

Green Building

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By Andrew Messenger

“Thinking Green” is the new buzzword of the twenty-first century. There are the green IBM commercials that demonstrate a substantial amount of money saved if a business, “goes green;” the Mac commercial with the new energy saving computer that runs on less energy than a quarter of a light bulb; the car commercials competing for the most fuel efficiency. It seems that every individual or business in the twenty-first century is concerned with the environment and what we are putting into it. Cars are without a doubt the leading contributor to green house gases, but what about buildings? They are everywhere; we live in them, work in them, and learn in them. The majority of our lives are spent inside buildings, so it is not a surprise that buildings in the United States account for 72% of electricity consumption, 39% of energy use, 38% of all carbon dioxide (CO₂) emissions, 40% of raw materials use, 30% of waste output (136 million tons annually), and 14% of potable water consumption (Green Building).

The newfound sensation of ordinary people beginning to think that, “tree-hugging” environmentalists may actually have a point is a result of global warming and the depletion of natural resources. Natural resources such as oil are nonrenewable. As the population increases and we continue to plow through more trees and burn more coal than ever to account for the energy needs, we see an exponential growth of pollution in the atmosphere. The consequence of this is global warming. More and more infrared rays from the sun are reflected back to earth due to the greenhouse gases such as carbon dioxide, a byproduct of burning natural resources to provide energy to homes and buildings. That is why people in this world are trying to create alternative ways to produce energy. While nothing too significant may happen in our lifetime, our children and grand children may be the bearer of potential heavy environmental issues. People are now aware of this and realize the consequences of the lives we live and our apparent necessity for electricity. Because buildings consume so much energy, it would be greatly advantageous to design buildings that are more energy efficient or even self-sufficient in which the buildings produce as much energy as they consume. The cost may be higher now, but if the nation does not start building green, our consumption patterns will either use up the available energy or drive the price up so that building becomes unaffordable. Done right, sustainable building could actually reduce our carbon footprint and thus reverse the effects of global warming.

The time for green building is right because the nation, and the world, are coming to a real understanding of the adverse effects of global warming. That reality is leading to public policy that will make traditional energy resources (such as coal plants) much more expensive for consumers. Also, in an attempt to get out of our nation’s economic problems, the government is about to contribute billions of dollars to massive building projects all across the nation (Adams). So now is the time as an industry to make the commitment to build sustainable, green buildings. The challenge will be to convince clients – consumers, businesses and government – that the initial costs are worth savings in the long run.

So what is green building anyway? Well in short it is the design of a building contributing to lessen the energy requirements while still maintaining the proper functions. As an example we will look at Tony Case, the owner of Seattle-based Case Design & Project Management, and his projected development that he would like to call a green building. Case said, “Because we are

thinking about hanging onto the building for the long term, we really felt like it's in our long-term interest to create as sustainable a building as we can" (Cohen). Case plans to build a four-story building with five apartments and six live-work units at 2705 S. Winthrop St., in Rainier Valley, WA (See Figure 1). "More interestingly, he plans for it to meet a strict set of green-building requirements, including that it produces at least as much energy as it consumes, reuses the water that falls as rain on the site for toilets and laundry, offsets the **carbon footprint** of its construction, uses local materials, diverts nearly all construction waste from landfills and includes "design features intended solely for human delight and the celebration of culture, spirit and place appropriate to the function of the building" (Cohen). Case is planning on investing sustainability in the apartment building and over time his energy savings will outweigh his initial costs.

In this last example, the reason that Case was looking at "green building," is because he wanted it to last. That is the wonderful thing about green building. All of the materials used are much longer lasting. Wood is typically used for only the flooring and cabinetry, and in some houses fast growing bamboo is used for flooring. To build a typical house in the Midwest, a small portion of a forest is required. Most of the structural elements in a house are made of wood as well as the roof and deck. Wood will eventually break down because of termites and water damage. With green buildings the materials are renewable and will last longer. Steel, concrete, and glass are more durable resulting in a longer life for green buildings. The challenge in getting people to switch to green building is that at this time it is slightly more expensive to produce, initially. In the long run, people will save money on utilities and the building or house will eventually pay for the initial cost.

