

# Go Green

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Energy efficiency is a hot button topic in America. People are increasingly interested in the idea of making all aspects of life more energy efficient in order to have a cleaner and healthier environment. Prime examples are hybrid cars, and cleaner energy sources such as the hydrogen fuel cell. Green building can now be added to the list. “According to the EPA, in 2002, buildings accounted for 67.9% of the total electricity consumption in the United States” (Peterson, 2011). “EPA reports that indoor air pollutant levels are about two to five times higher than those of outdoor air” (Peterson, 2011). By making homes more energy efficient, it’s also making them better for the resident’s wallets and health.

There is a major problem knowing health is at risk in homes. Jon Schoenheider, owner of a prominent custom home building company located in Southeastern Wisconsin, Regency Builders, addressed the issue of energy inefficient homes today and how it is impacting his business on a daily basis. “When I talk with my customers in today’s poor housing market, I explain that there have been more technological advances in energy savings in the last 5 years compared to the all the 25 years I have been building homes. Energy will only continue to rise in cost” (Jon Schoenheider, personal communication, November 16, 2011). Going green in residential homes will not only help correct the massive amounts of energy homes use on a yearly basis, but will also make people healthier because homes will be cleaner inside. Although making a home more energy efficient may be more expensive, it is worth the investment for resale value, individual health, and lower energy bills.

Before delving into the specific technologies and advances that have made construction more energy efficient, there needs to be a clear understanding of what

“green” means in terms of residential building. “Green building is an extremely broad term and many people have significantly different interpretations of it” (Pat Hietpas, personal communication, November 14, 2011). This can make it very confusing and challenging to compare standard construction to green construction. Unfortunately, in today’s market, many people take advantage of this to trick customers into thinking they are receiving a product that they’re actually not.

“For example, there is a local builder here that actually has created a marketing brand for his company that uses the word “green” in it. It gives the customer the impression that this builder is on the cutting edge of green building. I reviewed his standard building practices on this website and found that his standard practices are very average building practices that are equaled or exceeded by most builders in the area” (Pat Hietpas, personal communication, November 14, 2011).

This practice of making unsubstantiated claims to enhance sales is known as “green washing”. In this case, this particular company claims to be green with no solid evidence to back it up. But the tactic is successful in doing what is intended to, and many customers fall prey to this method because they lack knowledge of the topic and do not realize they are being fooled. According to the United States Environmental Protection Agency (2011), “Green, or sustainable, building is the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance and demolition” (Introduction section, para. 2) This definition will be the basis of assessing green building and its advances over the years in this paper.

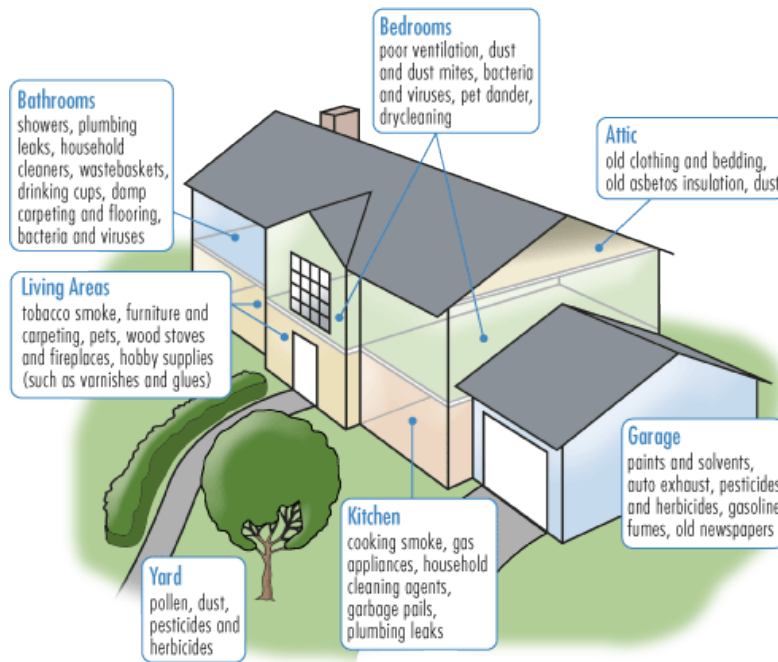
The importance of green building is increasing rapidly for builders today. Government and media have pushed the green movement in the past five years, bringing

a high level of awareness to the average consumer. They are progressively interested in learning more and then applying it to their lives. The Internet has also made information easily accessible for consumers to do their own research aside from what is being provided to them, which leads them to form opinions on green building prior to talking to a builder. Builders have to be knowledgeable and current on all ideas involving green building in order to answer any questions that may arise in initial meetings when they are trying to lock customers into building a new home.

