Buildings: The Environment Connection
The big picture

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Orientation Workshop
Agenda for Sustainable Buildings

New Kolkata Development Authority and **Centre for Science and Environment (CSE)**

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Beginning of a conversation……..

Spotlight: Cities

Urban explosion

-- By 2025 around 65 per cent of the world's population is projected to live in cities – equal to the global population in 1986. -- A billion more will be added over the next three decades in Asia – almost adding a whole new India. More than half of them will be living in cities

India's urbanisation is still modest at 30 per cent and is expected to be 40 per cent by 2030. But this is more than the population of the United States.

India's urban mosaic

Skewed growth: 70% of urban population are in about 400 cities. The rest in about 4000 towns and cities. About one third of the total urban population in the megacities..

Shadow growth: Top rung cities show strong trend towards suburbanisation.

Slow growth at the bottom: Lower rung towns stagnating. Some have grown due to infrastructure investments and rural to urban migration.

Kolkata– 14 million people – registered 7% increase. Mega cities have shown slower growth

The Hindu/New Delhi/June 27, 2012

Greening the urban jungle

Urbanisation took centre-stage at last week's Rio+20 conference for good reasons. Cities collectively consume 75 per cent of world's natural resources, generate 50 per cent of waste and emit about 70 per cent of the greenhouse gas. With no slowing down of urbanisation in sight, this consumption is bound to increase. It is now abundantly clear – as UNEP's recent report on sustainable cities convincingly demonstrates – that unless cities become resource efficient and reduce waste generation, national and global sustainable development would be impossible to achieve. This is a warning bell to Indian policymakers, who have so far focused on the economic growth of cities and ignored their environmental performance. Consuming 40 billion tonnes of raw material every year has its consequences. The first visible challenge is the staggering waste cities produce. Conventional wisdom has been to find more landfill sites. This approach would demand more land over time and cities cannot endlessly appropriate the resources of their region. It would lead to potential conflicts and the loss of productive agricultural land would partly offset the economic benefits provided by the cities. Pursuing standard solutions and treading the beaten path of town planning would not help. Only a radical change in course will create zero-carbon, zero-waste habitats, which is imperative.

It would be impractical to cap the growth of cities. Neither is it the objective of the current debate. The question is how to transform them. Certain cities have taken the lead and shown a way forward. For instance, Copenhagen recycles most of the waste it generates and lets only 3 per cent go to the landfill. Extending the idea of recycling, Kitgum town in Uganda traps used water from houses and utilises it to grow food in grey-water gardens. Cities in Malta have opted for a smart bi-directional grid system to regulate their power consumption. There are more inspiring examples. With the Central government dithering on commitments to reduce emission levels and the National Mission on Sustainable Habitats failing to offer anything substantial, Indian cities can no more rely on centrally directed policies and projects. They have to adopt best practices on their own and launch projects with clear green benchmarks. A good beginning would be to promote non-motorised transport. Even in larger cities such as Chennai, the share of bicycle trips, despite poor arrangement, is as high as 12.5 per cent of the total trips. Building dedicated bicycle tracks would significantly reduce transport related emissions. If Indian cities are keen to improve the quality of life and remain economically competitive, they have to leapfrog to become desirable green places to live in.

Sprawling …..

Kolkata suburbs: the new growth story

Urban Sprawl (sq. km.) in the last 100 years

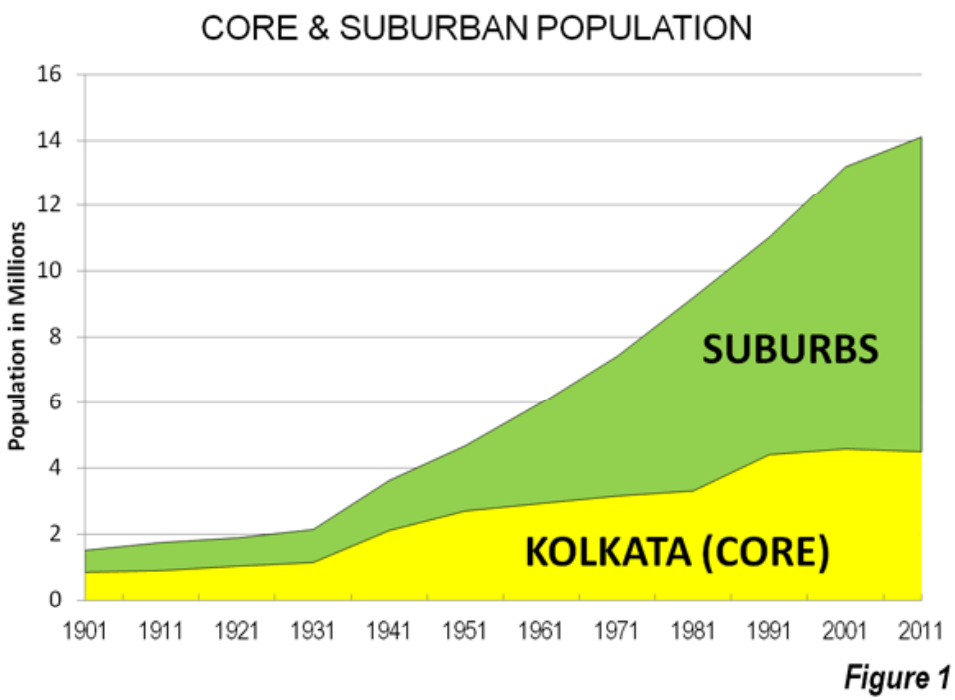
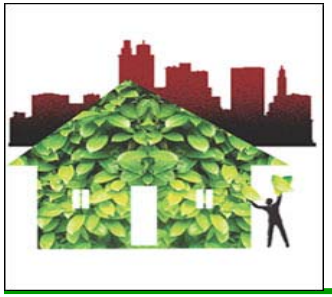


Figure 1

The current average annual housing need is 70,000 units, which is projected to shoot up to 90,000 units by 2025 (KMDA, 2000).

New planned settlements to decongest the core



City: The focal point of climate mitigation and energy security discussions

Cities: the central focus of discussion in the Rio+20 conference ….

Energy Outlook 2009 tracks cities for the first time

Already two-third of world's energy is consumed in cities – by half of world's population.

By 2030 cities will be consuming 73% of world energy.

Globally cities account for 70% of CO2 emissions.

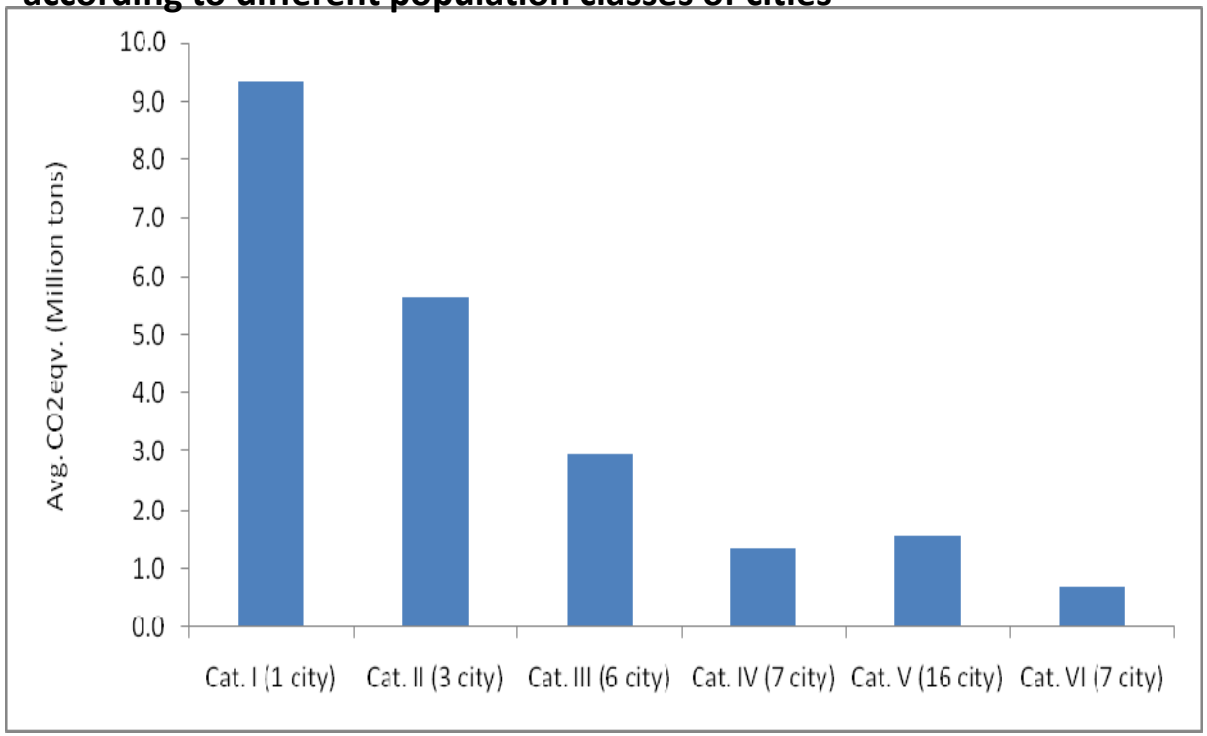
Big increase in global CO2 from increase in floor space in buildings of various types, -- especially in non-OECD countries.

Massive increase expected in ownership of household appliance

Cities collectively consume 75% of world natural resources, generates 50% of waste, and emits 70% of greenhouse gases.

Cities: Energy guzzlers

Bigger Indian cities guzzle more fuel
Total CO2 equivalent emissions (million tons/ annum) classified according to different population classes of cities



Source: Based on data provided in 'Energy and Carbon Emission Profile of 53 South Asian Cities', published by ICLEI, British High Commission and Census of India 2001 for city population data

Global cities under pressure to mitigate setting targets and deadlines for CO2 reduction……

London – 60% by 2025
Paris: -- 25% by 2020
Toronto – 30% by 2020; 80% by 2050 from 1990 level
Tokyo – 25% by 2020 from 2000 levels

Indian cities to frame climate mitigation plan and targets

Energy security challenge

- Reduce energy imprints of urban consumption – buildings represent the microcosm of urban demand

Trends in building spaces – how big is the problem?

We don't know enough……. Real estate sector lacks transparency

Very poor data base on trends in building spaces in India:

Ministry of housing and poverty alleviation tracks demand for housing but not other built up areas. Planning commission and others on trends in the construction sector. But buildings are a very small component of the construction industry…..

Real estate service providers, investment banks, and research foundations are the principal source of information……But very opaque and not verifiable……

A few cities – Hyderabad, Bangalore, Chennai, Delhi, Mumbai have a little better data due to new growth etc.

Disparate estimates make a curious jigsaw ….. But indicative of an explosive trend: Eg.

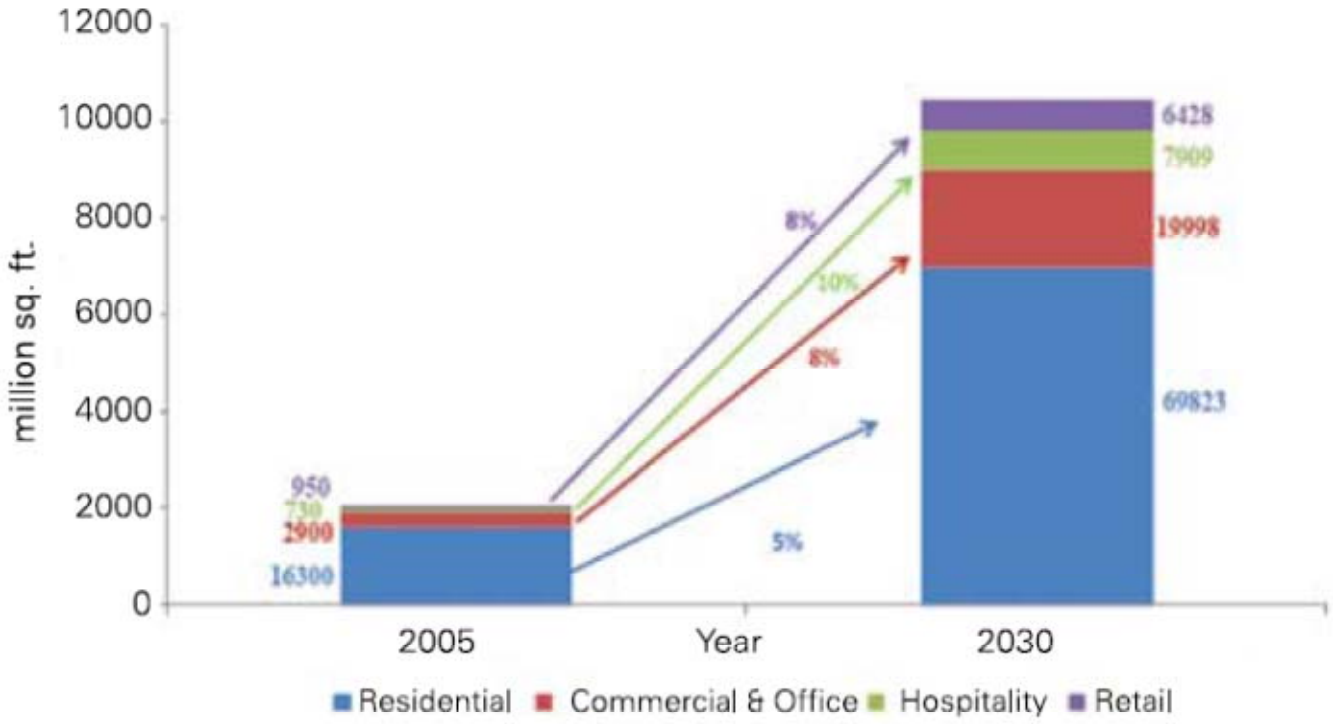
Constructed area in 2005: close to 25 billion square feet.