A controversial topic in green building is the building of green schools. People on one side argue that the savings are not equal to the cost of building a green school. Advocates of green schools argue that it is a better learning environment for the students and teachers and saves energy (Kats, 4). According to Gregory Kats in, "Greening America's Schools Costs and Benefits,"

As a rough estimate a green school could lead to the following annual emission reductions per school: 1,200 pounds of nitrogen oxides (NOx) – a principal component of smog, 1,300 pounds of sulfur dioxide (SO2) – a principal cause of acid rain, 585,000 pounds of carbon dioxide (CO2) – the principal greenhouse gas and the principal product of combustion, 150 pounds of coarse particulate matter (PM10) – a principal cause of respiratory illness and an important contributor to smog" (Kats, 6). (See Figure 2, 3 for examples of green schools).

The decrease in emissions is a result of a decrease in energy demands due to an increase of windows to provide natural ventilation for cooling and sun for heat and light, components on the roof that capture rain for use in toilets and washing, so less water is needed. These are very important factors from an environmentalist point of view, but what about financially?

On average a green school conserves 33% more energy than ordinary schools (Kats, 4). Gregory Kats did a study of thirty green schools and found that on average green schools would save \$0.38/ft². On a long-term scale, around twenty years, schools would save a total of \$9/ft² for all direct and indirect savings (Kats, 6). A direct saving would be immediate decrease in energy resulting in less cost. Indirect saving means lower demand for energy causing a market wide price decrease in energy (Kats, 5). Schools are a great investment for green building because it provides a large number of people with a healthier atmosphere to learn and teach. The cost is outweighed by the results, but that means higher taxes for the public up front, which explains why it is not in practice nationwide. Schools are complex places in which many operations take place

in many rooms such as the gym, lunchroom, classroom, offices, etc. The design is more complex and that contributes to higher fees.

But what about houses? Could a house be well enough designed to conserve 100% energy and be affordable to middle class people? A Zero-Energy-House, ZEH is a house that produces as much energy as it consumes. In 1998 in Lakeland, FL, one of the very first ZEH's to be tested was built. The control was the builder's standard model and the other was a super-energy-efficient photovoltaic residence (PVRES). Both houses have the same floor plan. The only difference was that one house was enhanced with contemporary technology (See Figure 4). The yielded results set the stage for a national Zero-Energy-Homes program (ZEH).

In one year, the PVRES home used 6960 kWh of electricity and had a PV system production of 5180 kWh. For the same year, the Control used 22,600 kWh. This gives a yearly energy savings due to the differences in the energy efficiency of the two homes of 70%. Putting the PV system production into the numbers shows that the PVRES house's net energy use (electricity from the utility) for the entire year was only 1780 kWh" (ZEH).

The PVRES house had a 92% savings in utility energy compared to the standard house. What was even more impressive is that during the hottest days of the year in Lakeland the house actually sent more energy to the grid than was brought to it. This was attributed to the photovoltaic cells on the solar panels capturing the rays and harnessing them into energy. Solar panels are a very effective source of energy, but also very expensive. The house was a success in terms of saving on energy bills, but in order for a buyer to get their moneys worth on all the technology put into the home, they would have to wait for several years, but the environmental impact is evident.

