Maintaining growth with air quality control in India : Transport sector

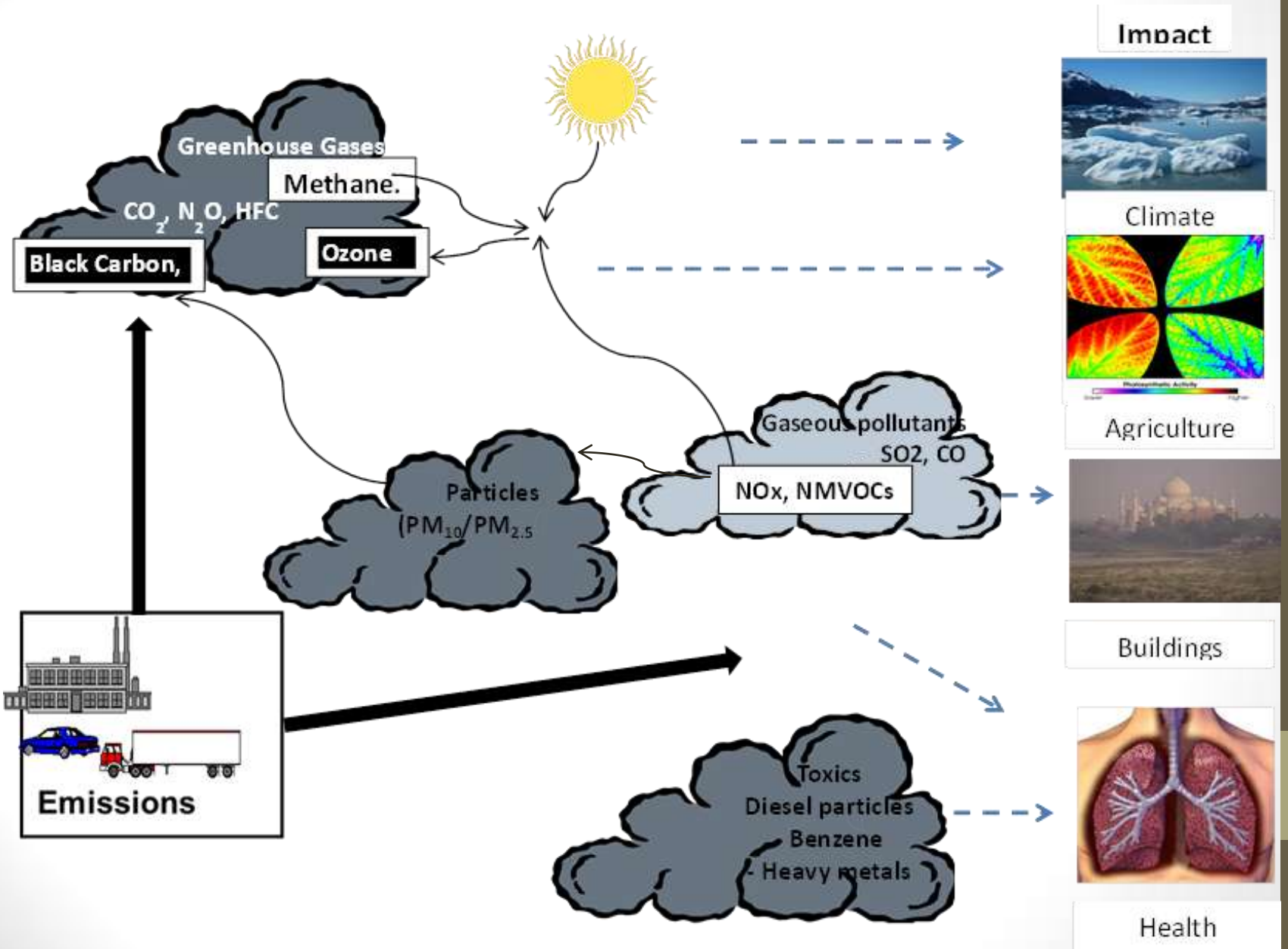
Sumit Sharma

TERI, New Delhi

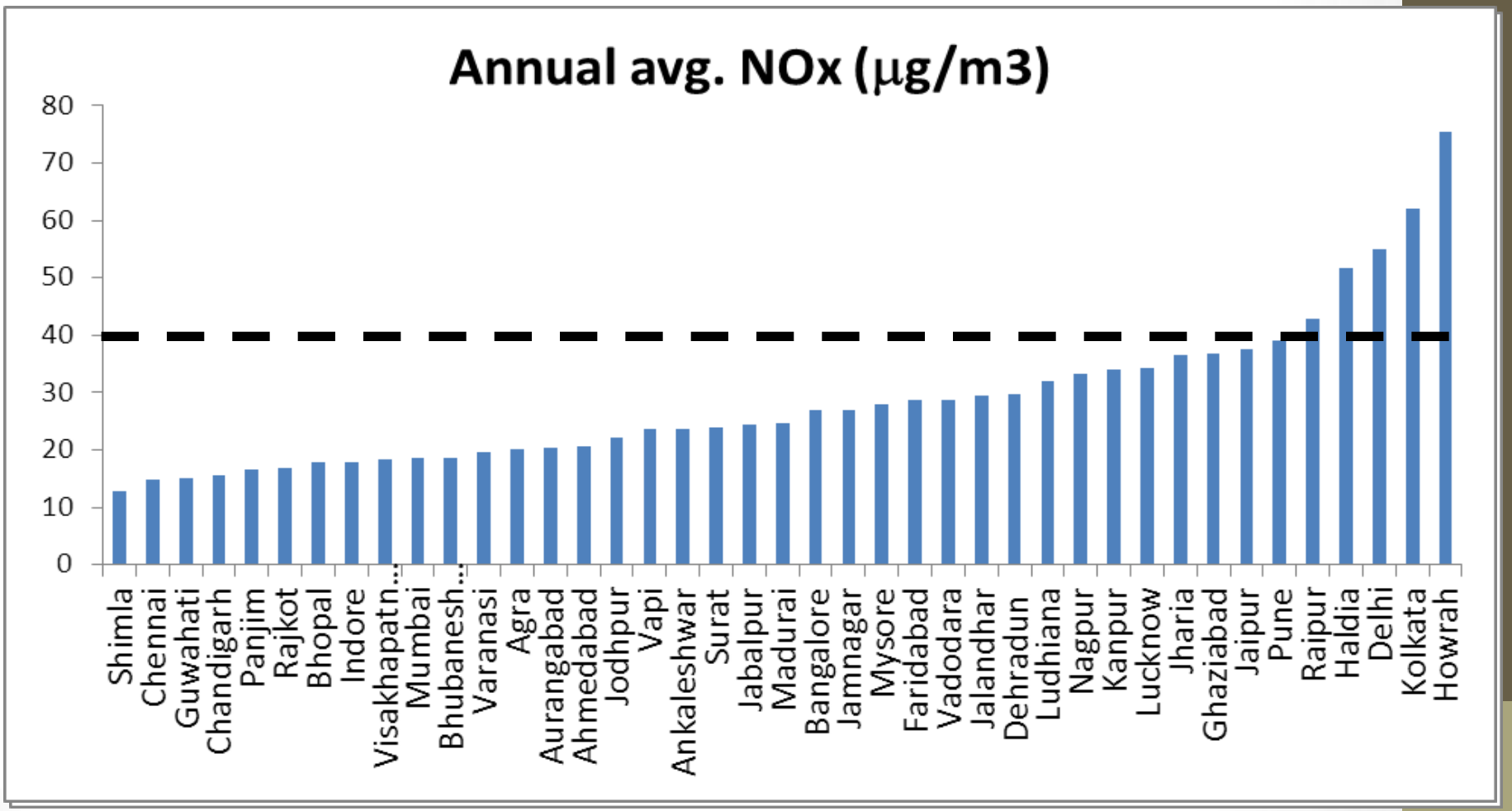
The growth story

- India since 1950 : Population, index of industrial production and number of vehicles have grown 3.3, 50, and 460 times, respectively
- 53 cities million plus cities. expected to grow to 85 by 2025
- 31% urbanisation , expected to grow to 38% by 2025.
- Unprecedented growth of personal vehicles in India.
- Aspirations to own personal vehicles reinforced by limited public transport
- Growth of vehicles far more in cities, leading to congestion and emissions and effects over health .

