Green Building

History of Green Building

History of Green Building – Historical Buildings

Green building is defined by the Office of the Federal Environmental Executive as "the practice of: 1) increasing the efficiency with which buildings and their sites use energy, water, and materials, and 2) reducing building impacts of human health and the environment, through better siting, design, construction, operation, maintenance, and removal throughout the complete life cycle."[1] While the green building movement has gained momentum in the last decade, the origin can be traced back to the late nineteenth century.

According to David Gissen, curator of architecture and design and the National Building Museum in Washington DC, structures such as London's Crystal Palace and Milan's Galleria Vittorio Emanuele II used methods that decreased the impact of the structure on the environment. Systems such as roof ventilators and underground air-cooling chambers were used to regulate indoor air temperature.[2] In the early twentieth century, several skyscrapers such as the Flatiron Building and the New York Times Building in New York utilized deep-set windows and the Carson Pirie Scott department store in Chicago had retractable awnings. Both of these techniques were effective in controlling interior temperature while lessoning the buildings' impact on the environment.[3]

From the 1930's through the 1960's, the forward thinking cooling methods mentioned above gave way to some new building technologies that would change inner-city building construction dramatically. The invention of air conditioning, reflective glass, and structural steel popularized the enclosed glass and steel buildings that litter the American city today. These buildings were able to be heated and cooled with massive HVAC systems that consumed huge amounts of cheap and readily available fossil fuels.[4] The massive consumption of energy required to inhabit these buildings made their viability tenable and entirely dependent upon energy availability and cost.

History of Green Building – The Infancy

Around the time that the "glass box" style high rise had become the icon of the American city (circa 1970), a forward thinking group of architects, environmentalists, and ecologists[5] were inspired by the growing environmental movement and the higher fuel costs that were prevalent during the 1970s.[6] The genesis of these two scenarios ultimately resulted in the modern build green movement.

The first Earth Day, celebrated in April 1970, gave some credence to this new building concept, but the OPEC oil embargo of 1973 gave the burgeoning environmental movement, and subsequently the green build effort, the kick start it needed. With gas lines stretching for blocks, some Americans began to question the conventional wisdom that we should be so independently reliant upon fossil fuels for our energy.[7]

As a result of the oil embargo, amongst other energy concerns, the American

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[1]Office of the Federal Environmental Executive, "The Federal Commitment to Green Building: Experiences and Expectations," 18 September 2003.
[2]Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[3]Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[4]Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[5]Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[6]http://www.nyc.gov/html/nycwasteless/html/in_business/green_building.shtml
[7]Building Design and Construction, "White Paper on Sustainability", page 4, November 2006

Institute of Architects (AIA) formed a Committee on Energy that was broken into two camps. "One group looked toward passive, such as reflective roofing materials and environmentally beneficial siting of buildings, to achieve energy savings, while the other concentrated more on technological solutions, such as the use of triple-glazed windows."[8]

As energy concerns subsided, momentum for green building and the environment, in general, slowed down, but a dedicated core-group of architects continued to push their green building concept forward. A couple of notable buildings constructed during the seventies which utilized concepts of green design are: The Willis Faber and Dumas Headquarters in England, which utilized a grass roof, day-lighted atrium, and mirrored windows; the Gregory Bateson Building in California, which used energy-sensitive photovoltaic (solar cells)[9], under-floor rock-store cooling systems, and area climate-control devices.[10]

Through the late seventies, throughout the eighties, and into the early nineties, much research was commissioned on energy efficient processes. This research resulted in more effective solar panels, pre-fabricated efficient wall systems, water-reclamations systems, modular construction units, and direct usage of light through windows in order to decrease day-time energy consumption.[11]

History of Green Building – The Greening of the White House

When Bill Clinton was elected President in 1992, the green build/sustainability communities began to toss around the idea of "Greening the White House" as a way to put their ideas on the radar of everyday American society. Twenty-three years after the initial Earth Day, Bill Clinton announced a plan to make the White House the "model for efficiency and waste reduction."[12]

