01 WHY 'GREEN' BUILDINGS?

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Buildings are complex ecosystems. They use up resources and can generate wastes. Available evidence shows buildings can be responsible for 40 per cent of the energy, 30 per cent of raw materials, 20 per cent of water and 20 per cent of land used up by cities. Additionally, they can account for 40 per cent of carbon emissions, 30 per cent of solid waste generation, and 20 per cent of water effluents discharged in our cities.[1]

In India, the real estate sector contributes a hefty 10 per cent of the country's GDP. Though India's urbanisation remains modest at 30 per cent and is expected to only go up to 40 per cent by 2030, it is still substantial in absolute numbers. Almost 590 million people will be living in India's cities which would be nearly twice the size of USA today.[2]

Future urban growth will see greater involvement of the middle class. A 2010 study on urban infrastructure, done by … McKinsey, estimates that the so-called 'seeker' class (with a household income of Rs 200,000-500,000 per annum) will be the most dominant income class and is expected to be half of all urban households by 2025.[3]

With changing income levels, future cities will witness more concentrated buying power, transformed lifestyles and aspirations to high-end, resource-intensive comfort levels. Increasingly, they will face the challenge of balancing this kind of lifestyle with the need to be resource-efficient. They will need to find ways to build more sustainably and efficiently, and to emit much less than they are doing now.

Real estate and urban growth: the trends

Available data – which is extremely limited – suggests some trends. According to Environmental Design Solutions Pvt Ltd (EDS), a New Delhi-based consultancy firm, the overall constructed area in India in 2005 was estimated to be close to 21 billion square feet. By 2030, this is expected to swell by around five times to approximately 104 billion sq ft.[4]

In terms of constructed area, the maximum growth will be seen in the residential and commercial sectors (four to five times the 2005 figures). Hospitality and retail, which have had a relatively smaller constructed area so far, shall achieve a higher compound annual growth rate (CAGR) in the range of 8-10 per cent; by 2030, they will become 7-11 times what they were in 2005.[5]

According to real estate consultant Cushman & Wakefield, if one considers built-up spaces by usage, the demand for residential space dominates at 63 per cent. India has been ranked number two in Global Retail Development Index 2008 -- this indicates that high-end construction activities are expected to escalate here. Statistics corroborate this. In most states, the construction industry is growing fast at 10-17 per cent annually. Maharashtra, Delhi-NCR, Tamil Nadu and Gujarat are recording the maximum urbanisation in the range of 30-50 per cent – and consequently, the highest number of projects.[6]

Residential spaces: The Planning Commission has estimated that at the end of the 11th Five Year Plan, housing shortage is expected to be more than 26 million units for all income classes. While so far the government has been providing housing for different income

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NCR tops residential realty charts, leaves other metros far behind

The National Capital Region (NCR) has emerged as the largest residential market in the country, with more number of .units compared to the other five metros of Mumbai, Chennai, Bengaluru, Kolkata and Hyderabad put together. Nearly 86,000 residential units entered the market here in the financial year 2012. Ghaziabad contributed nearly 34 per cent, followed by Gurgaon and Noida. Nearly 40 per cent of the units launched fell in the Rs 25-50 lakh bracket. This could be viewed as an effort by developers to please the middle income segment. A staggering 5 lakh units were under various stages of construction in the NCR as of March 2012.

Source: Tiwary A.K, 2012, NCR is the largest residential market. The Economic Times, May 26

groups, in the coming years, the focus will shift to the lower income groups. Under the National Housing and Habitat Policy 1998 and 2006, the government is expected to build 2 million dwelling units a year. The Jawaharlal Nehru National Urban Renewal Mission stipulates a smaller target of 1-2 lakh units a year – one million of these coming during the 11th Plan: this, however, will cover only 1 per cent of the housing shortage.[7]

With 75 per cent of the urban population in India being in the bottom rung of income levels, the demand for low cost housing will go up from 25 million units in 2007 to 38 million by 2030.[8]

