



GREEN BUILDINGS: REVIEW

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ABSTRACT

India is experiencing an incredible growth in the construction and real estate industry. Due to this rise in the construction sector raised many issues related to the environment and sustainability. As per economic policy forum, in its report mentioned that in India the energy consumption in buildings is for heating, ventilation and air Conditioner accounts for between 45% and 65% of total electricity consumption. Another study states that the construction sector of India emits about 22% of the total annual emission of CO₂ which is very harmful for the environment. So to handle the adverse situation a new and important concept is emerging in India that is Green Building. So this article gives you the understanding about the green buildings, How the green building get rating from the rating agencies, Importance of green buildings, and examples of some companies and organization that are taking the advantage of green wave and is flourishing.

Key words: Green Growth, Urbanization, Construction Sector, Electricity Consumption, Energy utilisation.

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1. INTRODUCTION

Green growth involves rethinking growth strategies with regard to their impact on environmental sustainability and the environmental resources available to poor and vulnerable groups (Para 3.15, TFC, 2009)

Green growth is about maximizing economic growth and development while avoiding unsustainable pressure on the quality and quantity of natural assets. It is also about harnessing the growth potential that arises from transiting towards a green economy (OECD, 2011).

Construction sector (covering both buildings and infrastructure) is essential for economic growth and development and exerts a lot of environmental pressure (exacerbated when done

the conventional way) and consumes natural assets (like top soil, water, wood, stones, and metals/glass/alloys) during construction; and also involves increased consumption of electricity and water.

With this context, green growth in building sector comprises of minimising environmental implications caused due to construction activities and thus, focuses on energy conservation, energy efficiency, integration of renewables, lesser consumption of water and sustainable waste management. It also aims at building resilience (to climate change impacts/extreme events) without compromising the thermal/visual comfort of the inhabitants/users.

The building sector is interdependent and interrelated to several other sectors; and therefore the measures taken to achieve green growth in this sector are bound to have several benefits and co-benefits. The Green Growth vision for the building sector is envisaged to have the following

- Optimal utilisation of land for settlement keeping in mind the eco-sensitivity of various areas
- Nearly Net Zero Buildings (NZEB) by 2047 for both new and existing buildings with emphasis on regional priorities within the country
- Supply of alternative native high performance low-cost materials to high embodied energy materials such as steel, cement, bricks and glass
- Enhanced use of passive design measures and optimal use of active measures for thermal comfort
- Adoption and adaption of alternative construction technologies with lower embodied energy/cost savings/faster construction

Nearly net zero energy buildings (NZEB) is mentioned here as there are considerable constraints in having NZEB in cooling dominant climate and drastic changes in technology (energy efficiency and energy generation through renewables) is required.

Other pre-requisites of green-growth development such as balanced regional development, improved urban planning, and development in other sectors of the economy are not covered here.

1.1. Urbanization trends and projected demand for real estate space in India

India is a fast urbanizing country. The urban population grew from 290 million in 2001 to an estimated 340 million in 2008 and is likely to increase to 590 million by 2030. There is a distinct disparity observed in the state of urbanization within the country as seen in Figure 1.

Amongst the five states likely to be urbanised more than 50%, Punjab stands at number five while Himachal is expected to be primarily non-urban with not more than 20% urbanised population by 2030.

There is no single reliable statistics on correct information on the total built-up area and area added every year for various categories of building types across the country. Different real estate and management companies, research institutes and organizations bring out reports/articles with estimation of existing building stock or estimated area added to the existing building stock every year. There is a wide variation in the numbers estimated in these reports and it is difficult to cross check the accuracy of these numbers as all the estimations are based on secondary data and different methodologies are used for arriving at these numbers. The real estate demand is likely to be led by the residential buildings, including affordable housing segment. As per a report of the Royal Institution of Chartered Surveyors (RICS), 4127 million m² of real estate space (which includes residential, retail, offices, hotels, health care, and education sectors) is expected to be built between 2012 and 2020³ (Figure 2).

