Cities and the Environment Connection
The big picture

Anumita Roychowdhury
Centre for Science and Environment

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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

What about India?

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.

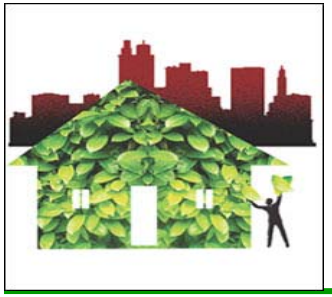
Slow growth at the bottom: Lower rung towns stagnating. Some have grown due to infrastructure investments and rural to urban migration.

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.



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.

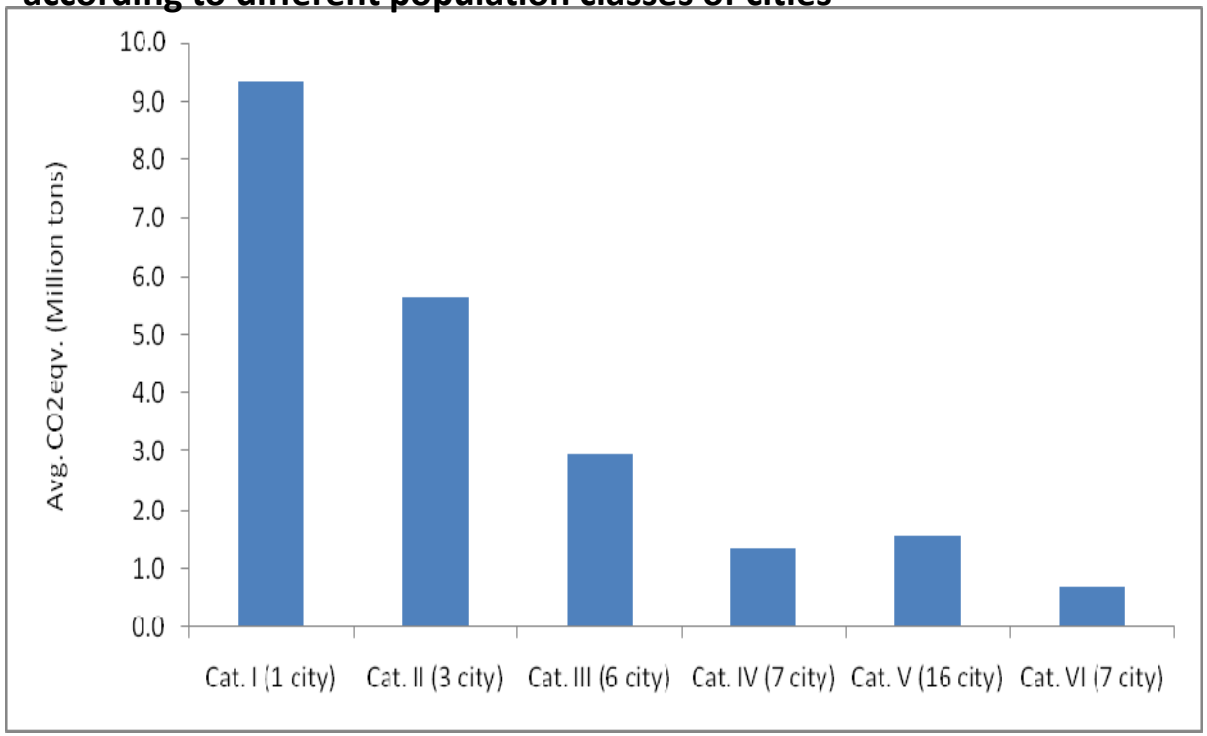
Big increase in global CO2 from increase in floor space in buildings of various types, -- especially in non-OECD countries.

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.

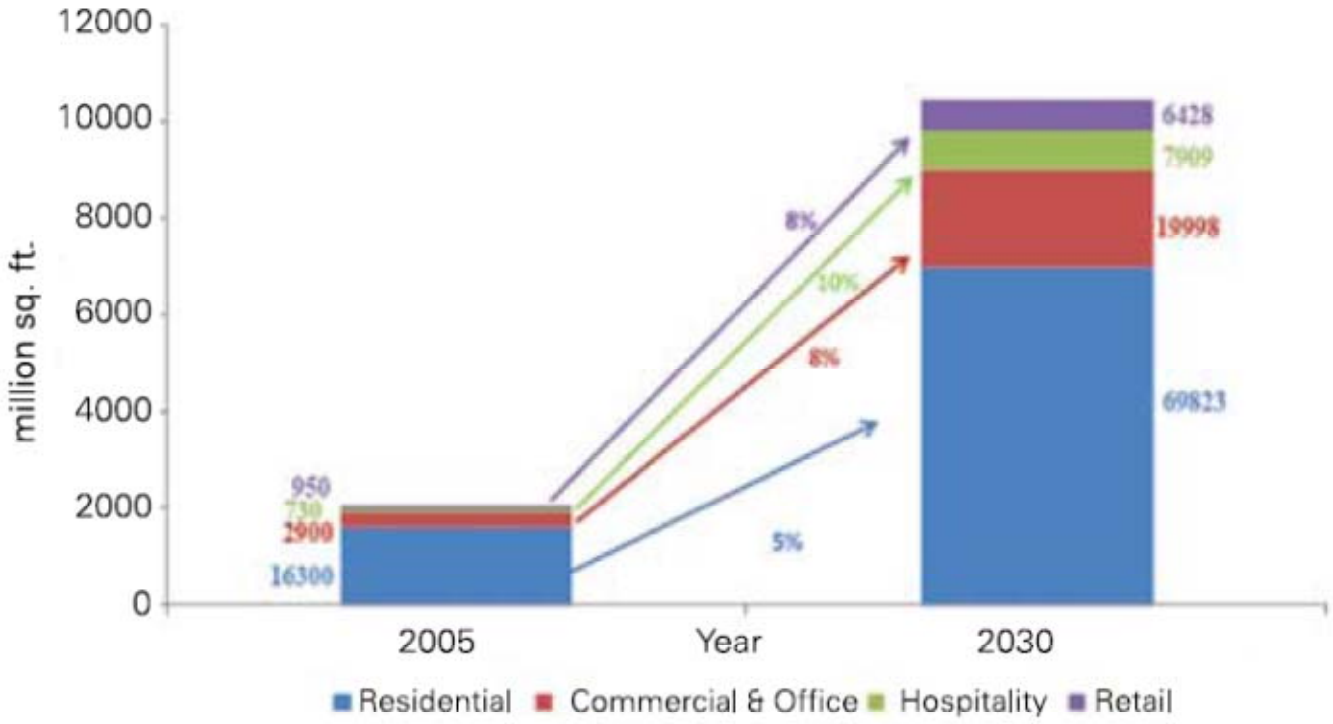
Constructed area in 2005: close to 25 billion square feet.

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)

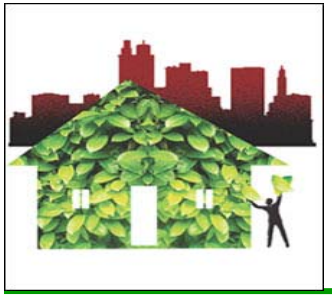
Building sector: explosive growth



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)

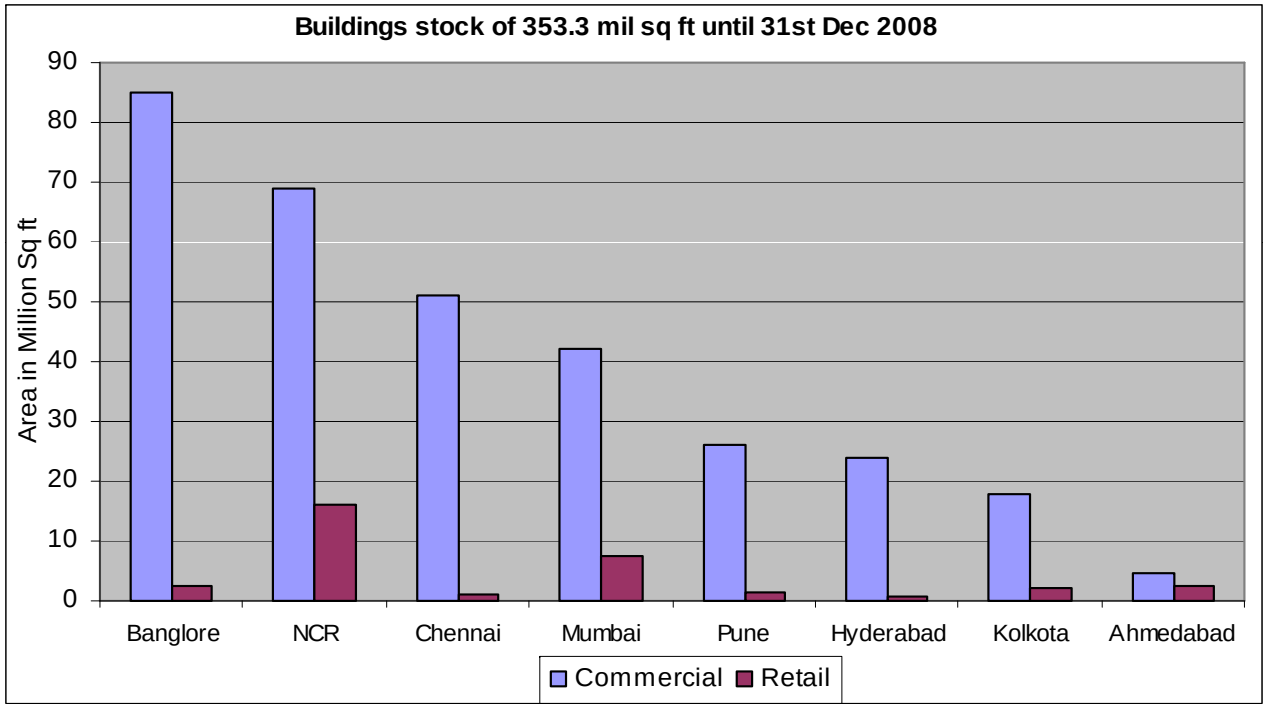
Trends in metro cities explosive

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)

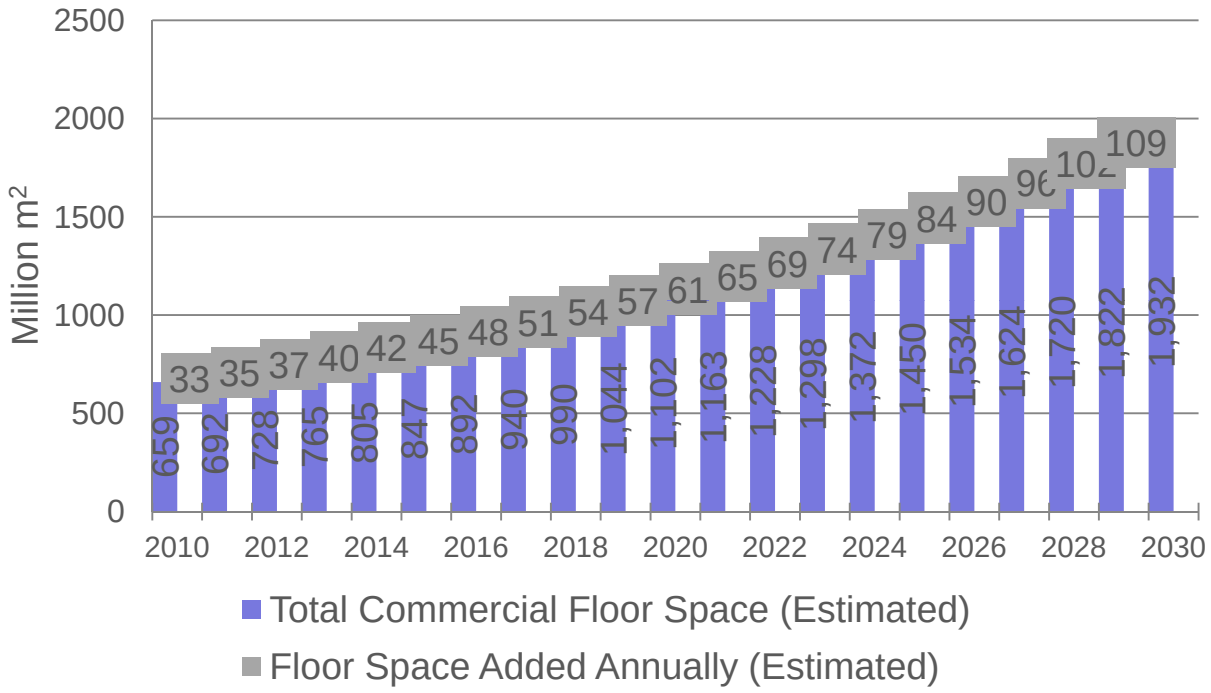
Suburbs: **new growth and resource conflict areas**

- 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

Curb energy guzzling

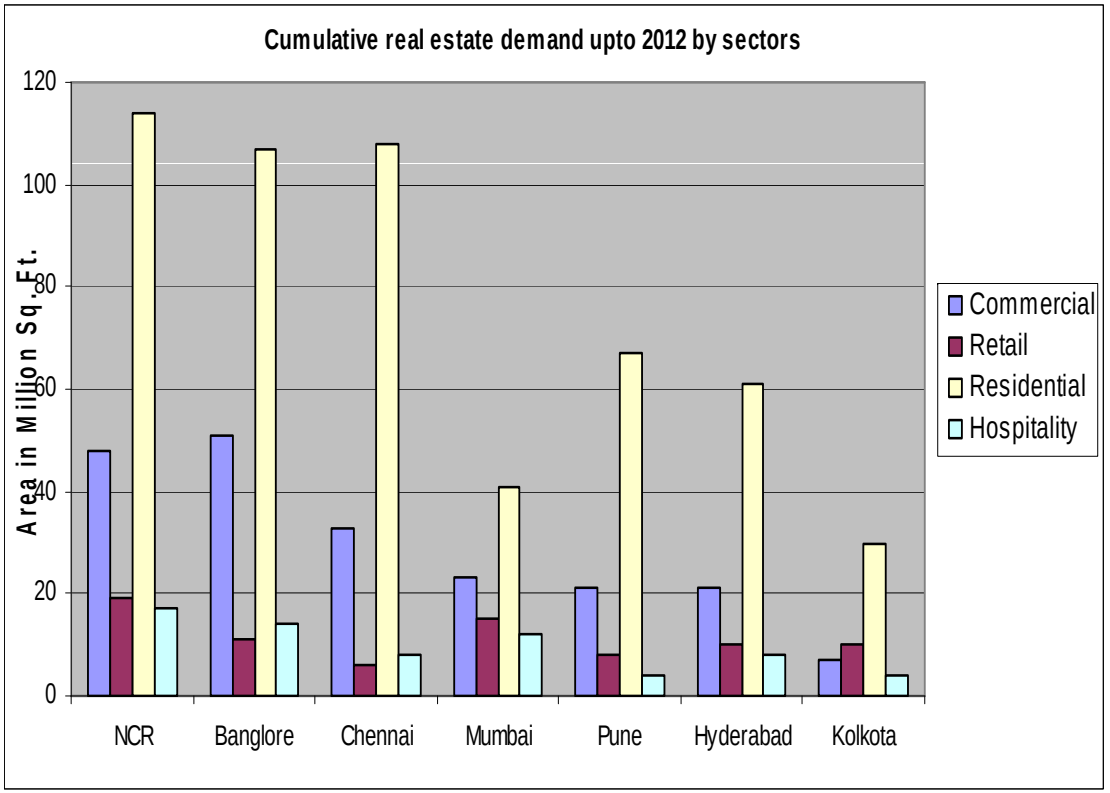
In the US, energy intensity increased from an average 310 kWh/m2/yr in 1995 to an average of 351 kWh/m2/yr in 2003 -- 15% increase. – due to higher levels of lighting and equipment in commercial spaces.

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: Also RAY Earmarks 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..

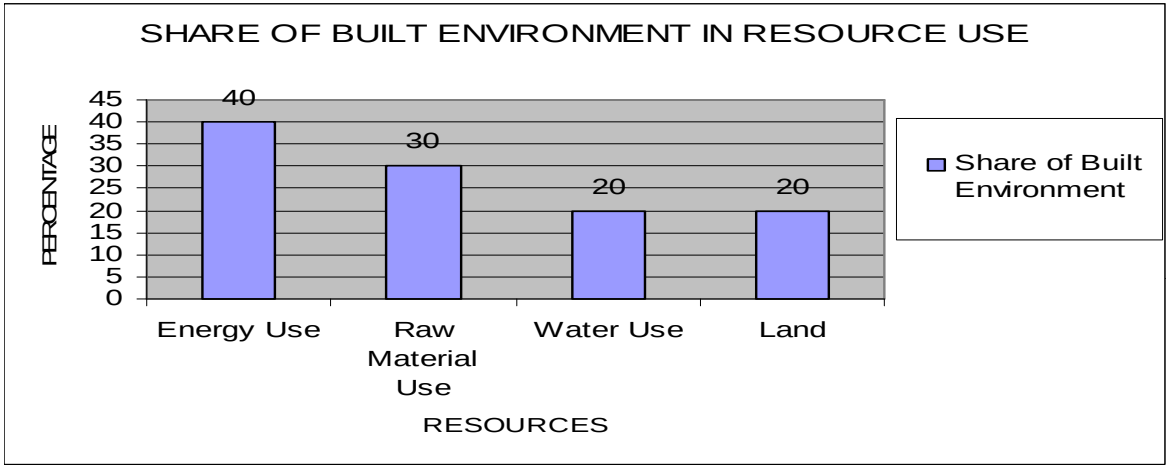
Middle and high income housing: More private players. Eg. CREDAI - association cover 80% of the real estate development in 13 states. Scope of corporate social responsibility.

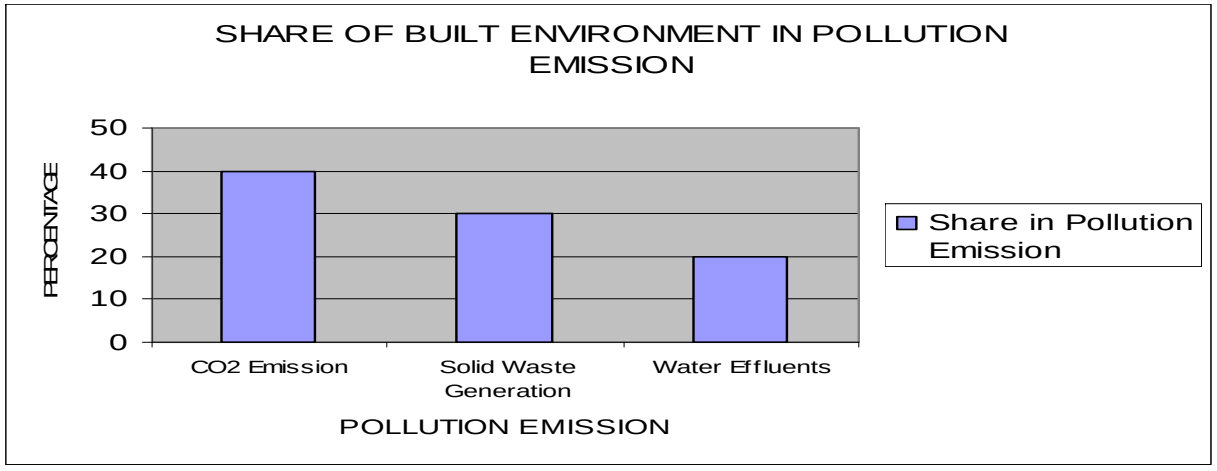


Green worries?.....

Buildings: earthscrapers

Burden of Built Environment

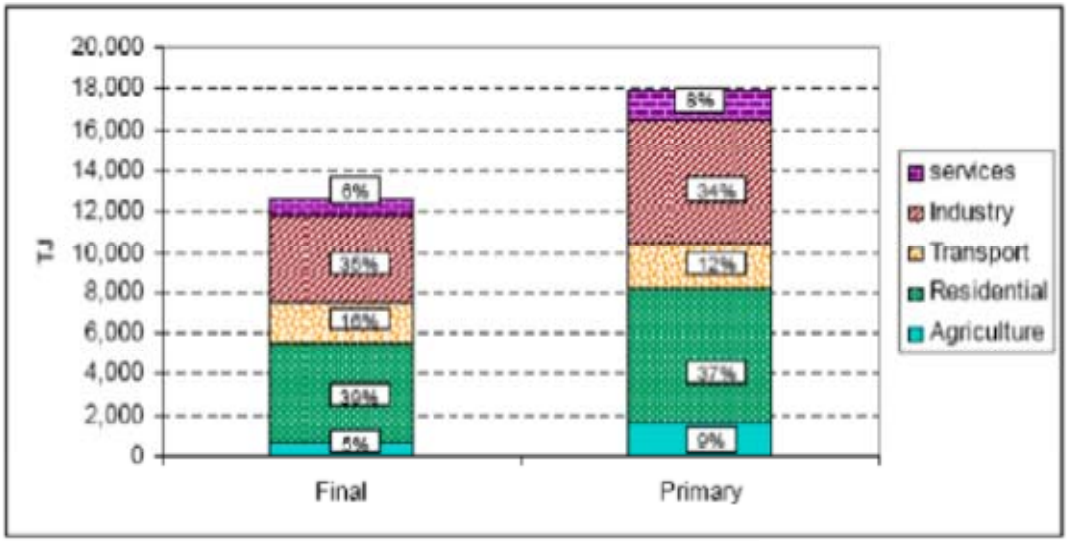




Source: Anon, 2008, Green Buildings – an overview, Capacity Building Series (2008-2009), June 2009, TARA Nirman Kendra, New Delhi

The energy challenge…….