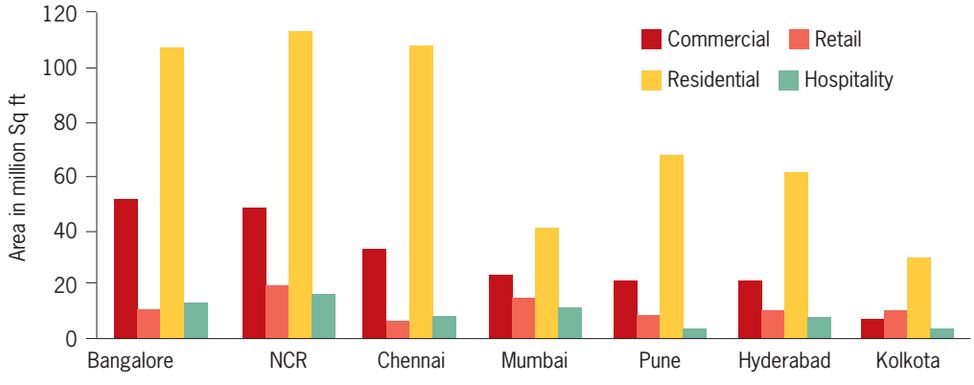
The private sector real estate developers are also expected to be important players; CREDAI, the association of builders and developers, has 3,000 members. Between them, these members cover 80 per cent of the real estate development in 13 key states of India.

***Retail and commercial space*:** According to the Indian Brand Equity Foundation (IBEF), the stock of commercial office space in India in 2006 was 45 million sq ft, while retail space was 19 million sq ft. Cushman & Wakefield estimates that the pan-India cumulative demand projection for the real estate sector for 2008-12 is 1,098 million sq ft (built-up area) – three times the size of Panjim city in Goa. Cushman & Wakefield also pegs that this real estate growth will be very concentrated -- almost 80 per cent of the projected demand will be in seven major cities of India.[9]

With the share of organised retail likely to increase to US $306 billion by 2010 (as estimated by Ernst & Young), retail expansion will be phenomenal. The National Capital Region (NCR) will hog 50 per cent of the future demand, while Mumbai will take up about 16 per cent (see fig 1: Cumulative real estate demand upto 2012). The rate of increase will

Fig 1: Cumulative real estate demand upto 2012

Cumulative real estate demand upto 2012 by sectors



Source Anon, 2008, The metamorphosis, changing dynamics of Indian realty sector, Cushman & Wakefield, May

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be high in Hyderabad, Chennai and Bengaluru as well. [10]

McKinsey's report titled India's Urban Awakening, projects that to meet the growing demand, India will have to build 700 to 900 million sq meter of residential and commercial space a year within the 2030 timeframe – this is equivalent to adding two new Mumbais to the country's landscape.

The outlook of investors towards the Indian real estate sector is also looking up. In 2006, real estate and construction accounted for less than 4 per cent of the total foreign direct investment (FDI) in the sector; currently, it stands at over 22 per cent. With the government allowing 100 per cent FDI in this sector, more than 110 mega-million dollar deals have been signed between foreign investors and Indian firms between 2000-11.[11]

This boom will have its resonance on environment, resources and lifestyles. Here, we examine briefly what will be the scale and nature of the impacts on resources such as energy and water, and on parameters such as urban traffic – and why, therefore, building 'green' will ensure the boom does not go bust.

Resource impacts of buildings -- energy

The World Energy Outlook 2009 states that two-thirds of the world's energy is already consumed in cities by just half the world's population. By 2030, cities will be using up 73 per cent of the energy.[12]

In India, the residential sector is a significant user of primary energy at 37 per cent of the total[13]. If only electricity consumption is considered, building sector has 30 per cent electrical energy consumption in India; what's more, its consumption is growing at the rate of 8 per cent per annum.[14] The Bureau of Energy Efficiency (BEE), responsible for energy regulations for buildings, has come up with typical values for different climatic zones of the country as well as for different building usages. The values show that offices, retail establishments and hotels are high-end users of energy (see table 1: Typical energy consumption in buildings- climate zone and building use wise). The BEE does not have good data on residential buildings.

Table 1: Typical energy consumption in buildings – climatic zone and building-use-wise

Building Category	Climatic Zone wise Typical Energy Consumption kWh/ft²/yr (In bracket in kWh/m²/yr)			
	Temperate	Warm & Humid	Composite	Hot & Dry
Office	18.55 (199)	15.36 (165)	8.68 (93.39)	8.14 (87)
Shopping Mall	28.43 (306)	15.31 (164)	27.96 (301)	11.87 (128)
IT Park	10.08 (108)	3.62 (39)	45.14 (485)	NA
Hotel	NA (324)	30.13	NA	37.2 (400)
Hospital	NA	NA	NA	11.7 (126)
Residence	15-30			

Note: a. IT Park in temperate and W&H zone were not fully functional
b. Shopping Mall is W&H zone was not full AC
N.A. No Building of category was available in the buildings surveyed
Source: Bureau of Energy Efficiency,

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The key challenge of energy management in buildings is how to minimise energy use at a higher comfort level. According to BEE, most commercial buildings in India have an energy performance index (EPI) of 200 kwh/sq m/year or higher. The BEE considers 180 kwh/sq m/year as the typical national average; buildings in North America and Europe have an EPI of less than 150 kwh/sq m/year due to overall efficiency gains.[15]

Energy consumption in buildings needs to be understood in terms of embedded energy that varies according to the building material used, as well as direct use of energy during building construction and operations phases. It is possible to select materials and architectural designs that can help improve thermal efficiency of buildings and reduce energy use.