Plethora of air pollutants ……



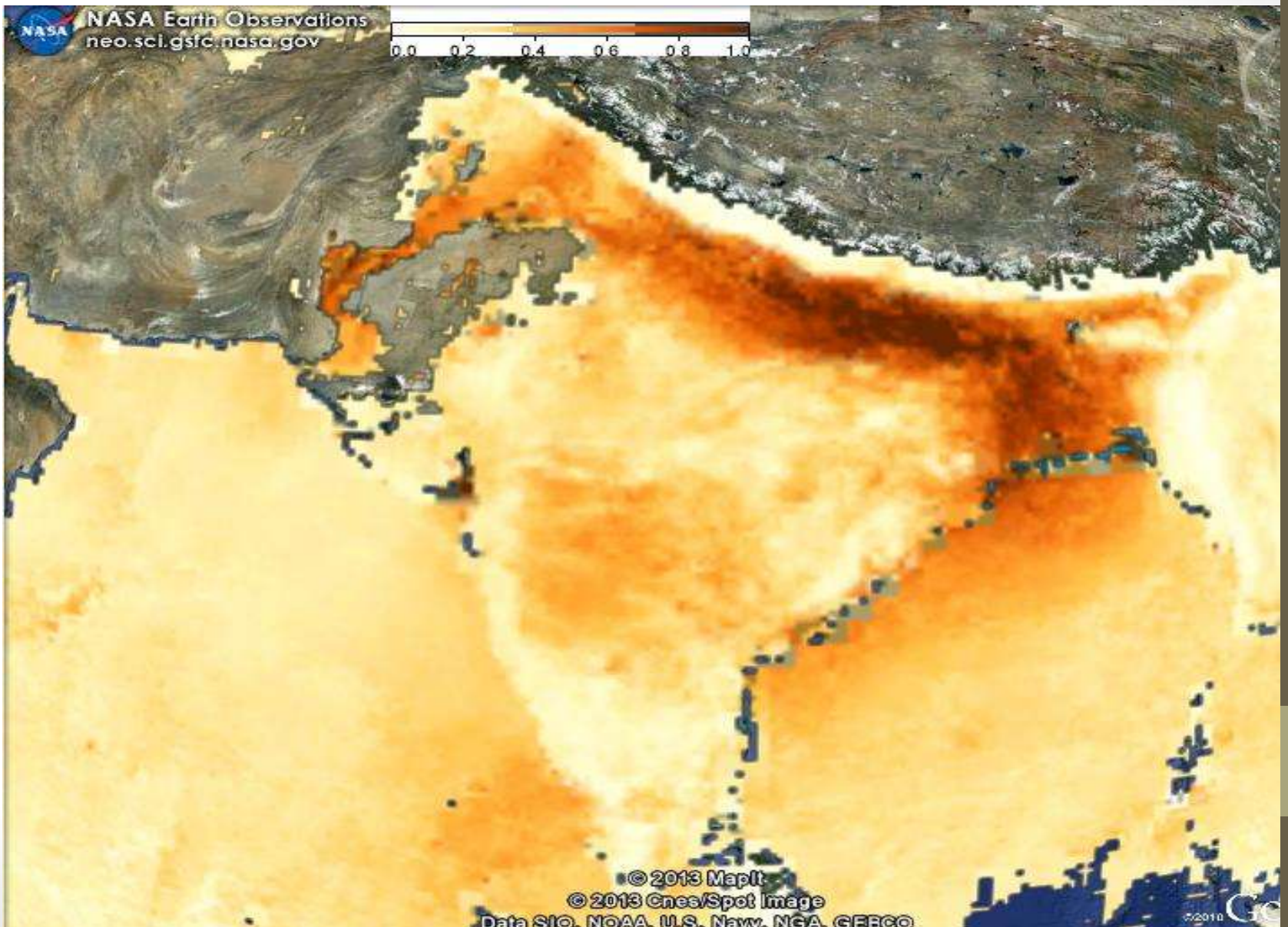
Air quality in India



More than 80% cities violate the standards of RSPM

Source: CPCB, NAMP data

Satellite view (AOD)



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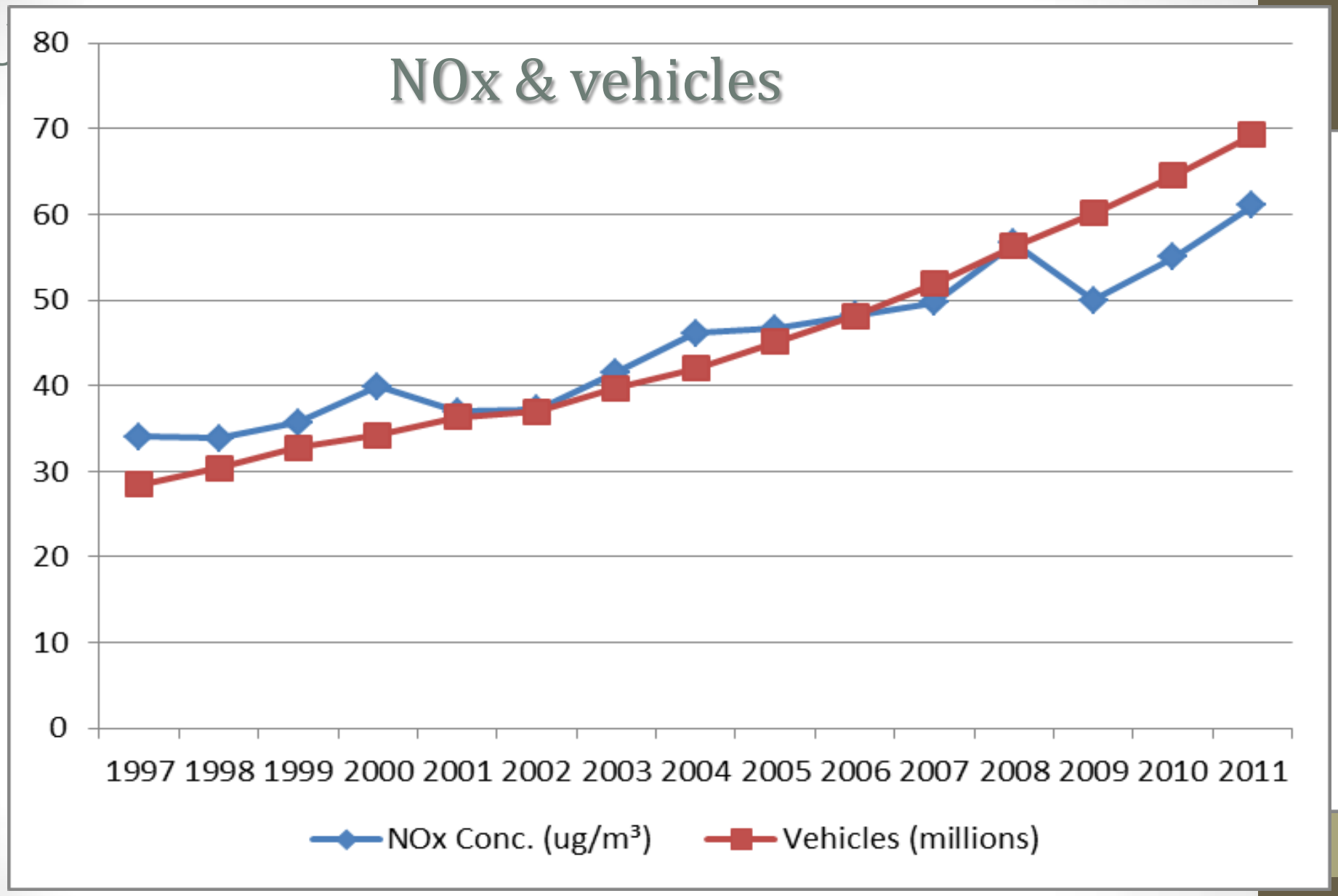

NOx & vehicles
80
70
60
50
40
30
20
10
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
NOx Conc. (ug/m³)
Vehicles (millions)

Impacts

- Sufficient evidence to document the causal relationship with the onset of childhood asthma, non-asthma respiratory diseases, impaired lung function, cardiovascular mortality and morbidity.
- GBD estimates, about 6 lakh mortalities attributed annually to ambient air pollution in the country.
- WHO, 2012 Diesel exhausts are carcinogens
- Nationally aggregated relative yield loss of wheat and rice due to high ozone exposure totals 5.5 million tons in 2005, which could have fed 94 million people in India (Ghude, 2014)
- Effects on buildings, visibility, ecology etc