Expected to be 5 times and reach to approximately 104 billion square feet by 2030. A CAGR between 5 to 10 percent to be achieved …..

Hospitality and Retail to achieve higher CAGRs -- 8– 10%. By 2030, -- 7 to 11 times of the level in 2005.

Maximum growth in residential and commercial sector -- four to five times of 2005 figures. (EDF)

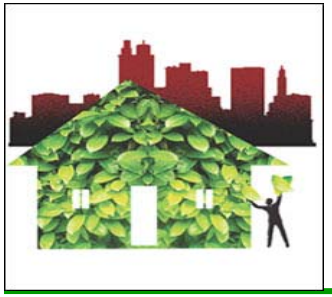
Building sector: explosive growth



Source: Planning Commission - Environmental Design solutions 2010/CW

India's challenge: The ECO-III forecasts - 70% of building stock that will be there in 2030 is yet to come up in the country.

Developed countries, a very small addition is made to the building stock each year. In the UK, at least 80% of the homes to stand in 2050 have already been built. In France buildings constructed before 1975 thermal regulations will represent over 50% of the building stock in 2050



Lifestyle pressure amidst poverty

Middle class growing rapidly:
The 2010 McKinsey study on urban infrastructure estimates that the seeker class (with household income of 200,000 – 500,000 per annum) will be the most dominating income class and is expected to be half of all urban households by 2025

About 16% households fall in mid-high to rich income class. (Jones Lange 2010)

Cities will see more concentrated buying power, transformation of lifestyle and aspiration for high end resource intensive comfort level.

Urban poverty remains high
Nearly 21% of urban population -- but 40% to half in Delhi and Mumbai, live in slums. All low income groups are not necessarily in the slums. 75% of the urban population in the bottom rung of income level – Rs 80/day (USD 1.8). (Mckinsey 2010)

19% households cannot afford any housing (Jones Lange 2010)

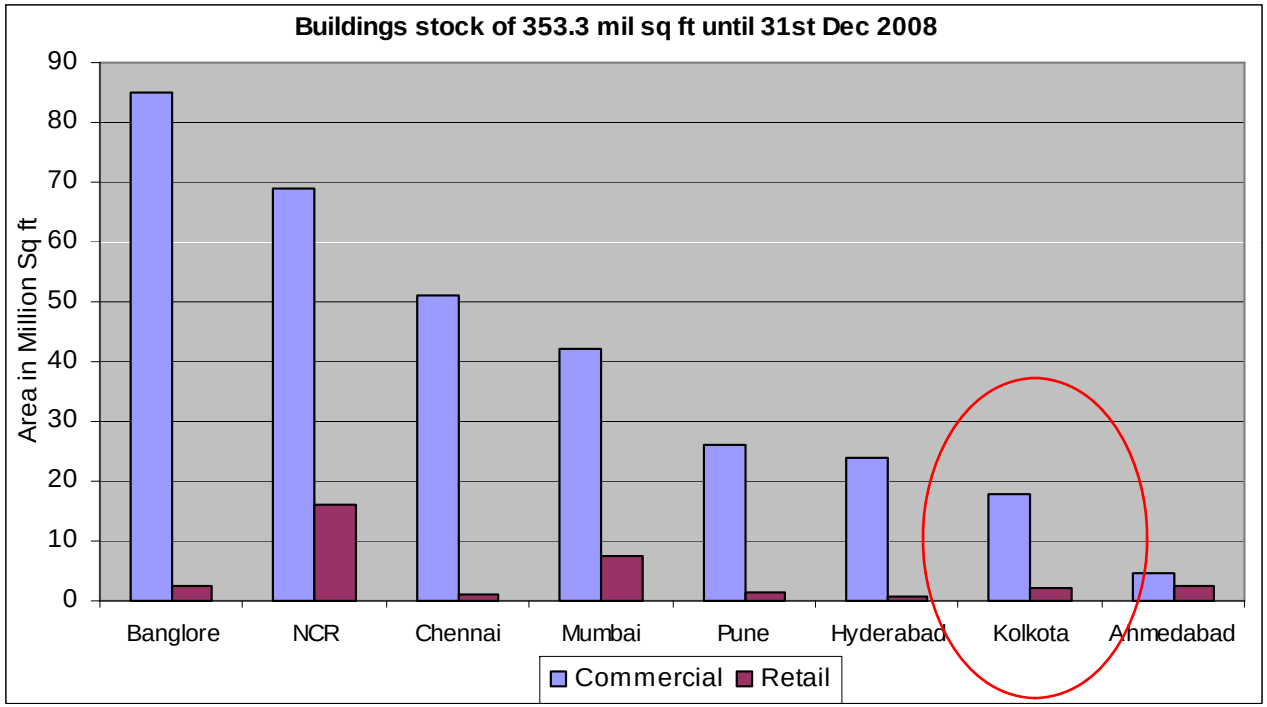
Metro cities: explosive trend

Office stock must increase nearly 20 million sf/ year in New Delhi, Mumbai, Bangalore to meet growing demand;
Space of shopping malls 79 million sf in 257 centers are estimated in 15 largest cities of India (BEE)

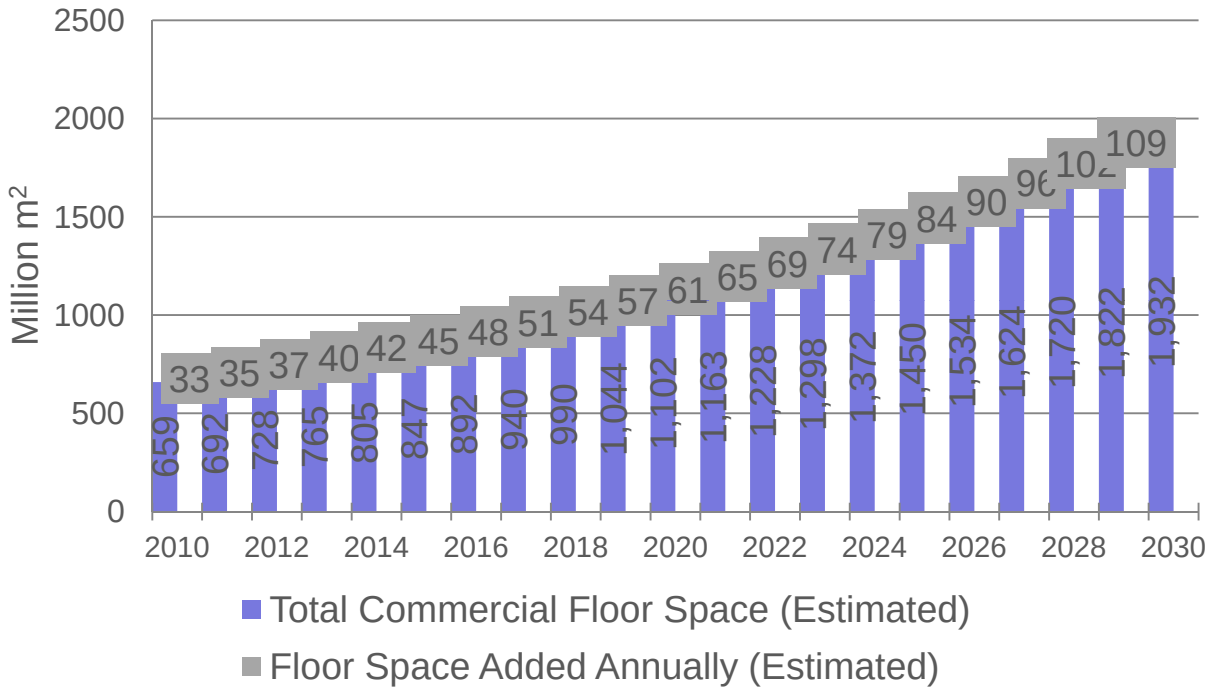
Suburbs: **new growth and resource conflict areas**

- 95% of new residential projects in suburbs
- 60% of operational office spaces in metro cities in suburbs
- More than half of retail spaces in suburbs (J Lange)

Commercial and retail stock in cities



Commercial Buildings Growth Forecast



Commercial Floor Space Projection for India *(Assuming 5-6% annual growth)*

SOURCE: USAID ECO- III Project

Commercial space can skew energy guzzling

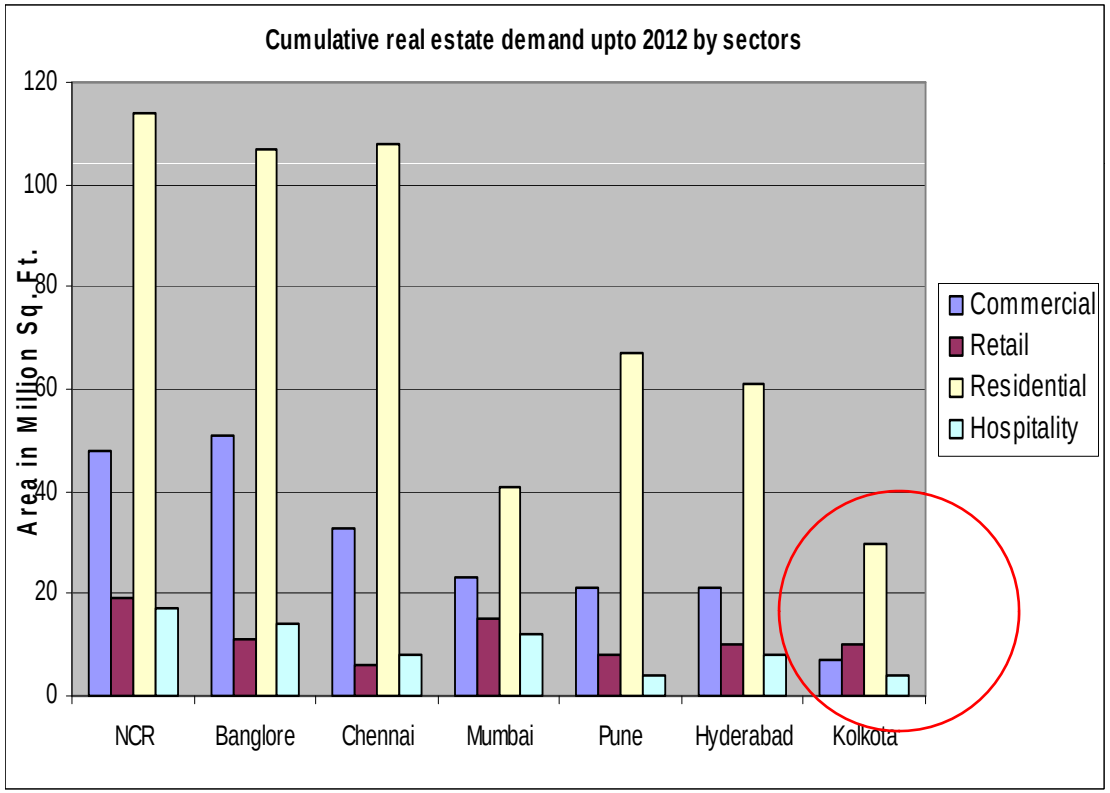
The US,-- energy intensity increased from an average 310 kWh/m2/yr in 1995 to an average of 351 kWh/m2/yr in 2003 -- **15% increase**. – due to higher levels of lighting and equipment in commercial spaces.

