

# Sustainable architecture and design



**Sustainable, eco-friendly architecture can often be seen as the radical hippy of neo-liberal architectural discourse, with its practical application in the 21st century limited and problematic. Is there space for the synergy of idea in this regard, producing usable and practical or whimsical and gracious buildings that also adhere to the classical ideas of beauty and proportion?**

Sustainable <sup>[1]</sup> and eco-friendly architectures <sup>[2]</sup> were the subject of much left of centre discourse throughout the 1960's and 1970's against the backdrop of late Modernism and the initiation of constructed, clean post-Modernity. They were in opposition to the shock of the 'new' the marvels of concrete and structural steel and the innovations that supported closed environments such as elevators and air-conditioning. The seemingly 'hippy' applications of buildings that suited the environment, responded to them, and trod lightly in their space appeared irreconcilable in the context of the masculine, rational and spare elements of Modernity. The fear that beauty <sup>[3]</sup> could not exist in a mixed relationship, that a building could be both environmentally friendly and be visually appealing was not always an option in the hegemony of late modernism. However, this paper discusses the synergies that arose from these apparently oppositional ideas.

The modernist era of tower blocks and buildings that fitted in with the 'form follows function' premise, ignored the possibilities of working with the environment and also being informed by it. The post-War building boom was expeditious, masculine and prolific, with the modular systems of the International Style informing all of the above. The shock of the new, invention and innovation left little space for the architectures engaging with the environment or the vernacular textures. Issues of sustainability were

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very much part of a neo-liberal brief, and disregarded by the world order of the time who had not yet woken up to the issues regarding the depleted ozone layer and greenhouse gas emissions.

However, occasionally, there was minor dissent, particularly in the British colonies, where the imposed architecture of the colonist had been, to some extent environmentally adapted by the settlers using vernacular materials and adapting some elements of the indigenous building systems that they found there. Throughout this, though, the prevailing post-War building idiom of the mother country was largely retained, adaptability being one of the successes of Modernism.

Those careful and socially conscious architects that contested the climatically and culturally inappropriate imposition of modernism strove to combine old and new materials and old and new technologies to create regionally appropriate buildings that were a vernacular in their own right and yet a new architecture that combined all the radical notions popular in the hippy culture of the late 1960's.

Norman Eaton, a South African, was cognizant of environment and reduction of the air-conditioning loads when he designed his Netherlands Bank Building (1965) in Durban, South Africa, a five level building where the building stands on a white marble podium and forms a pavilion in the centre of the high-rise urban fabric. The external curtain wall is replaced by a *brise-soliel* of green ceramic hollow clay blocks forming a massive sunscreen and significantly reducing the air conditioning loads in a hot, humid climate.

‘ The unbroken expanses of ceramic screening were the result of Eaton’s approach to the challenge of Durban’s heat and were not employed for aesthetic effect alone. The open and yet cool aspect of the interior and the considerably reduced load on the building’s air conditioning system testify to the screens functional success. Behind the screen and invisible from the outside a second curtain wall, this time of glass, also covers the building, so that all internal levels are well lit but at the same time well protected against the glare and heat of direct sunlight.’ (Haropp-Allin; 1975: 107)

Visually, although the building is a regionalist adaptation of what was a prevailing modernist format, the building and its incorporated garden spaces provides cool relief and a refuge in a hard edged landscape. [4]

Almost two decades later, the Australian John Andrews in his Eugowra Farmhouse, New South Wales, (1979) maximized the orientation of the building such that he combined the use of prevailing winds for cooling in the Australian outback together with a central fireplace for heating. A prominent rainwater tower in the centre of the roof is both a strong vertical element, creating ‘ architecture’ and at the same time harvesting water which is a critical necessity in the arid environment. This element is also able to spray water onto the roof for cooling in extreme weather. This was all combined using modern materials in a vernacular idiom combined with a classical symmetry, producing a gracious neo-outback veranda house.

