environmental architecture
19/151 foveaux st surry hills nsw 2010
t: 02 9332 1211 f: 02 9332 1355 abn: 73 342 704 770

environa studio

sustainable design futures for modern tropical buildings

a talk in Bangkok on 26 August 2008 and in Ho Chi Minh City on 4 July 2008

Introduction

Sustainability may be said to be about four basic elements: fire, water, earth and air. These are Aristotle's ideas of the fundamental elements of the earth, and in sustainability they represent:

- The energy used in buildings
- The water cycle
- The materials and construction
- The use of space

Traditionally, discussions of sustainability have focussed on the design for climate aspects of buildings, often concentrating on the design of the envelope or "skin" to filter the external climate to provide a comfortable indoor environment. But thermal comfort in the broader view of sustainability, thermal is only one of many aspects that need to be addressed.

Fire = Energy

The energy used in buildings is most often electricity, which is an intensive source of green house gasses. This energy is used for four main areas:

- Thermal comfort
- Water heating
- Appliances
- Mechanical services

Each of these areas needs to be addressed if we are to reduce the green house gas footprint of the building.

Water

One of the greatest environmental damages that can occur is the construction of dams for water use that fundamentally alter the flow of rivers and the consequent eco-systems. We should be thinking of buildings as "micro-dams", where every building collects and stores its own water using the natural distribution of the rain to deliver the water to the buildings rather than relying on a complex system of pipes. At the other end of the cycle every building should learn to treat and manage its water before it is put back into the ecosystem, relying on grey water and black water treatment systems to reduce the buildings impact on the environment.

Earth = Materials

Most recent discussions about sustainable construction has concentrated on the materials that are used: from sourcing of the raw materials, through primary and secondary manufacture and the installation of the product. In the most advanced thinking, the process is viewed holistically in what has come to be termed "Life Cycle Analysis" (LCA). However, when we look at this full cycle, we realise that it is the construction process that has the most impact on the environment, in particular on the greenhouse gas out-put. Whilst we may have limited choices in the type of materials that we need, particularly for structural components of the building, we have much wider choices about how we construct the building to reduce the waste generated in construction, to increase the safety for workers building the building, and to reduce the impact of the building in its local environment during construction. An important aspect of this is the introduction of prefabrication to building which assists in all of these areas to make a more sustainable building.

Air = Space

After a consideration of the first three elements we can realise that the fundamental cause of sustainability can only be reached when we reach the issue of consumption. In Western terms, there can be no such thing as a "sustainable McMansion". So much of what is happening in the sustainable arena is "greenwash": trying to put a green spin on "business as usual", to pretend that we can continue to build, at the same size, or even bigger, but by tinkering at the margins, we can make them appear green. I believe it is important to address the issues of lifestyle and to show ways in which we can increase the quality of our life whilst decreasing the size of the buildings that we build. This is the real challenge of sustainability, to be able to build smaller and better, with greater quality and lesser quantity in order to be able to live in more sustainable cities with more sustainable buildings.

I wish to review each of these elements showing some influential buildings followed by a discussion of what our concerns in that area should be.

FIRE = ENERGY

Projects presented and discussed (in some detail)

- Resort on Little Green Island in the Whitsundays, Queensland
- Moon Shadow building in Darwin, Northern Territory
- Lend Lease headquarters building in Sydney, New South Wales
- CH2 bulding in Melbourne, Victoria

Discussion

It is clear that addressing the thermal climate issues will require hybrid buildings, where part of the building may be maintained by mechanical ventilation or air conditioning and where other parts of the building may be more naturally ventilated. These hybrid buildings may require the occupants to adjust to various parts of the building in various seasons and various times of the day, rather than expecting a black box experience where the one room remains at a constant temperature all year round. This has the added advantage of introducing the occupants to the idea of living with the climate, rather than living against it and understanding the rhythms that underpin our life.

A second point is the use of rating tools to either regulate or encourage the adoption of sustainable principles. Typically these rating tolls are computer simulations prior to the construction of the building to show where the energy usage patterns will be. The history of them as a regulatory tool has been very poor. The tools tend towards the elimination of worst practice rather than the promotion of best practice. Price movements in the costs of energy would have far greater impact on the poor levels of practice than the implementation of such tools. On the other hand, they have great use in encouraging and the understanding of the increased benefits of the building to lifestyle: that is, that a sustainable building can offer a far better internal environment than a traditionally air conditioned building. This is critically important in promoting the idea of sustainability being not an alternative, but a better way. This we have called the Third Wave of Sustainability, that is, beyond the idea of firstly moral encouragement and secondly the use of regulations, it may turn out that the third way of demonstrating how sustainable buildings are better than any other form may ultimately encourage greater use. In particular, recent post-occupancy evaluation studies the United States show that the increased attendance and performance of workers can offer far greater monetary returns to the building owners and occupiers than the saving in energy costs.