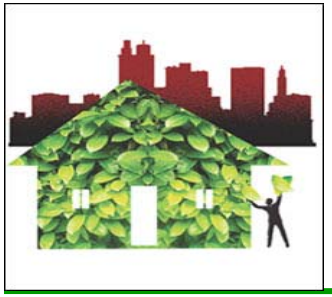
Challenge of residential space

Residential space: Planning Commission: The housing shortage to be more than 26 million housing units for all income classes

The government to focus more on EWS and LIG: RAY -- 20-25% of developed land in all housing projects (both public and private agencies) for EWS/LIG with cross-subsidization. These need designs for improved comfort..

Middle and high income housing: More private players. Eg. CREDAI - association cover 80% of the real estate development in 13 states. Scope of corporate social responsibility.





Towns made to order

Town boom: IDFC's India Infrastructure report 2009: -- the size of private 'integrated' townships ranges from 100 to over 1000 acres.
More than 200 such townships planned -- especially around the metros.

Touted as Walk to Work Green Towns – without green benchmark

Urban planning in existing towns: an opportunity -- states to support and facilitate sustainable infrastructure

-- Public transport connectivity
-- Metered water and electricity supply
-- Decentralized waste water management
-- Decentralized, sustainable energy management
-- Increase permissible density especially in areas with infrastructure.
-- Higher density along transport corridors

Real estate boom in Kolkata….

New towns to attract massive investments
-- Foreign direct investment for the development of urban areas – Eg Kolkata West International City (KWIC) etc. Large number of foreign investment firms, real estate firms, and housing finance institutions in the city.

Rajarhat township -- state government-led urban development – (West Bengal government through the statutory body of HIDCO)

Large land parcels for cooperative-style housing

Big private developers -- Ambuja, Unitech, Schrachi, etc.,

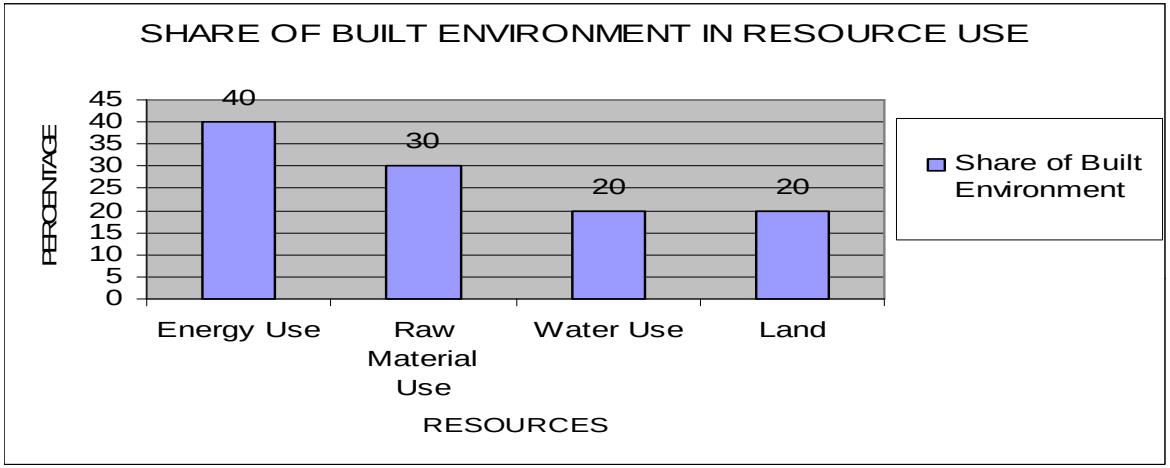
Integrated housing constructions, -- Housing for all income groups through a cross-subsidy approach.

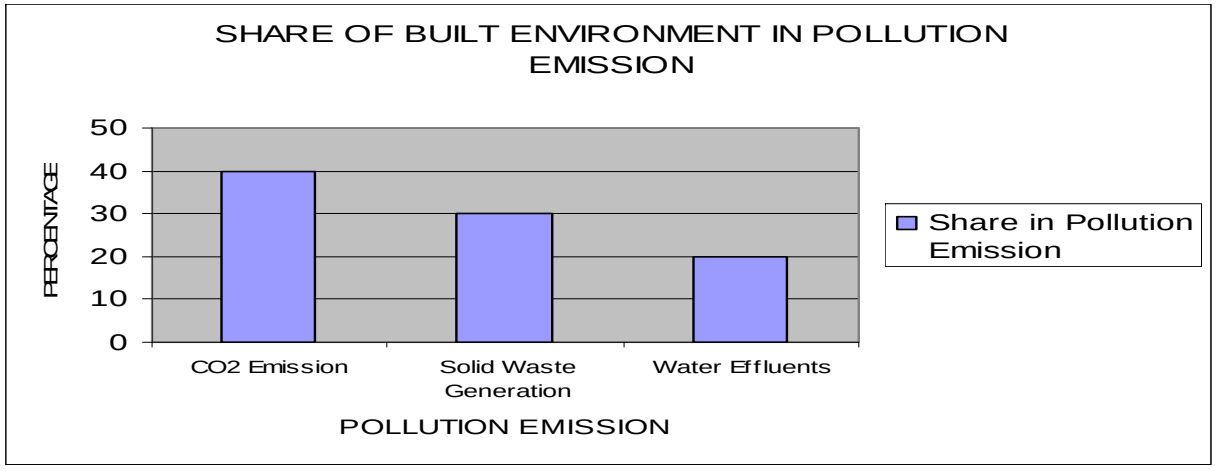
Residential density and FSI restrictions altered for the new township

Green worries?.....

Buildings: earthscrapers

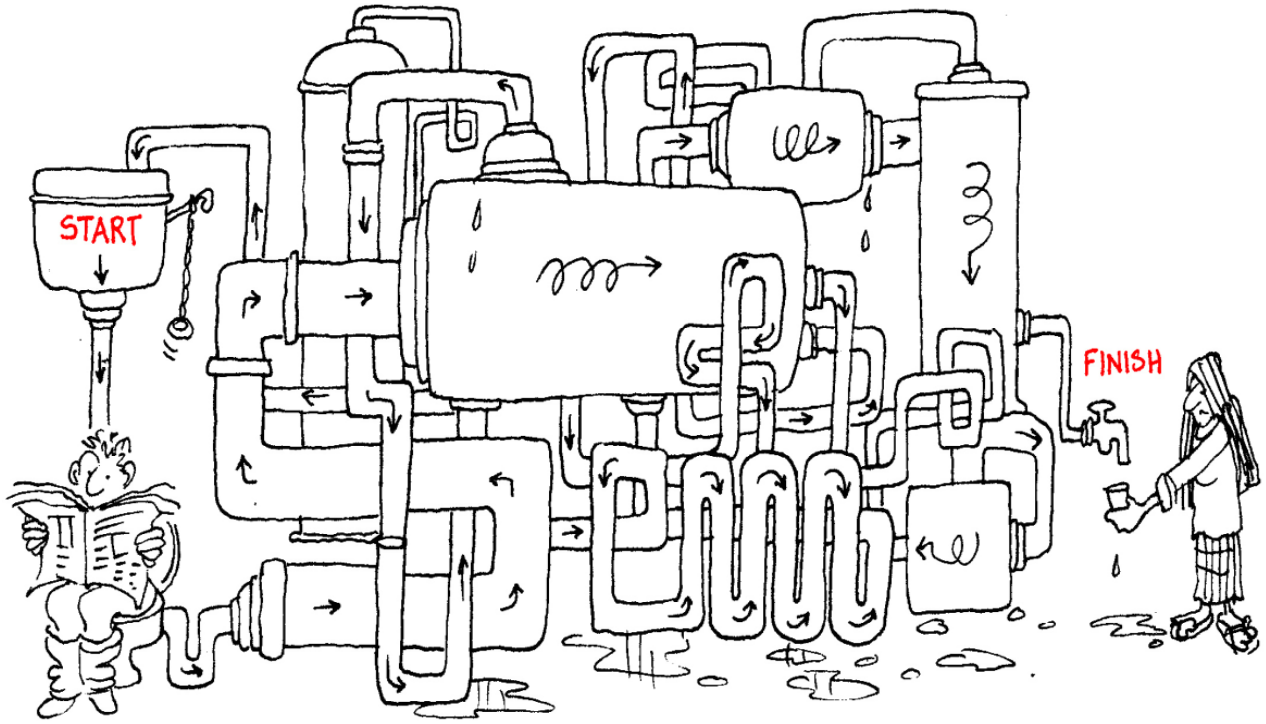
Burden of Built Environment



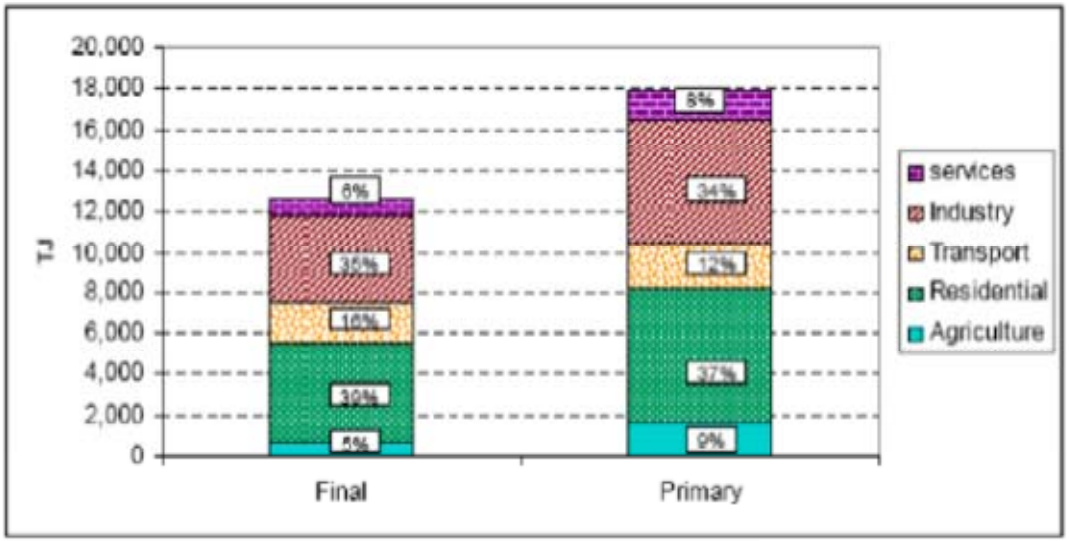


Source: Anon, 2008, Green Buildings – an overview, Capacity Building Series (2008-2009), June 2009, TARA Nirman Kendra, New Delhi

Managing the wastes from buildings



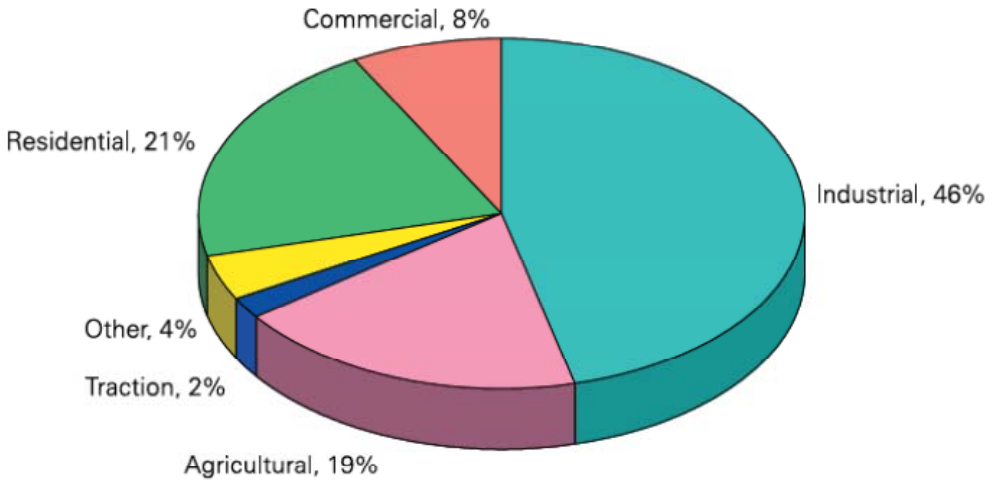
Primary Energy by User (including biomass) 2004



[1] Primary electricity is equal to the electricity consumed directly and the indir necessary to produce the electricity.