With these examples quoted above, a strong sense of regionalism is implicit in the sustainability and the environmental generators that form the ‘ natural’ brief. For a building to be modern, beautiful and environmentally

sustainable, it follows that the structure should be in a regionalist ‘idiom’ using modern materials housing modern facilities, with the incorporation of some of the vernacular, as the meaning of the site and the climate is by definition a regionalist issue.

It was not only in the antipodean regions that this critical discourse was occurring. From the beginning of the 1960s, a number of papers and publications supporting the architecture of the vernacular and its many manifestations, connecting this to environment, culture and landscape, spawned the radical publications such as ‘*Shelter*’ (1973) which explored the notions of building using traditional materials, textures and forms, and adding to this sustainable methods of drainage, rainwater capture, foundation formation and environmentally friendly methods of heating and cooling. This treatise however was aimed at people pursuing more of an alternative lifestyle, using the landscape and other culture’s building methods to house them in an ecologically sustainable fashion. More conventional publications such as the work of Fitch in 1960, and the works of Rudofsky (1965) and Rapaport (1969) explored the connections between climate, landscape and culture. They investigated the traditional means by which building were constructed to address all the social and climatic constraints that produce sustainable buildings that tread lightly on the landscape and do not need large amounts of extra resources such as heating, cooling, and electricity consumption. These publications were still way left of the conservative centre, and not embraced by the rapidly mechanized northern countries. Few architects in the formal sector were prepared to stick their necks out in this regard, leaving the alternative

housing solutions to those that pursued alternative lifestyles. A marked example does, however, stand out- Paolo Solieri, a student of Frank Lloyd Wright conceived of his Arcosanti Project in 1970, where some 70 miles north of Phoenix, Arizona, a compact complex hoping to eventually house some 5000 people is designed in a way such that the outside arable land is maximized, the living areas are condensed providing ready access to open desert for all dwellers, and a number of large greenhouses provide food for the inhabitants. These structures also act as solar collectors for winter heat. Solieri's aim was to design an urban environment that would function in a manner providing the maximum social, economic and health benefits, as well as treading lightly on the landscape on which it sits minimizing the effects on the earth. His principle of ' arcology which married the ideas of ecology and architecture is described below.

In nature, as an organism evolves it increases in complexity and it also becomes a more compact or miniaturized system. Similarly a city should function as a living system. It must follow the same process of process of complexification and miniaturisation to become a more lively container for the social, cultural and spiritual evolution of humankind. The central concept around which these developments revolve is that of arcology- architecture and ecology as one integral process. Arcology is capable, at least theoretically, of demonstrating positive response to the many problems of urban civilization, population, pollution, energy and natural resource depletion, food scarcity and quality of life. Arcology is the methodology that recognizes the necessity of the radical reorganization of the sprawling urban landscape into dense, integrated, three- dimensional cities in order to

support the complex activities that sustain human culture. The city is the necessary instrument for the evolution of humankind.” – Paolo Soleri (Arcosanti Workshops 2000 pamphlet)

The Cosanti-Arcosanti pamphlet notes that Newsweek commented that ‘ As urban architecture, Arcosanti is probably the most important urban experiment undertaken in our lifetime’ (Cosanti-Arcosanti pamphlet; 2000) However, despite this accolade by the popular, ‘ thinking’ press, the project, nearly four decades later, struggles along still in the construction process, and is more of a site for those people that pursue the alternative than people living mainstream, corporate lifestyles. As a site it is a museum, a school, a point of pilgrimage. For very few people, it is a lifestyle. Bringing these combined issues of ecological, social and economic sustainability, to the forefront, making them trendy and implicit, has been the largest challenge to the production of sustainable architectures. The realisation that the construction industry and the operation of the buildings that it makes, as Hyatt quotes (himself and) Edwards (Hyatt in Abley & Heartfield; 2001: 30) makes it ‘ responsible for 50% of ‘ all energy resources consumed across the planet, making the construction industry ‘ the least sustainable industry in the world’. This fact has taken a while to entrench itself in ‘ first world’ industry.