Homes today account for over two-thirds of Americas total energy consumption. Greater energy efficiency in homes is not only good for the environment, but also for the wallet. Energy efficiency means less heating, ventilation, and air conditioning (HVAC) equipment is necessary in the home. HVAC equipment includes anything that has to do with heating, ventilation, and air conditioning in the home. In a typical home, heating and cooling a home accounts for about half of the total energy consumption. Improving how efficient a home is in doing these simple functions can greatly reduce the energy bill for homeowners. Making sure a home is properly insulated and sealed of all air leaks can also make a tremendous difference in energy consumption.

Health concerns are another major benefit of green building. Air pollution levels inside a home are surprisingly higher than outside. Both pollution from human behavior (such as smoking), and from natural conditions (such as radon gas), are found in homes, as shown in figure 1. Materials previously used in construction were the direct causes of many of these pollutants. “VOC’s, or volatile organic compounds, are frequently found in paints, solvents, carpets, cleaning products, and some household appliances” (Peterson, 2011). Asbestos is another major pollutant that is directly linked to fatal lung conditions.

By improving the quality of material used, and going green, the amount of pollutants in a home can be greatly reduced. “Homes today that utilize new green building techniques lead to better health over time for the residents of the home” (Peterson, 2011). This is arguably the most positive advantage to green building, however it is not the last.



**Figure 1: Sources of Air Pollution.** Source: <http://www.pryo-heating.com>

American society today values less waste production and creating a cleaner environment. Green building is a great way to produce less waste in construction process. “One simple way that green architecture produces less waste is by using renewable materials, such as plant matter and sustainable lumber, or reusing traditional materials, such as recycled stone or metal” (Peterson, 2011). Homes today are also designed in a way that there is less waste in the day-to-day operations after construction when clients move into the home. Going green and making homes more energy efficient is a benefit to

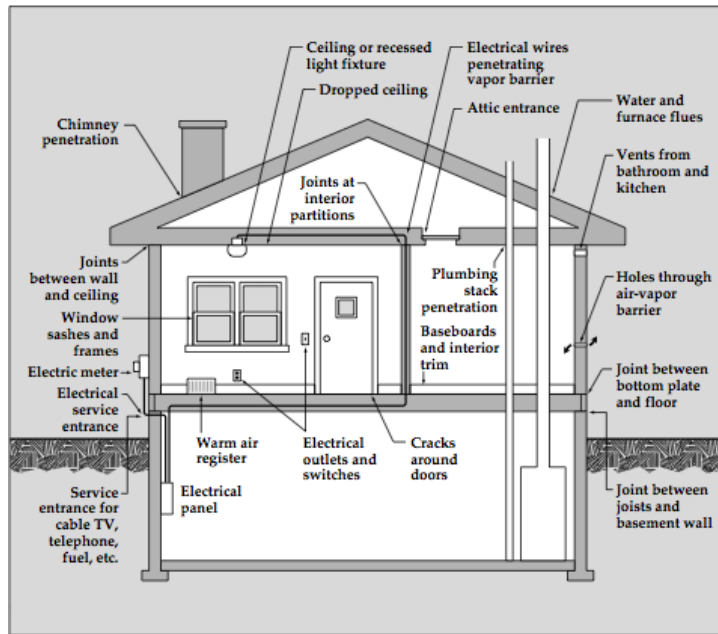
not only residents, but the country as well. Knowing this, what about the design of old homes made them so inefficient in consuming energy?

Energy inefficiency in homes cannot be explained by one single reason. It is instead a combination of many flawed features that increase homes energy consumption.

“With older homes, it is typically the products and equipment that are in the homes: windows, appliances, furnaces, etc. that are not as efficient as today’s products. With today’s homes it typically comes down to workmanship” (Pat Hietpas, personal communication, November 14, 2011).

Today, government mandates minimal efficiency of most products, so there will not be as large of a variation as seen in older homes. Installation of certain products is key when increasing homes optimal energy efficiency. A builder could buy the most efficient window on the market, but if it is not installed properly, it will not operate as designed. This fact shows how important it is for contractors and builders to install each part of the home as the manufacturer suggests.