According to the U.S. Department of Energy there are four different types of Net-Zero-Buildings or homes. They are as follows: Net-Zero Site Energy — A building that produces at least as much energy as it uses in a year, when accounted for at the site. The measurement time frame is annual. 1) Net-Zero Source Energy — A building that produces at least as much energy as it uses in a year, when accounted for at the source. "Source energy" refers to the primary energy required to generate and deliver the energy to the site. To calculate a building's total source energy, imported and exported energy is multiplied by the appropriate site-to-source conversion multipliers. 2) Net-Zero Energy Costs — A building where the amount of money a utility pays the building's owner for the energy the building exports to the grid is at least equal to the amount the owner pays the utility for the energy services and energy used over the year. 3) Net-Zero Energy Emissions — A building that produces at least as much emissions-free renewable energy as it uses from emission-producing energy sources annually. Carbon, nitrogen oxides, and sulfur oxides are common emissions that NZEBs offset. 4) Near Zero Energy — A building that produces at least 75% of its required energy through the use of on-site renewable energy. Off-grid buildings that use some nonrenewable energy generation for backup are considered near zero energy because they typically cannot export excess renewable generation to account for fossil fuel energy use. Whichever type an architect chooses is based upon the style of the house, the budget, and the client's specifications, but more importantly, to achieve a net-zero-home, material selection is crucial.

In order for a building to truly be environmentally friendly we have to think about not only the energy efficiency of the types of materials selected, but also how those materials were produced

and how much energy was consumed and emissions projected into the atmosphere. Piper Kujac of Inhabitat Design suggests,

Eliminate wood framing and use prefabricated building components (panels and trusses) that are more efficient, durable, flexible and generally make for a tighter building envelope. SIPS (structurally insulated panels) use oriented strand board, which is produced from smaller trees that can be sustainably harvested. They have EPS (expanded polystyrene) rigid foam insulation in their core, which means fewer drafts, less noise, lower energy bills, and a more comfortable indoor environment (Kujac, 5).

Durable, recyclable materials, such as stone, brick, and stucco, are preferred over virgin wood, metal, or plastic for siding on a house. These are simple changes, but necessary to save our natural resources.

We have explored alternative forms of energy and seen how much of a positive influence green building can make in the environment. Although the cost of initiating green building is more substantial upfront than traditional building methods, in the long run, the benefits green building provides to the environment and the billions of dollars that Americans will eventually save in energy bills, will surpass the upfront cost and the consequences future generations will endure if we do not start making, “green thinking” a global concept (Melvin). But how is it possible for an entire population of a nation such as the United States to change their dirty polluting ways? Companies will lose money because at the present level of technology it is more expensive to emit less pollution. The solution to these concerns has already started to be addressed, for the United States anyway, (which so happens to be the most wasteful and pollutant country expending over twenty-five percent of the world's energy with only five percent of the total population) due to newly elected President Obama (Venteicher). Obama is an advocate of sustainability and green building (Adams). Obama's plan for green building is explained in an article in BusinessWeek titled, Obama's Green Building Agenda. This is what it says,

Green building is at the forefront, and Obama has proposed the expansion of federal grants that assist states and municipalities to build LEED-certified public buildings. Furthermore, Obama has planned to call for all new federal buildings to be carbon neutral by 2025. To accomplish this, newly constructed buildings would have to increase initial energy efficiency by 40 percent within five years, and existing buildings would have to increase efficiency by 25 percent (Adams).

The obvious bearer of these costs of the new federal buildings is the federal government, but what about small business owners or even big ones that are not funded by the government?

A new global warming bill may also aid in the efforts to reduce pollution in the atmosphere and also explain who is to fork up the cash, if passed. A story appearing in Time magazine discusses the new bill,

Introduced April 1, the measure would require all sources of warming gases — produced by the burning of coal, oil and natural gas — to cap their emissions at 20% of 2005 levels by 2020. If they exceed their

limits, polluters can buy credits from cleaner sources (Weisskopf).

Basically the cleaner the operation that businesses can run, the more money they will make. If a business does not meet the energy and pollution requirements then they may save money because of not, "going green," but they will then have to buy credit from cleaner sources to stay in business while the cleaner sources are saving money on energy and making money off lazy companies. The incentive is definitely there. Whether or not the bill gets passed remains to be seen, but one thing throughout all the fuss on green thinking remains constant. We have lived a wasteful lifestyle for a couple hundred years now with no regard for the planet. The negative effects of our actions are starting to manifest with severe weather and melting ice caps and something needs to be done or Earth, as we know it will slowly start to die. It is time to make an impact on the environment and address the worldwide necessity of design for an energy-conscious future.



John is

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