GREEN ARCHITECTURE: PATHWAY TO SUSTAINABILITY IN THE BUILT ENVIRONMENT

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ABSTRACT

Green building architecture is all about buildings entire life cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. People are now concern about factors such as economy, utility, durability and comfort, therefore the knowledge of green sustainable building becomes important to the building industry and the society in general. "Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction."This paper highlights the importance of green building, the differences between "green" and "sustainable" as are often used interchangeably, and the basic principles of achieving sustainable architecture. Principles of sustainable architecture which includes energy efficiency, water conservation, use local and natural materials among others, were also highlighted. The most important thing to know about making our home green is to keep it small, only big as necessary for the functions intended; large houses use lots of energy and materials to build and to keep comfortable.

Keywords: Green Architecture, Pathway, Sustainability, and built environment.

INTRODUCTION

The idea of energy efficiency, healthy buildings have been around for long time, so why is it just recent that the concept of 'green' or sustainable building is entering the main stream and catching the attention of the building industry and the academia? There are probably several reasons; global warming, rising energy cost, the growing awareness and liability costs associated with "sick building syndrome" and concerns about our limited water

supply. Many people recognize the reality of global warming and climate change, they are beginning to understand that the status quo is no longer acceptable. Green talk is everywhere: drive less, walk more; switch-out incandescent bulbs for compact fluorescent; replace high-flow faucet and shower heads for low-flow fixtures (Noreen Beatley, 2008). The list goes on, but whatever the reason or reasons; green and sustainable building is a concept whose time has come. However, the words "green" and "sustainable "are often used interchangeably and sustainable has a more precise meaning that is often obscured, distorted, and diluted by the commercialization and marketing of the green movement. In the context of our built environment, sustainable takes its meaning from " sustainable agriculture "or the ability to produce food indefinitely, without causing irreversible damage to ecosystem health. Albert A. Bartlett (2009). Green architecture means different things to different people, but the term relates to a trend in the field of architecture where buildings are designed and constructed, with water and energy efficiency out of environmentally friendly green materials. Green materials are building materials that are environmentally friendly, renewable, biodegradable and recyclable, e.g. carbon, polyurethane (Fanie Buys & Roneesh Hurbissoon, 2014). Green building is also known as "a sustainable or high performance building" (US Environmental Protection Agency, 2010: online). Van Wyk (n.d.) argues that green buildings are now a universally accepted principle that promotes the construction of environmentally friendly buildings; they can be defined as buildings that minimize their impact on the environment while improving their indoor environmental quality. (Fanie Buys & Roneesh Hurbissoon, 2014). Why then is green architecture important to prospective developer, the building industry and the academia in general? The answers in all cases are to ensure a decent, secured healthy life for all species on this planet. Other benefits worthy of mention include: environmental benefits, economic benefit and social benefits.

Defining Sustainable and Green Architecture

Sustainable architecture is a comprehensive topic in which many different concerns such as design, materials, use of energy, cost

and the environment, are interwoven in the interest of creating a functional structure which meet the needs of the present without compromising the ability of the future generations to meet theirs. Brook Muller et al (2005)

Green architecture includes all aspect of architectural design and construction that enhance sustainable, healthy living. This might simply relates to choosing materials that do not offgass toxic chemicals or might relate to significant building designs that naturally capture and reuse all of the water and energy that is required for comfortable living within. Dauda A. et al (2010). According to Natasha Palich et al, (2013) sustainable design can be define as an approach to building procurement and other urban development which works towards achieving zero net environmental impact. This includes but is not limited to the following: 1. Eliminating the use of non-renewable resources; 2. Eliminating air, soil and water pollution; 3. Creating healthy and accessible indoor and urban environments; 4. Protecting and enhancing natural ecosystems and cycles; 5. Supporting the conversion of 'waste' into useful resources; 6. Creating a built environment that is resilient, flexible and adaptive to climate change; 7. Supporting decentralized electricity and water systems; 8. Supporting a move towards understanding and implementing 'positive development 'and; 8. Supporting sustainable modes of travel.

Albert A. Bartlett at www.sustainabledwelling.com says: A home's design is "green" if its serves to reduce many of the harmful impacts buildings have on our environment and our home's inhabitants. So "green" home design revolves around four key issues:

1. Designing for energy efficiency including the use of renewal energy sources such as wind, geothermal, and solar.
2. Creating a healthy indoor air environment with adequate ventilation and making material choices that minimize volatile organic compound (VOC's) out gassing within the home.