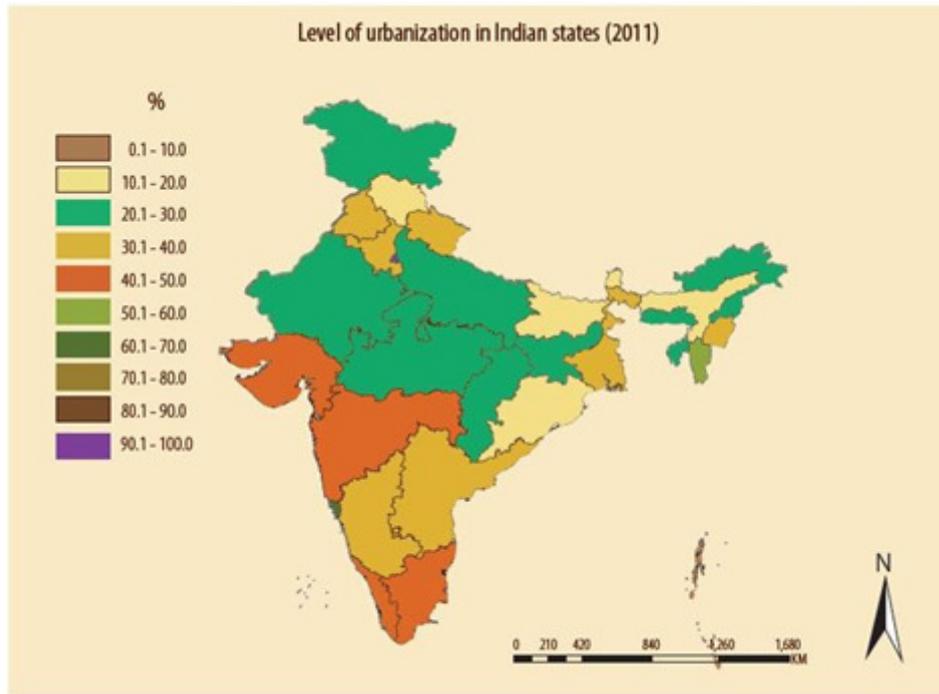


Figure 1 Urbanization in Indian states in 2011

Source: Ruchira and Kansal (2014)

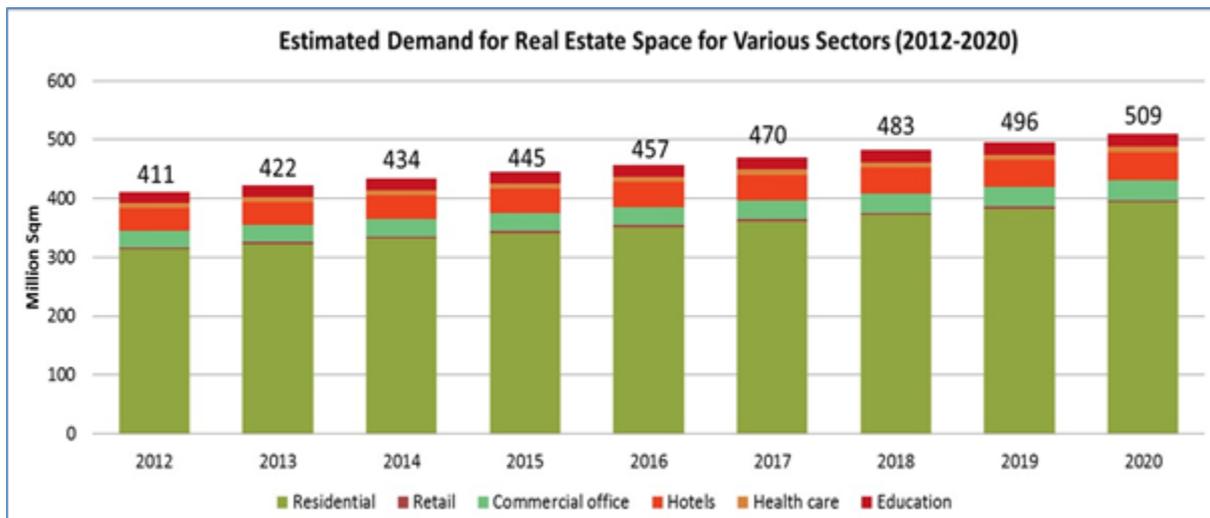


Figure 2 Estimated demand for real estate space for various sectors (2012-20) Source: RICS (2011)