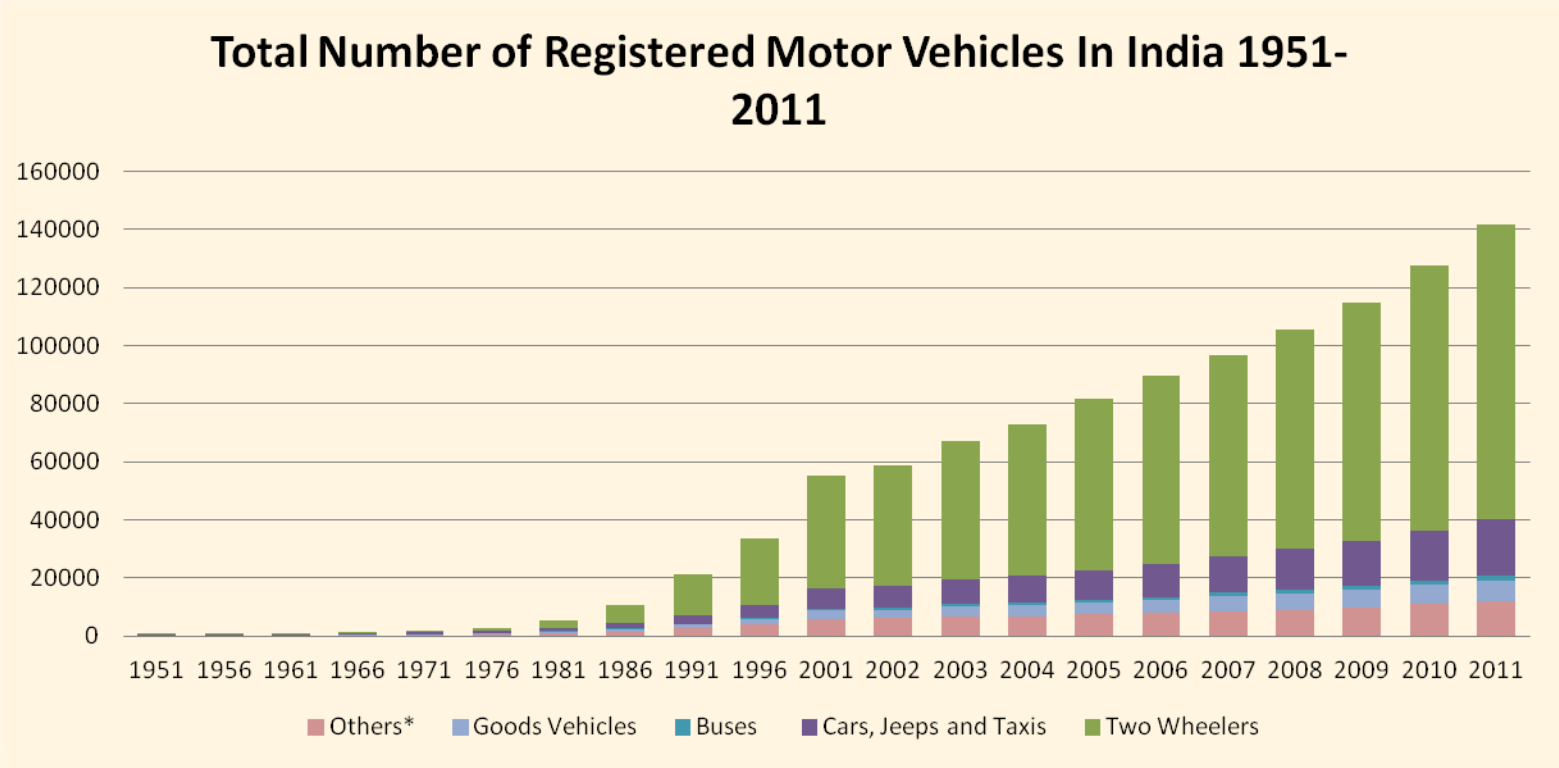
- It warms too ..Bond et al 2014 confirmed second highest radiative forcing of black carbon

- Impacts image …

Possibilities in transport sector

Growth in Number of Motor Vehicles

- Over 1/3rd of the total vehicles in 53 million +cities
- Second tier cities show greater increase in vehicle population

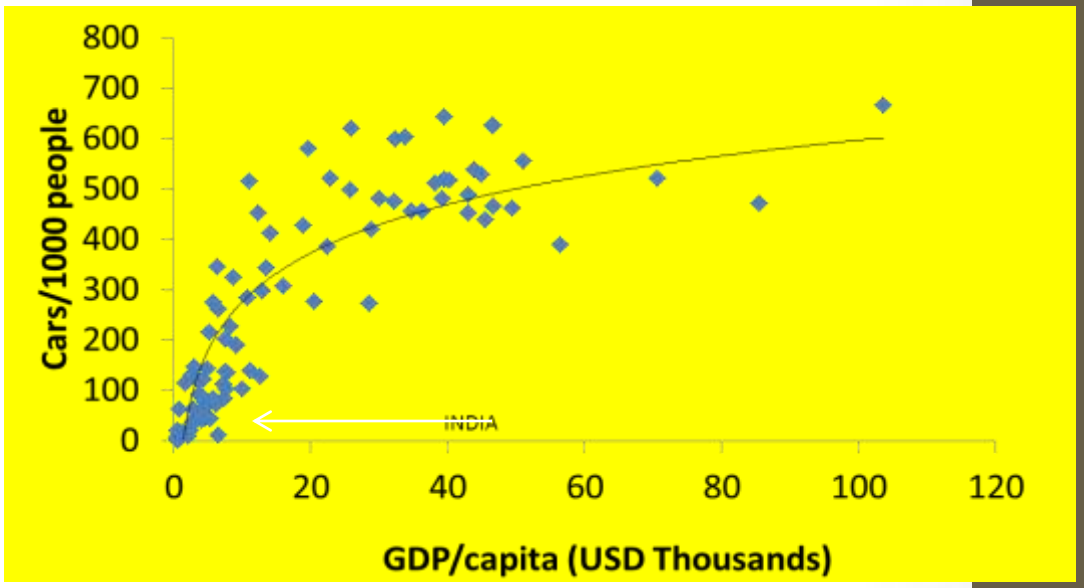


Others: tractors, trailors, three wheelers (passenger vehicles), etc

MoRTH, ROAD TRANSPORT YEAR BOOK (2009-10 & 2010-11), http://morth.nic.in/writereaddata/mainlinkFile/File838.pdf

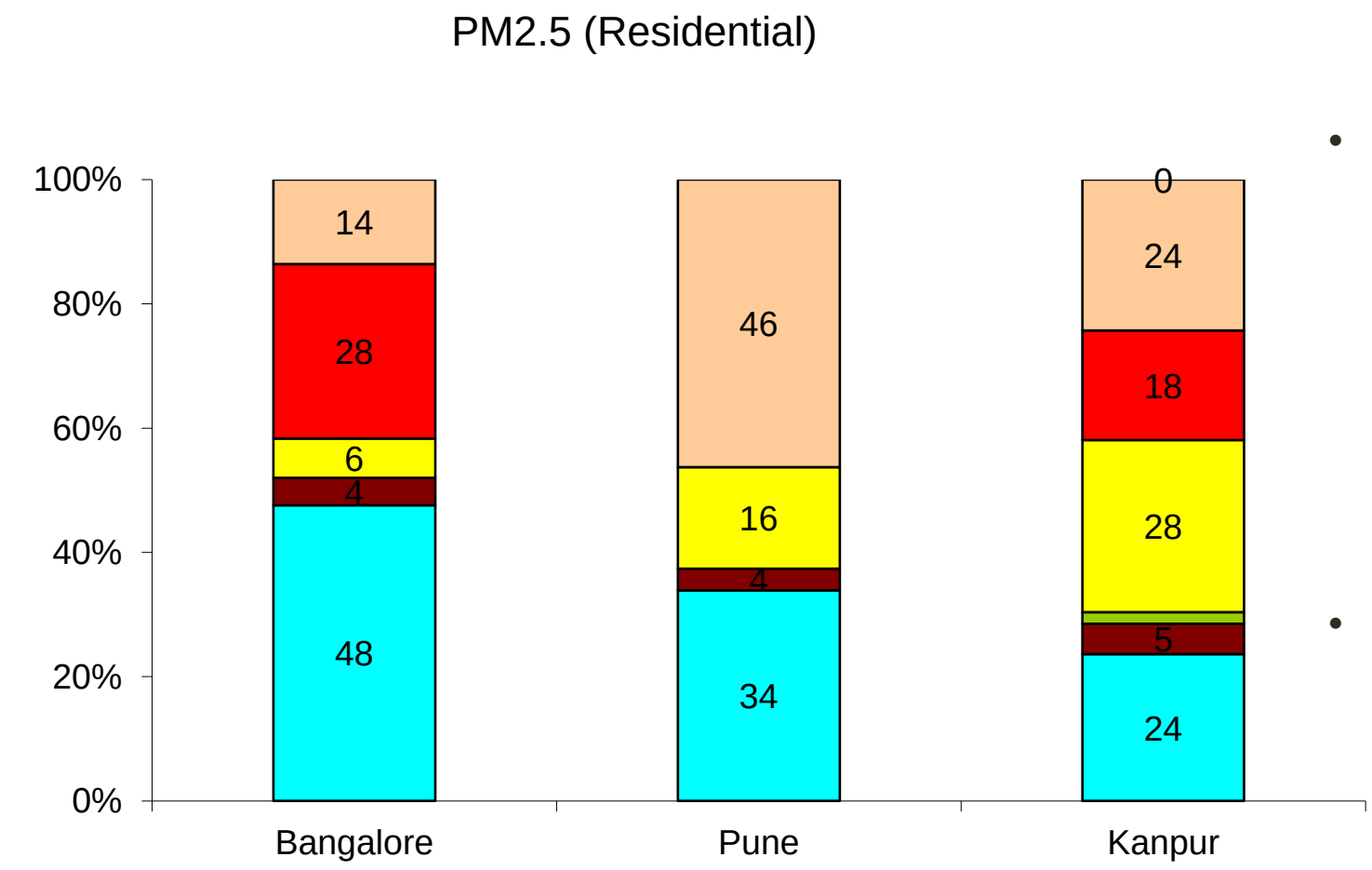
Vehicular growth

- About 28000 two wheelers, and 4200 cars added to India's vehicular fleet daily (2011)
- As per Census 2011, 21% households have two wheelers whereas 4.7 % have cars/jeeps/vans
- More growth expected