It is notable that in much of the Western world, which is considered to be a milder climate than the tropics, the major issue is cooling, not heating. This is because denser occupied buildings, such as apartments and particularly offices have far greater need for heat evacuation in the hotter seasons than supplying heat in Winter. In addition, heating can often be supplied in natural gas which has a much lower greenhouse gas impact than the use of electricity to provide air conditioning. In this regard, we may see temperate and milder climates looking to solutions from the warmer and indeed tropical climates to address the more important conditions of “coolth“ rather than “warmth”.

WATER

Projects presented and discussed:

- Marr Grounds houses and studios, Tanja, New South Wales
- Fernbrook Courtyard houses, Warriewood, New South Wales
- FutureHouse project for Stockland

Discussion

Whilst the need for rain water collection and storage should be a fairly obvious step in a sustainable building, there are two design elements that need to be addressed:

1. The water cycle needs to be made evident in the design of the building, particularly in the design of roofs, getters and storage systems. In this regard, the use of skillion roofs, in particular a parasol or fly-roof over the entire building that can be tilted or oriented to collect water in one small location where it can be better filtered and then directed to a tank is important.
2. The use of planting, particularly green walls and green roofs needs to be explored within the building to maximise water usage and the increased potential for productive gardens in the building. Given that 25% of the worlds green house gasses is used in the production of food, it will be extremely important in the future to return to “Local Food” which can be grown very close to, or better still, on and above the building where we can return the land area to good agricultural use even while it has a building occupying the ground space.

EARTH = MATERIALS + CONSTRUCTION

Projects presented and discussed

- Sustainable bathrooms
- House of The Future, Sydney, New South Wales
- Marmol Radziner prefab factory Los Angeles

Discussion

Most commentators have approached this topic by concentrating on the sustainability of materials, and to that end there has been a considerable amount of basic research, which is best represented on the Australian website EcoSpecifier. By using the web, we can analyse the origins and various aspects of a variety of materials. This information is currently being combined by a variety of research organizations into Life Cycle Assessment (LCA) but as yet we do not have a comprehensive and agreed universal standard for assessing the impact of materials, let alone an agreed standard within Australia or New Zealand. I believe this is a critical research item that will take place over the next 5 years in order to establish a level playing field for the assessment of materials.

A second consideration is the manner of construction. Of course this is implicit in the LCA assessment, however there are other critical environmental spin-offs, including the production of waste on site, the

disruption to the local neighbourhood when construction takes place, the wasteful use of excess materials. In this regard we believe that the use of prefabricated elements in a building holds great promise. We would distinguish between prefabrication, which may be the construction of elements of the building such as whole walls or window components or floor or roofing components from the other form of prefabrication, which we will pre-assembly, where whole sections of the buildings (bathrooms, kitchens or whole buildings themselves) can be pre-assembled in a factory. It is clear to us from our research, it is likely that a combination of prefabrication and pre-assembly will be the way forward in sustainable building.

AIR = SPACE

Projects presented and discussed

- New Cantebury Rd apartments, Sydney, New South Wales
- Stockland apartments, Brisbane, Queensland
- Micromaisonette conceptual project

Discussion

Despite all the rigours of the first three elements of sustainability, nothing succeeds like a reduction in consumption in lowering the impact on the earths resources. There is a very difficult political conundrum for Western nations, such as Australia, who have been profligate not only in their energy use, but also in their planning of cities, leading to sprawling suburbia, low densities of living and massive dependence on car transport. Where these countries are asking, or even in some cases demanding, that the second and third world not follow that example but in fact have far denser and more compact cities with less space per person. This is rightly perceived by developing nations as extremely hypocritical, although would be more morally correct to adopt the minimalist approach. Overall in sustainability terms it is this disjunction between the desires for developing nations to grow and increase their footprints and the desire of western countries to curtail others if not themselves that causes the biggest headache for sustainability. The problem has been exacerbated by the export of “starchitechts” (star architects) whose name is renowned for their designs rather than their sustainable acumen. The Western world owes it to the developing world to provide advise that is culturally consistent as well as being sustainably accurate.