Issues of sustainability and appropriate technology are not new- as mentioned earlier they formed the basis of developmental jargon in the ‘ Third’ World. Sustainability in architecture as a technical approach in the management of particular resources has been the subject of discussions in the last three decades, with the 1975 ‘ Alternatives to Growth’ conference <https://assignbuster.com/sustainable-architecture-and-design/>

which expanded the definition realizing the limits of a static- state economy: this time sustainability fell within the realms of the economists and not the built environment practitioners. Then, the issue of the control of technology by the Northern Hemisphere was dealt with by Willy Brandt who, in 1980, led the Independent Commission on International Development Issues, producing a report headed ' North- South- A Programme for Survival'. (Heartfield in Abley & Heartfield; 2001: 97) Here, the connections between sustainable development and appropriate technology were made, entrenching the idea of appropriate technology in a developing country context. This was almost fatal, as Heartfield notes ' What appropriate technology meant for the less developed world was the lowering of expectations; less capital input, less expenditure, less technology.' (Ibid; 97) Perhaps this perceived ' lower' level of existence is one of the reasons why the plea for incorporation of these ideas of sustainability in the northern hemisphere fell largely on deaf ears. ' It could be said that sustainability is a fudge. It raises all the same presuppositions of the limits to growth thesis, that absolute resource limits are upon us, but avoids their implied conclusion, a moratorium on growth. What the concept of sustainability preserves of the ideology of limits is the sentiment of constraint and parsimony.' (Ibid; 97) Finally, the Bruntland Report <sup>[5]</sup> submitted in 1987 is seen by Heartfield as being credited with the ' popularizing of the concept of sustainable development.' (Ibid: 96). However, although this may have made the concept more digestible, it did little for popularizing its practice, for, as the Bruntland Report, quoted in Heartfield states- ' Sustainable development requires that those who are more affluent adopt lifestyles within the planet's ecological means'.(Ibid: 97) Despite this so called acceptance, a much later

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technical work in a somewhat a pleading tone, by Crowther notes that ‘ The ecologic responsibility is to ourselves and the global legacy of human habitation. *Every choice made from concept, to design, to realization is a demand that results in ecologic and biologic consequence.*’ (Crowther; 1992: vii)

However, the throwing of these twentieth century gauntlets such as that by Crowther has received results in latter years. Prototypical examples as that presented by Pearson in his Gaia House (Pearson; 1989: 40-41) may have influenced some of the challenges to be presented; the principles in his charter declare ‘ Design for harmony with the planet, Design for peace for the spirit, and Design for the health of the body. The first instruction involves the use of ‘ green materials’ that have as embedded qualities ‘ low environmental and social costs’, which are ultimately bio-degradable and can be or are recycled. Together with this the importance of correct orientation, the use of all the elements for energy including wind, recycling grey water and collecting rain water all add to the minimized impact on the soil. Pearson also mentions the need to maximize the efficiency of the natural spaces by planting indigenous trees and flowers. (Pearson; 1989: 40)

It was only recently, with the building explosion on the Pacific Rim, and the attacks on the World Trade Centre, that the northern hemisphere began to seriously address these issues of sustainable construction, particularly in the densely populated cities of Europe.

In October 2001, the Royal Institute of British Architects (RIBA), hosted a conference that was to address the issues of creating environments that

addressed issues of sustainability. This conference, 'Sustainability at the cutting edge', 'was to provide an overview of the science and technology behind sources of renewable energy which would assume prominence in the next decade. This review was placed in the context of increasing concern about the impact of climate change and the fact that the built environment in countries like the UK is the worst culprit in terms of carbon dioxide emissions.' (Smith, 2003; xi) This quotation, from Smith's technical work, emerged from this gathering. More of a handbook, it examines environmentally sensitive options for heating and cooling, and offering the option for drastically reducing emissions in urban buildings in an environment that (now) tacitly accepts the need for ecological architecture.