Data WDI, 2011

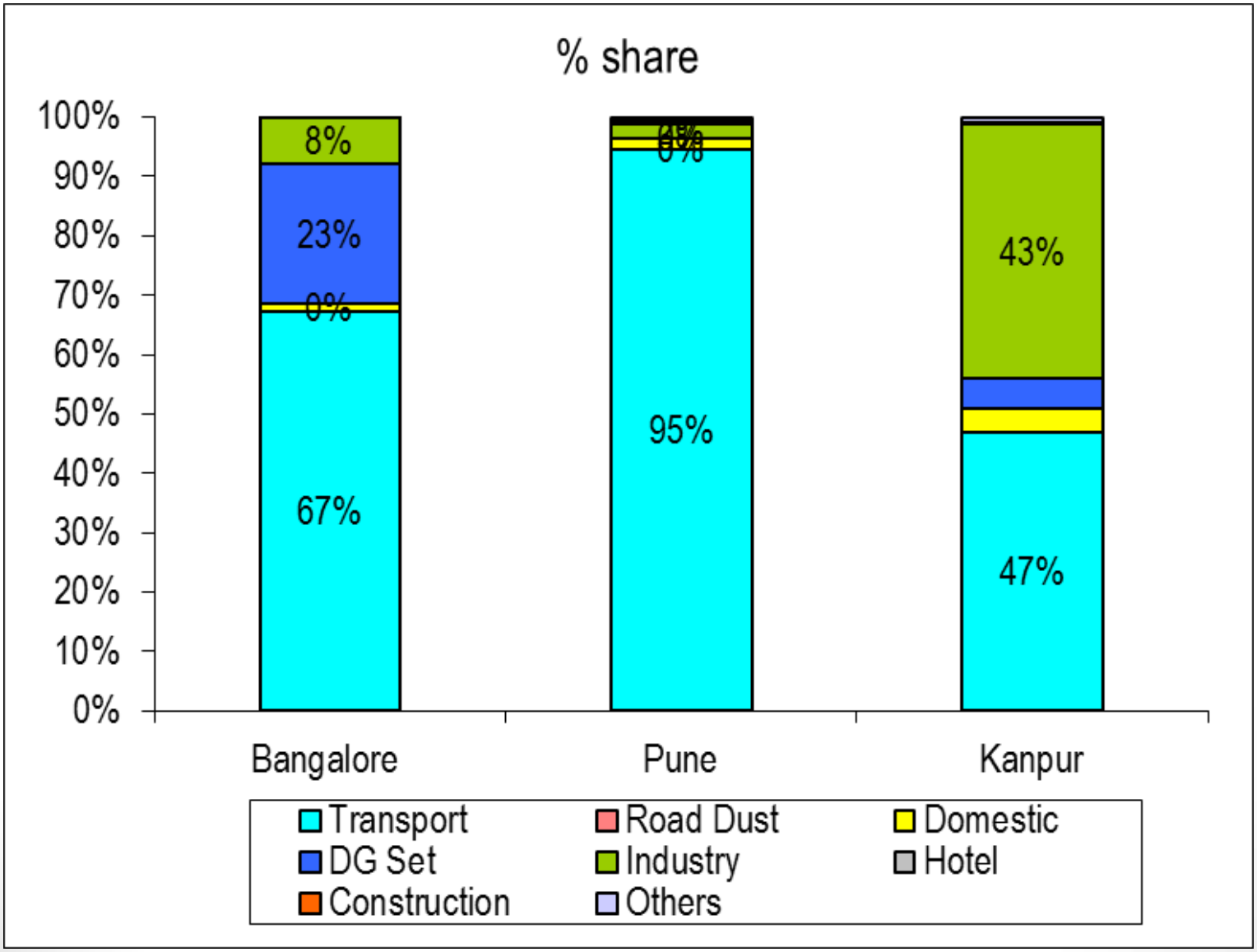
Source apportionment study (PM)



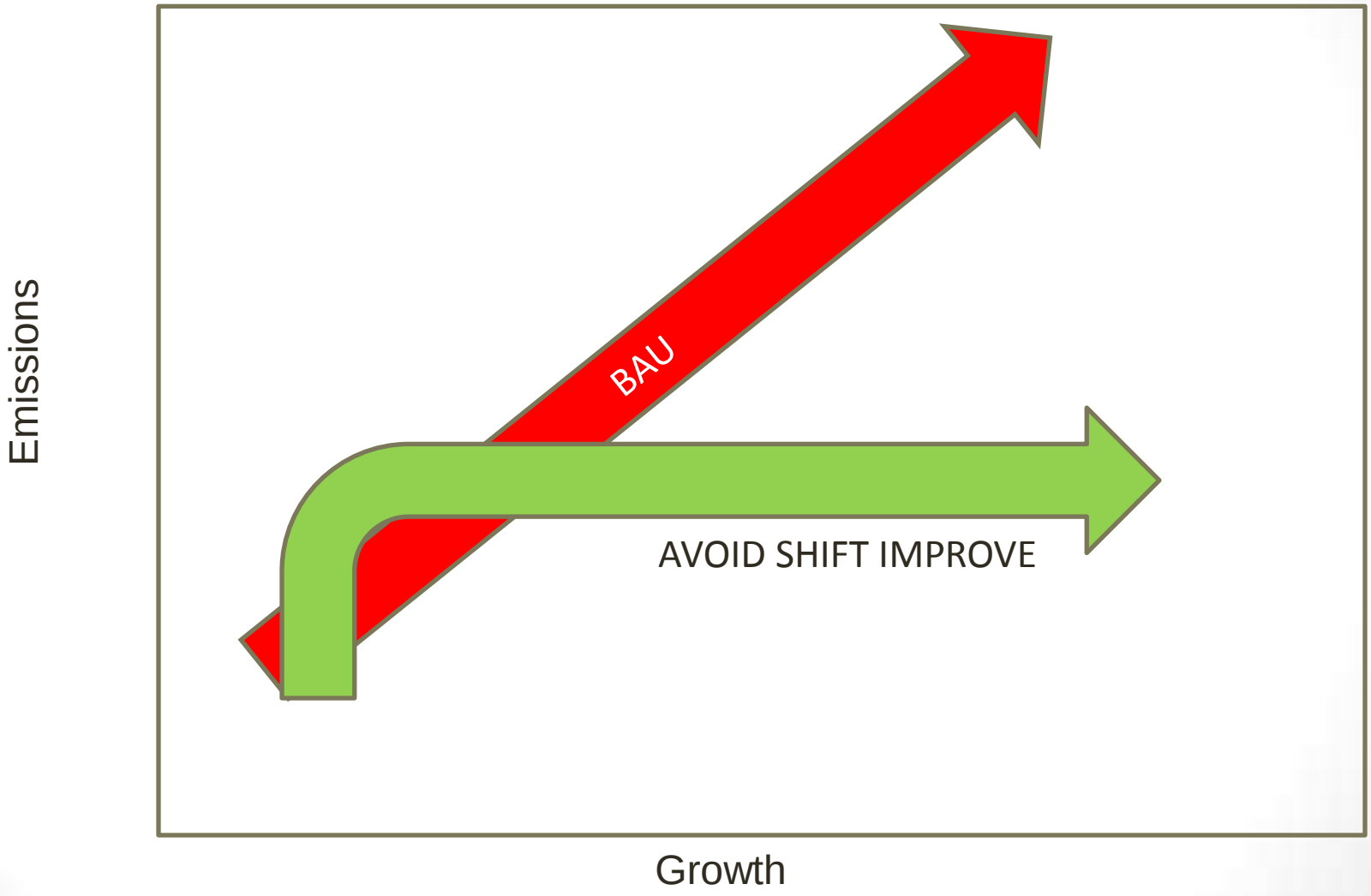
- **Share of transport sector increases if we move from PM10 to PM2.5 (finer fractions)**
- **In non-industrial cities, it is the largest source**

