STRATEGIES FOR GREEN DESIGN

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1. Saving our environment is the most vital issue that humankind must address today, feeding into our fears that this millennium may be our last.

For the designer, the compelling question is: how do we design for a sustainable future? Businesses and industries face similar concerns of seeking to understand the environmental consequences of their functions and processes, to envision what these might be if they were sustainable, and to find ways to realise this vision with ecologically benign strategies, new business models, production systems, materials and processes.

Green design is not just eco-engineering. These are indeed important part of green design (see ‘grey ecoinfrastructure’ below) and are rapidly developing and advancing systems towards a green built environment and architecture but not exclusively.

Green design is also not just about rating systems (such as LEED or BREAM, etc.). These are useful checklists but are not comprehensive. They are useful as a list of reminders of some of the key items to consider in green design and useful in proselytising green design to a wider audience.

The contention here is that achieving effective green design is not as easy as it had been contended. It is complex. While still incomplete, there are a number of design strategies that can be adopted in part and in whole, in combination to arrive at the goal of achieving a state of stasis with the natural environment.

A number of design strategies is presented here as approaches to green design and planning.

2. The first design strategy is to view green design in terms of weaving of four strands of infrastructures: the ‘grey’ (the engineering infrastructure being the eco sustainable engineering systems and utilities), ‘blue’ (water management and closing of the water cycle by design with sustainable drainage), ‘green’ (the green ecoinfrast ructure or nature’s own utilities) and ‘red’ (our human built systems, spaces, hardscapes, society and regulatory systems).

Green design is the blending of all these four sets of infrastructures into a system seamlessly.

The Green infrastructure.

The green infrastructure is the ecoinfrast ructure that is vital to every masterplan. This ecoinfrast ructure parallels the usual grey urban infrastructure of roads, drainage systems and utilities. This is an interconnected network of natural areas and other open spaces that...
conserves natural ecosystem values and functions and sustains clean air and water. It also enables the area to flourish as a natural habitat for a wide range of wildlife, and delivers a wide array of benefits to humans and the natural world alike, such as providing a linked habitat across the landscape that permits bird and animal species to move freely.

This ecoinfrastructure is nature’s functioning infrastructure (parallel to our human-made infrastructures, designated as grey, blue and red in fractuctures here), and in addition to providing cleaner water and enhancing water supplies, it can also result in some, if not all, of the following outcomes: cleaner air; a reduction in heat-island effect in urban areas; a moderation in the impact of climate change; increased energy efficiency; and the protection of source water.

Having an ecoinfrastructure in the masterplan is vital to any ecomasterplanning endeavour.

Without it, no matter how clever or advanced is the eco-engineering gadgetry used, the masterplan remains simply a work of engineering, and can in no way be called an ecological masterplan or, neither in the case of larger developments, an ecocity.

These linear wildlife corridors connect existing green spaces and larger green areas, and can create new larger habitats in their own right, or may be in the form of newly linked existing woodland belts or wetlands, or existing landscape features, such as overgrown railway lines, hedges and waterways. Any new green infrastructure must clearly also complement and enhance the natural functions of what is already there in the landscape.

In the masterplanning process, the designer identifies existing green routes and green areas, and possible new routes and linkages for creating new connections in the landscape. It is at this point that additional green functional landscape elements or zones can also be integrated, such as linking to existing waterways that also provide ecological services, such as drainage to attenuate flooding.

This ecoinfrastructure takes precedence over other engineering infrastructures in the masterplan. By creating, improving and rehabilitating ecological connectivity of the immediate environment, the ecoinfrastructure turns human intervention in the landscape from a negative into a positive. Its environmental benefits and values are an armature and framework for natural systems and functions that are ecologically fundamental to the viability of the locality's plant and animal species and their habitat, such as healthy soils, water and air. It reverses the fragmentation of natural habitats and encourages increases in biodiversity to restore functioning ecosystems while providing the fabric for sustainable living, and safeguarding and enhancing natural features.

This new connectivity of the landscape with the built form is both a horizontal and a vertical endeavour. An obvious demonstration of horizontal connectivity is the provision of ecological corridors and links in regional and local planning that are crucial for making urban patterns more biologically viable. Connectivity over impervious surfaces and roads can be achieved by using ecological bridges, undercrofts and rafts. Besides improved horizontal connectivity, vertical connectivity with human buildings is also necessary since most buildings are not single storey but multistorey. Design must extend the ecological corridors vertically upwards, with greenery spanning a building from the foundations to the green gardens on the rooftops.

The Grey Infrastructure.

