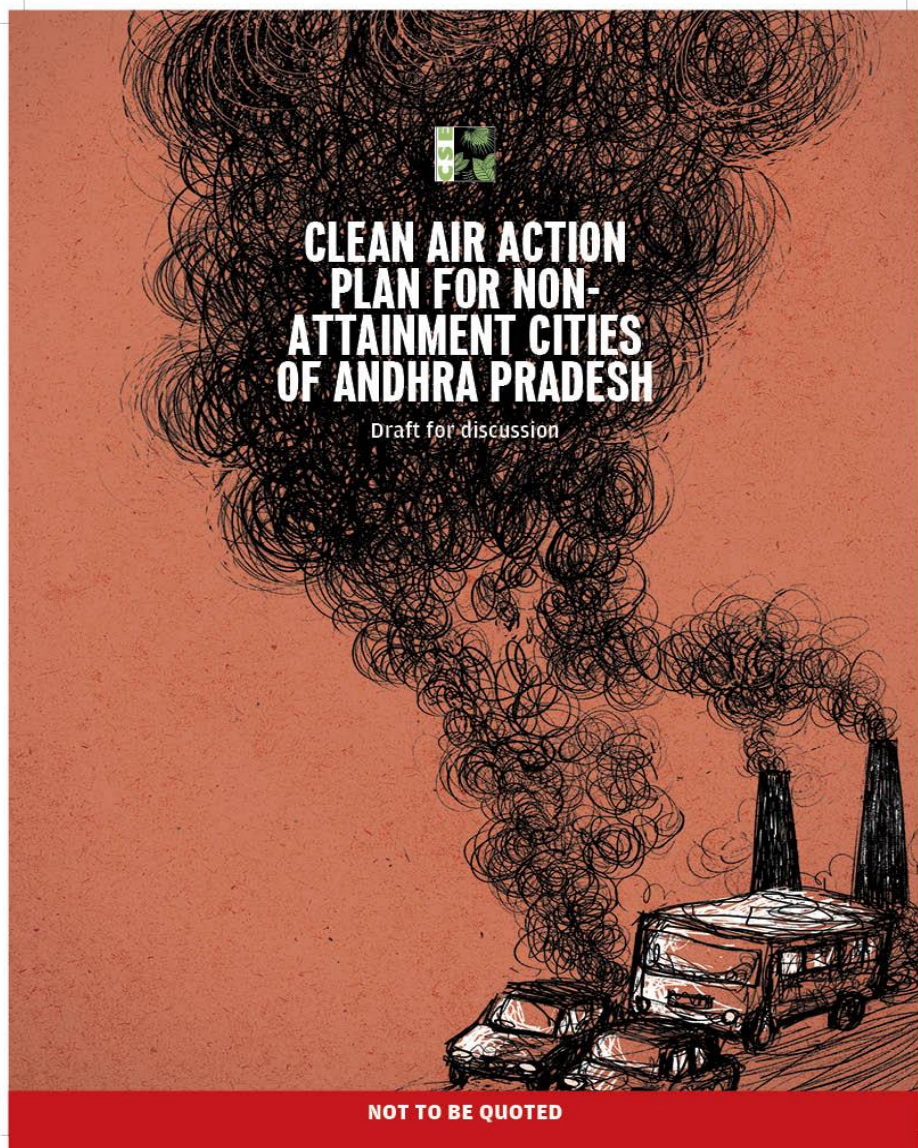


Clean Air Action Plans for non-attainment cities of Andhra Pradesh



Anumita Roychowdhury
With Tanushree Ganguly, Ananya
Choudhury, Shambhavi Shukla

Centre for Science and Environment

Workshop on Clean Air Planning in
non-attainment cities of Andhra
Pradesh

Joint Initiative of Andhra Pradesh
State Pollution Control Board and
Centre for Science and Environment
Vijaywada, October 22, 2018



City-wise and cross sectoral action plan



Cities to be covered:

- Vijaywada
- Vishakhapatnam
- Guntur
- Kurnool
- Nellore

Sectoral plan

- Air quality management and monitoring strategies
- Industry and power plants
- Vehicle and transportation strategies
- Waste burning
- Construction activities
- DG Sets
- Solid fuel burning
- Road dust
- Greening



Expectations from Clean Air Action Plans



Key elements of clean air action plan

- **Need air pollution reduction targets and timeline; National Clean Air Programme (NCAP) has set a generic target of 35% reduction; Need more city and sector specific targets based on the current baseline**
- **Assess challenges in each sector and benchmark action in each sector in all cities to assess level of improvement and stringency needed.**
- **Compliance and monitoring strategies; Monitor progress**
- **Need robust data; Assessment of pollution sources and health risk**
- **Adopt legal framework for time bound implementation and compliance for each pollution source; fix responsibility**
- **Important to link all sectors effectively; Detailing strategies important to guide and monitor action**
- **Fiscal strategy, institutional arrangement and capacity building; Monitoring of impact of the plans**
- **Need equitable, affordable, and innovative solutions**
- **Combine local air quality control with regional air quality planning (including rural monitoring) to reduce the of trans-boundary effect**



Genesis of:

- 1. Graded Response Action Plan**
- 2. Comprehensive Clean Air Action Plan**
- 3. National Clean Air Programme (NCAP)**



Genesis of Graded Response Action Plan

Supreme Court asked: *“Do you have a plan before city shuts down?”*



SC order dated December 2, 2016:

“In the circumstances therefore we direct the Central Government to examine the matter and issue an appropriate notification under Section 3(1) of the Act incorporating graded responses as proposed. In the Notification the Government may also make it clear that the implementation of the graded responses shall be under the orders of the EPCA and that all authorities, governmental or otherwise shall act in aid of such directions.”

January 12, 2017:

Environment Ministry notified GRAP for Delhi and NCR under Environment Protection Act. Action earmarked for “Moderate to Poor” to be implemented throughout the year.

October 17, 2017:

Winter defined as October 15 to March 15. EPCA decided to make action for “Very Poor” category the default measure for winter. --- Action for “Severe” categories to be implemented if such conditions persist for 48 hours



Supreme Court also asks for comprehensive action plan



The Supreme Court order dated 06.02.2017

“In our opinion, it would be appropriate if all the concerned authorities namely the EPCA, the Government of Delhi as well as the Governments of NCR i.e. Governments of Haryana, Rajasthan and Uttar Pradesh along with CPCB hold a joint meeting within a period of two weeks from today and thereafter come up with one comprehensive plan merging all three plans. We direct accordingly.”

SC order dated December 13, 2017

“There are certain time lines which have been mentioned in the reports. These may be discussed by the MOEF with EPCA within two weeks. Since the MOEF has no objections to the recommendations made (except as regards the time lines), the recommendations made in these two reports may be notified, publicized and implemented by the MOEF at the earliest.”

SC order dated 25 January, 2018: MOEF to propose a national action plan

Ministry of Environment and Forests and Climate Change issues draft National Clean Air Programme



Comprehensive Action Plan



- **First ever mandatory plan with short, medium and long term measures for all key pollution sources:**

- vehicles and fuels; public transport and mobility, industries and brick kilns, power plants, waste burning, construction activities, diesel generator sets, road dust, crop burning, domestic fuels etc.

- **Action with deadlines, and agencies responsible for implementation**



Technical Session I: Air Quality Management and Monitoring



Proposed measures in the current draft action plan



- **Vijaywada** – 1 CAAQM station; source apportionment study; public awareness, awareness programme in schools; Helpline for non-compliance
- **Vishakhapatnam** – 4 CAAQM stations; (2 implemented); Source apportionment (completed); Advisory on air quality (conducting awareness programme)
- **Guntur** - AQI to be calculated and reported website (report on weekly basis for manual and realtime for automatic monitors); Establish air quality management division in SPCB
- **Kurnool** – AQI to be calculated and disseminated through digital boards; Establish AQ Management Division in SPCB; Helpline
- **Nellore** - AQI to be calculated and reported website (report on weekly basis for manual and realtime for automatic monitors); Establish air quality management division in SPCB

What more is needed?



Status of air quality in each city



V

Good air quality – 50% below the standards

IV

Meets the ambient air quality standards and reduce exposure

III

Improvement

II

Stabilisation

I

Lost gains



Assess the stage of evolution in each city



V

City has **good ambient air quality** (50% below Indian Standard); eliminated household exposure and controlled exposure from all sources; minimised health impact

IV

City meets **Indian air quality standard; nearly eliminated household pollution**; control of air pollution and exposure from all sources.

Reduced health impact

III

City has robust system to monitor and assess air quality and implements **time-bound action plan** to meet standards and reduce exposure.

II

City has **adequate capacity to monitor and assess** air quality and has developed air quality action plan to reduce all exposures.

I

City does minimal air quality monitoring and has taken minimal action to control air pollution.



Assessment of Air quality trends for action planning



Current status of air quality monitoring

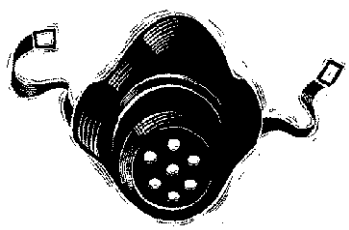


Monitoring stations

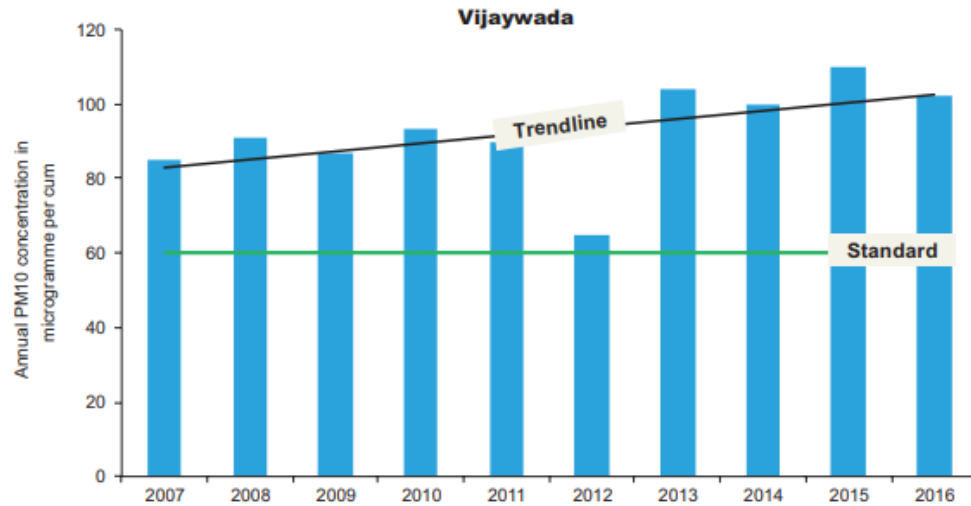
- Vizag = 3 real time + 10 manual
- Vijayawada = 1 real time + 8 manual
- Nellore = 1 manual
- Guntur = 2 manual
- Kurnool = 1 manual

For the annual trend we have taken data from the NAMP stations submitted in Rajya Sabha by CPCB.

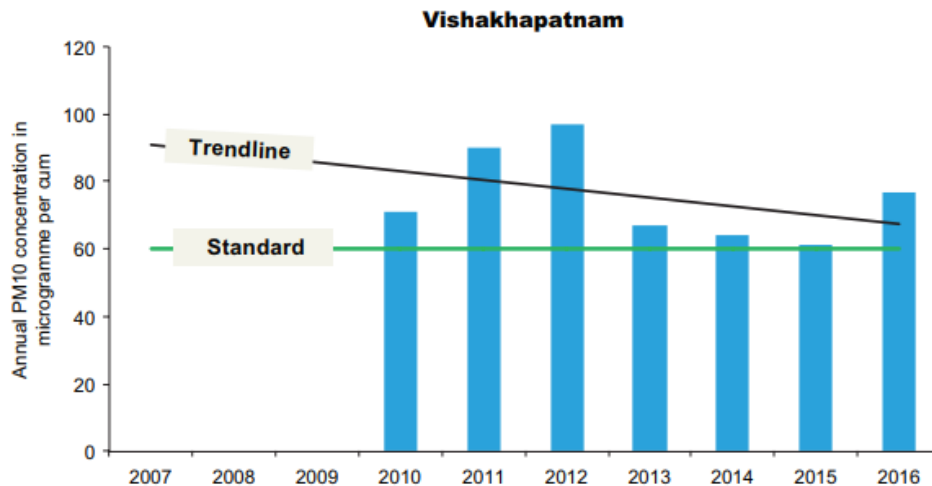
For winter analysis: Data from CPCB website for two cities: Vizag (2 real time monitors whose data was available in CPCB website) and Vijayawada (1 monitor whose data was available on CPCB website).



Trend in annual average PM10



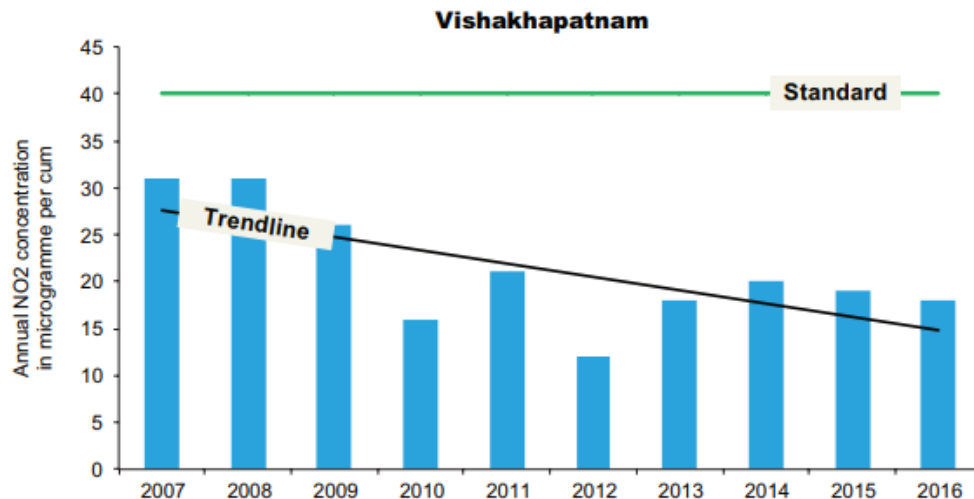
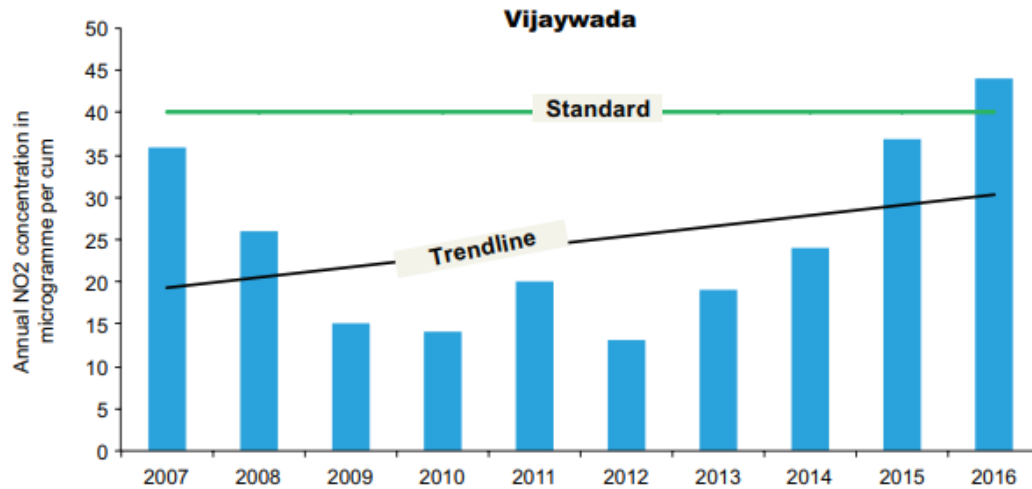
- **Vijayawada: Rising trend**



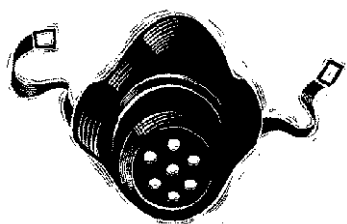
- **Vishakhapatnam: declining trend**



Trend in annual average NO₂

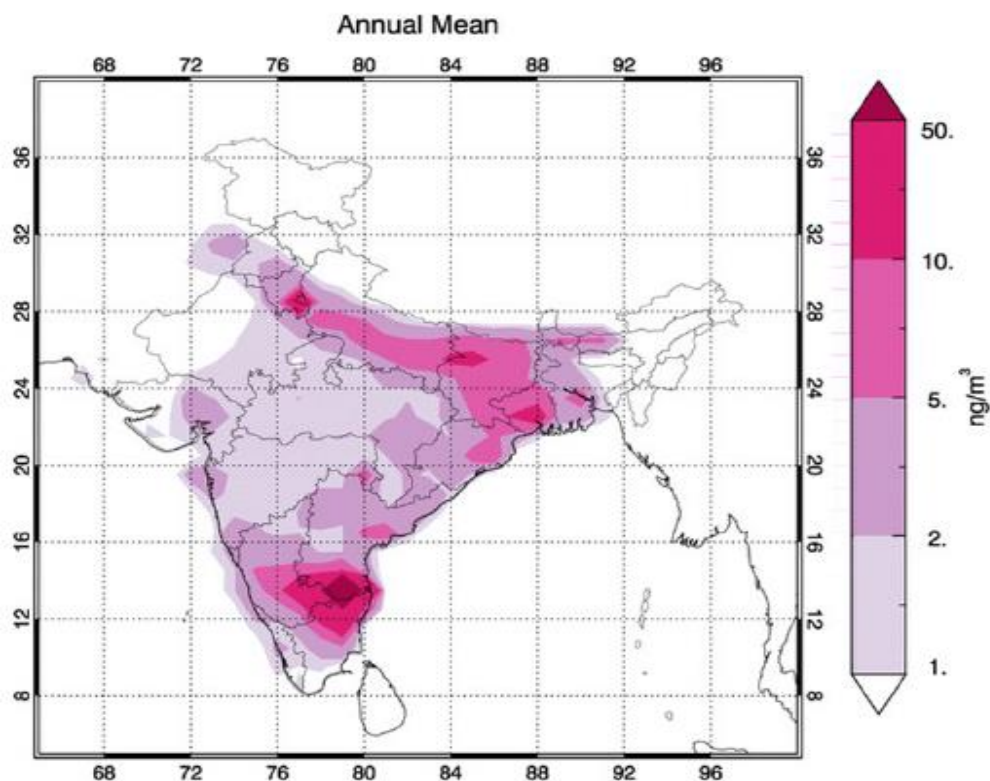


- Vijayawada: NO₂ shows rising trend and has started to exceed the standards
- Vishakhapatnam: Declining trend. Reasons not clear
- Data for PM_{2.5} and ozone not publicly available



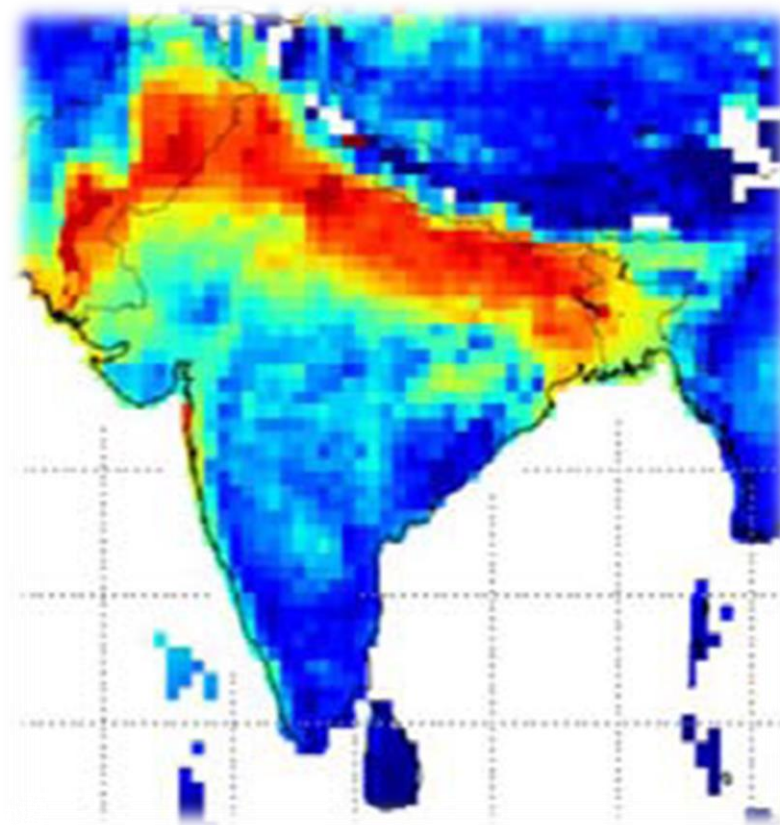
Regional challenge

Annual PM2.5 mean



Source: 2015, Norwegian Institute for Air Research, International Institute for Applied Systems Analysis, IITM

Daily PM2.5 mean



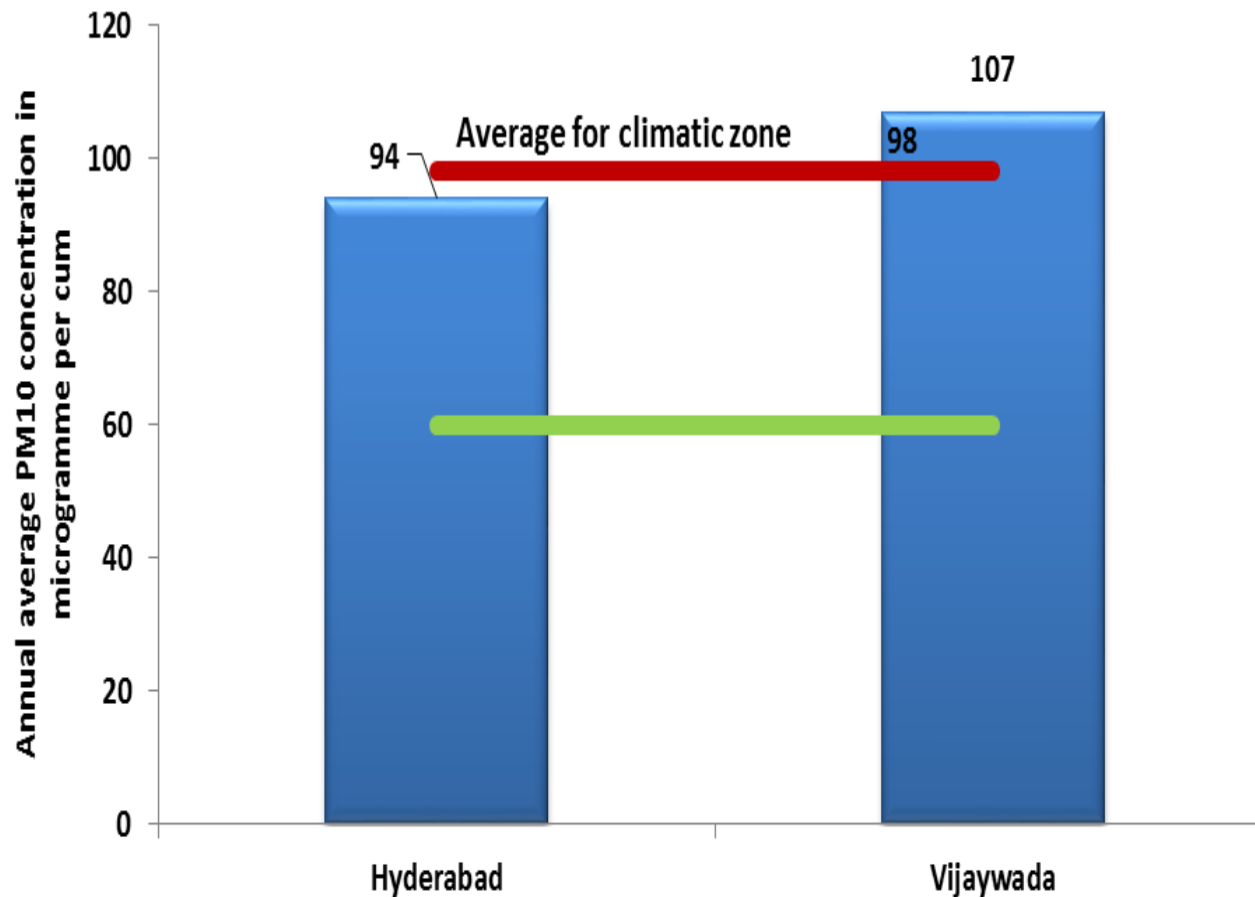
Source: Sagnik Dey 2016, Indian Institute of Technology Delhi,



Vijaywada at risk



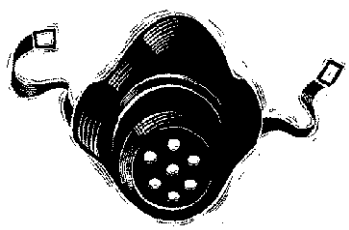
Hot and Dry - South



Poorer air quality than the average in the climatic region



Strengthen air quality monitoring



Elements of air quality monitoring and assessment strategy



•Air quality monitoring strategy

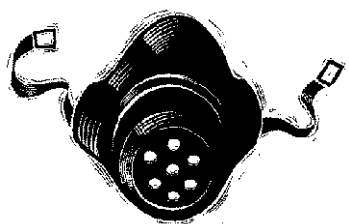
- Monitoring network design (By population distribution and land-use (industry, residential, traffic intersections, sensitive areas etc).
- Leapfrog to realtime monitoring. Adopt good monitoring protocol
- Select pollutants and meteorological factors (temperature, relative humidity, wind speed and direction, Mixing height data etc)
- Quality control and assurance for credible data
- Data reporting and public information system
- Pollution forecasting and Realtime monitoring of stack emissions

•Pollution source assessment strategy

- Emissions inventory and Source apportionment
- Modeling tools

•Exposure management

- Clean air action plan to be implemented in time bound manner
- Set up institutional process for air quality management



Adopt official criteria to decide the number of Air quality monitoring stations in each city



- Proposed expansion of monitoring network**

City	Population	Number of monitors required	Existing number of monitors	Additional number of monitors required
Vijayawada	1,476,000	11	9	2
Visakhapatnam	2,000,000	13	13	
Guntur	743,654	8	2	6
Nellore	2,966,082	15	1	14
Kurnool	4,053,463	18	1	17

Note: This table lists the minimum number of monitoring stations required.

*Existing number of monitors includes combination of manual and real time monitoring. Most stations in Andhra Pradesh are manual and do not provide daily air-quality data

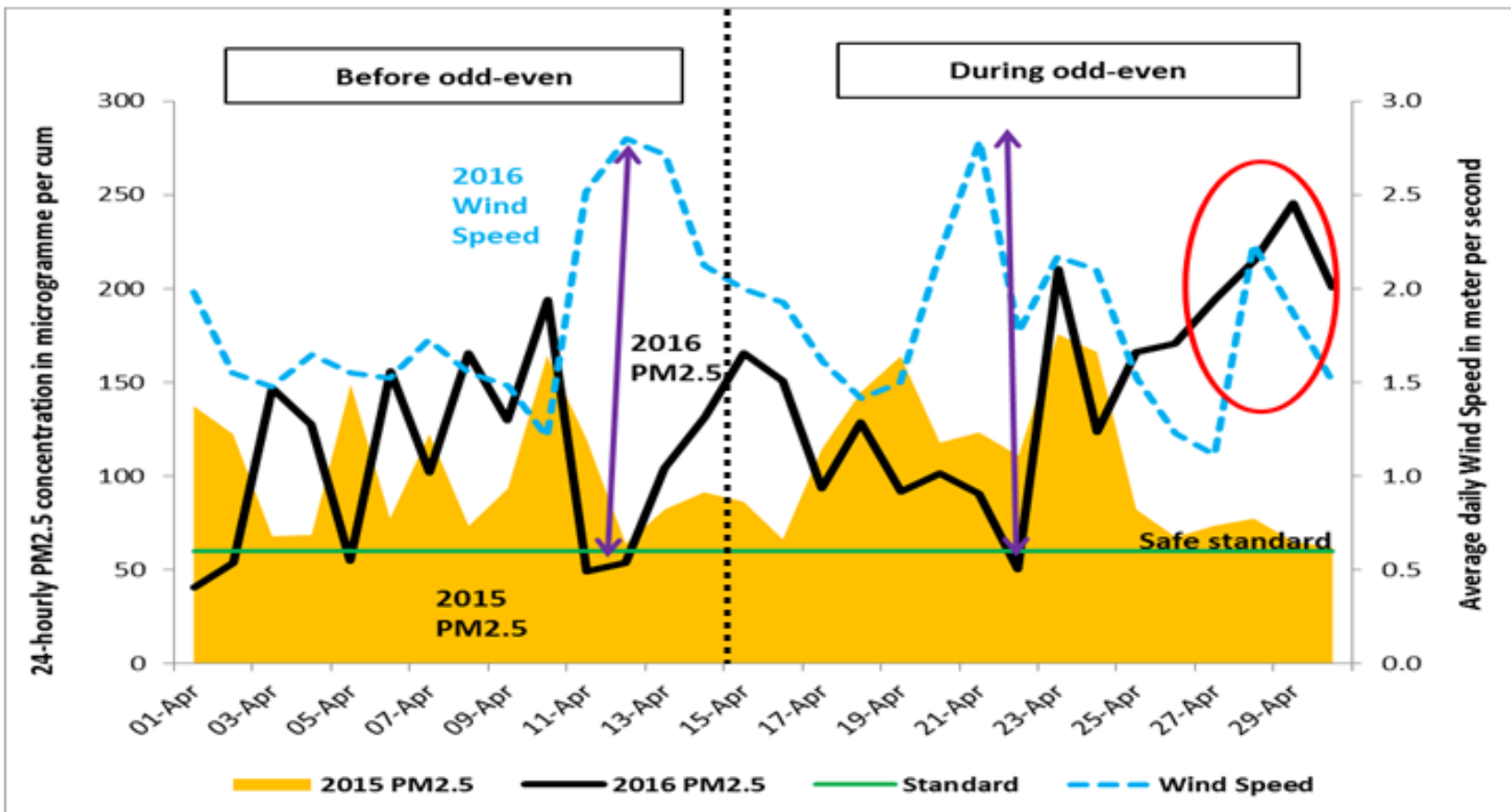
- Based on CPCB guidelines -- there should be atleast one station for every one million population; Class 1 cities should have a minimum of three stations each; mega cities about nine each; industrial areas about six and capital cities six each.
- Need real time monitors for real time action; manual monitors underestimate problem



How local action in Delhi is compromised because of crop residue burning



Odd-Even 2.0 proves the point



Source: CSE analysis of DPCC real time data

- Average PM2.5 level during the first week **was 24%** lower than the average of the preceding fortnight of April 2016. But pollution peaks during second week



Set air pollution reduction target



Based on past three years annual average baseline:

- Vijayawada requires to reduce its PM10 concentration by approximately 42% from the current base level to meet the annual standard.
- Vishakhapatnam requires to reduce its PM10 concentration by approximately 11% from the current base level to meet the annual standard.
- **Reduction targets decide the level of stringency and the scale of action needed**
- Example: Delhi needs to reduce PM2.5 levels by 74% to meet the PM2.5 standards



**Make air quality monitoring
relevant to public health**



Deadly Smog Episode in Delhi: November, 2016.....





Why Graded Response Action Plan?