The "Greening of the White House" program was designed to improve "energy efficiency and environmental performance of the White House complex by identifying opportunities to reduce waste, lower energy use, and make an appropriate use of renewable resources, all while improving the indoor air quality and building comfort."[13] In March 1996, it was reported that through the first two years of the "Greening" project, more than $150,000 per year in energy and water costs, landscaping expenses, and expenditures associated with solid waste were saved. Since 1996, $300,000 has been saved annually due to additional projects. In all, 845 metric tons per year of carbon emissions were eliminated during Clinton's presidency.[14]

Some of the methods utilized to "green" the White House are as follows:

1. Building Envelope – decreasing energy lost through the roof, windows, walls, etc.
2. Lighting – utilizing energy-saving light bulbs and maximizing use of natural light.
3. Plug Loads – Energy-saving office equipment was installed. Refrigerators and coolers were replaced with more energy-efficient models.
4. Waste – a comprehensive recycling program was initiated.
5. Vehicles – leased many vehicles that utilized cleaner burning fuels.

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[8] Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[9] "Photovoltaic Fundamentals", www.fsec.ucf.edu/pvt/pvbasics
[10] Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[11] Building Design and Construction, "White Paper on Sustainability", page 4, November 2006
[12] Building Design and Construction, "White Paper on Sustainability", page 5, November 2006
[13] "The Greening of the White House", http://clinton3.nara.gov/Initiatives/Climate/greeningsummary.html
[14] The Greening of the White House", http://clinton3.nara.gov/Initiatives/Climate/greeningsummary.html

6. Landscaping – reducing unnecessary water and pesticide usage.[15]

History of Green Building – Where are we Now?

With the overwhelming success of the "Greening of the White House" other governmental institutions have since been given a green makeover. The Pentagon, the Presidio, and the U.S. Department of Energy, among others have gone green.[16]

The concepts of building green and, on a larger scale, sustainability are ideas that we hear all of the time. These two concepts, however, are rarely properly understood. "Sustainability is a systemic concept, relating to the continuity of economic, social, institutional and environmental aspects of human society, as well as the non-human environment. It is intended to be a means of configuring civilization and human activity so that society, its members and its economies are able to meet their needs and express their greatest potential in the present, while preserving biodiversity and natural ecosystems, and planning and acting for the ability to maintain these ideals for a very long time. Sustainability affects every level of organization, from the local neighborhood to the entire planet".[17] In short, the concept of sustainability refers to thinking holistically about how everything you do affects everything around you. It is an attempt to minimize each person's impact on the world.

Today, green building is one of the fastest growing building and design concepts. Every month new magazines are popping up that report on this growing trend. Architects, designers, and homeowners are becoming infatuated with the cost saving possibilities, energy saving emphasis, modern look, and the symbiotic relationship with nature that green buildings possess.

The United States Green Build Council (USGBC) is the foremost leader and educator within the world of green building today. They are the sanctioning body for LEED, the program with which points are awarded to various design applications within a building ultimately resulting in LEED certification for the building.

USGBC (The United States Green Build Council) & LEED (Leadership in Energy and Environmental Design)

USGBC

The USGBC was created to promote the design and construction of buildings that are environmentally responsible, profitable, and healthy places to live and work. They are focused on integrating building industry sectors and leading a market transformation towards greener construction. The organization consists of various trade associations, architects, designers, and individuals all interested in the greening of the construction business.[18]

Between 1990 and 1995, the USGBC worked feverishly with the American Society of Testing and Materials in order to create a rating system for sustainability. ASTM's rigorous consensus-based process moved much too slowly for the USGBC and in 1995 it was determined that they would create their own rating system to exist under the USGBC banner. A committee was formed to study other green building programs currently in existence and after three years LEED 1.0 unveiled.[19] By 2003, LEED was refined down to its current form that is the talk of the construction and design communities.

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[15]The Greening of the White House", http://clinton3.nara.gov/Initiatives/Climate/greeningsummary.html

[16]Building Design and Construction, "White Paper on Sustainability", page 5, November 2006

[17] http://en.wikipedia.org/wiki/Sustainability

[18] "An Introduction to the USGBC and LEED Green Building Rating System", www.usgbc.org

[19]Building Design and Construction, "White Paper on Sustainability", page 7, November 2006

LEED

In short, LEED is a system for designing, constructing, and certifying green buildings. Buildings are classified as Certified, Silver, Gold, or Platinum depending upon the number of points they acquire within 6 building components[20]:

1. Sustainable Sites
2. Water Efficiency
3. Energy and Atmosphere
4. Materials and Resources
5. Indoor Environmental Quality
6. Innovation and Design Process

Within each of these categories, there are a specific number of credits available via many subcategories. LEED ratings are rapidly becoming boasting points for property owners with property values of LEED certified buildings skyrocketing.