1.2. Share of construction sector in GDP

Services constitute a major portion of India’s GDP with a 64.8% share in GDP at factor cost (at current prices) in 2013-14 — an increase of 6 percentage points over 2000-01. The share of construction sector in the overall GDP is 7.8%. The CAGR of services sector GDP at 8.5% for the period 2000-01 to 2013-14 has been higher than the 7.1% CAGR of overall GDP during the same period. The GDP contribution of the construction sector is estimated to grow at a CAGR of 9.5-10 percent till 2022 in real terms.

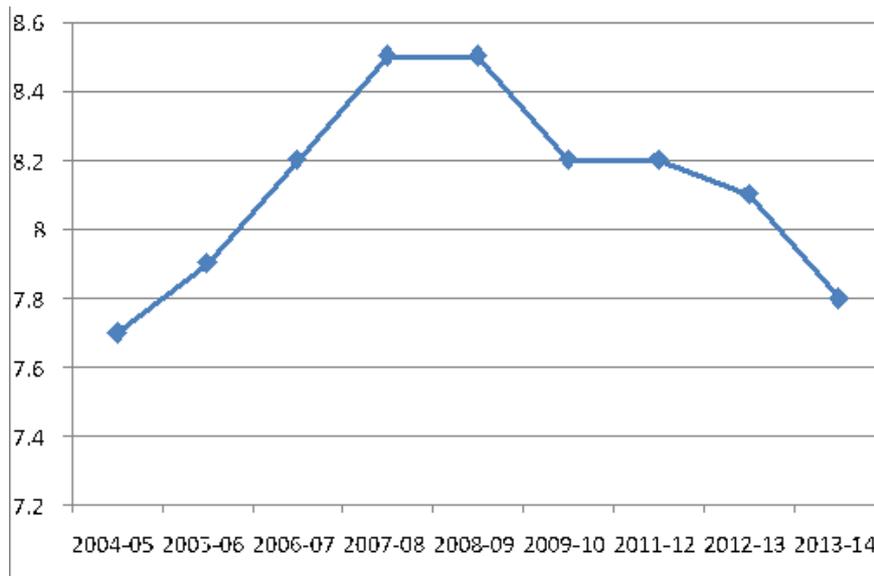
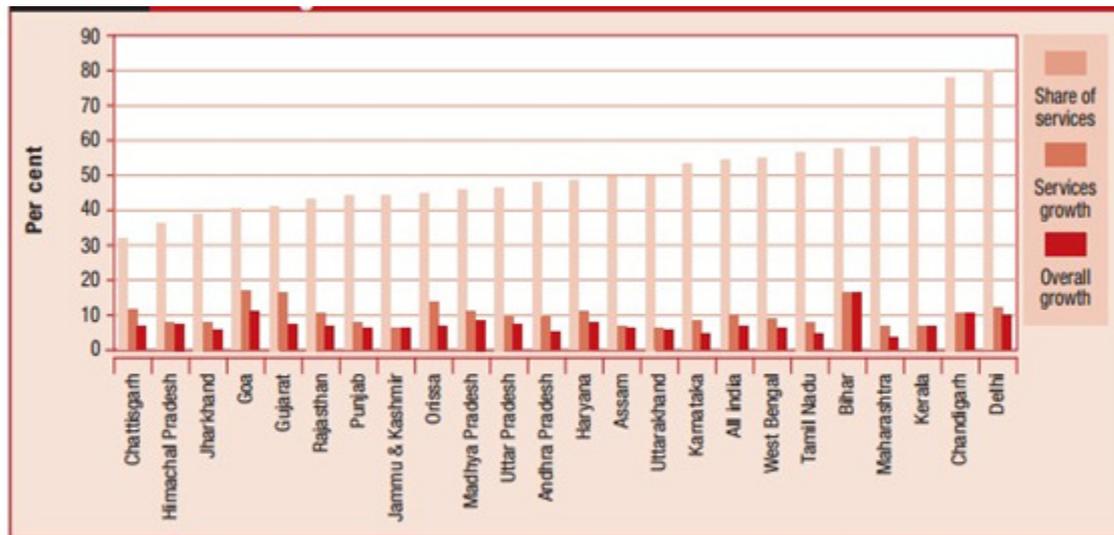


Figure 3 Share of construction sector in GDP at factor cost

Source: Central Statistical Office (2015)

A comparison of the share of services in the gross state domestic product (GSDP) of different states and union territories shows that the services sector is the dominant sector in most states of India (**Error! Reference source not found.**). Unlike Delhi, Chandigarh, States such as Himachal Pradesh and Punjab have shares below the all-India share.