The direct use of energy in building operations varies between residential and commercial buildings. In commercial buildings lighting, heating, ventilation, and air conditioning dominate consumption patterns – with just lighting and air conditioning accounting for 80 per cent of the consumption. Residential buildings witness more diverse uses: lighting, ACs, fans, coolers, refrigeration, televisions etc. In residential buildings, fans and lighting use up the maximum energy, 34 per cent and 28 per cent respectively.[16]

Buildings can save all this energy -- by adopting energy-efficient building design and appropriate building material, innovative and energy-saving operational features and energy-efficient electrical appliances, in-situ renewable energy, etc. But regulations need to play a critical role here in ensuring the adoption of these features.

Energy audits of buildings done by BEE show that existing buildings in India have a 30 to 50 per cent energy saving potential. For example, energy use at an EPI of 605 kwh/sq m/year in a typical new hospital can be brought down to 312 kwH/sq m/year, says the BEE. Similarly, in a typical office building, EPI can be reduced from 186 to 86 kwh/sq m/year.[17]

Estimates from energy consultant Environment Design Solutions (EDS) show significant potential of greenhouse gas (GHG) savings (24 per cent from lighting and 12 per cent from ACs) from energy conservation measures.ref McKinsey (2010) estimates that the national power demand can be reduced by as much as 25 per cent by 2030 by improving energy efficiency of buildings and operations. In fact, with improved and optimised insulation, more efficient electrical appliances etc, energy consumption can be reduced by 55 per cent – this can lead to a 150-million tonne reduction in CO2 emission by 2030.[18]

Resource impacts of buildings – water

Another key resource impact of buildings is on water, both as intake and waste. Water deficit is becoming a serious constraint in Indian cities. With irregular and inadequate municipal water supply, dependence on groundwater is increasing. A National Institute of Urban Affairs (NIUA) study of 2005 concludes that 56 per cent of metropolitan, class-I and class-II cities are dependent on groundwater either fully or partially.[19] Cities are now drawing water from sources hundreds of kilometers away, giving rise to conflicts with the existing users of that water. It is within this scenario that the building sector is taking shape in Indian cities.

In buildings, water is used intensively during both construction and operational phases. During construction, foundation laying, brick-soaking, masonry, curing, concreting, whitewashing, laying of roofs and flooring – all require water. A 2011 study in India looked at a group of high income multistoried apartments in Kolkata with a total built-up area of over 3 million square feet. The buildings had primarily used steel and concrete as their building material. The study found embedded water (water used in the production of

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building materials) to be 25.6 kilolitre/sq m, while the water consumed in actual construction was 2 kl/sq m – the total (about 28 kl/sq m) was almost 8 kl higher than in countries like Australia.[20]

Embedded water in typical building materials

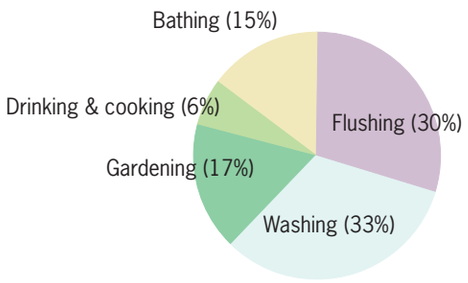
- 1 kg of concrete – 2,000 litres of embedded water
- 1 kg of steel -- 40 litres
- 1 kg of aluminum -- 88 litres
- 1 kg of plastics -- 185 litres
- 1 cumec of brick -- 300 -714 litres

The study also found that 85,62,021 kl of water was consumed for the construction of an entire building in Kolkata, which is equivalent to the amount of water needed by nearly 34 families with five members each for a whole year at 138 litre per capita daily![21]

However, there is some scope of savings in this sector. For example, research on concrete mixes in Indian conditions has estimated a savings of 75 lakh tonnes of cement and 37 lakh kilolitre of water by using water reducers.[22]

A large part of water use in buildings can be attributed to the operational phase of buildings, where it is directly related to lifestyle of the occupants. The average water consumption in India has been calculated as 135 litre per capita per day (as prescribed by the Central Public Health and Environmental Engineering Organisation or CPHEEO) (see fig 2: Break up of 135 lpcd water consumption). But this is a much contested figure – other agencies have arrived at estimates which are quite different.