3. Specifying building materials and resources that are sustainable, have low embodied energy, and produce a minimal amount of upstream environmental impact.
4. Providing for the efficient use of water via appliance, faucet, and shower head choices and in arid climates by xeroscaping and recycling grey water and capturing rain water for landscaping and other non-potable uses.

Differentiating "Green" from "Sustainable"

Over the last few years, the word "green" has gained a definition that goes way beyond color. Today, "green" has established itself in our vocabulary as an adjective, noun and verb, not to mention a movement. Just like the term "green," "sustainability" encompasses a broad range of activities and issues. It's sustainable (and green) to support local farms, and to buy goods and services from locally owned businesses. Regardless of where you shop, it's sustainable (and green) to bring your own reusable shopping bags instead of consuming disposable plastic bags that persist in the environment and are made from petroleum products.

Green isn't always Sustainable

Very often the terms 'green' and 'sustainable' are used interchangeably. However, according to Kibert C J (2005), the term 'sustainability' addresses the ecological, social and economic issues of a building. (Fanie Buys & Roneesh Hurbissoon, 2014), defined the term 'sustainable construction' as the "creation and operation of a healthy built environment, based on resource efficiency and ecological design". RICS (2010), on the other hand, provides a definition of 'green building' as a sustainable building or green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use, including energy, water and materials, while reducing building impacts on human health and the environment during the building's life cycle, through better siting, design, construction, operation, maintenance and removal.

To get a better understanding of where these differences between "green" and "sustainable" lie, we might start with a

definition of sustainability that came out of a 1987 conference at the United Nations: *Sustainable entities are those that meet present needs without compromising the ability of future generations to meet their needs.*
Here's another definition of sustainability from the Environmental Protection Agency: *Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.*
To understand the difference between "green" and "sustainable," consider a popular "green" product like bamboo flooring. Without doubt, a lumber product made from a renewable resource is green. But most bamboo flooring is made in China and transported to end users in the U.S. on ships and trucks that burn diesel fuel. That's not sustainable because our supply of fossil fuel is finite and because burning this fuel contributes to global climate change.

In general, sustainable products and activities are subject to a higher standard of performance because of "future" factors. A car can be considered "green" simply because it manages to deliver 40 miles per gallon of gasoline. But it's not sustainable for us to be extracting fossil fuels from the earth and burning them at current rates.

Thirteen Principles of Sustainable Architecture

As "consumers" we are frequently confronted with life style decisions that can impact our environment. One of the most momentous choices that any of us will make is the kind of house we live in. Tafline Laylin, (2012) and Kelly Hart, (2014) have come up with a list of thirteen principles of sustainable architecture that can guide us in our housing choices.

Small is beautiful. The trend lately has been toward huge mansion-style houses. While these might fit the egos of those who purchase them, they don't fit with a sustainable life style. Large houses generally use a tremendous amount of energy to heat and cool. This energy usually comes from the combustion of fossil fuels, depleting these resources and emitting greenhouse gases and pollutants into the air. Also, the larger the house, the

more materials go into its construction; materials which may have their own environmental consequences. A home should be just the right size for its occupants and their activities. The key to this is efficient use of space, good organization, and keeping possessions to a manageable level.

Heat with the sun. Nothing can be more comfortable for body and mind than living in a good solar-heated house. I say "good", because proper design is crucial to the comfort of such a house. You may have gone into a solar house and felt stifled by the glaring heat, or perhaps you shivered from the lack of it. Good passive solar design will provide just enough sunlight into the rooms to be absorbed by the surrounding thermal mass (usually masonry materials), so that the heat will be given back into the room when the sun goes down. The thermal mass is a kind of "heat battery" that stores the warmth, absorbing it to keep the room from getting too hot during the day. A rock house might have tons of mass, but be uncomfortably cold because of this energy bleed. So a good solar design will utilize materials of the right type in the right places, blending thermal dynamics with utilitarian design.

Keep your cool. A well designed solar house is both warm when you want it, and cool when you want it; that is to say, the temperature tends to stay fairly even. A good way to keep your cool is to dig into the earth. If you dig about six feet into the earth, you will find that the temperature there varies by only a few degrees year round. While this temperature (about 50-55 degrees F.) might be too cool for general living comfort, you can use the stability of the earth's temperature to moderate the thermal fluctuations of the house. If you dig into a south-facing hillside to build, or berm the north part of the house with soil, you can take advantage of this. The part of the house that is underground needs to be well insulated, or the earth will continually suck warmth out of the house.