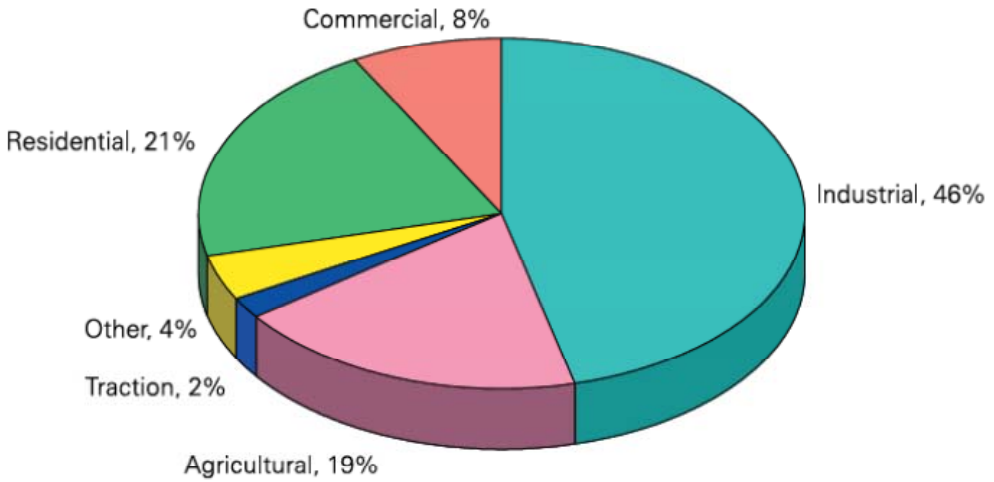
Primary Energy by User (including biomass) 2004



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

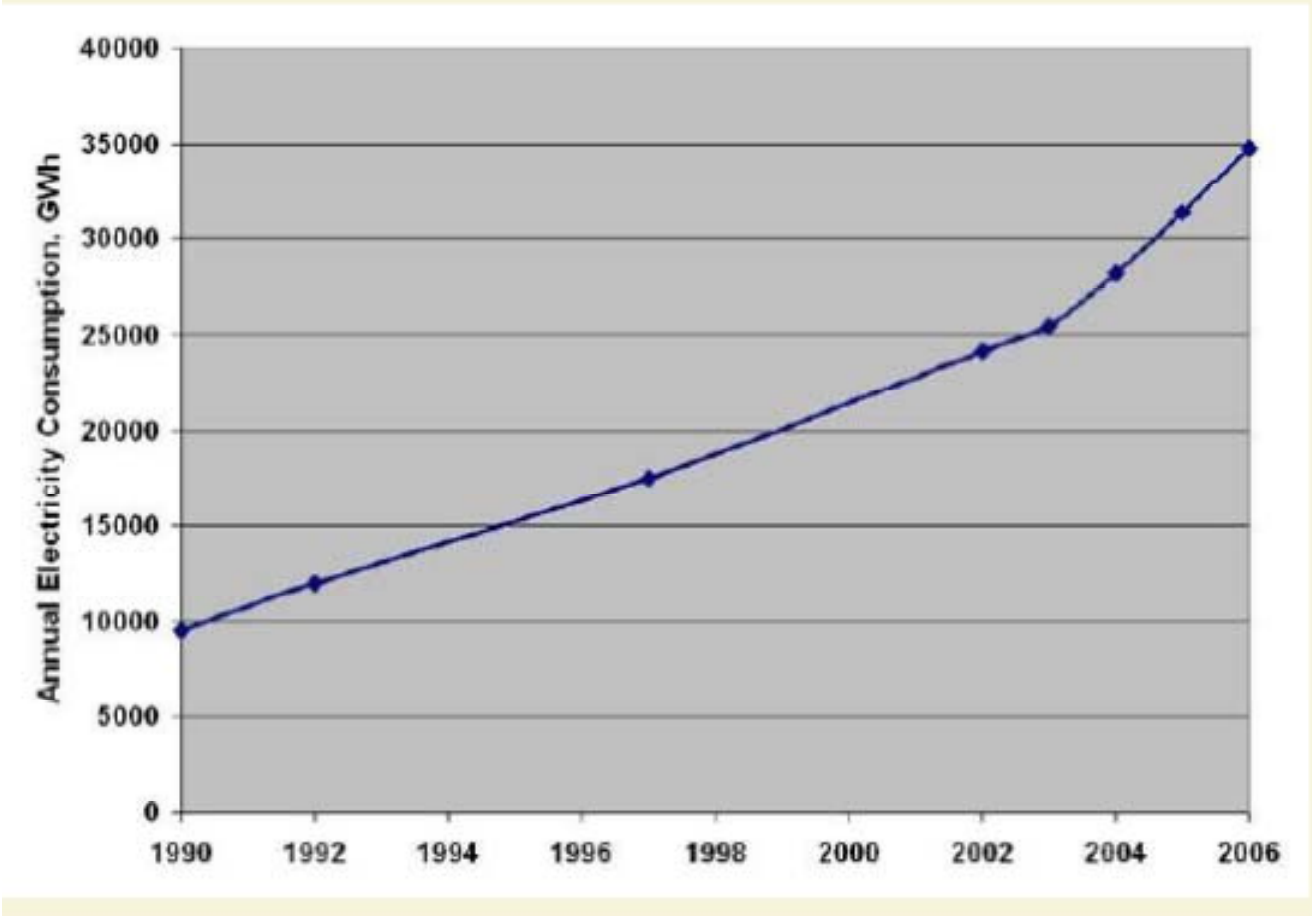
Residential sector consume nearly the highest

India's Primary Electricity Consumption

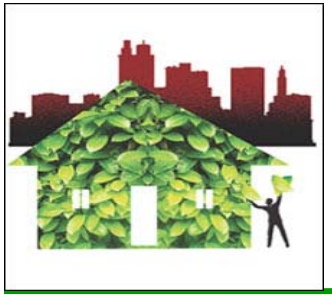


Electricity Use in the Commercial Sector is exploding

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)……..

ECBC being adapted in Punjab

First generation action ……..

First generation action in Delhi

Initiated and proposed

-- Cool roof programme initiated

-- Implementation of ECBC in government buildings

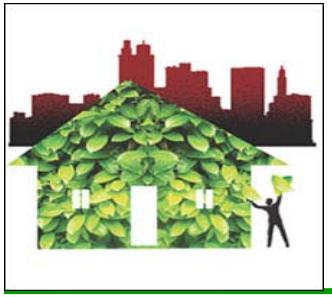
-- Fulfill the targets of Enhanced Energy Efficiency Mission to retrofit 100 existing buildings with area above 10,000 sq ft

-- 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

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.

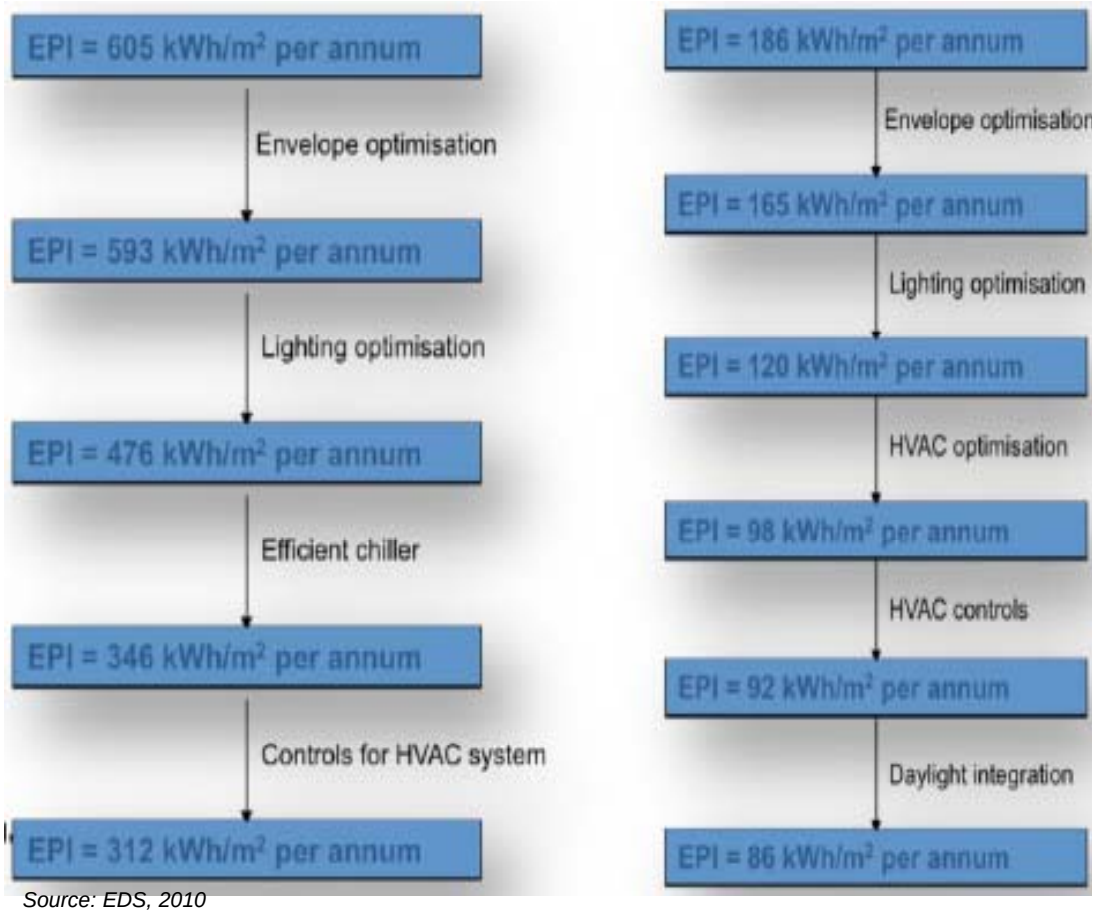
-- **Retrofit existing stock**:

-- **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

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..

Green building is common sense

Punjab Energy Development Agency building

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

Dazzled by Glass.....

The Forest Complex on 'green building design' principles -- a lot of emphasis on conservation of energy. "*Achieved by using high performance glass on the façade, which would let in adequate light but keep out the heat*."

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.

Unsuitable for the tropical climate of India that need 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 .

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.

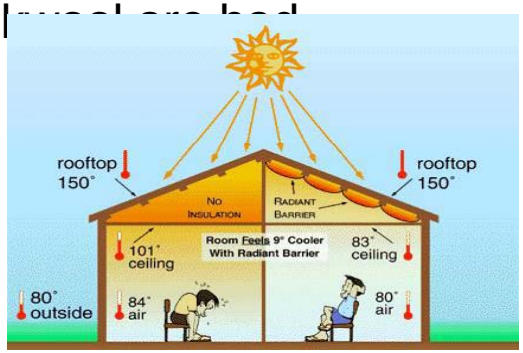
Concerns…..

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

The code does not differentiate between climate zones or between conditioned and non-conditioned buildings.

Increased use of expensive, imported and environmentally inappropriate materials.

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



…….Try different and innovative methods

Indian construction has followed a system approach using many natural and passive cooling methods. -- sun shades, ventilation, and insulation to keep structures cool and comfortable.

Need more 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.

Try different methods and material: Replacing 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.

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

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.

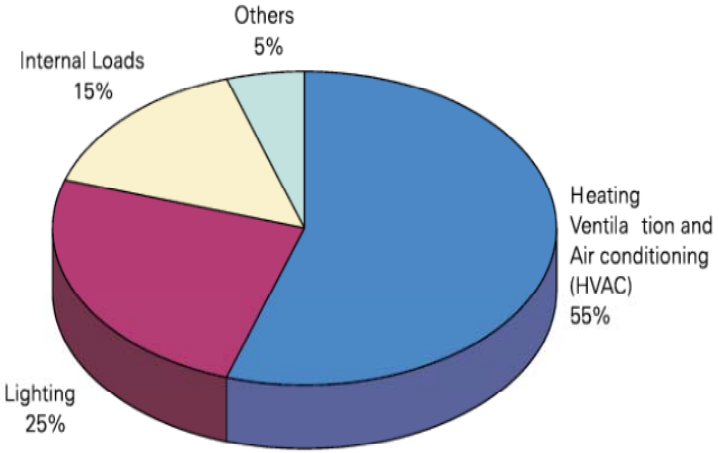
In 2012, Supreme Court order enforcing new environmental control guidelines issued by the Ministry of Environment and Forest (MoEF), restrictions were imposed on mining and brick kilns. The prices of construction materials increased by almost 30%.

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 …….

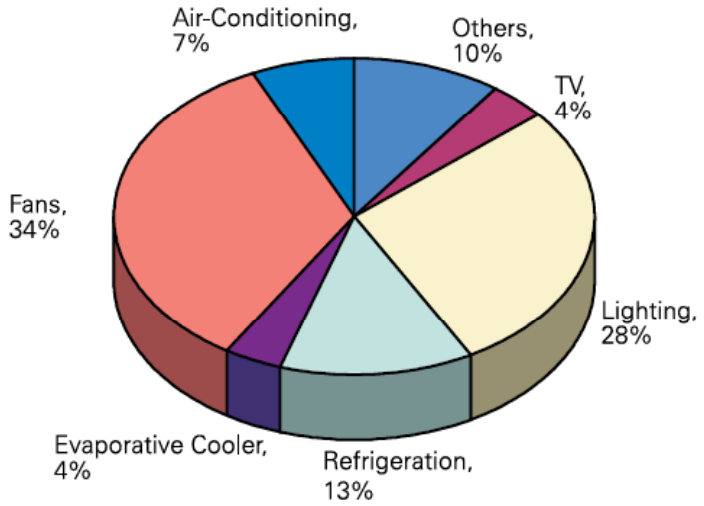
HVAC use up maximum energy in commercial buildings



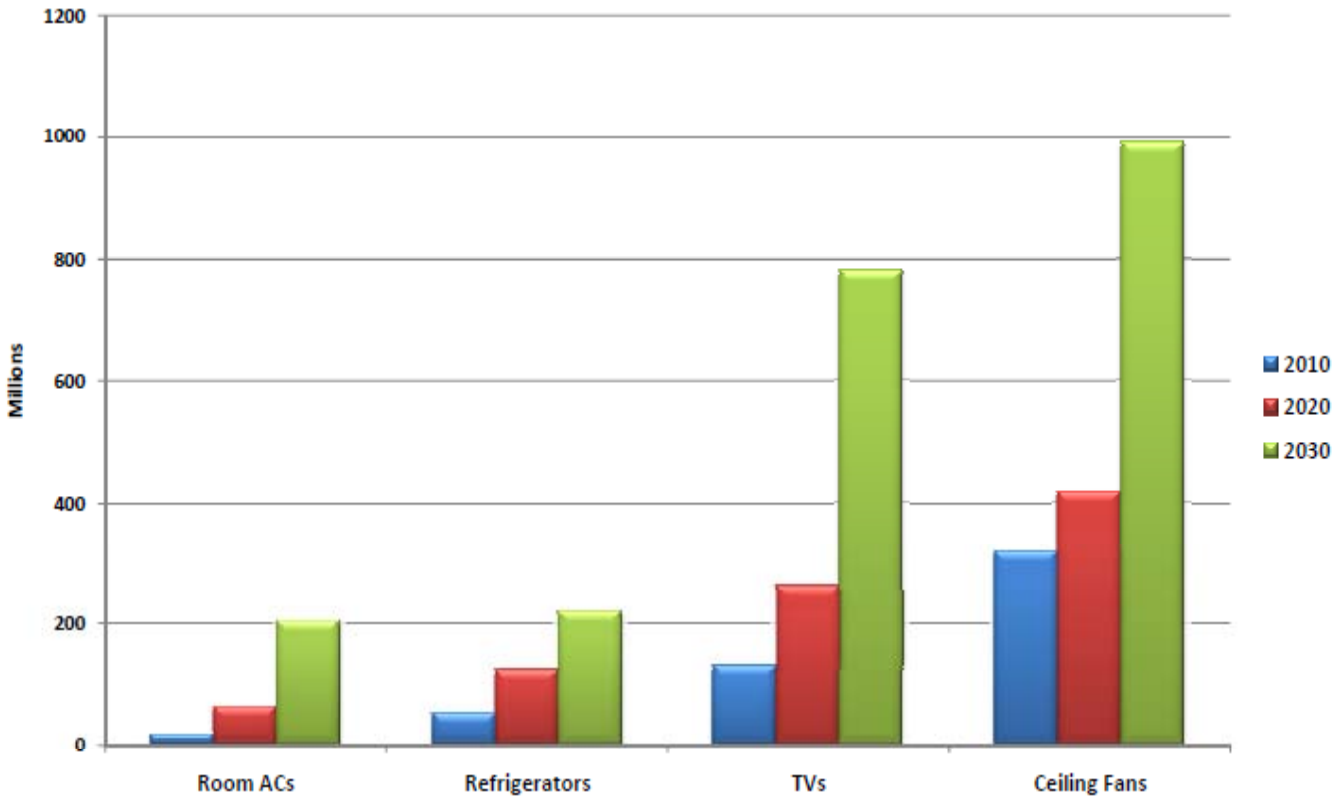
Lighting and AC use up 80 per cent of the energy in a commercial building. AC market is growing at 25% a year

Source: Bureau of Energy Efficiency

Fans and refrigerators use maximum energy in residential buildings



Ownership of Appliances in India Growing Rapidly

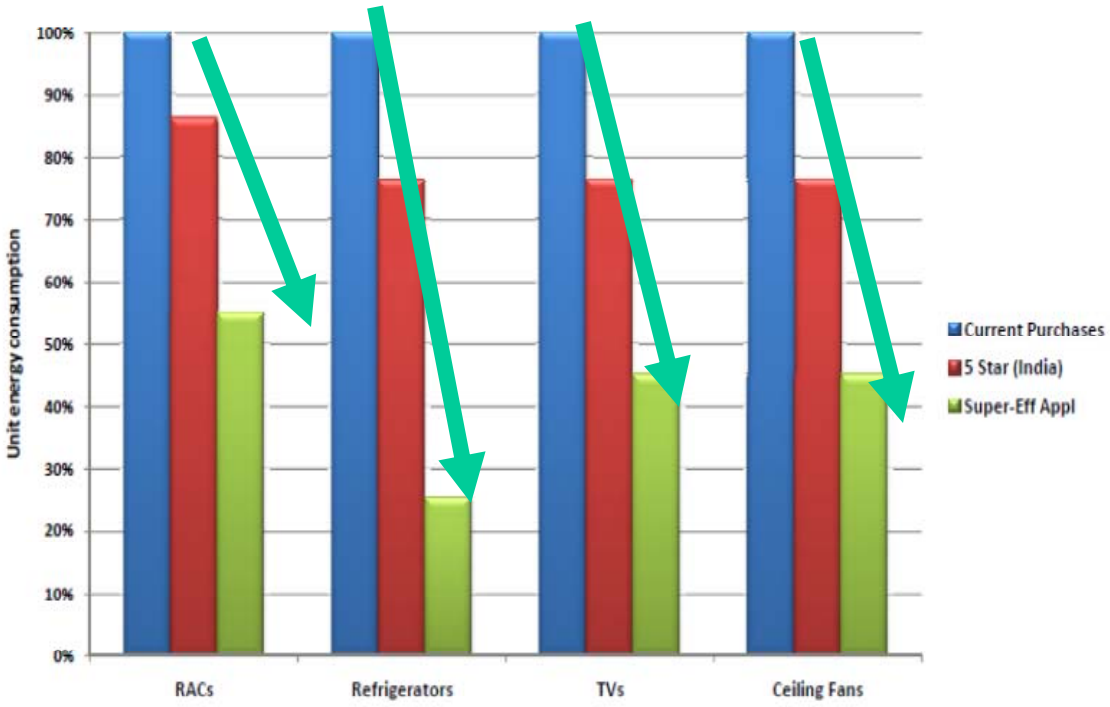


Estimates From Daljit Singh 2011, Prayas

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

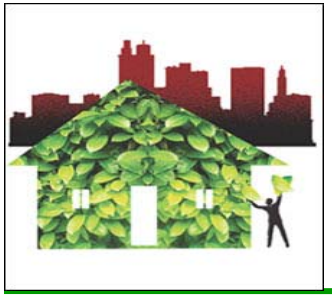
Labelling is encouraging shift to efficient models in some categories

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;

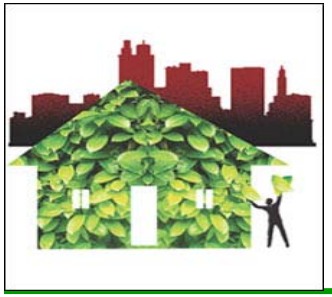
-- Retailers increase lighting use even after meeting specifications -- total energy use increases

-- 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

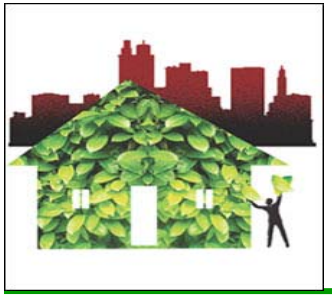
Legally binding under the Environment Protection Act

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

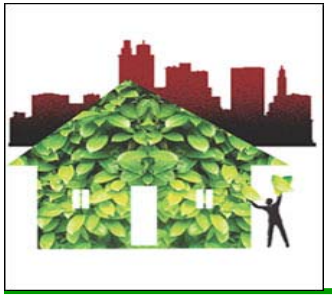
Escape routes … the phenomenon of 19,999 sq mt…….

