Sustainable Construction: An Idea Whose Time Has Come

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Throughout recorded history, humans have constructed built facilities to shelter themselves and their possessions and to meet needs critical to human survival and prosperity. While the impacts of buildings on their environment have not always been immediately apparent, their cumulative effects on our planet over time have become undeniable. For example, buildings are responsible for over 10% of the world's freshwater withdrawals, 25% of its wood harvest, and 40% of its material and energy flows. 54% of energy consumption in the United States is directly or indirectly related to buildings and their construction. 30% of all new and remodeled buildings suffer from poor indoor environments caused by noxious emissions, off-gassing, and pathogens spawned from inadequate moisture protection and ventilation, resulting in $60 billion annually in lost white-collar productivity from Sick Building Syndrome in the U.S. alone. Nearly one-quarter of all ozone-depleting chlorofluorocarbons (CFCs) are emitted by building air conditioners and the processes used to manufacture building materials. Approximately half of the CFCs produced around the world are used in buildings, refrigeration and air conditioning systems, fire extinguishing systems, and in certain insulation materials. In addition, half of the world's fossil fuel consumption is attributed to the servicing of buildings. The average U.S. household is annually responsible for the production of 3,500 pounds of garbage, 450,000 gallons of wastewater, and 25,000 pounds of CO_2 along with smaller amounts of SO_2, NO_X, and heavy metals. Lighting accounts for 20-25% of the electricity used in the U.S. annually. Offices in the U.S. spend 30 to 40 cents of every energy dollar for lighting, making it one of the most expensive and wasteful building features. Finally, the construction industry is responsible for 8-20% of the total municipal solid waste stream, 14% on average.

These effects of buildings have impacts on a global scale, and as a result, we are beginning to see increased incidence of problems that affect us all – deforestation, soil erosion, loss of ecosystems, global warming, ozone depletion, and others. The way we create and use the built environment needs to change if we are to continue to survive and prosper in the long term as a species. A new approach to building is now emerging to address these problems: sustainability. This concept means meeting the needs and aspirations of humans in the present without limiting the ability of future generations to meet their own needs. Making our built environment sustainable is about creating buildings that allow us to continue to enjoy the standards of living we experience today, while at the same time ensuring that our children and their children will continue to have access to the goods and services needed for survival in the future. Ecologists and environmentalists have long told us that we need to protect the environment for its own sake. We are now discovering that we need to protect it for our own survival as human beings. Sustainability shows us that we need the services provided by natural ecosystems – we cannot survive without forests to clean our air and provide the timber for our buildings, without wetlands to purify our water and spawn the fish we eat, without soil to grow our food, or without microorganisms to digest our waste. Sustainability is a practical reason to protect the earth – we need it for our own survival!

What does a sustainable construction project look like? What are the attributes of a project that make it sustainable? First, a sustainable project has no net negative impacts on natural ecosystems. In the materials and energy that it requires, the effects of the project on its site, and the waste products that it generates, the facility must not degrade ecosystems. While some degradation is inevitable in order to construct a facility on a site, a sustainable project will include provisions for restoring or enhancing ecosystems on its own or another site in order to be truly sustainable. Second, the project should minimize the need for materials and energy over its entire life cycle, and minimize or eliminate the

need for nonrenewable resources. If it requires nonrenewable materials such as metals or minerals, it will acquire these resources from the waste streams of other projects rather than taking them from the earth. It should not use renewable resources at a rate faster than they are replaced. In short, a sustainable project does not create any negative impacts to the earth's resource bases or ecosystems that it does not repair. Finally, it achieves these goals while meeting the needs of humans for which it is being built, including being built on time and within budget, to the desired levels of quality and performance. The most environmentally friendly building in the world is still an unsustainable waste of resources if it does not meet the requirements of the people it was designed to serve.

One of the most significant barriers to creating sustainable facilities is designing projects that meet sustainability requirements without costing more than the owner can afford. The challenge for you as an architect, engineer, builder, or project manager is to find sustainable solutions that meet the owner's needs for a facility, don't damage ecosystems or deplete resource bases, and don't cost more than a traditional project would cost. These goals can be achieved by increasing the efficiency with which we build and operate facilities and by avoiding costs that are traditionally associated with construction projects. For example, reducing the waste generated by a construction project can be paid for by savings in landfill fees and waste hauling. Construction recycling can result in payback by converting waste (a liability) into a useful resource needed by someone else (an asset). In many projects, natural systems can be used to perform the functions traditionally provided by engineered systems at a significant reduction in cost. For example, living machines made of plants, snails, bacteria, and other organisms, natural drainage swales, and constructed wetlands can be used to collect and treat wastewater without requiring any input of chemicals typically needed by engineered conveyance and treatment systems. The result is healthy plants and purified water that can be safely used for other purposes. In other cases, any additional costs of construction can easily be offset by savings in the life cycle cost of construction. For example, installing more efficient but more expensive hot water heating systems can be paid back by savings in energy costs over the operational life of the building. Similarly, more durable but expensive materials such as concrete paving can be economically superior to less durable but cheaper materials such as asphalt if the life cycle replacement costs are considered. And paving systems, once installed, are typically used indefinitely – can you think of any roads that are no longer used after they are built?

The costs of labor, materials, and equipment increase with each passing year. The cost of environmental damage is increasingly resulting in heavy fines and other penalties in countries around the world, which must be paid by those who design, build, and own the facilities that cause them. By creating built facilities that are durable and flexible to meet human needs long into the future, we can avoid these costs by building our projects right the first time, saving costs for our clients in the future. We should also seek opportunities to avoid unnecessary costs in the first place, by minimizing waste, eliminating unneeded systems, and maximizing the efficiency with which we build our projects. The key to sustainable projects that are economically viable is to consider the impacts of each decision from the standpoint of the whole project, rather than individually. Choices that may initially seem more expensive are often cheaper in the long run when all the costs and benefits are weighed.

In conclusion, sustainability is becoming an important consideration for construction projects around the world. Sustainability offers a way of meeting the needs for which we construct projects, while avoiding the negative impacts traditionally caused by those projects. The ultimate goal of sustainability is our long term survival as the human race. The negative impacts of our present methods of construction can no longer be denied. The time has come to seek better ways of building that will maintain our quality of life and ensure that our children and their children can continue to live as well as we do.

Recommended Resources

http://www.naturalcapitalism.com – The online version of the revolutionary book *Natural Capitalism,* which describes how to design sustainable projects that are economically viable.

http://www.buildgreen.com – The online site of *Environmental Building News*, one of the foremost resources for ideas and reviews of products and technologies for sustainable buildings. Contains checklists of sustainable strategies that can be used in your projects for little or no cost.

http://www.greendesign.net – An online directory of initiatives and organizations involved with green or sustainable design around the world. Also includes descriptions of many useful references for sustainable design.

About the Author

Annie Pearce is the director of the Sustainable Facilities and Infrastructure Program at Georgia Tech Research Institute. She has been involved with sustainable design as a teacher and researcher for nearly ten years. Her program at Georgia Tech provides training and information for all facets of sustainable facilities and infrastructure. For more information about the ideas in this article or to contact Dr. Pearce, see http://maven.gtri.gatech.edu/sfi..