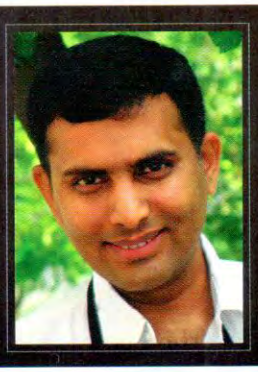
Measuring Sustainability of Building Materials – A Call for Action

There is an urgent need of understanding the building materials manufacturing industry and introducing sweeping reforms in the manner in which they are extracted, manufactured, used, recycled and disposed off, says Vasudevan R Kadalayil, Principal Architect, Ecumene Habitat Solutions Pvt Ltd.



With a Master's degree in Design Science (Energy Conservation) from the University of Sydney, and a passion for Green and Sustainable built environment, **Vasudevan** along with three other partners set up Ecumene Habitat Solutions Pvt Ltd, focusing on design of Green Buildings.

Growing population compounded with increasing affluence and affordability is exerting an unprecedented pressure on natural resources in India. The building industry is at the forefront of consumption of these resources. The construction industry has been growing at a Compound Annual Growth Rate (CAGR) of 13.3 per cent, and this translates to a similar growth rate in

consumption of building materials like cement, steel, etc. There is an urgent need of understanding the building materials manufacturing industry and introducing sweeping reforms in the manner in which they are extracted, manufactured, used, recycled and disposed off. This article is an introductory primer on the concept of "green materials" and the basis on which the "greenness" or sustainability of a building material could be measured.

LIFE CYCLE ENERGY OF MATERIALS

The concept of life cycle energy of building materials is becoming a subject of interest for many scientists across the world. For long, the typical life cycle of materials has been considered to be a linear Cradle-to-Grave approach. The cycle would begin with extraction and end with the product being disposed off as waste. The current thinking is a more cyclical Cradle-to-Cradle approach, where the waste would then be converted to a resource for reuse in the same or another function. A typical example of such a process would be fly-ash bricks. It is a waste product that comes out of combustion of coal in power plants. The disposal of fly ash was a nagging problem until the discovery that it could be used effectively to create lightweight and strong bricks and added as pozzolana material in cement.

EMBODIED ENERGY

Life cycle energy or the embodied energy of a material is the sum-total of energy that is required for a particular material to be extracted, processed and brought to the site of application. Measurement of embodied energy would have far reaching consequences in terms of helping the consumer make an informed decision on selecting a building material that would have the least embodied energy.

TYPICAL ENERGY USAGE TYPES

Energy expended for various stages can be categorised as:

- **Extraction Energy:** The energy used for extraction of the material from its native source.
- **Transportation Energy:** The energy used for transportation that typically would happen between the location of extraction to the location of processing and then to the location of application.
- **Processing Energy:** The energy used for the processing of the raw material to the finished state.

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EMBODIED CARBON

Embodied carbon is essentially a measure to estimate the effects of pollution that would be caused due to the extraction, transportation, processing, and use of material. Exercises in measurements of embodied energy and embodied carbon have been undertaken in the west, particularly in United Kingdom, as the University of Bath, UK has developed an Inventory for Carbon and Energy (ICE). In India, research organisations like the Indian Institute of Science, Bengaluru and others have undertaken some pioneering work in this area.

ENVIRONMENTAL DEGRADATION

Extraction of material for various uses is the root cause of a majority of the environmental degradation that we witness around the globe. This could be in the form of destruction of natural resources, depletion or extinction of wildlife, and destruction of natural wildlife habitats.

SOCIAL COSTS

It is the author's firm belief that sustainability does not just stop with measurement of the above mentioned factors. Extraction of materials brings with it social upheaval, many a times, at the risk of complete eradication of the sole livelihoods of people living in the area of extraction or processing. Extraction of minerals involves large-scale relocation of native populations as has been witnessed in the Chota Nagpur Plateau and its environs. Proper rehabilitation of these societies also needs to be carried out in order to reduce long-term social inequity and damage. In addition of an effective regulatory system that could monitor and audit the agencies involved in extraction, there must be a measure that could document the 'social cost' of a material. In such a manner, power is given to the consumers to make an informed choice on the material that they would purchase.

NEED FOR CONCERTED RESEARCH EFFORTS

Efforts in the green building industry have been based on reduction of operational resources of a building. Rating systems like GRIHA and LEED do not address the aspect of sustainable building materials enough, as there is very little data that is available on the 'greenness' of sustainable materials. There needs to be a concerted effort by the construction industry to understand and act upon the larger problem that we have at our hands as a country. As per the 2011 Census, India has a population of 1.3 billion people. Considering that, major population is still just below or above the poverty line, it is only logical to assume that further growth would put massive strain on the existing natural resources. This growth would be the cause for a degree of environmental degradation that would not have been witnessed in the history of earth's civilisation.

The way forward would involve:

- Creation of a nodal coordination agency for research and policymaking. This would have representations from educational/research institutions, construction industry, contracting companies, mining industry, etc
- Creation of a nationwide research policy and strategy
- Institution of scholarships and research grants
- Consolidation, review and analysis of data on a periodic basis and establishment of benchmarks
- Creation of a roadmap towards gradual phasing-in of these benchmarks into techno-legal regulations

An exercise of this kind demands the attention of all in the construction industry and a call for concerted action in this regard must be recognised at the earliest, in order that we leave an earth, that could be meaningfully enjoyed by succeeding generations.