Fig 2: Break-up of 135 lpcd Water Consumption



Source: Anon, 1999, Manual on Water Supply and Treatment, Third Edition – Revised and Updated, Central Public Health and Environmental Engineering Organisation, Ministry of Urban Development, New Delhi

Very few institutional attempts have been made to compile and analyse patterns of water use in buildings. Broadly, studies show that toilets and bathrooms are the biggest water guzzlers in a house, with flushes, taps and showers devouring more than 60-70 per cent of the total water used.[23]

A study on water poverty in urban India (2008) by the Mumbai-based Tata Institute of Social Sciences (TISS) states that at the household level, bathing consumes the highest amount of water. Together, in all the seven cities it surveyed it was found that bathing accounts for about 28 per cent of the total water used. Consumption in toilets (20 per cent), washing clothes (19 per cent) and washing utensils (16 per cent) follows. On an average, less than 10 per cent of the total water in a household is used for drinking and cooking (see Fig 3: Average domestic water consumption for various activities). This shows that promotion of water efficiency standards for water appliances and right pricing signals can help reduce water usage.[24]

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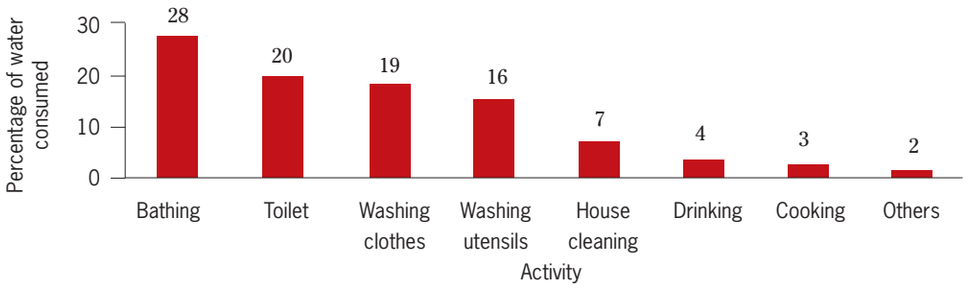
Fig 3: Average domestic water consumption for various activities



Source: Shaban. A, 2008, Water Poverty in Urban India: A Study of Major Cities, In: UGC-Summer Programme, June 30- July 19, 2008, Jamia Millia Islamia, New Delhi

Lifestyles of the rich in cities promote wasteful use: multiple toilets with showers, bath tubs etc, washing machines, dishwashers, car washing, landscape irrigation and swimming pools are some of the activities and areas which guzzle a lot of water. Another important component that is generally overlooked is leakages in buildings. Leakages generally occur in old fixtures and fittings due to aging, waning, faulty washers/handles, high pressure or corrosion. Water loss due to leakage can be in the range of 10-30 per cent. A modest leak figure of 3 litre/hour on a 24x7 basis can lead to water loss to the tune of 26,000 litre annually.[25]

The question is, how can this flow be restricted or capped? The National Building Code (NBC) for India lists the water supply requirements for various building types -- residential, institutional and commercial. The NBC is followed across India for provision of basic amenities, though on a voluntary basis. Type of building usage also determines the nature of interventions. For instance, hotels use up a lot of water, drawing mainly from deep tubewells or municipal supply.

Countries like Australia, Singapore and USA have assessed water use and its patterns for developing effective strategies. In India, there is considerable scope for doing that. For instance, commercial buildings with very high water usage in laundry, dishwashing, cooling towers and landscape irrigation can reduce water consumption by installing water-efficient fixtures. According to the American Water Works Association, households can reduce daily per capita water use by about 35 per cent by installing more efficient water fixtures and regularly checking them for leaks.

Regulatory intervention, of course, is a must. Regulations can help influence a range of decisions on water usage. For example, waterscapes, fountains etc in buildings can be suspended during summer months. Central to water conservation and efficiency improvement is doing more with less. Installing and retrofitting water-efficient fixtures, augmenting supply through measures like rainwater harvesting and stormwater management, and recycling and reusing wastewater for construction, horticulture, flushing etc are some of the measures that may work.

Other impacts

While buildings and real estate exercise a number of other impacts, one of the relatively little known concerns is that of traffic impacts of buildings. Growing motorisation and the ever worsening mobility crisis -- in which personal vehicle usage is marginalising public transport, cycling and walking -- has added this very serious dimension to the impact assessment of buildings in cities. This is especially true for large commercial buildings that induce additional traffic in the neighbourhood and thus contribute hugely to the local air pollution and congestion.

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