The Future of Green Building
By Robert Turk

The past decade has witnessed a steady increase in the need to address environmental considerations as part of the design process for commercial and residential buildings. A consultant on sustainable building practices, Robert Turk looks at the emerging field of eco-friendly design in terms of new projects, retrofitting efforts and the need to cope with climate change in the future.

THE TREND TOWARD “green design” has emerged through the convergence of two requirements: the need to reduce the environmental impacts associated with the construction, operation and decommissioning of buildings, and the need for increased understanding of how each element of a building functions and the design options available to optimize its performance. As urban populations grow across the globe, but especially in Asia, the importance of managing the impact of the built environment will only increase.

THE EVOLUTION OF GREEN DESIGN

Many building designers consider green design to simply be good design, in that a building should consider the environment in which it is located. From this perspective, green design is not new. Throughout history civilizations have responded to the environment around them and constructed their dwellings accordingly. Mediterranean communities, for example, have historically used passive measures, such as shutters, to ward against temperature increases during the day and to provide an opening at night to enable the cooler evening winds to remove ambient heat. Native Americans survived the oppressive heat of the American desert through the use of thick-walled adobe structures. Other passive design measures, such as the application of light façade colors to reflect solar radiation, also reduce the level of heat gain.

Such well-known approaches are really the fundamentals of green design in that the form of the building is used as the initial basis to...
reduce the measures needed to ensure building comfort. Green design goes beyond good design because it is being driven by the need for a more sophisticated understanding of where the environmental impacts in the life cycle of a building (material fabrication, construction, operation and decommissioning) are occurring and where opportunities exist to manage or mitigate these impacts.

This need for greater understanding obviously stems from the increasing awareness of the impact society is having on the environment. The environmental movement emerged in the United Kingdom and the United States in the 1950s to manage airborne emissions that were having detrimental health effects, especially in large cities. The 1952 great smog of London was a catalyzing event that is estimated to have led to the deaths of thousands of people.¹

The legislative response in these countries — the 1956 Clean Air Act in the United Kingdom and the 1963 Clean Air Act in the United States — restricted the release not just of emissions into the air, but also of other pollutants into the water and soil, referred to as “point source” emissions. Such legislation has over the years been largely replicated across the globe to protect the health of citizens from the direct release of harmful substances.

Since then, our understanding and appreciation of the environmental impact of urbanization and industrialization has increased. Issues have arisen such as acid rain, loss of biodiversity and the depletion of the ozone layer. Over the past two decades, however, global climate change caused by man-made emissions of greenhouse gases (carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride²) has become the most significant environmental issue facing humanity. Respected medical journal *The Lancet* referred

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to climate change as “the biggest threat to global health of the 21st century.”

The primary source of greenhouse gases is the burning of fossil fuels to generate electricity for urban and industrial areas. It is estimated that in developed countries, 20 percent to 40 percent of energy consumption derives from commercial and residential buildings. As such, the relationship between the consumption of fossil-fuel energy (primarily from grid-based sources) and climate change has driven the need to find ways to reduce this consumption within the built environment.

While climate change is a significant issue, it is important to recognize that green design principles incorporate other environmental considerations — such as water consumption, use of hazardous materials, non-renewable resources and ozone-depleting substances.

**VOLUNTARY RATING SCHEMES**

The requirement for a holistic consideration of environmental issues within the design process has been succinctly captured in voluntary rating schemes for building design. The Building Research Establishment (BRE) in the UK introduced the first scheme in 1990, the Building Research Establishment Environmental Assessment Method (BREEAM) for office buildings. It defined a series of categories considered to be of significance for reducing the environmental impact over the life-cycle of a building, from material specification to energy and water consumption.

This UK rating scheme has been used as a template for the development of country specific ratings in many countries, including the US (LEED), Singapore (Green Mark), India (LEED-India) and Australia (Green Star). The original BREEAM scheme has expanded and now considers a variety of building types, from healthcare facilities to factories and residential housing.
The success of voluntary rating schemes stems from the ability to provide a common language to recognize and certify building owners and developers that in turn provides a mechanism for building owners and developers to attract tenants with their “green” credentials.

BUILDING RETROFIT
A focus on green design is often part of developing a new building. But what about existing structures? Increasingly, major cities are accounting for their carbon emissions and developing strategies to reduce these emissions. In doing so, they discover that to significantly reduce the demand for fossil fuel-based energy, an extensive retrofit of the existing building stock is required. This has led to the launch of a number of extensive retrofit programs, such as the “1,200 Buildings” program in Melbourne that seeks to retrofit the majority of commercial buildings in the city by 2020.

The William J. Clinton Foundation has also identified the significance of the existing built environment through the Clinton Climate Initiative’s (CCI) Energy Efficiency Building Retrofit Program. This global program works with building owners and financiers to develop suitable commercial packages that overcome the initial capital cost barriers to retrofitting.

MOVING PAST ALTRUISM
From an environmental perspective, the need to reduce the environmental impact associated with the life-cycle of a building is clear. Building owners and developers are, however, predominantly commercial entities with fiduciary duties to ensure a return to investors and are therefore highly unlikely to act on a purely altruistic basis.

The drivers for incorporating environmental considerations into a design process are a company’s recognition that a business opportunity exists through green design, combined with government steps such as subsidies, incentives or legislation.