LEED has been assisted in its success by the early adoption of many government agencies. Today, however, it is mostly a market driven engine with the number of LEED registered projects growing each year.

Characteristics of LEED Building

Site Design and Planning

- Site a building within close proximity of commuter rail or bus lines, to reduce pollution and any land-development impacts associated with increased automobile usage.
- Establish building specifications that maintain the current level of storm-water runoff, or decrease the amount of imperviousness already existing onsite.
- Develop a site with a minimum density of 60,000 square feet per acre. Channeling development to urban areas with existing infrastructure protects green spaces and preserves natural habitats and resources.

Material and Product Selection

- Use building materials and products that contain post-consumer recycled content.
- Support the regional economy by using materials and products manufactured regionally.
- Encourage environmentally responsible forestry through the use of wood or wood-based material that meets Forest Stewardship Council's Principles and Criteria for wood building components.
- Utilize rapidly renewable materials, such as bamboo flooring, wool carpets, strawboard, cotton ball insulation (made from denim scrap), genuine linoleum flooring, or poplar oriented-strand board (OSB). Using rapid renewables helps reduce the use and depletion of finite raw materials.

Construction and Demolition Waste Management

- Develop and implement a waste management plan that diverts a substantial amount of construction, demolition, and land-clearing debris from landfills to recycling or salvage facilities.
- Reuse a percentage of salvage or refurbished materials from construction, demolition, or land clearing as new building material. For more information on the benefits of salvaging materials from existing sites, go to www.deconstruction.com.

Energy and Atmosphere

- Generate building electricity on site, from renewable resources like geothermal, solar, or biogas sources.
- Eliminate the use of CFCs (chlorofluorocarbons) in new heating, ventilation, air-conditioning, and refrigeration (HVAC & R) systems.

[20] Building Design and Construction, "White Paper on Sustainability", page 7, November 2006

Eliminating the use of CFCs reduces ozone depletion.

- Contract with a green power provider to purchase building electricity generated from renewable resources, such as solar, wind, geothermal, biomass, or low-impact hydro sources.
- Optimize energy performance.

Water Management

- Install water-efficient or low-flow equipment and appliances in kitchens and bathrooms to reduce water consumption.
- Use water-efficient irrigation, captured rain, or site-recycled water for onsite landscaping.
- Utilize innovative wastewater technologies, such as treating waste water on site or significantly decreasing the amount of potable water used for sewage conveyance.

Indoor Environment

- Design the HVAC system and building envelope to provide for the most optimal delivery and mixing of fresh air. Effective air exchange supports the safety, comfort, and well-being of building occupants.
- Reduce the number of indoor air contaminants by selecting paints and coatings, adhesives, carpets, and composite woods that emit low VOCs (volatile organic compounds) or none at all. Examples of low VOC emitting products are carpets made of wool, carpets made of recycled plastic bottles, and low VOC paint.
- Establish segregated areas for chemical-using operations (such as copy/printing rooms and housekeeping); these areas should have separate outside exhaust and no air recirculation.
- Maximize day lighting and view opportunities. Day lighting and increased view opportunities can save energy costs and enhance worker productivity. [21]

Stone in Green Building

What is Stone's Current Perception

With the growing influence of green building, it is imperative that the natural stone industry does everything it can to position its product as being green friendly. Despite what many of us in the industry may think (natural stone is about as green as something can get), that perception is at odds with the prevailing thought among the architecture and design communities. Much of these misconceptions arise from the inaccurate idea that mining natural stone is somehow on par with strip mining, an environmentally devastating practice.

One facet of LEED certification where natural stone stands out is in product origin. A major tenant within the green community is that of supporting local products and business. LEED points are available for products whose origin or manufacturing is within 500 miles of the building site. Regionally manufactured and extracted materials reduce environmental impact by lowering emittance of greenhouse gasses during transportation while supporting local economies. Fortunately for the stone industry, there is a quarry site within 500 miles of nearly everywhere in the United States and Canada.

