Green Building
An Executive Summary

By Sandy Wiggins

Making the Case

The American Institute of Architects defines ***Sustainability*** as "The ability of society to continue without being forced into decline through the exhaustion or overloading of the resources on which it depends." Underlying this definition is a profound implication, that is, that the economy is dependent upon and subservient to the environment. This concept is in direct contradiction to the economic model adopted by humanity with the advent of the industrial revolution which takes for granted that the environment is subservient to the economy. Achieving sustainability requires a wholesale shift in economic thinking.

Consider the definition of ***Capital***. Economists define capital as "Accumulated assets used to generate income or wealth." Capital, for government, business or individual purposes, is broken down into three distinct categories of assets:

1. Human capital: labor, organization, culture and intellectual assets
2. Financial capital: cash, investments and other monetary assets
3. Manufactured capital: buildings, machinery, infrastructure, and other technology assets

Every businessperson is familiar with the need for and use of these three forms of capital. Capital, in any form, functions as a business's endowment in the sense that the interest income from an endowment will continue in perpetuity as long the endowment is maintained. If the principal (capital) of the endowment is drawn down, income declines. If the principal is depleted, income disappears. The "sustainability" of the endowment requires that the principal be preserved.

Missing from the list of types of capital above are the natural resources and systems that provide the raw materials for industry and human existence. They are missing because, in the strictest sense, the current economic ethic does not consider them as capital. Natural resources are consumed or used up (rather than utilized) without regard for their ultimate disposition. The natural systems which produce those resources are continuously degraded without regard for future yield. For the past two and a half centuries, society has been liquidating its principal and calling it income. Review these under publicized but incontrovertible facts:

- The global flow of natural resources, not including water, required to sustain the world's economy today is 1,000,000,000,000,000 pounds per year. Less than 2% of this material stream is ever reused or recycled.

- The ratio (by weight) of waste generated to durable goods manufactured in our economy is 100:1.
- The energy efficiency of our economy (the percentage of consumed energy that actually does the useful work it is intended to do) is 2%.
- The net total of the world's forests is shrinking at a rate of 20,000,000 acres per year, most of it being converted for agriculture or rangeland.
- 50% of the world's rangeland is overgrazed and deteriorating into desert.
- Globally, topsoil is disappearing twice as fast as natural systems can replace it, at the rate of seven billion tons annually.
- Two thirds of the world's fisheries are being fished beyond capacity and the global fishing fleet is currently operating at a harvest capacity that is twice the sustainable yield of the world's oceans.
- 27% of the world's coral reefs are dead or dying.
- The current rate of species extinction exceeds the mass extinction following the age of dinosaurs.
- 15,000 of the 20,000 landfills in the U.S. are closed or over capacity.
- The major aquifers on every continent are being depleted faster than they can be recharged. The U.S. alone is running at a 4 trillion gallon a year fresh water deficit.
- The consensus opinion of the world's experts is that we will run out of oil in the next 35-70 years.
- Humanity is pumping 15,000,000 tons of CO2 into the atmosphere every day. Global warming is affecting crop yields.
- The world's grain harvests have fallen short of annual demand for four successive years and global grain reserves are at their lowest in a century.
- World population is increasing at the rate of 10,000 people per hour, or 87,000,000 per year (10+ times the population of New York City).

The two curves represented by the statistics above, rising population and declining natural systems, are already colliding. Unless government and business put on the mantle of leadership and take immediate action, the consequence of this collision will be uncontrolled economic decline. This imperative has given rise to the idea of Green Building. Because buildings account for 40% of global natural resource consumption, 40% of energy consumption, generation of 60% of greenhouse gas emissions, and because the construction of buildings generates as much waste as all of the municipal garbage in our country every year, the development of buildings is the single largest target of opportunity for changing the sustainability equation.