Airflow in and out of a house also plays a large role in energy efficiency. This can occur in many areas of a home, as shown in figure 2. If a lot of outside air is flowing in and out of a home, it will force heating and cooling systems to work harder to maintain the desired temperature of a home, thus costing more to operate. Good air sealing alone may reduce utility cost by as much as 50 percent” (United States Department of Energy, 2000).



**Figure 2 Sources Of Air Leakage In The Home.** Source: <http://home.ltgovernors.com/weatherize-your-home-assessment.html>

Because builders understand what makes homes so inefficient, many new methods have been adopted in the building process to improve the home's ability to consume energy. In order to understand these improvements, the concept of the thermal envelope must be understood. "A thermal envelope is everything about the house that serves to shield the living space from the outdoors" (United States Department of Energy, 2000). The thermal envelope comprises all wall and roof assemblies, insulation, air vapor retarders, windows, and weatherstripping and caulking.

Before aspects of the thermal envelope can be applied to a home, a structurally supportive and energy efficient frame needs to be created. The conventional wood framed home can be extremely energy efficient when used properly, which is why most builders today choose it. There are three methods that are utilized by builders in constructing an energy efficient, yet structurally stable frame: Optimum Value Engineering (OVE), Structural Insulated Panels (SIPs), and Insulating Concrete Forms (ICF). "Optimum

Value Engineering uses wood only where it is most effective, thus reducing the costly wood use and saving space for insulation” (United States Department of Energy, 2000). Although this method is very effective, builders must be very educated on the process of determining where wood is needed to build a structurally sound home. “

Structural Insulated Panels are generally made of plywood or oriented-strand board that is laminated to foam board” (United States Department of Energy, 2000). SIPs act as both framing and insulation, which leads to much faster construction while providing the same quality of insulation. The quality of the home is also superior using this method because there is less room for error for workers compared to OVE.

IFC is the best method of the three overall, “Insulating concrete forms consist of two layers of extruded foam board (one inside the house and one outside the house) that act as the form for a steel-reinforced concrete center” (United States Department of Energy, 2000). This is the fastest, sturdiest, and most efficient technique of the three.

Once the basic foundation for a home is build, aspects to improve the thermal envelope can be applied. The proper insulation of a home can increase energy efficiency substantially because it decreases the amount of airflow between the inside and outside. A more energy efficient home has a much higher insulation R-value. An R-value describes the ability of a material to resist heat transfer. Lower R-values correspond to a faster heat loss.

“For example, a typical home in New York might have insulation of R-11 in the exterior walls and R-19 in the ceiling, while floors and foundation walls may not be insulated. A similar, but well-designed and constructed home will have

insulation levels that range from R-20 to R-30 in the walls and from R-50 to R-70 in the ceilings” (United States Department of Energy, 2000).

Foundation walls should be as well insulated as the living space walls because poorly insulated walls have a negative impact on its energy consumption. Although many homes have good insulation levels, it is often poorly installed. This poses a major problem when people want more energy efficient homes.

Condensation build up of water vapor in a homes structure is a major threat to the overall integrity of a home, and also it’s thermal envelope. A solid and well-designed structure will lead to a “greener” home, so it is important to insure condensation buildup does not happen. Vapor retarder’s control the moisture diffusion, thus protecting the home from a structural flaw. The way in which a builder designs and installs vapor retarders depend on the climate in which the home is being built. “Regardless of climate, water vapor migration should be minimized by using a carefully designed thermal envelope” (United States Department of Energy, 2000).

Another way to make a homes thermal envelope stronger is to ensure that it is tightly sealed, therefore windows, caulking, and weatherstripping prove to be vital. “A typical home loses more than 25 percent of its heat through windows” (United States Department of Energy, 2000). Today, the general rule of thumb is to use windows with an Energy Star label, which creates windows that are about twice as efficient as those used ten years ago. Placement of windows is also critical. Builders should design homes to have less windows on the northern, southern, and western sides to increase energy efficiency. Caulking and weatherstripping should be used to seal potential air leaks. Caulking is used wherever there is potential for air leakage, and weatherstripping is

installed around door and window frames to insure that they are air tight sealed when shut.