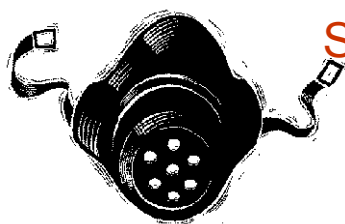
Two factors are responsible for smog episodes:

-- i) **Adverse weather conditions** which cannot be changed and ii) **emissions** that can be changed.

Temporary lowering can help to lower pollution peaks and exposure

In longer term emissions must be permanently reduced so that peak episodes are not repeated

Capacity to monitor and forecast critical



Supreme Court asks Government: “Do you have a plan before city shuts down?” Need Graded Response Action Plan



National Air Quality Index and Health advisory

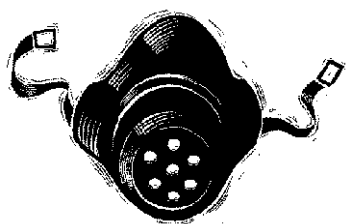
AQI Category (Range)	PM ₁₀ 24-hr	PM _{2.5} 24-hr	NO ₂ 24-hr	O ₃ 8-hr	CO 8-hr (mg/m ³)	SO ₂ 24-hr	NH ₃ 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5 -1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

Link GRAP with National Air Quality index (NAQI) notified in 2015

This classifies daily air Quality based on degree of severity

Health advisory defined

AQI	Associated Health Impacts
Good(0-50))	Minimal Impact
Satisfactory (51-100)	May cause minor breathing discomfort to sensitive people
Moderately polluted (101-200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201-300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very Poor (301-400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
Severe (401-500)	May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced even during light physical activity



Graded Response Action Plan



<p>Moderate – When PM2.5 is between 61-90 $\mu\text{g}/\text{m}^3$ or PM10 is between 101-250 $\mu\text{g}/\text{m}^3$</p>	<ol style="list-style-type: none"> 1. Stringent enforcement/stop garbage burning in landfills 2. Close/strictly enforce pollution control regulations in brick kilns and industries 3. Strictly enforce pollution control in thermal power plants through PCB monitoring 4. Periodic mechanized sweeping of roads 5. Strict vigilance and no tolerance for visible emissions 6. Strict vigilance and enforcement of PUC norms 7. Stringently enforce rules for dust control in construction sites and close non-compliant sites 8. Deploy traffic police for smooth traffic flow at identified vulnerable areas 9. Strictly enforce Supreme Court order on diversion of non-destined truck traffic 10. Strictly enforce Supreme Court ban on firecrackers 11. Information dissemination social media, mobile Apps should be used to inform people
<p>Poor – When PM2.5 levels are between 91-120 $\mu\text{g}/\text{m}^3$ or PM10 levels are between 251-350 $\mu\text{g}/\text{m}^3$</p>	
<p>Very Poor - When PM2.5 levels are between 121-250 $\mu\text{g}/\text{m}^3$ or PM10 levels are between 351-430 $\mu\text{g}/\text{m}^3$</p>	<ol style="list-style-type: none"> 1. Stop use of diesel generator sets 2. Enhance parking fee by 3-4 times 3. Increase bus and metro services by augmenting contract buses and increasing frequency of service 4. Stop use of coal/firewood in hotels and open eateries 5. Residential Welfare Associations and individual house owners to provide electric heaters during winter to security staff to avoid open burning by them 6. Alert in newspapers/TV/radio to advise people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement.
<p>Severe - When PM2.5 levels are above 250 $\mu\text{g}/\text{m}^3$ or PM10 levels are above 430 $\mu\text{g}/\text{m}^3$</p>	<ol style="list-style-type: none"> 1. Close brick kilns, Hot Mix plants, Stone Crushers 2. Shut down Badarpur power plant 3. Intensify public transport services. Introduce differential rates to encourage off-peak travel. 4. Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.
<p>Severe + or Emergency - When PM2.5 levels cross 300 $\mu\text{g}/\text{m}^3$ or PM10 levels cross 500 $\mu\text{g}/\text{m}^3$ (5 times above the standard) and persist for 48 hours or more</p>	<ol style="list-style-type: none"> 1. Stop entry of truck traffic into Delhi (except essential commodities) 2. Stop construction activities 3. Introduce odd and even scheme for private vehicles based on license plate numbers and minimize exemptions 4. Task Force to take decision on any additional steps including shutting of schools



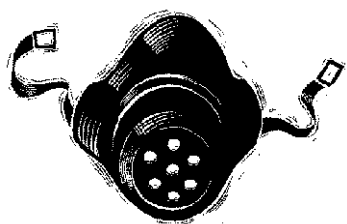
Action to be taken by public...



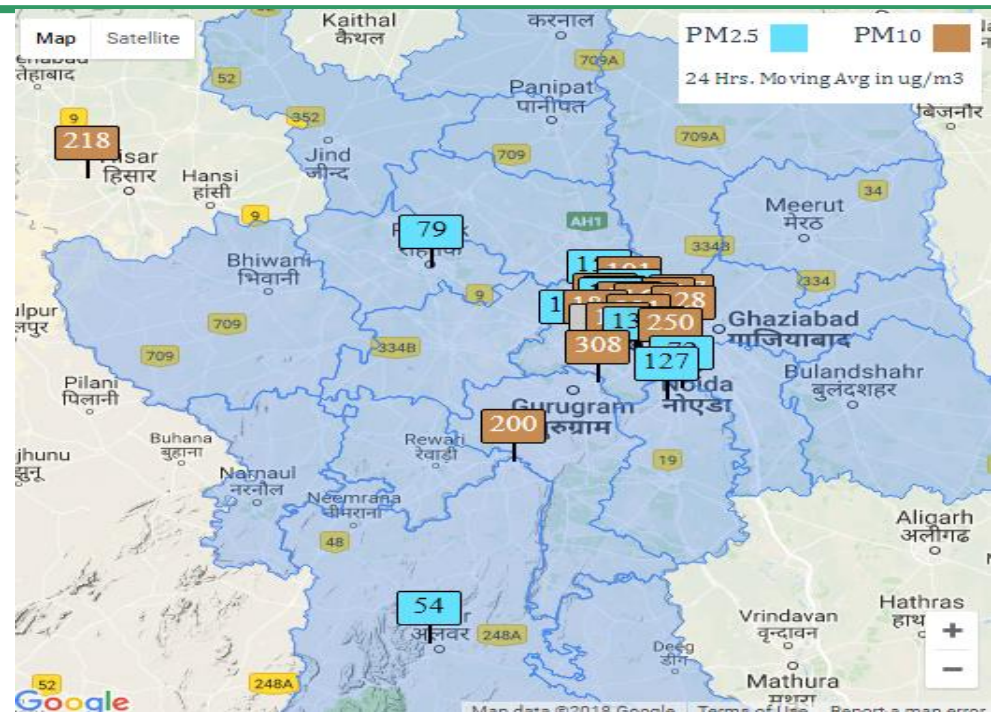
AQI categories	Action
Very poor, severe and emergency	Those suffering from heart diseases, asthma, and other respiratory disease may consider avoiding undue and prolonged exposure
	Schools to suspend all outdoor activities and sport events during Severe and Very Poor conditions
	Report visible emissions from vehicles, industries, power plants, garbage burning, and other non compliances to the respective control rooms
	Do not use diesel and kerosene generators
	Maintain vehicles properly (PUC certificate, replace car air filter, maintain right tyre pressure)
	Minimize unnecessary travel, use public transport and avoid using private vehicles



Example from Delhi and NCR



Network of Continuous Ambient Air Quality Monitoring stations in Delhi and NCR



Source: <https://app.cpcbccr.com/AQI/>

Source: CPCB website

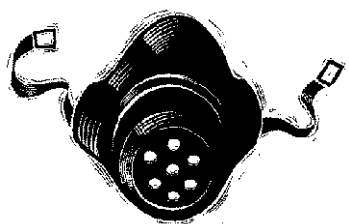
•Number of continuous Ambient Air Quality Monitors

Delhi = 30 stations – 17 stations linked with the network

Haryana = 3 (one each in Faridabad, Gurugram and Rohtak) To set up = 22 manual and 13 realtime stations

Rajasthan = 2 (one each in Alwar and Bhiwadi) To set up 2 realtime stations

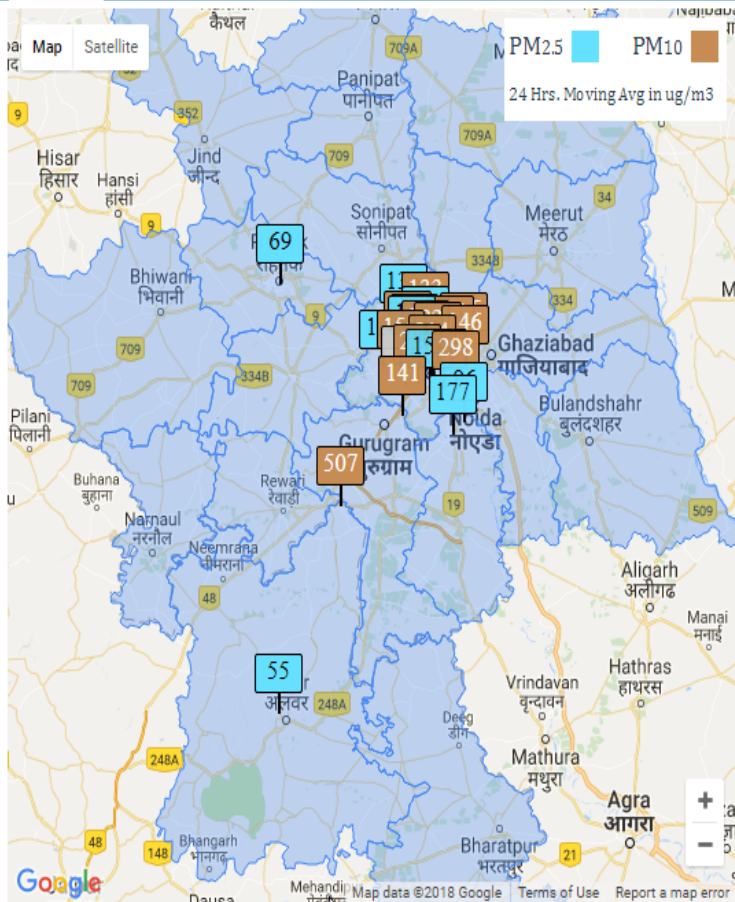
Uttar Pradesh = 3 (2 stations in Noida and 1 in Ghaziabad) – To set up 6 manual and 8 realtime stations



AQI portal of CPCB for daily reporting



Central Pollution Control Board - Delhi NCR



Station Delhi NCR

Concentrations Trend based on PM10 and PM2.5

Air Quality status for severe + conditions

Active Stations: 22

InActive Stations: 3

Delhi NCR

Category: Very Poor (PM2.5: 121 - 250 or PM10: 351 - 430)

24 Hrs. Moving Avg

PM 2.5 : 131 PM10 : 233

Saturday, 27 Jan 2018, 02:00 AM

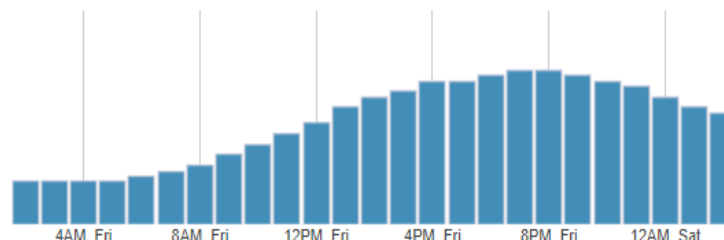
Pollutant

Parameter Concentration Trends

Min Max

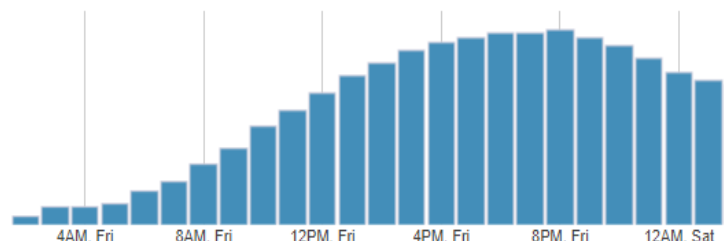
PM2.5
(ug/m3)

118 139



PM10
(ug/m3)

202 246





SAFAR (IITM) Pollution Forecast



Delhi



Pune



Mumbai



Ahmedabad









Air Quality Forecast (1-3 days): Levels in $\mu\text{gm-3}$

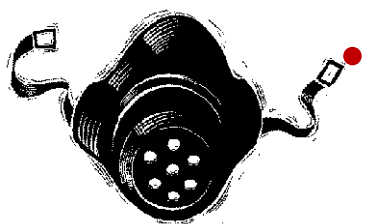
DELHI

PUNE

MUMBAI

AHMEDABAD

Pollutants	Today	Advisory	Tomorrow's Forecast	Advisory	After 3 days	Advisory
PM10 ($\mu\text{gm-3}$)	242	Moderate 	266	Poor 	254	Poor 
PM2.5 ($\mu\text{gm-3}$)	145	Very Poor 	159	Very Poor 	152	Very Poor 



• GRAP implementation begins from October



- Closure of Badarpur coal power plant from October 17 to march 15
- Closure of Brick kilns without cleaner zig zag technology
- Diesel generator sets not allowed in Delhi - except notified essential services.
- Tighter action on waste, construction and road dust
- Direction to start preparedness for action on other sources



November 2017: Severe and emergency action



- Closure of all brick kilns without zigzag technologies
- Closure of all hot mix plants
- Closure of all stone crushers
- Parking charges increased 4 times;
- Public transport services asked to intensify – metro to add more coaches and lower fares
- All trucks stopped from entering Delhi
- Construction activities stopped;
- Solid fuels not allowed in open eateries and restaurants
- Resident Welfare Associations advised to provide heaters to security guards
- Intensify traffic management
- Intensify enforcement of non-destined trucks



November 2017: More action added



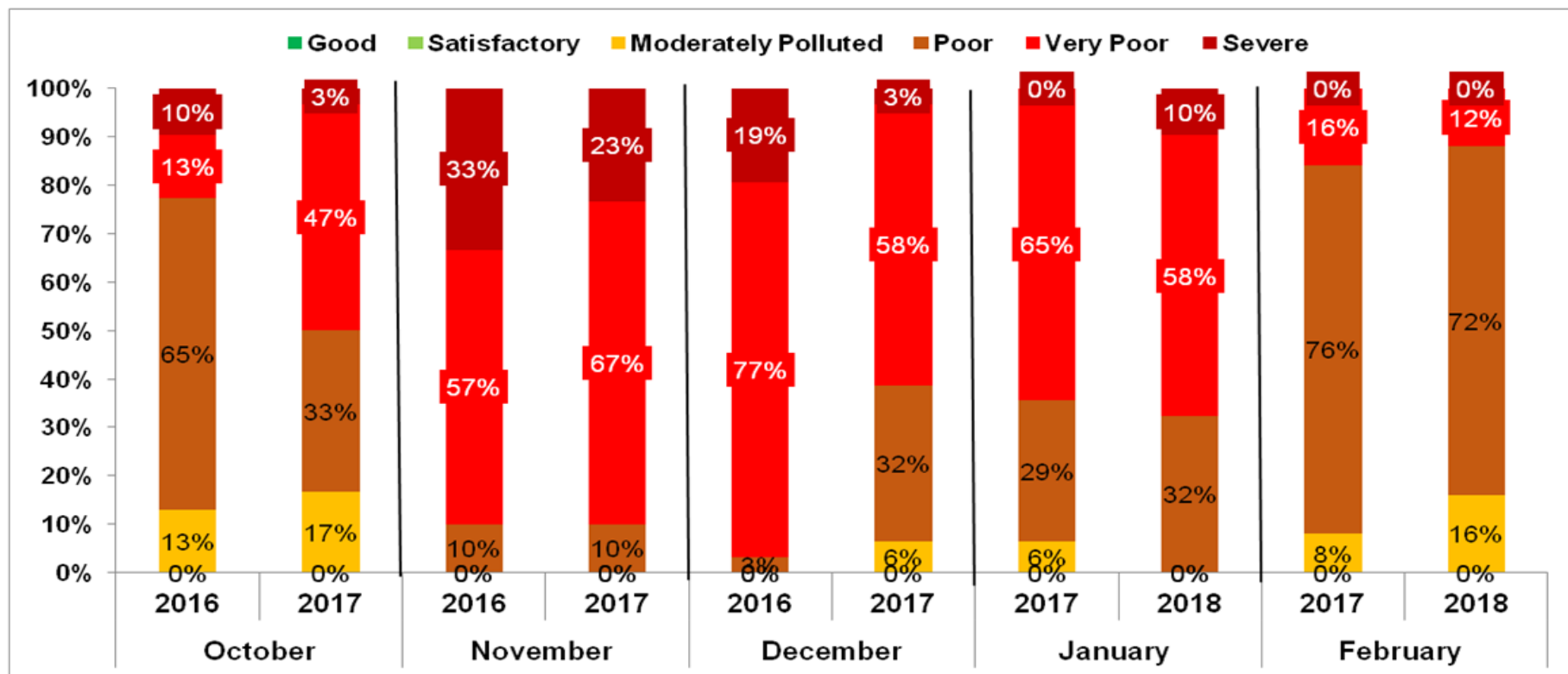
November 8: Pollution levels 11 times higher than the standards

- Entry of truck traffic stopped (except essential commodities)
- Construction activities stopped in Delhi and NCR
- **These measures were withdrawn after levels subside**



Impact of GRAP

Analysis of CPCB's Daily AQI bulletin for Delhi 2017-18 and 2016-17



Source: CSE's analysis of CPCB AQI data

- Number of days in severe category has decreased compared to previous winter except in January.
- Overall, a small improvement –number of days in poor-very poor category have increased while days in very poor-severely polluted category have declined



Graded Response Action Plan in AP cities

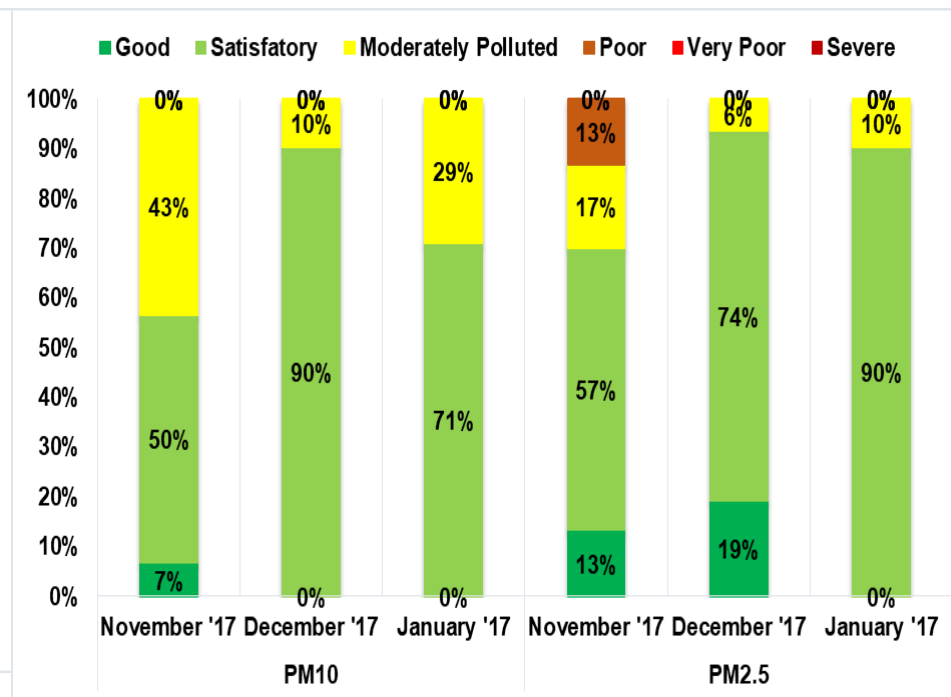
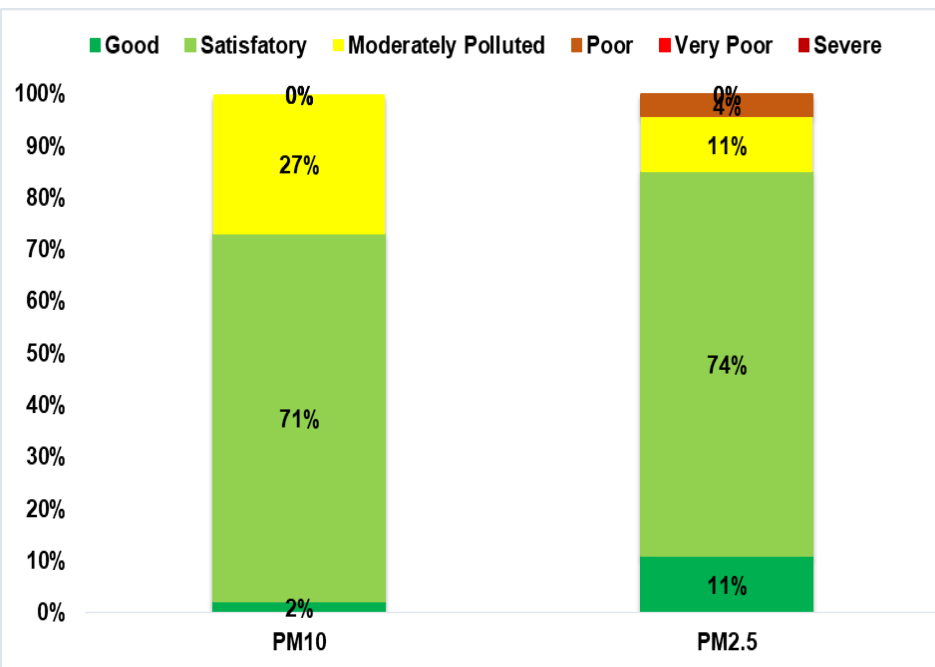


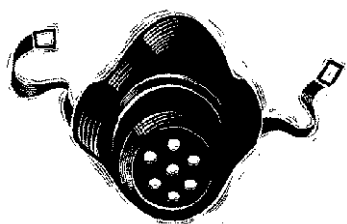
Vijayawada: Classification of days during winter based on AQI categories



PWD Grounds, Vijayawada: PM10 and PM2.5 concentration during winter months based on AQI categories from 1 November 2017 to 31 January 2018
PM2.5: 4% of all days in winter in poor category

PWD Grounds, Vijayawada Month-wise analysis of PM10 and PM2.5 concentration based on AQI categories from 1 November 2017 to 31 January 2018
November – 13% of days in poor category for PM2.5

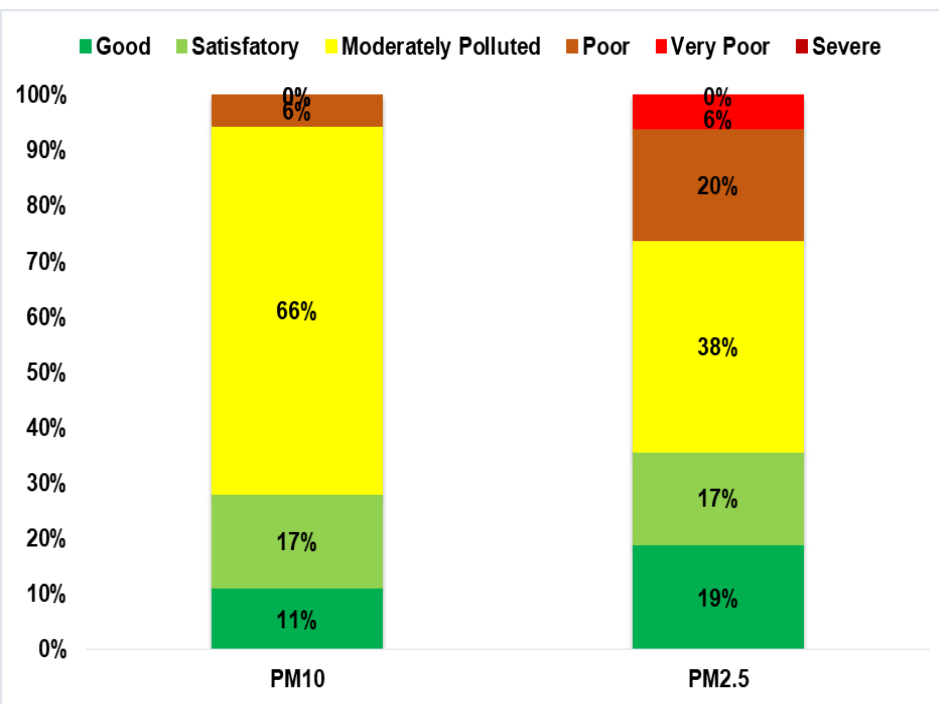




Classification of days during winter based on AQI categories

APIIC and GVM Corporation PM10 and PM2.5 concentration during winter months based on AQI categories from 1 November 2017 to 31 January 2018

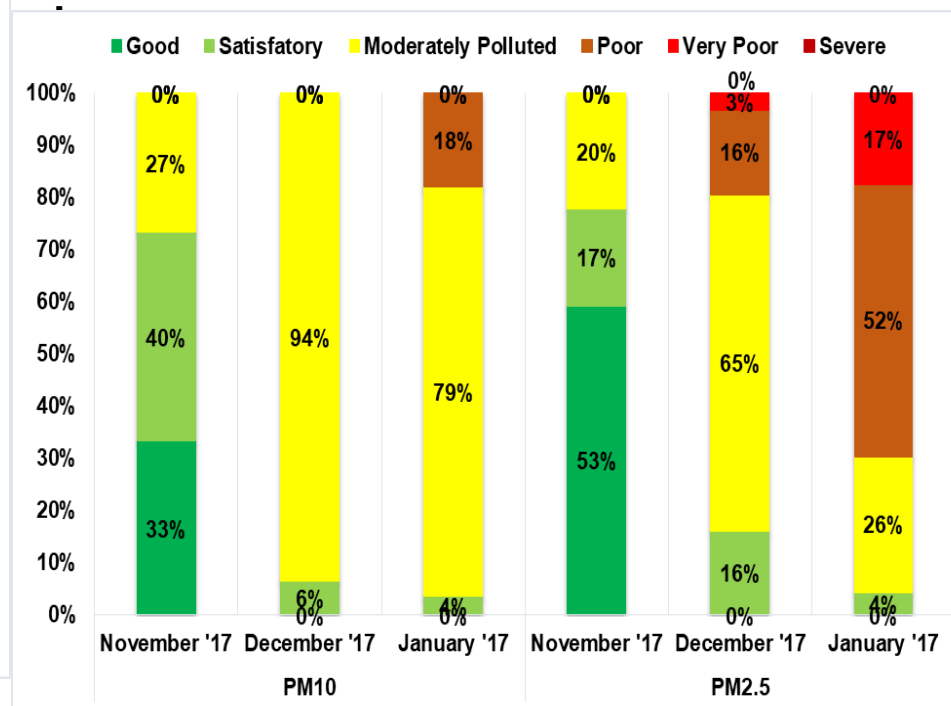
6% of all days during winter in very poor category; 20% in poor category



APIIC and GVM Corporation Month-wise analysis of PM10 and PM2.5 concentration based on AQI categories from 1 November 2017 to 31 January 2018

PM10: January 18% of days in poor category

PM2.5: December - 3% in very poor; 16% in poor; **January** – 17% in very poor and 52%





Opportunity of low cost sensor based monitoring systems



- **NCAP has provided for adoption of Sensor based technology for air quality monitoring**

- Range of application – exposure and hot spot monitoring

This can be linked in real-time to meteorological stations, and telecommunication networks or run off-line.

- Can build public awareness – citizens'science

- Help map local micro environment to inform policy

- EPA, UNEP, California Air Resources Board evaluating these technologies

- Strategy for low cost sensor based monitors to generate baseline data to create awareness and inform policy? Validate data against regulatory monitor?



Where is pollution coming from?



Source assessment



The key instruments of air quality planning:

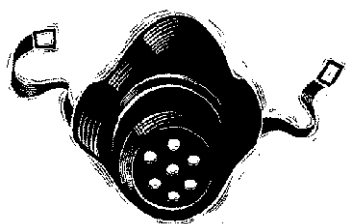
Emissions inventory

Source apportionment

Air quality modelling

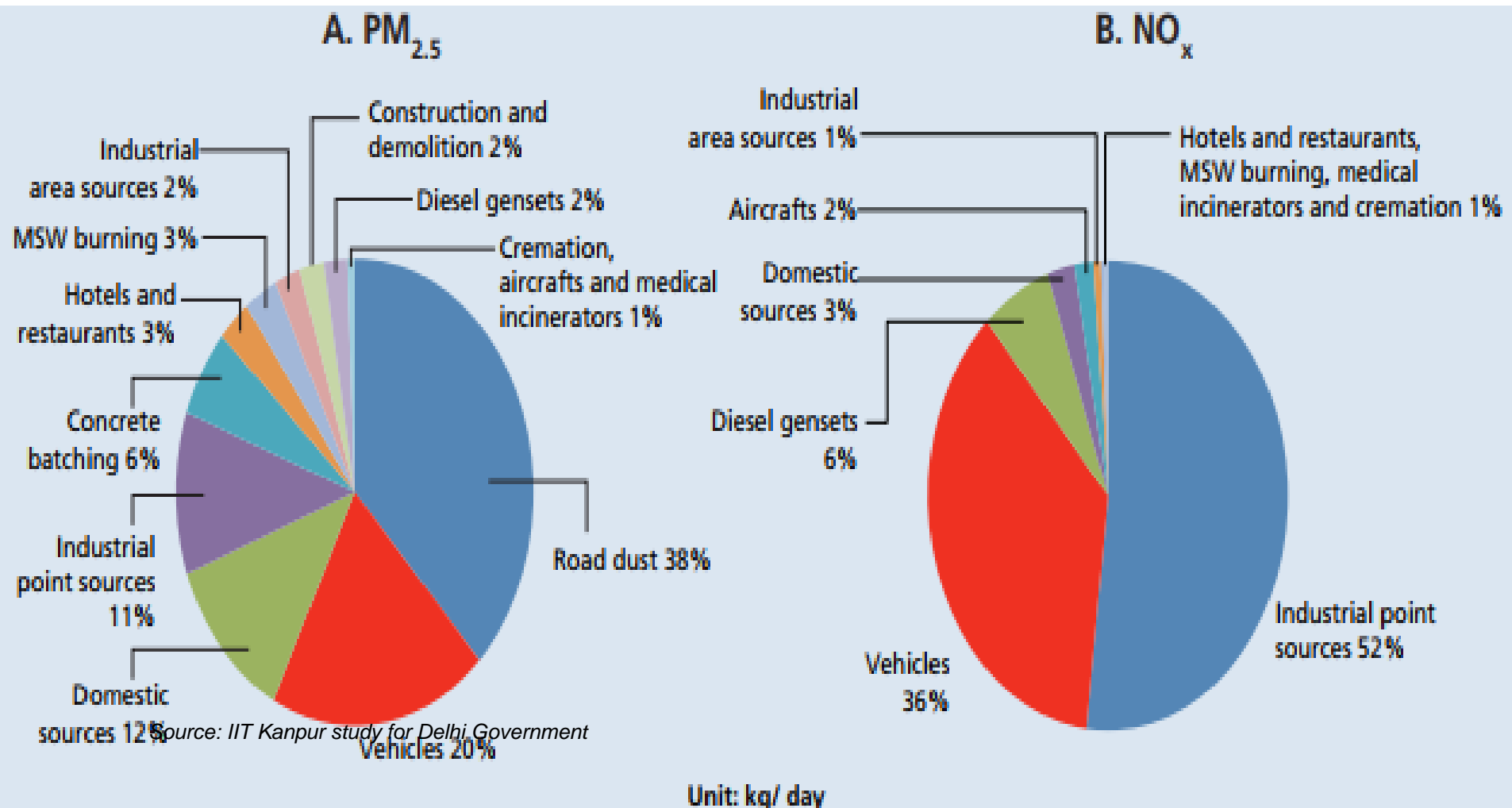
Need this to create baseline and assess change over time

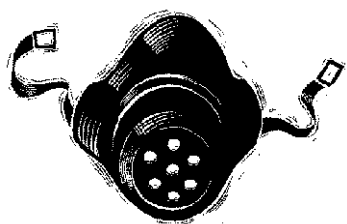
Barriers – Lack of quality data on emissions from different sources, lack of emissions factors, inadequate capacity to design such studies, need financial resources



Contribution of pollution sources

Example from Delhi





Ambient air quality vs Exposure



Union Ministry of Health and Family Welfare India
Report of *Steering committee on air pollution and health related Issues*,

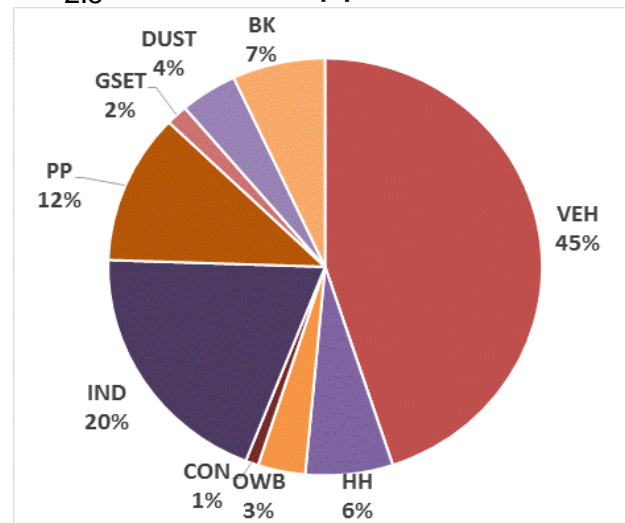
More important to know how close we are to the pollution source, what are we inhaling, and how much time we spend close to the pollution source than what occurs generally in the air that is influenced by climate and weather.