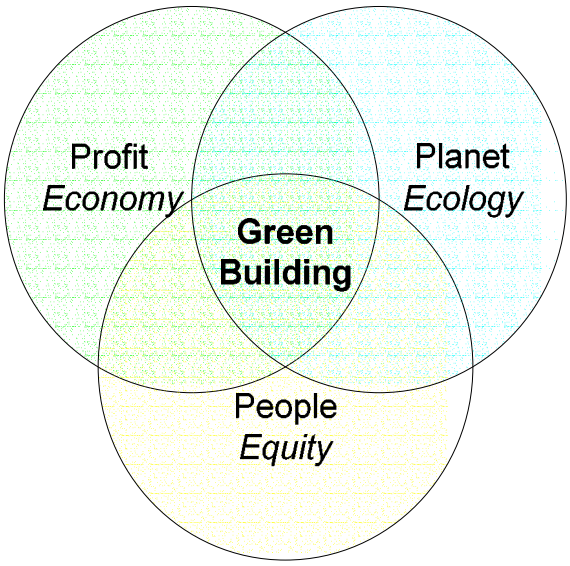
Green Building

What is a "Green Building?" In simple and ideal terms, when you add up the sum total of all of its parts, which include:

- the development of the land on which it stands,
- the energy consumed during construction and ongoing operation,

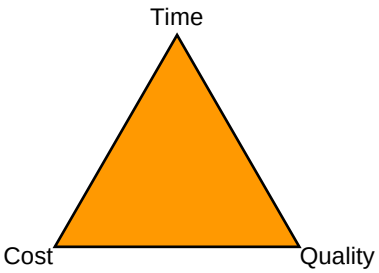
- the disposition of the waste generated during its construction and throughout its useful life,
- water consumption,
- sewerage and other pollutant emissions,
- the raw material extraction, manufacture and transportation for each and every product used in construction,

a building that has a net zero impact on the sustainability of the natural systems which support our economy is a Green Building. At this writing in 2003, development of a building that meets this ideal definition is a nearly impossible task due to the unsustainable state of the many industries that contribute to the creation of a building. So, in today's economy, development of a Green Building needs a transitory definition. Green Building can best be defined as the highest-performance, lowest-environmental-impact, project-specific solution for a given budget, climate, location, community, and function. Balancing these factors is often referred to as observing the *triple bottom line*, or defining a yield in terms of Economy (Profit), Equity (People) and Ecology (Planet). An ideal solution lies within the intersection of these three systems.

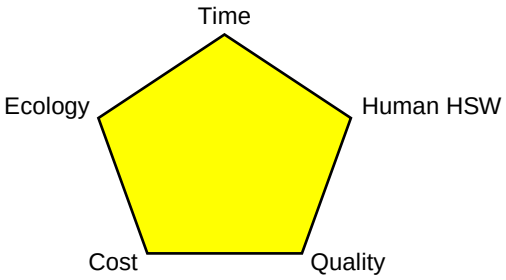


Fortunately, this task is not only achievable today, but can be accomplished without increasing hard cost over "conventional" building development, and when done successfully, creates a capital endowment which generates an extraordinary economic return year after year throughout the building's useful life. Success, however, requires the adoption of a new development paradigm.

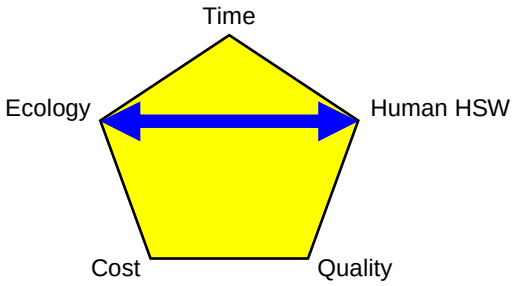
The paradigm shift begins with decision making. Every decision made during the development, design and construction of a "conventional" building is made based on the tension between these three criteria:



The decision paradigm for development of a green building is modified to include additional criteria:



Including environmental impact and human health, safety and welfare as equal factors in every decision is a fundamental shift which guides the green building process. What's more, a growing body of evidence is proving that there is a direct and profound connection between these two new criteria. Building strategies which improve human well-being tend to work directly in favor of the environment. Conversely, when sustainable principles are incorporated into a building's design and operation, they have a beneficial impact on human health and performance.