A number of approaches which demonstrate the sensitive manipulation of all elements of the brief to create an ecologically sound, a culturally sensitive, a socially appropriate and an economically viable building have come to light, many of which employ much of Pearson's First Principle as mentioned above.

[6] The examples fulfill a variety of scales of development, and different intensities in terms of sustainability with regards to site. On the one hand, it is sadly disasters that prompt new innovative methods of shelter, in a modular though aesthetic form. Out of the Hurricane Katrina catastrophe came the Modular Transitional Growth Housing (MTGH) [7] a conceptual system that consists of a number of elegant forms which can be bunched together in a variety of forms and combinations to shelter, recycle, light and cool. Architect Philippe Barriere introduces a BioClimatic design element with high ceilings and naturally stimulated ventilation which assists in the above. However, this highly conceptual modular structure is on the knife edge of

socially practical and Marxist zeal- seen as an approach that can solve a multitude of housing problems from disaster relief to inner city complexes to fishing retreats, the reality of its implementation is as conceptually choppy as Arcosanti- mass appeal is visual but not implicit.

A more practical and tangible solution to a mass housing challenge is the Greenwich Millennium Village (GMV) by Ralph Erskine, (a veteran of inner city housing in his seminal Byker Wall Project at Newcastle-upon-Tyne) together with EPR Architects Limited. <sup>[8]</sup> The concept is the total regeneration of the Greenwich Peninsula, particularly the site of the former gasworks, where the Millennium Dome <sup>[9]</sup> stands. Its proximity to central London and the City mean that its viability as a dormitory suburb on bus and train routes is practical. The discourse as to how to reuse ‘brownfield’ sites is to some extent resolved here, with the ultimate provision of some 900 residences by the end of 2007 with expansions continuing till 2015. The most important feature of this project is that a newly formed community is occupying the apartments that cater for a variety of different ‘social classes’, with a series of amenities such as an ‘eco-park’ green space, as well as office and retail developments. Using a prefabricated system, the buildings are hardy, but incorporate a generous use of colour. From the perspective of the environmental sustainability point of view, the rainwater is collected, grey water is recycled, insulation is good, which minimizes overheating by artificial means in winter, and the use of recycled materials such as timber, street furniture, and concrete has been a priority (GMV Fact Sheet 5 <sup>[10]</sup>). Maximum efficiency is critical to the brief and in this regard, the website offers the following information-

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The need for artificial lighting is minimized by the provision of large windows meaning less running costs. These windows are made from environmentally sustainable material, and are also well insulated and draught proofed.

Thermally, the buildings are constructed to standards 10% higher than the national standards, which assist in the reduction of emissions. Also, the highly coloured paint is specially chosen for its non-toxic values, and is a non-polluting paint. Water saving devices are used in all sanitary fittings, and plumbed appliances. The rooms in the apartments have sliding sections that maximizes flexibility and enables multiple uses of living space <sup>[11]</sup> .

Power is supplied by a combined heat and power system (CHP) where the generated heat (as opposed to the generated power) is put to use. Excess power is sold off to the national grid (GMV Fact Sheet 4 <sup>[12]</sup> )

The energy constraints that were used as a benchmark in the design process ranged from the amount of energy required for manufacture, to the contribution their manufacturer makes to greenhouse gas emissions. The success of this project thus far has meant that the developers were the first large developers in the United Kingdom to be awarded the ‘ Excellent Eco-Homes’ rating which is an incentive submitted by the Building Research Establishment to promote the construction of eco-friendly domestic buildings. This is certainly a far cry from the establishment’s attitude a few years ago!