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,,,

Reform EIA for buildings

Strong post-construction monitoring…site selection and acquisition after environmental clearance….

Establish clear benchmarks for assessment: Link with ECBC. Institutional and monitoring mechanism for ECBC to align with environmental clearance process

Align with existing norms and other regulations.

Quality of information and disclosure. Data and methodology to be more transparent. Need protocol for data generation, data quality, consistency, and reliability.

Build capacity for enforcement and monitoring.

Energy audits should be mandatory for bi-annual reports.

Harmonise EIA-ECBC-NBC – plug and socket for better results….

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 1 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

DHS- Design Home Solutions

Source: Micro Home Solutions

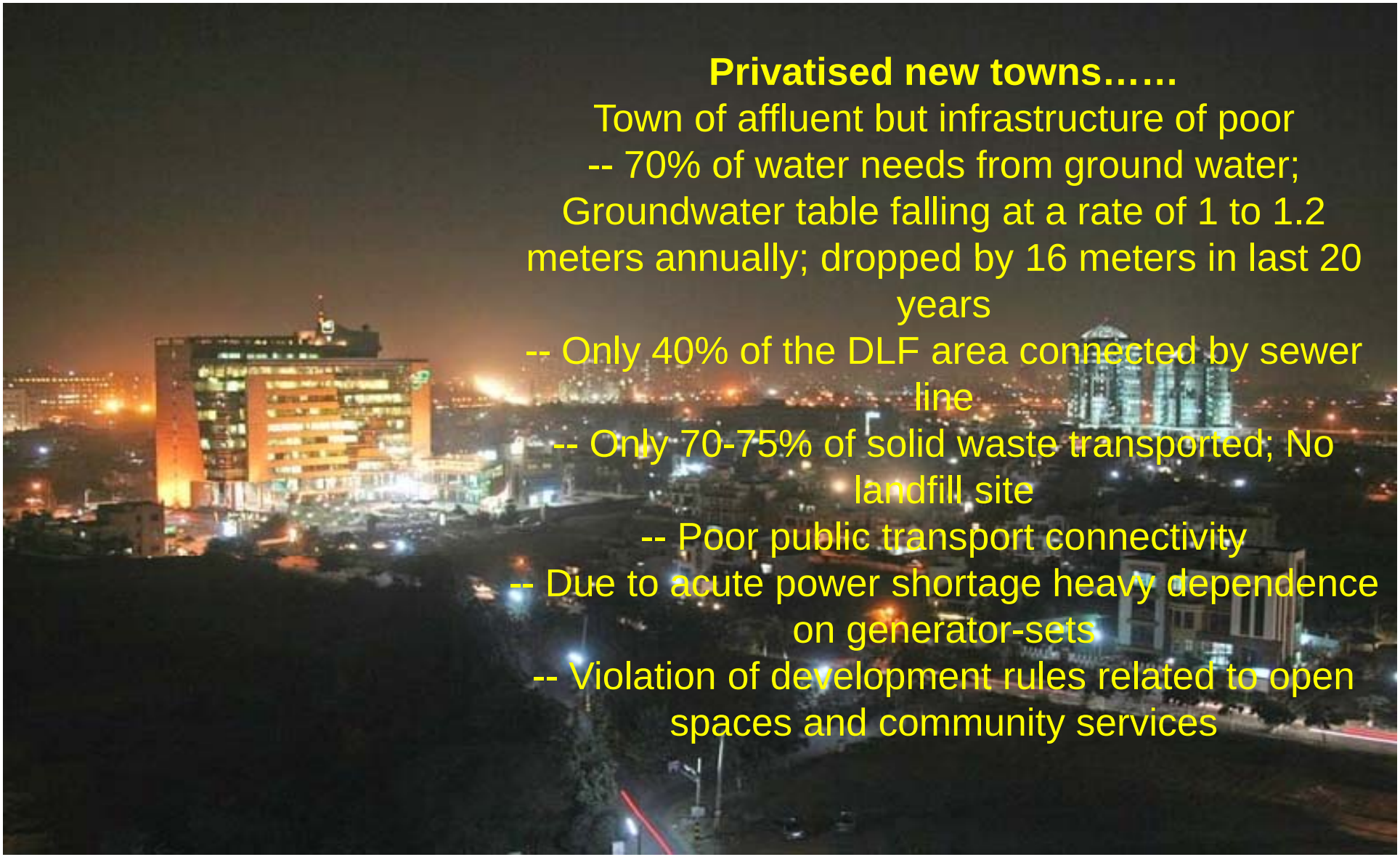
Its about town and neighbourhood…..

Towns made to order: IDFC's India Infrastructure report 2009 states -- the size of private 'integrated' townships ranges from 100 to over 1000 acres and more than 200 such townships are being planned especially around the metros. Touted as Walk to Work Green Towns – without green benchmark

Urban planning in existing towns: an opportunity Punjab: Integrated development of 147 cities. The state has notified master plans of 32 cities, 72 local planning areas. Punjab to have master planning for all its urban centres

-- Provide, support and facilitate sustainable infrastructure
    -- Provide public transport connectivity
    -- Provide metered water and electricitysupply
    -- Support decentralized waste water management
    -- Support decentralized, sustainable energy management
    -- Increase permissible density especially in areas with infrastructure. Higher density along transport corridors

Gurgaon syndrome……



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

High density development……

Punjab: Punjab is moving towards high density development. The new policy expected in December 2012 expected to incentivise high-rise constructions in order to make optimal utilisation of urban space.

Delhi framing Transit Oriented Development Policy

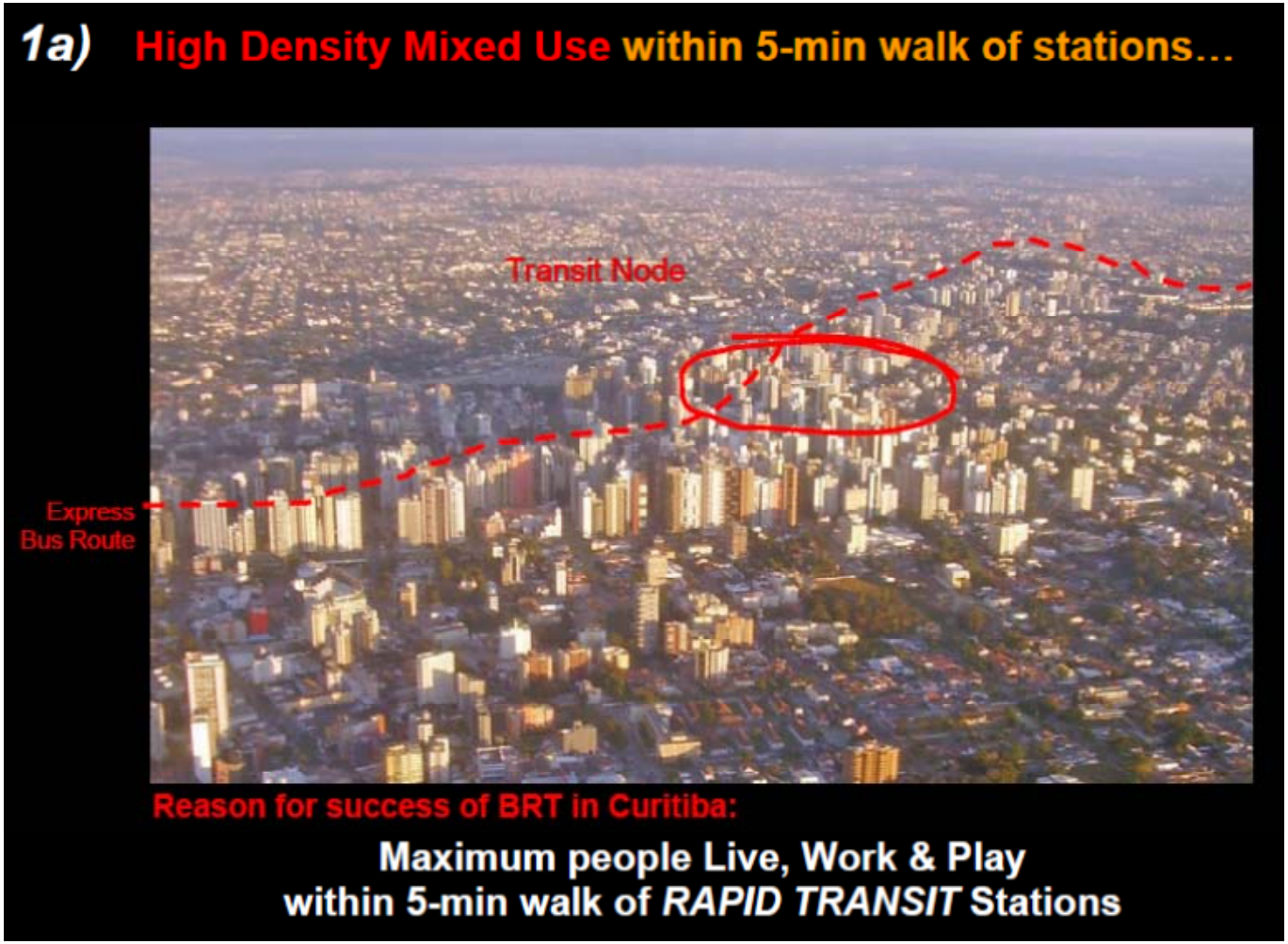
-- Plan for the maximum FAR and density that can be absorbed by the Plan area. Look at FAR-density bonuses

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

-- Existing density in Delhi is (less than/ equal to) 250 du/ha. This requirement will be increased depending on the permissible FAR

If cities grow big, its scale and density make waste treatment, recycling facilities, and public transport more efficient.

Transit lines will have impact on building sector



Buildings and neighbourhoods

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

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)

Polluted urban air, vehicles and our health

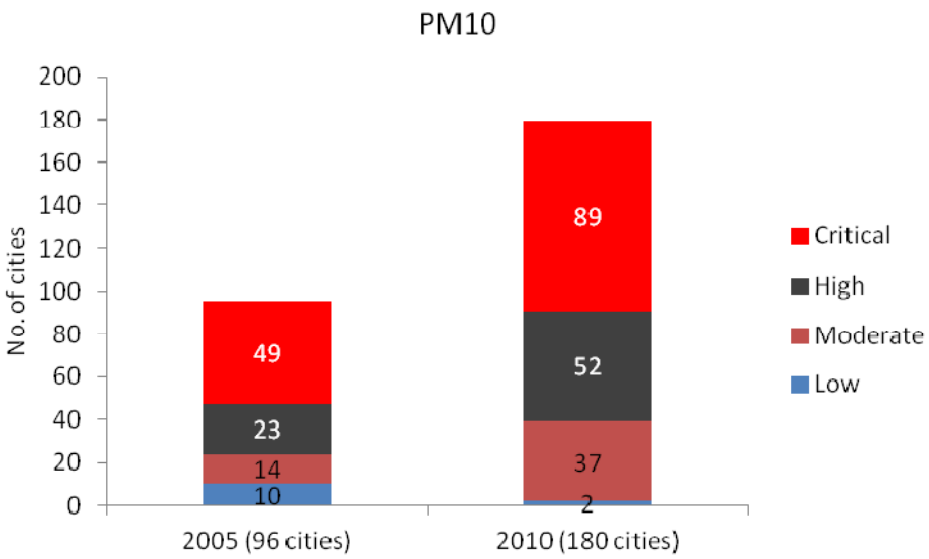
Killer particles ….Cities with critical pollution level increasing

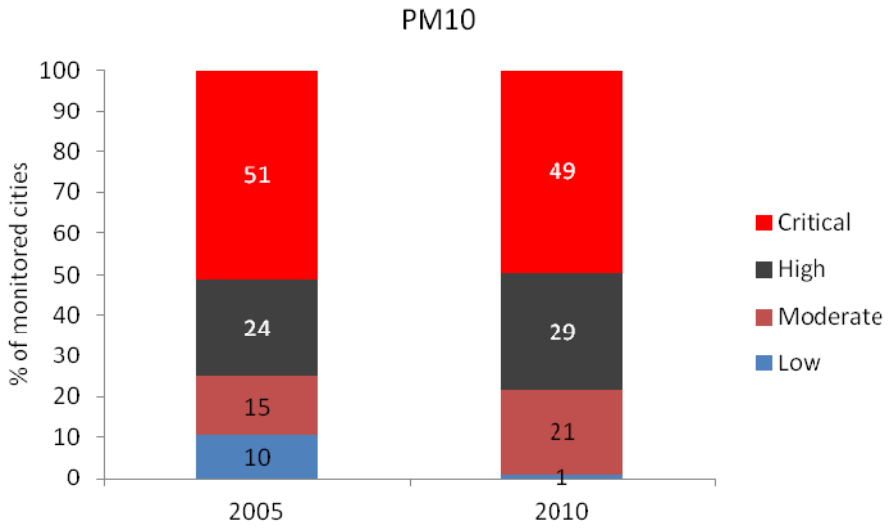
PM10 exceedances in cities (2005 and 2010)

-- PM10 monitoring increased from 96 cities in 2005 to 180 cities in 2010.

-- Low polluted cities fallen from 10 to 2. But the number of critically polluted cities (1.5 times the standards) have increased from 49 to 89 cities.

-- In 2005 – 75% of cities exceeded the standard. In 2010 about 78% of cities have exceeded the standard.



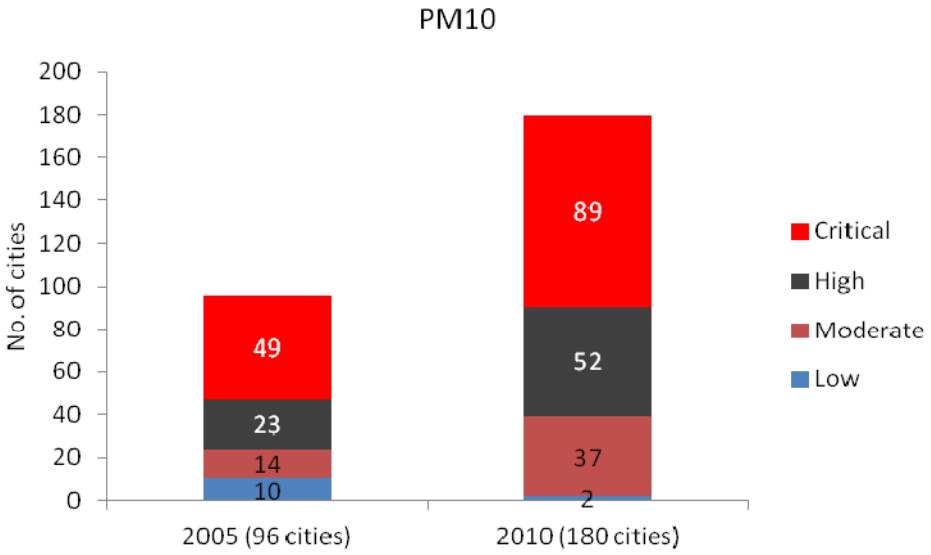


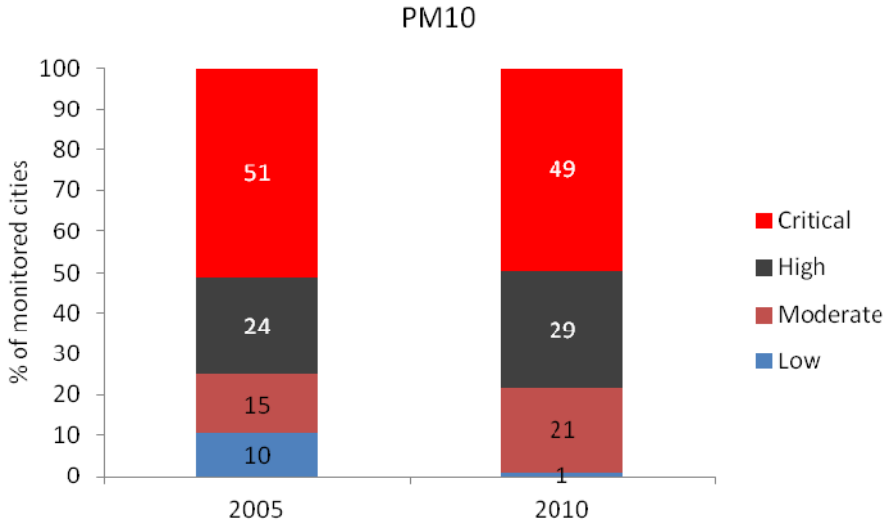
Source: CSE computation based on CPCB data

Emerging threats….. NO2 on the rise

NO2 exceedances (2005 and 2010)

-- NO2 monitoring increased from 100 cities in 2005 to 177 cities in 2010. 2005: Only 1 city exceeded the standard. This has increased to 19 cities in 2010





Source: CSE computation based on CPCB data

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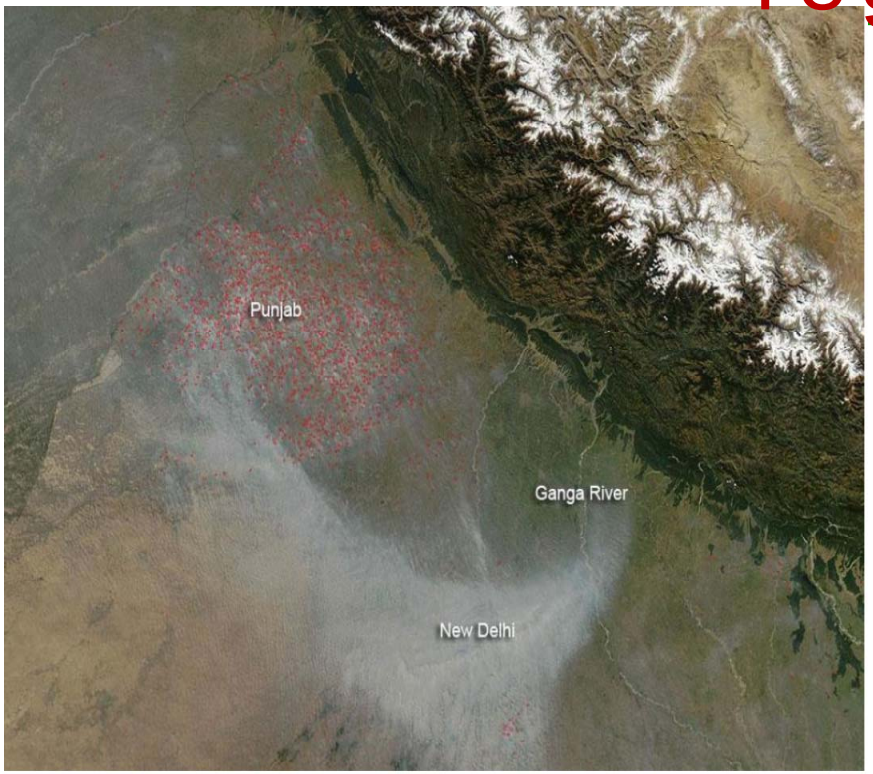
Slide 56

u1 user, 11/29/2012

Cross boundary pollution in the NCR region



October 2012: **Arial raids…….Smoke from Punjab hogged news this year** This is NASA image of smoke plume from agricultural burning

Action needed on all sources of pollution in the NCR region…….

As many as 1.2 million vehicles enter and exit Delhi daily…..

Need regional approach to air pollution control……

NOIDA reports unique problem: *Toxic fumes from polluted drains*

■**Media reportage on complaints from residents** – that they are forced to spend extensively on repairs of home appliances every season. Most affected areas are Sector 41 in Noida and Sector 1, 2 and 3 of Vaishali etc.

■**Suspect** -- Toxic gases damage the coating on the condenser joints of the AC system, that causes leakage of coolant gas. Article blames toxic ammonia, hydrogen sulphide fumes from the river and drain which corrodes metals and electrical equipments. Also has health impact.