Ambient concentrations is easier to measure change over time, but do not always well represent human exposures, -- heavily influenced by nearby sources with less affect on general ambient concentrations

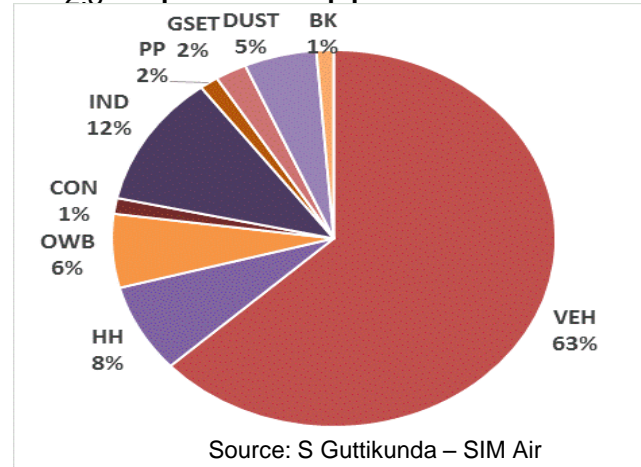
Ambient concentration is not a good surrogate for total air pollution risk, -- cannot indicate exposure and health outcome

Chennai

PM_{2.5} emission apportionment



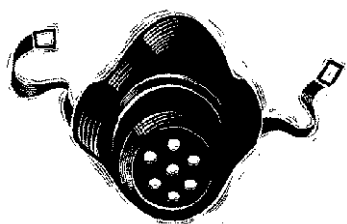
PM_{2.5} exposure apportionment



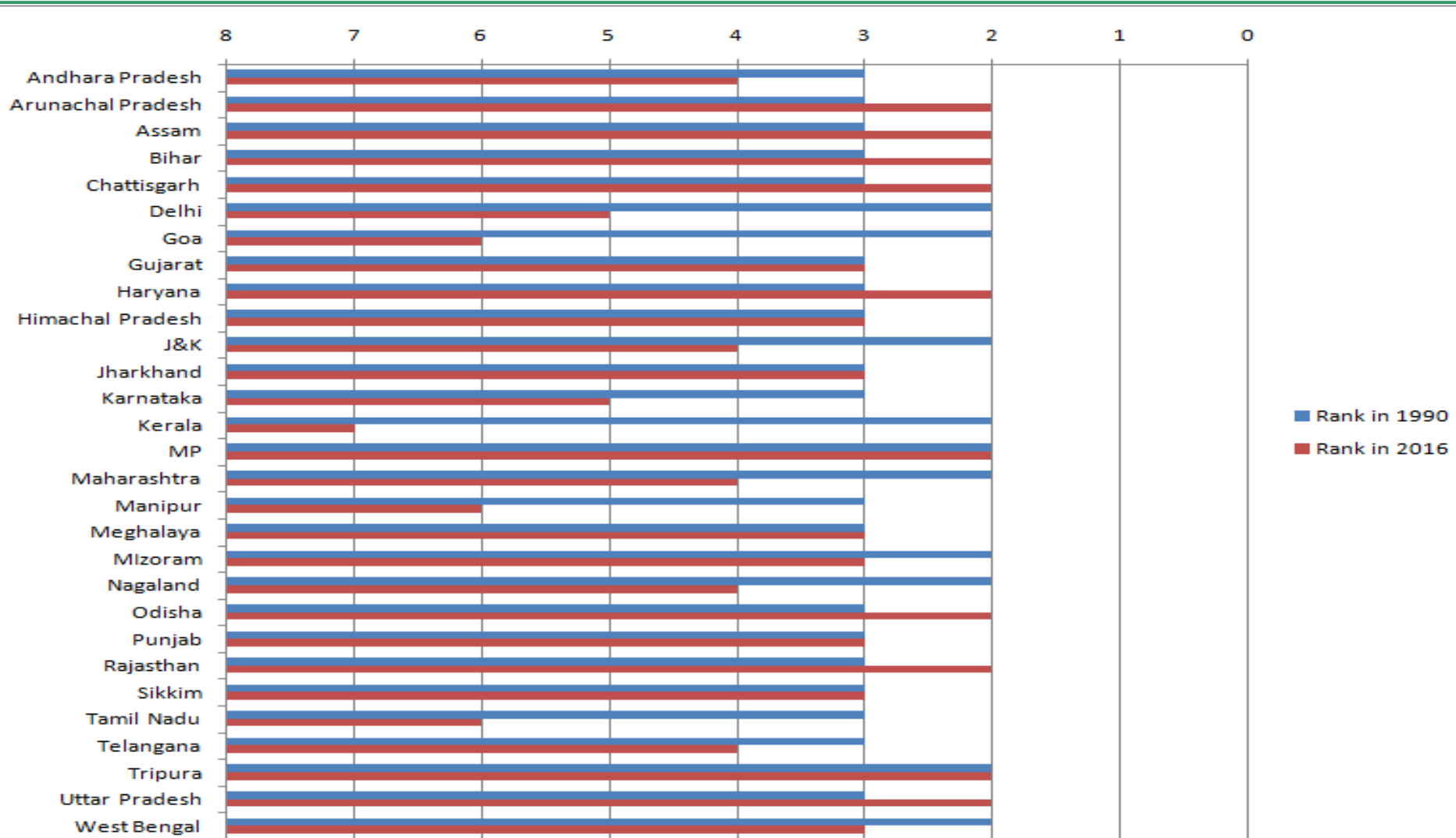
Source: S Guttikunda – SIM Air



Health impacts



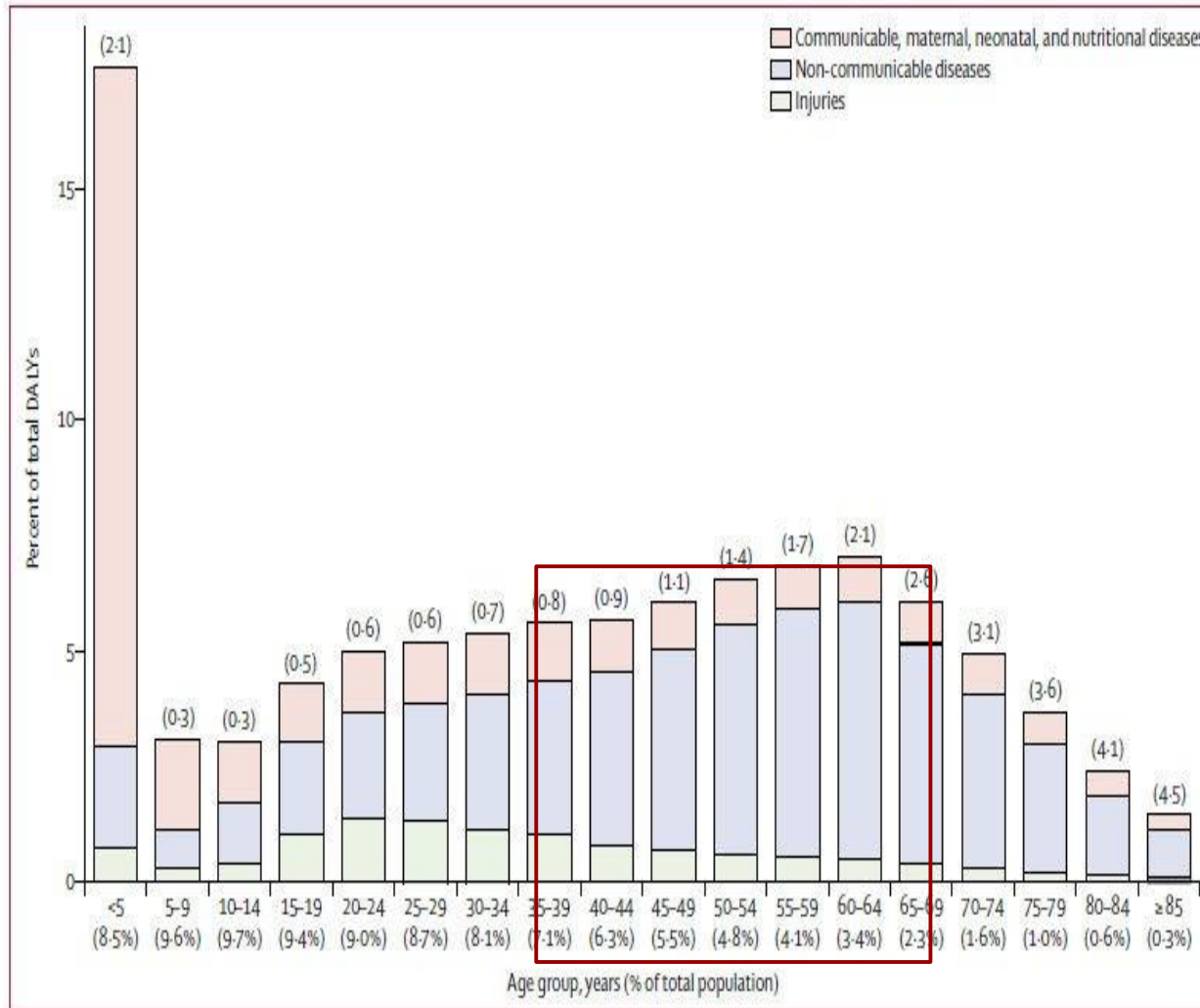
Air Pollution high risk factor in Indian states (1990 vs 2016)



Source: India's Health of Nation's States Report, 2017: IHME-ICMR



Most productive age group highly vulnerable



Age group between ages 35 and 60 most vulnerable to non-communicable diseases. Increases vulnerability to air pollution

Source: India State Level Disease Burden, Lancet, 2017



Health of children compromised.....



2012 epidemiological study on children in Delhi (CPCB and Chittaranjan National Cancer Institute of Kolkata):-- Covered about 12,000 school- going children from 36 schools.

-- Every third child has reduced lung function. Sputum of Delhi's children contains four times more iron-laden macrophages than those from cleaner environs, indicating pulmonary hemorrhage.

-- Levels of biomarkers in children higher in areas with high PM10 levels.

-- Children grow up with 10% smaller lungs (SK Chhabra study 2017)



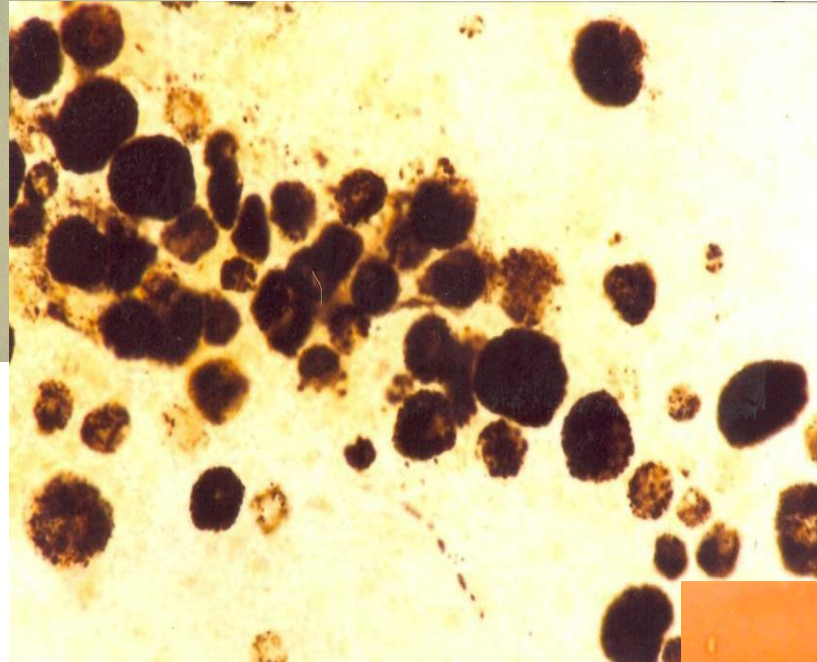
Emerging evidences of health impacts in India.....



Alveolar macrophage - biomarker of air pollution



Control area:
Sundarbans

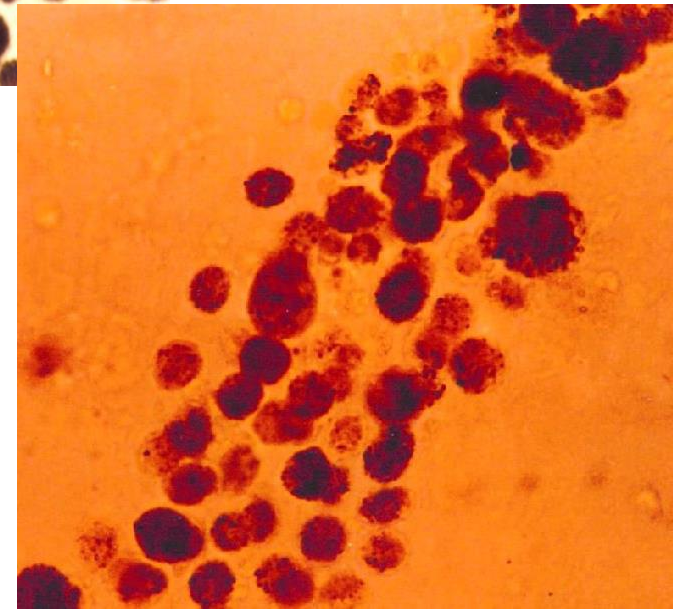


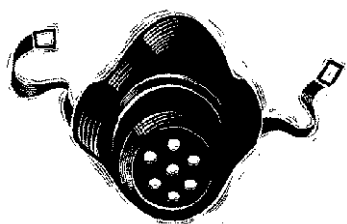
Larger AM – particle laden

Control group; Kolkata taxi
driver

Increase in AM number

Sputum cytology of a 14-year old
girl, showing abundance of particle
laden AM





Look at these black spots on the lung. The unfortunate owner lives in Delhi and has been breathing polluted air. Air full of carbon particles which accumulate in the lungs (black spots). What you can't see is a cocktail of gases and tiny particles, even smaller than carbon that get into our bodies. Actually, you are getting polluted.

Delhi lung

Capital punishment

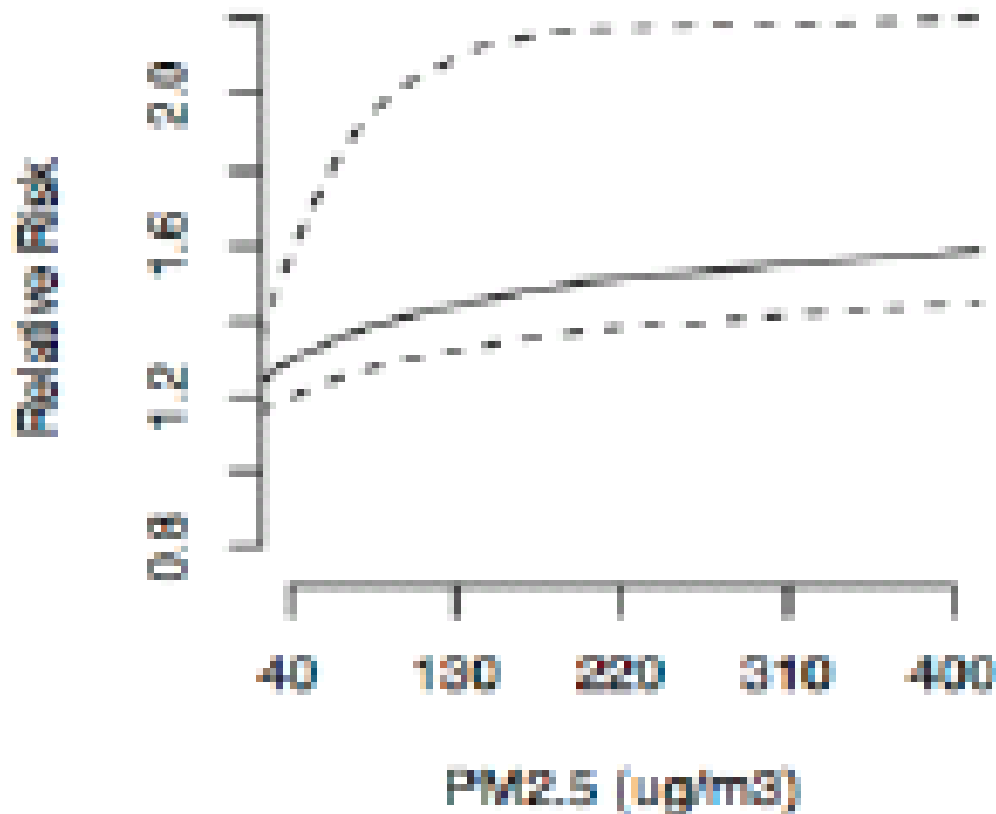
Scary? But those cars are so sexy. Source: CSE



Be warned Most of the health effects occur at lower annual average levels



Integrated Exposure-Response function for Ischemic Heart Disease





Hyderabad.....



- 2000:** -- Respiratory symptoms and spirometric observations in relation to atmospheric pollutants in urban population. Respiratory and ventilatory abnormalities higher in commercial areas with higher SO₂ and NO_x. (Kumar KS et al 2000)
- 2006:** Vehicular exhaust might induce cytogenetic damage in traffic police. (Sreedevi V et al 2006)
-- Reproductive outcome in the wives of traffic policemen exposed to automobile exhaust: Significant increase in the frequency of abortions in the wives of policemen, neonatal deaths in their offspring's and significant decrease in frequency of live births in the offspring of traffic policemen when compared to the control group. (Sreedevi V et al 2006)
- 2008:** -- Altered lung function in petrol filling workers etc (Nazia Uzma et al 2008)
- 2009:** -- Oxidant stress, antioxidants and nitric oxide in traffic police of Hyderabad: Exposure to air pollutants can increase oxidant stress, decrease the levels of antioxidants and nitric oxide lead to lung damage. (Suresh Y et al 2009)
-- Cytogenetic evaluation of traffic policemen occupationally exposed to vehicular exhaust: A significant increase was seen in the mean frequency of chromosomal aberrations in non smoker and smoker traffic policemen (V Sree Devi et al 2009)



Traffic exposure in Indian cities



Chennai: Traffic police, bus drivers, and auto-shop workers was significantly associated with lower levels of haemoglobin. (Toxicol Ind Health. 1996 Sep-Oct;12(5))

Bangalore: Study found increased prevalence of asthma in children of lower socioeconomic classes. (H Paramesh)

Hyderabad: Traffic police of Hyderabad had plasma levels of lipid peroxides high etc. These results suggest that exposure to air pollutants and emissions from the vehicles that can increase oxidant stress, lung damage and is likely to cause respiratory problems (India in Environ Pollut. 2000 Aug;109(2))

- **Reproductive endpoints of traffic policemen exposed to vehicular exhaust** -- A significant increase in neonatal deaths and abortions in the wives of traffic police and a decrease in live births was observed. The findings suggest that exposure to vehicular exhaust induce adverse reproductive outcome in the traffic police (*J. Hum. Ecol.*, 20(2): 77-82 (2006))
- **Analysis of chromosomal aberrations in traffic policemen.** A significant increase in chromosomal aberrations. Vehicular exhaust among important triggers (*Indian J Med Res* 130, November 2009)
- **Hyderabad:** Drug off-take study conducted by S V S Medical College, found highest drug sale in Punjagutta and Abids zones that have recorded highest PM1 and PM10 levels.



Further refine strategies

Air quality monitoring grid plan – representative of population distribution.

Land use (commercial, residential, roadside, sensitive etc)

Augment real time monitoring of PM2.5, NO2, ozone among others

Need weather data and regional assessment

Satellite based monitoring

Source apportionment and emissions inventory studies

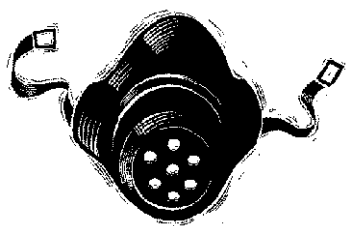
Health impact studies

Assess application of low cost sensor based monitoring for hotspot and exposure monitoring

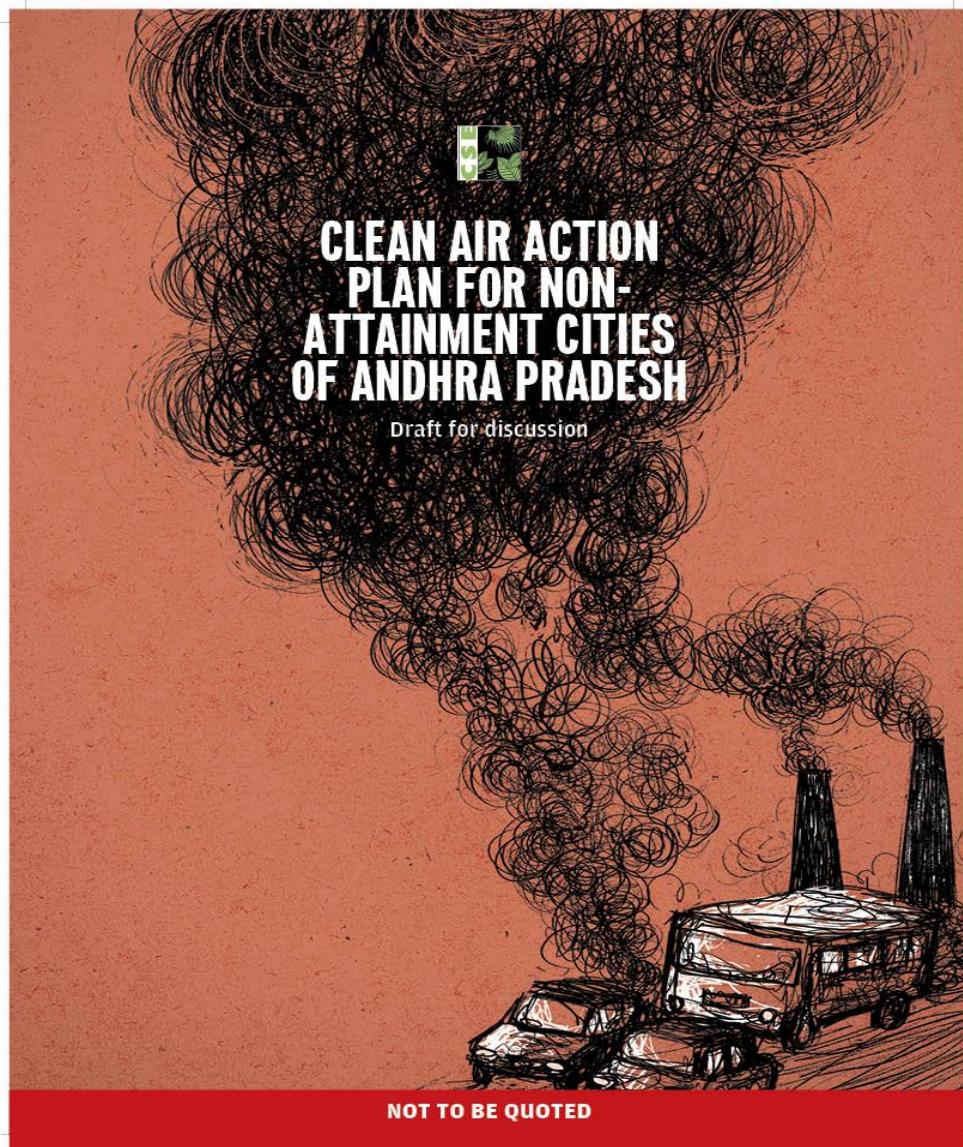
Dissemination of AQI and health advisory

Graded response action plan and comprehensive action plan

Set air quality reduction target to decide the level of stringency



Clean Air Action Plans for five non-attainment cities in Andhra Pradesh



Anumita Roychowdhury
With Tanushree Ganguly, Ananya
Choudhury, Shambhavi Shukla

Centre for Science and Environment

***Workshop on Clean Air Planning in
non-attainment cities of Andhra
Pradesh***

**Joint Initiative of Andhra Pradesh
State Pollution Control Board and
Centre for Science and Environment
Vijaywada, October 22, 2018**



Technical Session II: Industries and Power Plants



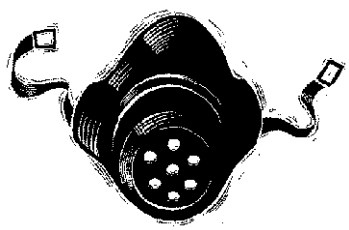
Distribution of Industries in Andhra Pradesh



District	Type of Industries
Guntur	Cement, Spinning, Lime Kilns
Krishna (Vijayawada)	Automobiles, Pharma
Visakhapatnam	Refinery, Steel, Power Plant
Nellore	Steel, thermal power plants, rice mills, engineering
Kurnool	Cement, Mining, Lime Kilns

Source: APPCB presentation made in CSE

- **Steel mills, cement industries and thermal power plants all fall under the category of 17 highly polluting industries**



Visakhapatnam- A critically polluted area



- Visakhapatnam was declared as a critically polluted area by CPCB in 2010.
- An action plan was proposed to bring down the pollution level in the city, which was followed by progress reports in 2012 and 2016.
- All the polluting industries in the city were identified and specific measures were proposed to curtail the pollution stemming from these industries.
- Hindustan Petroleum Corporation Ltd. and Vishakapatnam Port Trust of India were found to be affecting the air quality of Visakhapatnam



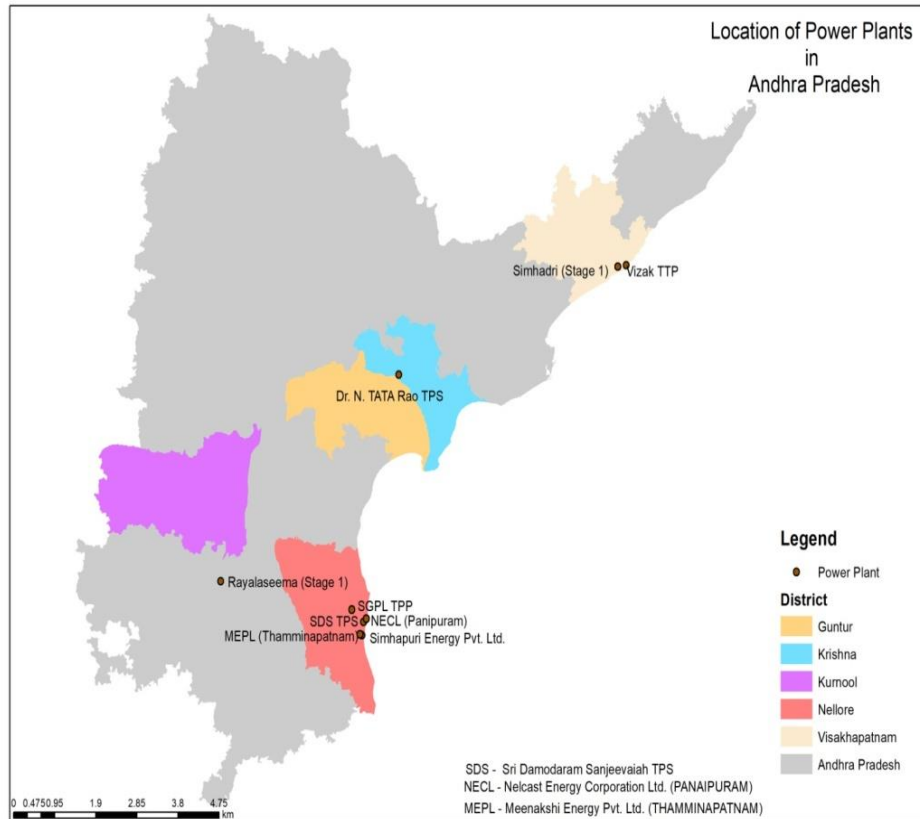
Power Generation Scenario in Andhra Pradesh



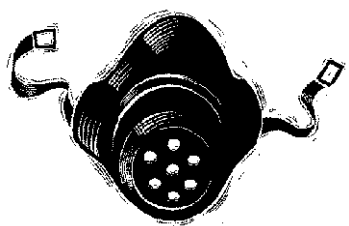
- As of September, 2018 the total power generation capacity of Andhra Pradesh stands at **17657 MW**, of which **16507 MW of power is generated by thermal power plant.**
- The state is currently powered by **9 thermal power plants**
- The CEMS recording of NO_x, SO_x and PM emission levels from the power plants were acquired from multiple sources. When compared to the emission standards notified by CPCB in January 2018 these power plants show major exceedences.



Distribution of power plants in Andhra Pradesh



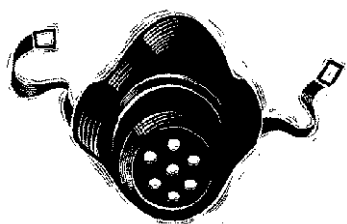
- Major power plants are in Vijayawada and Visakhapatnam
- Based CEA's monthly coal statement for August'18 Dr N Tata Rao thermal power plant, and the Simhadri TPP consumed approximately **750,000 tonnes** and **641,000 tonnes of coal** respectively
- Andhra Pradesh could benefit from gradual transition to cleaner sources of energy



Measures proposed in the current draft Clean Air Plans



Action Listed	Status according to action plan
Ensuring installation and operation of air pollution control devices in industries.	Implemented. All stack emission monitoring data is connected to CPCB/APPCB websites.
Ensuring emission standards in industries.	Implemented. Emissions being monitored by CEMS
Adoption of cleaner technology in brick kilns	No brick kilns within the city municipal boundaries.
Banning and closure of polluting units	This action features in the plans of Vijayawada and Visakhapatnam and according to the plans has been implemented in Vizag already.



