

Special Lecture delivered by Dr. Gajanan M. Sabnis Emeritus Professor, Howard University, Washington, DC on “Sustainability and Green building”

Dr. Gajanan Sabnis, commenced his presentation with a brief history of sustainability and he specifically recalled the definition of sustainability adopted by the American Society of Civil Engineers in November, 1996. The definition adopted then, is as much valid today as it was then and is reproduced below:

“Sustainable development is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development”.

In the same breath, Dr. Sabnis also reminded the audience of the following definition of Green Buildings as given by the U. S. Green Building Council:

“Design and construction practices that significantly reduce, or eliminate the negative impact of buildings on the environment and its occupants with regard to site planning, safeguarding water use and water use efficiency, promoting energy efficiency and renewable energy, conserving materials and resources, and promoting indoor environmental quality”.

In the above backdrop he reeled out some of the relevant statistics of the U.S. construction sector :

- 76 million residential buildings in the U.S.
- 5 million commercial buildings in the U.S.
- 40% raw materials consumption by this sector.
- 32% of the total energy produced goes to this sector.
- 17% fresh water is consumed by this sector.
- 25% global wood harvest is used up in the U.S.
- 5 billion gallons of water per day is used just for toilets.
- In terms of waste generation one may note : 25-40% of municipal solid wastes, 50% of the CFC production and 30% of the CO₂ production in the country.

In addition the building operations result in 49% of sulfur dioxide emission, 25% nitrous oxide emission and 10% of all particulate matters.

Dr. Sabnis emphasized that building green can be done for no additional cost. LEED buildings in the U.S. show only 2-3% cost increase on an average but it is believed that

they can be done for the same budget as traditional buildings with proper planning. Savings from green buildings more than return any premium that one may choose to put into it. Design fees may be higher for Green Buildings but the construction costs can be reduced. In this context he reminded about Gandhian engineering which was targeted towards “getting more from less for more “. In other words, when the green buildings are made less expensive, many more people at the bottom of the pyramid will afford it and the societal benefits will accrue rather than making them expensive as a prerogative only for the top.

Concrete, he reiterated, is a green and durable product, if properly designed and used. The ready-mixed concrete plants should be a preferred mode for supply of concrete and he also gave an example of how a concrete home survived in a flood- devastated area in the U.S. (Fig. 1). Similarly, concrete houses saved lives in the case of fire (Fig. 2).



Fig 1: Survival of a Concrete Home in a flood-devastated area



Fig 2: Survival of a Concrete Home in a fire

A lot of useful steps should be taken at the design stage such as for the facade, the plan configuration, natural lighting, roof top section, etc. Water tanks/ catchment can be located on the roof top with a meter of water body, which acts as an insulator from the heat. Additional coating can be applied around the water area to reduce the glare and the surface temperature.

Use of Portland Pozzolana cement, recycling of water etc. should be duly considered. Dr. Sabnis also emphasized the importance of life cycle cost analysis (LCCA).

He illustrated the approach towards making a green house with the help of his own home in the U.S. which has the following important features:

1. Insulated concrete.
2. Recycled light-gauge steel.
3. Composite structure using concrete and steel.
4. Geothermal energy source.
5. Solar energy to complement the geothermal system.

An internal view of the hybrid construction is given in Fig. 3.



Fig 3: Staircase of composite steel and concrete

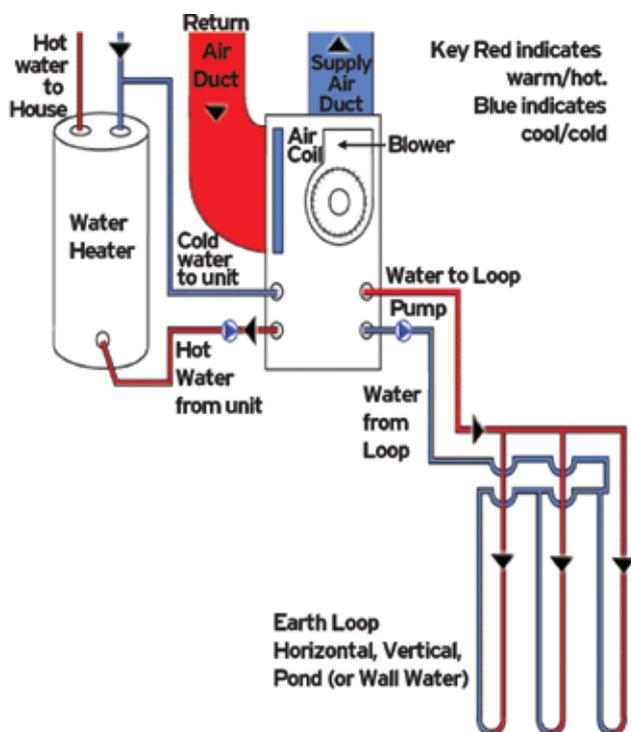


Fig 4: Geothermal heat pump installation system

The incorporation of geothermal heat pump (GHP) in the building was highlighted as a means of recycling the green energy. About a meter below the earth's surface, temperature remains relatively constant round the year (~15°C). A geothermal system, which consists of an indoor unit and a buried earth loop, capitalizes on this constant temperature. In the summer the system benefits from cooler temperature of the earth and carries it indoors. In the winter the process is reversed. Heat from the earth is carried indoors. The indoor unit compresses the heat to a higher temperature and enables space as well as water heating. This reservoir is available to any site, any locality, any country, at all times. A schematic circuit of the system is given in Fig. 4.

Other energy conservation measures included the use of low-E value windows, savings in utility bills, better sound insulation and external thermal insulation. Use of solar panels in the U.S. was also found to be economically viable with a payback period of 5 years and ROI of about 20%.

Finally, Dr. Sabnis put forth a case study of a sustainable city, providing the highest quality of life with the lowest environmental footprint having the following indices:

- 100% renewable energy
- zero waste
- zero carbon emission
- Fossil fuel free zone

He referred to the Masdar City initiative in Abu Dhabi in U.A.E. see (Fig. 5) It was indicated that the International Renewable Energy Agency (IRENA) established in Bonn on 26th January 2009 will share experiences on best practices and lessons in this project.



Fig 5: Masdar City Initiative

In conclusion, Dr. Sabnis mentioned about his book entitled "Green House: The Energy Efficient Home" and also about his next monograph on "Sustainability and Concrete" to be published later this year.

[Lecture was delivered on Healthy Construction Lecture series by Dr. Gajanan M. Sabnis, Emeritus Professor, Howard University, Washington, DC. at Bangalore and Mumbai on 4th and 5th June, 2010 respectively]