■**None of the concerned agencies have any data on this matter.**

■**Carry out spot checks and ambient air quality monitoring** to assess the magnitude of the problem.

■**Carry out chemical analysis of corroded metals, copper pipes, other metal fittings**

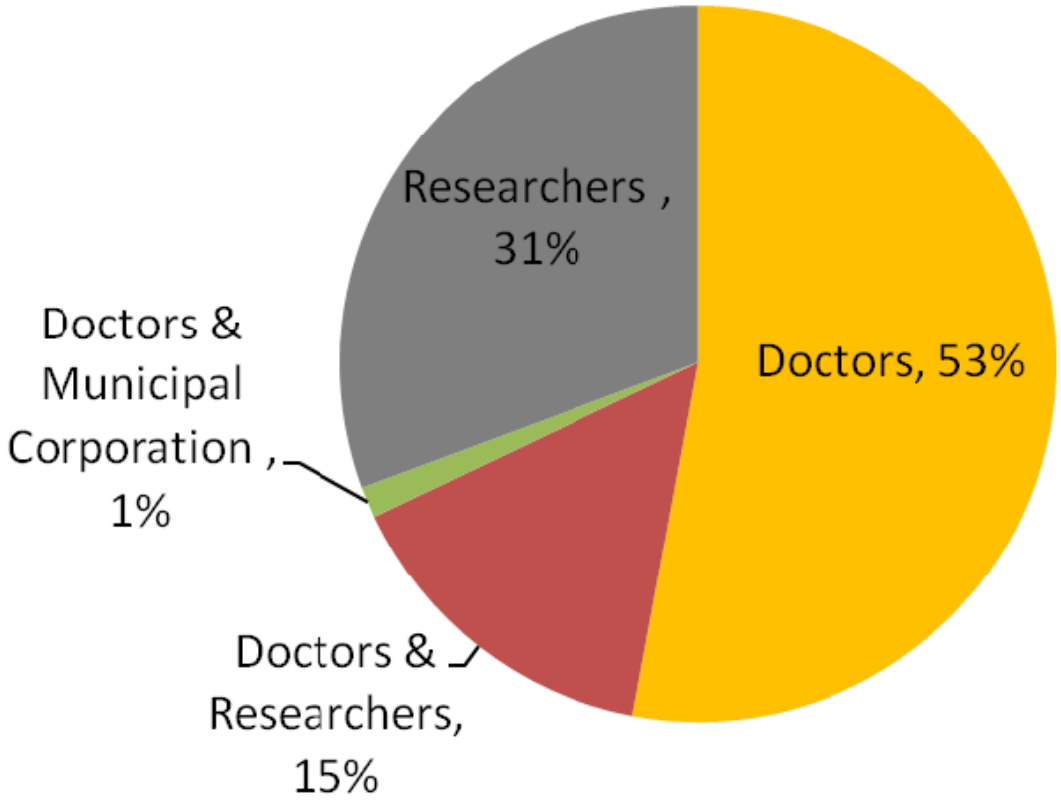
■**Water analysis** in the key drains in the affected areas

■**Prepare action plan** for the drains, treatment of the polluted waters and pollution management for protection of neighbourhoods etc.

What about public health?……..

Most studies done by doctors themselves…….

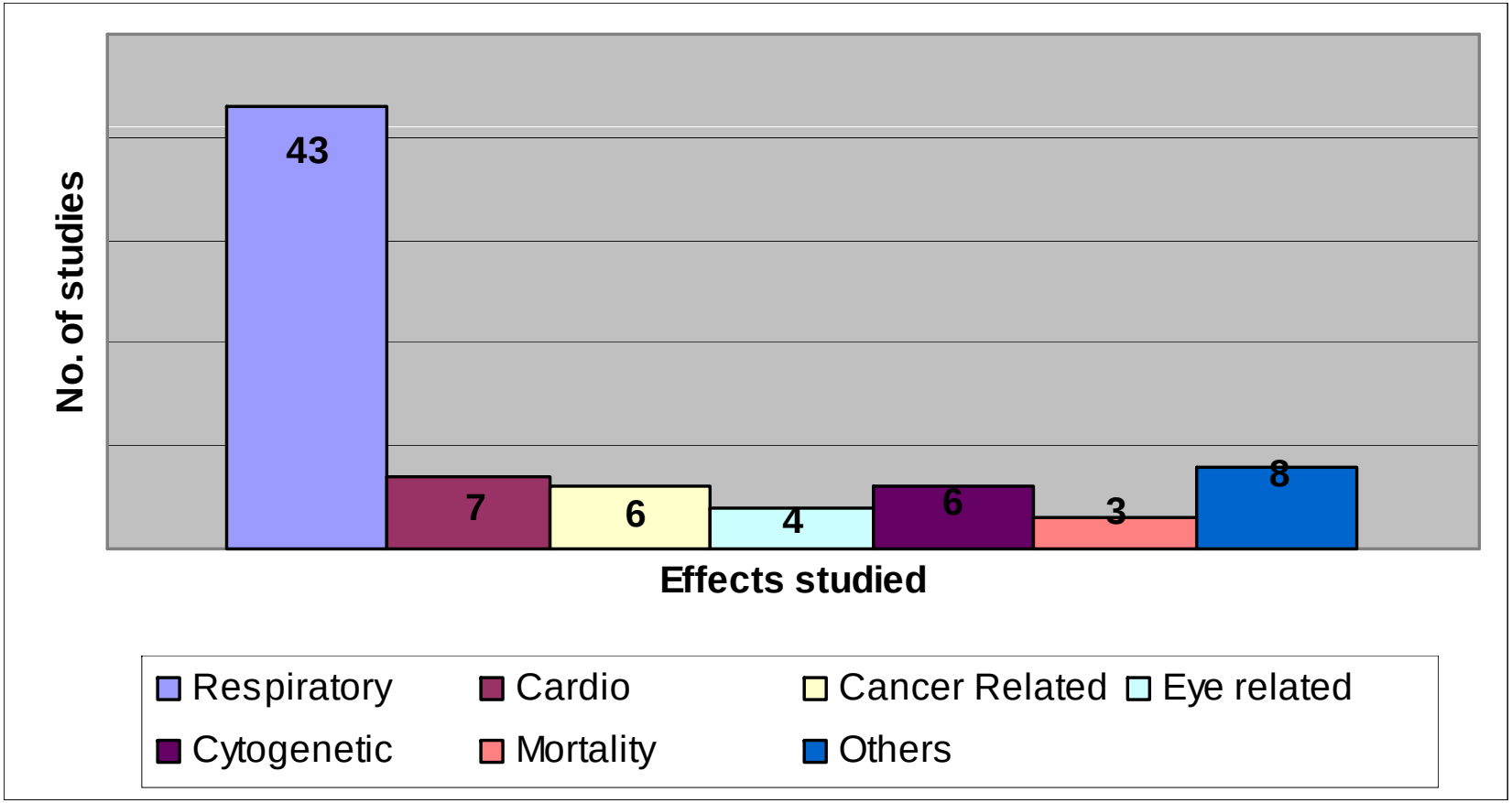
Who has done the studies?



Source: CSE

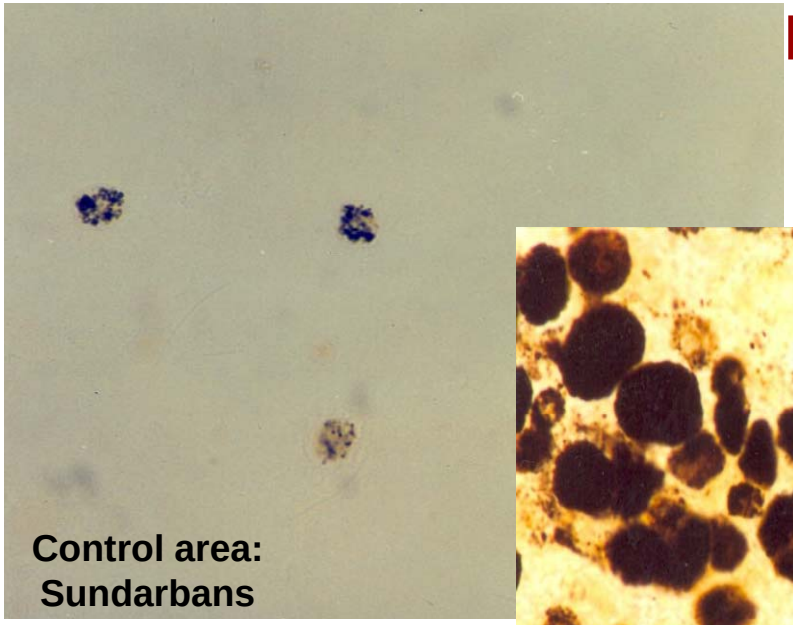
Studies looking at a more diverse health end points….

Predictably respiratory health symptoms dominate….
Broadens to other health end points – cardiovascular, eye disorders, cellular changes, cancer, premature deaths….



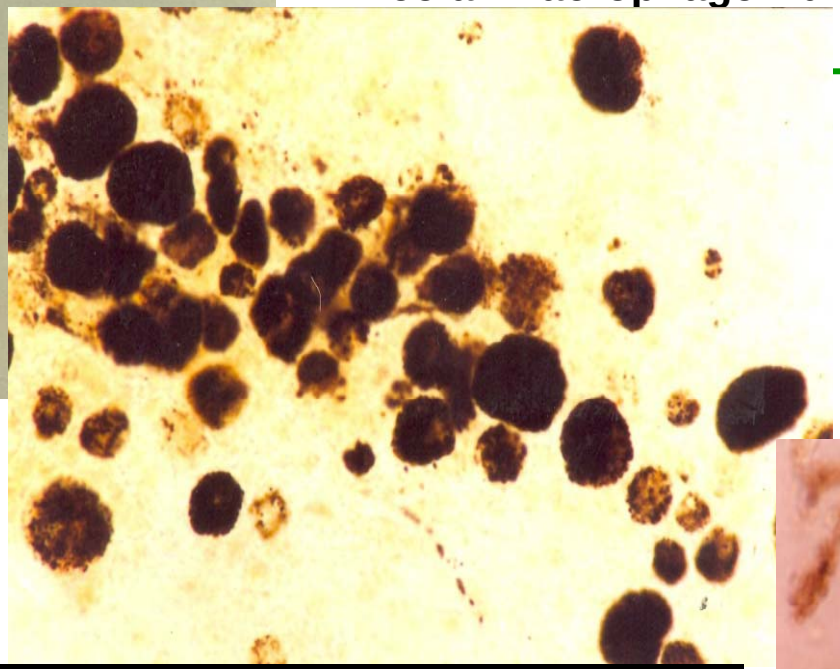
Source: CSE

Emerging evidences of health impacts in India……



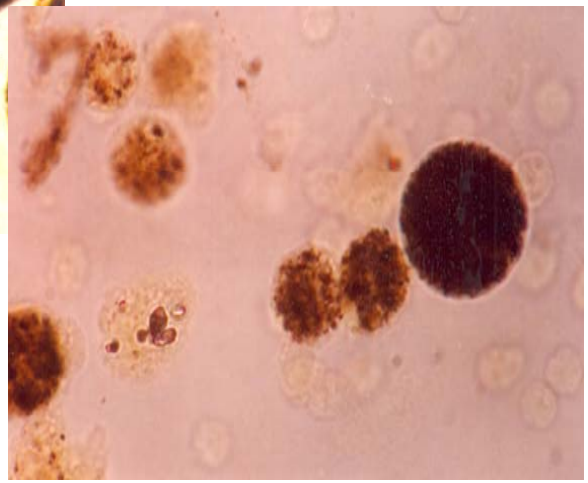
Control area: Sundarbans

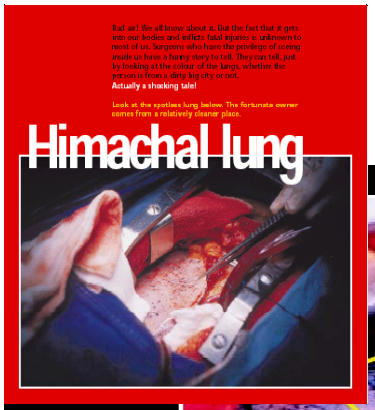
Alveolar macrophage - biomarker of air

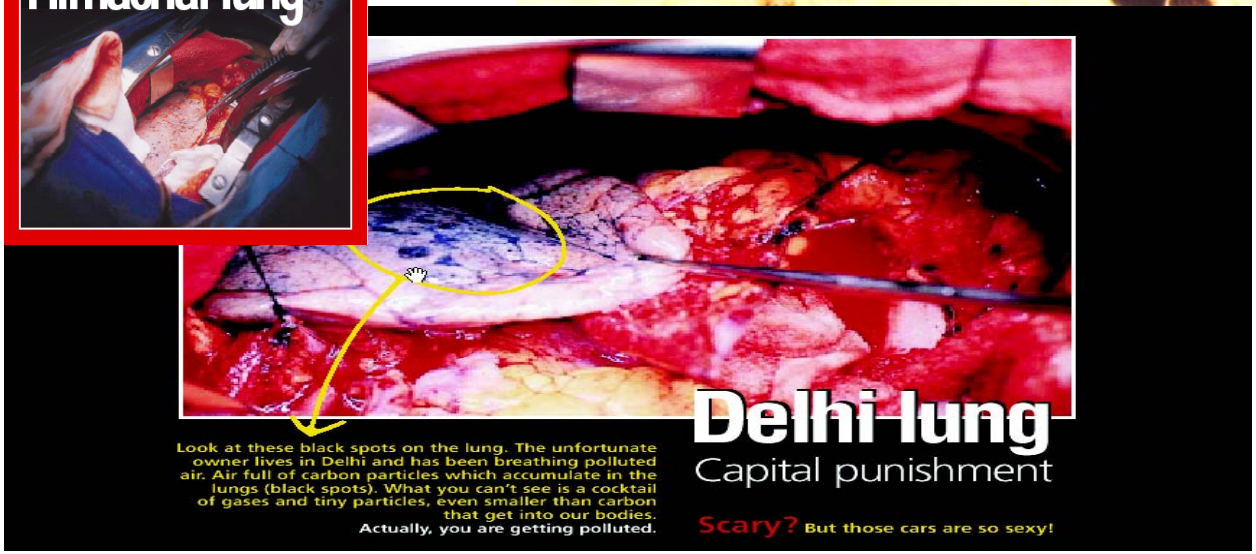


Exposed group; Kolkata taxi driver

Increase in AM number



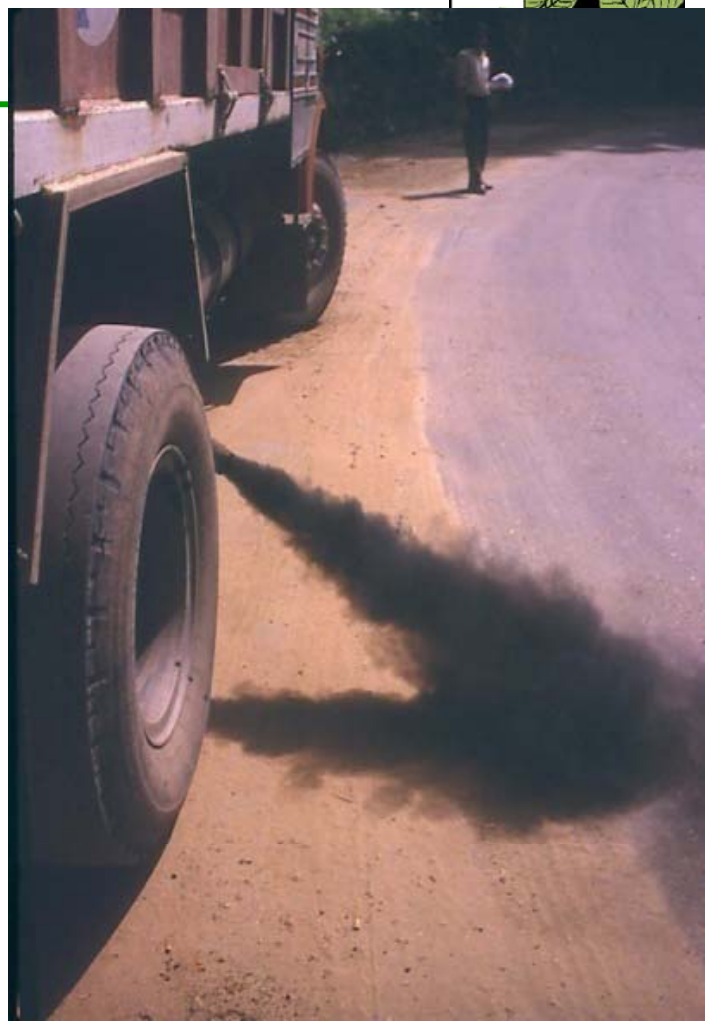




Why vehicles are a special concern?.....

High exposure to vehicular fume

- Vehicular emissions contribute to significant human exposure. Pollution concentration in our breathe is 3-4 times higher than the ambient air concentration.
- In densely-populated cities more than 50 – 60% of the population lives or works near roadside where levels are much higher. This is very serious in low income neighborhoods located close to roads.
- Poor have a higher prevalence of some underlying diseases related to air pollution and proximity to roadways increases the potential health effects.
- In three cities World Bank review found vehicles contributing an average 50% of the direct PM emissions and 70% of PM exposure.
- The WHO report of 2005: Epidemiological evidences for the adverse health effects of exposure to transport related air pollution is increasing.

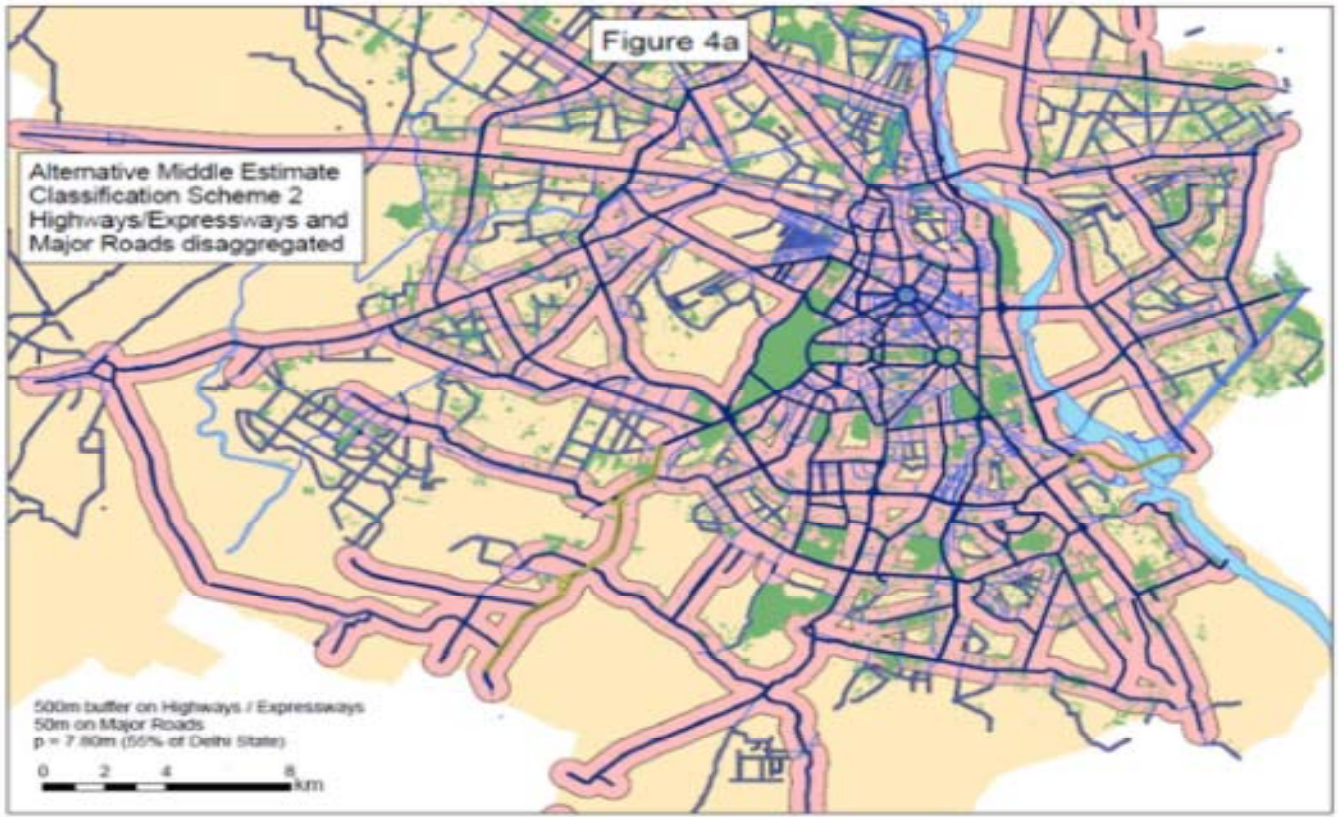


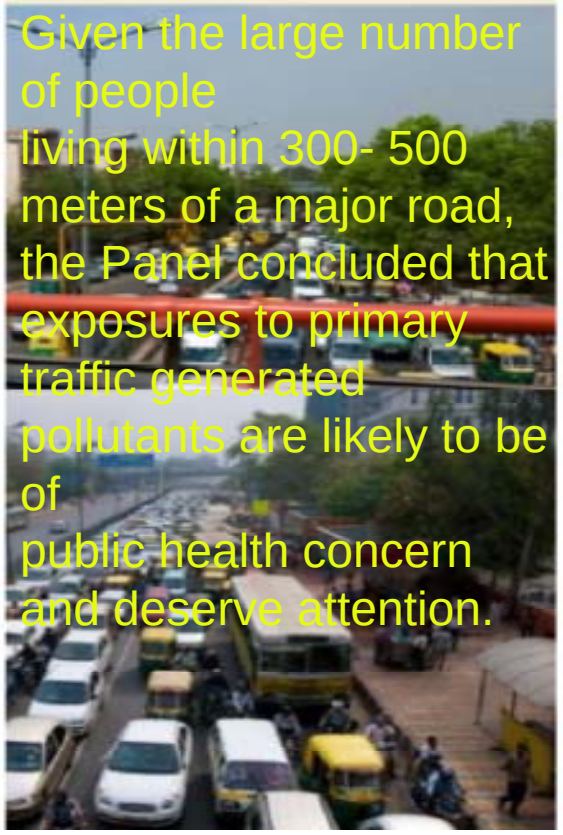
People living close to roads are most exposed to vehicular fume

Evidence from Delhi….