This phenomenon results from two aspects of successful green buildings. Sustainable designs tend to connect people with their buildings and buildings with the natural environment and, by extension, people with the natural environment. Successful green buildings also deliver significantly improved indoor environmental quality by eliminating

pollutants and allergens, increasing ventilation effectiveness and utilizing natural daylighting.

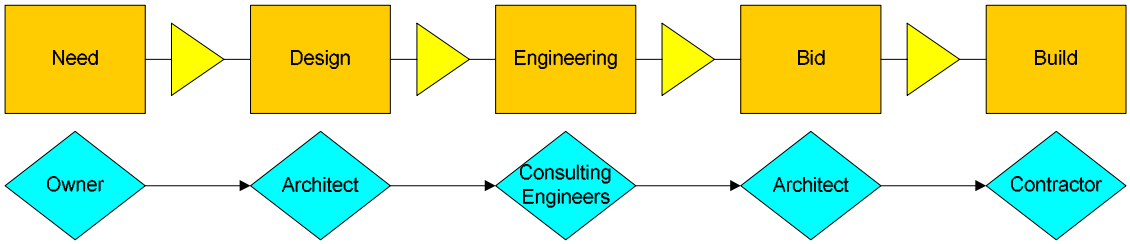
These green building qualities translate into dramatic bottom line benefits. In the office environment, there are now numerous well documented cases of reduced absenteeism ranging from 15-40% and sustained increased productivity of 3-15% after moving employee populations into green buildings. The resultant savings make the typical 25-50% energy savings of green buildings appear paltry. In the educational environment, repeated studies have documented as much as a 25% improvement in student performance on standardized math and language test scores when taught in naturally daylit green school buildings. A similar study on human performance in retail environments discovered that retail sales could be increased by an average of 40% through the use of natural daylight in lieu of artificial lighting. In health care, research studies in Japan, Germany and the UK are documenting a direct relationship between the built environment and patient recovery. High indoor environmental quality and built connections with the natural environment are being credited with faster recovery rates and reduced hospital morbidity.

With such compelling facts and figures, why hasn't green building been universally adopted? The answer is that successful development of green buildings requires changing paradigms and reeducation. Most people are naturally resistant to change and will only respond to change initiatives when they are championed by leadership.

Conventional vs. Integrated Design Process

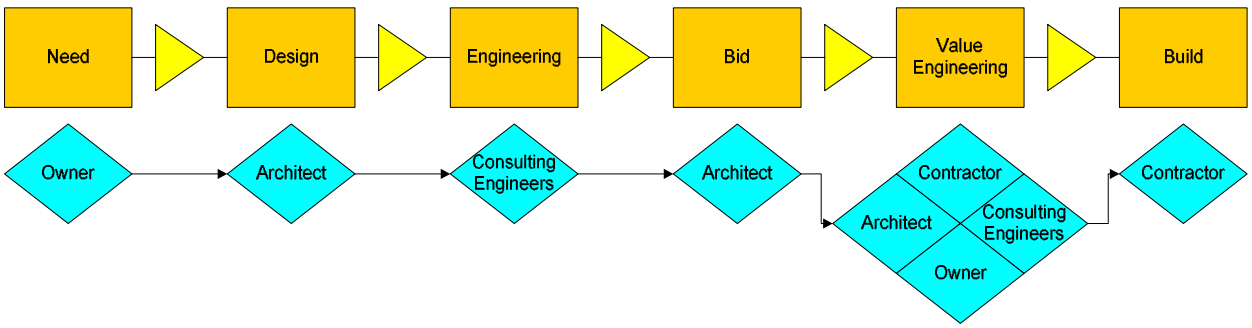
It is important to understand that the Building Industry is not really an industry at all. It is a vast, loose association of companies and interests working together through established conventions and traditions to produce very expensive, very complex, one-of-a-kind manufactured products. A large commercial or institutional building project can involve as many as 30 design consultants, 60 contracting firms, 200 manufacturers and any number of other professional firms such as attorneys, strategic planners, etc. In spite of their cost and complexity, buildings are generally designed and constructed without the benefit of the rigorous research and testing used by other industries to perfect their products before going to market. Instead, individual building components are optimized by subordinate industries and then selected and assembled, hoping for the best. Rather than a well integrated optimized product, the result, to borrow a euphemism from the military, is usually "a bunch of spare parts flying together in close formation."