The grey infrastructure is the usual urban engineering infrastructure such as roads, drains, sewerage, water reticulation, telecommunications, and energy and electric power distribution systems. These engineering systems should integrate with the green infrastructure rather than vice-versa, and should be designed as sustainable engineering systems.
The Blue Infrastructure

Parallel to the ecological infrastructure is the water infrastructure (the blue infrastructure) where the water cycle should be managed to close the loop, although not always possible in locations with low rainfall. Rainfall needs to be harvested and recycled. The surface water from rain needs to be retained within the site and to be returned to the land for the recharging of groundwater by means of filtration beds, pervious roadways and built surfaces, retention ponds and bioswales. Water used in the built system needs to be recovered and reused inasmuch as possible.

Site planning must take into consideration the site’s natural drainage patterns and provide surface-water management such that the rainfall remains within the locality and is not drained away into water bodies. Combined with the green ecoinfrastructure, stormwater management enables the natural processes to infiltrate, evaporate-transpire, or capture and use stormwater on or near the site where it falls while potentially generating other environmental benefits.

Waterways should not be culverted or be deculverting of engineered waterways, but should be replaced with the introduction of wetlands and buffer strips of ecologically functional meadow and woodland habitat. Sealed surfaces can reduce soil moisture and leave lowlying areas susceptible to flooding from excessive run-off. Wet and greenways need to be designed as sustainable drainage systems to provide ecological services. Buffers can be integrated with linear green spaces to maximize their habitat potential.

Ecodesign must create sustainable urban drainage systems that can function as wetland habitats. This is not only to alleviate flooding, but also to create buffer strips for habitat creation. While the width of the buffer may be constrained by existing land uses, the integration through linear green spaces can allow for wider corridors. Surface-water management aims to be designed as sustainable drainage systems to provide ecological services. Buffers can be integrated with linear green spaces to maximize their habitat potential.

The Red (or Human) Infrastructure

The human infrastructure is the human community, its built environment (buildings, houses etc), hardscapes and regulatory systems (laws, regulations, ethics etc). These need to be designed to be ecologically functional meadow and woodland habitat. Sealed surfaces can reduce soil moisture and leave low-lying areas susceptible to flooding from excessive run-off. Wet and greenways need to be designed as sustainable drainage systems to provide ecological services. Buffers can be integrated with linear green spaces to maximize their habitat potential.

3. The second design strategy is to regard green design as the seamless and benign environmental biointegration of the artificial (the human made) with the natural environment. It is the failure to successfully integrate that is the cause of environmental problems. In effect if we are able to integrate our business processes, our designs and everything we do or make in our built environment (which by definition consists of our buildings, facilities, infrastructure, products, refrigerators, toys, etc.) with the natural environment in a seamless and benign way, there will be in principle, no environmental problems whatsoever. Successfully achieving this is of course easier said than done, but here lies our challenge.

We can draw an analogy between ecodesign and prosthetics design in surgery. A medical prosthetic device has to integrate with its organic host being – the human body. Failure to integrate well results in dislocation in both. By analogy, this is what ecodesign in our built environment and in our businesses should achieve: a total physical, systemic and temporal integration of our human-made, built environment with our organic host in a benign and positive way. Ecodesign is essentially design that integrates our artificial systems both mechanically and organically, with its host system being the ecosystems.
Designing for bio-integration can be regarded at three aspects: physically, systemically and temporally.

Physical and systemic integration requires a discernment of the ecology of the site. Any activity from our design or our business takes place with the objective to physically integrate benignly with the ecosystems. We must first understand the locality’s ecosystem before imposing any human activity upon it. Every site has an ecology with a limiting capacity to withstand stresses imposed upon it, which if stressed beyond this capacity, becomes irrevocably damaged. Consequences can range from minimal localised impact (clearing of a small land area for access), to the total devastation of the entire land area (clearing of all trees and vegetation, leveling the topography, diversion of existing waterways, etc).

We need to ascertain its ecosystem’s structure and energy flow, its species diversity and other ecological properties and processes. Then we must identify which parts of the site (if any) have different types of structures and activities, and which parts are particularly sensitive. Finally, we must consider the likely impacts of the intended construction and use.

This is, of course, a major undertaking. It needs to be done diurnally over the year and in some instances over years. To reduce this lengthy effort, landscape architects developed the sieve-mapping technique for landscaping mapping. We must be aware that method generally treats the site’s ecosystem statically and may ignore the dynamic forces taking place between the layers and within an ecosystem. Between each of these layers are complex interactions.