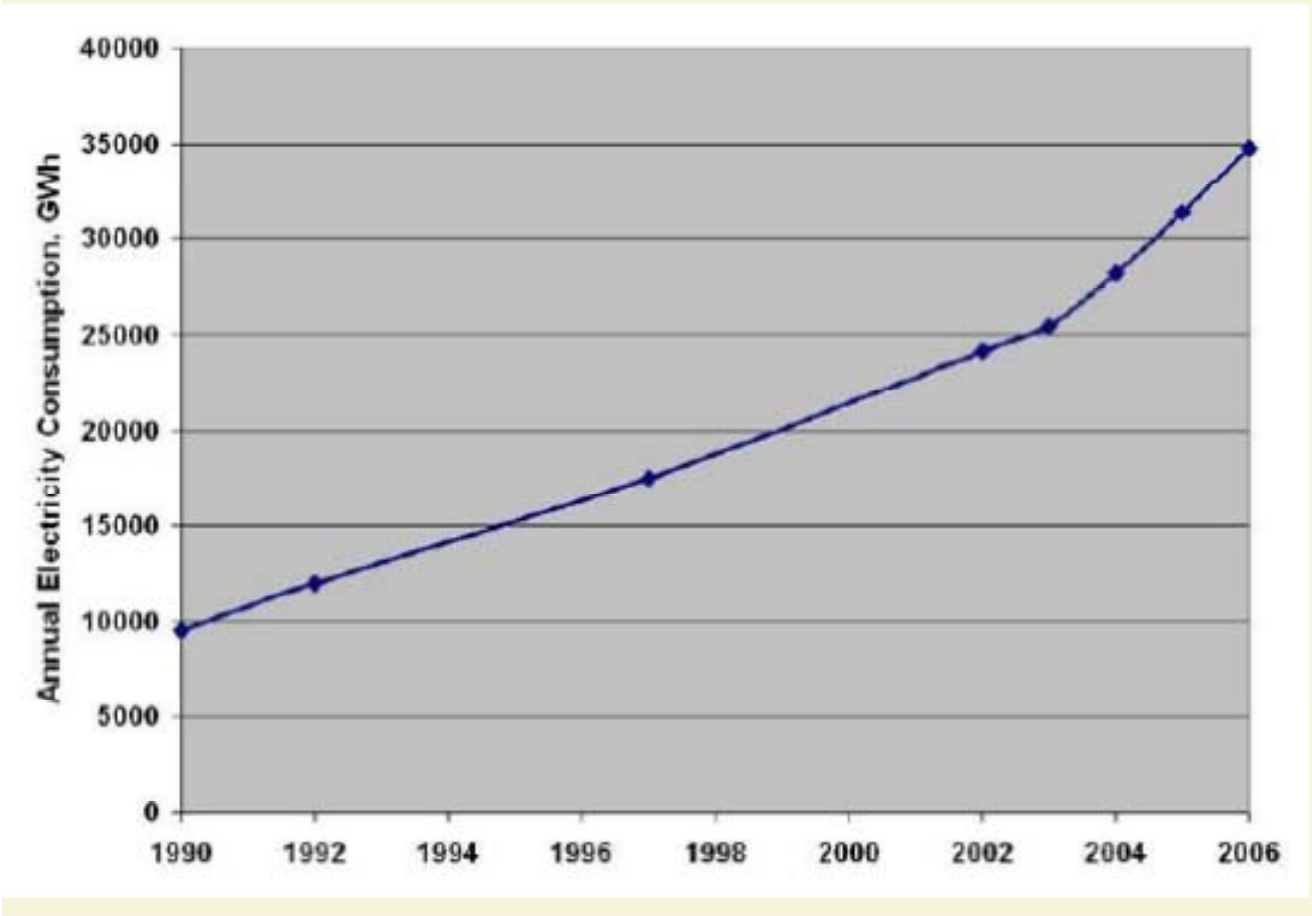
Residential sector consume nearly the highest

India's Primary Electricity Consumption

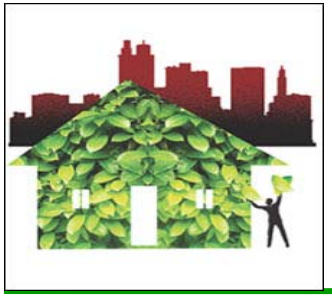


Electricity Use in the Commercial Sector is exploding

climatic zone-wise and building-use-wise



Source: Bureau of Energy Efficiency,



Emerging policy opportunities…..

Integrated Energy Policy 2006: Demand side management in buildings

NBC should be amended to facilitate efficient buildings
Publicise innovative approaches
Make energy audits compulsory for all load above 1 MW
Initiate benchmarking; Amend building byelaws to enable solar water heaters

ECBC: Sets minimum energy performance standards. Has legal back up from the Energy Conservation Act; Voluntary, to become mandatory

National Habitat Standard Mission: Acknowledges Building energy consumption increasing from a low of 14% in 1970 to 33% in 2004-05. That mandatory ECBC can save 1.7 billion units of electricity per year….

National Habitat Standards: In the making to guide action in cities

National building code adding a chapter on and sustainability

Environment Impact Assessment (EIA)……..

First generation action ……..

First generation action in Delhi

Initiated and proposed

-- Cool roof programme initiated

-- Implementation of ECBC in government buildings

-- Revision of master plan

-- Fulfill the targets of Enhanced Energy Efficiency Mission to retrofit 100 existing buildings with area above 10,000 sq ft

-- Delhi secretariat to be converted into a green building. About 15 more government buildings identified

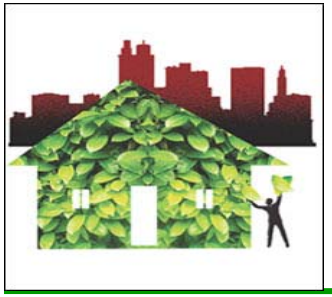
-- Solar water heater system mandatory in industries, hotels, hospitals, nursing homes, and residential buildings with 500 sq meter area. Subsidy for purchase of solar water heater etc

-- Proposal for a solar city in the NDMC area

First generation opportunities and action in Kolkata and new towns of West Bengal

- Policy discussion on adaptation of ECBC
- Regulation of building construction and guidelines for provision of infrastructure facilities (water-supply, sewerage, drainage, roads, bus stands etc.)
- West Bengal Green Energy Development Corporation Limited to promote grid connected renewable energy based power projects
- Rooftop Solar PV Power Plant
- Solar Hot Water Systems Campaign Programme
- Installation of Solar Street Lightings Systems
- Solar housing complex in new kolkata

Next generation challenge……..



Change the practice……

-- **Scalability**: The challenge is not to have a small number of high performance sustainable buildings, but to raise the sustainability of the entire stock of buildings in active use.

-- **Effective reduction in new stock**: Use of combination of passive and active design measures and operations.

-- **Retrofit existing stock**

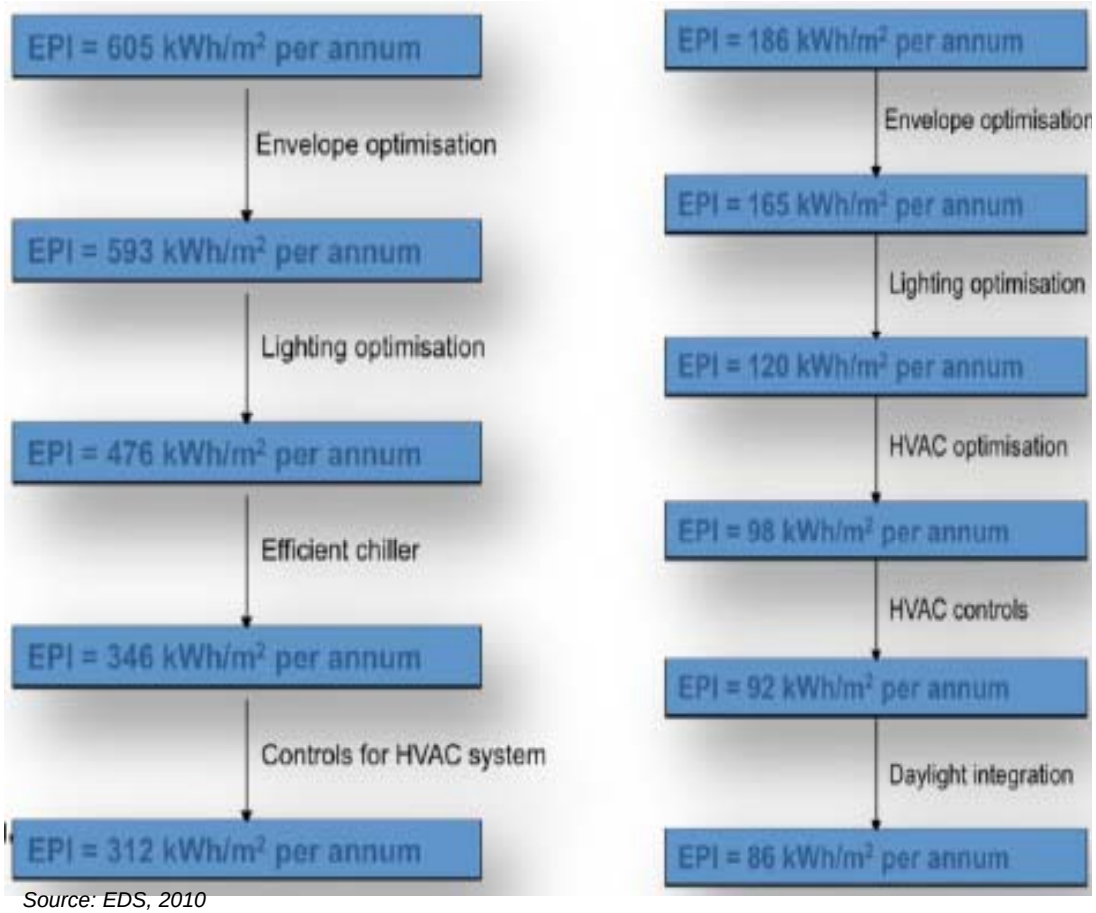
-- **Improve the performance of appliances** to maximise savings.

-- **India still has a large stock of very low-energy homes:** Leverage this to achieve much better energy targets. Do not lock up more energy by design

The energy challenge…….

Many steps to influence energy consumption in buildings

Impact of energy efficiency measures on the EPI of commercial buildings (office and hospital buildings)

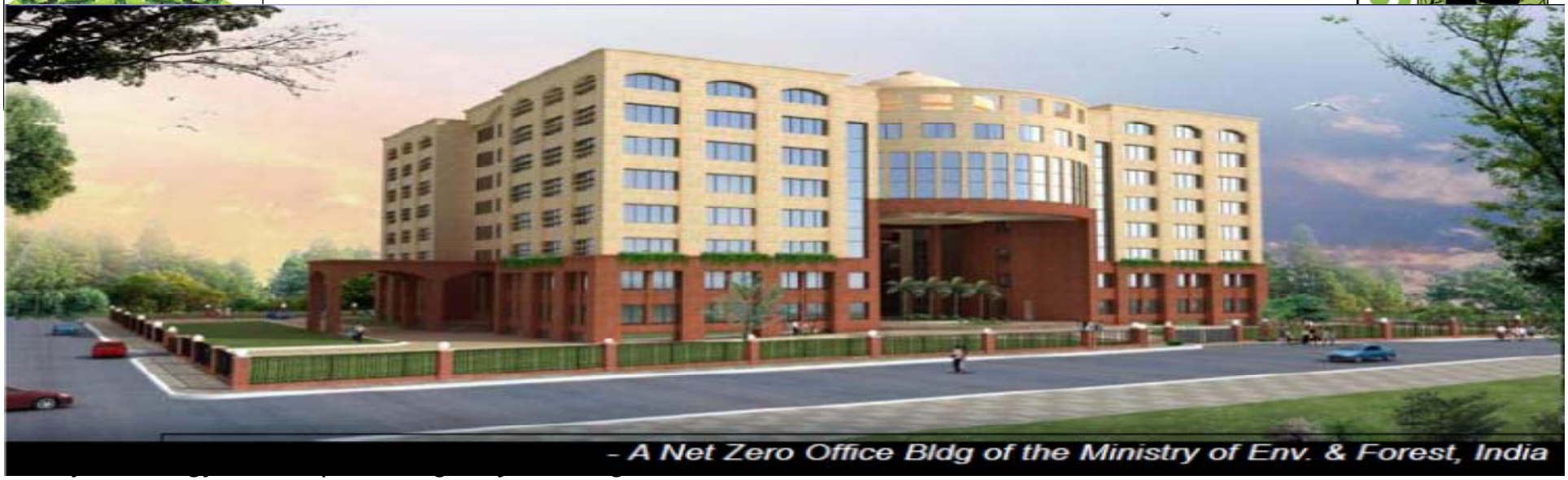


Source: EDS, 2010

The energy audits of buildings by the BEE shows that existing buildings have 30 to 50 percent energy savings potential.