Contd...



Action Listed	Status according to action plan
Shifting of polluting units	Implemented. All stack emission monitoring data is connected to CPCB/APPCB websites.
Upgradation of air pollution control equipment	These actions feature in action plans for Kurnool and Nellore.
Insisting upon use of cleaner fuels	
Stipulation of stricter emission standards compared to national standards	
Encouraging solar and gas based power plants	



Strategic Loopholes



- **Regular monitoring and ensuring compliance with emission standards:** Prior to ensuring compliance, it is necessary to test the authenticity and the accuracy of the data the Continuous Emission Monitoring System is providing. How could authenticity of the data be ensured?
- **Use of cleaner fuels:** Need list of approved fuels to be used within the city limits
- **Need emissions reduction target in industry**
- **Implementation of NOx and SOx standards in industry and upgradation of emission control equipment:**
- **Adoption of cleaner brick kiln technology:** Need specific design guidelines for the kilns to maximize benefit from the conversion of conventional clamp kilns to induced draft kilns
- **Encouraging solar and gas based power plants:** The state is working towards achieving its target of 40% power generation from non-fossil fuel sources by 2030. A more timeline and milestone based approach needed.



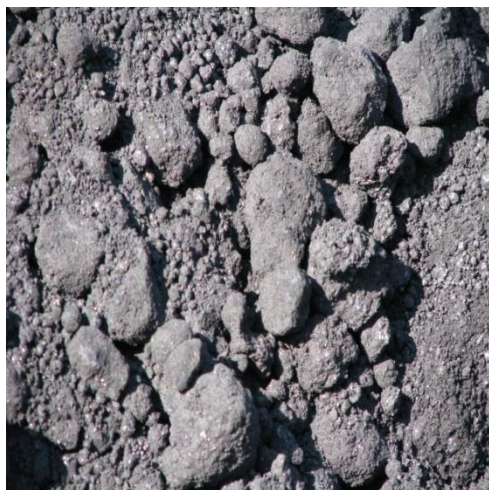
Sector specific issues and strategies



Action on dirty industrial fuels– Furnace oil and Petroleum Coke



(Left)
Sample of
Fuel/
Furnace Oil



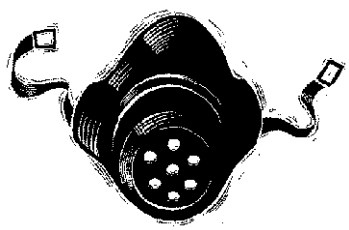
(Bottom)
Sample of
Petroleum
Coke

EPCA-CSE investigation: Extremely high sulphur levels -- more than 20,000 ppm to 74,000 ppm in contrast to only 50 ppm sulphur in BS-IV transport fuels

Import of Petcoke increased more than 14 times, since 2010-11 -- Compounded Annual Growth Rate of 45.92%.

Lower prices incite its use. Under GST, these fuels are in 18% slab. But Input tax under GST is credited back to the industry, -- effective tax rate is 0%

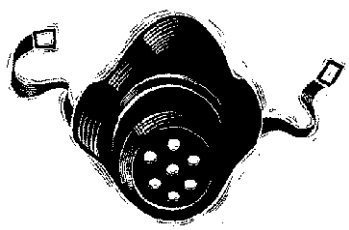
Cleaner alternatives such as Natural Gas and Electricity are taxed high – as high as 26% in some states.



India has become the dump yard



- In the US, the use of PetCoke in power generation has plummeted due to heavy restrictions.
- Until 2014, China was the biggest buyer of US Petcoke. But sulphur restrictions and local bans on new power plants have closed this supply from US.
- Import of pet coke is under the Open General Licence (OGL). Not restricted like other Hazardous substances
- The MOEFCC has submitted in its affidavit to the Supreme Court that it is considering regulation petcoke imports.
- Strong industry opposition
- Supreme Court observed – India is becoming world's dustbin..



National spin off from Delhi action – national emissions standards



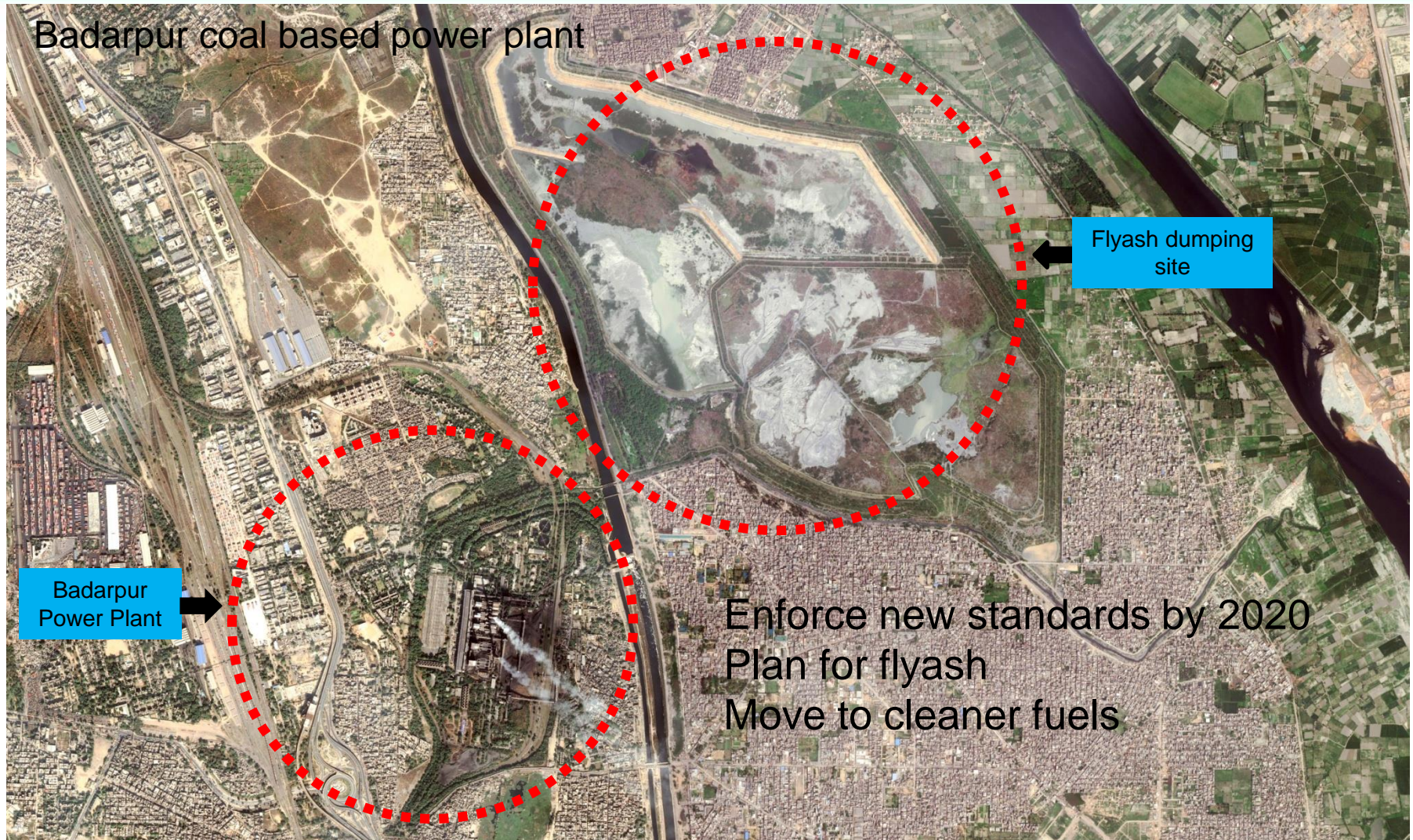
Supreme Court Directive October 24, 2017

- Banned use and sale of these fuels in Haryana, Rajasthan and Uttar Pradesh from November 1, 2017, in addition to Delhi, where it has been banned since 1998.
- Directed MoEFCC to notify national standards for NOx and SOx for 34 groups of industries. To be implemented by December 31, 2017.
- MoEFCC has been fined an amount of Rs 2 lakh for consistent inaction in this regard
- Excerpt from Supreme Court Order dated November 17, 2017 –
“...We may note that pollution caused by pet coke and furnace oil is not a problem confined only to the NCR region but appears to be a problem faced by almost all the States and Union Territories in the country... we request all the State Governments and Union Territories to consider taking similar measures ...”
- October 2018 – Ministry of Commerce & Ministry of Environment, Forests & Climate Change to consider restricting usage of all petcoke in India – domestic & imported



Coal power

Enforce new standards



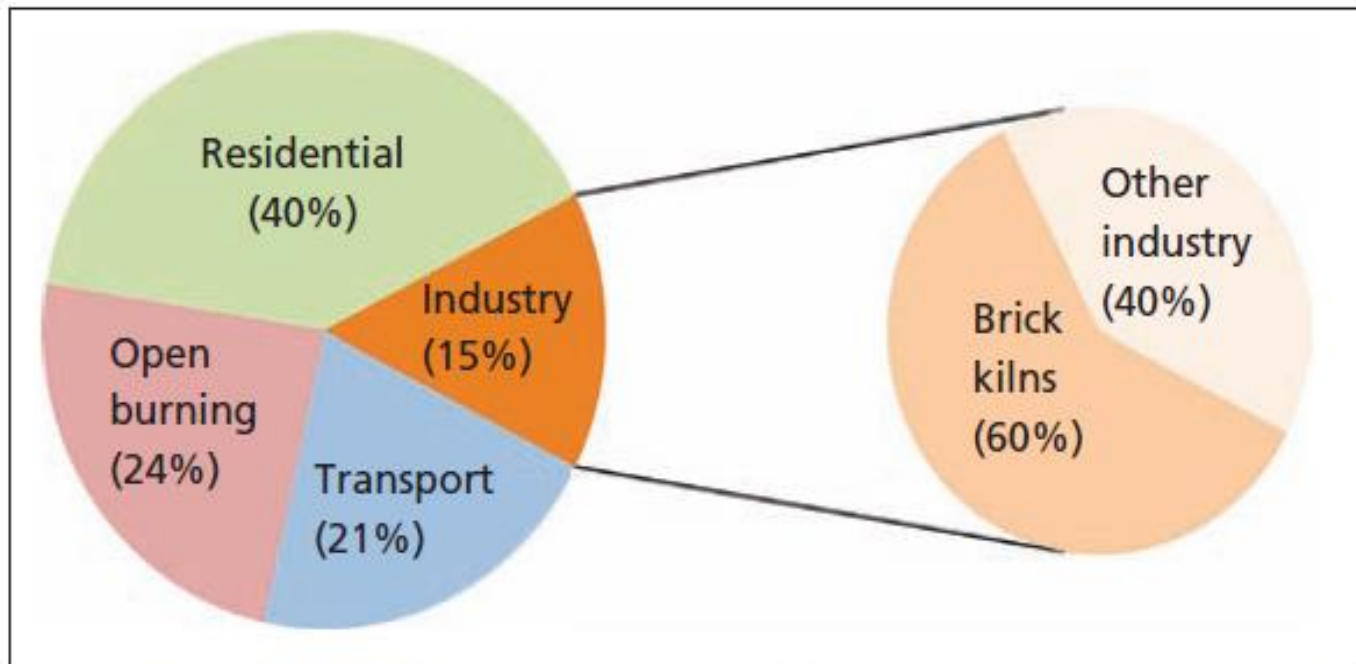


Bricks and black carbon...



- **70 percent** of India is yet to be built. Includes 60 million housing stock by 2022
- Homes, offices and factories require large quantities of building material.

Black carbon from brick kilns



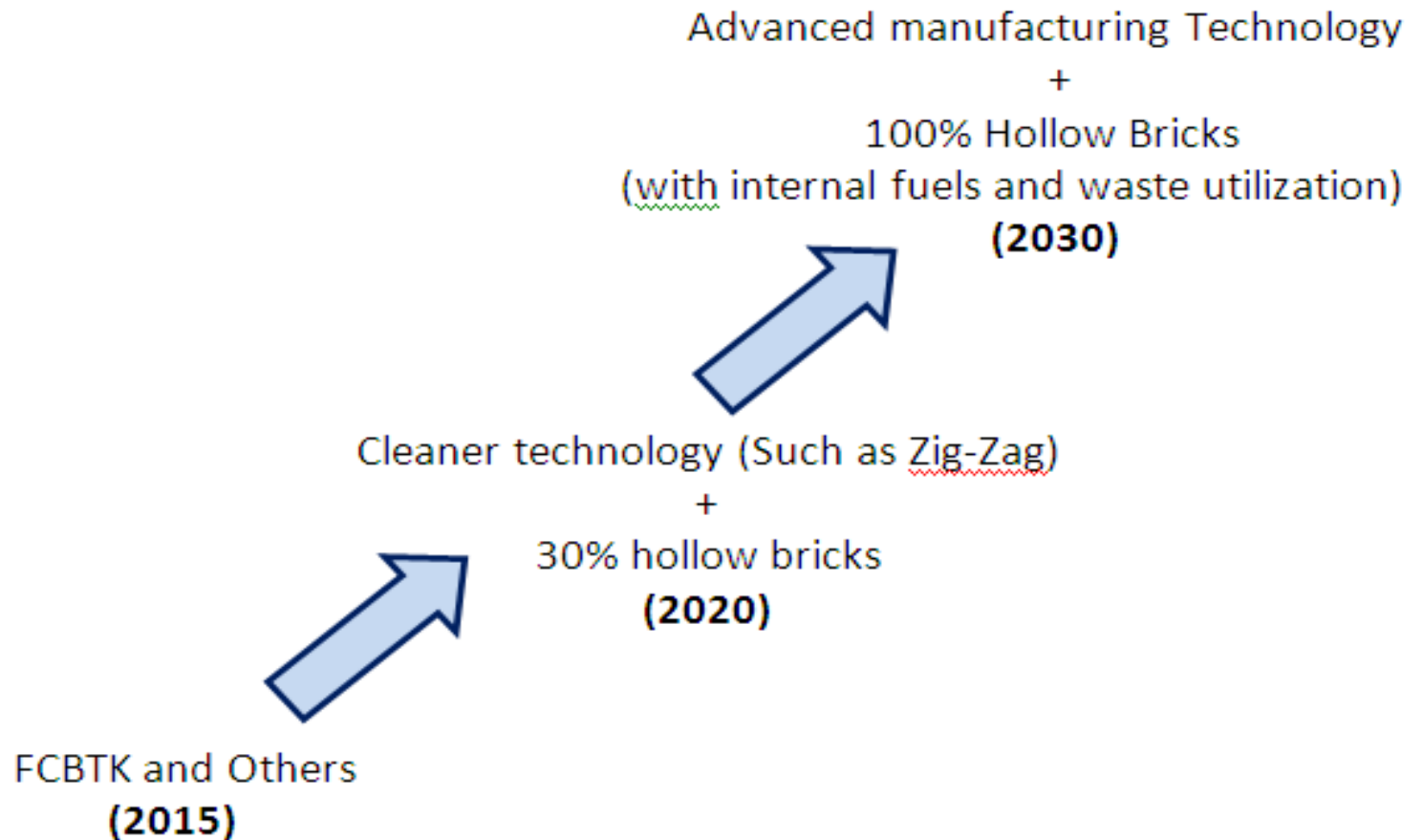
Source: Anon, *Reducing Black Carbon Emissions in South Asia – Low Cost Opportunities*, Environmental Protection Agency, United States



Define Roadmap



Ensure improvement in
technology





Action on Brick Kilns in Delhi-NCR



- All brick kilns without zigzag technology shut for winter of 2017-18
- Non-zigzag kilns will be allowed to operate in NCR districts from March 1, 2018, to June 30 2018 for one last season.
- Affidavit from brick kiln owners to convert brick kilns to zigzag technology. 623 kilns have converted.



Opportunities



Ministry of Environment and Forests -- new draft standards for Brick Kiln sector by

Proposed particulate matter standards -- 250 mg/ Nm³ – This can not be met by FCBTK.

Ban/phase out on new FCBTK from 2017 onwards

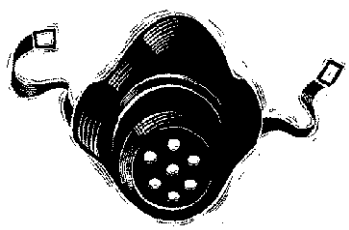
Push for a technology roadmap starting with Zig-zag and then to other technologies.

Utilise National Clean Energy Fund for upgradation of existing kilns within 3-5 years

National resource efficient brick mission

Need promotional campaign replace traditional bricks with hollow and perforated bricks, flyash bricks, concrete blocks with recycled waste, etc

-- Success in amending BIS standards on C&D waste. To take this forward for other wastes



Leverage CEMS



- 17 categories of industries has installed CEMS. Selected parameters are monitored and data is transferred to SPCB and CPCB simultaneously.
- Minimal software based data analysis is done and alarms are send to the industry and service provider
- Presently more of data capture is targeted only
- Data is not being used for compliance check. No system in place for this, presently. It may take time as legal amendments are required along with infrastructure.
- Confidence on data quality is low. There are multiple problems which affects data quality-needs strategy to deal with



Implementation challenges



Multiple problems with CEMS -- poor implementation

- Incorrect installation of CEMS
- Wrong technology selection, setting
- No proper operation, calibration and other maintenance
- Data tampering at source
- Inadequate knowledge base and skills in regulators, industries and service providers, is the biggest barrier

CEMS Guidelines; system not in place

- Lab still not empanelled to carry CEMS related work, needed for testing, calibration, performance check, correct installation etc.
- No system of certification system in India till date. Many industries have installed domestic equipment without any quality/performance check.



Need additional measures



- Need approved fuel list; ban and discourage dirty fuels**
- Introduce Nox and SOx standards for industry and new standards for power plants**
- Monitoring and compliance in industrial hotspots**
- Addressing informal industrial units and unauthorised areas (including stone crushers)**
- Strategy for monitoring and compliance**



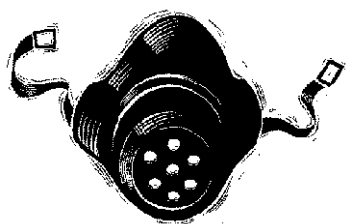
Strategy for CEMS implementation



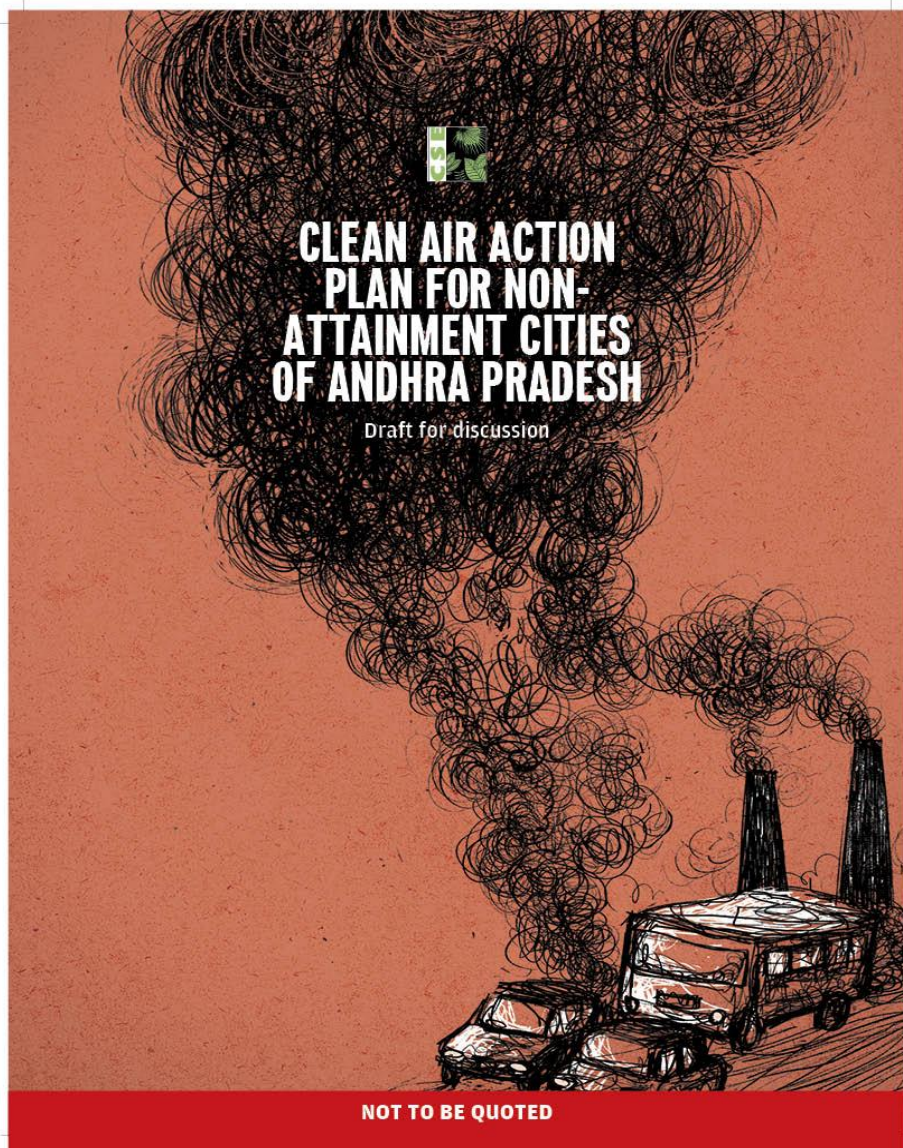
Time-bound strategic efforts needed to make CEMS successful.

- ✓ **Inspection/verification of current Installation status.**
Identification of problem; Need capacity building and training
- ✓ **Industries can be asked to do self-assessment, and submit the report.** Need guidance and training.
- ✓ **Regulators can do better data analysis to assess the situation and take measures.** Need training.
- ✓ **State may explore the opportunity to develop state-level system of lab-empanelment** for CEMS related work.
- ✓ **Centre need to develop national level Quality assurance system and Lab empanelment system ASAP**

Need capacity building of regulators, industries and service providers is must.



Clean Air Action Plan for non-attainment cities of Andhra Pradesh



**Anumita Roychowdhury
With Tanushree Ganguly, Ananya
Choudhury, Shambhavi Shukla**

Centre for Science and Environment

***Workshop on Clean Air Planning in non-
attainment cities of Andhra Pradesh***

**Joint Initiative of Andhra Pradesh State
Pollution Control Board and Centre for
Science and Environment
Vijaywada, October 22, 2018⁷⁷**



Technical Session III: Vehicular Emissions and Mobility Management



Measures Proposed in Current Draft Plan



Same plan for all 5 cities with minor variation

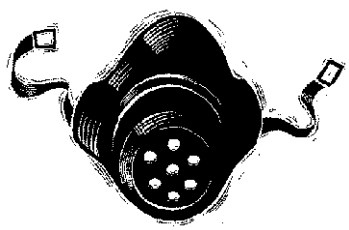
- Restrict 15 year old diesel commercial vehicles.
- Ban on registration of Diesel driven auto-rickshaw /Tempo.
- Promotion and operationalization of E-rickshaw.
- Retrofitting of particulate filters in diesel driven vehicle.
- Introduction of cleaner fuels (CNG/LPG) for vehicles
- Regular checking of vehicular emission and issue of pollution under control certificate
- Retrofitment of particulate filters in diesel driven vehicles
- Checking of fuel adulteration
- Monitoring of vehicle fitness
- Development of Multi-layer parking.
- Traffic management



Weak policy link with mobility and urban design strategies



- Poor linkage with mobility action
- Weak linkage with augmentation and integration of public transport, walk and cycle
- No linkage with compact city and road design; transit oriented development practices



Guiding principles for vehicular pollution



Vehicle technology and fuel quality

- Leapfrog to clean emissions standards (BSVI)
- Introduce clean fuels and accelerate transition to zero emissions electric mobility
- Ensure vehicles remain low emitting through out their useful life on road; lower real world emissions
- Ensure rapid fleet renewal
- Promote fuel efficiency for energy security
- Need scrappage and end of life policy

Reduce and reverse automobile dependence

- Improve modal share with detailed public transport and para transit strategy and multi-modal integration
- Walking, and cycling strategy with feeder systems to improve last mile connectivity and integration
- Link with urban planning and design to reduce travel needs and distances
- Restraint measures for personal vehicles usage – (parking policy, road and congestion pricing, low emissions zones, tax measures etc)



Emissions from on-road vehicles

How are five cities positioned on a scale of 5?



V

City ensures **that in-use vehicle do not emit more than their designed maximum emission** and has **completely weeded out gross polluting vehicles.**

IV

City has **advance pollution monitoring and control system with real world testing facility** and has **majorly weeded out gross polluting vehicles.**

III

City has **advance pollution monitoring system** (advanced emissions testing, on board monitoring) and **adopted polluting vehicle management**

II

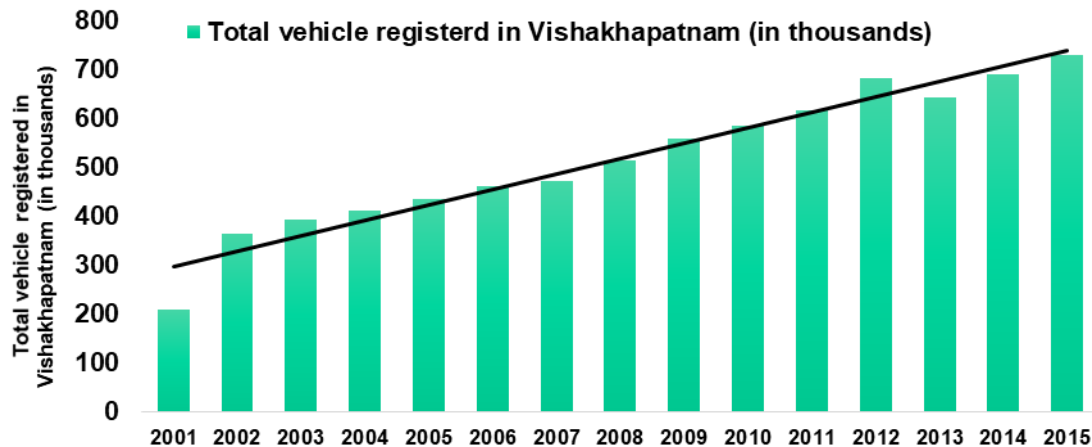
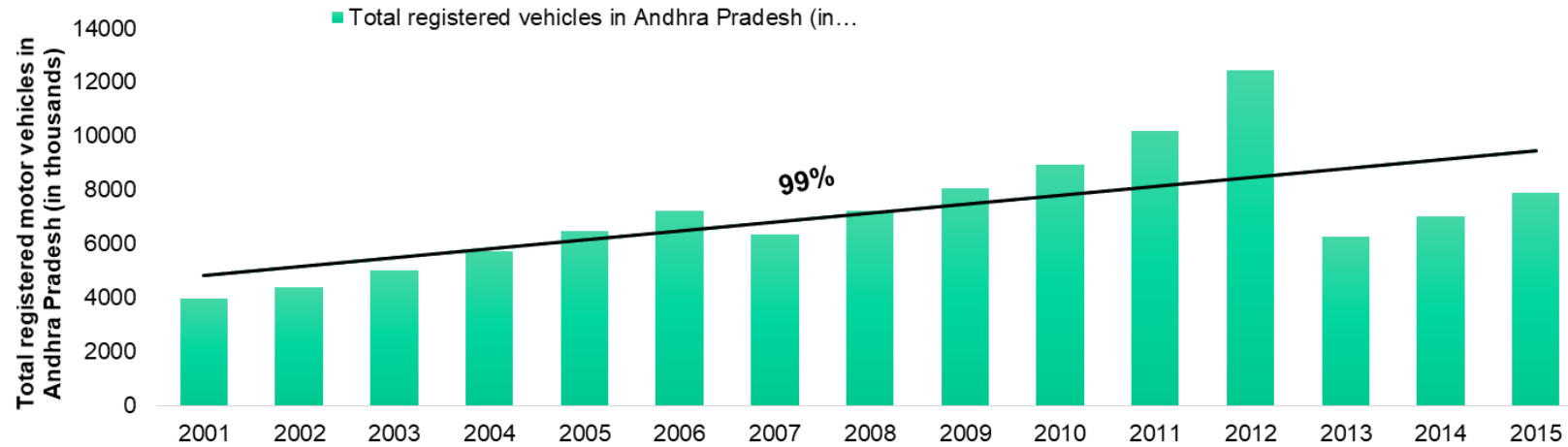
City has **improved upon mandatory pollution control infrastructure** and has **adopted additional measure like cleaner fuel.**

I

City **does minimum as per the national law and standards to restrain emissions from in-use vehicles.**



Motorisation in Andhra Pradesh

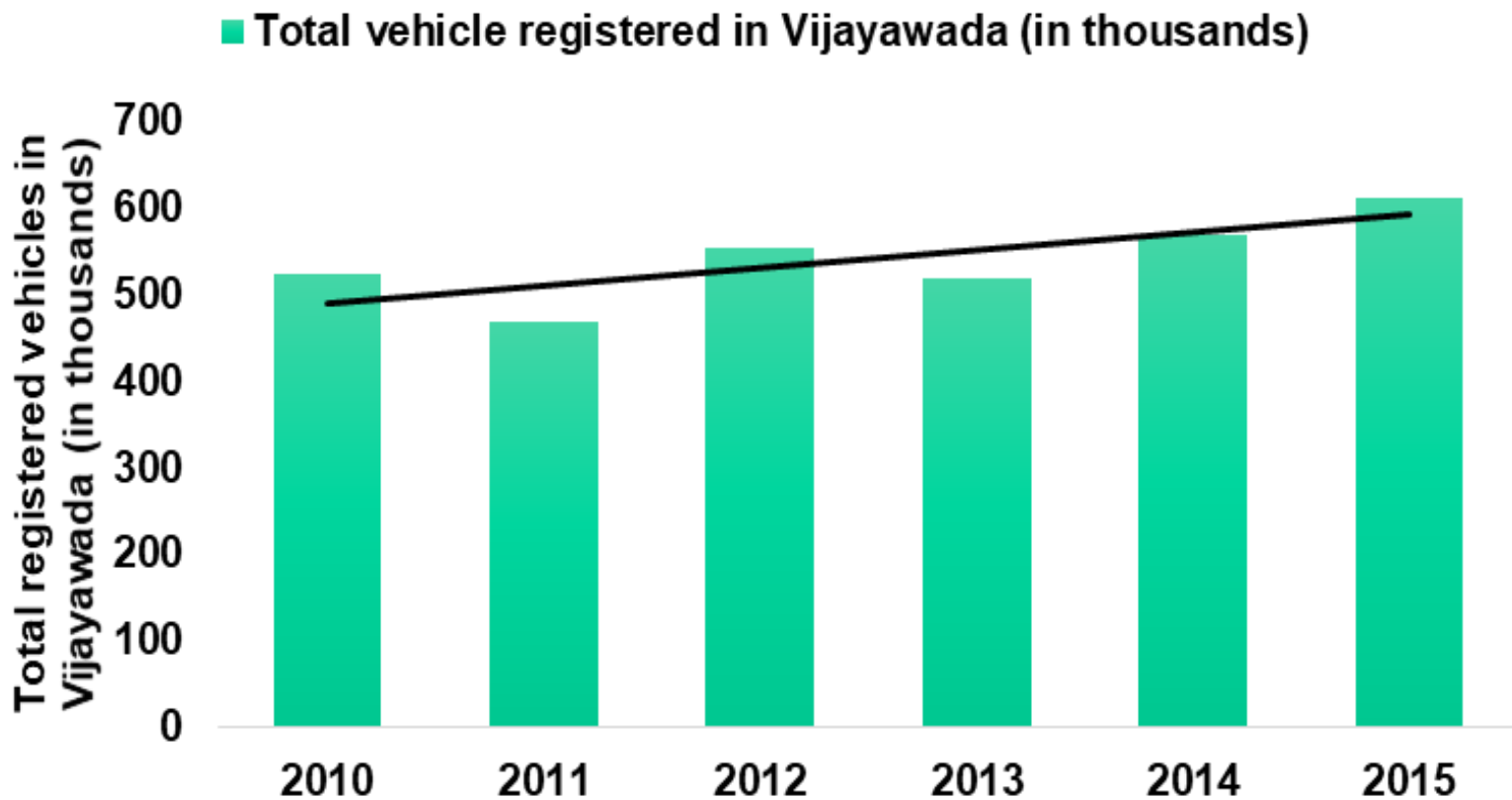


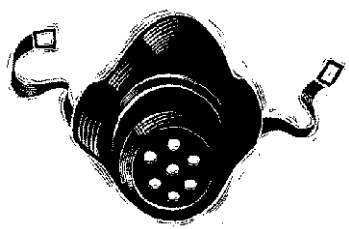
- Annual growth rate of vehicles -- **10%**
- Vishakhapatnam -- **5%**