Source: CPCB, 2010

Source apportionment study- NOx



Opportunities



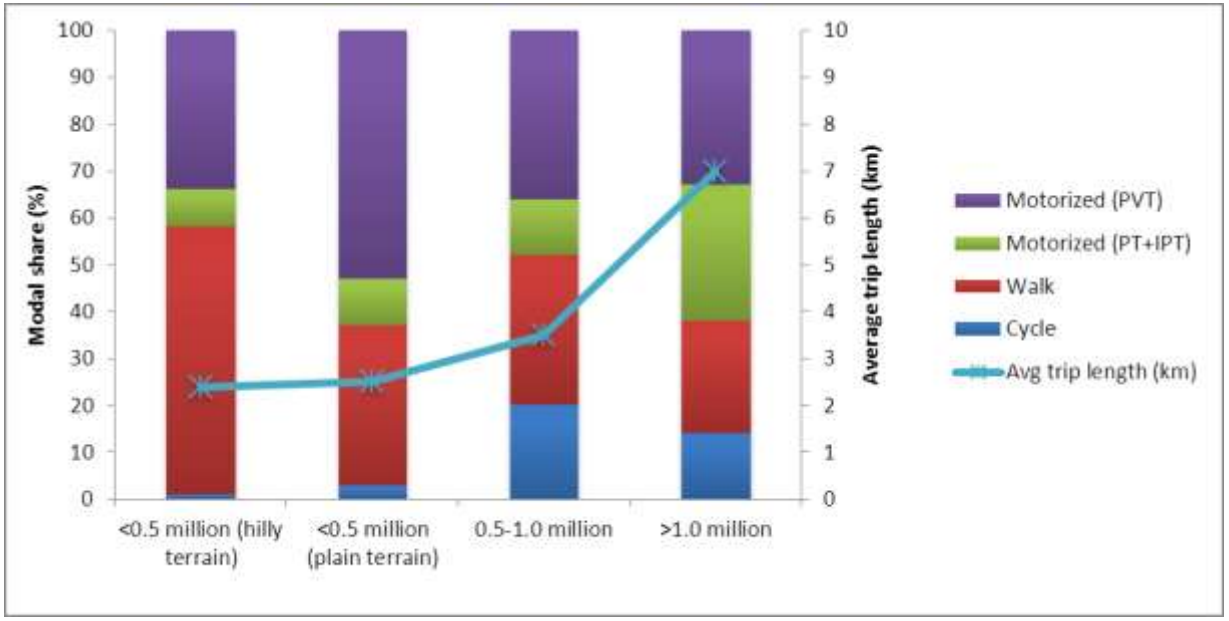
AVOID options

- To reduce the overall mobility demand and ensure efficient mobility
- Integrated landuse planning
- Virtual mobility
  - E-work
  - E-trade
  - E-governance
- Intelligent transport systems

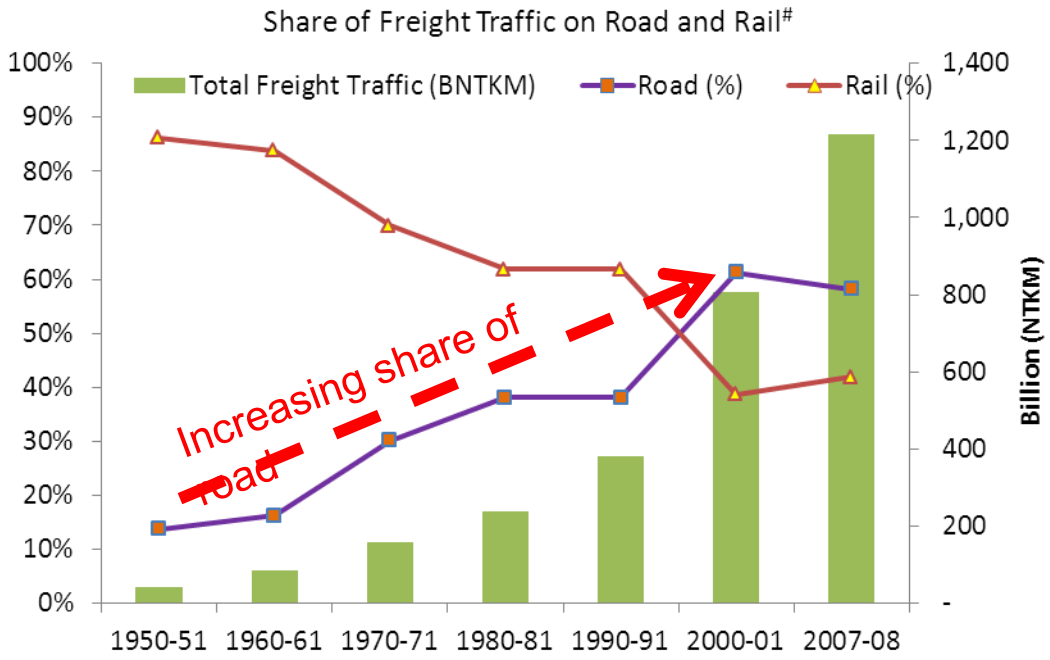
Shift measures
Non-motorised transport

- Lack of infrastructure for non-motorized transport and the increasing trip lengths affected NMT users in cities
- Share of NMT, though high in cities, is declining as cities grow
- Maintain and increase the share of NMT

Mode share in Indian cities



Shift measures : Road to rail



% Share (NTKM)*

Road = 50.12%

Rail = 36.06%

Coastal shipping = 6.8%

Pipeline = 7.48%

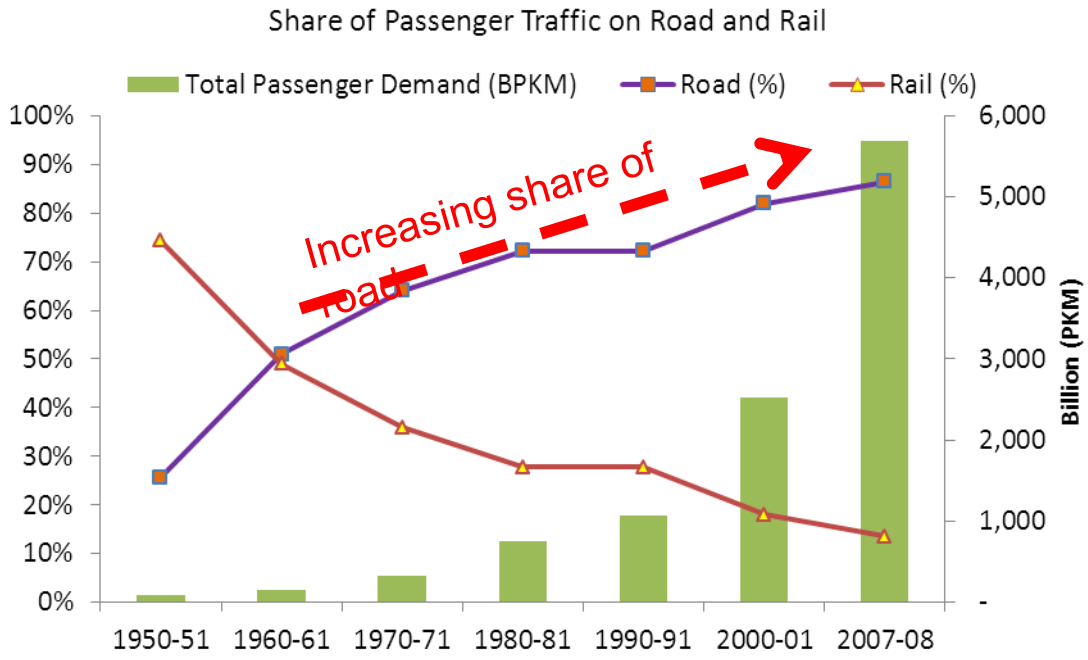
IWT = 0.24%

Airways = 0.02%

- *Continuous erosion in the share of Railways in freight movement and increase in share of less fuel efficient road transport*
- *Road transport is the most dominant mode of transport with over 50% of the freight*

**Modal share in total freight traffic as of 2007-08, source: RITES Total Transport Study; #Compiled from 11th Five Year Plan Working Group Report on Road Transport and RITES Total Transport Study*