Low carbon strategy of the Planning Commission
Possible to make massive cuts in energy usage

But need grassroot action in cities..



Model building design that helps save energy and money by leveraging sun's movement

Shell roof and the 25 kWp solar photovoltaic plant

Green building is a challenge of the balance…….

….. A lot is possible. But avoid flipside

Cool roof: Low hanging fruit

Need cool roof programme – Light reflective surface; vegetative cover; etc
LBNL and IIIT-H study found annual energy savings in range of 13-14 kWh/m2 with cool roof in a commercial building in Hyderabad. For a building with 150 sqm roof area this saving can be worth Rs. 14,700.

Assess methods –

-- Most paints are toxic and do not last more than four years. Consider white tiles etc.
-- The glare from the reflective roofs can annoy nearby high rise buildings.

How rooftops of two cities differ

Dark rooftops in Delhi

White rooftops in Jaisalmer

Insulation……for thermal comfort

The challenge of AC paradigm

High performance buildings will require good insulation. Poorly insulated buildings severely affect the efficiency of air conditioning units, cause high energy losses.

Push for high performance insulation products: Increasing demand of air conditioned building increasing demand for high performing insulation. ….

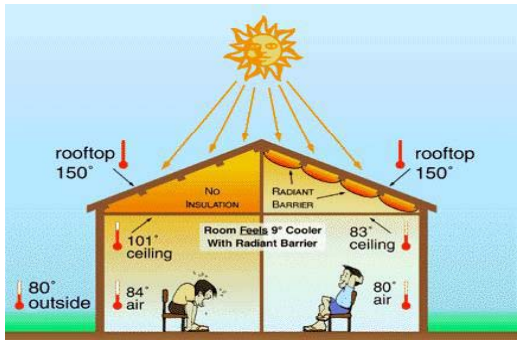
--Insulation materials -- mineral wool, rock wool, vermiculite, foams expanded polystyrene, extruded polystyrene among others.

ECBC has fixed high insulating capability norm (R-value) to ensure rapid uptake of high performance insulating material in air conditioned buildings.

Concerns…..

Increased use of expensive, imported and environmentally inappropriate materials.

Environmental lifecycle effects not accounted for: Glass wool, rockwool are bad for health. Thermocol (polystyrene) is less stable, releases gases through process of degradation …….



How can regulations push for performance based innovative methods?

System approach for thermal comfort -- using natural and passive cooling methods. -- sun shades, ventilation, insulation for cool and comfortable structures. Ceiling fans for low energy cooling

Creative passive cooling designs and methods. to reduce to solar heat gain. Innovative designs -- filler slabs, double roofs, cavity/filler walls, composite walls, shading and many others.

Many methods and material: Replace conventional building materials like brick and concrete with autoclaved aerated concrete (AAC) blocks, hollow blocks, thermocrete or other building materials with inherent higher R-values can also improve buildings' insulation.

Balance high cost technology –complex technological package requiring high investment …Eg. Special glazing technology

Low cost simple Technology for enhanced environmental and functional performance

Cavities in the walls insulate an apartment in Bellary, Karnataka (Photo by:Ashok B Lall)

Dazzled by Glass.....

Uses.... sense of open space. Allows natural light. Keeps dust away…Reduces the need for artificial light; aesthetics etc

But..... Traps heat… the principle of greenhouse. Increase energy use for cooling.

Why so much glass in tropical climate of India that needs to control heat gain and high glare.
Eg. Delhi receives 2,688 hours of sunlight annually London only 1,480 hours.

Glass environmentally harmful. Unsafe, fire hazard

Yet… ECBC allows a maximum wall-to-window ratio (WWR) of 60 per cent.

Different orientations require varying WWR. Make its use strategic .

Ask why?

Air tight glass building in hot and humid climate

Why?.....?

Tell why?

Kolkata Museum of Modern Art
(Herzog & de Meuron)

It provides the logic……..

"-- Kolkata has a tropical wet and dry climate, experiencing hot and humid summers and high levels of precipitation……

-- This uses **passive methods** where feasible **to control the climate in and around the building**,

-- The urban scale spaces are shaded and **offer natural cross ventilation through careful planning**…. etc……"

Kolkata's own wisdom

(Photographs: **Courtyards Houses of Kolkata: Bioclimatic, Typological and Socio-Cultural Study** by **Nibedita Das**)

Courtyard Houses of Kolkata

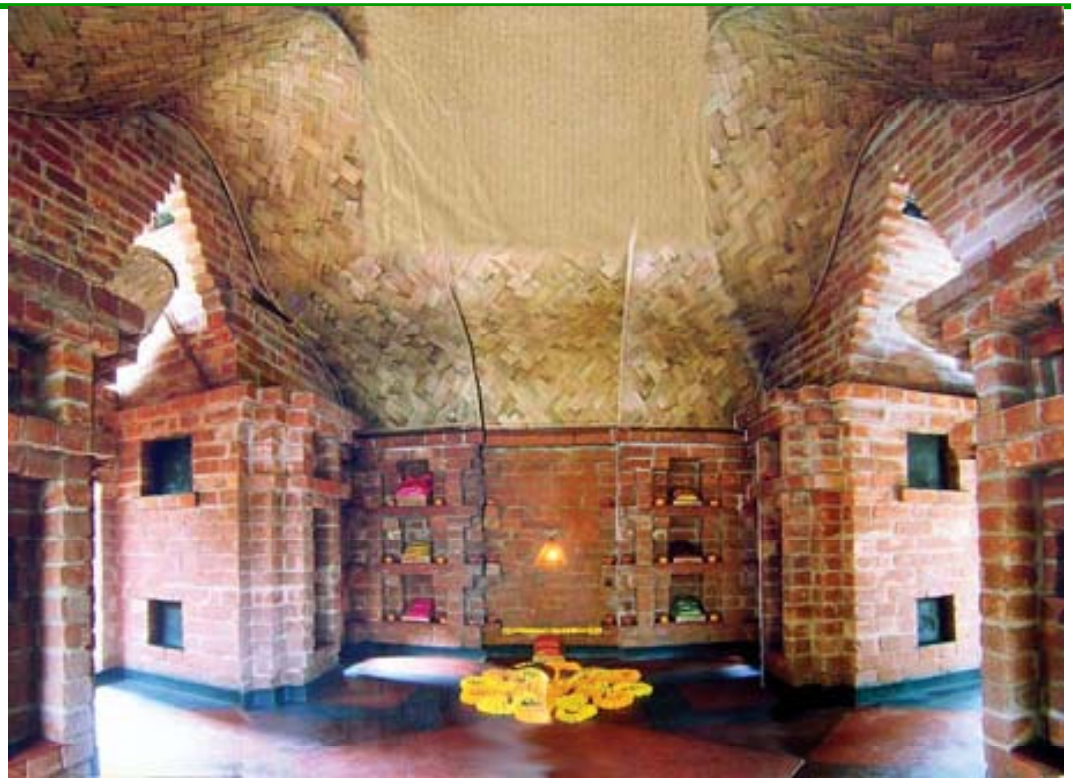
For hot-humid climate of Kolkata

SOLAR ACCESS: Solar radiation is helpful in January and February. Other months -- only wind can give comfort.

VENTILATION -- A deep arcaded area is a transition space ….Provide shade and also ventilation

Allow summer breezes to ventilate and cool…... Windows designed to provide shade from south sun but allow southern breezes. (Source N Das)

Need local science for strong modern identity



Meditation room for Asha Niketan: -- **Laurent Fournier**

Exposed bricks and bamboo mesh arches:

•High ceilings, Arches and big window openings for better ventilation and lighting

•Local materials

•Less use of steel and concrete

•Reviving and improvement in local building techniques

Paradigm shift in building material

Promote locally appropriate, locally available material with low embedded energy……

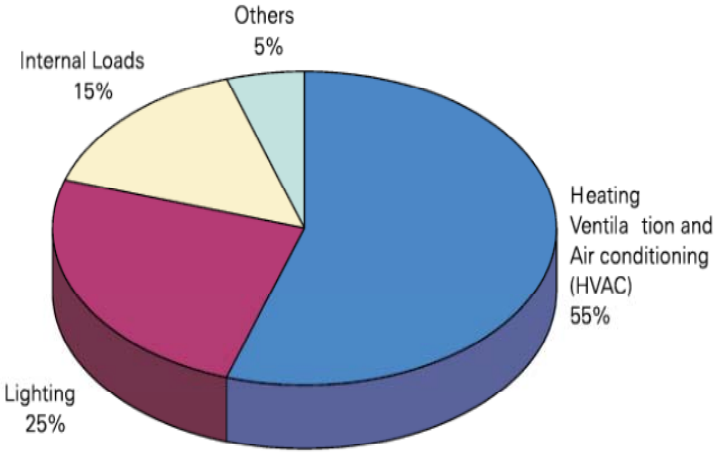
The new policy expected to incorporate measures to promote the use of green materials to create sustainable buildings.

This may be looked at as an opportunity to use alternate building materials.

Appliances and behaviour …….. An opportunity

Varying pattern of end use of energy …….

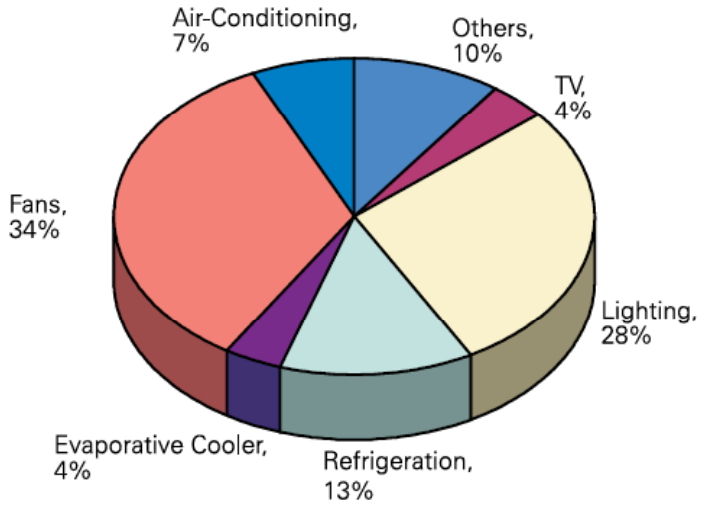
HVAC use up maximum energy in commercial buildings