Vijayawada: Motorisation

Vijayawada's annual vehicle registration **growth rate is 6%**

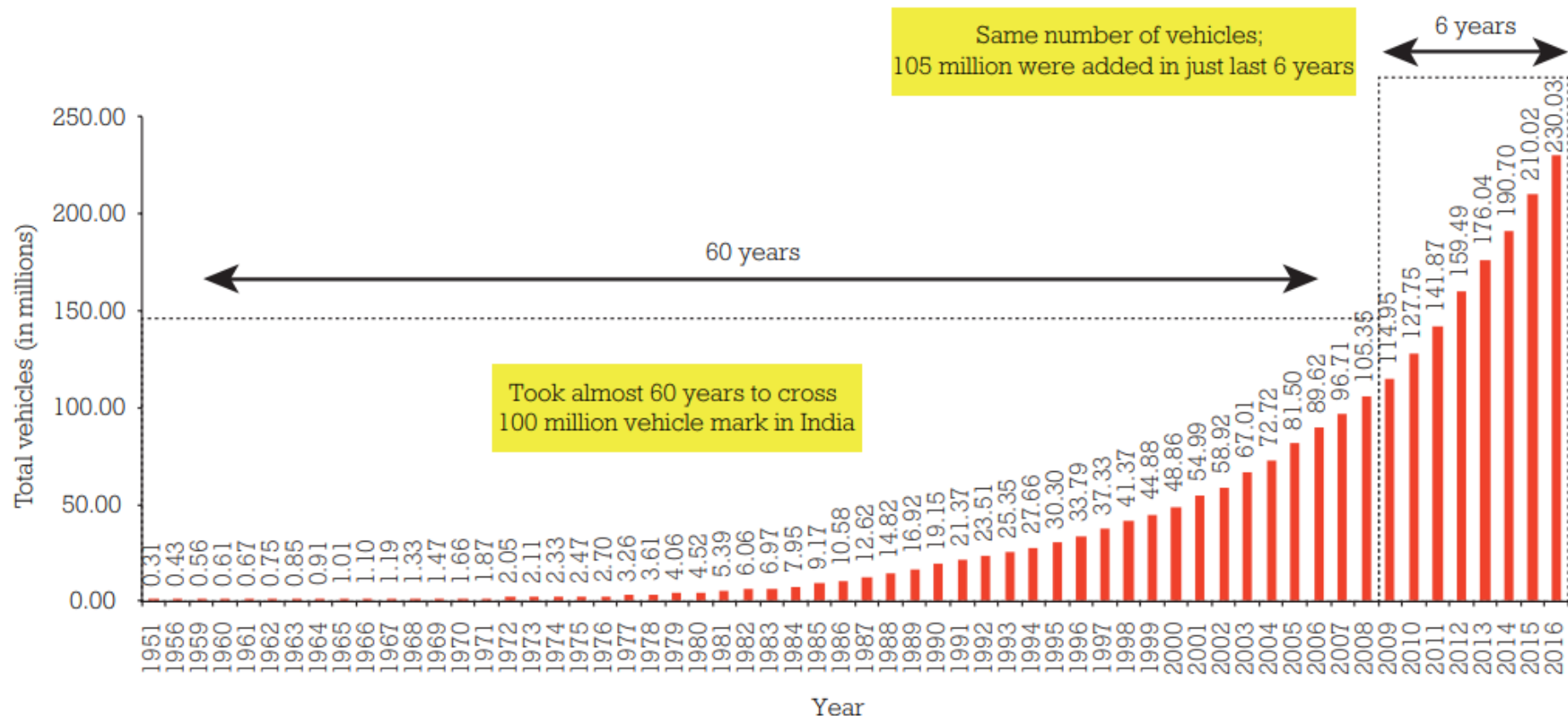




Trends in total vehicle registration in India (1951–2015)



Total vehicle registrations—the number has increased **700 times**

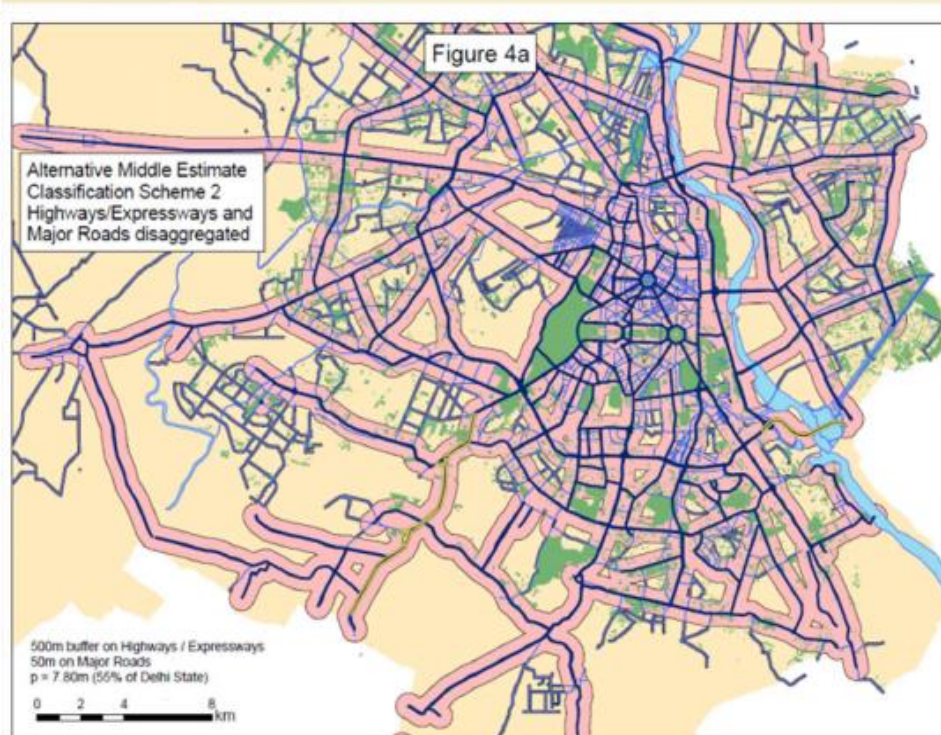




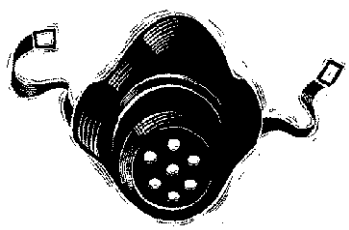
People living close to roads are most exposed to vehicular fume



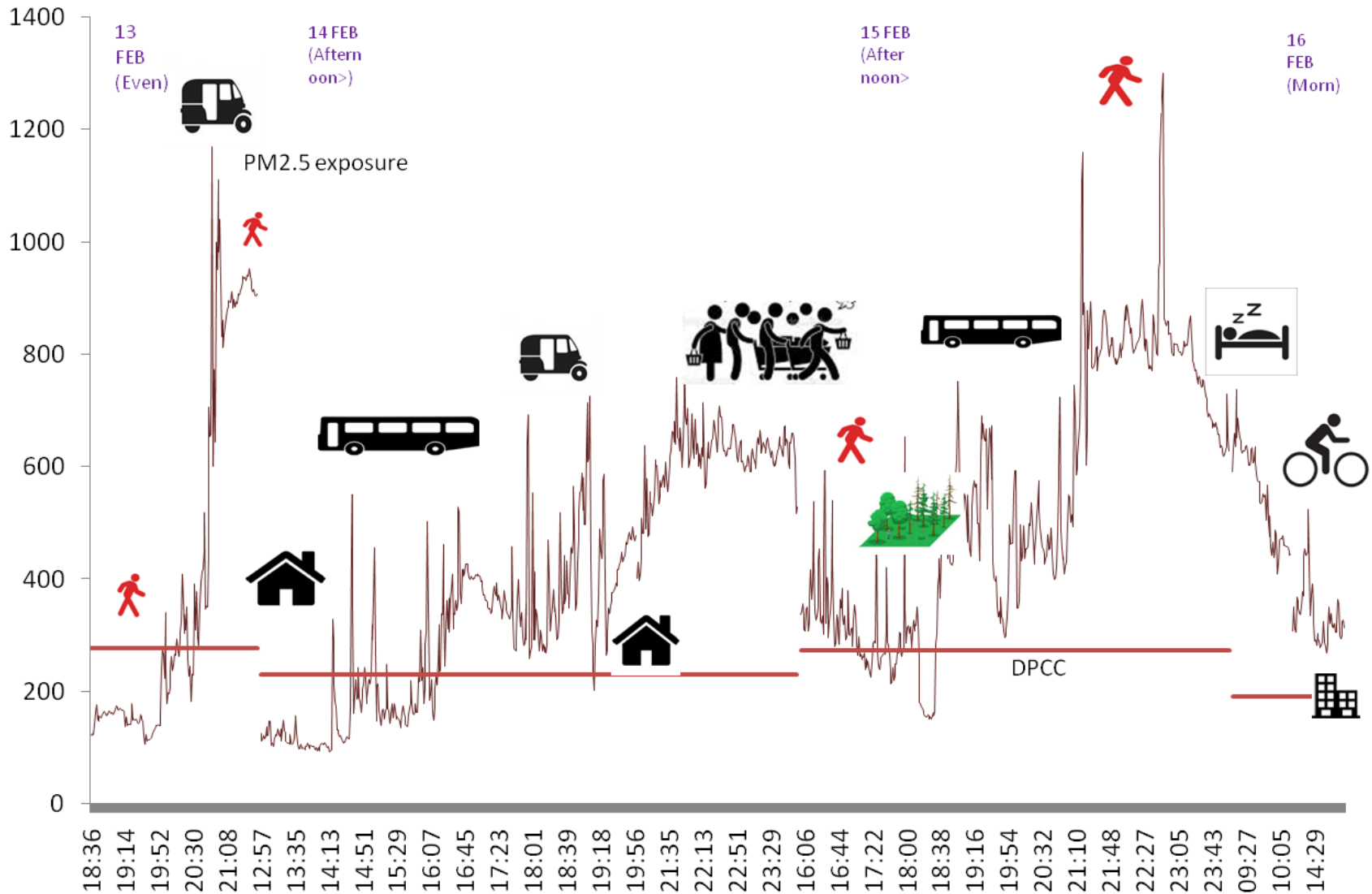
The Traffic Impact Area in Delhi: New HEI Analysis: 55% of the Population within 500 meters of a Freeway; 50 meters of a Major Road



Health Effect Institute:
Influence of vehicular
pollution maximum
upto 300-500 m from
roadside. About 55%
of Delhi's population
live within this
influence zone.



How much pollution we breathe while travelling?



Source: Based on CSE exposure monitoring and DPCC data for ambient levels



Adverse impact of dieselisation



Particulate norms for diesel car (Particulate emissions from petrol cars are negligible and not regulated)	NOx norms for petrol and diesel cars. (Diesel emissions equalize with petrol only at Euro VI level)
<p>in gramme / km</p> <p>■ Diesel cars ■ Petrol cars</p> <p>Euro 3 (India) Euro 4 (India selected cities) Euro 5 (2009 in Europe) Euro 6 (2014 in Europe)</p> <p>NA</p> <p>50%</p> <p>80%</p>	<p>in gramme / km</p> <p>■ Diesel cars ■ Petrol cars</p> <p>Euro 3 (India) Euro 4 (India selected cities) Euro 5 (2009 in Europe) Euro 6 (2014 in Europe)</p> <p>50%</p> <p>28%</p> <p>56%</p>
<p>Note: PM emissions from petrol vehicles are so negligible that these are not regulated in petrol vehicles</p> <p>Source: Based on data available in www.dieselnet.com</p>	

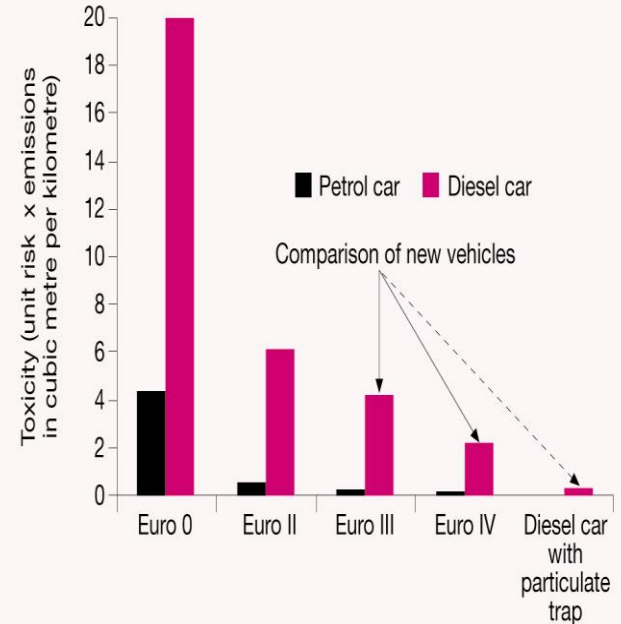
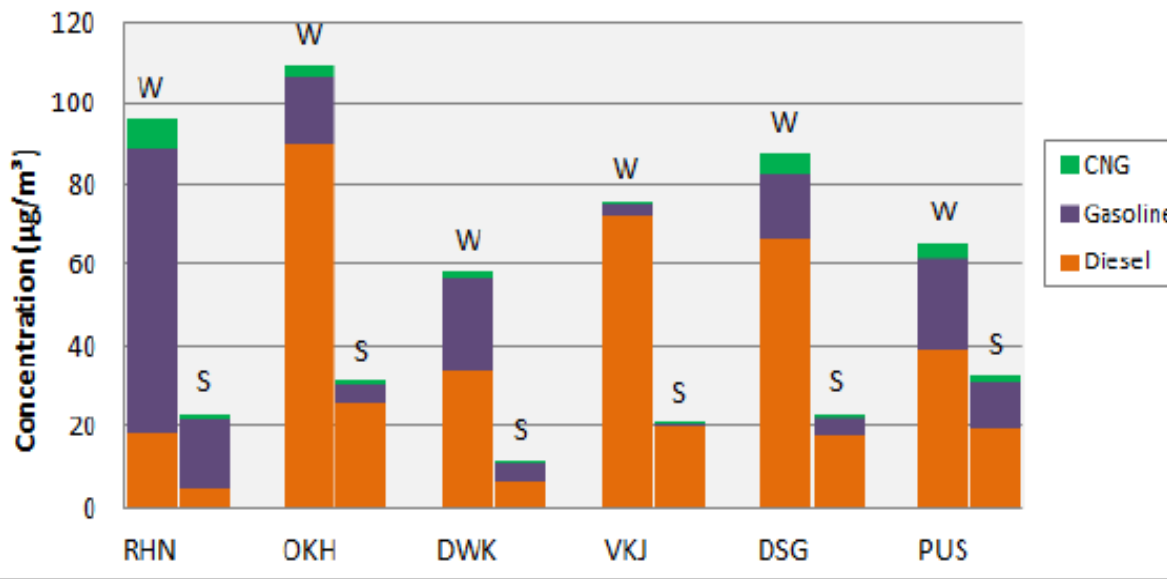
Diesel cars legally allowed to emit 3 times more NOx
Several times more PM



High contribution of diesel cars to PM2.5 levels



(a) PM2.5: Fuel contribution in Vehicles



Source: IIT Kanpur Study, 2015

IIT Kanpur study: Diesel cars are 25% of the total car fleet and contribute 78% of PM2.5 from vehicles

ICCT- 4 times greater cancer risk in Delhi from diesel cars compared to petrol cars; More than 280,000 avoidable cancers in Delhi NCR caused by diesel exhaust (based on emissions estimates of IIT Kanpur study)

WHO: Class 1 carcinogen for link with lung cancer



Global action on diesel cars



London: Pre Euro VI cars not to be allowed inside the ultra low emissions zone in Central London.

France: Euro VI diesel cars not to be included in the new category 1 colour coding scheme that classifies vehicles according to how much they pollute. French government to “progressively” ban diesel vehicles. **Paris:** To phase out pre-2011 diesel cars by the end of the decade.

Madrid: To ban polluting diesel cars from the city centre from 2020.

Netherlands: In 1998 the Third National Environment Policy targeted to reduce diesel share to only 5% in 2010. Dutch registration and circulation taxes for diesel cars are close to prohibitive. Kept share of diesel cars in Netherlands lower than EU average.

Brazil Sales of diesel passenger cars and commercial vehicles below 1,000 kg are banned since the 1970s

Beijing has banned diesel cars as a pollution control measure. China has the lowest diesel car penetration at less than 1%. China taxes do not differentiate between petrol and diesel fuel.

Sri Lanka has imposed several times higher duties for diesel cars compared to petrol cars and have reduced diesel car sales.



Action on dieselisation in Delhi



- 1% cost of car (2000 cc and above) as environment pollution charge
- Dedicated fund from revenue – funding of air quality monitoring

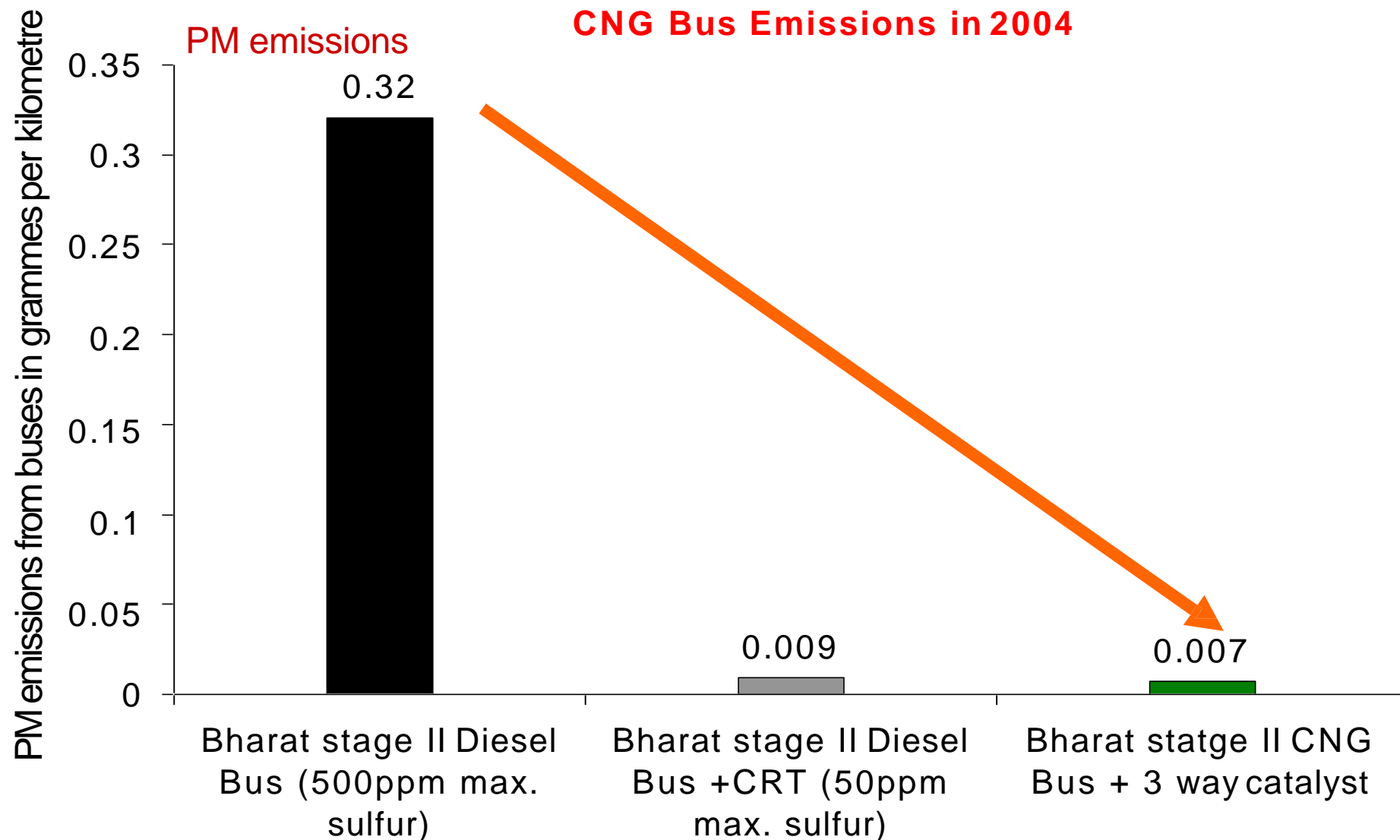
Supreme Court Directive March 26, 2018: *Learned ASG to state on affidavit the issue of pricing of diesel fuel so that the low price, particularly for passenger vehicles, does not act as an incentive to purchase diesel vehicles as against petrol vehicles. This examination is required in view of the fact that the diesel vehicles are far more polluting than petrol vehicles.”*

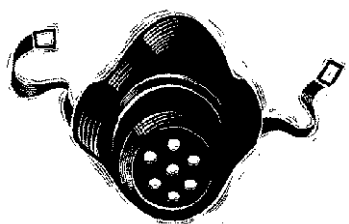
NGT order to scrap 10 year old diesel cars



Natural gas vehicles: Our opportunity to sidestep poor quality diesel and leapfrog

Euro II diesel bus emits nearly 46 times higher PM than Euro II CNG bus in India.





Comparative emissions of Indian diesel and CNG buses (Euro II vintage)



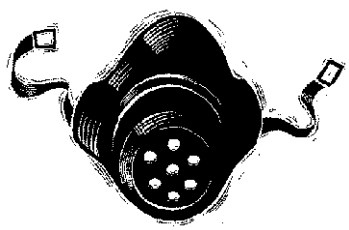
Type of bus	CO g/km	HC g/km	NOx g/km	PM g/km
Euro II diesel bus on 500 ppm sulphur fuel + DOC	1.45	0.29	6.24	0.35
Euro II diesel bus on 350 ppm sulphur fuel + DOC	0.65	0.15	5.85	0.11
Euro II diesel bus on 50 ppm sulphur fuel + CRT	1.42	0.04	13.58	0.009
Euro II CNG bus +three way catalytic converter	3.18	1.455	5.35	0.0065



Second generation CNG: Continues to give benefits



Bus type	CO (gm/kwh)	NMHC (gm/kwh)	NOx (gm/kwh)	Total Particles
Diesel bus				
Acceleration	7.87	7.58	8.42	645000 billion (or 6.45x10 ¹⁴)
Cruise	2.68	-	7.14	446000 billion (or 4.46x10 ¹⁴)
CNG bus				
Acceleration	0.43	0.15	0.87	278 billion (or 2.78x10 ¹¹)
Cruise	2.2	0.57	0.82	437 billion (or 4.37x10 ¹¹)
Euro VI (WHSC) (WHTC)	1.5 0.40	0.13 0.16	0.40 0.46	600 billion



Prepare for BS VI transition

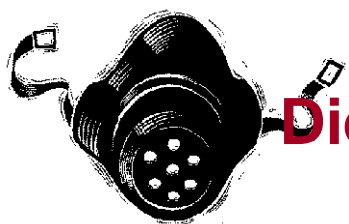


Diesel technology roadmap

- **Euro IV:** Change in injection system + turbo charge+ cooler EGR+oxi cats + lowering of fuel sulphur
- **Euro VI:** Improve fuel atomisation with increased injection pressure+ Constantly regenerating traps for PM control + SCR for NOx control

CNG technology roadmap

- **Euro II:** Conventional stoichiometric engines with mechanical air-to fuel mixing systems+ exhaust oxygen sensor+ cats
- **Euro III:** Moved to lean burn engine with oxi cats
- **Euro IV:** Improved stoichiometric engine with port injection + three way catalytic converts
- **Euro VI:** Advanced stoichiometric engine + cooled EGR + turbo charging +improved combustion chamber + Three Way Catalytic converter



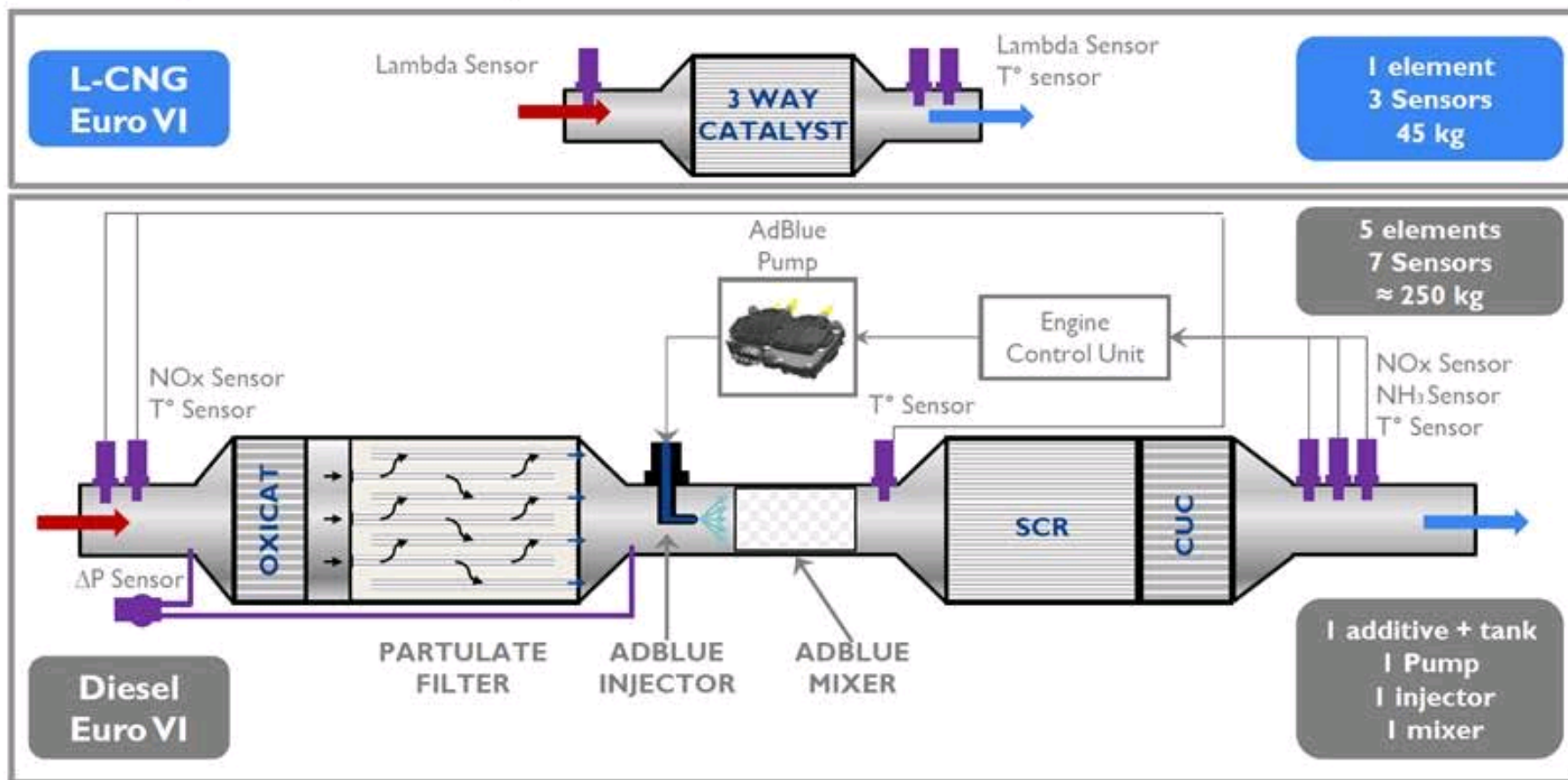
Diesel and CNG pathways to meet Euro VI norms

Diesel emissions control route more complicated



IVECO Stralis Natural Power

Environmental benefits – Simple EATS





Take action to make technology work



Need stringent in-use compliance strategy to make technology work

- Congested and slow traffic can lead to problems for advanced diesel. Exhaust temperature is too low for the SCR system to function and too low for the particulate filter to regenerate
- Ensure adblue refilling requirement and that refilling systems are working.
- More alternative fuel technologies for buses evolving – biogas, hybrids, electric. Creates more opportunities for public transport on clean technologies – a win-win
- All new fuels and technologies need their own eco-system – standards, maintenance regime, refuelling systems etc



Electric mobility



- New FAME policy (Faster Adoption and Manufacturing of Hybrid and Electric Vehicle – focus on public transport strategy)
- Support for electric buses
- Government procurement of E cars
- Link E-mobility with public transport and para transit (E rickshaws – disruptive – 60% of battery storage by 2020)
- Charging infrastructure; affordable strategies for batteries

An opportunity – as post Euro VI scenario for mainstream fuels more complex and expensive



**Next big transition in vehicle sector:
Addressing real world emissions, in-service
compliance and on-road emissions
management.....**



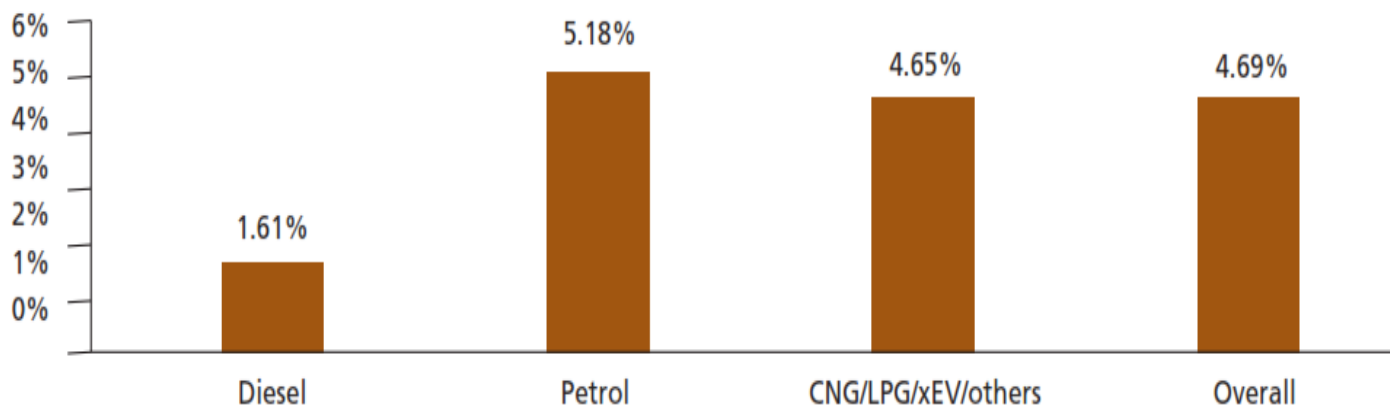
Current emissions inspection very weak



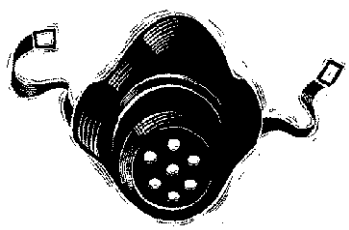
Poor failure rate – nearly all vehicle pass

- **Lesson from Delhi:** Only 1.68% of diesel vehicles fail the smoke density tests and about 4.5% of petrol vehicles fail the CO and HC tests.
- Global approach: identify 15-20% of the most polluting vehicles.
- Only 23% of vehicles turn up for tests
- Failed tests are often not recorded as vehicle owners refuse to pay the test fee if their vehicles fail.