Another major design issue is the systemic integration of our built forms and its operational systems and internal processes with the ecosystems in nature. This integration is crucial because if our built systems and processes do not integrate with the natural systems in nature, then they will remain disparate, artificial items and potential pollutants. Their eventual integration after their manufacture and use is only through biodegradation. Often, this requires a long-term natural process of decomposition.

Temporal integration involves the conservation of both renewable and non-renewable resources to ensure that these are sustainable for future generations. This includes designing for low energy built systems that are less or are not dependent on the use of non-renewable energy resources.

4. The third design strategy is to regard green design as ‘ecomimesis’ as imitating ecosystems based on its processes, structure, features and functions. This is one of the fundamental premisses for ecodesign. Our built environment must imitate ecosystems in all respects e.g. recycling, using energy from the sun through photosynthesis, systems that head towards increasing energy efficiency, holistic balance of biotic and abiotic constituents in the ecosystem, etc.

Nature without humans exists in stasis. Can our businesses and our built environment imitate nature’s processes, structure, and functions, particularly its ecosystems? For instance, ecosystems have no waste. Everything is recycled within. Thus by imitating this, our built environment will produce no waste. All emissions and products are continuously reused, recycled within and eventually reintegrated with the natural environment, in tandem with efficient uses of energy and material resources. Ecosystems in a biosphere are definable units containing both biotic and abiotic constituents acting together as a whole. From this concept, our businesses and built environment should be designed analogously to the ecosystem’s physical content, composition and processes. For instance, besides regarding our architecture as just art objects or as serviced enclosures, we should regard it as artefacts that need to be operationally and eventually integrated with nature.
As is self-evident, the material composition of our built environment is almost entirely inorganic, whereas ecosystems contain a complement of both biotic and abiotic constituents, or of inorganic and organic components.

Our myriad of construction, manufacturing and other activities are, in effect, making the biosphere more and more inorganic, artificial and increasingly biologically simplified. To continue without balancing the biotic content means simply adding to the biosphere's artificiality, thereby making it increasingly more and more inorganic. This results in the biological simplification of the biosphere and the reduction of its complexity and diversity. We must first reverse this trend and balance our built environment with greater levels of biomass, ameliorating biodiversity and ecological connectivity in the built forms.

Ecodesign also requires the designer to use green materials and assemblies of materials, and components that facilitate reuse, recycling and reintegration for temporal integration with the ecological systems. We need to be ecophilic in our use of materials in the built environment. In ecosystems, all living organisms feed on continual flows of matter and energy from their environment to stay alive, and all living organisms continually produce wastes. Here, an ecosystem generates no waste, one species' waste being another species' food. Thus matter cycles continually through the web of life. It is this closing of the loop in reuse and recycling that our human-made environment must imitate.

5. Fourthly, ecodesign can be regarded not only as the creation of new artificial ‘living’ urban ecosystems or rehabilitating existing built environments and cities, but also as one of restoring existent impaired and devastated ecosystems regionally within the wider landscape to our designed system.

We should for instance, improve the ecological linkages between our designed systems and our business processes with the surrounding landscape, not just horizontally but also vertically.

Achieving these linkages ensures a wider level of species connectivity, interaction, mobility and sharing of resources across boundaries. Such real improvements in ecological nexus enhance biodiversity and further increase habitat resilience and species survival. Providing ecological corridors and linkages in regional planning is crucial in making urban patterns more biologically viable.

We must biologically integrate the inorganic aspects and processes of our built environment with the landscape so that they mutually become ecostatic. We must create ‘human-made ecosystems’ compatible with the ecosystems in nature. By doing so, we enhance human-made ecosystems’ abilities to sustain life in the biosphere.

6. The fifth strategy for ecodesign is to regard our designed system in the context of the biosphere globally as a series of interdependent interactions, whose monitoring is necessary to ensure global environmental stasis and repairing of environmental devastations by humans, of natural disasters and impacts of our human built environment, activities and industries. These sets of environmental interactions need to be monitored for appropriate corrective action to be immediately taken to maintain global ecological stability.

7. The above are strategies that can be used to approach green design and achieving a sustainable environmental stability. Green design goes beyond the conventional rating systems such as LEED or BREEAM, etc. which are indeed useful indexes for comparing the greenness of building
designs. They are however not effective design tools. They are not comprehensive enough in approaching the issues of environmental design at the local, regional and global levels. Generally stated, ecological design is still very much in its infancy. The totally green building or green city does not yet exist. There is much more theoretical work, technical research and invention, and environmental studies that need to be done and tested before we can have a truly green built environment. We all need to continue this great pursuit.

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