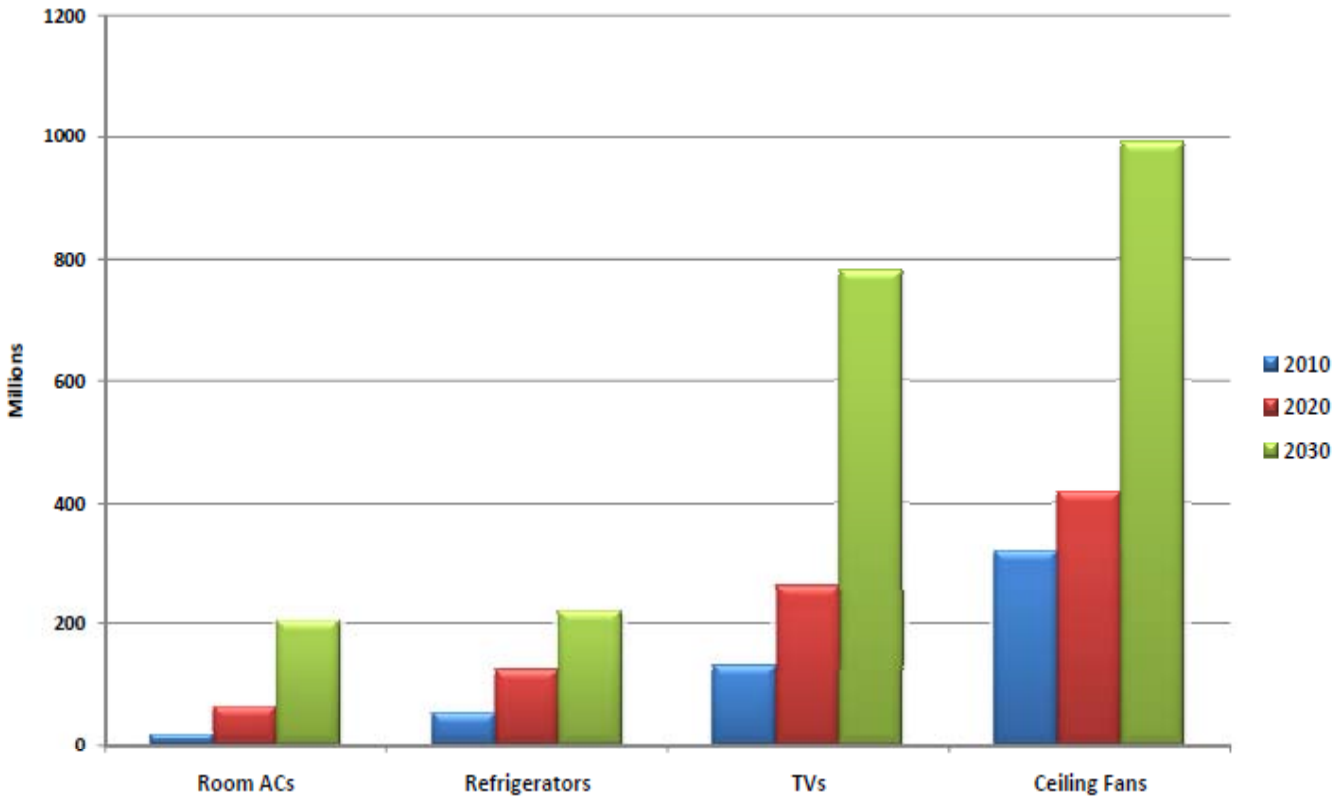
Lighting and AC use up 80 per cent of the energy in a commercial building. AC market is growing at 25% a year

Source: Bureau of Energy Efficiency

Fans and refrigerators use maximum energy in residential buildings



Ownership of Appliances in India Growing Rapidly

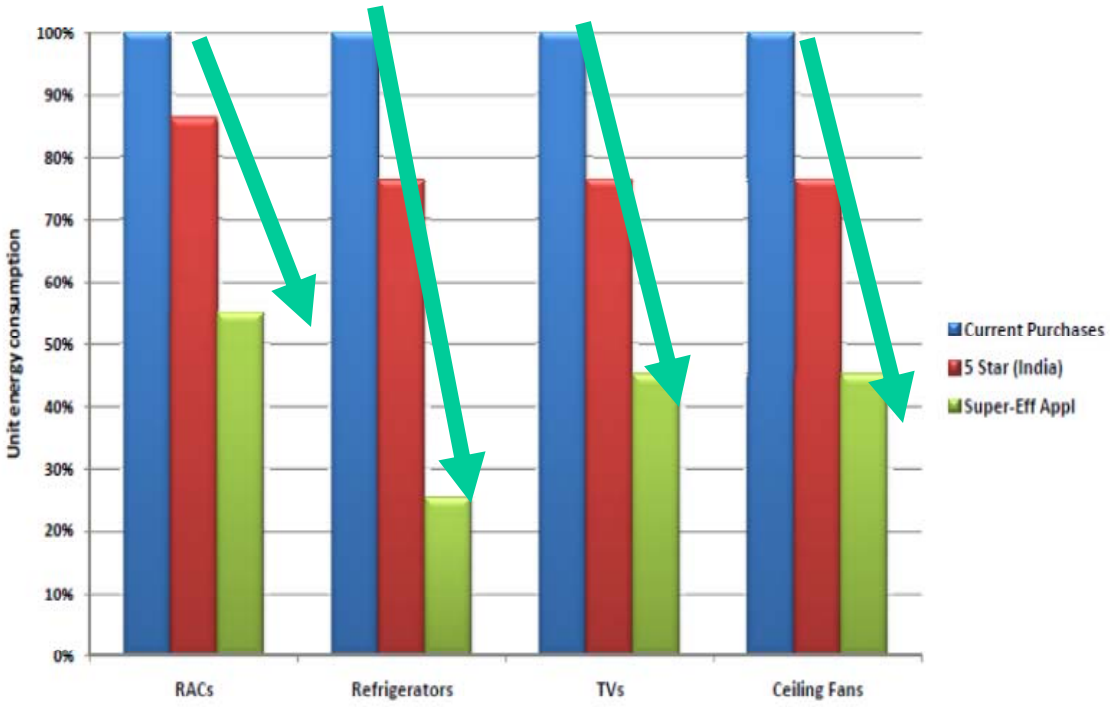


Estimates From Daljit Singh 2011, Prayas

By 2030, more than 70% of the stock of appliances will have been added just after

Can we have energy prudent society?

Comparison of Consumption of Current Purchases and Highest Rated in India with Best World-Wide



Large gap between average current purchase and highest rated model (5-Star), and even larger gap between highest rated and best commercially available world-wide.

Impacts

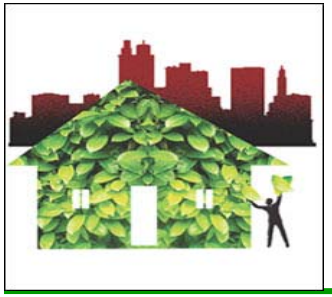
Labelling is encouraging shift to efficient models in some categories

İn 2009-10 and 2010-11, 85-90% of labeled frost free refrigerators were 4 or 5 Star

But room ACs, -- only 15-20% are 4 or 5 Star, but increasing.

Appliances without mandatory labelling, -- large fraction are unlabeled.-- Only 2% of ceiling fansare labeled.

Estimates From Daljit Singh 2011, Prayas



But.....

Energy losses from rebound effect

-- Multiple ownership of efficient appliances use more energy than a single inefficient one – like refrigerator;

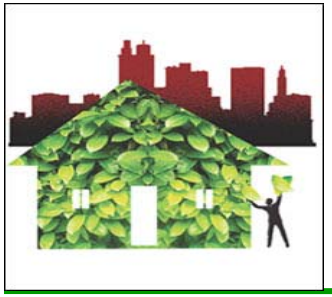
-- Retailers increase lighting use even after meeting specifications -- total energy use increases

-- Study show (WBCD) -- people may increase usage after installing efficient lights -- Lose up to 12% of the expected energy savings by leaving them on longer. Efficient furnace lose up to 30% because people raise the thermostat.

-- Use a range of energy indicators -- absolute total usage; Per person per year; Per square meter per year -- to track change.

-- Need policies to influence behaviour – Change billing practices to make users pay specifically for the energy used. --- Global studies show that when tenants are billed for actual consumption, energy use for heating typically drops by 10 to 20%.

Implementation challenges…….



EIA for buildings -- A major check point: Is it working?

Only comprehensive legal instrument that addresses environmental and resource impacts of **high impact buildings** comprehensively – land, water, energy, waste, pollution, etc

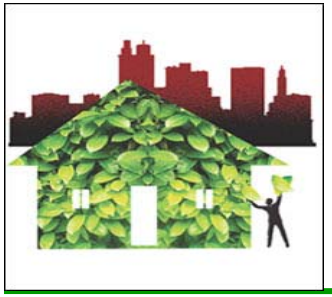
Legally binding under the Environment Protection Act

Influence much larger built up area than any other: Eg -- from energy stand point compare -- EIA and ECBC.

Only in Haryana, -- about 927 buildings reviewed for environmental clearance between 2008-2011. The area data for 446 buildings shows -- 8,29,89,836 square meters.

In contrast, according to the BEE website the ECBC registered buildings nationwide accounted for 829,787 sq meter until 2010.

How can we realise the full potential of this instrument?



Promising tool… but a blunt tool……..

Why EIA is not working effectively for buildings?

Form 1 and 1A are not as exacting as the detailed EIA for industrial and mining projects

Construction can precede consent … blunts the edge

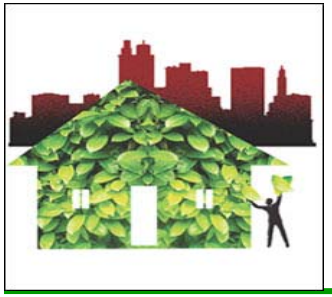
Escape routes … the phenomenon of 19,999 sq mt…….

No clear siting policy ……. Very weak post construction monitoring

No follow up on compliance reports

No public consultation

Inadequate resources and staff ……. and many more….



Weakens sectoral interventions……

Water, energy, waste, land resource, pollution, traffic impacts……

For each sector Form 1 and Form 1A demand some information……

Eg – on Energy it demands to know --

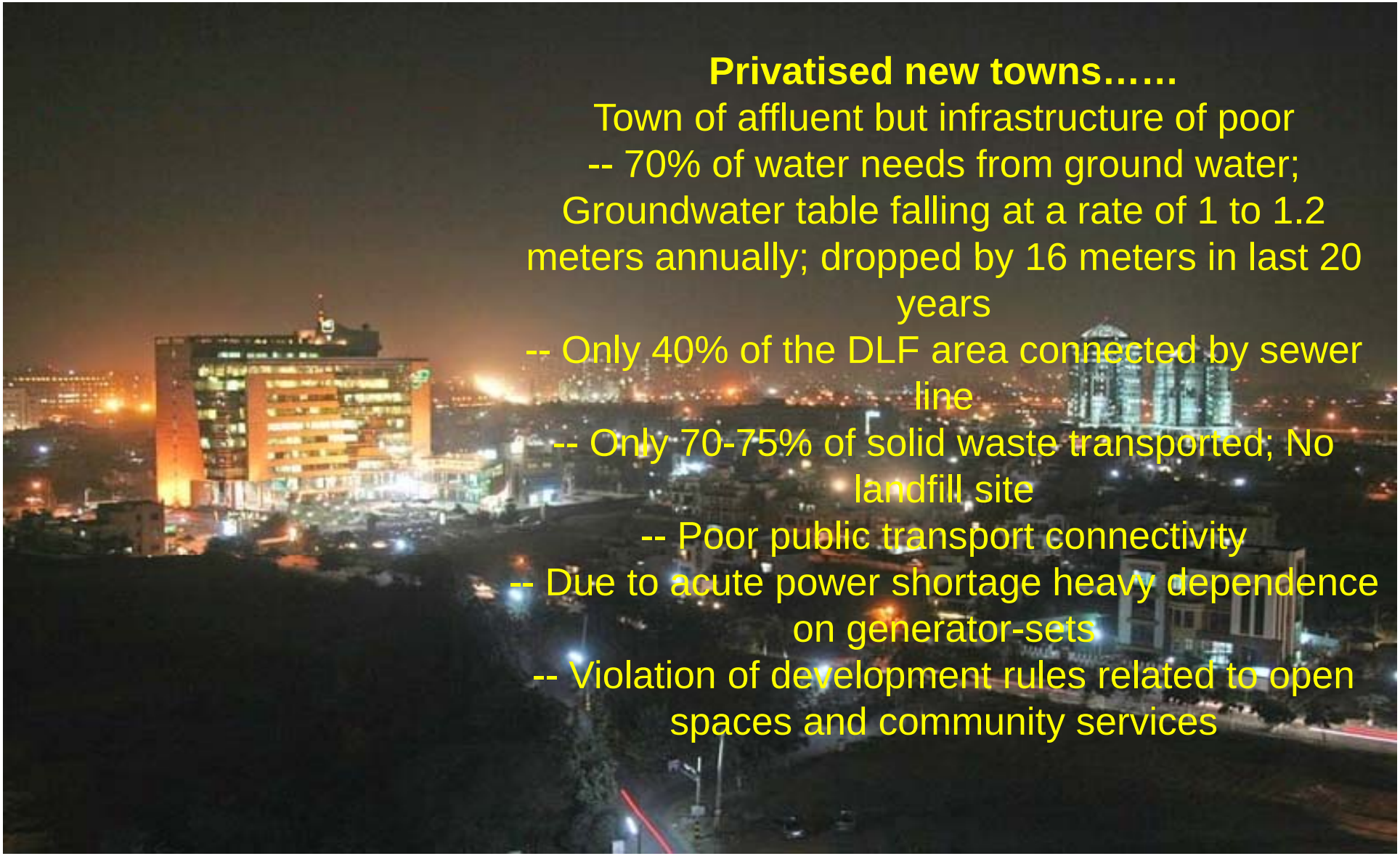
-- Power requirement
-- Application of glass in buildings
-- Renewable energy application
-- Passive solar architectural features
-- Lighting, ventilation, space conditioning
-- Thermal characteristics of the building envelop
-- Impact on micro climate
-- safety etc

No formal linkage with ECBC

But can this make a difference?……

No clear numbers and benchmark; Sometime response as generic as – “All relevant features like orientation of building, shading effect will be incorporated…” On thermal characteristics of buildings — “in accordance of ECBC,,,

EIA could not prevent Gurgaon disaster……



Privatised new towns……

Town of affluent but infrastructure of poor

-- 70% of water needs from ground water; Groundwater table falling at a rate of 1 to 1.2 meters annually; dropped by 16 meters in last 20 years

-- Only 40% of the DLF area connected by sewer line

-- Only 70-75% of solid waste transported; No landfill site

-- Poor public transport connectivity

-- Due to acute power shortage heavy dependence on generator-sets

-- Violation of development rules related to open spaces and community services

Green rating of buildings

Voluntary green rating schemes growing in popularity in globally.