Note: Data in the case of Goa and Jammu and Kashmir are for 2007-08. Shares in current prices, Growth rate constant prices.

Figure 4 Share of growth of services sector in 2008-09

Source: Economic Survey 2014-15

Real estate and ownership of dwellings with a share of 5.9% in India’s GDP grew by 5.6% in 2012-13. Real estate in particular, grew by 26.1%. Housing activities have both forward and backward linkages which not only contribute to capital formation, generation of employment, and income opportunities but also to economic growth. Estimates show that every rupee invested in housing and construction adds 78 paise to the GDP (Economic Survey 2014-15)

Though house prices have skyrocketed over the years in many cities and towns as per the National Housing Bank's RESIDEX index of residential prices in India across cities, few cities like Ludhiana (Punjab) witnessed a 16% decline.

Investments in the real-estate sector have a positive and multiplier impact on allied industries, such as cement, steel, sand, timber and architecture. As per statistics, 78% of the sum spent on the construction of a housing unit gets added back directly to nation's GDP.

1.3. Employment generation by buildings sector

The sector is the second largest employment generator after agriculture with an estimated share of 20-30%. The employment levels in the construction sector increased from 17.54 million in 1999-2000 to 52.16 million by 2009-10 as per the Planning Commission estimates.

Confederation of Real Estate Developers' Associations of India (CREDAI) estimates that the employment in the real estate sector was nearly 7.6 million people in 2013. Given the total existing demand for real estate in the country, the number of real estate sector employees could go up to about 17 million by 2025.

1.4. Green growth and buildings

It is widely recognised that the consumption of resources by buildings increases with the level of economic development. Additional factors are population growth, urbanization patterns/level, shift from biomass to commercially available energy carriers, especially electrification, income (a strong determinant of the set of services and end-uses), level of development, cultural features, level of technological development, individual behaviours, availability and financial aspects of technologies/materials.

The sector is a big consumer of resources (energy, water, materials) and generator of pollutants during the construction, operation and demolition phase. Access to adequate shelter/house continues to pose a big challenge for India, in spite of several key programs and initiatives run by the government at national and sub-national levels. Living in inadequate houses and habitat further degrade the environment and also pose grave health implications for the residents and surroundings. It is therefore rightly believed that greening the building sector can help transform into a green economy because of its inter-linkages with all the other sectors of the economy.

The building sector currently consumes 30% of the overall electricity consumption (from utilities) by the country, out of which almost 72% is consumed by the residential sector. A closer look at the electricity consumption pattern of the residential sector shows that fans and lighting consume more than 60% of total the consumption. As per a study, the average household is likely to consume five times more electricity in 2020 than in 2000. An increasing trend of appliance ownership by households is reported which will lead to an increase in fuel demand. With reference to the year 2011, by 2021 the electricity consumption by heating/cooling appliances and by lighting will grow by 180% and 80% respectively (World Bank 2008).

