

# Build Better Buildings with Zero Emission Design

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A zero-energy building is a term used to describe a building with zero net energy consumption and zero carbon emissions annually. Zero energy buildings can be independent from the energy grid supply. Sandeep Goswami, sustainable habitat consultant, explains how India can work on such designs.



**T**otal Zero Energy Homes are buildings which consume the same amount of energy it is producing. What it actually means is Electrical Energy and to some

extent Water can be recycled.

In the present available technology we have yet to devise a style which could truly give us a Total Zero Emission without compromising the modern lifestyle we live in. However, the recent World Resources Institute report says 2012 could well be the start towards a truly affordable Renewable Energy (RE) source, which is a positive step towards TZED (Total Zero Emission Design).

Let us examine what present technology we have for a Better Building Design. In

India, sustainable building design concept did not come in with the LEED Certification program which the United States of America devised and exported with great success. It was always there, only in our quest to ape the Western design, without understanding the pros cons we forgot to design well. However it cannot be denied that having come to India, Leadership in Energy & Environmental Design-LEED as is most known by improved the awareness level and was soon molded to suit the Indian lifestyle. The CII affiliated, Indian Green Building Council devised the IGBC -Green ratings which most Builders & Corporate Houses around the Country are adopting. What was superlative is, this success of IGBC made the Government of India take notice and revive its commitment towards Sustainable growth in form of GRIHA (Green Rating for Integrated Habitat Assessment).

While many consider both IGBC & GRIHA as competing Green certification program, those who know can only see them to be complimentary and beneficial to India as a whole. And there are a few instances where Architects are designing buildings which take the best of both even though they are not going for any Rating certification. While all this is good it still does not fulfill the true TZED norms because a building from Foundation to Finish is the single largest consumer of all the industry sectors. Anything that is Mined - Extracted - Harvested - Skinned -Chopped - Melted or Frozen is used in a building in some form or the other. And here again we manage to change the original property of the material so much that, it is considered 40% of the World GHG comes from Building related activity and 60% of total waste is Building related.

So how does one proceed to design T-ZED? Now to be truly ZED one must relearn to design and construct with Mud & Bamboo and mix it with use of new technological expertise and products such as Thermo Polymerized Rock , which probably is the best invention to reuse plastic waste. It may not be perfect yet but if popularized perhaps it can have potential. Let us explore the materials in a little more depth. It was HUDCO that sponsored the first international conference on mud architecture in 1987 at Thiruvananthapuram.

The Housing and Urban Development Corporation (HUDCO) head quarter in New Delhi is a beautiful example of traditional architecture with modern functionality. The Stabilized Compressed Earth Block (SCEB)



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Technology used therein offers a cost effective, environmentally sound masonry system. A lot of research has been done on this field and what is required most is that, India which has a rich tradition in mud architecture and more than 65 million of about 118 million houses in the country are made of mud, leading Architects and researches make it main stream. Although there are many buildings in New Delhi and elsewhere in the country, designed from stabilized mud blocks and are modern buildings, designed by Master Architects which are timeless in beauty, ascetics and functionality, one wonders what taking India so long to understand the benefits of Sustainable Design and why a catalyst LEED / GRIHA was required to wake it from its slumber.

While it is true that Mud's declining use in India does not relate to its properties as much as to the perception that a house is more than just a shelter. Most Indians consider a house an appreciating asset and a long-lasting investment and so even the poor dream of a brick-and-mortar home.

If Indians are to accept the use of mud in house construction, they must be shown it can be made to last longer and at costs they can afford. Contrary to what most people think, mud structures do not deteriorate rapidly provided they are properly maintained. Part of mud's poor reputation is because long-established mud-building techniques have been forgotten or ignored. Though people have been building mud houses for thousands of years, the technology is still not sufficiently developed or widely known. It has been a while since The Building Centre in Delhi has worked on the problem of mud and developed a technology to give the exterior facing of mud blocks a veneer of stone, cement or tile. This not only waterproofs the mud block but also makes it more attractive without losing any of the advantages of mud.

Having understood how the masonry work can be made let's look at structural and finishes.

Here we can reinvestigate the properties of Bamboo. Bamboo has a long and well established tradition for being used as a construction material throughout the tropical and sub-tropical regions of the world. With the rising global concern, bamboo is a critical resource as it is very efficient in sequestering carbon and helps in



reduction of Green House gas emissions. Bamboo, a highly versatile resource and widely available, is being used as an engineering material for construction of houses and other buildings. A number of small and medium sized demonstration structures have already been constructed during past few years. These have shown very good performance in different climates.

A study of the feasibility of using bamboo as the reinforcing material in precast concrete elements was conducted at the U. S. Army Engineer Waterways Experiment Station way back in 1964. Ultimate

strength design procedures, modified to take into account the characteristics of the bamboo reinforcement were used to estimate the ultimate load carrying capacity of the precast concrete elements with bamboo reinforcing. Bamboo was given consideration for use as reinforcement in soil-cement pavement slabs in which the slabs behave in-elastically even under light loads. For this case ultimate load analysis was shown to be more economical and suitable for use. Further, The BMTPC (Building Materials & Technology Promotion Council) in collaboration with Indian Plywood Industries Research & Training Institute (IPIRTI), Bangalore, have jointly developed a technology for manufacturing of Bamboo products which are durable, strong, water-proof, and decay-insect-fire resistant.