Country	Rating system
United States	Leadership in Energy & Environmental Design (LEED-United States)
	The Green Globe Rating System
	Energy Star (United States Environment Protection Agency)
Canada	Leadership in Energy & Environmental Design — Canada (LEED-Canada)
Australia	Green Star
	Australia Greenhouse Building Rating (AGBR)
United Kingdom	Building Research Environment Assessment Method Consultancy (BREEAM)
Europe	European Environment Agency rating
Hong Kong	Building Environment Assessment Method- Hong Kong (HK-BEAM)
Japan (CASBEE)	Comprehensive Assessment System for Building Environment Efficiency
Taiwan	Ecology, Energy Saving, Waste Reduction and Health (EEWH) (Taiwan)
Singapore	BCA Green Mark
Philippine	Philippine Green Building Council
South Korea	Green Building Council (Korea)
India	GRIHA
	Indian Green Building Council

Greening of building spaces

Details on green rating systems in India

Heads	LEED/IGBC	GRIHA-NRS
Inception Year	2001	2007
Total buildings registered	1505	179
Total Buildings rated	223	8
Square ft registered	1.09 billion sq.ft	Not provided
Square ft rated	Not provided	Not provided

Source: IGBC and GRIHA website

Yet another estimate shows that about 730 million sq ft. have been rated. That is a mere 3 per cent of the existing built up area of 25 billion sq ft. Miniscule!

Why voluntary green rating under scrutiny today?

Voluntary rating schemes work on reputation advantage. It stimulates market and speeds up market uptake of green features. But as private voluntary schemes these remain outside the pale of regulations.

But now the voluntary rating programmes are getting linked with official incentive programmes.

Maharashtra government: Increased floor space index; reduced consent fee; rationalisation of property tax; reduction in state taxes etc. Pimpri Chinchwad

NOIDA, UP: NOIDA authority awards 15 per cent extra FAR (floor area ratio – extra built up area) to projects which commits for LEED gold rating.

Ministry of Renewal Energy incentives for on-site renewal system

Union Environment Ministry allows separate queues for environmental clearance for fast track clearance to buildings that are pre-certified for GRIHA and LEED.

This demands performance monitoring

CSE review of the rating system

Opaque system: There is no data and information on the performance of the green rated buildings. Even in cases where rating systems have been promoted with government back up and incentives there is no record of the actual performance of the buildings.

No performance monitoring and reporting: The Government of India as well as state/ local governments are beginning to give incentives for rated buildings. But no official system for regular monitoring, reporting of information on actual performance of buildings.

No strategy to improve public acceptance of the green rating systems: Documentation of the efficiency measures in buildings and their performance is essential to build public support and acceptance of these programmes. But there is very poor level of information on the applications, costs and pay backs in the public domain.

Globally rating systems are being made more accountable……..

CSE review: without proper performance monitoring green rated buildings perform sub-optimally and sometimes worse than the standard buildings.

Eg. In the US the US Green Building Council -New Buildings Institute study of 2008 showed wide variability in LEED energy performance which was a cause for concern.

In Canada study by the National Research Council Canada, in 2009 shows that on average, LEED buildings used 18-39 per cent less energy per floor area than their conventional counterparts. But, 28-35 per cent of LEED buildings used more energy than their conventional counterparts.

This demands performance based green rating

Poor persons home are not energy guzzlers. But need design innovation to improve comfort……

Greening of poor people's home

Not just resource efficiency in rich person's home. Green measures needed to improve comfort and efficiency of poor peoples' home

Slum development plans can be leveraged

Good practices -- Eg. SAM-BKL project of IGSS: In 2008

'Micro Home Solutions' – Night shelters: designed comfortable shelter with canvas, chicken mesh, bamboo and ropes

-- Design innovations in low cost homes

Source: Micro Home Solutions

DHS- Design Home Solutions

Opportunity for affordable housing in Rajarhat New Town

Building and the neighbourhood…..

Why this difference in urban form?

Old Kolkata by the Hoogly

New Town Kolkata

Need high density development: Cities to set norms

Source: Kolkataskyline.wordpress

Nationally policy is expected to incentivise high-density development for optimal use of urban space and resource efficiency.

Higher FAR do not automatically result in densification.

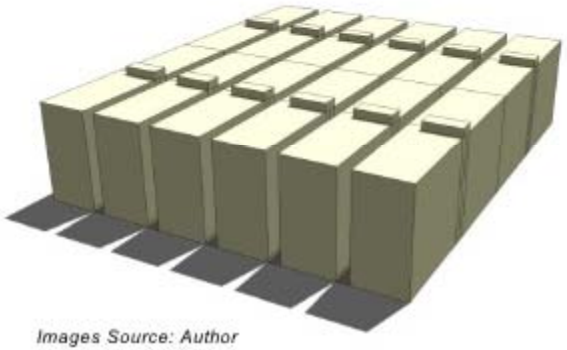
-- Provision of large unit-sizes defeat the purpose of densification.

Link the FAR threshold with a minimum density requirement.

-- Maximum permissible FAR and densities to be based on the capacity of public transport, circulation network and the physical infrastructure thresholds of the area.

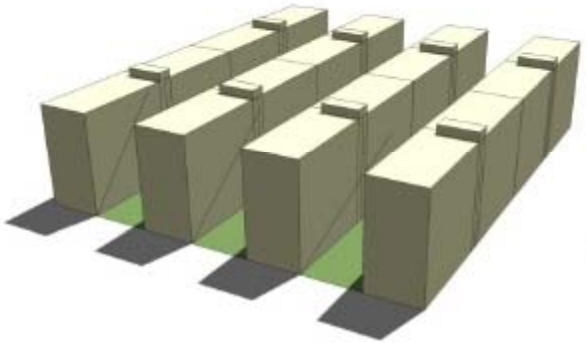
Provide a variety of mixed-use, mixed-income housing, employment and recreation options within walking/cycling distance of each

High rise vs high density…….

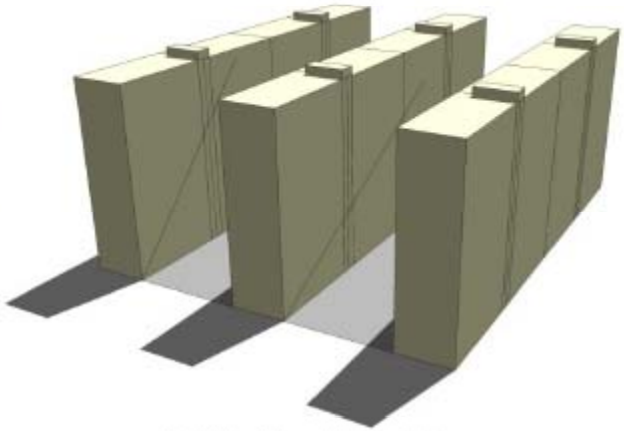


Images Source: Author

Net block level FSI = 6.5
Density = 2600 units/Ha @ 25sq.m. each



Net block level FSI = 4.4
Density = 1750 units/Ha



Net block level FSI = 6.0
Density = 2400 units/Ha

UNDESIRABLE OPTION

Current low-income housing complexes being constructed all over Mumbai Region.

DESIRABLE OPTION

Midrise housing with optimal spacing between buildings allowing daylight and airflow through public spaces and homes.

UNDESIRABLE OPTION

Taller buildings, when designed in rows, require larger spacing in between for adequate daylight access – creating an undesirable urban experience.

Delhi setting norms for high density requirements

Delhi framing Transit Oriented Development Policy (DDA/UTTIPEC)

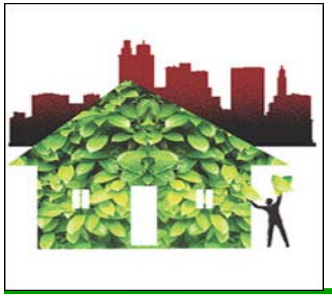
Density minimums as per the table below:

Gross FAR (site)	Minimum permissible density (with ±10% variation)	
	Residential dominated project (Residential FAR ≥ 50%)	**Predominantly non-residential** (Residential FAR ≤ 30%)
Below 1.0	Under-utilization of FAR (not permitted)	Under-utilization of FAR (not permitted)
1.1 - 2.0	200- 400 du/ha	100 - 200 du/ha
upto 3.0	400 - 600 du/ha	250 - 400 du/ha
3.1 - 4.0	600 - 800 du/ha	400 - 600 du/ha

*** Site level FAR shall be based on Approved TOD Influence Zone Plan.**

-- Mixed land-use norms: At least 30% residential and 20% Commercial & Institutional use of FAR is mandatory within the Influence Zone.

-- Rajarhat plan 2006 for 3,779 hectares: -- Residential space -- 38 percent; - Industrial land -- 6 percent, -- Commercial land -- 10 percent, -- Institutional use -- 8 percent, -- Transportation zones -- 11 percent, -- Open spaces -- 24 percent, -- IT sector -- 4 percent of 135 hectares diverted for use by IT sector users (source: HIDCO, 2009).



Build compact city

……Devil is in detail

National Habitat Standard Mission of the Ministry of Urban Development

Guidelines for compact mixed land use

-- 95% of residences should have daily needs retail, parks, primary schools and recreational areas accessible **within 400m walking distance.**

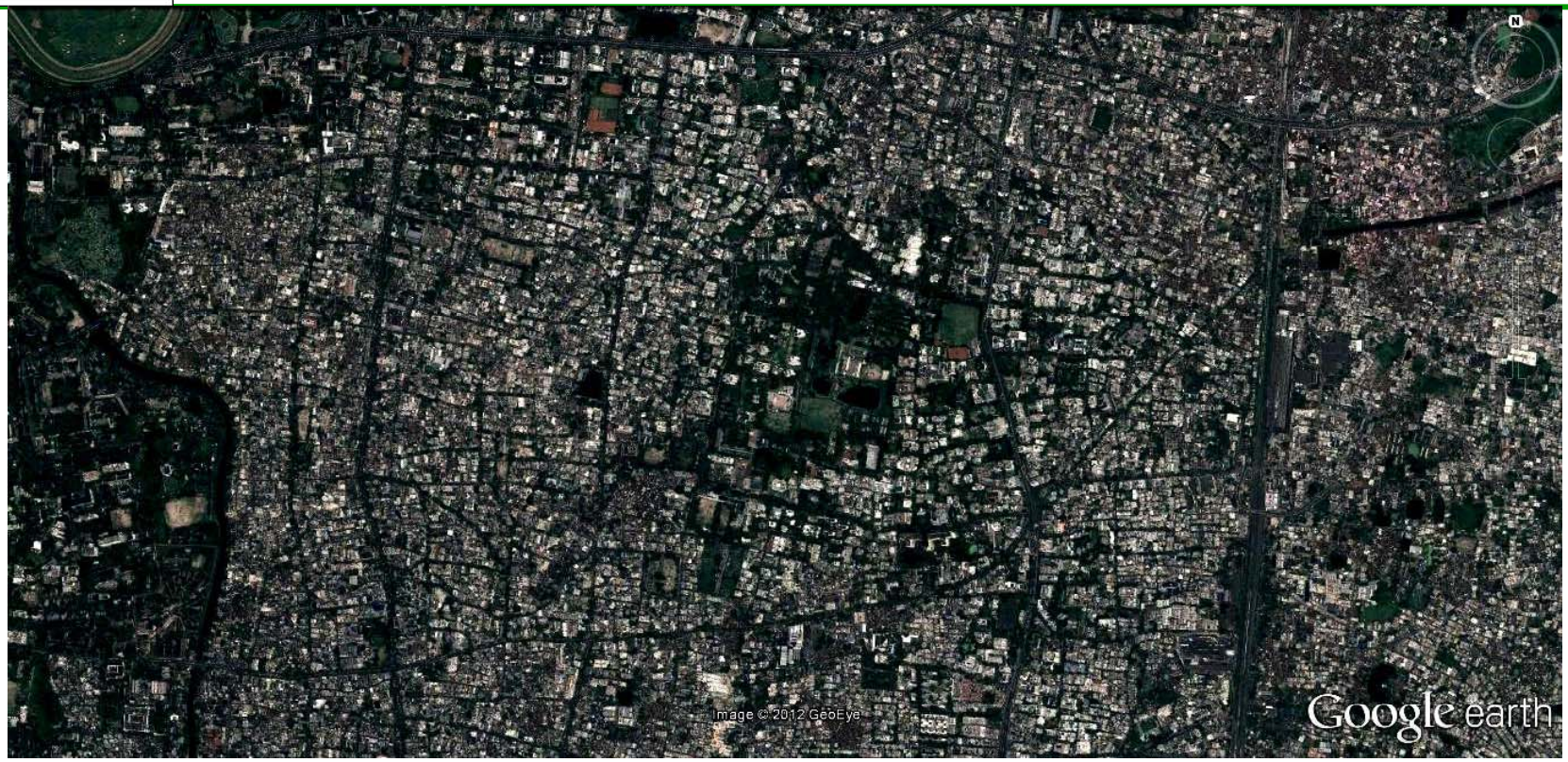
-- 95% residences should have access to employment and public and institutional services by public transport or bicycle or walk or combination of two or more.