The multi-award winning BedZED (Beddington Zero Energy Development) completed in 2002 through the Peabody Trust with Bill Dunster Architects also puts these principles into practice. The mixed-use and mixed-tenure <https://assignbuster.com/sustainable-architecture-and-design/>

development of BedZED is the UK's first and largest 'carbon-neutral eco-community', also built on a 'brownfields' site <sup>[13]</sup> in Sutton, near London. The concept behind the project was to produce as much energy from renewable sources as it consumes, creating a net 'zero-fossil energy development', and therefore a 'carbon-neutral development'; it thus provides no net addition of CO<sub>2</sub> to the atmosphere <sup>[14]</sup>.

Smith describes the development as 'a prescription for a social revolution; a prototype for how we should live in the twenty-first century if we are to enjoy a sustainable future. (Smith; 2003: 153)

The BedZED design concept is itself a model of flexibility, with a variety of different forms of accommodation as well as different types of tenure.

Altogether there are 82 homes of different sizes, some for sale and others rental units aimed at social housing income levels. Amenity is also important, cementing social sustainability, with facilities such as a kindergarten, health centre, commercial use node, exhibition centre and an organic shop!

Environmental sustainability is ensured through the construction of massive walls that store heat for release in cooler periods. Also, a 300mm rock-wool insulation (Smith; 2003: 54) provides for extra insulation on both the walls and the roof. The windows are triple glazed. Orientation plays a large part in the energy efficiency of the buildings, with north facing elevations of office and commercial space optimizing the softer light and minimizing the need for air-conditioning, whilst the homes, which benefit from the warmer orientation, face south. Low energy lighting is used where needed to assist in the reduction of electrical output. As with GMV, the choice of materials was

dependant on their low embodied energy, and were sourced from suppliers as close as possible to minimize transport energy costs. The use of timber from sustainable sources, recycled materials, grey water recycling, solar power, and roof gardens serve to embed the environmental responsibility. Power is also supplied by a CHP plant.

A critical point about BedZED is the minimizations of vehicle use- residents are encouraged through education and the ‘ Green Transport Plan’ to promote alternative means of transport such as walking and cycling. <sup>[15]</sup> Also, the provision of efficient public transport means that the reliance on motor cars can be reduced.

A larger infrastructural solution is that of the Vastra Hamnen waterfront development at Malmo in Southern Sweden. This used to be a ‘ brownfields’ site that was part of the old dockyard. A number of architects including Erskine are involved with the project. The city was participant in the forming of the brief, dictating colour, ecological rigour, provision of park space, and minimal building performance. A wind turbine provides a large source of energy. Again, the complex is socially mixed, minimizing the potential for creating class-based residential neighbourhoods and there are shops on the street level, with the intention that the owners live above them. As in the previous example, the streets are car free and a pool of electric vehicles which are powered by wind energy is available to transport residents to town. Sewage enters the main system in the city, but other waste is dispensed of internally, where residents dispose of food in one tube and then dry waste in another. The tubes lead to common disposal sites where the dry waste is incinerated and the food is composted providing biogas which

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returns to the occupants through the gas main. Smith considers this project as one that has ‘achieved reconciliation between market forces and environmental priorities.’ (Smith; 2003: 144)

The single-building environmentally-efficient challenge was taken up by Sir Norman Foster and his partner Ken Shuttleworth in the Swiss Re Headquarters building, St Mary Axe. It remodeled a conceptual idea developed by Sir Buckminster Fuller and Foster in 1971 called the ‘Climatoffice’ which ‘suggested a new rapport between nature and workspace; its garden setting created a microclimate within and energy conscious enclosure, while its walls and roof were dissolved in a continuous triangulated skin. (Walker in Heartfield & Abley; 2001: 207) Swiss Re was completed in 2004. It is notably the first building of its kind in England to manipulate environmental conditions to minimize air-conditioning, wind loads etc. The forty floors are designed as a series of rectangular plates that spiral up the building, assisting in daylight entering the building and reducing the amount of artificial lighting (Powell; 2003: 219) Revival of and recirculation of stale air is facilitated by roof gardens, also known as ‘bioclimatic terraces’ which re-oxygenate the building. These roof gardens are also used as social gathering spaces, which aids in increasing the quality of the work place. Most of the ventilation is natural, and unlike many buildings of its kind, the windows can all open. The base of the building has been formed to minimize wind load on the building and to minimize the creation of wind corridors so often found at street level in cities. (Powell; 2001: 219)

