Urban Pathways

FACTSHEET on
Green buildings
2018

Wuppertal Institut

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In brief

Conventional construction techniques account for significant adverse environmental impacts, due to their major energy and resource consumption: global energy use (40%), global GHG emissions (38%), global potable water use (12%) and solid waste streams (40%) result from building activities. Total emissions from the cement industry contribute up to 8% of global CO2 emissions (Andrew 2017).

The careful design of green buildings in developed and developing countries can reduce building related energy use by 30-50%, GHG emissions by 35%, water use by 40% and waste outputs by 70% (Comstock et. al 2012). The integrated design approach in green buildings optimises energy use and incorporates renewable energies, saves water and ensures its reuse/recycling, uses efficient means of transport and reduces distances, undertakes site planning and biodiversity conservation, improves indoor environmental quality and occupant's health with thermal comfort, reuses and recycles materials and manages waste effectively - aiming at the reduction of the environmental footprint of buildings. Green building certificates such as DGNB in Germany, BREEAM in UK, GRIHA in India are some of the rating systems for evaluating and certifying green buildings.

Examples/measures

Some of the measures to reduce the environmental impacts of the buildings during the construction and the use phase are (Shrestha 2016):

- Energy efficiency: the largest share of domestic energy consumption is used for heating, cooling, ventilation, lightings and hot water. Designing buildings adapted to climate zones, the proper selection of the building form, its orientation and building envelope technologies can significantly enhance energy efficiency. Further, energy use can be optimised by including efficient Heating, ventilation, and air conditioning (HVAC), lighting and the use of building automated systems. The use of renewable energy technologies, in addition to energy optimisation, such as PV and solar heated water etc help to further increase the efficiency level of a building.

- Green buildings ensure water efficiency or secure water resources by recycling/reclaiming water use, capturing greywater for use in landscape or sanitary systems, by the efficient use of drinking water through better design and technology and capturing on-site stormwater for use or groundwater recharge.

- The selection of appropriate sites in green building reduces damaging virgin land or disturbing eco systems, infrastructure needs and increases community connectivity. Proper planning of buildings reduces heat island effect and stormwater control, and increases indoor air quality and comfort.

- The efficient use of building materials conserves non-renewable resources and reduces the environmental impacts of a building throughout its life cycle. The material efficiency of a building can be increased through the efficient use of materials, the substitution of concrete with wood or the high-grade use of recycled material, resulting in minimised waste streams and reduced GHG emissions.

Some cities such as Mexico city in Mexico and Pune in India (explained in case study) have initiated Sustainable building or eco-housing program incorporating these measures. Mexico city's Sustainable Buildings Certification Programme (SBCP) contribute to the city's aim to reduce GHG emissions 50% by 2050 compared to 2000 levels. It grew out of the city's First Climate Action Programme that was set to tackle challenges in the building sector. Participation from owners and tenants is incentivise through tax reduction, reduced energy and water bills, access to project financing, accelerate permitting procedures, and

prospects of increased rental yields from green premium. The 40 certified buildings in 2015 have achieved a total reduction of 20.1 million kWh of electricity, 66,120 tonnes of CO2e and savings of 205,690m3 of potable water (Trencher et al. 2017).

Results

Energy and resource efficient buildings not only help to reduce their impact on the environment (such as through energy saving and energy security, GHG emission reduction, natural resources management/ protection, water saving and water security, and reduction of carbon footprint in the building), but also help in the socio- economic development of the country by providing security and health benefits, enhance quality of life, long-term cost saving, green growth and green economy and (energy) poverty reduction). The financial benefits of green buildings include investment payback (with varying payback period), higher rent, higher building values and job creation.

Technical and financial considerations

Various BATs (Best Available Technologies) are available worldwide, from simple to complex systems, which can result in huge reductions in energy and resource use. With the selection of the appropriate technologies, careful designing and detailed construction processes, green buildings are perceived to have higher upfront cost compared to conventional buildings. But it proves to be economically beneficial in the context of building's life cycle. Data from 170 green buildings in the USA showed that it costs, on average, only 1.5% more to construct green buildings than to construct conventional buildings, while public perception was that the cost would be approximately 17% more (Kats, 2010 in UNEP, 2011).

