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Natural Technology – New Ways of Working with Nature

TOWARDS A SOLAR VERNACULAR

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The challenges we face in the 21st century are daunting. We need new ideas, new methods and new standards to meet them. Part of this new thinking must include buildings that use as few non-renewable resources as possible and result in minimal local, regional and global pollution. Solar Vernacular buildings must be part of this solution optimising the usefulness of free solar energy and building on a local sustainable resource base.

Solar building contrasts with the more common notions of many architects, who see a building not in terms of their performance or impacts but as a work of art, perhaps on exhibition in a settlement, or as 'frozen music' in the people-less pictures of glossy magazines. Some architects see the process of design as a production line with the building as a product to be deposited on a site, regardless of its particular environment or qualities.

Why bother to change such stereotypes? Because the alternative is not acceptable and 'modern buildings' are literally destroying the planet. It does not help that the numbers of people on the planet are growing so rapidly (5.3 billion in 1990; 8.1 billion by 2020; 10.7 billion people in the 2080s) or that we have increasingly sophisticated technologies to exploit the Earth's natural resources. But it should be widely known that buildings are the single most damaging polluters on the planet, consuming over half of all the energy used in developed countries and producing over half of all climate changing gasses.

The shift towards green design began in the 1970s and was a pragmatic response to higher oil prices. It was then that the first of the oil shocks sent fossil fuel prices sky high and the 'futurologists' started to look at the life history of fossil fuels on the planet and make claims about how much oil and gas were left. Their predictions were alarming, and thirty years on we appear to still have abundant oil. However, their calculations on total reserves were fairly accurate and many of their predictions have yet to be proved wrong. It is now estimated that we have left around 40 years of conventional oil reserves and 65 years of gas left, at the current rates of extraction. Recent studies point to 2012 being when the oil shortages will really begin to bite hard and start changing the face of society. The oil crisis of the 1970s resulted in the rise of the solar house movement, homes built to use clean renewable energy from the sun.

In the 1980s came the next big shock - climate change. It was then that the rates of depletion in the ozone layer, and the increase in the greenhouse gases and global warming became apparent. The predictions made by the Intergovernmental Panel of Climate Change in 1990s, the hottest decade on record.

Just as people dismiss the fossil fuel depletion claims by saying that "they were wrong in the 1970s about oil, you see we have not run out yet", so climate change predictions are simplistically rebuffed with phrases such as "the climate of the world has always changed". Now it is different.

The main Greenhouse gas is carbon dioxide and the main source of carbon dioxide (c.50% of all man made emissions) is buildings. If we continue to produce greenhouse gases at the current rates of increase in a 'business as usual fashion' predictions by the UK Meteorological Office indicate impacts will be substantial and will include by 2080:

- Global average temperatures will rise 3˚c over the 1961-1990 average by 2080
- Substantial dieback of tropical forests and grasslands will occur with resulting loss of CO2 sink
- Substantial decreases will occur in rainfall in Australia, India, southern Africa and most of South America and Europe and the Middle East. Increases will be seen in North America, Asian (particularly central Asia) and central eastern Africa.
- Cereal yields at high and mid-latitudes such as North America, China, Argentina and much of Europe will increase. At the same time cereal yields in Africa, the Middle East and particularly India will decrease leading to increases in the risk of hunger in some regions.
- Sea levels will be about 40cm higher than today with an estimated increase in the annual number of people flooded from c.13 million today to 94 million in 2080. 60% of this will occur in southern Asia, from Pakistan through India, Sri Lanka, Bangladesh and Burma and 20% in South East Asia from Thailand, Vietnam, Indonesia and the Philippines. Under all scenarios sea level rises will effect coastal wetlands, low lying islands and coastal lowlands.
- Health impacts will be widespread and diverse. By the 2080s an estimated 290 million more people will be at risk from malaria, with the greatest risk in China and central Asia. Less people will die in winter in cities in temperate areas and more in summer from heat related problems. (www.met.office.gov.uk/sec5/CR_div/CoP5/obs_pred_clim_change.html). Skin cancer rates have soared. In Queensland, where UV-B radiation is the highest, 3 out of every 4 people are predicted will get skin cancer. In America, in 1935 the chances of getting skin cancer were 1 in 1500, in 2000 it is 1 in 75 (www.geocities.com/Rainforest?Vines?4030?impacts.html)

  There are so many related impacts of greenhouse gas emissions that we only touch on them here. Yet we see them illustrated daily in newspaper articles on the extinction of species, the increase in number and intensity of floods and cyclones, water shortages, and the starvation that result from droughts. What is sure, is that we must act now to reduce CO2 emissions globally and that one of the most effective sectors from which to achieve rapid reductions in emissions is from buildings. Houses consume around half of all the energy used in buildings.

  A recent Report by the Commission on Environmental Pollution in the UK states that if we are to start to try and stabilise climate change we will have to introduce cuts of around60% of all CO2 emissions. This means using less energy to run the home (www.rcep.org.uk/). This is actually not too difficult, as demonstrated in many solar houses. For instance the Oxford Solar House emits around

140kg/CO2/a (kilograms of carbon dioxide per annum) while other similar houses in oxford will produce around 6500kg/CO2/a. This is because the Oxford Solar House is largely run using renewable solar energy, and it demonstrates how important solar technologies are for our future.

But what is the typical architectural response to the challenge of global warming? It is not to make the building do more of the work in providing better shelter against climate change, or use solar technologies, but to install air-conditioning, which is a key element in the vicious circle that is creating global warming.