Shift measures : Road to rail



% Share (BPKM)*

Road = 86.7%

Rail = 12.9%

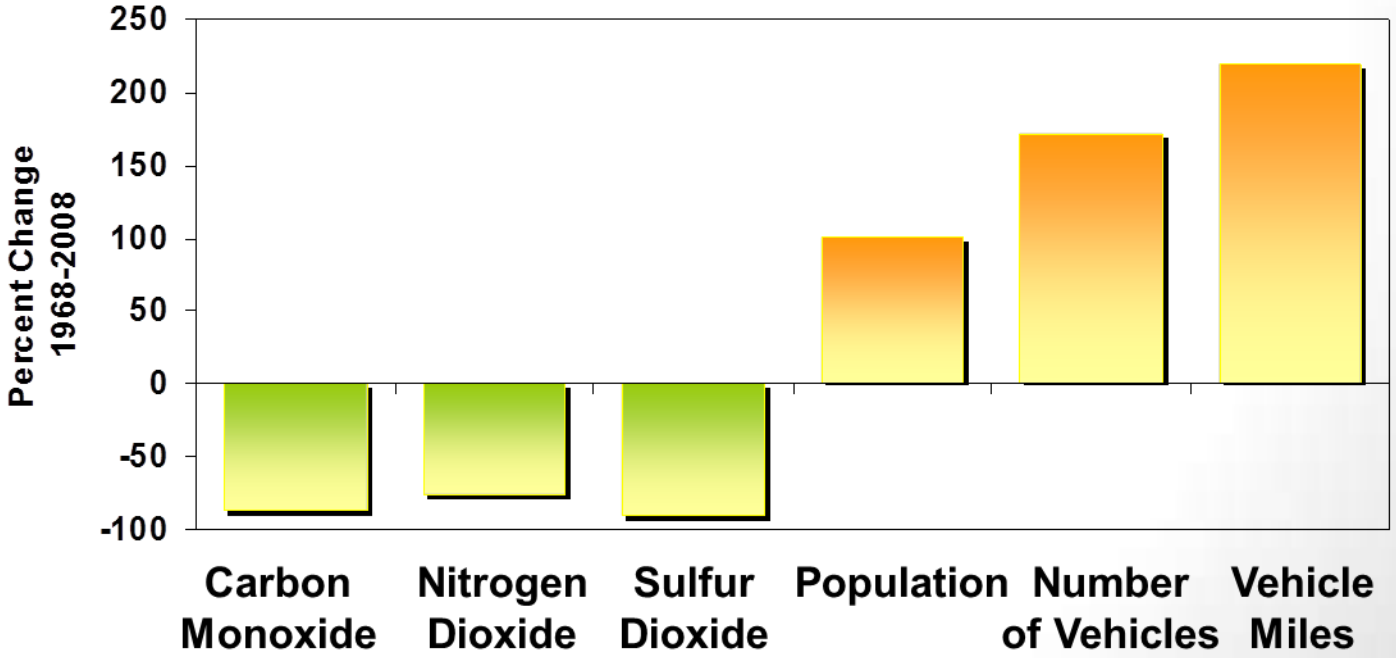
Air= 0.4%

- Substantial shift from rail to road
  - Rail dominates long-haul
  - Road dominates short-haul
- Road transport is the most dominant mode of transport. Almost 90% passengers moved by road in 2010-11
- Air based passenger transport has seen a rapid growth in the last decade

**Modal share in total passenger traffic as of 2007-08 compiled from 11th Five Year Plan Working Group Report on Road Transport and Statistical Summary – Indian Railways*

IMPROVE : Fuels and vehicles

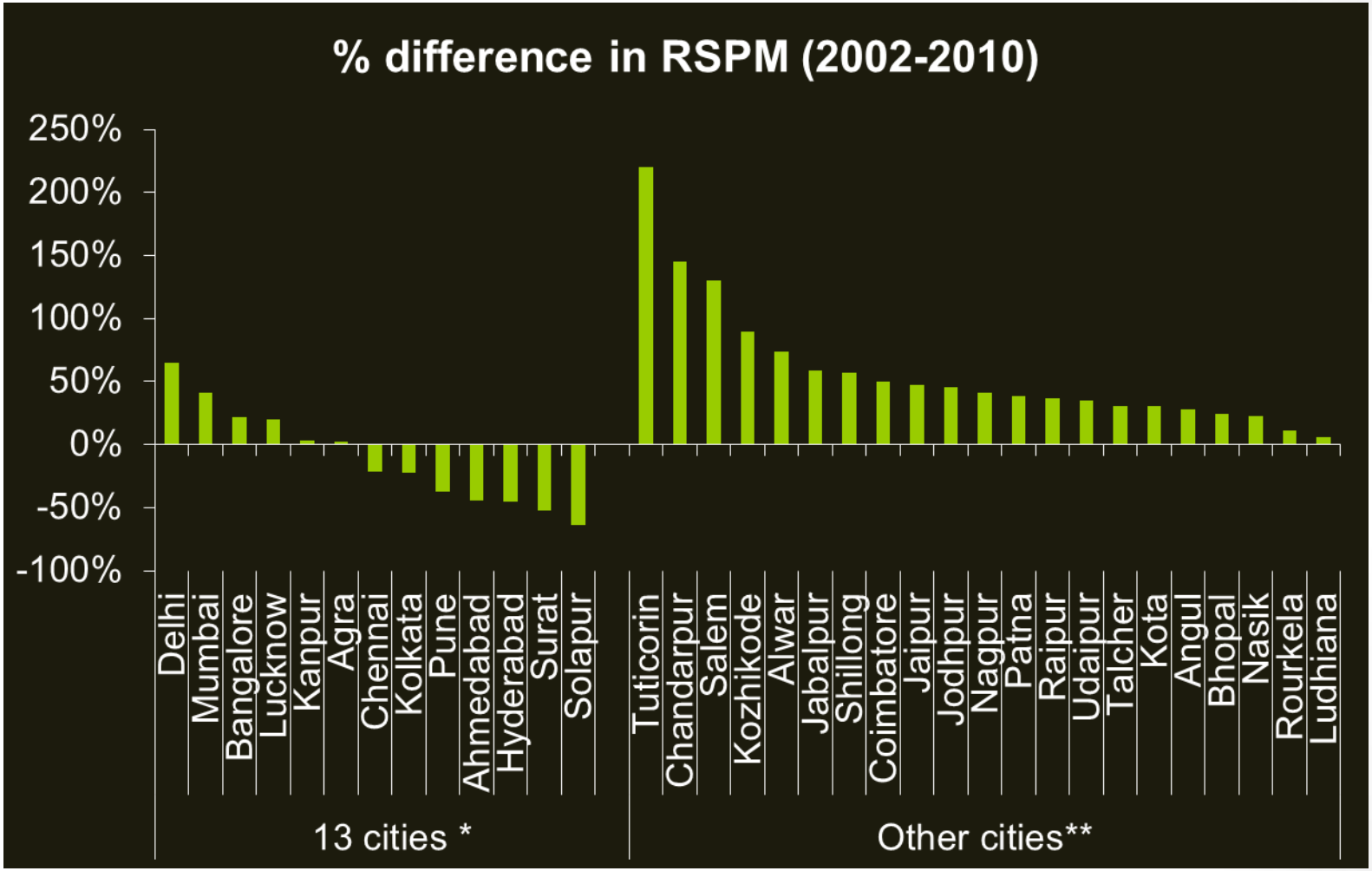
- Quality of fuel and technology of vehicles play an important role in defining emissions
- California introduced clean fuels and vehicles and reduced emissions of
  - ozone precursor gases (CO, NOx and SO2) by 75% to 90%
  - black carbon (major part of diesel PM) emissions by 90%



Auto Fuel Policy 2002- India

- One set of standards for air quality
- Different vehicle emission and fuel quality standards for 13 cities and rest of the country
- Dual standards effectively treat the majority of the citizens in the country as second class citizens who can continue to live in polluted environments.
- Many other cities in the country are much more polluted than the ones where better quality fuel is presently provided.
- Better quality vehicles moving out of 20 cities, may fill the inferior quality fuel and may end up choking their engines
- No road map after 2010

Impact of AFP on air quality (RSPM)