Graph 2: Failure Rate by Fuel Type in Delhi



Source: Analysis of data provided by the Department of Transport, Govt. of NCT of Delhi in 2016-17.



Institutional challenges



- Lack of qualified and skilled PUC operators
- Lack of knowledge of proper testing procedures
- Improper testing and manual data reporting
- Non-functioning equipment
- Updated calibration certificates not available
- Very few inspectors for strong oversight of centres
- Numerous PUC centres



Observed malpractices

Haryana NCR



Broken non-functioning testing equipment was a common sight across Rohtak.

Smoke meter was not connected to the computer.

Still issued a pass certificate



Enforcement challenges

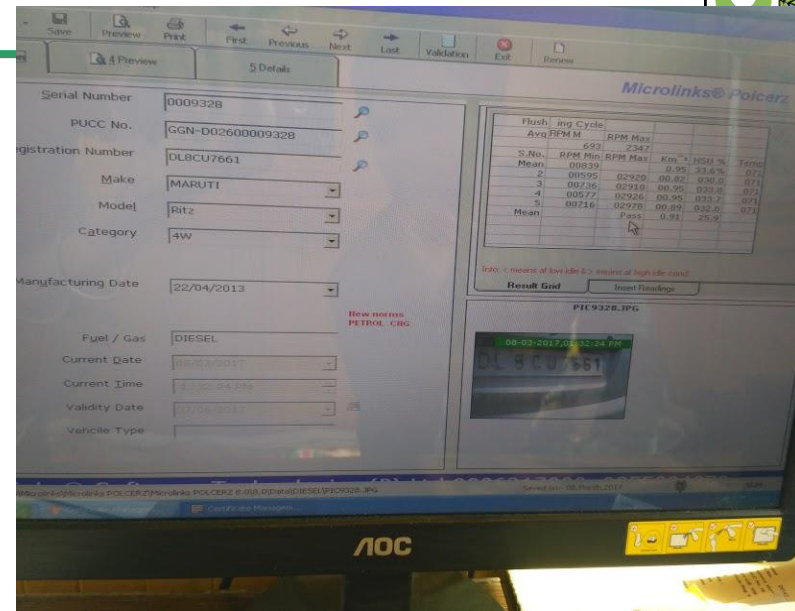
Haryana NCR



Indrsuddha Associate PUC, Faridabad, Centre code- FBDD0061

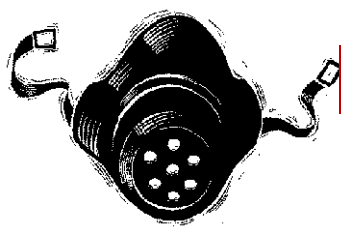
This PUC centre had a non-functioning diesel smoke meter.

The centre still issued a pass certificate



Vishesh PUC, Gurgaon, Centre code- GGNP02997

The image shows fake software called “certificate management programme”. The diesel-testing equipment was turned off when the operator showed these readings as the results of the EPCA audit vehicle. This is a common software found across PUC centres



Improper Testing Procedure

Haryana NCR



- PUC Operators often have no working knowledge of operations
- PUC centres still issue valid PUC pass certification using manipulative software

Testing of a decoy test vehicle using a petrol emission analyzer in Gurgaon, Haryana



Observed malpractices UP-NCR



Narendra Prayavaran Sewa Samiti, Bulandshahr,
Centre code- 687

A fake PUC certificate was issued for the decoy diesel vehicle by the PUC centre which did not have any test equipment.



Chaman Prayavaran Sewa Samiti, Anoopshahr, Bulandshahr,
Centre code- 908

There was no testing equipment in this centre at the time of inspection. It only had a computer and printer to issue PUC certificate.



Legal mandate for compliance and monitoring in Delhi-NCR



March 6, 2018: CPCB notified CAP for Air Pollution Control In Delhi and NCR under Section 3 and Section 5 of The Environmental (Protection) Act, 1986.

On-Road Vehicles

- **Link PUC certificates with annual vehicle insurance** to ensure 100 per cent compliance.
- **Auditing of Pollution under Control (PUC) certification centres**
- **Tighten PUC norms for post-2000 vehicles.**
- **Upgradation of in-use emissions testing for diesel vehicles**
- **Enforcement of law against visibly polluting vehicles**
- **Implement an on-board diagnostic system fitted in new vehicles for vehicle inspection**
- **Delhi to review and upgrade the commercial vehicle testing centre.**
- **Improve annual fitness tests**
- **Set up centralised testing centres for both emissions and fitness tests**



New generation action

Bigger interest in paradigm shift in in-use management systems

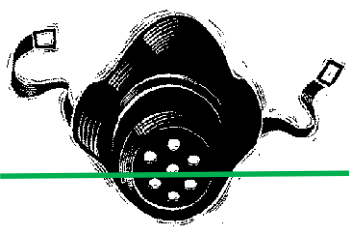
SC order dated May 10, 2018 with regard to remote sensing: It was stated that remote sensing screening of emissions has been found to be extremely effective

- **Integration of On-board diagnostic systems with regular emissions inspection**

**On-schedule implementation of BS VI fuel and emission standards.
(SC takes on board PEMS based RDE test)**

- **Introduction of 10 ppm sulphur fuels and retrofitment**
- **Sticker policy for cars; Interest in low emissions zones**
- **Phase out of old vehicles – scrappage policy**

Delhi government to introduce remote sensing monitoring



Prepare for BSVI now



On Board Diagnostic system:

- BSVI OBD has no requirements for permanent OBD code storage, making OBD clearance an easy task by battery disconnection. Permanent fault codes are necessary for use of OBD in I/M program.
- Some monitoring requirements are open for interpretation, such as OBD threshold limit values and In-use performance ratios

In-service conformity requirements:

- Instead of “at the request of the Type Approval Authority”, establish a detail defect reporting system
- provide a specific list of emission control components in the document for manufacturers to report on frequency and substance of faults
- set a minimum emission component warranty requirement

Real Driving Emissions: Adoption of all the packages of RDE in India right from the beginning is essential.



Trucks



- **Lesson from Delhi**

- Pollution compensatory charge based pollute pay to equalise the toll cost to remove distortion

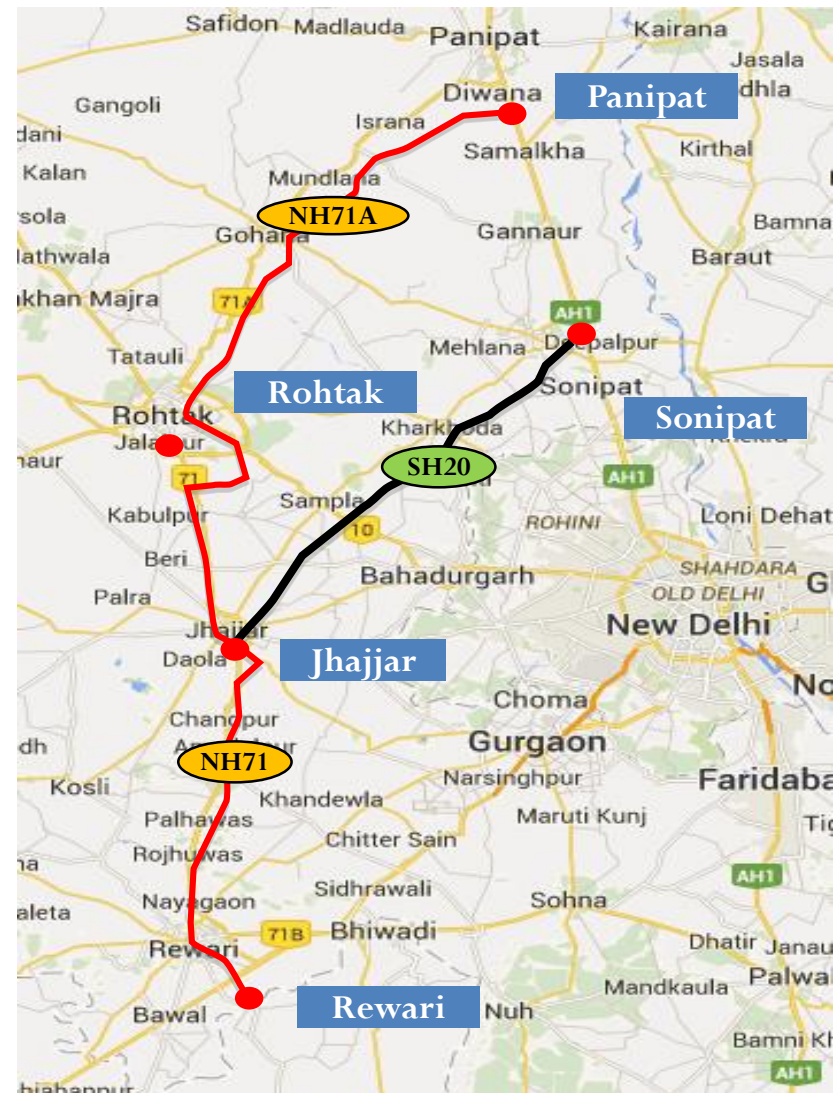
- **Example:**

- NH 71 and NH 71A are toll roads connecting Rewari with Jhajjar and Rohtak to Panipat.

- The toll rate for the 3-axle trucks to travel on this road is Rs 1420.

- But MCD toll in Delhi for a 3-axle truck would be Rs 450.

- Not much difference in trip length -- Travelling via NH71 and NH 71A is 172 km. But travelling through Delhi is marginally shorter at 163 km.





Polluter pay principle

- Environment compensation charge on each truck entry into city

Implementation of Radio-Frequency Identification (RFID) on trucks: Enable electronic payment and tracking as they pass through the tollbooths.

This is being implemented in Delhi

- Substantial revenue generation
- To fund pollution control and electric mobility



STATUS REPORT FOR EPCA



EASTERN PERIPHERAL EXPRESSWAY

STATUS REPORT FOR EPCA





Emission and Fuel Quality for New Vehicles



Short-term priority action

Ensure on-schedule implementation of BS VI fuel and emission standards, including early delivery of BS VI fuel for vehicles to modify technologies. Ensure registration of only BS VI- compliant vehicles from April 2020

Action on dieselization: Tax measures are needed to nullify incentives for diesel cars over petrol cars. A fund can be created from this revenue to fund pollution control efforts.

Mandate and Expand CNG programme: The existing infrastructure for delivery and use of CNG for vehicles in cities of Andhra Pradesh is negligible. This needs to be improved on an urgent basis to promote cleaner fuels. Target public transport vehicles and local commercial vehicles



Emission and Fuel Quality for New Vehicles



Short to Medium term action

Introduce battery-operated vehicles in targeted segments of two-wheelers, three-wheelers and buses. Link up electric mobility with public transport strategy. Electric bus transport strategy Plan infrastructure for charging and battery disposal.

Accord priority to battery-operated para-transit as feeders and for last mile connectivity in congested traffic areas. Ensure organized deployment to reduce congestion.

Install vapour recovery systems in fuel refueling outlets to reduce benzene emissions in selected cities.

CPCB has issued direction for installation of stage I and Stage II vapor recovery system in all retail outlets with capacity 3000 klm and more in 46 million plus cities by December 2017.

Fuel quality: Prepare an action plan to check fuel adulteration and random monitoring of fuel quality data.

To ensure that fuel testing is done across city for all combustion fuels.



On-Road Vehicles



Short to Medium term action

Auditing and reform of Pollution under Control (PUC) certification centres and Upgrade in-use emissions testing for diesel vehicles.

Evaluate the following for inclusion in vehicle inspection and maintenance programme:

- Integrate on-board diagnostic system fitted in new vehicles with vehicle inspection. Improve facilities for its implementation.
- Remote sensing application for emission monitoring
- Loaded mode emission test for commercial diesel vehicles

Link PUC certificates with annual vehicle insurance to ensure 100 per cent compliance (as per the Directive of the Hon'ble Supreme Court).



On-Road Vehicles



Short to medium term action

Enforcement of law against visibly polluting vehicles: impose penalty, launch extensive awareness drive against polluting vehicles.

Introduce sticker system to identify vehicles by age and fuels for movement regulations

- Implement scrappage policy for old trucks and buses
- Set up modern centralized vehicle inspection centres for upgraded tests

Divert truck traffic: Ensure effective diversion of non-destined trucks into city. Alternate routes need to be improved to ensure that non destined commercial traffic does not enter the city

Check overloading: Expedited installation of weigh-in-motion bridges / machines (WIM) at entry points of the city. As per the CMVR, a penalty of 10 times the applicable rate for over-loaded vehicles is applicable.

Intra-state freight transport plan: Submit plan for inter- and intra-state transport sector for short term, mid-term and long term action points to improve rail-based freight traffic to reduce dependence on trucks.



Link with mobility management



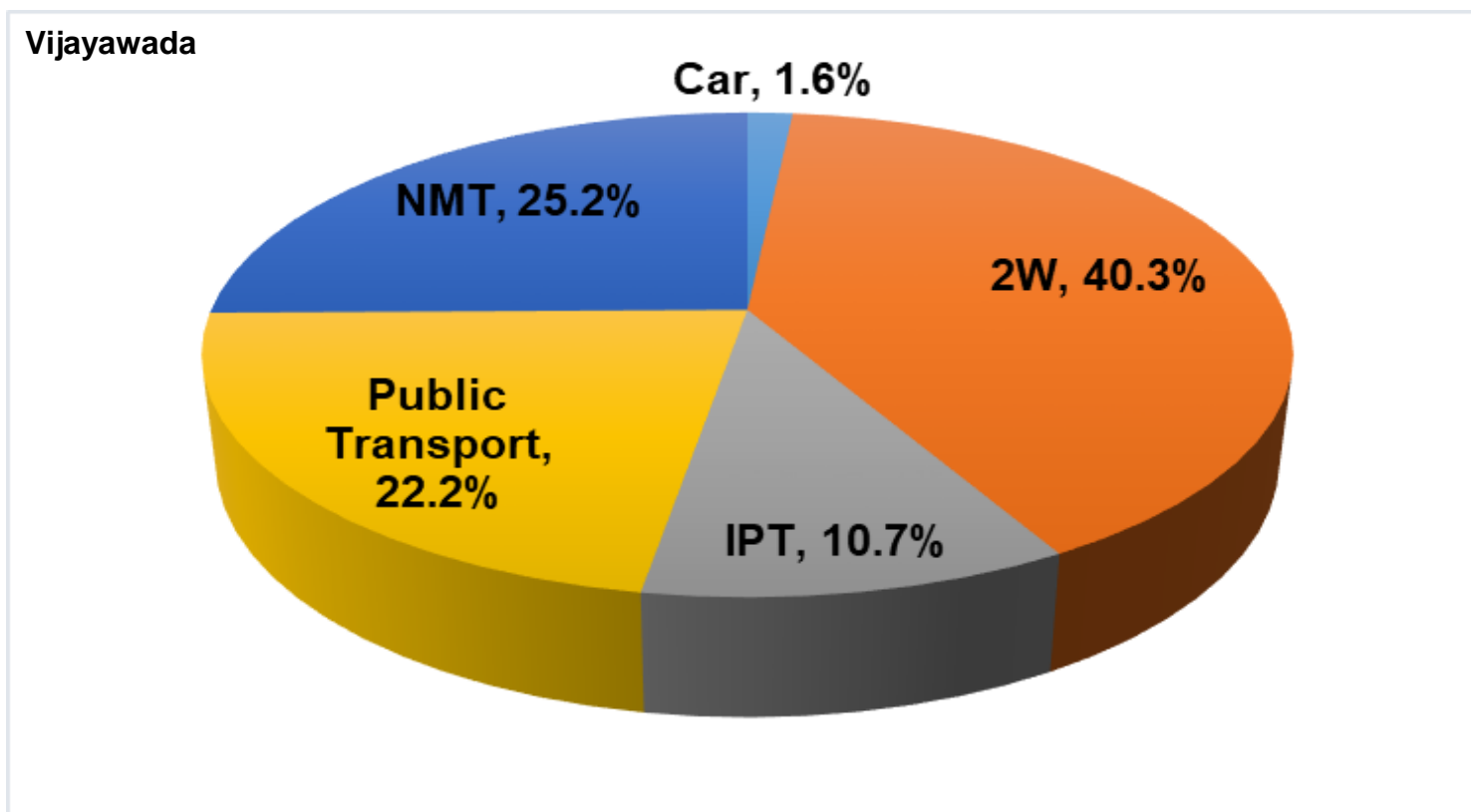
Cars occupy more road space, carry fewer people, pollute more, guzzle more fuel.

They edge out public transport users, pedestrians, bicycles, cycle rickshaws ..



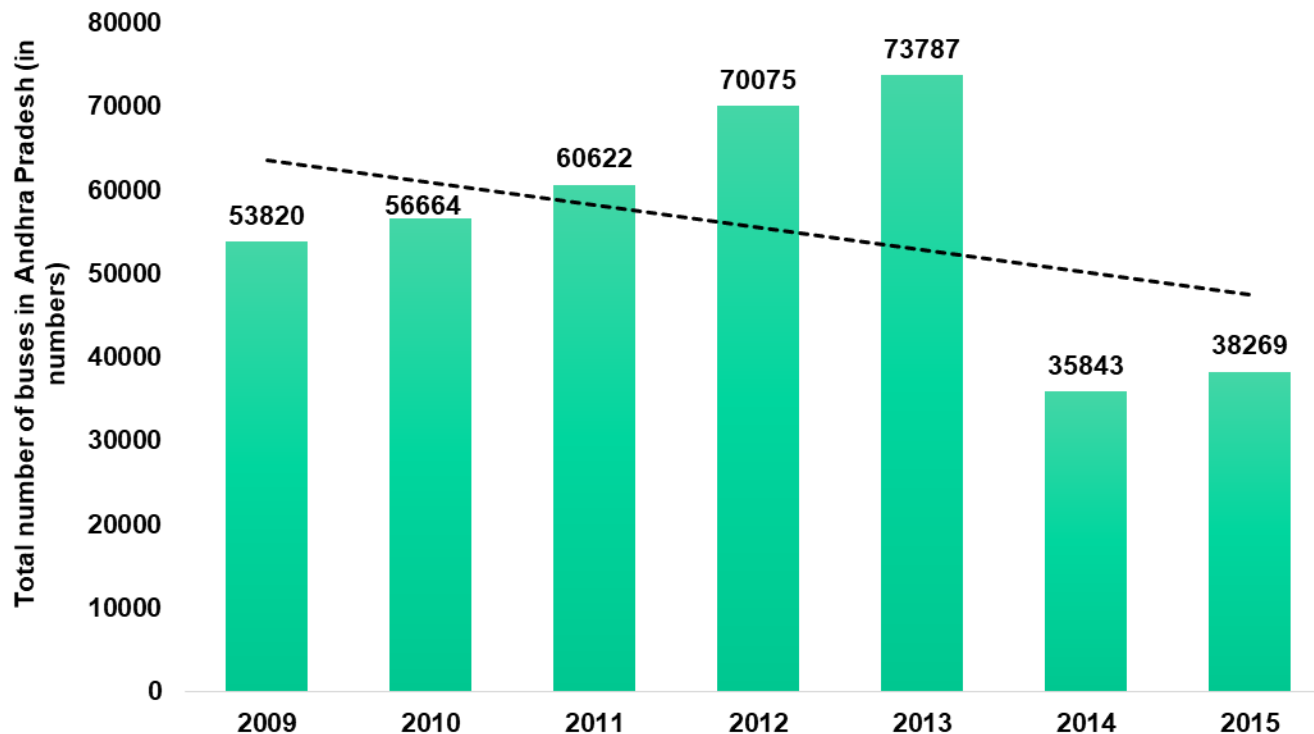
Modal Share of Vijayawada

2017: Good modal share for public transport, NMT, and para transit: 57.4%. Protect and improve this baseline
2 wheelers dominate – 40.3%





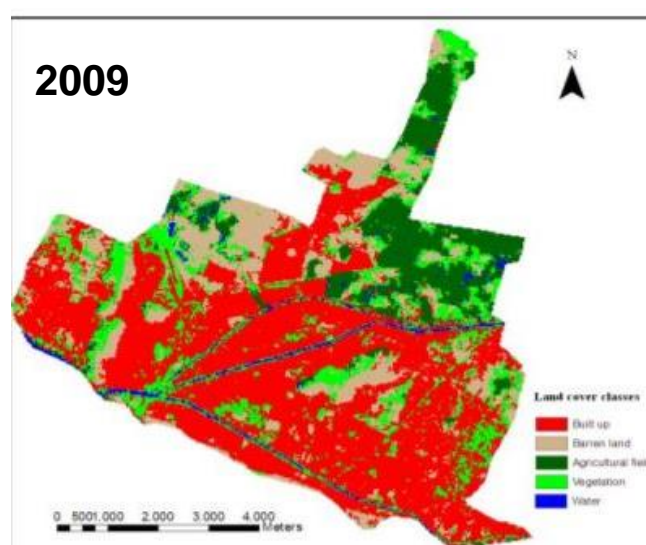
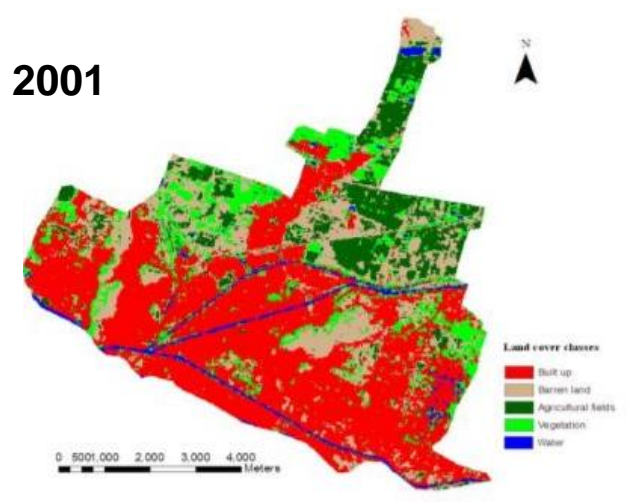
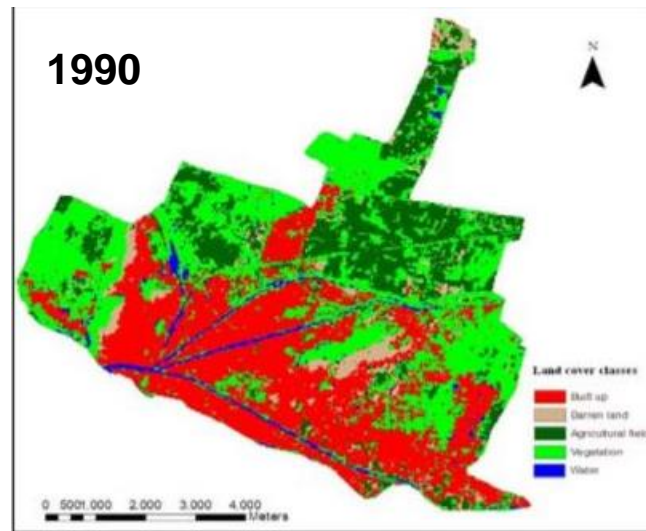
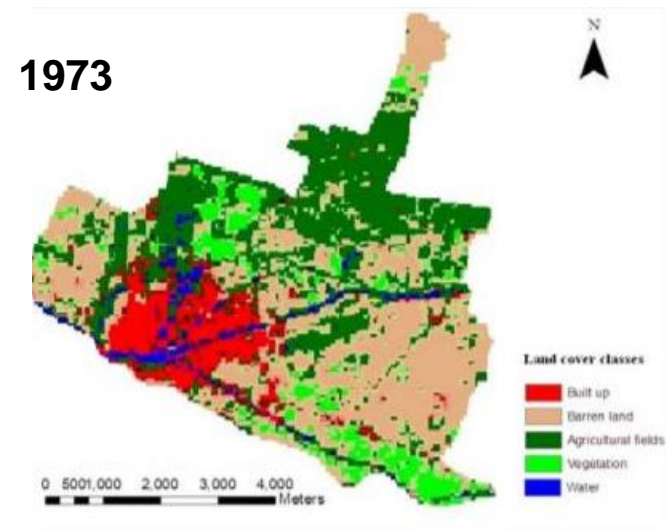
Poor State of Public Transport: Declining City Bus Service



- City grows but there is a sharp decline in Bus numbers. From 73787 to 35834.
- A **29 per cent decline** in the number of buses in the state
- Pushes people more to use personal vehicle.
- Very poor city-based data



Sprawling City: Vijayawada



- City sprawling: increase in trip length.
- Increases the dependence in personal vehicle.
- Most growth outside municipal limits



Who pollutes and guzzles more from urban commute?



Cities under scanner

Megacities-- Delhi, Mumbai, Kolkata, Chennai, Bengaluru
Hyderabad

Metropolitan cities: -Ahmedabad, Pune, Jaipur, Lucknow,
Kochi, Bhopal, Vijaywada Chandigarh

How are cities coping to reduce emissions and energy use from urban commute?

- Particulate matter
- Nitrogen oxides
- Heat-trapping carbon dioxide
- Energy consumption



What parameters influence energy use and emissions from urban commute?



Parameters that require policy focus

- Population – Planning for number of people
- Per person trip generation and volume of daily travel trips
- Average trip length by modes of transport
- Share of different modes in all motorised trips
- Average distances that modes cover and total kilometers they travel
- Level of vehicle technology and fuel quality

Challenges of such assessment

- Lack of official data base
- Mobility plans, Census of 2011, project reports, research studies
- Better data may modify ranking but the overall message from ranking will not change



What is this ranking?



Cities have been ranked based on two approaches:

- i) Ranking based on overall aggregated emissions and energy use from urban commute:** Based on combined score for all parameters – establishes the overall position of all cities
- ii) Ranking based on per trip emissions in cities:** A smaller city may have lower overall pollution but may have high emissions per trip due to a polluting mode. Emission is influenced by the mode of travel for a trip we make and the level of its technology and fuel quality. This is a better indicator to plan remedial measure

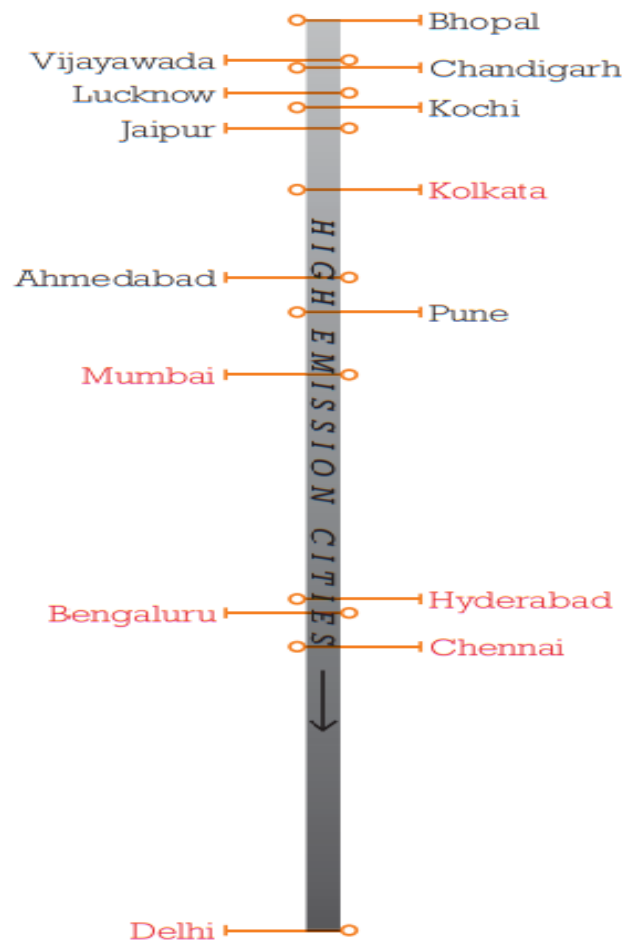
- **Where are our cities in this race?**



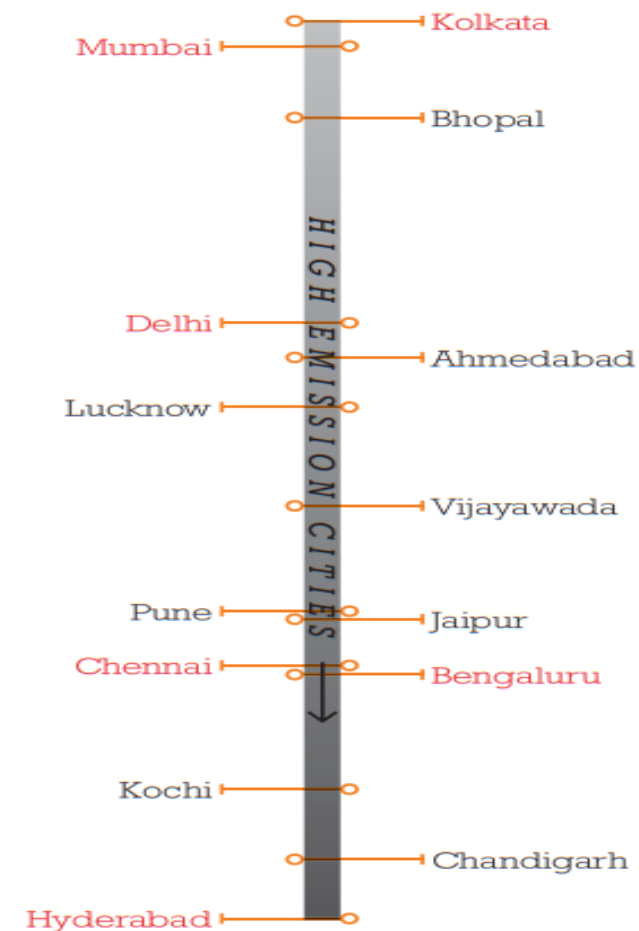
Comprehensive Ranking of the Cities (All Modes)



Based on overall emissions and energy consumption



Based on per travel trip emissions and energy consumption





The rider

From a public policy stand-point, it is important to recognize that the difference between cities in terms of emissions of toxic and warming gases and transport energy use, **is not a matter of chance.**

It is a matter of choice—a result of conscious decision-making and prioritization related to sustainable modes, compact urban form and road design, and transportation planning, that influence commuting choices of the masses.