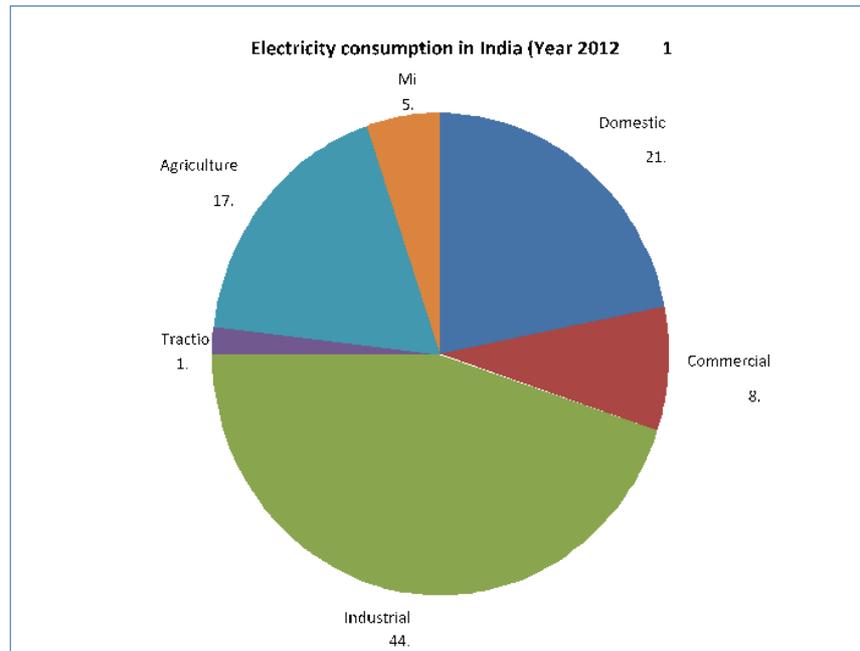


Figure 5 Electricity Consumption in India (2012-13)

Source: Central Electricity Authority, 2014

India like many other developing countries faces several social, economic and environmental challenges for the building sector. Non availability of house and an ever increasing housing requirement need with increasing urbanisation is one of the biggest challenges India face. The Report of the Technical Group on Urban Housing Shortage (Ministry of Housing and Urban Poverty Alleviation, Government of India) estimated the shortage of urban housing in India at 19 million dwelling units for the 12th Five Year Plan (FYP). Close to 95% of this shortage is concentrated in the population identified as Economically Weak Sections (EWS) and Low Income Groups (LIG). Whereas, the total rural housing shortage for the 12th FYP (2012-17) is estimated at 44 million dwelling units.

A large section of the society living in so-called slums, shanties, jhuggies, pavement, rural areas live in unhealthy conditions with poor sanitation facility, inadequate ventilation, poor thermal comfort and non-availability of safe drinking water leading to environmental pollution. This further leads to poor health of the inhabitants, morbidity and mortality, loss of income and productivity. Indoor air pollution from poorly combusted solid fuels combined with poor ventilation is a serious concern in the sector and cause of premature deaths and lung infection. Studies suggest estimated two million premature deaths, particularly in women and children due to exposure to indoor smoke (Wilkinson et al. 2009)

Having an alternative pathway for the building sector is a need of the hour given the increasing urbanisation rate and projections of reaching 50% urbanised by 2030 (McKinsey 2008). Cities, which are already suffering with huge infrastructure gaps in all respects-water supply, sewage, sanitation, solid waste management, power, will find even greater challenges in meeting the increasing housing requirement for all sectors-specially the marginalised ones. As per the National Housing Bank, factors such as rapid increase in land prices, inadequate infrastructure, absence of long-term loans for borrowers at reasonable rates, limited developer finance and lack of access to housing finance for low-income, rural and informal groups are some of the constraints for affordable housing. Although there are several government programmes and self-help groups to push affordable housing, but these have not been able to

achieve the desired scale. Funding agencies are often shy to fund low income housing due to unclear land titles, lack of mortgage insurance, inability to assess credit risks and absence of salary/income statements.

Apart from the above, there is another section of the housing sector which essentially caters to the needs of middle and upper income groups and is increasingly becoming more electricity and water intensive due to changing lifestyles, demand for air-conditioners, and penetration of more gadgets and appliances. Due to split incentives, developers are less interested in building green housing.

Building sector also comprises of commercial buildings which include various institutional and industrial establishments such as banks, hotels, restaurants, shopping complexes, offices, and public departments supplying basic utilities. Commercial buildings are often energy and resource guzzlers and therefore, offer ample opportunities to take a greener path in the entire life cycle. Greener commercial buildings besides saving on energy both during construction and operation, save on fresh water use consumption, recycle and reuse of treated wastewater on-site and reduction of waste going to the dumpsite/landfills. The sector poses a lot of opportunities to convert the new construction happening in this sector as resource and energy efficient.