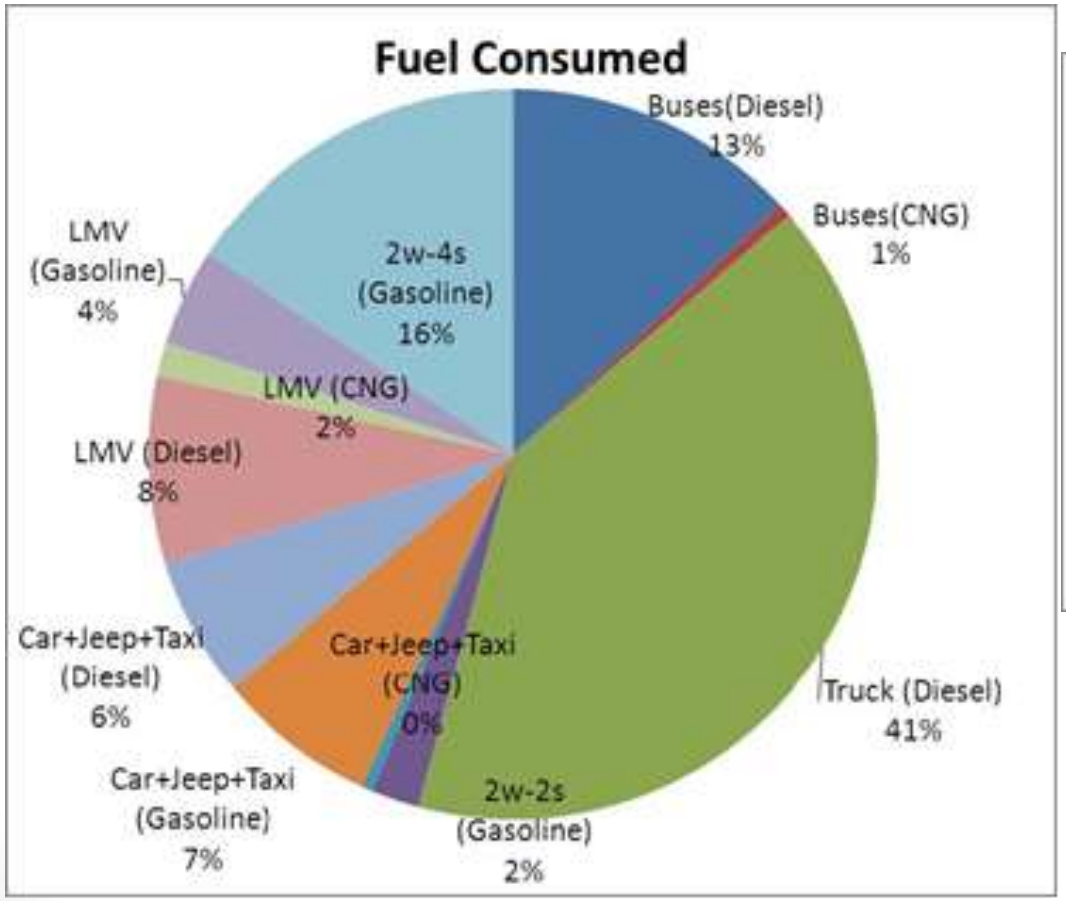


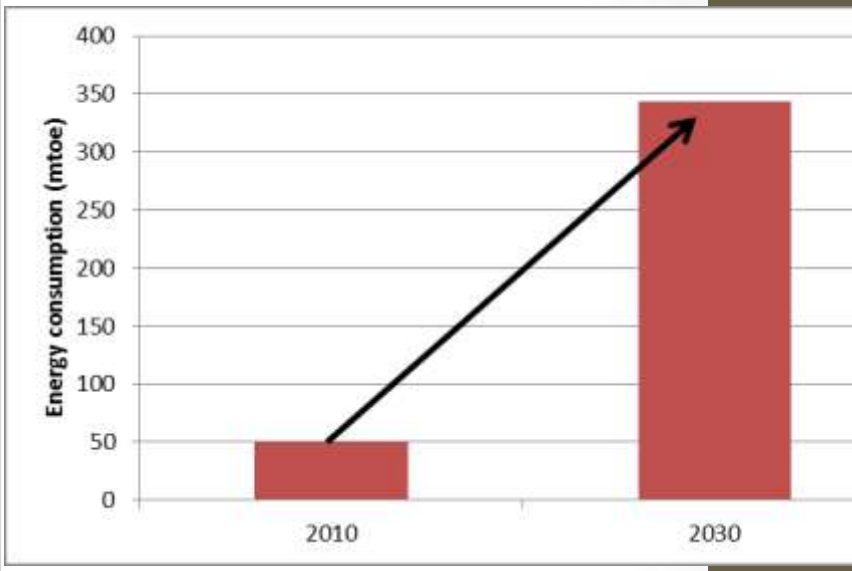
*13 cities : Selected in AFP, 2002 for advanced implementation of BS norms

** Other cities which show higher increase in RSPM in the last 8 years.

Data source : CPCB, NAMP

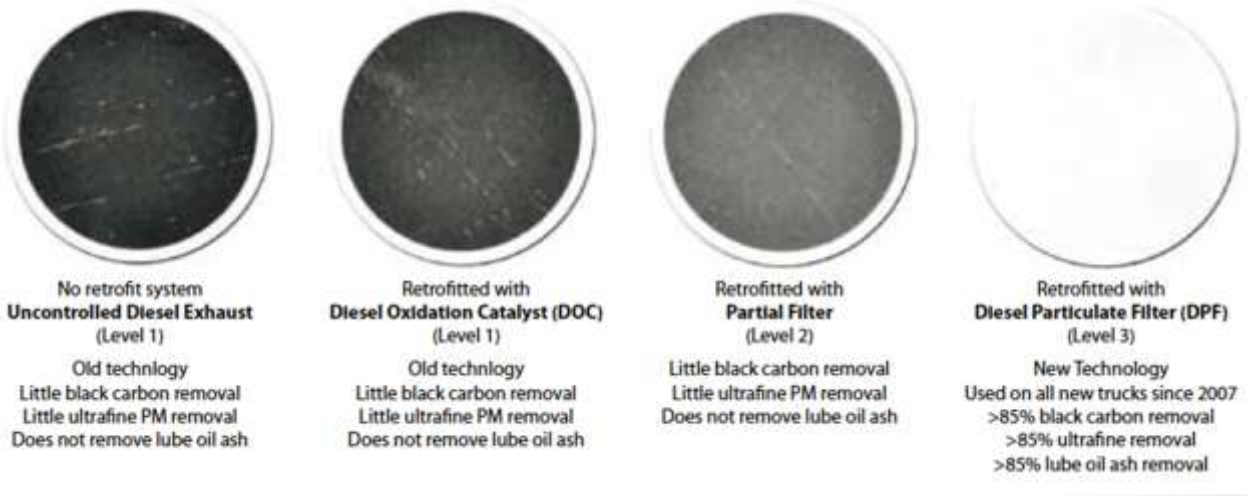
Road transport energy consumption and projections (2010-2030)





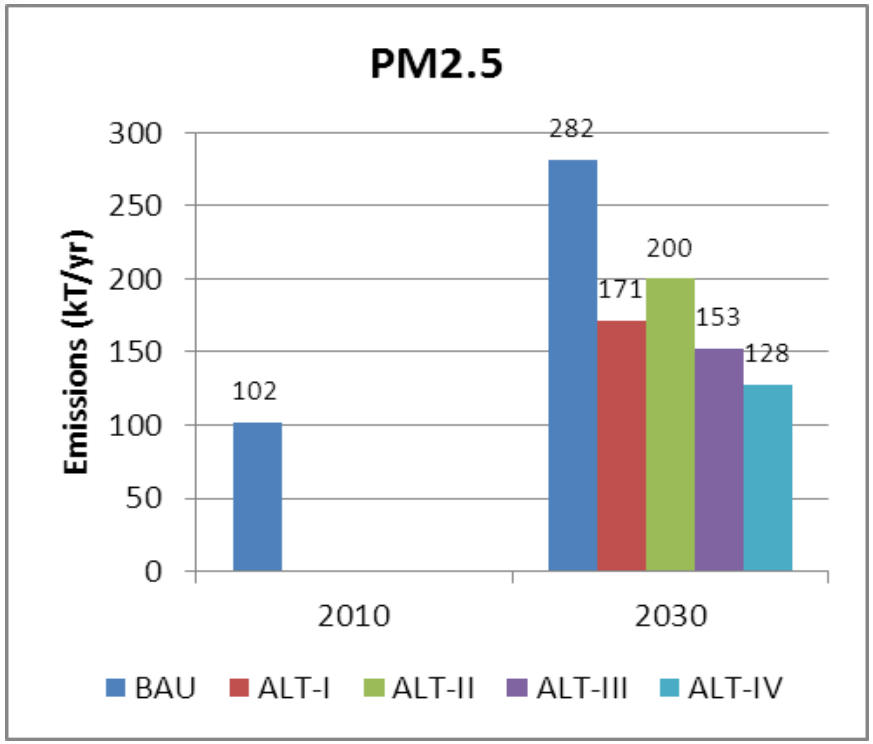
Further advancements required

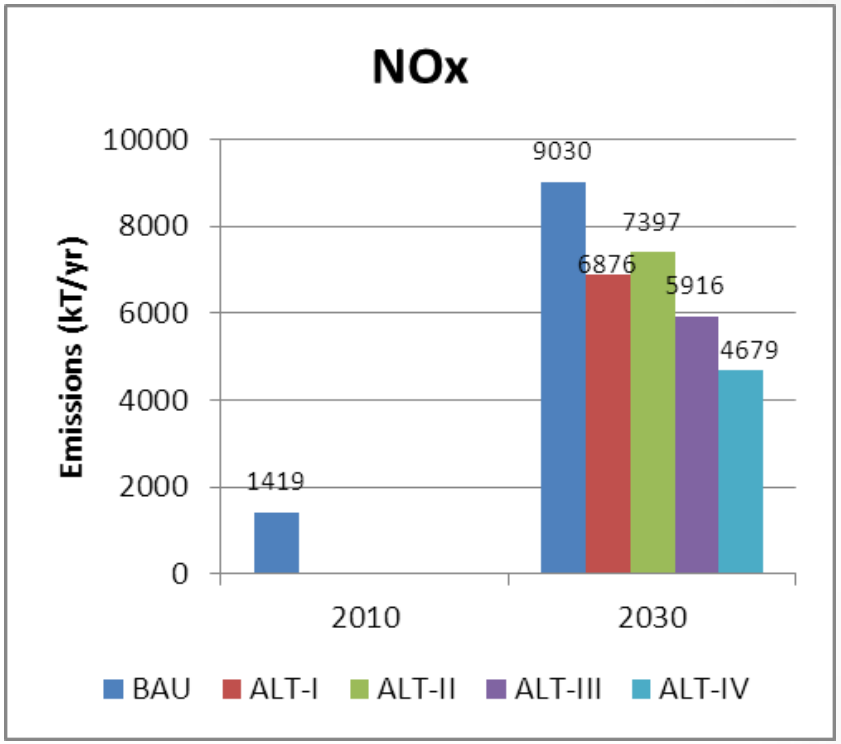
- Euro IV/V equivalent fuel quality (diesel and petrol) have much reduced sulphur content which will help to improve air quality.
- It will enable the use of advanced emissions control technologies on light duty and heavy duty diesel vehicles.
- Reach of CNG would still be limited.
- *Expanding the reach of EURO IV/V equivalent fuel to the entire country* would reap considerable air quality benefits.