The only way for a thermal envelope to be as strong as desired is for the builder to preform checks throughout the construction of a home. Regency uses an excellent example of this with what they call a “3 party energy evaluation”. This is a three-step plan preformed by a independently hired firm that specializes in energy consumption. Step one uses a computer program to design a home that is modeled to fit a specific energy performance level. This provides customers the opportunity to decide how much they want to invest into their home to make it more “green”. Step two is the pre-drywall visit that occurs during the framing and insulation stage of construction.

“This process allows us to verify plans/specs and evaluate carious aspects of the home at a critical stage of construction to ensure that the home will meet program standards for air tightness, ventilation capacity and combustion safety” (Pat Hietpas, personal communication, November 14, 2011).

This step is critical because it is the last chance to address important issues of airflow before covering with insulation and drywall. The final step is a performance test that takes place near the end of construction. This test analyzes the mechanical systems of the home, and any potential problems that may occur with them. Four tests are performed at this stage: blow door testing, infrared scanning, HVAC airflow testing, and ventilation system testing. Blow door tests locate air leakage in a home so they can be properly caulked off. Infrared scanning located insulation flaws in hidden locations in the home, as shown in figure 3.

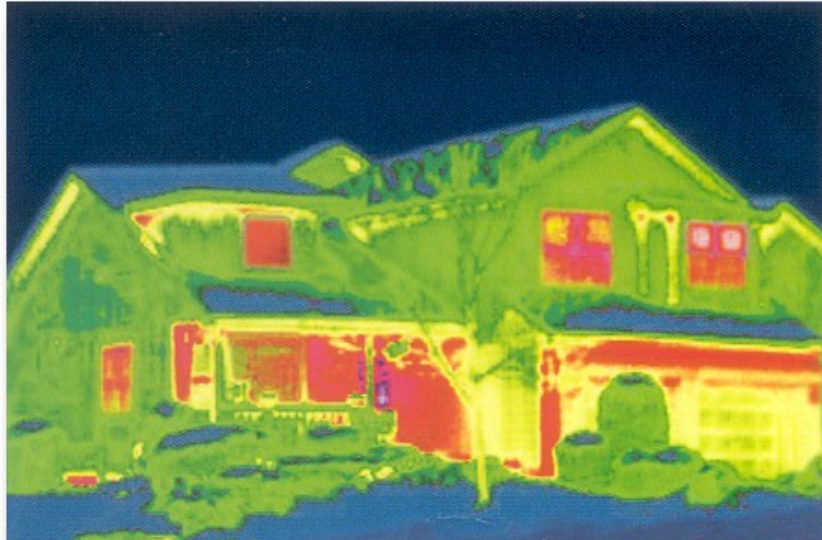


Figure 3: Infrared Scan for Energy Efficiency. Source: <http://www.paenergypros.com>

“We

find HVAC airflow testing to be extremely valuable to address comfort concerns before they happen. For new homes, we are focused on the air leakage integrity of the windows/doors and completeness of attic insulation, but are looking for any air leaks which may have not been addressed during the rough-in Site Visit” (Pat Hietpas, personal communication, November 14, 2011).

Ventilation system testing confirms that the home’s ventilation equipment meets the required standards.

Much is known on how to make homes more “green”. Now more than ever this concept is affecting builders all over America. It is important for interested builders to understand the concept of “green building”. It is a very general term, therefore knowing what can be done to make a home more energy efficient can not only help the environment, but also the resident’s wallet. Most clients are relatively familiar with the idea of green building, and want to gain the builders knowledge on the matter. Builders need to fully understand all aspects of energy efficacy and determine with the customer

that “green upgrades” should be included. More often than not, all customers are interested in including enough new technology to minimize energy cost, and to increase a homes return on investment.

It is a fact that the housing market is struggling in today’s economy. Competition between local builders is fiercer than ever. Being known as a company that is good at building energy efficient homes could potentially be the reason a client chooses them over another company.

There have been drastic improvements in the past ten years that have made homes more efficient than ever. Even so, the idea of “green building” is still in its infancy stage. Research is conducted every year by builders and outside agencies to create more energy efficient homes and structures. This poses a very thought provoking question. How much farther can building go in making “greener” homes? Will it ever get to the point where energy costs can be reduced to almost nothing by installing a technology that surpasses anything known to man today? No one can say for sure, but with the advances in things such as cars, wind power, or photovoltaic’s, maybe that technology could be applied to homes in order to make them more efficient as well.

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