The conventional development cycle follows a linear paradigm, often referred to as the "Champion Model," which is representative of Industrial Age thinking. At its worst, a building project is handed off from one constituent to the next with an end result that is reminiscent of the childhood game *Whisper Down the Lane*.



Implicit in the diagram above is the traditional habit of having engineering follow design. Architects are the leaders of the conventional project development process. They translate an Owner's need into programming and a design, which is then handed to their subcontractors, consulting engineers, to "make it work." While most professional architects consider the economic ramifications of material and system choices, the linear process robs the project of enormous environmental and economic opportunities which can be leveraged through a more holistic and collaborative approach.

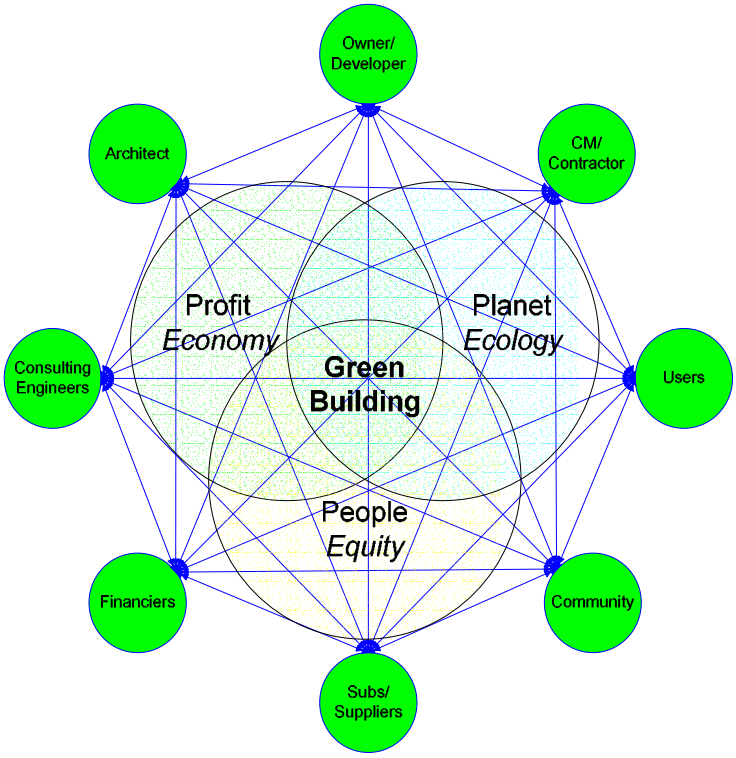
It is also very common for projects following this model to progress to the Bid Phase after many months or even years of planning, only to discover that the project is over budget. The standard solution to this problem is *Value Engineering.* Value engineering only occurs following the discovery of a budget problem. It is an effort that usually includes the architect, consulting engineers and owner, but is typically led by the contractor, who in the model above has had no prior involvement in the planning process. As practiced today, value engineering provides neither *value* nor *engineering* as it is often performed under significant time duress and usually results in the elimination of project scope or downgrading of carefully planned project systems and finishes in order to cut cost.



What is noteworthy about the diagram above is that it illustrates that the first time in the development process that the key stakeholders work collaboratively is at the end of the planning cycle in a frenzied attempt to correct budgetary problems. More enlightened owners often engage a construction manager to work along with the architect and consulting engineers during the planning phase of the project in order to mitigate cost overruns later in the development cycle. Unfortunately, even this approach follows the linear model as the project is handed from architect to consulting engineers and then to

the construction manager for estimating and "value engineering" at each successive stage of design. While the construction management approach eliminates cost surprises late in the planning process, the results of the linear process are the same: a building with suboptimal performance and a larger than necessary environmental footprint.