The Traffic Impact Area in Delhi:

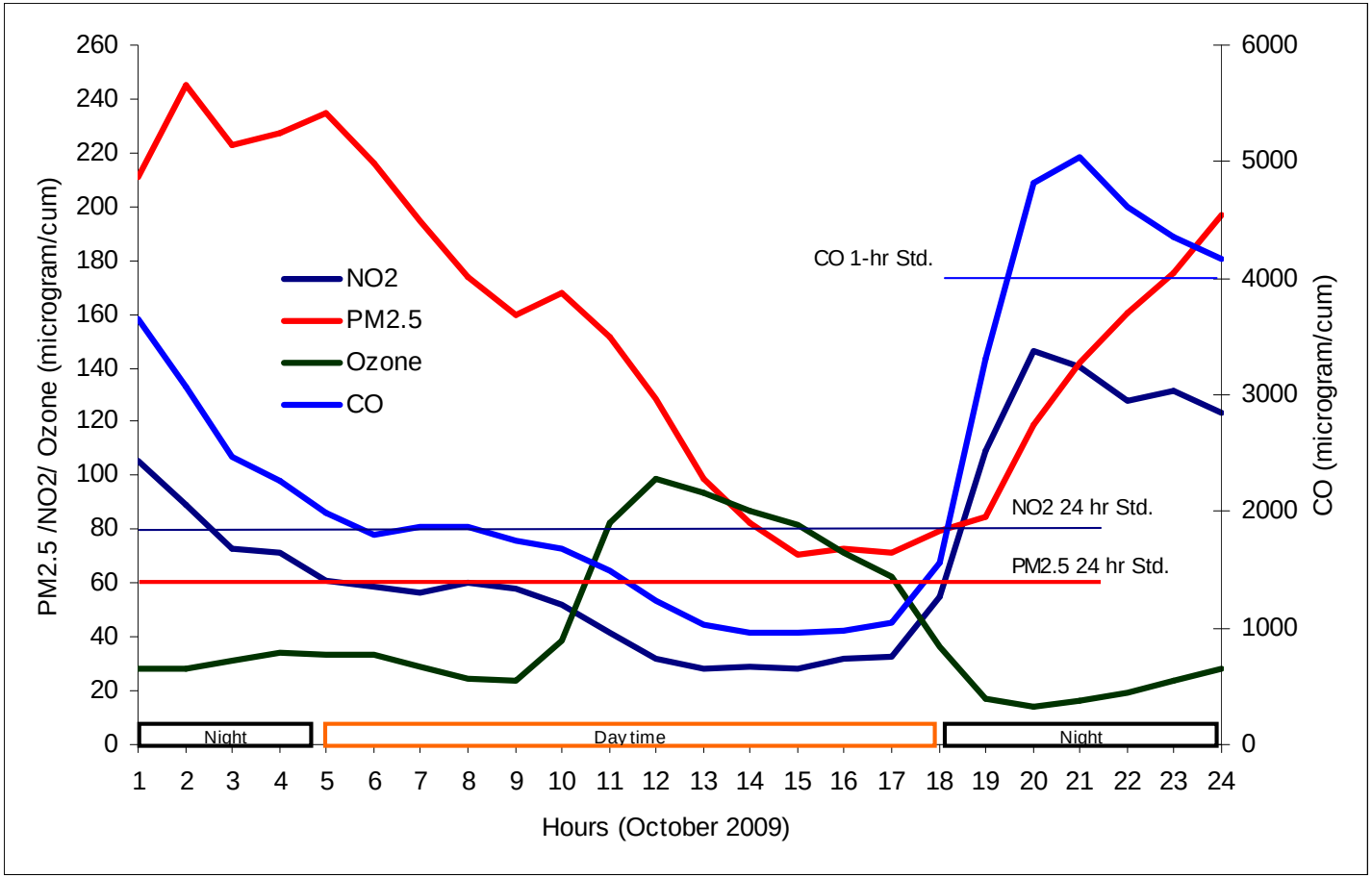
*New HEI Analysis: **55% of the Population** within 500 meters of a Freeway; 50 meters of a Major Road*





Given the large number of people living within 300- 500 meters of a major road, the Panel concluded that exposures to primary traffic generated pollutants are likely to be of public health concern and deserve attention.

Effect of traffic on pollution



Ozone, PM2.5 and CO levels remain high during morning and evening peak hours. Even night time NO2 levels high – influence of truck traffic

Source: CSE analysis based on CPCB air quality data

What has Delhi achieved?

On vehicle technology and fuel quality

Enforced Euro II emissions standards in 2000, five years ahead of schedule, Euro III in 2005, Euro IV in 2010

Mandated pre-mix petrol to two- and three-wheelers

On alternative fuels

Implemented largest ever CNG programme

Largest ever public transport bus and three-wheeler fleet on natural gas

Other measures related to vehicles

Capped the number of three-wheelers

Phased out 15 year old commercial vehicles

Strengthened vehicle inspection programme (PUC)

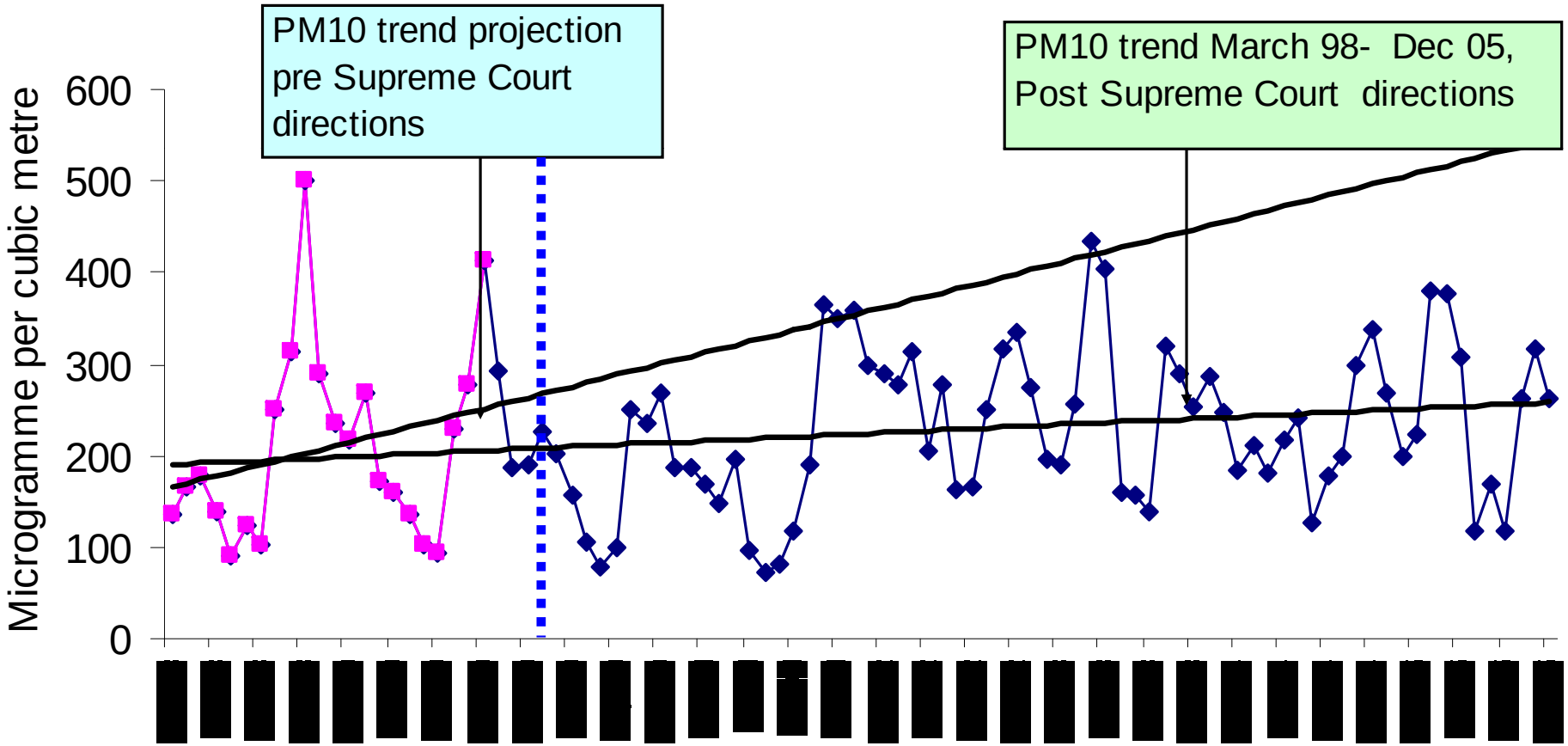
Efforts made to bypass transit traffic

Relocated polluting industry. Stricter action on power plants

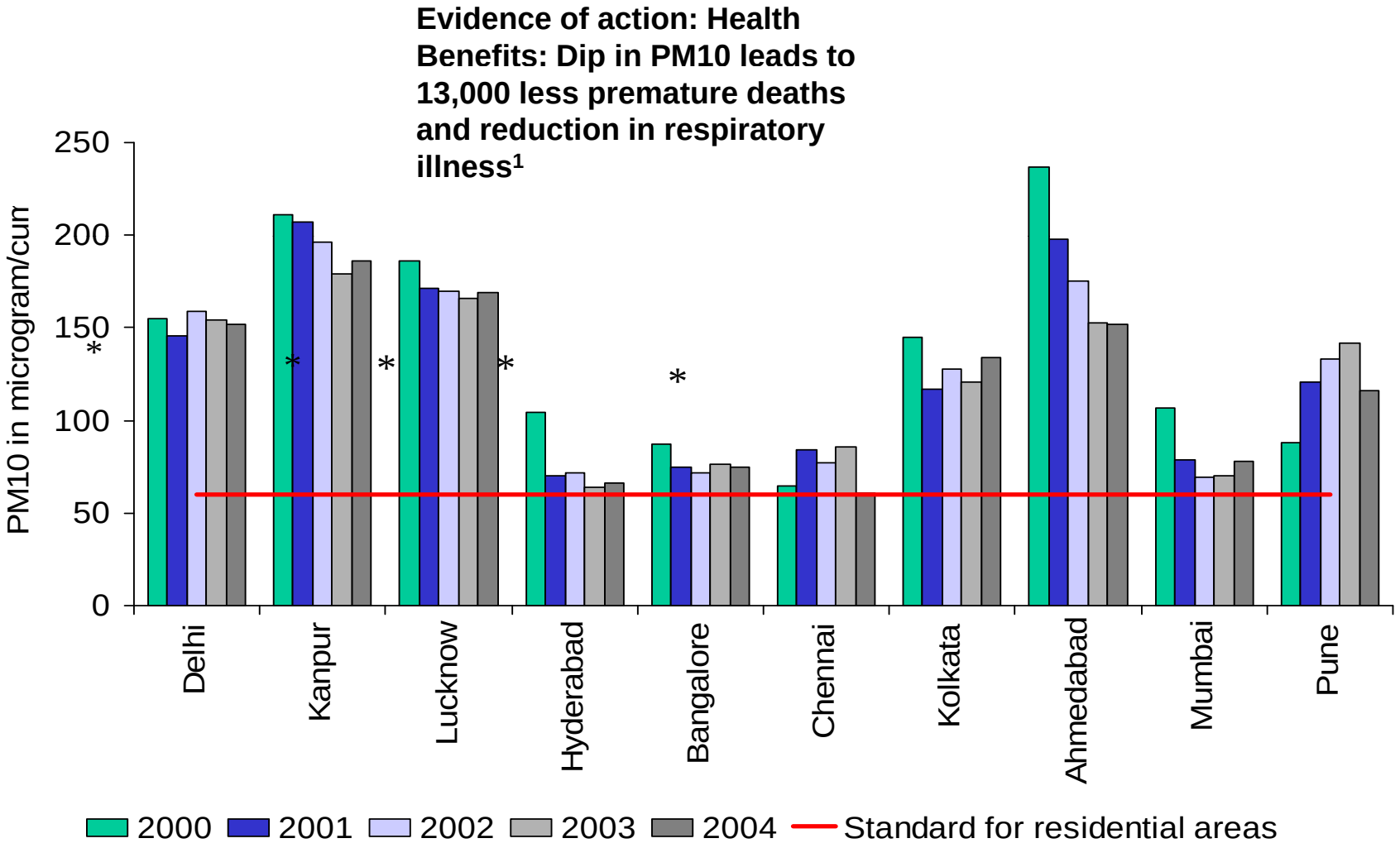
Other major Indian cities have also begun to implement clean air action plans nearly patterned along the same line….

Delhi got cleaner air: it avoided pollution

PM10 at ITO Traffic Intersection



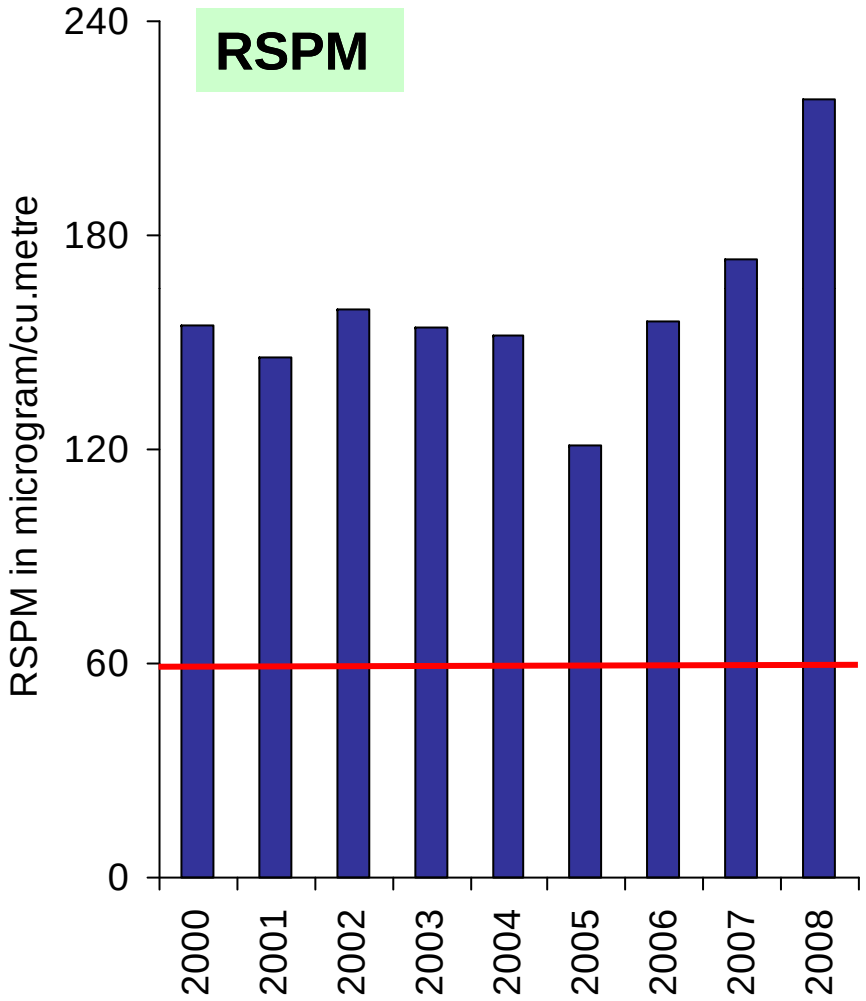
Action helps to protect public health

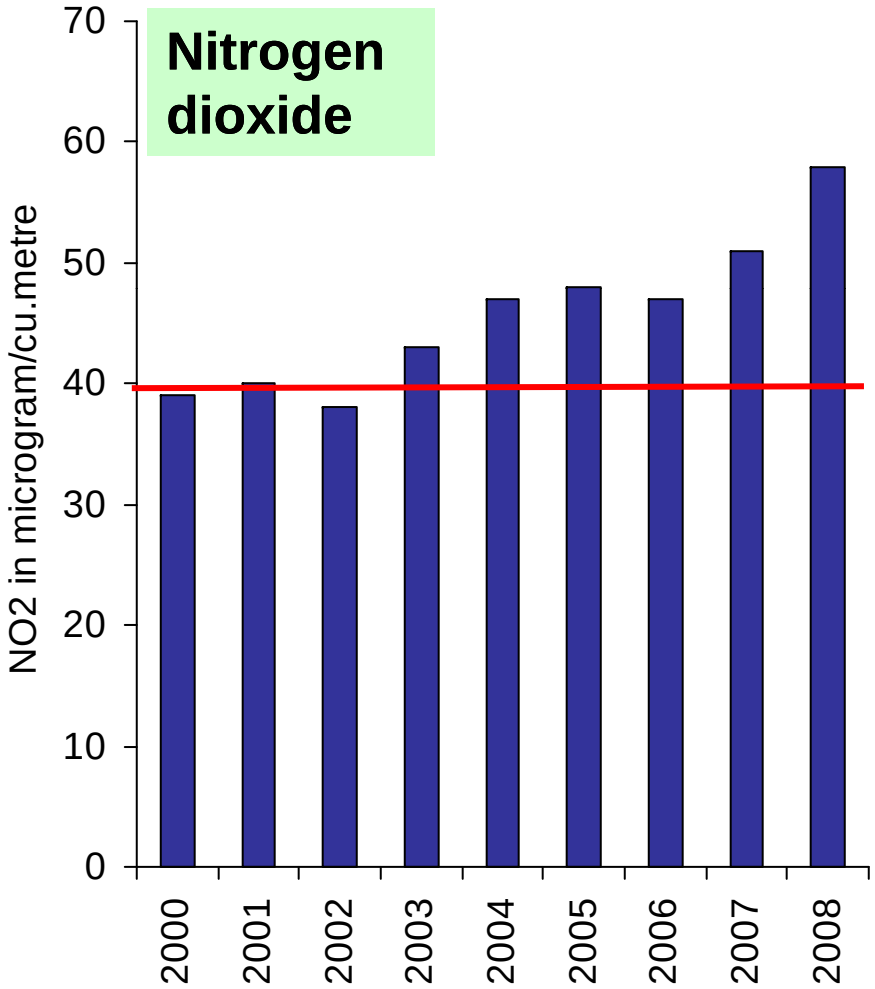


Source: Based on NAMP data, CPCB, 1. World Bank 2004,

Lost gains…….. Learn from Delhi

Delhi has lost its gains. After a short respite pollution curve turns upward





Based on CPCB data

Clean air targets still elusive

- **India needs time bound air quality targets to meet standards**
- **No punitive action on state governments for not meeting the ambient air quality norms**.
- **Abatement plans are not designed to meet local air quality demands**
- **Emissions regulations are kept weaker for most of India.**

- In the US the air quality standards are federally enforceable. If the states fail to meet the air quality targets the EPA can impose sanctions, such as cut highway funds. Civil society can sue the state governments. **"**Citizen Court Suits" is explicitly allowed in the Act against EPA for failure to promulgate NAAQS, failure to adopt emissions standards, failure to develop or implement adequate state implementation plans.