The next product which one must look at is manufacture and use of Thermo Polymerized rock - which is created from waste plastic. It is as strong as concrete; has excellent thermal insulation characteristics ("U" Value for modular building wall is 0.2 0); is very durable (estimated at 80 plus years); is water proof; is fire retardant; is not susceptible to insect infestation; does not rot; does not leech any harmful elements; has a "Low Carbon Footprint"; is 100% recyclable; has better flex and tensile characteristics than concrete; has a Compressive Strength range 22 KN/mm<sup>2</sup> to 38 KN/mm<sup>2</sup>. This can be used with Hydrafoam blocks which are already approved product by HUDCO.

To build a perfect Sustainable township a Developer must combine a team of architects, planners, infrastructure engineers, structural engineers, construction management personnel, interior and product designers, horticulturists, trained artisans and technicians and most importantly have in their panel Environmental scientist and Geologist. And motivated by urgent need to identify, innovative technologies to supplement age-old concrete and brick & mortar based construction for masonry work. Current times require technologies which are sustainable in terms of one or more of the following parameters i.e. use of locally available resources – material & manpower, cost effectiveness, eco-friendly, easy to adopt in construction practice, can be cast – in situ to reduce transportation, faster to build and energy efficient.

# People, Planet and Sustainability

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If you Google the meaning of "Sustainable Development (SD)", it returns with millions of results in a fraction of a second. Different people may interpret the meaning of sustainable development differently. In short, it refers to a development paradigm where emphasis is given to efficient use of available resources for not only meeting the present needs but also of the future generations and at the same time preserving the environment. This definition first coined by the Brundtland Commission in 1980s, and later on became what is now the most widely quoted interpretation of SD.



Scientists and individuals have always wondered how the earth would look like in times to come if its residents continue to rise in numbers. Can its eco-system

continue to feed people forever and maintain the equilibrium? In 1972, the Club of Rome commissioned a modelling work to study the future of our planet as a result of a rapidly growing world population, industrialization, pollution, food production, and resource depletion. The findings of the same were presented in the famous book, titled Limits to Growth. Three main conclusions were reached by this study. The first predicted that in the next 100 years, the society would run out of non-renewable resources if there is no major change in physical, economic, or social relationships, which govern the world development. In the second conclusion of the study, piecemeal approaches to solving problems were considered insufficient.

Only drastic measures for environment protection proved to be suitable. Third and lastly, overshoot and collapse can be avoided only by an immediate limit on population and pollution, as well as a cessation of economic growth. In 2004, an updated edition was published, using the updated data gathered since the previous work. The message was loud and clear that the overshoot cannot be sustained without collapse; however, humanity can still reverse some of its damage to earth if it takes appropriate measures to reduce inefficiency and waste. The famous Academy Award

winner documentary of 2006 'An Inconvenient Truth' directed by Davis Guggenheim and based on the US Vice President Al Gore's campaign to educate people about global warming ends by saying: "Each one of us is a cause of global warming, but each one of us can make choices to change that with the things we buy, the electricity we use, the cars we drive; we can make choices to bring our individual carbon emissions to zero. The solutions are in our hands, we just have to have the determination to make it happen. We have everything that we need to reduce carbon emissions, everything but political will . . ."

One could disagree on assumptions, sources & quality of information and approach for arriving at such conclusions but not on the final message. Clearly, the balancing act for sustainable survival hinges on the choices and actions of the people. Now, if you were to ask a common man "what does sustainability or sustainable development mean to you?" most of them would struggle to give an answer. At first sign of any expected petrol price hike, I don't understand why we have to rush to filling stations and wait over there in long serpentine queues to get our tank filled up. How much money will one save in this one-time refilling until the next price revision? This behaviour does not encourage conservation as it does not discourage people to drive less, consume less fuel and hence less vehicular emissions. But can we drive more economically or efficiently? No doubt such habits would give us far greater returns than saving some quick bucks on the eve of petrol price hike. This shows that our approach of conveying the meaning of sus-

tainability is ill-defined. A common person needs to be given basic knowledge with examples from the natural and social sciences to understand the principles of sustainable development, and how they can contribute towards it through simple actions in their day-to-day life. It is important to communicate sustainability in a manner that makes sense to people in their context.

Our inability to generate common interest could prove to be a major stumbling block in moving towards sustainable pathways in future. Efforts are being made continuously to educate and raise awareness about the concept and principles of sustainability. Over the ages, the looks and behaviour of homo sapiens have changed beyond recognition. Unfortunately, in this era, people are reluctant to change their basic lifestyles, to which they have become used to. We need to use techniques that emphasize on adapting the behavioural changes and not just on raising awareness. A majority of programmes focussing on awareness raising approaches are convenient for stakeholders, ranging from government to companies, to design and implement. However, these are not convenient to the people in understanding the real cause behind it, providing the knowledge and values that could trigger the desired change. Short-sighted interest of human race is not only contrary to the true meaning of SD but defeats the very purpose in achieving the desired long-term sustainable goals. ICTs (Information and Communications Technologies) could play a vital role in promoting sustainable development in future; challenge, however, lies in the management and collaboration for its effective utilization.