The larger the city, the higher the trip generation



(Per capita trip rate) 2017



- City economy, gender workforce influence trip rate and combined with population therefore the travel demand
- Megacities with high level of economic activity are at the top
- Mumbai in the lead, followed by Chennai, Kolkata and Delhi.
- Bhopal, Pune, Vijayawada, Lucknow, Kochi and Jaipur are placed in that order.

Note: *For Hyderabad, the trip rate is for Greater Hyderabad Municipal Corporation area which was constituted in 2007 and thus exhibits a non-uniform level of urban development within its boundary, possibly leading to a rather lower trip rate.



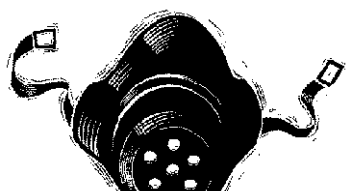
What is the average trip length of cars, two-wheelers and taxis/ autos in cities



■ Average trip length (ATL) of intermediate public transport (IPT)—taxis or autorickshaws (km)
■ Average trip length (ATL) of two-wheelers (km)
■ Average trip length (ATL) of cars (km)



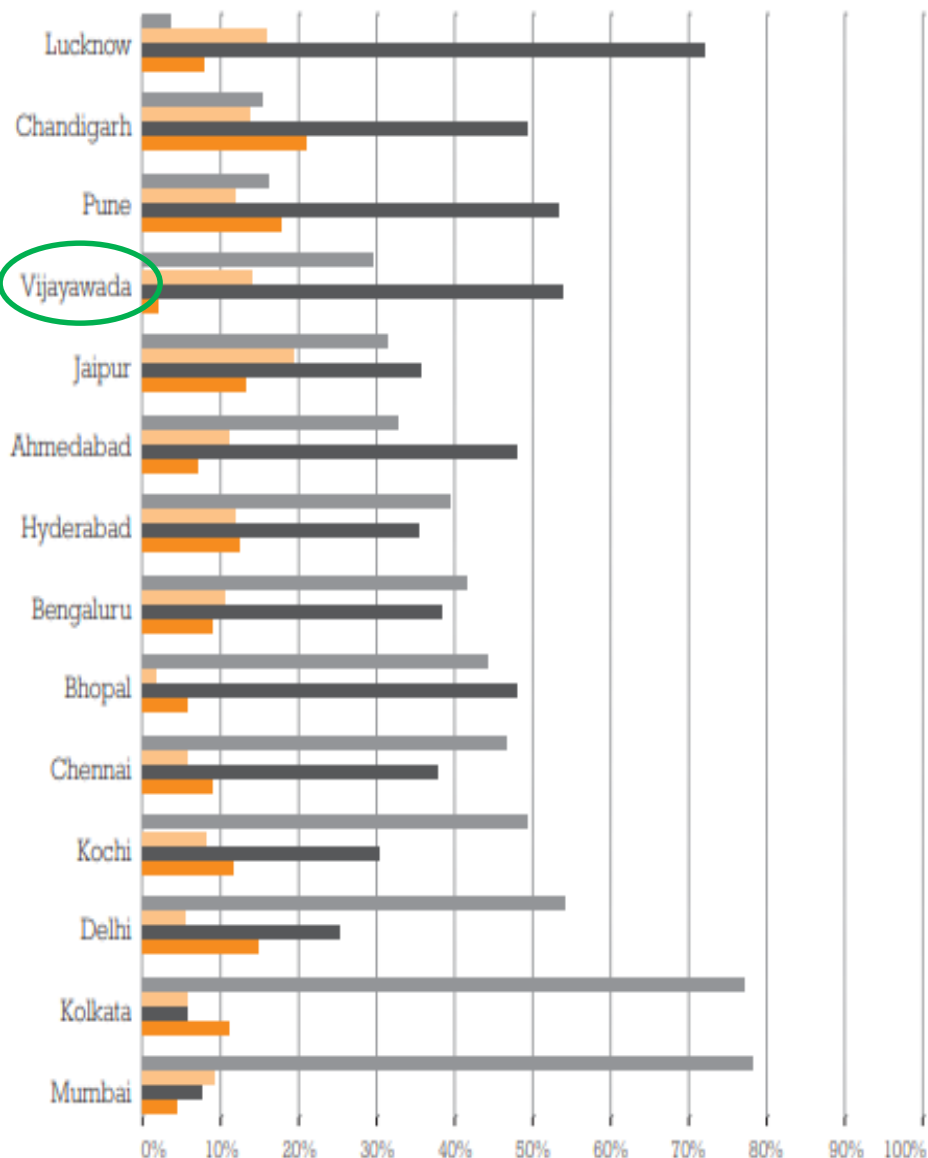
- Mumbai, Chennai, Delhi Hyderabad: -- high average trip length.
- Metropolitan cities of Kochi and Vijayawada: on the higher side (e.g. twin cities of Kochi—Ernakulam)
- **Kolkata, - a megacity, but with smallest average trip length among 14 cities.**



Share of different modes of transport in motorized trips



■ Public transport ■ IPT ■ Two-wheelers ■ Cars



- **Mega cities:** Public transport share higher; has the highest personal vehicle dependence for work trips-- Hyderabad, Bengaluru, Chennai and Delhi, with Mumbai and Kolkata bucking the trend.
- **Metropolitan cities:** Share of personal vehicle usage high -- Close to 80 per cent in Chandigarh; Lucknow, Ahmedabad and Jaipur at 70, 65 and 60 per cent respectively.
- Two-wheeler usage very high

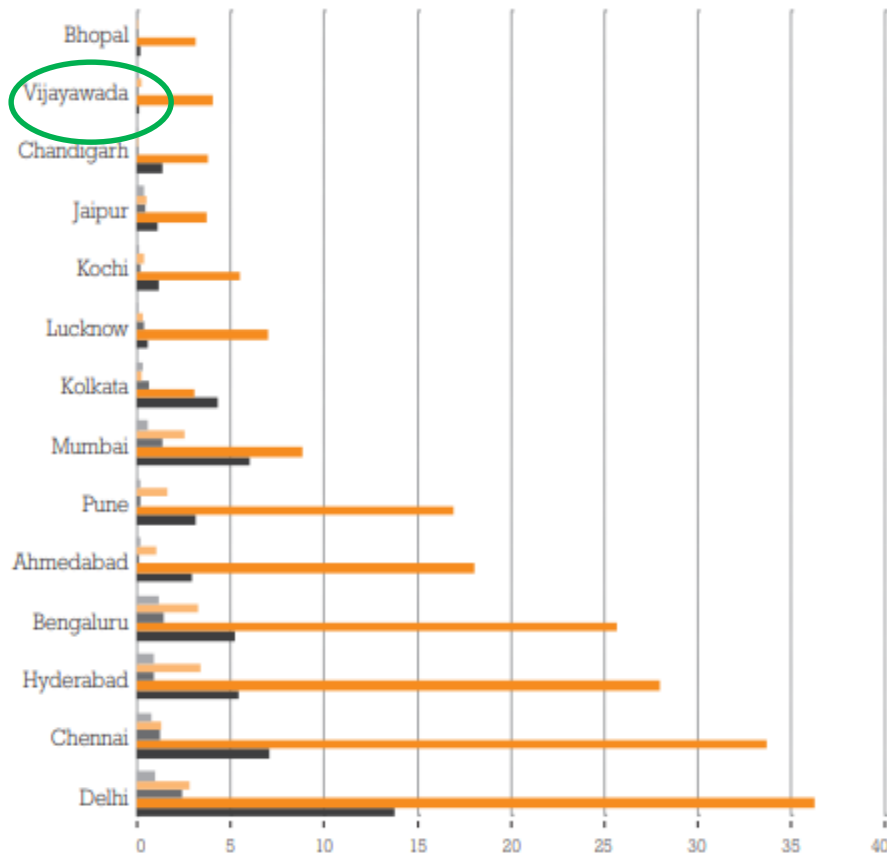


Average distance travelled by different modes of transport



Personal vehicles dominate the daily distance travelled in all the cities.

■ VKT STU buses (million km/day) ■ VKT 3-wheelers (million km/day) ■ VKT taxis (million km/day)
■ VKT two-wheelers (million km/day) ■ VKT cars (million km/day)



VKT: Vehicular kilometres travelled

Source: CSE analysis

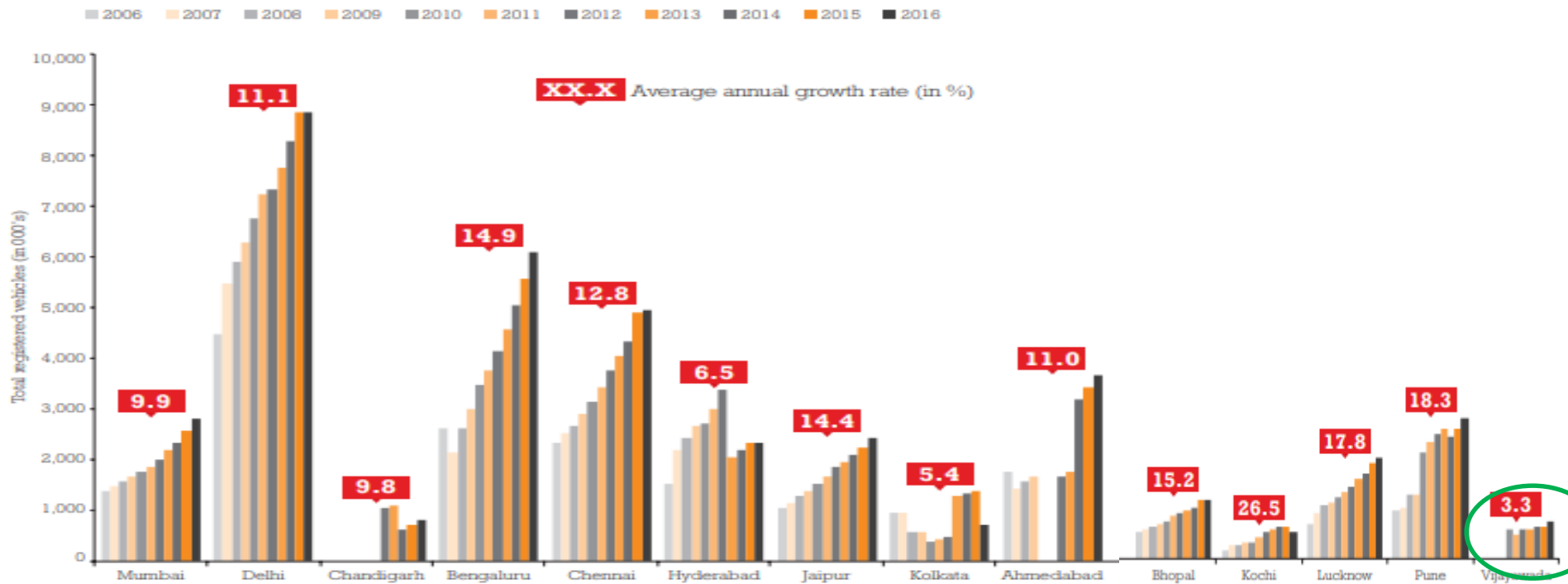
- Two-wheelers travel the maximum, -- in Delhi, Chennai, Hyderabad and Bengaluru.
- Kolkata and Mumbai, -- lowest share of personal vehicle trips in terms of total kilometres travelled.
- Metropolitan cities -- personal vehicles dominate



Levels Of Motorization in Different Cities



Trend in total registered vehicles and average annual growth rate in the 14 cities (2006–16)



- Mega cities have very high vehicle stock
- Metropolitan cities with smaller base have recorded very high growth rate



Total particulate emission load from urban commuting in the 14 cities (kg per day)



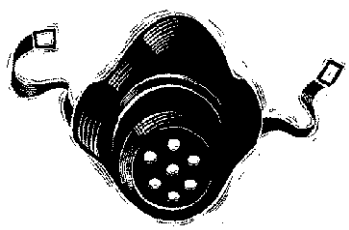
Particulate load from urban commuting in **Bhopal** is 11 times lower than **Delhi**.





Particulate emission load per trip from private and public modes of transport (in g per year)

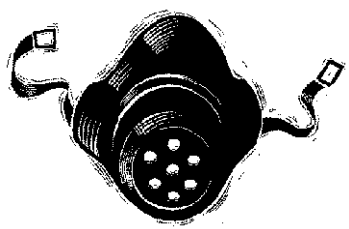




Total NO₂ emission load from urban commuting in the 14 cities (kg per day)



- jhgjhjhjhg



Nitrogen oxide emission load per trip from private and public modes of transport (in g per year)



■ Per trip (private transport) NO_x emission load
■ Per trip (sustainable modes, including public and non-motorized transport) NO_x emission load





Heat Trapping Gases increase Climate Risk in Cities



CO2 emission load from urban commuting in the 14 cities (in tonnes per day)

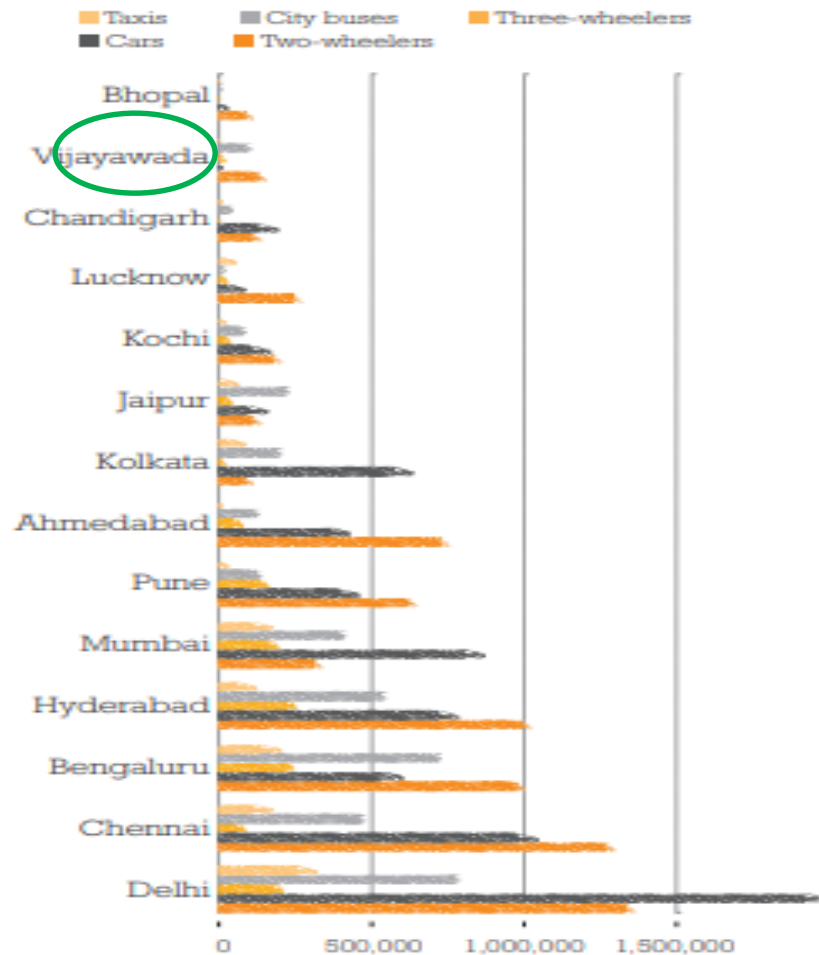




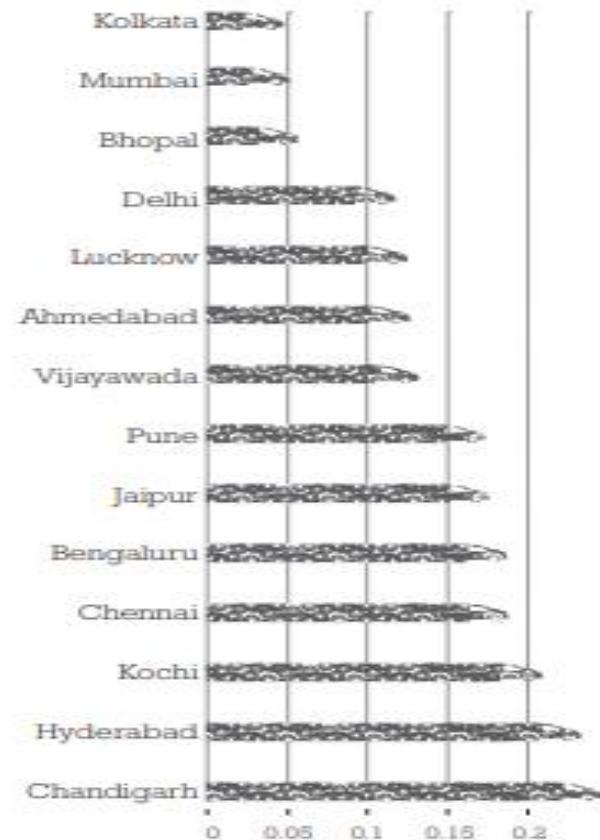
Heat Trapping Gases increase Climate Risk in Cities



CO2 emission load from different modes of transport (in tonnes per day)

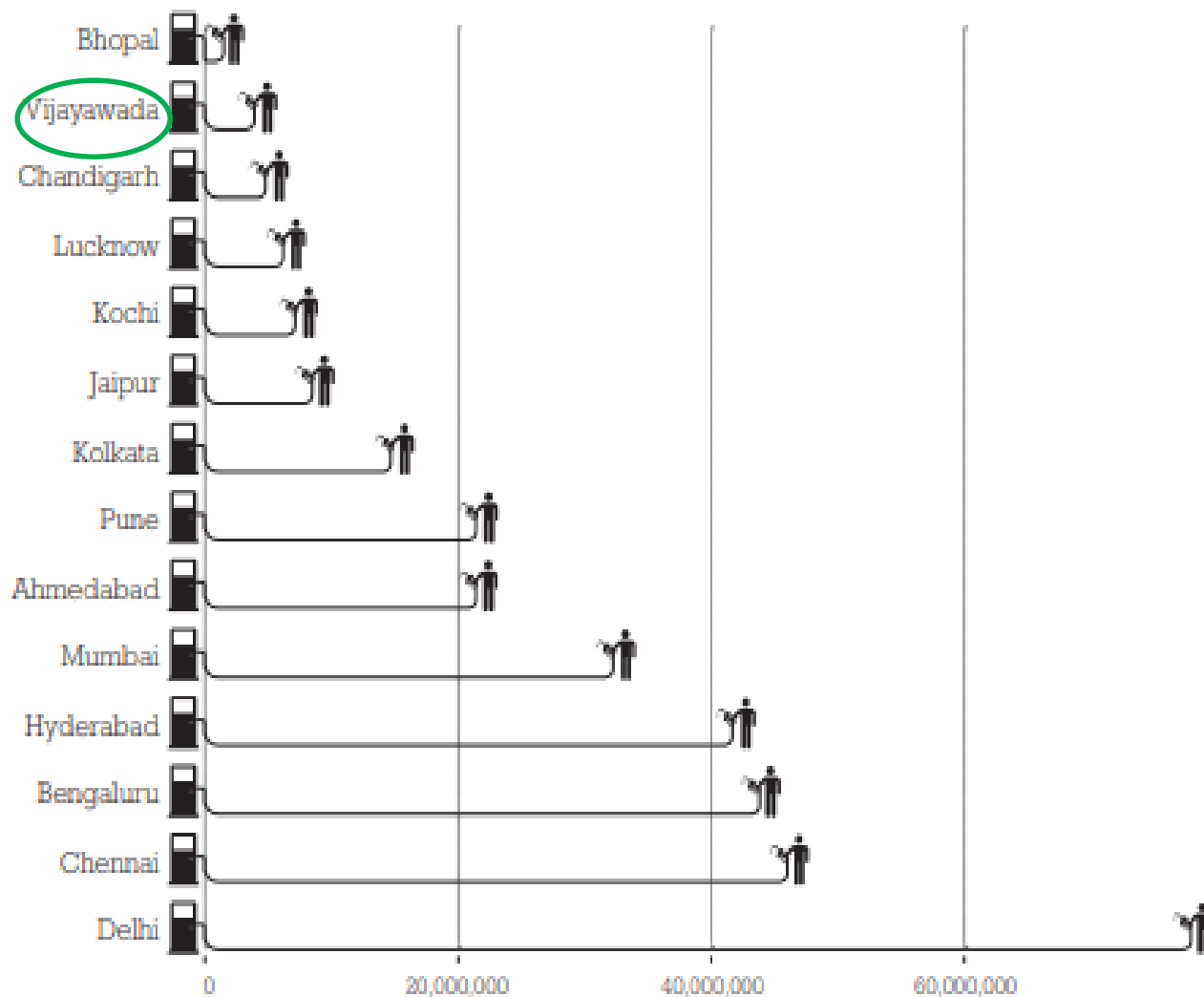


Per trip CO2 emission load in cities (kg)





Energy consumption for urban commuting in the 14 cities (in MJoules per day)

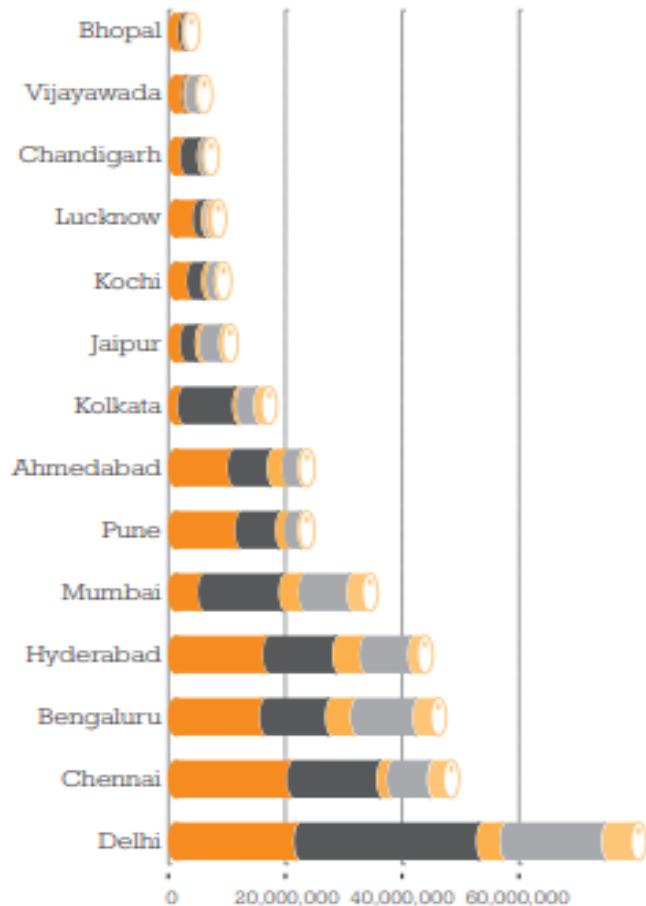




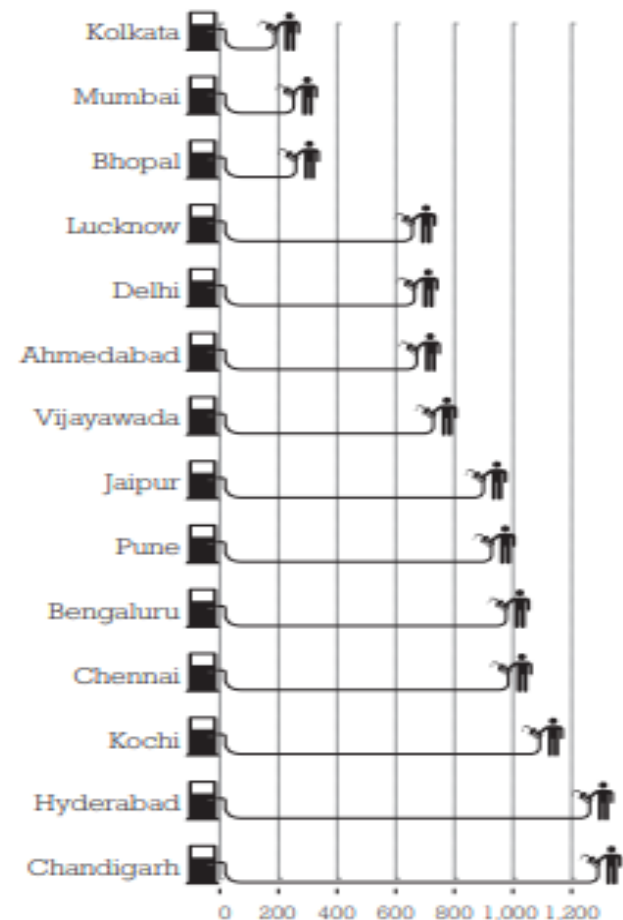
Maximum Energy guzzler-- Cars and two-wheelers



Mode-wise distribution of energy consumption
(in MJoules per day)



Per trip energy consumption in cities
(in MJoules per year)



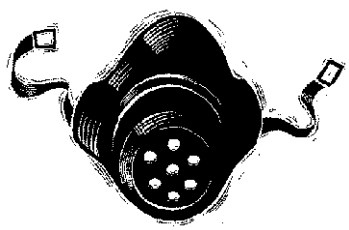


Public transport strategy weak



No strategy for improving public transport. No plan for improving city bus service. Using retired old (at least 10 years old) luxury buses as city bus.

Vijayawada has 15 km of BRT route, but it is no longer operational.



Amaravati setting sustainable principles; Need template for all cities



Amaravati

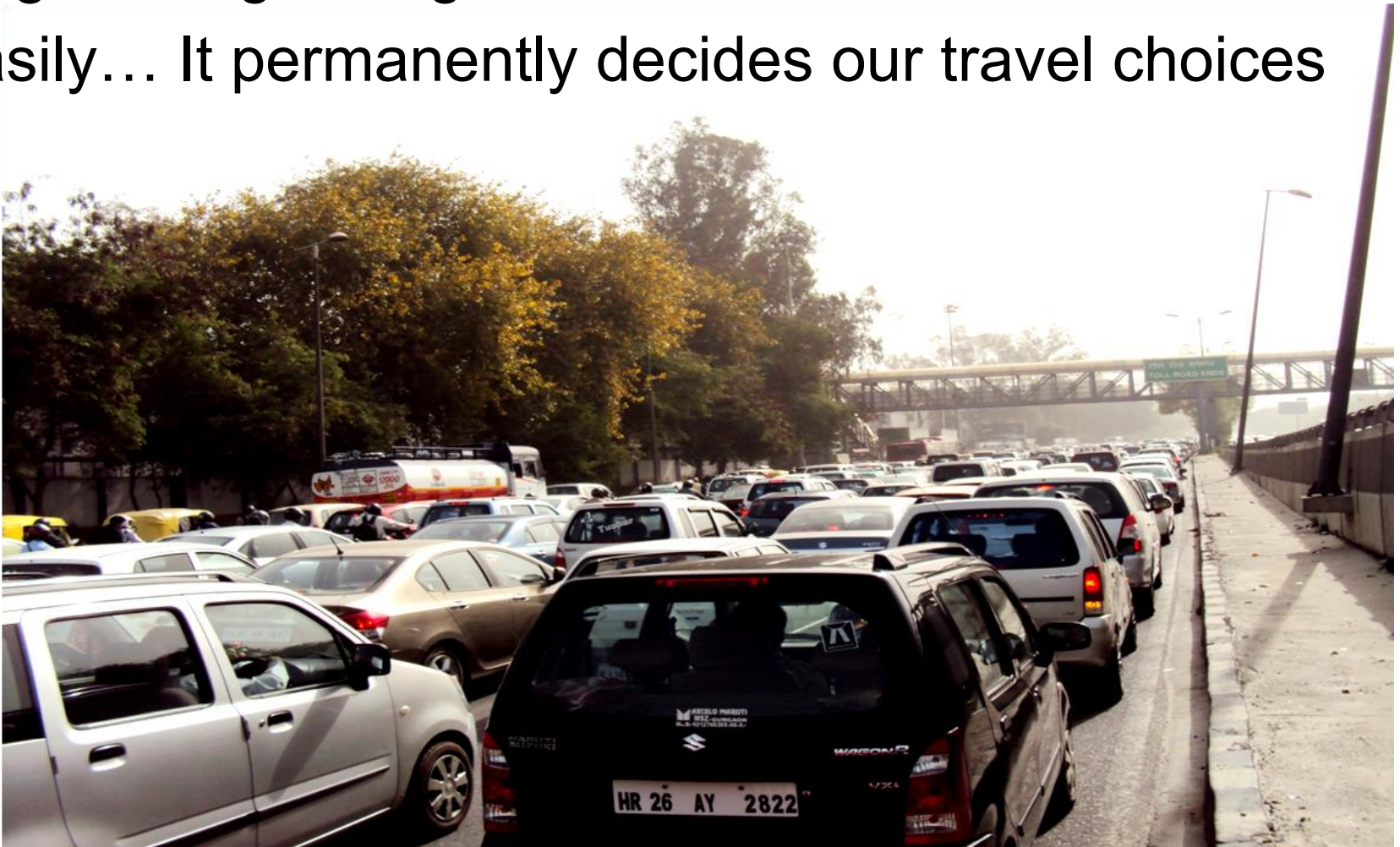
- **Targeted Public Transport** by 2050 - - **70% across the city** and **80% within CBD**
- **City-wide BRT and MRT network**
- **Hierarchical NMT Network**
 - Primary network of city parks along various natural features
 - Secondary network of neighbourhood parks along linear parks and storm water drain
- **Restrictive parking in areas served by public transport**
- **Layering of differential parking fee** corresponding to duration and area used
- **Park and Ride service**
- **Parking norms** and standards for **different land-use**
- **These principles not integrated with the clean air action plan of other cities**