- In India the eleventh five year plan, already underway, mandates the central government to set monitorable target of air quality -- achieve the standards of air quality in all major cities by 2011–12

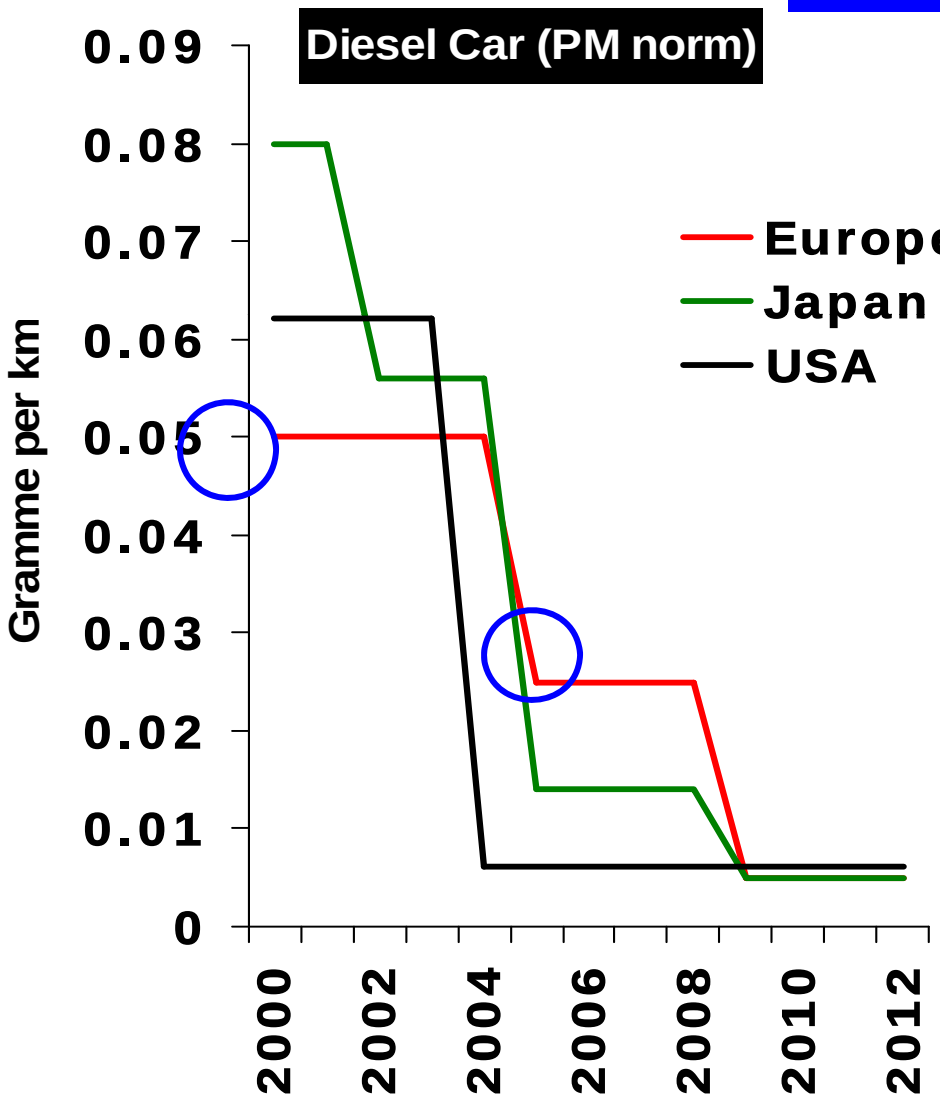
Ensure enforcement of air quality standards, accountability and compliance.

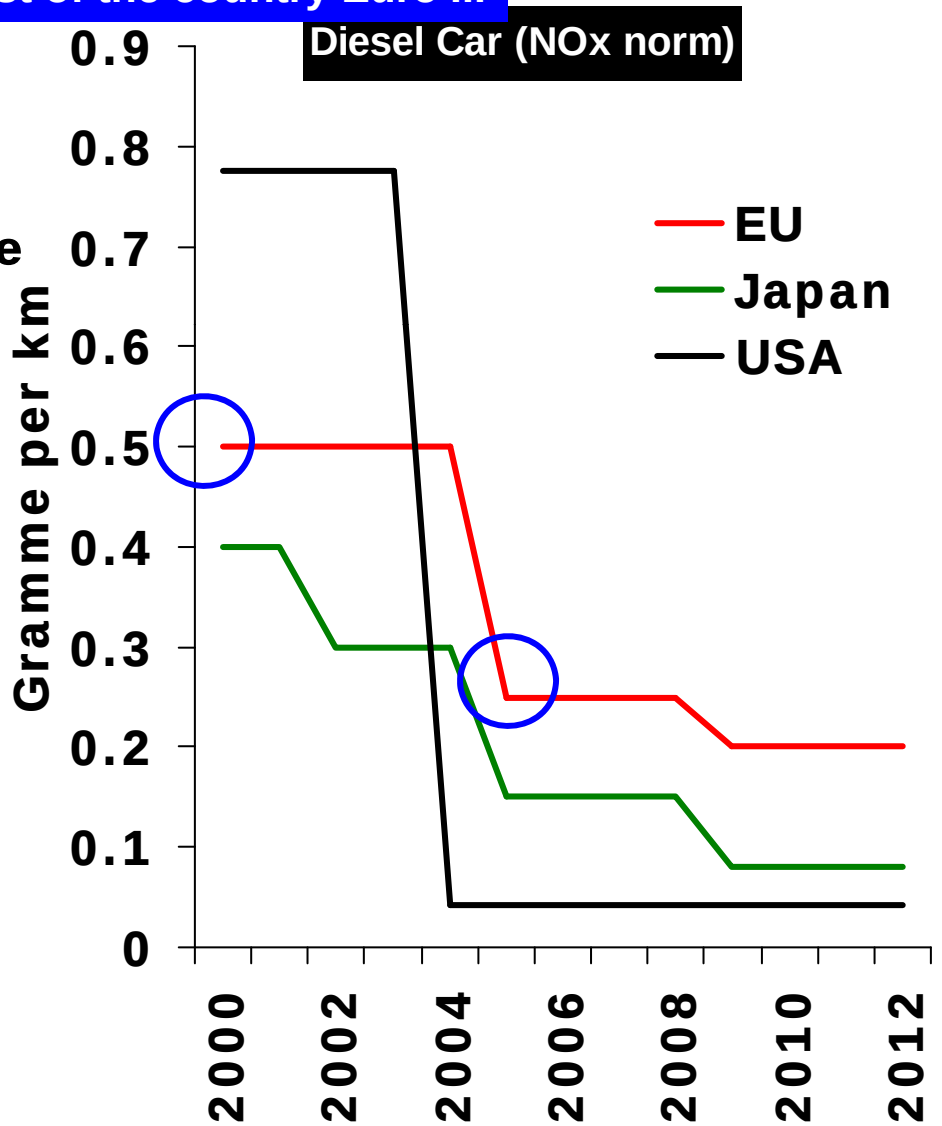
Second generation challenge

- Technology lag
- Mobility crisis

Public policy fails to drive emission regulations to reduce toxic exposure

Indian metros today (Euro IV).
But rest of the country Euro III

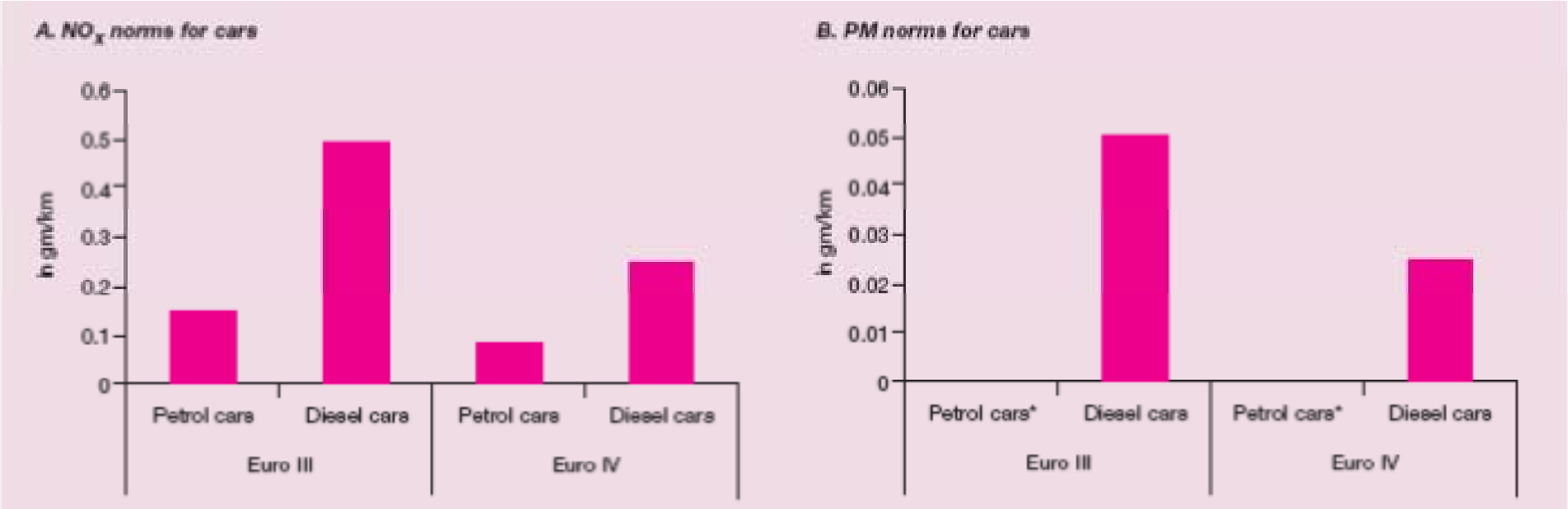




Diesel: License to Pollute

NOx norms for cars

PM norms for cars



One diesel car emits as much NOx as 3 to 5 petrol cars. PM is several times higher

Source: MP Walsh

The shocker…….

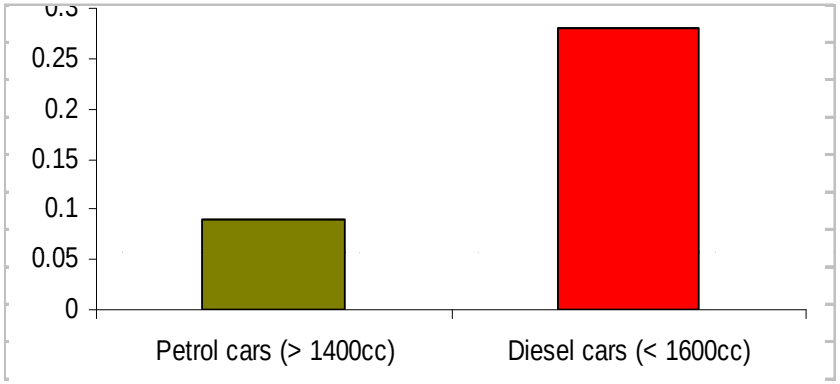
- **In June this year the International Agency for Research on Cancer of the World Health organisation (WHO) has reclassified diesel exhaust as Group 1 list of carcinogen that have definite links to cancer.**

- **Diesel exhaust is now in the same class of deadly carcinogens as asbestos, arsenic or tobacco among others.**

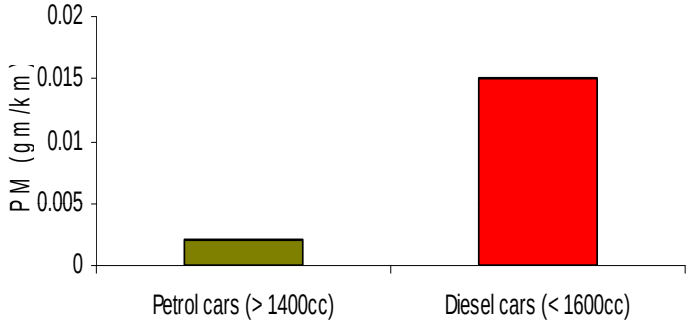
- **The IARC-WHO has urged worldwide efforts to reduce exposure to diesel fumes as much as possible.**

Toxic risks

Bharat Stage III NOx

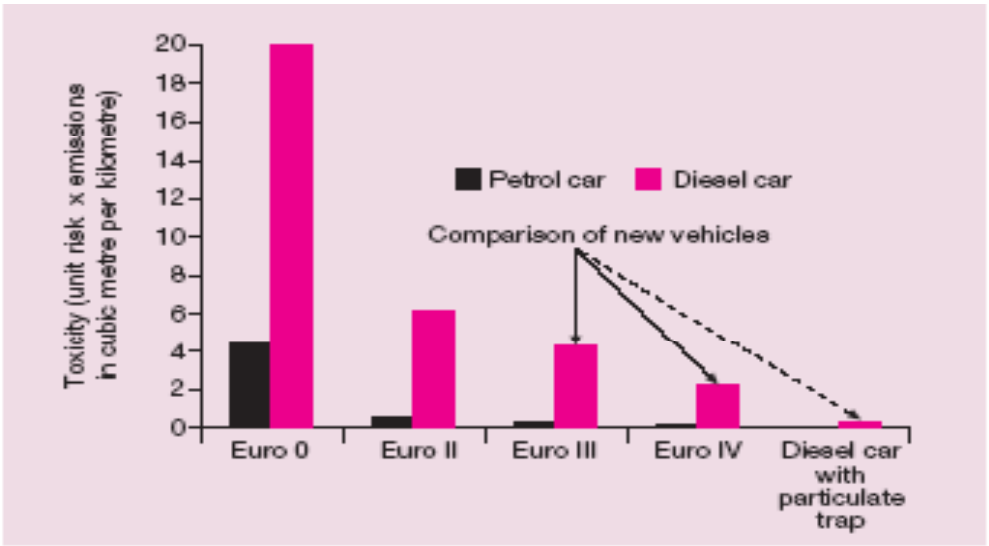


Bharat Stage III PM



Source ARAI

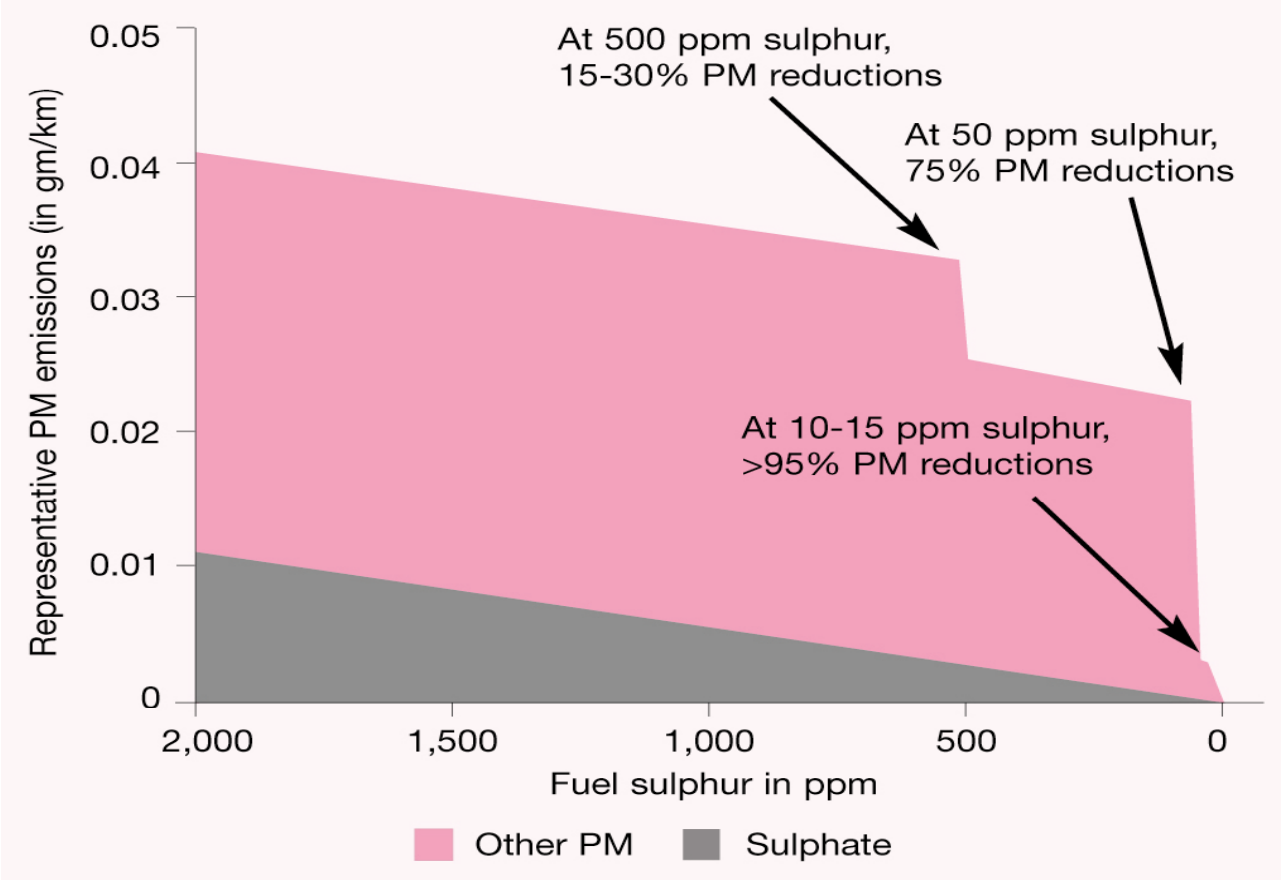
Toxic risk is high



Global move towards clean diesel

It is possible to reduce harmful diesel emissions drastically.

But in India there is no target for clean diesel



We need clean diesel (10 ppm sulphur) along with advanced after treatment system.

Need a fiscal strategy to meet the cost of makeover

Investment for refinery expansion not linked with improved emissions standards.

Source:
ICCT

taking active fiscal measures

-- **Brazil:** Diesel cars are banned because of the policy to keep taxes lower on diesel.

- **Denmark**: Diesel cars are taxed higher to offset the lower prices of diesel fuel.
- **China**: taxes do not differentiate between petrol and diesel.
- **Sri Lanka:** While total tax burden on petrol car is 244% on diesel car it is 436.90%
- **Europe:** Diesel cars sales have increased and so have levels of NOx and fine particles. Made quick transition to clean diesel.
- **European Commission** has calculated the difference in lifetime pollution costs of Euro IV diesel car and petrol car. Total pollution cost of a Euro IV diesel car is 1195 Euros vis a vis 846 Euros for a petrol car. This negates the marginal greenhouse gas reduction benefit of diesel car and it costs higher to the society.

Need solutions

Supreme Court directives for local solutions in Delhi

Tax diesel cars high

Bypass truck traffic

Improve public transport to reduce dependence on personal transport

Delhi government's short term measures:

Crack down on visibly polluting vehicles

Bypass truck traffic

Tax diesel fuel and create Air Ambience Fund

Restrain use of generator sets in social events

Enforce norms for generator sets etc

Need national action

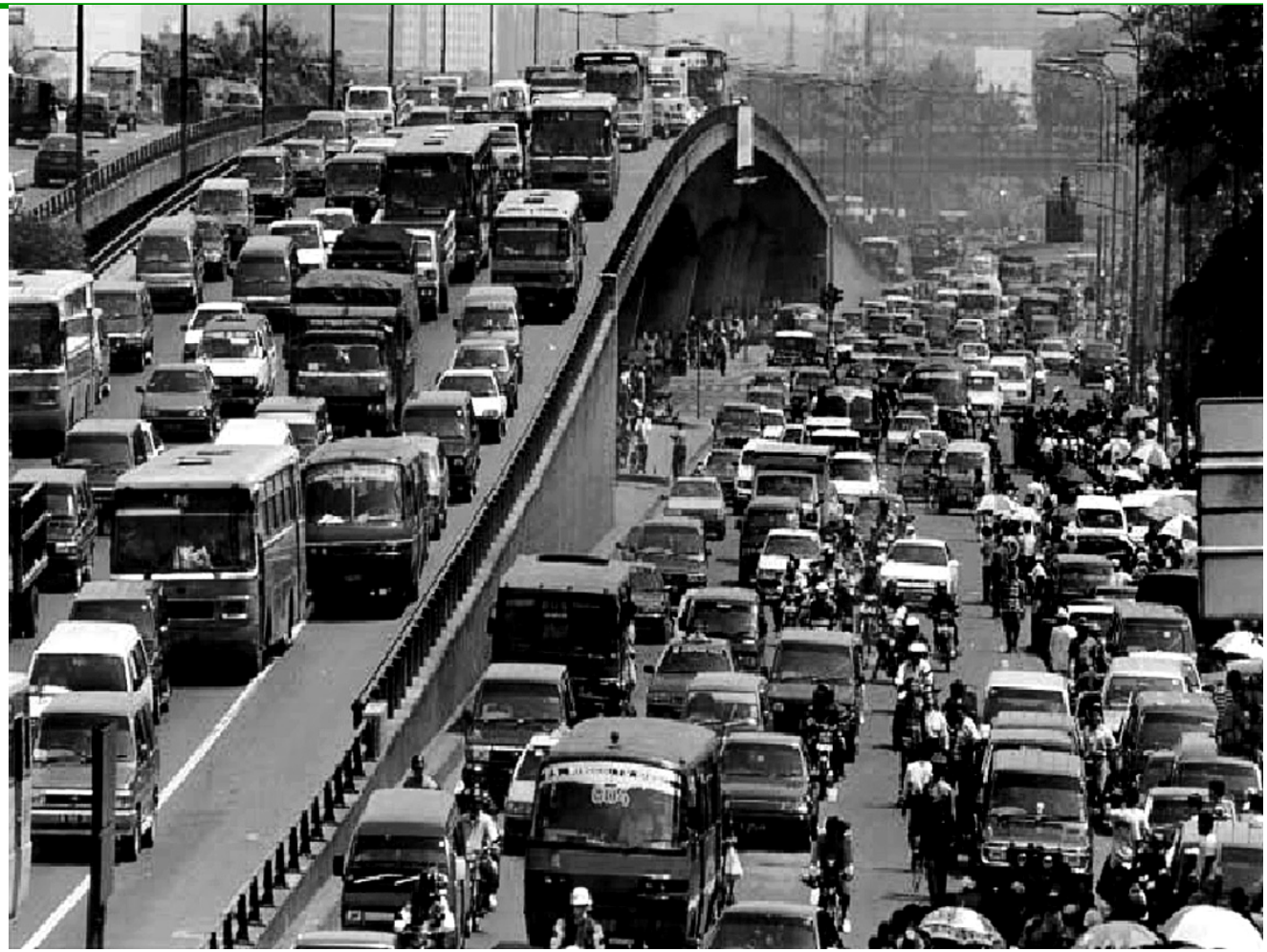
Introduce 10 ppm sulphur diesel nationwide and advanced particulate traps nation-wide

Mobility crisis and air pollution….