In view of the economic (as well as the environmental and social) benefits of green buildings, a variety of different stakeholders should feel incentivised to construct such buildings. But the stakeholders are confronted with general barriers that prevent the large-scale transformation of the market, including a lack of awareness of energy and resource efficient technologies and options, uncertainty about the related financial and other benefits (e.g. variations in payback periods), a lack of motivation due to other priorities (willingness to pay) and capital constraints and risk aversion (ability to pay).

Policy/legislation

In many countries, the construction of green buildings is still slow due to the lack of public policy to stimulate energy and resource efficiency and limited governmental efforts to regulate the conservative building industry (Ryghaug & Sørensen, 2009). Some of the policies that enhances the uptake to green buildings are:

- A clear political commitment to green buildings, demonstrated by setting ambitious yet achievable energy and resource saving targets
- Regulations with minimum baselines for green buildings to be set by standards and codes.
- Develop or strengthen the certification systems or labels (such as LEED in US and GRIHA in India)
- Flagship projects and public procurement policies that favour green buildings
- Provide information on energy and resource saving opportunities, cost savings and other benefits of energy and resource efficient buildings to investors and end users (such as through demonstration buildings, information campaigns and websites)
- Financial incentives (loans, grants etc) to tackle the increased up-front cost during construction.
- Capacity building for the workforce in the building sector (i.e. architects, planners, developers and building contractors etc.)
- Incentives for the recycling of construction and demolition waste.

Institutions

The lead agency for the initiation and implementation of green buildings is the department of housing in the ministry. Local governments such as planning authorities support public procurement policies. Associations Chamber of Architects act as multipliers and awareness developers. Subordinate authorities such as government offices for building and regional planning can also facilitate dialogue among the manifold stakeholders and contribute to aligning their interests. Funding support is needed from financial institutions – international (for demonstration, research and development, capacity building), national banks (for upfront cost, to provide incentive with low interest loan, e.g KFW in Germany, State Bank of India).

Transferability

Good practice examples of green building techniques are highly replicable to another cities and countries, but need to consider country's climate and the availability of technologies. The promotion of green buildings depends on the existing regulatory framework, urban planning specifications, and the pay-off structures for builders, architects, building companies and residents.

Case study: Pune, India

Context

India has introduced a national green building standard – GRIHA. It has also adapted to US LEED standard to local conditions in India (LEED India). Suzlon one Earth, an office building that house 2,300 people, is a Platinum certified LEED and GRIHA 5 star rated building in Pune built in 2010. Suzlon one earth is 100% powered by onsite and offsite renewable sources (80% hybrid wind and 20% solar) with energy optimisation measures to maximise daylight exposure that reduces the need for artificial lighting. The infrastructure within the campus is designed to enable water percolation which control storm water runoff and contribute towards an increased water table level (Lokaa Developer 2016).

Municipal corporation in Pune has taken active participation in building green homes. The Pune Municipal Corporation's (PMC) has also launched ECO-Housing Program in 2008 to encourage the green development in the city.

Image: Suzlon Earth one building in Pune (Photo: ashish963/flickr/2011)

In action

The PMC eco-housing program aims to promote environmental, economic, health and safety benefits in a building, and plans to educate developers, architects as well as buyers to improve the environment of the city as well as to create awareness of such homes. It uses Eco-housing assessment criteria to certify the environmental performance of the building, developed by Science and Technology Park of Pune. PMC has the concept of providing tax benefits of 5-10% for the green building construction.

Results

A number of green building construction in Pune is in rise but very slow. Through the PMC eco-housing program 63 projects are registered and 42 projects are awarded provisional certificate. Within 1.5 million sq. m certified built up area, the conventional energy use has been reduced (60-65% electricity saving) and increased the use of renewable energy for outdoor and indoor lighting. Further benefits are 50-55% of water saving by waste water treatment, reuse and management amounting to 9 million litres/day through rainwater harvesting and storm water collection and recharge, estimated carbon footprint reduction per year would be around 80,000 tonnes (PMC eco-housing website).

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