Apart from energy use, buildings sector is also responsible for roughly 12% of fresh water use, generation of an estimated wastewater of 22,900 million litres per day (Mld) , most of which goes untreated to the very sources of water-rivers, streams and ocean.

India generates more than 40 million tonne of municipal waste annually from urban centers which is collected poorly (average collection efficiency is 72%), transported inadequately (70% cities lack required transportation capacities) and disposed unscientifically (no sanitary landfill for municipal wastes exists). Prevailing solid waste management systems in Indian cities are publically operated through municipalities, which are already overburdened and have not been very effective as far as services are concerned (Ghosh and Kansal 2014) Building construction and demolition waste contribute significantly to the overall waste generation. Buildings are also responsible for a huge quantum of electronic and municipal waste. All of this needs immediate corrective action for all sustainability concerns.

In India as elsewhere in the world, the embodied energy of the building sector is increasing exponentially due to the high rate of construction (10-15%) and poor choices of materials. The traditional burnt clay bricks continue to be the primary raw material for building sector all over India. Brick making consumes fertile top soil from agricultural fields making these unfit for cultivation for many years. Also, brick making process causes a lot of air pollution and GHG emissions. Production of an estimated 170 billion bricks annually consumes around 24 million tonnes of coal and the process emits 61.3 million tonnes of CO₂ into the atmosphere (TERI 2012). Cement and steel are the other two key building materials which are also very resource intensive and account for considerable GHG emissions.

Greening of the building sector requires market push for appropriate green materials materials with low embodied energy to be made available at affordable costs. It is therefore, imperative that there is an urgent need to look for and develop alternative materials, which are energy efficient and more environment-friendly. Fly ash clay bricks, fly ash lime sand bricks, autoclaved aerated concrete (AAC) blocks are some of the alternatives being promoted. Introduction of the Energy Conservation Building Code, 2007 has also incentivised alternate building materials such as high performance glass and materials. Given the growing penetration of environmental assessment systems such as Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy & Environmental Design (LEED) and benefits accruing from energy efficient buildings, alternate materials market has a promising future. Use of fly ash in cement in the form of Portland Puzzolana Cement (PPC) is on rise. However, issues

continue with maintaining the requisite quality and/or unavailability of fly ash in all regions. Even on the technology front, building sector continues to depend on manpower intensive traditional construction practices, which are slow and highly dependent on skilled labour input - a category already scarce in availability. Of late, several foreign players have started coming to the country given the large market potential. Currently, there are hardly any materials' testing laboratories in the country to provide thermo-physical properties of the high performance materials and products. The country needs a well-drawn strategy at the highest level and an implementation plan to generate local markets for quality materials and products.

In spite of the overwhelming challenges in greening of the building sector, there is a silver lining in the form of potential to generate new green jobs in this sector. Besides, the sector requirement for high performance building materials has the potential for a vibrant industry. The challenge however, remains to make such materials and products available at an economical cost.

This sector also holds a good potential for renewable energy integration. Much work is already happening for mandatory inclusion of solar water heating systems in such buildings. Studies taken up by Greentech Knowledge Solutions for Ministry of New and Renewable Energy indicate some 0.7 million households using solar water heaters. In the hotel and industrial sector, the awareness and penetration of solar water heater is much larger. There is also a big market to introduce building integrated photovoltaic and other renewable energy systems (depending on the feasibility) for electricity generation (off-grid or on-grid) application. The ambitious Jawaharlal Nehru National Solar Mission anticipates covering 20 million sq. m by 2020 under solar thermal collectors. For grid power including rooftop and small plants, 20,000 MW is anticipated to be generated by 2020 through photovoltaic. This shall generate more green jobs besides the various associated environmental benefits.

2. CONCLUSION

Green building is a financially, health, and most importantly environmentally responsible idea that more people need to adopt. The United States Green Building Council developed LEED in order to help customers, designers, and builders to work together to create buildings with the minimal impact on the environment possible. Many building materials and renewable energy sources exists to lessen one's impact upon the environment.

Through educating, making environmental products more readily accessible and reliable, and by providing government incentives it is possible to encourage more people to adopt green building and all of the benefits that come along with it.

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