HIGHER TEMPERATURES

OZONE DEPLETION
GLOBAL WARMING

MORE
AIR-CONDITIONING

MORE ENERGY USED
MORE GREENHOUSE GAS EMISSIONS
MORE EMISSIONS OF OZONE DEPLETING CHEMICALS

Air conditioning systems present the greatest source of climate change gasses of any single technology. In America, which has only 4% of the world's population and yet produces around 25% of the global CO2 annually, over 40% of electricity generated is used in air conditioning systems. Energy efficiency is absolutely not an issue, in general, with the US architectural profession. Climate change is not an issue in the majority of architectural offices around the world who have systematically, over the last thirty years, shut the indoor climate off from the outdoor climate, so requiring air-conditioning to make the building habitable. Air-conditioning engineers have traditionally made their profits, by putting as much plant as possible into a building. It is not uncommon for heating and ventilation engineers to insist on having fixed windows throughout a building, not least because the calculations for system performance are too difficult if an open window scenario is adopted. So, for 12 months in a year, many buildings have to be air-conditioned while perhaps, for only 1, 2 of 3 months in a year, is the external climate uncomfortably hot or cold.

In addition many 'fashionable' buildings designed by architects contain excessive glass, overheat, create extreme indoor discomfort and can only be saved from becoming hellish environments by huge amounts of air-conditioning plant. When sensible engineers suggest that perhaps the building would be better without, for instance, the glass roof, architects have been heard to retort that engineers cannot understand great design ideas and they should do what they are paid to do and not express opinions about the buildings aesthetics.

The world needs a new profession of solar designers, archi-neers or engi-tects, who can design passive buildings, that use minimal energy and, what energy they do use, comes from renewable sources if possible. It is the only way forward.

The future scenario for global energy consumption developed in the early 1990s by the Shell oil company well demonstrates this. The demand for energy will continue to grow exponentially while conventional fuel sources such as oil and gas begin to show significant reductions in outputs. The gap is filled by renewable energies such as wind and photovoltaic (PV:solar electric) energy. It was on the strength of such predictions that Shell and BP have invested huge amounts of money in the development of PV production and distribution companies.

By the decisions we make on the drawing boards in our comfortable offices the global environment is changed. The world is warming and the ozone layer thinning. Some time in the not too distant future, building designers will be made to take into account their own global environmental responsibilities. This will be done through building regulations, cost hikes in fuel prices and carbon taxes. The sooner we start to change the language of architecture, from an appearance driven process, to a performance driven art, the better prepared we will be to lay the building foundations of the post fossil fuel age. The best place to start learning is with a solar house.

In a new book on Eco House design we have tried to bring together 'How To' information on key issues, not well covered in other books. This includes developing technologies, thermal mass, ventilation, cold bridging, materials issues, passive solar design, photovoltaics, cyclone design and grey water systems. The book is not a comprehensive guide to all aspects of low energy or ecological building. Many subjects have been well covered in other books. For example, passive solar design (Mazaria, 1984; Yannas,1994), low energy house design in the UK (Vales,1999); materials (Borer, and Harris,1998; Berge,1999) and timber frame houses (Pitts,1989 and 2000; Talbot,1993). We also think that house buyers can choose many elements for their house pragmatically, with a little help from their local building supplies store. For instance what the best glass is for their windows, based on what is locally available, compared performance data, and what they can afford.

In the book we incorporate the wisdom learnt from solar and ecohouses around the world in the Case Study section. These are not ordinary houses. The majority are built by architects for themselves and often by themselves, not for clients. They express in their varied forms, the local climates, resources, culture and the tastes of their designers as well as the design ethos of the times in which they were built.

The temptation to 'innovate' can often lead us unwittingly into problems, but from them we learn. For example the early solar houses often overheated because in the rush to utilise free, clean solar energy the dangers of the sun were underestimated. The best modern buildings do have excellent solar control and yet it is astounding to see how many still employ glass roofs and walls that not only can cause severe discomfort to people in them but also result in huge bills for compensatory cooling systems. Some people never seem to learn. Clients should avoid such designers.

Today photovoltaics are already cost effective in virtually all countries for off grid systems. In far-sighted countries, such as Japan and Germany, there are already over 10,000 installed domestic PV systems in use. In Britain that has just spent £900,000,000 on the Millennium dome at Greenwich there are about 10 installed grid connected PV systems on houses. To adapt an old Yorkshire expression some people are 'all front parlour and no Sunday lunch' when it comes to sustainability and sensibly investing in the future for our children.

It is incredible to note that many parts of the world the challenges of trying to reduce the catastrophic impacts of buildings on the environment are still left to individuals, even in Britain. The challenges ahead seem so enormous that it is difficult to see what we, as individuals, can do. But it was Confucius who said that if each person solved the small problems over which they have control then the larger problems would disappear.

Why are such important issues as the impact of climate change and fossil fuel deletion ignored by politicians when our species is so obviously at an ecological watershed?. We are only one species on the planet, yet we are multiplying exponentially, every day we destroy more and more other species and their ecological niches, and in many parts of the world we are even destroying our own peoples habitats. This was historically demonstrated on Easter Island where the population of the Island destroyed all the trees on the Island and had to flee to survive. This is happening around us today. Will it be obvious to us that we are the cause, when the first of the Small Islands disappear altogether with sea level rises? Will we register that fact? Can we respond to such challenges in time? Who knows? But one thing is sure that a basic building blocks for a more sustainable built environment are houses in the Solar Vernacular.