➢ Cleaire Advanced Emission Controls LLC, ICCT

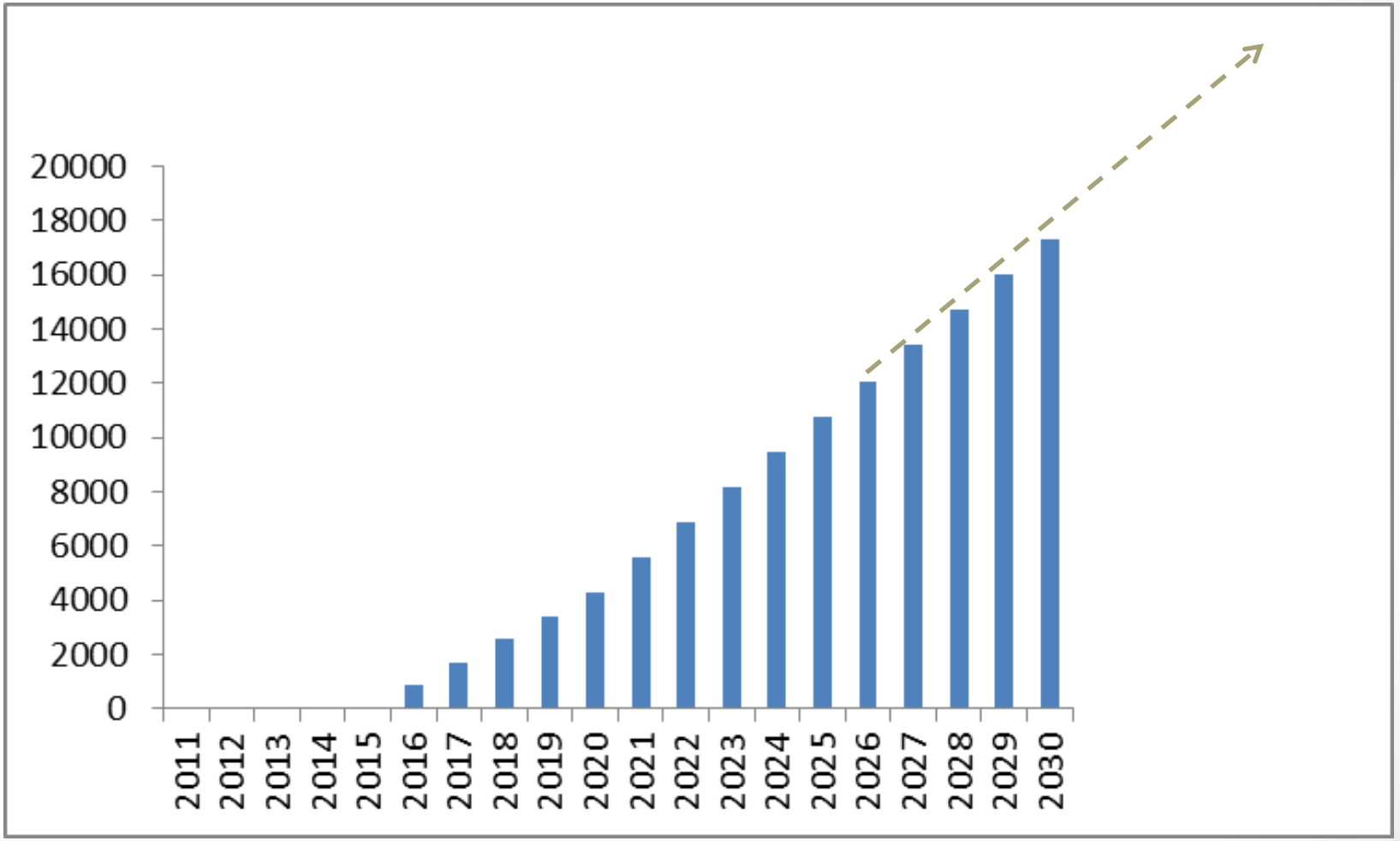
Effect of advancement of vehicular emission norms





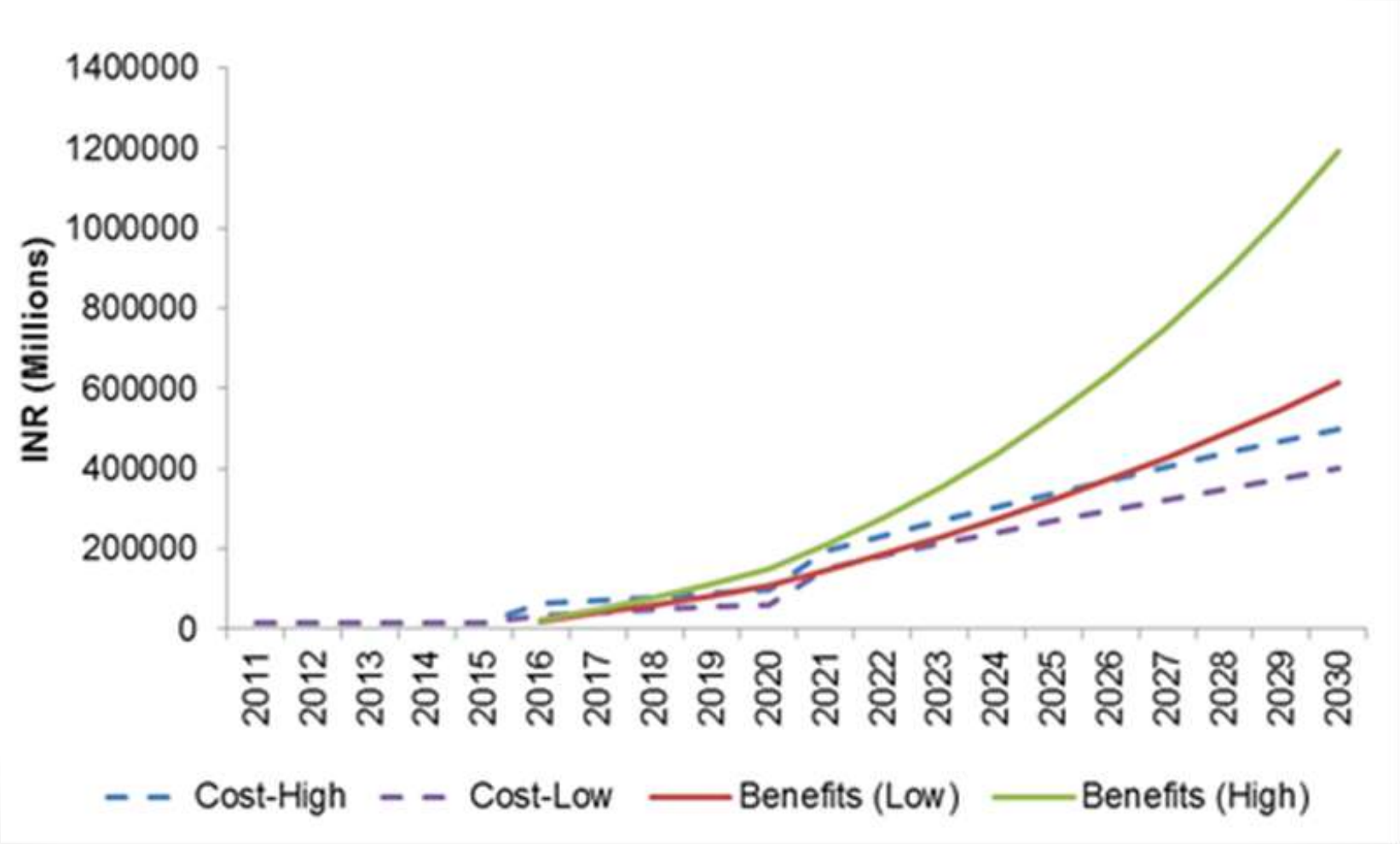
Scenario	Description
BAU	Based on the current plans and policies of the government without any further intervention. BS-III all across the country and BS-IV in 13 cities
ALT-I	Introduction of BS-IV all across the country by 2015
ALT-II	Introduction of BS-IV all across the country by 2020
ALT-III	Introduction of BS-IV all across the country by 2015 and BS-V in 2020
ALT-IV	Introduction of BS-IV all across the country by 2015 and BS-VI in 2020

Avoided mortalities



•Health impacts of only PM; NOx, CO, VOCs and O3 may additionally or synergistically aggravate the impacts. Agricultural impacts of Ozone and other pollutants are additional. Climate benefits are additional as reduction in PM will reduce black carbon concentrations too

Health benefits (PM) outweigh the costs very soon



Conclusions

- Air quality in Indian cities is severely deteriorated
- Growth is inevitable and BAU scenario projects a grim picture of air quality
- Transport sector is one of the important source contributing to finer fractions of PM, and NOx
- AVOID SHIFT IMPORVE measures required to reduce emissions without impacting the growth.

Key measures

- Integrated planning and virtual mobility
- Shift from road to rail and cars to buses
- ‘One country, one fuel and one standard’ in India
- Advancement of fuel quality and emission norms
- Commissioning of an effective I&M system across country
- Development of a fleet modernization programme

Thanks