-- At least 85% of all streets to have mixed use development.

-- Need small block size with high density permeable streets etc

UTTIPEC guidelines

Hierarchy of Facilities	Accessibility Standard from each home/ work place.*
MRTS Station	Approx. 800 m or 10 min walk
Metro feeder/ HOV feeder Stop	Approx. 400 m or 5 min walk
Bus Stop	Approx. 400 m or 5 min walk
IPT/ auto-rickshaw Stand	Approx. 250 m or 3 min walk
Cycle Rickshaw Stand	Approx. 250 m or 3 min walk
Cycle Rental Stand	Approx. 250 m or 3 min walk
Shared private parking garage	Approx. 500 m or 6 min walk



Central Kolkata

Older cities -- dense network of streets with excellent connectivity. The average block with public access streets under 1 hectare with block circumference of 400m or less.

California: SB 375 law -- requires jobs, recreation and housing planned in a way that people can live and work closer together, and drive less.

Enable change through design……..

Need guidelines for orientation…….

Proposed UTTIPEC guidelines for building orientation: All dwelling units should get minimum 2-hour solar access in at least one habitable area (living room, bedroom or private open space) on the shortest winter day of Dec 21 (Winter Solstice).

Avoid car feeders to buildings –
Public transport to define the urban form

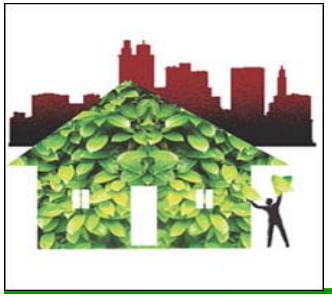
But……..

Poor walking access

Footpaths for beautification

Source: CSE

No mid block crossings for pedestrians – Advantage to vehicles



TOD norms in Delhi:
Urban design to decide travel choices……..

Urban design to induce Modal Shift in favour of public transport, IPT, cycling and walking modes with an approximate target of 80-20, especially for short trips.

Network Density criteria:

-- **Maximum distance between two vehicular streets in a network -- no greater than 250m (C/C) at any point…….**

-- **Maximum distance between two pedestrian/ NMT only streets in a network -- no greater than 150m (C/C) at any point. …**

-- No vehicular Street R/W within TOD Influence Zones shall be more than 30m….

-- **Signalized safe at-grade crossings for pedestrians and NMT** at all junctions and mid-blocks

-- **Streets meant primarily for NMT** movement as well as all streets of ROW 12m or below, should be limited to **maximum Speed of 20km/hr by design**.

-- **Traffic calming mandatory** for all streets with ROW of 12m or less -- like narrowing of driveway, meandering path (use of trees, islands, kerbs, street furniture, provision of sharp turns, traffic-calmed surfaces, green buffers, etc. (UTTIPEC Street Design Guidelines). Etc,

Mitigate traffic impacts of buildings

Eg EIA provides for traffic impact assessment of buildings. But rarely assessed….

But --- There is no provision for demand management to mitigate traffic impact in the surrounding areas.

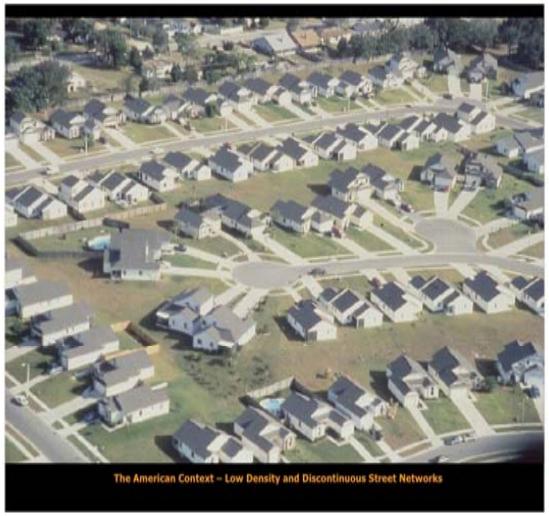
Cumulative impact of the construction on the carrying capacity of the surrounding areas not addressed.

Self reported plans provided by the project proponents are not cleared by any assigned authority

Make traffic related clearances from competent authorities mandatory

Do not repeat mistakes

Low density car centric growth: wasteful use of valuable urban land



Car centric infrastructure in the US

Parking: wasteful impact of cars **Minimum parking norms … Delhi --** 3 ECS/100 sqm in Commercial; 2 ECS/100 sqm in residential; 1.8 ECS/100 sqm in Government buildings. **Kolkata and Pune** specify ECS per 75 sq m; **Hyderabad** – upto 60 per cent of built up area……and so on

But why other global cities with higher car ownership provide less parking? In Tokyo parking norms in CBD lower than Delhi…..

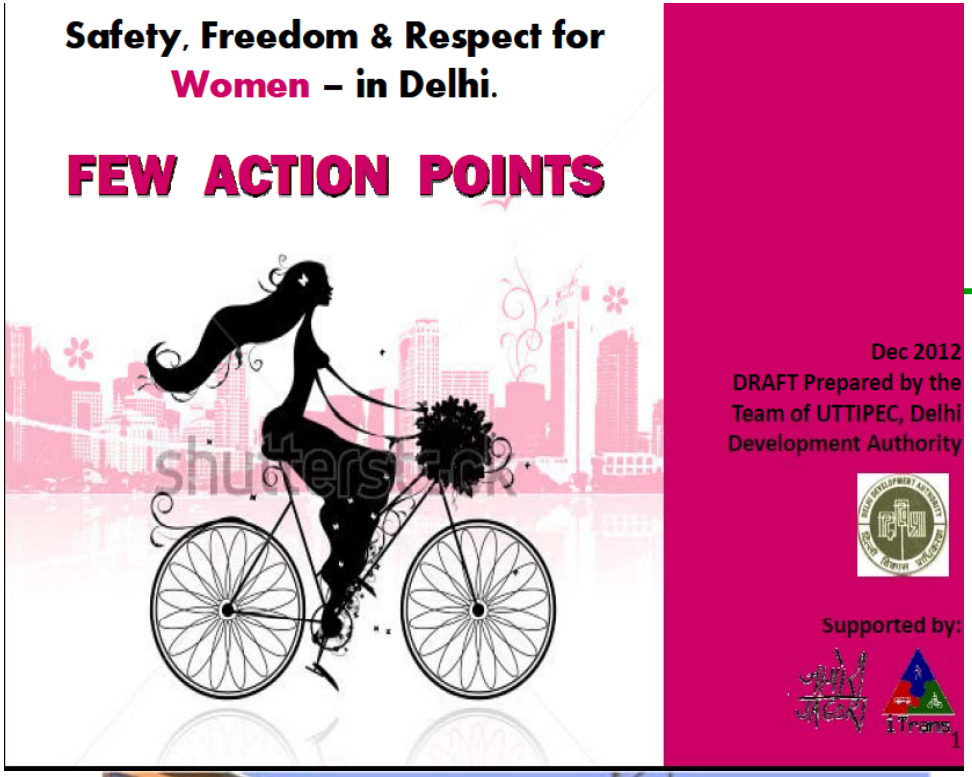
Shift from minimum requirement to maximum/caps

Flexible standards: Eg. In Hong Kong parking provision is decided based on accessibility of an area.

Sites may change from parking deficit to parking surplus with improved accessibility. For Eg, -- In CP parking demand dropped by 10% after introduction of metro.

- **Opt for common and shared parking. Discourage individual – private parking**

Build safe cities and buildings….



To ensure Safety of Pedestrians:

Safety and urban planning…

Excerpts:

Initiate planning and road design schemes where unwatched streets can be transformed... to make safe urban areas:
• **Get rid of walls and setbacks. Add street edge uses -- for road safety at night, Transparent fencing** shall be used above 300 mm high toe wall from ground level.
• Add planned hawker zones.

• Adhere to IRC 103:2012 for Street Design.
• Introduce planned mixed-use housing …along road edges of major vulnerable roads.

Slow down vehicles on Roads :
• No more signal free corridors- signalize existing ones.
• Remove gates on public streets from gated colonies from vulnerable areas.

Where will you feel more safe to walk?

Why do we have building setbacks and boundary walls?

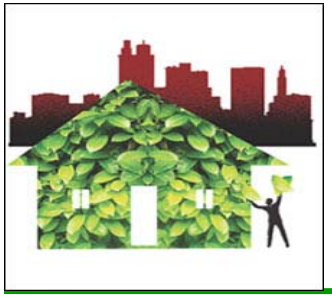
Need financial mechanism..

Financial mechanisms can make energy savings more valued by those involved in the development, operation and use of buildings.

Need transparency in energy use and cost in the building value chain

- Split incentives between building owners and users -- the returns on energy efficiency investments do not go to those making the investment

Buildings	City	Area (Sq ft)	Hike in cost (in%)	Payback on cost premium (in years)
CII Sobrabji Godrej GBC	Hyderabad	20,000	18	7
ITC Green centre	Gurgaon	170,000	15	6
Spectral Services	NOIDA	150,000	8	4
WIPRO	Gurgaon	175,000	8	5
Technopolis	Kolkata	72,000	6	3



Lessons from first generation action

Cities need clear roadmap and targets on green building construction and operations

Legal framework

-- Enforce building energy codes. Make them progressively more stringent

-- Need measurable results from post-occupancy valuation of buildings –Audit energy performance. -- Sub-metering controls and charging according to use; Incentive based billing

-- Labeling systems

Incentives and subsidies for green buildings

Capacity building for architects, engineers, developers; understanding of code requirements; technical tools for execution

-- **Introduce process incentives for developers for integrated design approaches to urban planning**

Need integrated approach to zoning laws and town building norms

Peoples' participation in planning (eg. Global best practices -- Friedburg, Germany).

Renewable energy application -- Onsite renewable generation for buildings.

-- Feed-in tariffs for on-site generation

Deepen public and policy understanding for the big change

Need people as partners

Tell people what “works” and what “doesn’t work” in terms of energy-saving strategies for homes.

Tell them about the rate of return on costs for energy-efficiency and products and appliances. People must know where to find information on options, prices and suppliers

Deepen understanding -- how individual decisions to conserve energy add up to overall savings that benefit the community.

Resource efficient city development without compromising economic growth (eg. Global best practices -- Vaxjo, Sweden – 30% decline in city GHG but 20% increase in regional GDP).

•Chitra Vishwanath's house is made of compressed stabilised earth blocks excavated from the site itself (Photo: Chitra Vishwanath)

Let’s begin the discussions…