Supreme Court has also asked for public transport strategy to control pollution…….

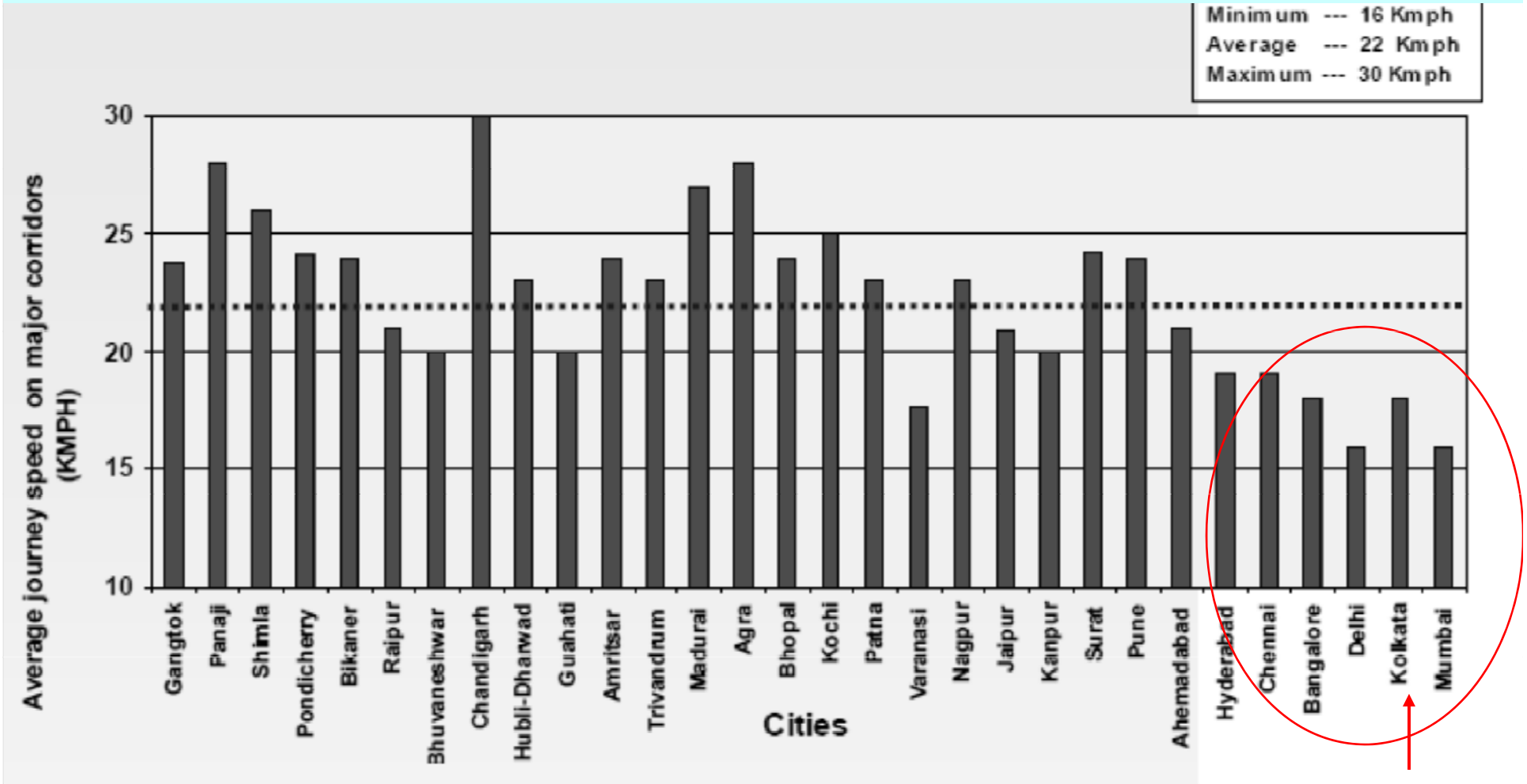
Challenge of mobility crisis

…… an increasing share of our daily trips are being made by cars that occupy more road space, carry fewer people, pollute more, guzzle more fuel. They edge out pedestrians, bicycles, cycle rickshaws and buses……..



With growing car dependency Indian cities are getting paralyzed

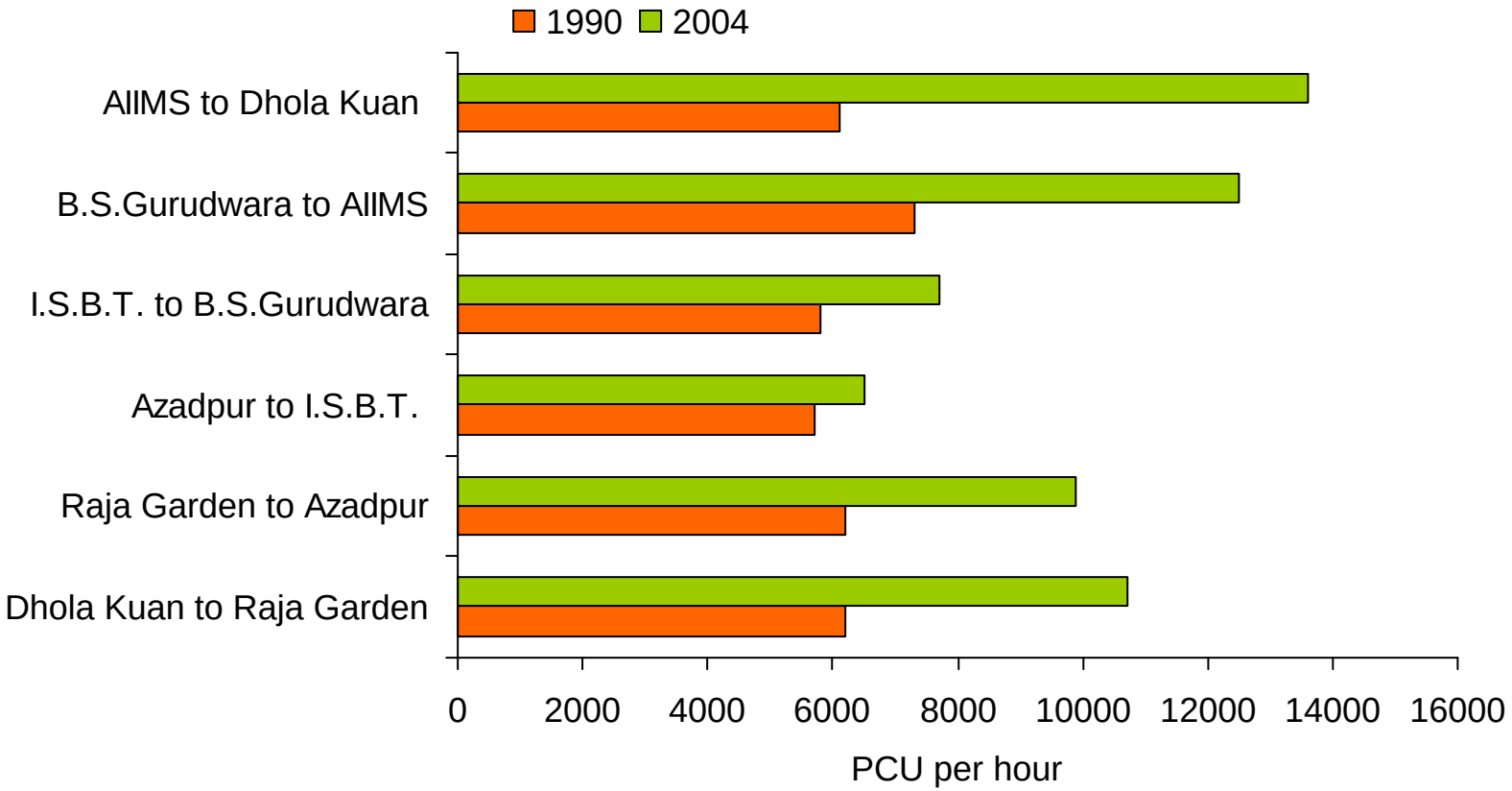
The average journey speed in Delhi (16 km/hr), Mumbai (16 km/hr) and Kolkata (18 km/hr): Abysmally poor compared to smaller cities



Source: Anon 2008, Study on traffic and transportation policies and Strategies in Urban Areas in India, MOUD, p63

Peak volume traffic – dominated by personal vehicles -- has increased phenomenally in Delhi

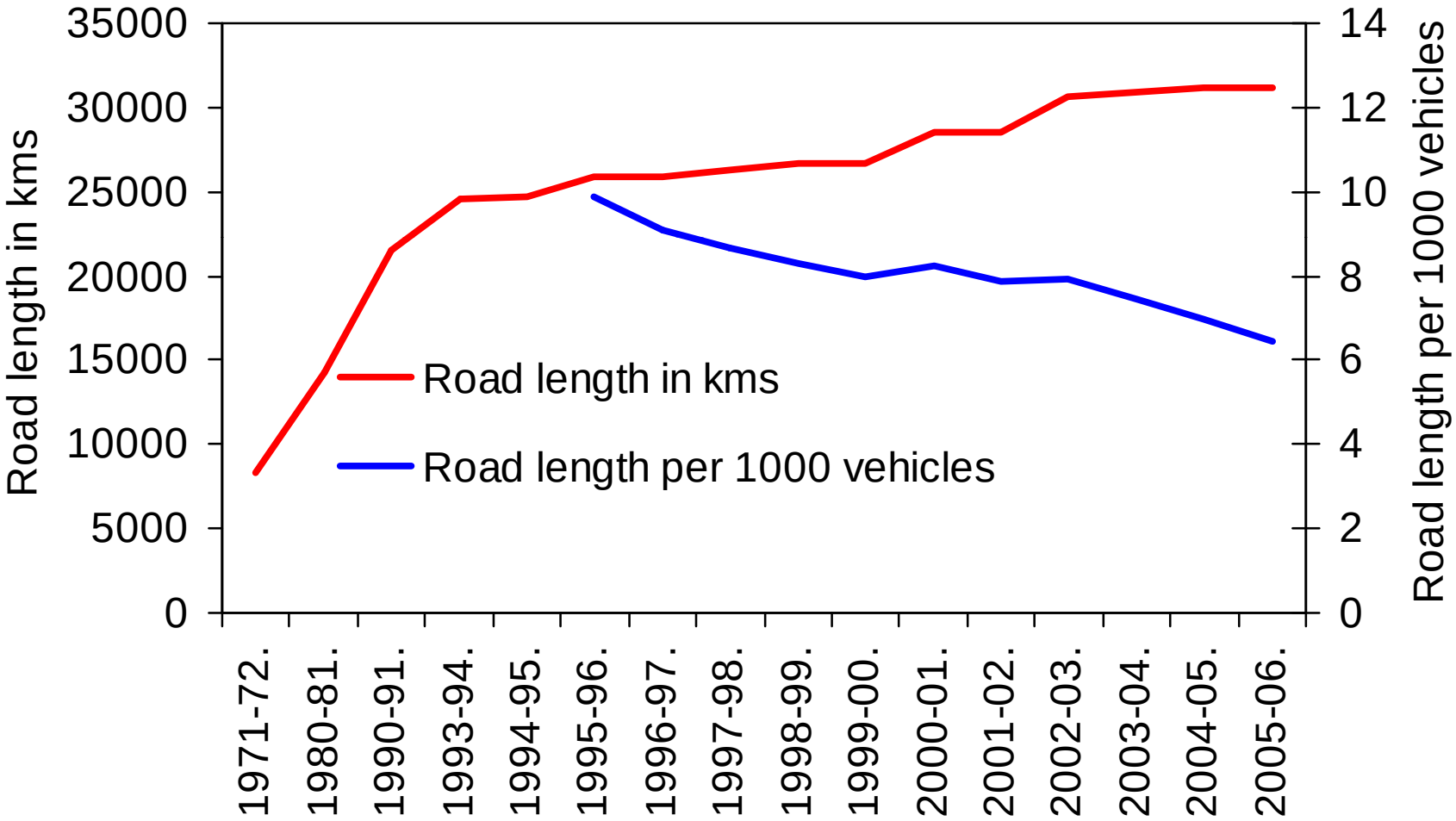
Nearly 123 per cent growth on many Delhi roads (in PCU/hour)



Source: Based on City Development Plan of Delhi, 2006, Eco Smart

Roads hitting dead end in Delhi

Roads expansion cannot keep pace with rising number of vehicles

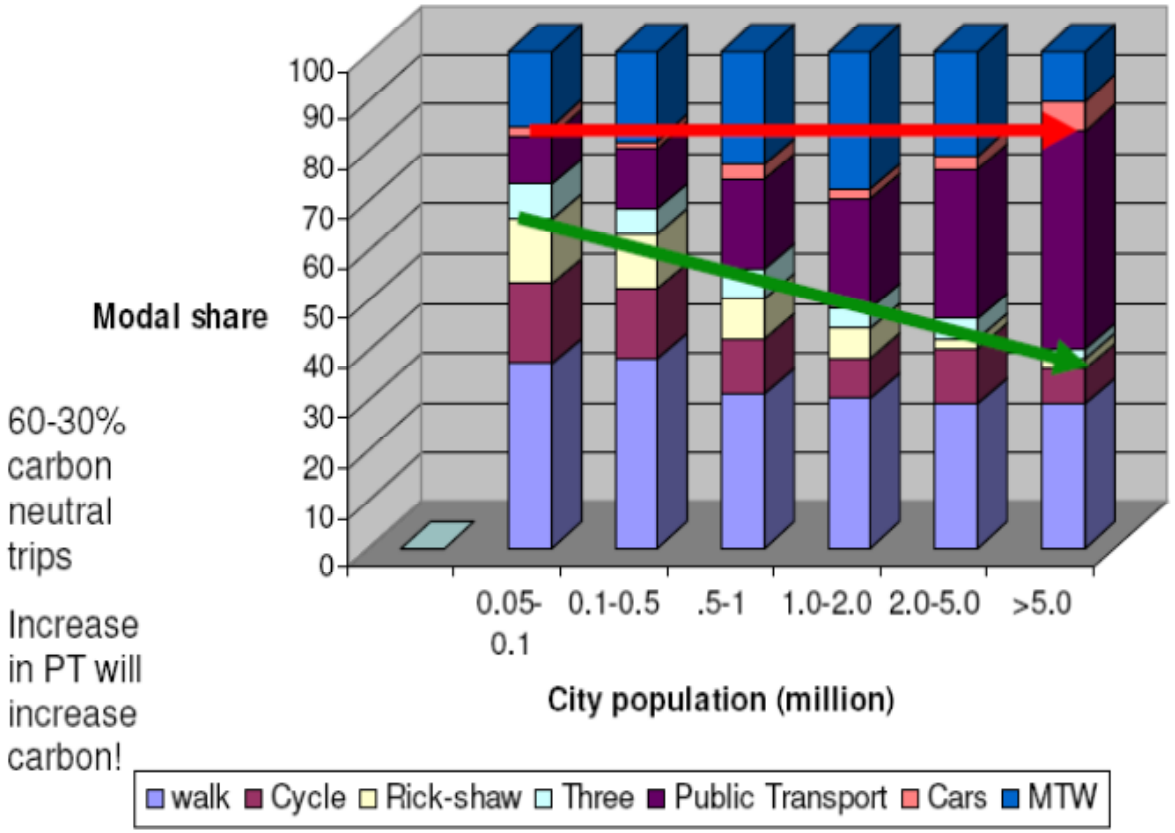


Source: On the basis of Economic Survey, Delhi Govt

public transport, walking and cycling

Urban Mobility

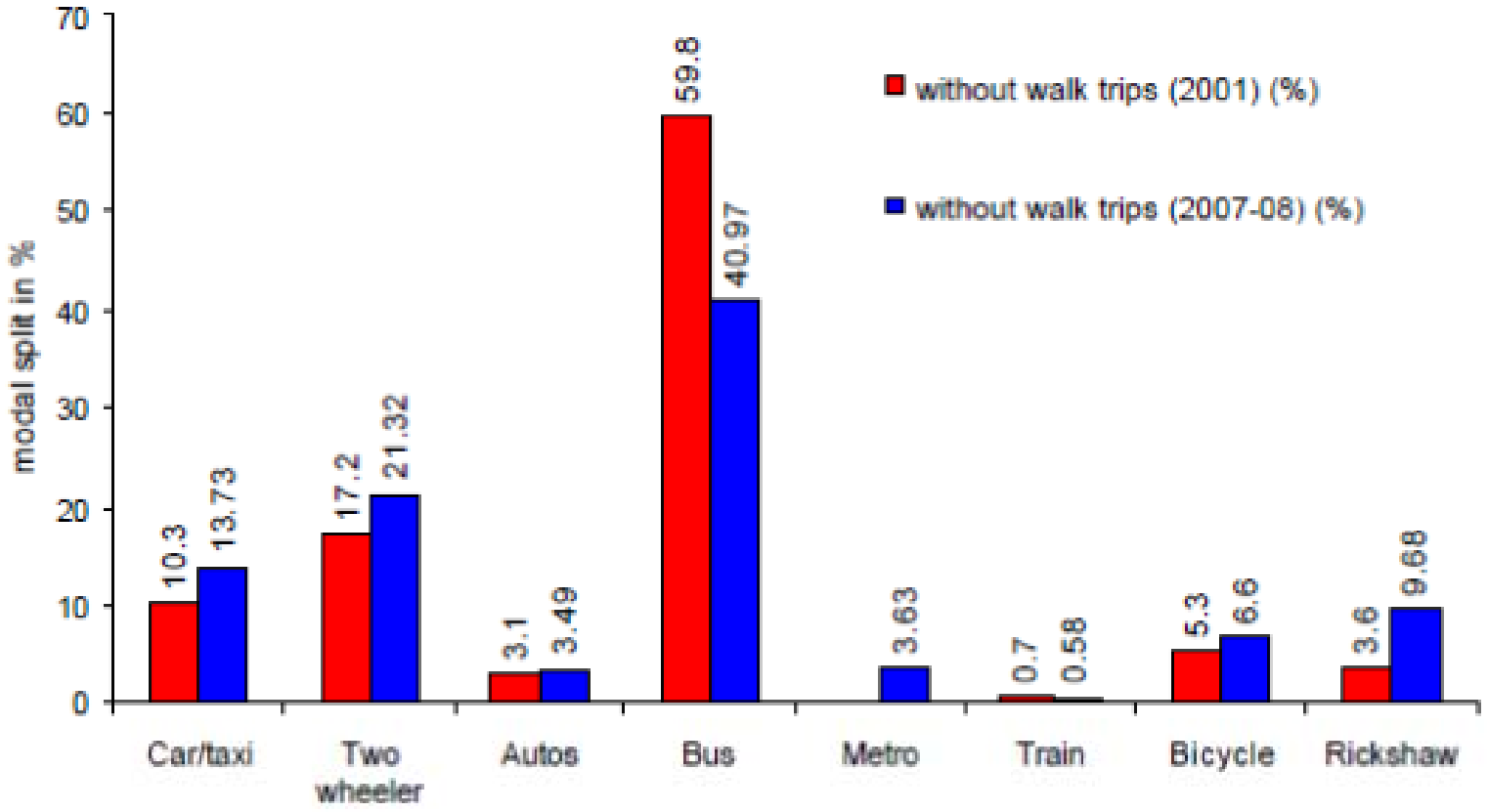
PT and NMV based, MTW majority personal vehicles



60-30% carbon neutral trips

Increase in PT will increase carbon!