Integrated Design is the final step in the paradigm shift required for green development. A fundamentally different approach, it engages every stakeholder in the project in collaborative problem solving at the very beginning of the development cycle. It encourages out-of-the-box thinking, cross fertilization of ideas and demands the iterative application of engineering and powerful computer simulations early in the design process in order to inform decision making and yield maximum value before the project team has invested months of effort in a flawed design.



Integrated design functions on the principle of holism, that is, the understanding that the whole is defined by the relationship between its elements or parts. Change any one part, and all of the other parts need to be assessed for the impact of the change. A successful green building is a final solution that is greater than the sum of its parts.

Decisions

Individual decisions are the building blocks of any development. Adoption of the sustainable paradigm drives those decisions toward people and the environment. The first decision made in the development process is the decision to build. This decision is usually made by an Executive or Board, and it is at this juncture that the vision for the project development can be set. Articulating the sustainable agenda for the project as a part of this first decision sets the course for Green Building.

The second decision should be the designation of a Green Champion for the project. The Champion needs to be conversant with the development process and a part of the project team. It is important that this person be charged with the mission and have the authority to uphold the green agenda during the lengthy and complex development cycle. Developing a successful green building is hard work, particularly for novice teams. Human nature will tend toward well worn, tried and true solutions to solve problems or save cost when the going gets tough. The Green Champion is responsible for keeping the vision alive at these critical points in the development cycle and challenging the project team to find better solutions.

Selection of the project team itself is the next important decision. Attitude is everything, as in order to develop a truly integrated design, egosystems need to be subordinated to ecosystems. It is important that at least one of the core team members be experienced with the integrated design process and sustainable building strategies. Facilitation of the integrated design process, particularly with inexperienced teams, will yield the best results and save the emotional and fiscal cost of backtracking. Whenever possible, the entire project team, including the constructor, end users and facilities managers, should be assembled at the earliest possible point in the project development in order to maximize the potential of the integrated design process.

Decisions regarding specific green goals for the project provide the road map for development. These goals are typically articulated during the charrette, an intensive early planning session that is a keystone of the integrated design process and which includes all of the project constituents. Using a system like the U.S. Green Building Council L.E.E.D. (Leadership in Energy and Environmental Design) rating system provides a holistic template for this purpose and stimulates dialogue on specific issues and strategies for the team to explore. Once established, these goals should be revisited at each step of the project development for guidance and to verify the success of the green building effort.

Finally, all buildings influence cultural habits. Once occupied, a successful green building can and should be used to start a cascade of individual and collective decisions that move its occupants toward a culture of sustainability.

Resources

The concepts presented in this paper are drawn from many different sources, some of which are listed below. Special acknowledgement must be given to Bill Reed, Vice

President of Integrative Design for Natural Logic, Inc., for some of the unpublished thoughts that have been included. The following resources are recommended for further exploration of the concepts of sustainability and green building:

Green Development: Integrating Ecology and Real Estate *by Alex Wilson, Jenifer L. Seal, Lisa A. McManigal, L. Hunter Lovins, Maureen Cureton, & William D. Browning*

The HOK Guidebook to Sustainable Design *by Sandra F. Mendler & William Odell*

Natural Capitalism: Creating the Next Industrial Revolution *by Paul Hawken, Amory Lovins, & L. Hunter Lovins*

Eco-Economy *by Lester Brown*

The Future of Life *by Edward O. Wilson*

Cradle to Cradle: Remaking the Way We Make Things *by William McDonough & Michael Braungart*

U.S. Green Building Council LEED Rating System: www.usgbc.org

Environmental Building News: www.buildinggreen.com

Rocky Mountain Institute: www.rmi.org

Governor's Green Government Council Video Series: free from www.gggc.state.pa.us