Department of Housing and Urban Development**

- a. FHA Energy-Efficient Mortgage
- b. FHA Section 203(k) Rehabilitation Mortgage Insurance
- c. FHA Energy-Efficient Home Mortgage
- d. FHA Mortgage Increase for Solar Thermal Systems
- e. FHA Title I Property Improvement Loan Insurance Government Insured (cont.)

❖ **U.S. Department of Veterans Affairs**

- The U.S. Department of Veterans Affairs (VA) guarantees mortgage loans for veterans.
- It can be used to purchase or refinance a home along with the cost of making energy-efficient improvements.

❖ **FINANCING AN ENERGY EFFICIENT HOME**

Because an energy-efficient home is cost-effective, there are financing programs available from mortgages to home improvement loans, which allow more people the opportunity to live in such a home. Consumers can benefit from energy-efficient financing whether buying, selling, refinancing, or remodeling a home. People looking to buy an energy-efficient home, can qualify for a better, more comfortable home because with lower utility costs, they can afford a larger mortgage payment. Most Energy-Efficient financing programs will encourage you to have an ENERGY RATING for your new or existing home, which will tell you and the lender how energy efficient it is. A rating typically involves an inspection by a professional energy rater who is certified under a nationally or state accredited Home Energy Rating System (HERS). An energy rater will inspect the energy-related features of a home, such as:

- a. insulation levels
- b. window efficiency
- c. heating and cooling systems
- d. air leakage

After inspection, the inspector will generate a report that includes the home's energy rating along with an estimation of annual energy use and costs. To help qualify for most energy-efficient financing, the report usually must show that the home is energy-efficient or that any recommended improvements are cost-effective and will save more money than would be needed to be borrowed to install them. While calculating whether a borrower qualifies for a mortgage, a lender can recognize these savings and add the cost of the improvements into the mortgage. Or, if the home is already energy-efficient, the lender can stretch the debt-to-income qualifying ratio (a borrower's monthly payment obligation on long-term debts divided by the borrower's net effective income or gross monthly income). An energy rater

will inspect the energy-related features of a home, such as insulation levels, window efficiency, heating and cooling systems, and air leakage. Energy-Efficient financing is offered through either government-insured or conventional loan programs. There are 2 types of Energy-Efficient Mortgages:

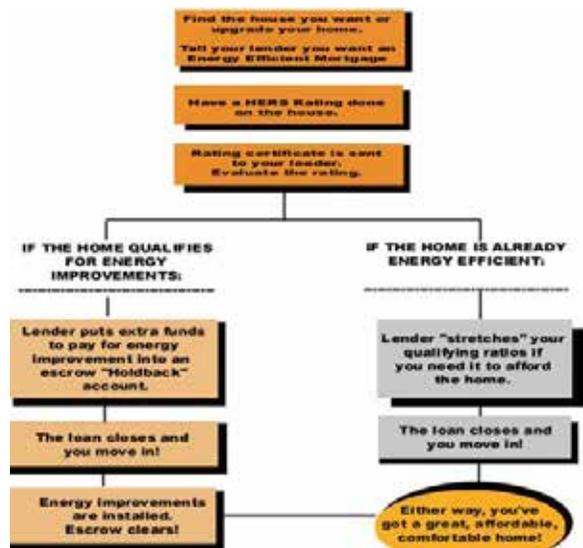
- **For a New Home**
- **For an Existing Home**

You can purchase or refinance a home that is already energy-efficient, or you can purchase or refinance a home that will become energy-efficient after energy saving improvements are made.

❖ **HOW AN EEM INCREASES BUYING POWER**

For a standard home without energy improvements:		
Buyer's total monthly income	\$3,000	\$5,000
Maximum allowable monthly payment 28% debt-to-income ratio:	\$840	\$1,400
Maximum mortgage at 90% of appraised home value:	\$132,900	\$221,500
For an energy-efficient home:		
Buyer's total monthly income	\$3,000	\$5,000
Maximum allowable monthly payment 30% debt-to-income ratio:	\$900	\$1,500
Maximum mortgage at 90% of appraised home value:	\$142,400	\$237,300
Added Borrowing Power Due to the Energy Efficient Mortgage:	\$9,500	\$15,800

❖ **THE ENERGY EFFICIENT MORTGAGE PROCESS SIMPLIFIED**



6 Conclusion

Energy efficient homes can dramatically decrease the cost of maintaining the average home. Energy efficient homes also have the benefit of using renewable energy sources, which conserves existing energy resources.

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