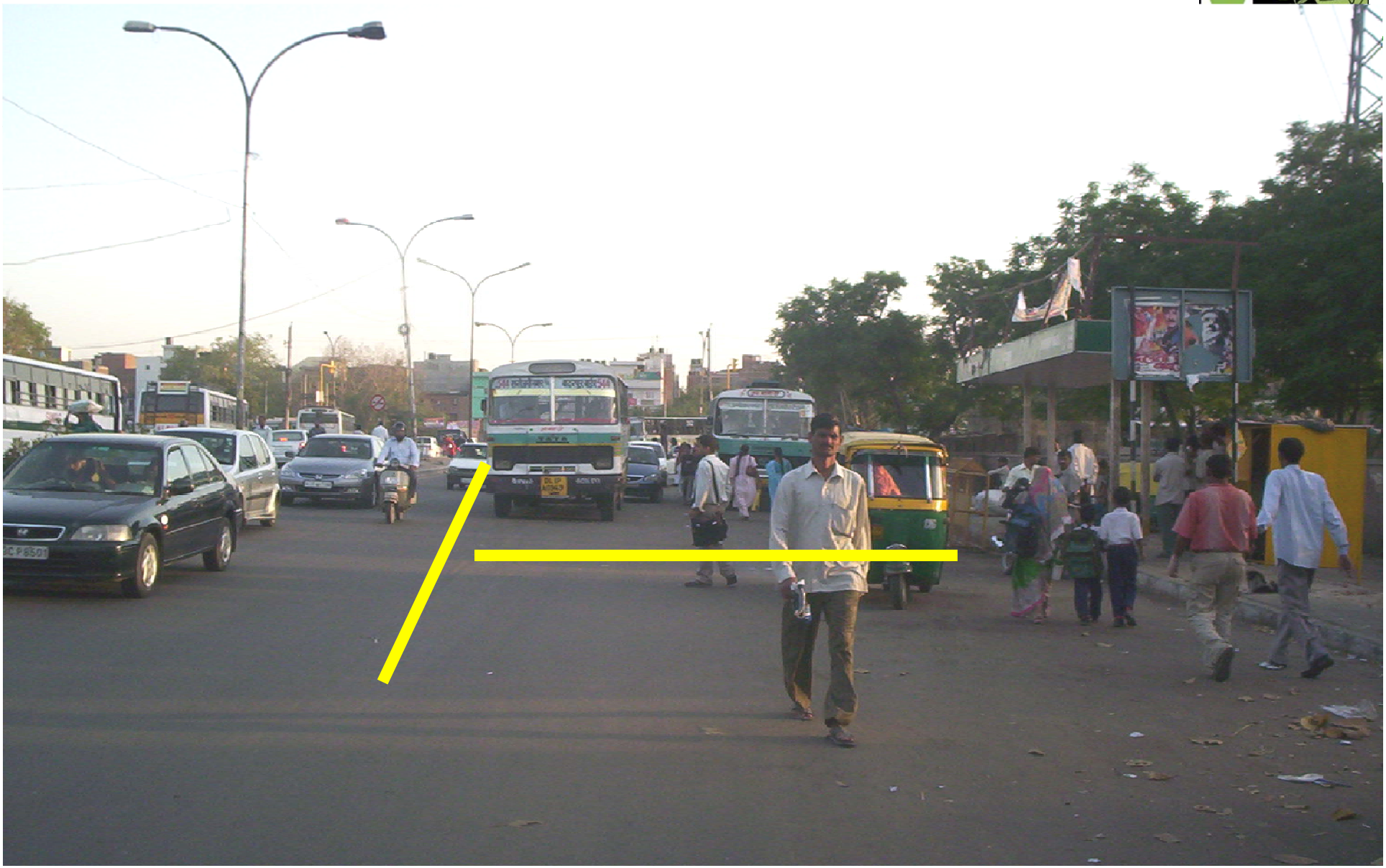
Reality check in Delhi
Public transport losing ground



Delhi Master Plan target: 80 per cent public transport ridership by 2020. Buses can help to meet 73 per cent. But bus share has already dropped to 40 per cent.

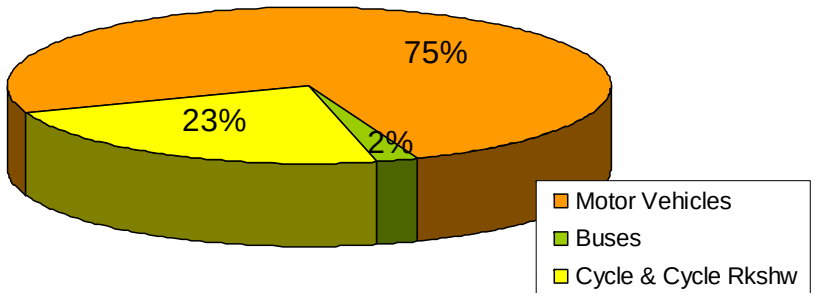
Source: Anon 2008, transport demand forecast study: study and development of an integrated cum multi modal public transport network for NCT of Delhi, RITES, MVA Asia Ltd, TERI, September

Reorganise roadspace to allocate more space to public transport.

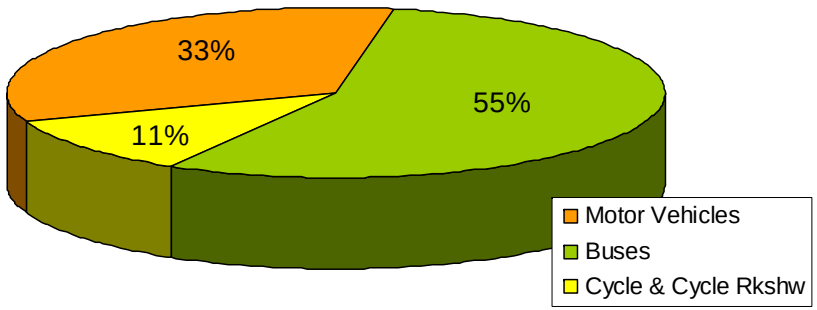


The Transition……..Reallocation of road space. More space to high capacity and non-motorised modes and majority commuters

Distribution of Vehicles - By Mode



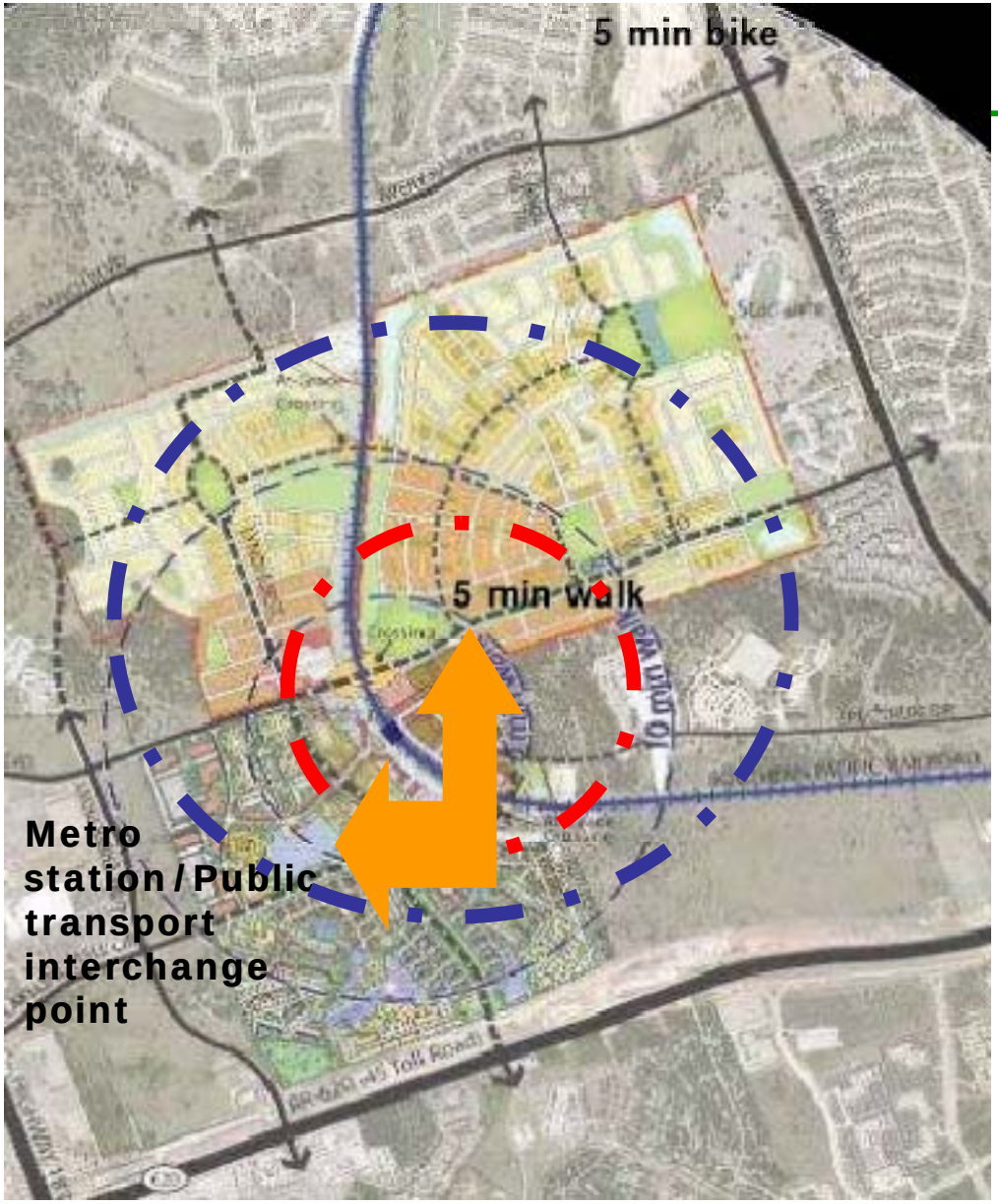
Distribution of People - By Mode



Moving vehicles vs. moving people

Delhi Bus Corridor

Delhi is developing guidelines for modal interchange location



Delhi-- UTTIPEC/DDA guidelines

Bus stop, cycle rental: within 50 meter level walk from station exit

Cycle and two wheeler parking :within 100 meter level walk from station exit

Auto rickshaw stand: within 150 meter level walk from station exit

Private car/taxi/auto rickshaw "drop off": with barrier-free of exiting pedestrians and NMT

Pedestrian exits, bus-stops and Cycle-rickshaw stands must be closest to main pedestrian exits from station.

Car parking if provided, must be BEYOND 250 M distance of Station/ or PT interchange point

Pairing of Origin-Destination (O-D) Nodes:
Provide cycle/ auto stands at nearby important destinations.
Signages at both end locations.
Private car parking only at Terminal Stations.
Discourage car parking at Stations within inner-city urbanized areas.

Poor approach to metro in NOIDA

Need good network of public transport system, taxis and improved autos, exclusive cycle-tracks …….

Need mixed land use to reduce travel distances and safe cities

Transit oriented guidelines
Remove setbacks to make streets safe, walkable…..

Enormous demand for commercial and office space in NOIDA.
Sector 62, 125, 126, 127, 132, 135, 136, 142,143, 144, 153, 154, etc., earmarked for more Institutional and office

Mixed land use zoning to optimise the use of valuable land along arterial roads

Need eye on the street: Shops and hawkers enhance safety

To ensure Safety of Pedestrians:


More than 45% of all travel trips in NOIDA are walk trip. Need walkways to improve usage of pubic transport
Dedicated lanes for bicycles and pedestrians
G Tiwari

Poor walking infrastructure in Delhi
Do not allow this to happen…….

Captive walker in poor neighbourhood (Govindpuri and Zaffrabad): Traffic and people on collision course…..

- Discontinuous, poorly paved footpaths, and not easily accessible
- Height and width of pavements violate norms
- Poor signages, no pedestrian refuge islands -- crosswalks are ordeal
- No kerbed ramps or blended crossings to access the crosswalk facilities
- Exposure to traffic very high.

Source: CSE

Indian style socialism

Aurangzeb Road and Govindpuri

We have counted 3 persons per 10 minutes in Aurangzeb Road and 100 person per five minutes in Govindpuri

Urban planning does not keep people in focus

Source: CSE

Car infrastructure severing neighbourhoods and pedestrian routes

(All India Institute of Medical Sciences intersection)

Before

After

ru

sh

increase walking distance for the ailing visitors using public transport

At least in one direction use of subway is unavoidable

Source: CSE

NOIDA Metro: No crossing for walkers

Jay walking….asserting their right to cross where convenient
But car centric design does not allow safe, quick and shortest crossing

Sai Chowk, Patparganj

Scindia House, CP

Seamless and signal free traffic is interrupting shortest direct route for pedestrians. This is inciting jay walking

Source: CSE

Unusable infrastructure: Wasteful

Unusable infrastructure: Wasteful
Guidelines of Indian Road Congress are inadequate

Eg. In the absence of proper guidelines on height of pavements unacceptably high pavements without proper gradients are being made…..

Source: CSE

Retrofitting changes…..

Connaught Place

- Sidewalks are now being rebuilt in Delhi

Source: CSE

It is possible to change

Redesigned streets in a small town of Nanded in Maharashtra

Before

After

Source: Pradeep Sachdeva

Message from the new road design: ……Human dignity and respect

Walking and cycling lane in the bus rapid transit corridor

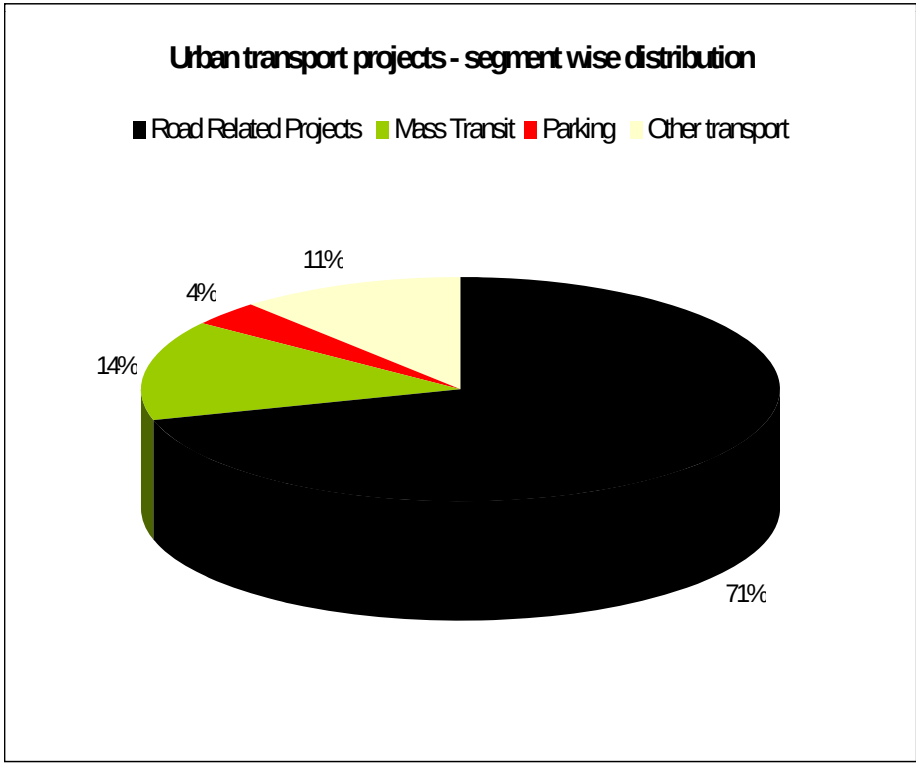
BRT Corridor Credit: SG Architects

But…..

Analysis of its projects sanctioned for transport until the beginning of this year shows that the investment is heavily biased towards road infrastructure. More than 71% of the transport related projects are road related projects.

Barely any investment in cycling and walking infrastructure.

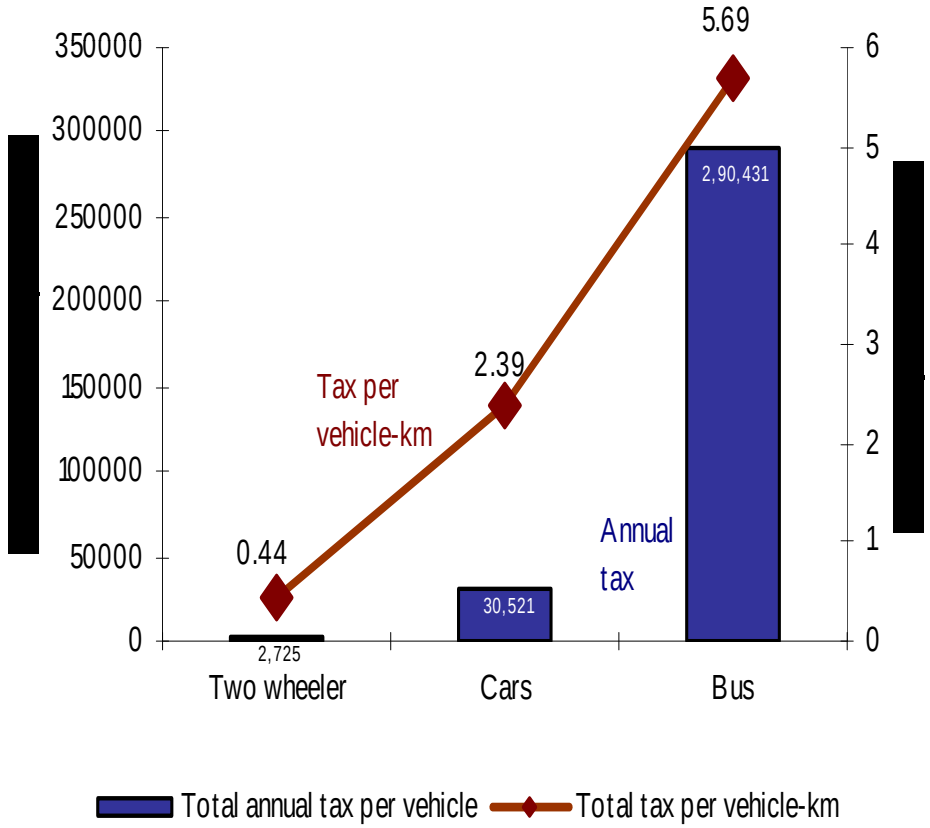
Funding ignores sustainable modes



Source: CSE

Why do we tax our buses more than cars?

If not corrected and bus fares are raised, a substantial public transport ridership can shift to two wheelers that have a running cost of a mere Re 1/km



Need parking levers to restrain personal vehicle usage

- **Parking: wasteful use of cars**: Out of 8760 hours in a year the total steering time of an average car is 400 hours. For about 90 to 95 per cent of the time a car is parked. (CRRI)
- **Insatiable demand for land**:
    - If demand for land for an average car is computed based on average car size and parking spaces per car -- the total cars already use up close to 10% city's urbanised area. The forest cover in Delhi is 11.5 %.
    - Daily registration of cars is generating demand for land bigger than 310 football fields! Land is expensive and has other opportunity costs.
- **Inequitous use of land**: A car is allotted 23 sq m for parking. Under low cost housing scheme only 18-25 sq m is allotted to very poor families. The car owning minority using up more and more road space and urban space.
- **Urban common, green spaces, walkways at risk**

Land is limited. Where will Delhi find more land to park cars?

Other countries are limiting and pricing parking supply

Portland, Oregon set an overall cap of 40,000 parking spaces downtown. This increased public transport usage from 20-25 per cent in the 1970s to 48 per cent in mid 1990s.

Seattle allows a maximum of one parking space per 100 square metres at downtown office

San Francisco limits parking to seven per cent of a downtown building's floor area

New York: Very high parking fees and limited parking supply lowers car ownership far below the average rates in other US cities.

Boston has frozen parking requirements at 10 per cent higher than the 1973 levels. This has helped Boston to meet the federal clean air standards.

Bogota has removed limit on the fees that private parking companies can charge. The revenue is dedicated to road maintenance and public transit improvement.

Shenzhen: Hike in parking fees during peak hours leads to 30% drop in the parking demand.

Tokyo: Enforcement against parking violations cuts congestion drastically . Private firms allowed to issue tickets for parking violations. This makes on-street parking expensive.

Bremen: No free parking in city centre. Parking charges higher than public transport cost.

Globally, customers agree to pay high parking charges if they get good shopping and pedestrian environment. This also improves business.

Cities are moving away from car centric infrastructure…….

Before

After

Seoul's Cheonggyecheon restoration proj

Cities that have destroyed roadways

San Francisco

Milwaukee

New York

Portland

Toronto

Seoul

Our cities need upscaled transition
Avoid future emissions
Shift to sustainable modes of mobility

Indian cities have begun to work towards policies for clean air and clean transportation. This will have to be enabled and scaled up.

Opportunity to provide scaled up alternatives

- Public transport and multi-modal integration
- Infrastructure for walking and cycling

Reduce demand for travel and vehicle usage

- Land-use planning to reduce travel distances
- Road pricing
- Tax rationalisation
- Parking policy and charges

Leapfrog technology

- Leapfrog to Euro VI emissions standards
- Fuel economy standards

Fund the transition: Need tax measures to allocate resources efficiently and raise revenue.

This needs support. Must not be allowed to fail..

Otherwise what???

Thank You