The new age commitment to the environment and the lessening of emissions is often approached with zeal- Artist Freidensreich Hundertwasser was approached by the Mayor of Vienna to remodel the Spittelau Energy Plant. At first he turned it down, opposed to the assumed ecological failings embodied in the project. However, after assurances that the remodeling of the plant would be including the provisions for drastically reducing emissions, he took on the project for free. Working together with Architect Peter Pelikan, the industrial façade was remodeled into a whimsical parody, where ‘ The power plant..... shows how to foreground the open creative spirit in harmony with nature and the anonymous city’ (Asensio; 2003: 31). Although this is not necessarily as direct an example as some of the new constructions mentioned above, I suggest that it is valid, given that the pressure to reuse buildings is a large part of architectural discourse, and is itself a tactic of sustainability and environmental recycling, the ‘ greening’ of them in terms of minimizing emissions, changing technologies, and in this case mitigating the massive industrial-ness of the power station, makes it more socially environmentally friendly for the residents of Vienna.

In the introduction to *New Architecture in Britain* , Powell states: ‘ the future of architecture, in Britain and elsewhere is linked to such vital issues- the fate of our cities, the housing crisis and the protection of the earth’s fragile environment- that discussion of style seems almost irrelevant.’ (Powell; 2003: 20) This statement, in a glossy publication of contemporary architecture is a far cry from the plea made by Crowther less than a decade ago <sup>[16]</sup> . Whilst I agree with Powell that the language of architecture is changing, as it always does, the discussion of style is not irrelevant- low



budget beauty and elegance is provided by the (highly theoretical) MGTH project, a mix of economic and social strata is contained in the Greenwich Millennium Village, a bold development more agreeable with the Vitruvian ‘Commodity and Firmness’, the BedZED and Vastra Hammen developments that limit motor vehicles and provide the use of electric cars. Ironically, it is perhaps the Swiss Re building, as Powell suggested in his 2001 volume ‘(that) reinforces the point that office towers can be distinctive, even beautiful, objects that complement, rather than deface, the skyline.’ (Powell; 2001: 219) which has managed to push the issue of sustainability and its connection with the very possibility of aesthetic beauty in the Vitruvian model into the forefront of populist architecture.

However, we must not forget, in the clamour of the new, those early visionaries that promoted the values of engaging with the environment and treading with sensitivity. The investigations into the connection between culture, landscape, environment and architecture that informed the basis of the approach to the buildings built today, were seminal works of their time, situated in an alternative environment that was far too left of the modernist mainstream to find favour. But we can also feel thankful that finally, the discourse of environmentally friendly architecture has emerged in the mainstream- let us hope that it is not too late.

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### Footnotes

[1] Sustainability as an idea was a large component of ‘development speak’ in the context of poverty and limited resources. This embraced notions of community participation as well as optimizing resources.

[2] The Oxford Dictionary of Architecture notes that ‘ecological architecture- Aims to respond to declining energy resources, eg using energy conservation, efficient insulation, rainwater, solar radiation, and wind power, and recycling as much as possible. The term was coined in the 1970’s’ (Curl; 1999; 220). Similarly, ‘green architecture- Buildings designed according to energy-saving criteria and the reduction of pollution.’ (Ibid; 288).

[3] From the third chapter of Vitruvius *De Architectura* comes the definition of beauty in architecture as *firmitas, utilitas, venustas* or Commodity, Firmness and Delight. The practicality of the building, as well as its robustness is as important as its beauty.

[4] The necessity to incorporate en