Future Areas of Emphasis

There are some areas where natural stone should be an obvious choice for green builders, but in which further research is needed to prove the hypothesis:

- The enduring life cycle of natural stone makes it a great green build option. Because stone has proven that over the

[21] http://www.nyc.gov/html/nycwasteless/html/in_business/green_building.shtml

centuries it holds up to weathering and time better than any other building material; one would think that less energy would be consumed by the initial fabrication and installation than in manufacturing and replacing another product.

- The ease of care and maintenance involved with maintaining natural stone applications should be very attractive to those in the green community. Harsh chemicals are not needed to either clean or finish stone.
- The recyclability of natural stone is unequaled. Nearly 100% of stone from old projects and scrap stone are recyclable.

These components of natural stone use need to be studied and reported on adequately before the natural stone industry can go to the USGBC and request LEED certification points.

Quarrying

In the past 15-20 years, the business of quarrying has been vastly cleaned up from an environmental perspective. Quarries today are required to comply with a strict code of practice and are monitored by OSHA, the Bureau of Mines of the US Department of the Interior, EPA, the Department of Resources and Economic Development, and the Mine Safety and Health Administration among others. This message needs to be spread throughout the entire construction industry. Quarrying is not what it was 20 years ago and certainly not what it was 50 or 100 years ago.

Quarry reclamation projects have added to the ability of quarries to limit their long term impact on the environment. Today, many old quarries are being turned into golf courses, lakes, recreations areas, and state parks. A list of quarry reclamation projects appears at the end of this chapter as examples of how old quarry sites can be successfully utilized for the public good.

As technology moves forward, the greening of quarrying will continue and this will, in turn, continue to further enhances natural stone's position among the green community.

The Committee on Sustainability

In order to properly position natural stone, to research elements of building with natural stone that would qualify for LEED points, and to market the use of natural stone as a green product; the Natural Stone Council has commissioned a Committee on Sustainability. The NSC's Committee on Sustainability will take the lead for the industry in ensuring that stone becomes a viable green building option. A couple of early initiatives for the committee are establishing a set of green best practices for quarrying and fabrication. The committee is also pursuing the commissioning of studies to research Life Cycle Assessment, Life Cycle Cost, Water Use Reduction, Construction Waste Management, and Material Reuse for the Natural Stone Industry. While the initiatives being undertaken by the Committee on Sustainability are aggressive, they are greatly needed in order to ensure that stone becomes a viable option for green building.

Quarry Reclamation Site List

Quarry Park and Nature Preserve
County of Stearns, MN
http://www.co.stearns.mn.us/1450.htm

Halibut Point State Park
Gloucester, MA
http://www.mass.gov/dcr/parks/northeast/halb.htm

The Quarry Golf Club
San Antonio, TX
http://www.quarrygolf.com/

Oak Quarry Golf Club
Riverside, CA
http://www.oakquarry.com/

Crystal Springs Quarry Golf Club
Maryland Heights, MO
http://crystalspringsquarry.com/

http://www.vtstateparks.com/htm/emerhist.cfm

Old Quarry Nature Center
Danbury, CT
http://www.danbury.org/oldquarry/

Quarry Lakes Regional Recreational Area
Fremont, CA
http://www.ebparks.org/parks/quarry.htm

Quarry Oaks Golf Club
Ashland, NE
http://www.quarryoaks.com/

Bomoseen State Park
Fair Haven, VT
http://www.vtstateparks.com/htm/bomoseen.cfm

Natural Bridge State Park
North Adams, MA
http://www.mass.gov/dcr/parks/western/nbdg.htm

Elephant Rocks State Park
Belleview, MO
http://www.mostateparks.com/elephantrock.htm

Canoe Creek State Park
Hollidaysburg, PA
http://www.dcnr.state.pa.us/STATEPARKS/PARKS/canoecreek.aspx#history

Banning State Park
Sandstone, MN
http://www.dnr.state.mn.us/state_parks/banning/index.html

Sleeping Giant State Park
Hamden, CT
http://www.sgpa.org/

Knightdale Environmental Education Park
Knightdale, NC
http://www.hsmm.com/UPLOADS/BD/News/20050427_013046/Art_Knightdale_Lnd%20Wtr_10%2004%20(final).pdf

Emerald Lake State Park
East Dorset, VT