Commercial
Commercial incentives are linked to the ability to demonstrate a corporate commitment to the environment, the potential for attracting and generating high revenue from tenants, and the need to reduce costs and operate buildings more efficiently. Commercial opportunities exist through green design by:

• A corporate entity developing its own signature green building as a public demonstration of a commitment to the environment. The benefits associated with the development of such buildings stem from brand recognition and the perception or reputation of the company. An example of this is the 30 St Mary’s Axe building in London, also known as the Swiss Re building, the first so-called ecologically friendly tall building in London, which was designed by Sir Norman Foster and opened in 2004.

• A building owner recognizing the need to provide a building with high green credentials to attract corporate or government tenants that value or require as part of their corporate social responsibility policy a building to meet minimum environmental specifications.

• The simple reduction in costs associated with increasing the efficiency of energy and water consumption. In 2007, the Global McKinsey & Company Cost Curve identified building operations as the area where the most cost-effective measures for reducing greenhouse gas emissions could be achieved. The curve demonstrated that...
the savings for improving the efficiency of thermal performance, lighting and air conditioning rapidly offset the cost of implementation.

Governments

Governments have available a range of mechanisms to require or to encourage green design as at least part of the building process. The main way is through application of national building code standards, such as those currently being considered in Hong Kong’s Mandatory Implementation of Building Energy Codes. Such requirements have been implemented in other countries, such as Australia and countries in the European Union.

Other regulatory approaches are less direct and leave the decision with the purchaser of the building through the requirement that at the time of sale, an assessment is undertaken of the building’s energy performance and provided to prospective buyers.

In addition, governments can play a role in providing guidance documents and promoting the benefits of particular approaches to green design or market mechanisms that foster environmental innovation. Further, governments can play a significant role through incentives and rebates for the installation of sustainable design features for both commercial and residential buildings.

Finally, governments, lacking overarching commercial motives, can act as the first mover in incorporating emerging technologies into the buildings they develop. An example is Council House 2 in Melbourne, which opened in 2006 and has won numerous awards and been called the most sustainable building in Australia for its pioneering use of a black water recycling system to handle waste, integrated wind turbines, a green roof and other features that demonstrate what is possible with current technology.

FUTURE DEVELOPMENTS IN GREEN DESIGN

There are a number of trends emerging in relation to green design centered on the need to mitigate carbon emissions. But as time passes, there will also be a need to adapt the urban environment to the expected climatic changes:

Carbon-neutral buildings

To achieve a carbon-neutral building, demand for energy in the building needs to be minimized and an alternate supply of zero-carbon energy incorporated within the building fabric.

To reduce energy demand, it is important to focus on major sources of energy use, such as the heating, ventilation and air conditioning systems and to minimize the use of mechanical systems. In this way, there is a trend towards using passive systems, such as natural ventilation and using the thermal mass of a building to store heat during the day and vent heat during the evening.

To generate energy within a building there are a number of options, such as solar photovoltaic panels and non-traditional wind turbines. If the focus is carbon neutrality, then the challenge is to provide a sufficient level of commercially viable alternative energy sources. Such viability can be influenced by the existing cost of grid electricity, the capital cost of installation, cost of maintenance and the efficiency of the alternative means of generation, given that it is restricted to the building.

Recognition of this challenge has led to an increasing focus on “precinct approaches” to carbon neutrality, whereby carbon neutrality is achieved across a series of buildings through the development of a central alternative energy generation hub or hubs. This enables greater optimization of alternative energy sources within a given site.

Materials specification

As our knowledge increases of the environmental impact of the energy consumption required
to operate buildings, there is an increased need also to understand the impact of the materials used for construction. As the demand for energy is reduced, the percentage contribution of the energy used during material fabrication increases, and, as such, becomes more significant. The Green Guide to Specification,\textsuperscript{11} first published by the BRE in 1996, provides an assessment of the environmental impact of common building construction materials in a number of categories.

**Climate change adaptation**

In March 2009, the Climate Change: Global Risks, Challenges and Decisions Congress in Copenhagen declared that greenhouse gas emissions were tracking at or above the levels of the extreme climate change scenario identified by the Intergovernmental Panel on Climate Change.\textsuperscript{12} This will lead to a level of climate change by 2030 that appears unavoidable. Building designers can play a significant role in reducing future vulnerability in urban environments to the risks posed by extreme weather such as heat waves and floods.

One approach that is gaining prominence is the incorporation of gardens and agriculture within the building structure. Vegetation within the building has the potential to significantly reduce the urban heat-island effect — that is, the warming associated with urban areas through the concentrated presence of buildings and traffic. The “Living Roof” on the Californian Academy of Sciences Building, which opened in 2008 in San Francisco, and other measures are reported to keep the building 10°F cooler than if it had been installed with a traditional roof.\textsuperscript{13} In Singapore, the proposed Trees@Puggnol project is predicted to reduce the ambient temperature by 3-4°C.\textsuperscript{14}

Over the past decade, there has been a rapid increase in the global price of food, as high fuel costs have led to higher agricultural costs, falling food stocks and land shifted out of food production to provide biofuels.\textsuperscript{15} If the vegetation used in buildings is agricultural, then it also has the potential to assist in addressing the ongoing global food crisis.

None of the above measures will eliminate global warming, but, taken together, they can provide the basis for a design-based commitment to build better, smarter and cleaner buildings. Over time, green design will be a vital component of our collective response to climate change.

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