Let nature cool your food. In the old days people relied on pantries and root cellars to help keep produce and other provisions fresh. Ice boxes made way for refrigerators, which are

obviously much more convenient, but somehow the use of cool pantries and root cellars also fell by the wayside. This is too bad because these spaces have functions that a refrigerator simply can't replace. Root cellars can store large quantities of produce from the time of harvest until the next summer. Cool pantries can store some produce, but also all manner of other foodstuffs and kitchen supplies can be kept there. Cool, dry storage is the best way to preserve most food. The cool of the earth can keep a totally bermed pantry or root cellar cool; the night air can also be used to cool a storage room. The convenience and security of having ample provisions at your finger tips cannot be beat.

Be energy efficient. There are many ways to conserve the use of fossil fuel. Using the sun, wind, or water to produce electricity is one. If you choose to do this, you will be forced to be careful in the way you use your electricity because it is limited. Whether you get your electricity from alternative sources or from the grid, it pays to choose energy efficient appliances. Front-loading clothes washers, for instance, use much less electricity, water and soap than the top-loaders. Compact florescent lights use about a third of the electricity of standard bulbs. Many appliances use electricity by just being plugged in (known as phantom load); be sure to avoid this.

Conserve water: In most part of the world, rain water falling on buildings has not been considered a useful resource. Buildings are typically design to keep the rain from the occupants, and the idea of utilizing rain water falling on the surfaces has not been widely explored. Building envelopes, particularly roof, can become rain water collecting devices, in combination with cisterns to hold collected water. This water can be used for irrigation or toilet flushing. These can be very effective and safe means of water conservation if done carefully to avoid bacterial infestation. Landscaping with drought tolerant, indigenous plants can save an enormous amount of water.

Use local materials. There are several benefits to using local, indigenous materials. For one, they naturally fit into the "feeling" of the place. For another, they don't burn as much fossil fuel to

transport them, and they are likely to be less processed by industry.

Use natural materials. Again, naturally occurring materials often "feel" better to live with. When you step onto an adobe floor, for instance, you feel the resilient mother earth beneath your feet. A major reason for choosing natural materials over industrial ones is that the pollution often associated with their manufacture is minimized. For every ton of Portland cement that is manufactured, an equal amount of carbon dioxide is released into the air. And then there is the matter of your health; natural materials are much less likely to adversely affect your health.

Save the forests. While wood is ostensibly a renewable resource, we have gone way beyond sustainable harvesting and have ruined enormous ecosystems. Use wood as decoration. Cull dead trees for structural supports. Use masonry, straw bales, papercrete, cob, adobe, rocks, bags of volcanic rock, etc., instead of wood. Unfortunately it is difficult to get away from lumber in making a roof, so consider making a dome from materials that can be stacked. Domes are also more energy efficient and use less material for the same space as a box.

Recycle materials. If the materials already exist, you might as well use them, because by doing so you are not promoting the creation of more of them. You might also be keeping them out of the landfill, or keeping them from being transported for further processing. Wood that is kept dry does not degrade much, nor does glass.

Build to last. There is an attitude in this throw-away society that an old house might as well be replaced by a new one. Unfortunately this is often true, because of shoddy construction or poor choice of materials, or lack of maintenance. A well made house can last for centuries, and it should. Moisture getting into a building can lead to ruin, and it is hard to avoid this, whether from the outside environment or from condensation from within. For this reason, it is advised to use materials that are not degraded by moisture.

Grow your food. Why not ask your house to help nourish you? With all of that south-facing glass, you might as well devote some of it to a greenhouse. Herbs and salad greens can be grown year round. What a pleasure! Growing food at home improves quality control and increases resilience – both very necessary in our region where food security is poor and where environmental regulations regarding food quality are poorly enforced.

Share Facilities. A basic tenet of sustainability is to share what you have with others. Doing this can diminish the need for unnecessary duplication of facilities. In this way a group of people can not only have fewer tools or appliances or functional areas, but at the same time they can have available a greater variety of these facilities. This benefits both the environment (through less industrial activity) and the individual (by providing more options for living.)

CONCLUSION

The most important thing to know about making our home green is to keep it small, only big as necessary for the functions intended; large houses use lots of energy and materials to build and to keep comfortable. Whether we like it or not, our society has evolved to consume resources at alarming rate with little regard for the long term consequences. Living more sustainable is a journey rather than destination, there are number of things we can do to live in a more sustainable manner, like reducing the use of plastics, and improving our homes energy efficiency. There are other things we can do as community members, like helping to promote farmers market, community gardens and mixed use development. Above all, keep learning, talking to others and taking actions where and when we can on sustainable issues. Finally, when water is conserved, houses right sized, passive solar design optimized, and above all, humane design provided our search for green sustainable architecture would become a reality.

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