Car centric road design locks in enormous pollution



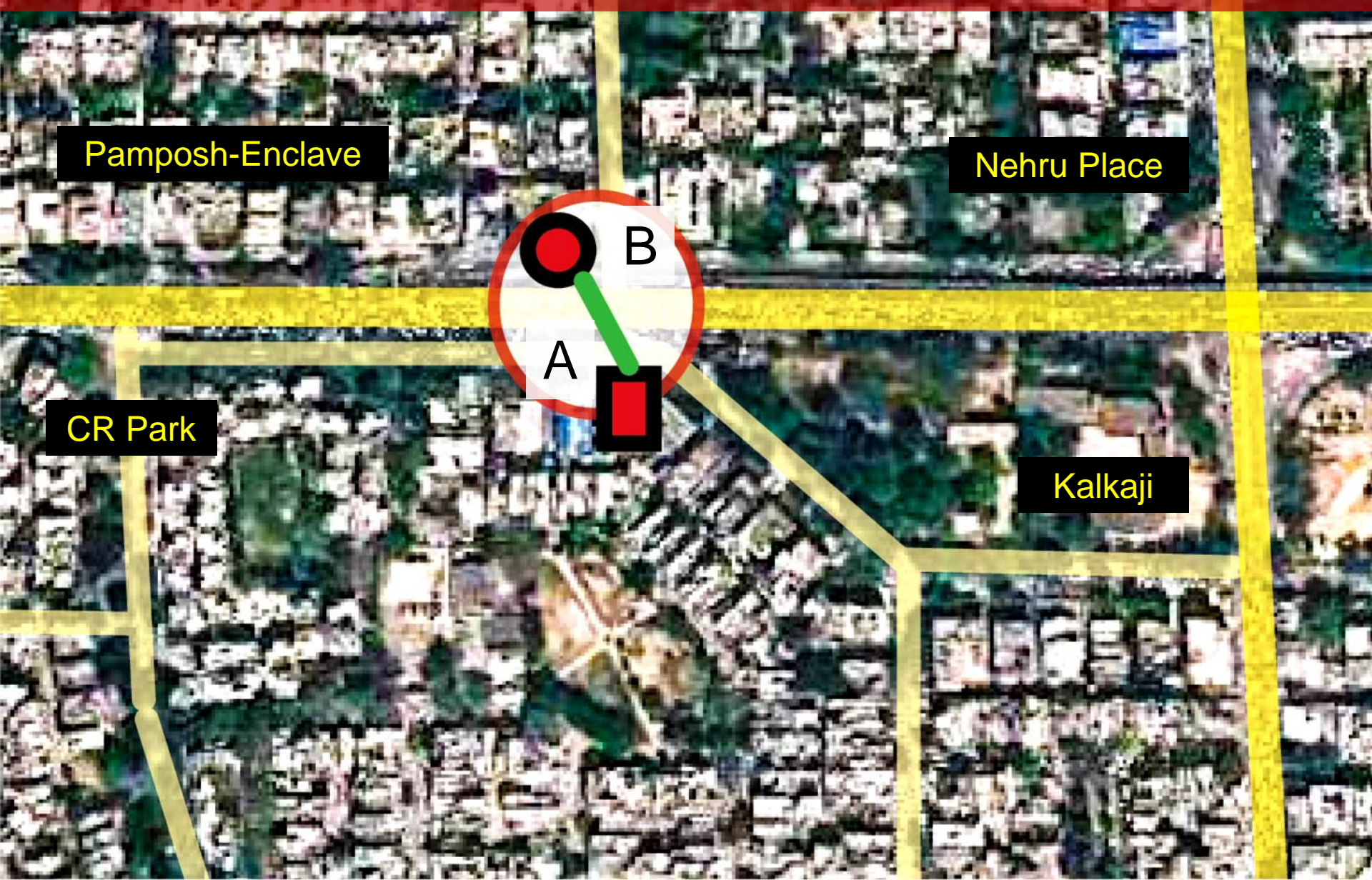
Engineering changes once made cannot be reversed easily... It permanently decides our travel choices



Case Study – Outer Ring Road (Nehru Place Flyover)

Travelling from A to B

Originally 30M across the road



Pamposh-Enclave

Nehru Place

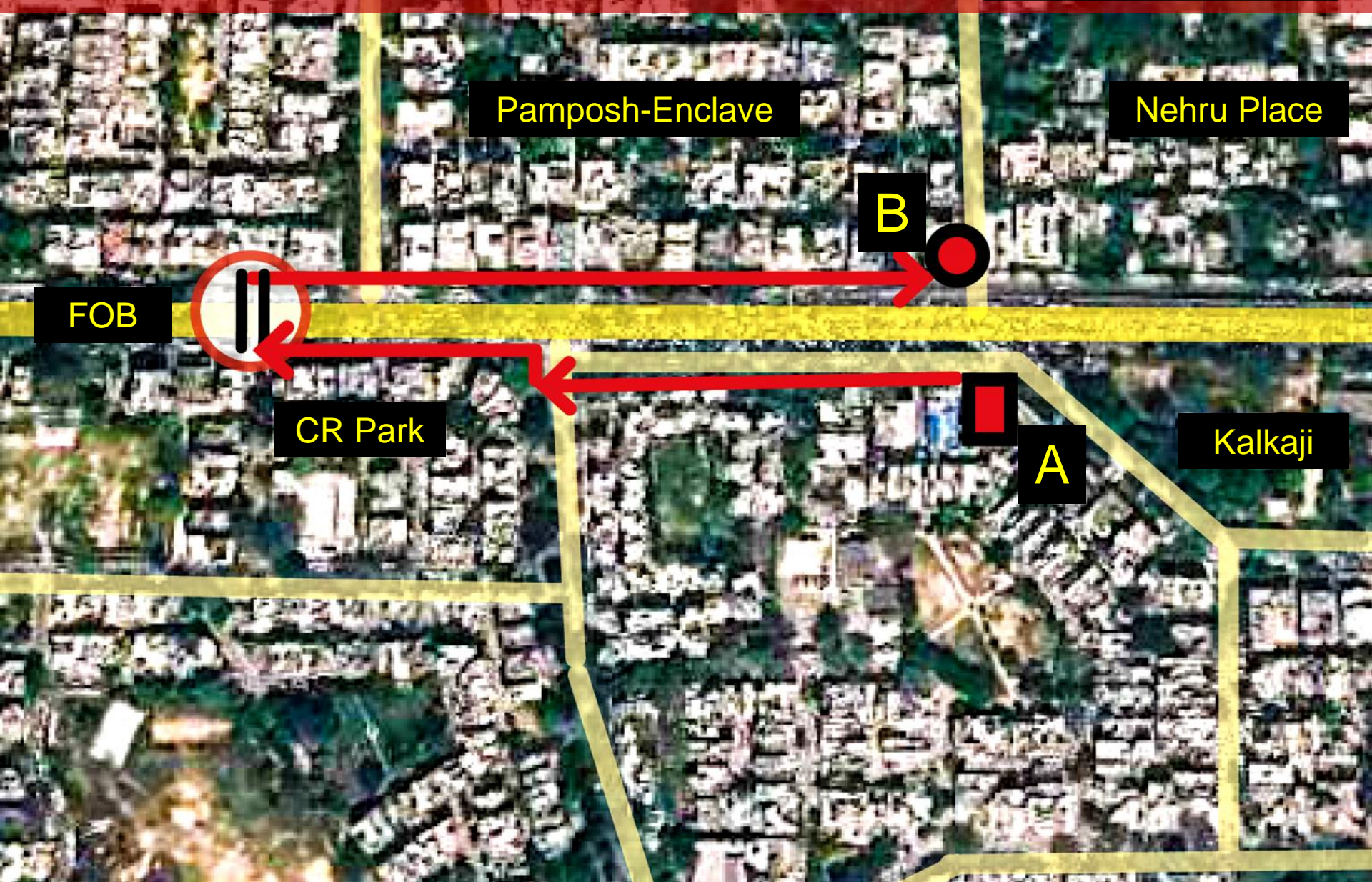
CR Park

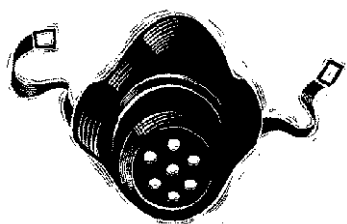
Kalkaji

Case Study – Outer Ring Road (Nehru Place Flyover)

Travelling from A to B – Pedestrian Route 1

1000M via FOB





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



Assess cities based on the stage of improvement in bus service



V

City is providing **integrated** bus service that is **highly efficient, sufficient, reliable, affordable and segregated with advanced passenger info service.**

IV

City provides bus service that is **sufficient**. **Innovation in augmenting quality of bus service, protects right of way (BRT), optimal use of infrastructure.etc.**

III

City provides bus service that is **insufficient but optimally utilizes its existing infrastructure.** Efficiency and reliability can be improved

II

City provides bus service that is **insufficient and sub-optimally utilizes its existing infrastructure.** Overall the service is stressed and unreliable.

I

City provides bus service that is **insufficient and poorly utilizes its existing infrastructure.** The service is inefficient and unreliable.



Setting benchmark for bus Service improvement



V

Bus service per 3 minutes during peak hour and 5-7 minutes during non -peak hour; serves entire population effectively; uses advanced passenger information system for reliable services; quality service, dedicated right of way, well integrated with other modes; affordable; runs on clean fuels

IV

Bus service per 3 minutes during peak hour and 5-7 minutes during non -peak hour; serves entire population effectively; uses advanced passenger information system for reliable services; quality service, dedicated right of way, well integrated with other modes; affordable; runs on clean fuels

III

Demonstrates substantial improvement from baseline on fleet utilisation; utilisation of passenger carrying capacity; route rationalisation 'for geographical and population coverage; improves operated kilometer; starts enforcing bus lanes and provide dedicated right of way, passenger information and ITS application

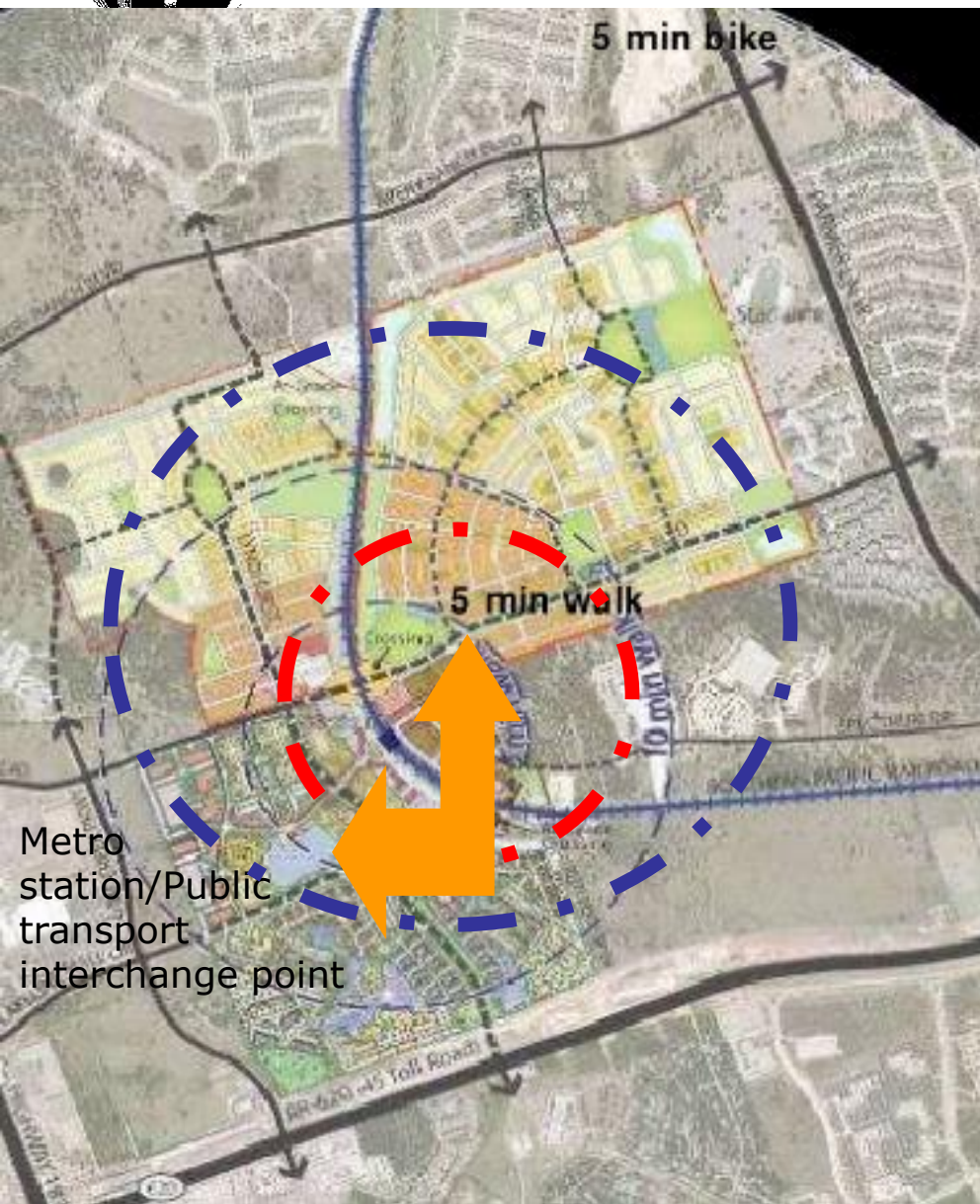
II

Demonstrates improvement from baseline on fleet utilisation; utilisation of passenger carrying capacity; route rationalisation 'for geographical and population coverage; improves operated kilometer; starts enforcing bus lanes

I

Inadequate and unreliable services. Poor fleet utilisation; underutilisation of passenger carrying capacity; no route rationalisation and poor geographical and population coverage; Operated kilometer are much less than scheduled kilometer; no dedicated right of way for buses

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.



Unsafe walking access....discourage low/zero pollution modes



Poorly designed walking infrastructure

- 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.



Delhi: wrong road design force people to cross in unsafe manner. This compromises public transport usage



Public transport needs safe walk access

In Delhi accidents near foot over bridges have increased



Street design norms can make streets safe and accessible



Connaught Place

- Implement street design guidelines



Source: CSE



Which city has highest share of public transport, walk and cycling trips?

No strategy to protect current usage of sustainable modes



V

When a city has a combined **modal share** of **more than 90 per cent** for all forms of public transport -- buses, trains, autos/taxis, and walking and cycle.

IV

When a city has combined **modal share** of **81 - 90 per cent** for all forms of public transport -- buses, trains, autos/taxis, and walking and cycle

III

When a city has combined **modal share** of between **71 -80 per cent** for all forms of public transport -- buses, trains, autos/taxis, and walking and cycle

II

When a city has combined **modal share** of between **61 -70 per cent** for all forms of public transport -- buses, trains, autos/taxis, and walking and cycle

I

When the city has **modal share** of **equal to or less than 60 per cent** for all forms of public transport -- buses, trains, autos/taxis, and walking and cycle



Walking and cycling



V

City provides **safe and dedicated** infrastructure for NMT with **zero pedestrian and cyclist fatalities. 50% of the daily trips are NMT.**

IV

City has **dedicated NMT infrastructure** and has **increased its NMT modal share over last 5 years.**

III

City has **advance NMT infrastructure with pedestrian rights** while **stablising its NMT modal share.**

II

City is **improving its NMT infrastructure** and has adopted pedestrian and cycling friendly schemes.

I

City provides **minimal NMT infrastructure** and has high pedestrian and cyclist fatalities.



Parking: Current proposal



Action Listed	Status
Prevent parking of vehicle in non-designated area	Features in all plan deadline for implementation is December 2019.
Development of Multi layered parking	Features in Visakhapatnam plan. Deadline for implementation is December 2019.



Why current parking policy will lock in more air pollution?



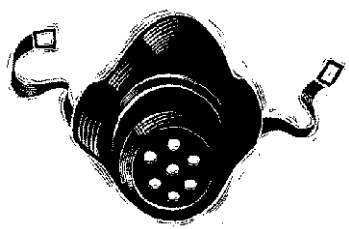
Unlimited and free parking incites more car ownership and usage that cause more pollution

Wasteful use: 90 to 95% of the time a car is parked and makes enormous demand on land

Inequitous use of land A car gets more space (23-26 sqm) to park than poor households get land to make houses (18-25 sq m).

Parking takes away space from other important development, walkways from pedestrians, and green areas





Parking demand in AP cities



Pressure on land: 95% of a vehicle's lifetime they remain parked somewhere. This creates enormous demand for urban land. Motorisation reflects demand for parking spaces (example for cars and jeeps) and it can be equated to number of football fields

	Number of Cars & Jeeps on road (as on March 31 st 2016)	Parking requirement in terms of no. of football fields (as on March 31 st 2016)
Vijayawada	60,549	139
Visakhapatnam	1,06,231	244
Guntur	52,958	122
Nellore	32,925	76
Kurnool	27,553	63

Vehicle Registration data sources:

- (1) Government Of Andhra Pradesh 2017, *Statistical Abstract of Andhra Pradesh 2016*, Number Of Motor Vehicles Of Different Classes And Categories on Road (As On 31st March, 2016), <https://desap.cgg.gov.in/jsp/pdf/SA-2016.pdf>
- (2) Ministry Of Road Transport & Highways 2018, Road Transport Year Book (2015-16), <http://morth.nic.in/showfile.asp?lid=3141>



Parking and clean air

It is still not clear to many how parking management and restraints can reduce air pollution and give public health benefits

Boston froze their parking requirements at a level that is only 10 per cent higher than the 1973 level to meet the Federal clean air standards.

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

Amsterdam -parking fees expanded to meet EU directives regarding NO₂ and PM₁₀ emissions. Car plate numbers are registered with emissions information. Trucks are allowed to unload for a maximum of 15 minutes in spots where they are not allowed to park

Zurich considers total NO₂ emissions when determining the amount of parking to be allowed.



Global parking pricing levers



Japan

Proof of parking regulations and ban on night parking on streets: Vehicle owner procures a “garage certificate” from the Police department for vehicle registration. This is re-issued in case of change of ownership or address .

Singapore and Hong Kong have stringent approaches towards restraining car ownership and usage.

Hong Kong has been more effective in restraining car ownership – about 60 cars per 1000 people vs 110 cars per 1000 people in Singapore. Singapore has three times more private car kilometres of travel per person than Hong Kong.

This is explained by the Hong Kong’s more expensive parking.



Effectively priced parking can make a difference



No meters

Grosvenor square, London



Meters

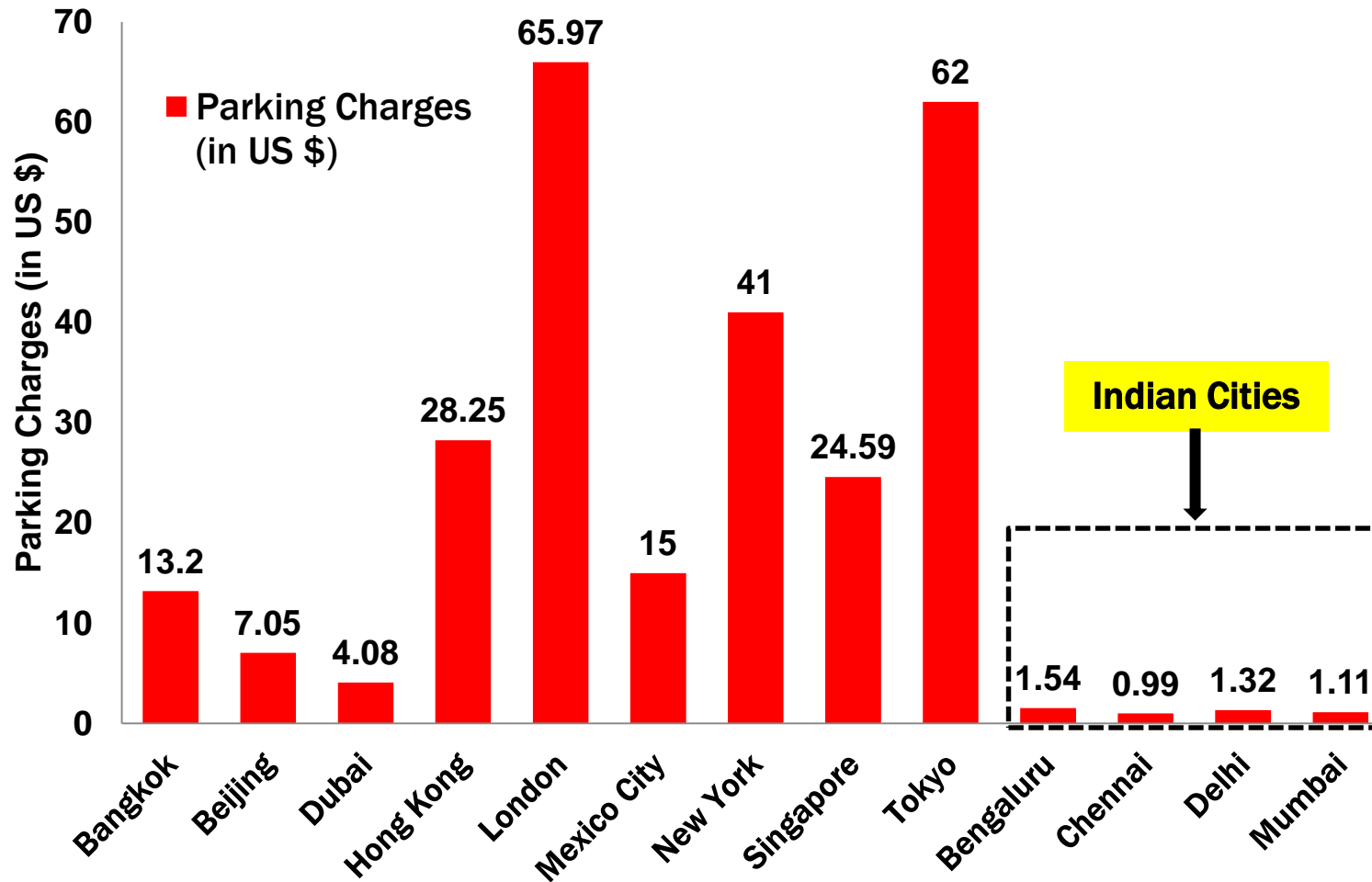


Prices quadrupled



Parking is cheapest in Indian cities

Parking charges in Indian cities are some of the lowest in the world.

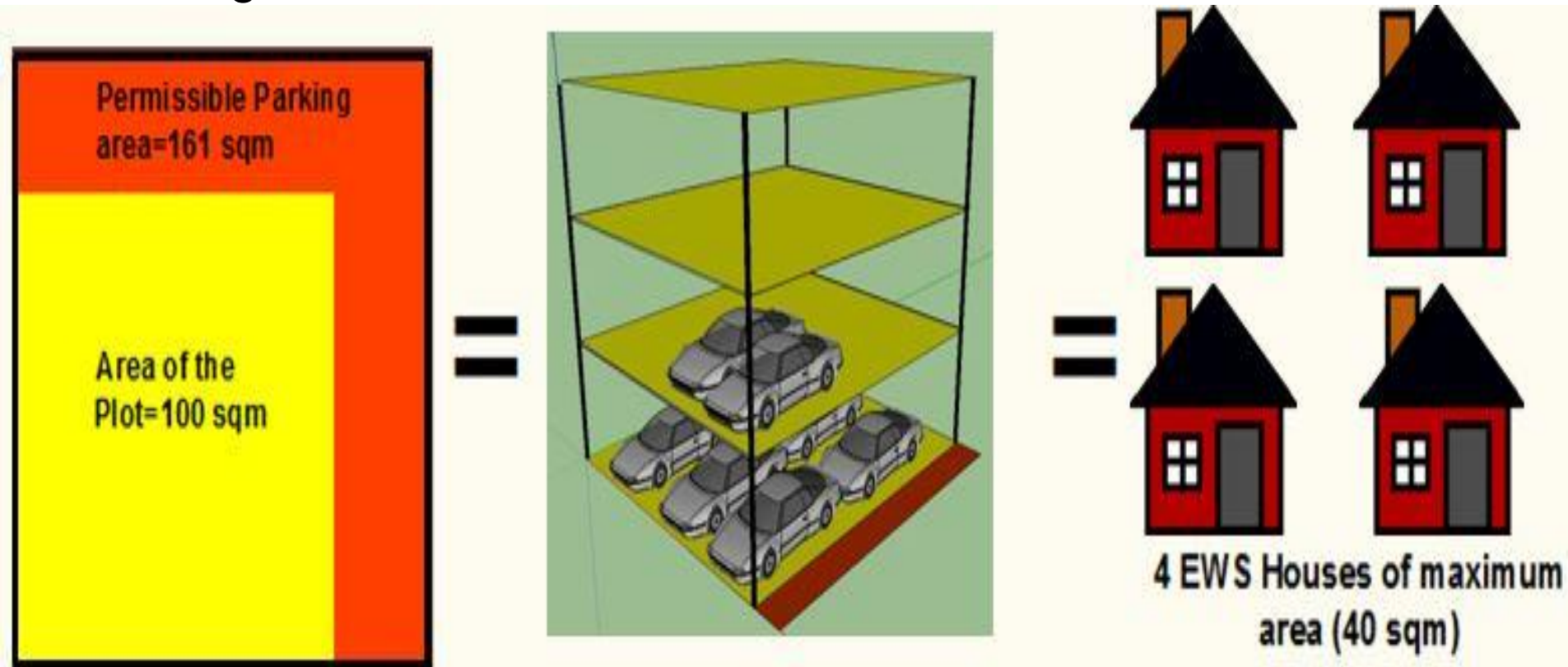




Why are we wasting so much valuable space for parking?



A 100 sqm plot built to the full allowable FAR (315 sq m) needs 161 sq m of parking space by Law - more than half. This is equal to one and half storey or space of 4 EWS dwellings....





Benchmarking action

Parking policy to restrain car usage



V

City provides **limited legal parking with a cap** and prices it effectively to **reduce car ridership and ownership.**

IV

City **limits creation of legal parking** and prices it based across all land uses on the **actual social and environmental cost associated with parking and motorisation.**

III

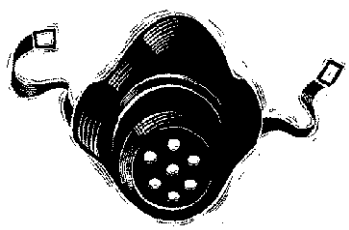
City allows **legal parking caps** and it is **regulated and priced.** Some parking restraint like proof of parking is available.

II

City allows minimum parking and prices it high and variably. There is a **fine for illegal parking.**

I

City provides unlimited parking and it is free or minimally priced to cater to increasing vehicular population. Illegal parking is unregulated.



Mobility strategies



Target share for public transport ridership should be at least 90 per cent by 2020-22

Augment bus numbers and services for each city

Carry out route rationalisation of bus routes

Reform public transport operations and implement service level benchmark

Integrate all forms of transport including BRT, conventional bus system and feeder systems

Fare integration and ensure low journey costs

Implement zonal plan for non motorised transport and pedestrian infrastructure and pedestrian plazas in targeted commercial areas

Implement bike sharing programme to improve last mile connectivity

Mandate safety and walkability audits

Enforcement of NMT lanes

Traffic impact assessment of infrastructure



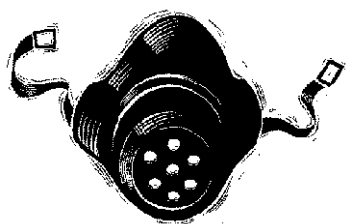
Mobility strategies



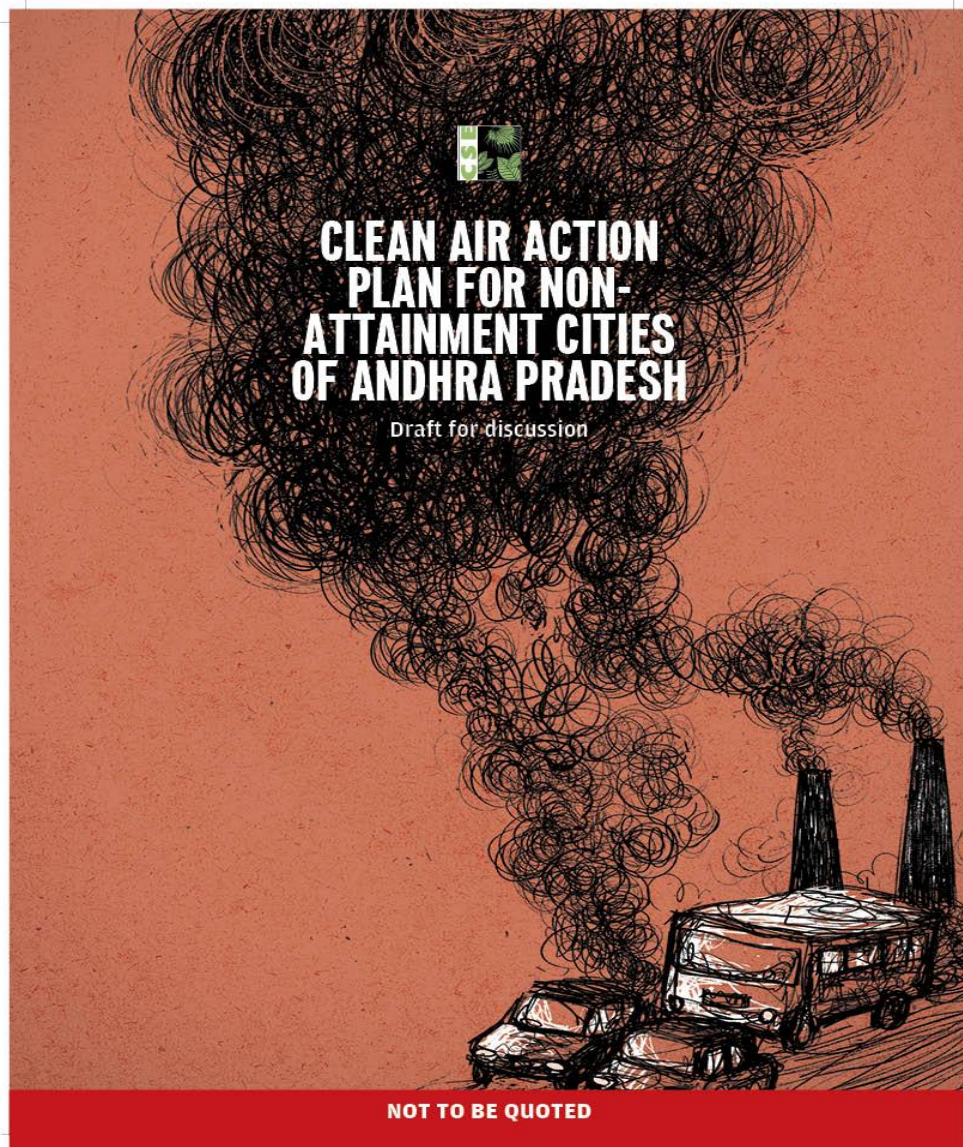
Parking area management plan for all neighbourhoods to identify and demarcate legal parking area, penalise illegal parking, residential parking permit, protect green areas, footpaths, parks, intersections, bus stops etc from parking encroachment; keep lanes free for emergency vehicles; variable parking pricing for demand management etc

Integrate urban planning with transportation planning and adopt transit oriented planning to reduce distances and motorized trip generation and also to improve sustainable modes

Need restraint measures for personal vehicle usage through parking policy, low emissions zones approach, tax measures and congestion pricing approaches.



Clean Air Action Plan for non-attainment cities of Andhra Pradesh



Anumita Roychowdhury
With Tanushree Ganguly, Ananya
Choudhury, Shambhavi Shukla

Centre for Science and Environment

***Workshop on Clean Air Planning in non-
attainment cities of Andhra Pradesh***

**Joint Initiative of Andhra Pradesh State
Pollution Control Board and Centre for
Science and Environment
Vijaywada, October 22, 2018**



Technical Session IV: Miscellaneous Combustion and Area Sources

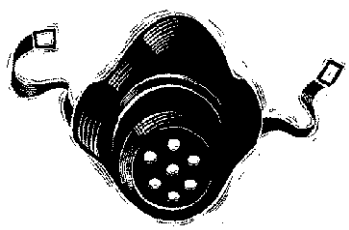


Area Sources



Area sources

- Waste/Biomass Burning
- Construction Dust
- Construction and Demolition Waste
- Domestic Emissions/Use of solid fuels
- Diesel Generator Sets
- Road Dust
- Crop burning?



Strategic gaps



- Plans include all the necessary source specific strategies.
- **Need to incorporate implementation and enforcement mechanism for the proposed action:**
For instance, to control garbage burning and to ensure that it is banned in the long-run, there should be a waste management mechanism in addition to report sightings of open burning and individuals involved being penalised.
- **Need compliance mechanism**
- **Address specific challenges of informal and unauthorised sector**



Waste burning





Measured proposed in the draft plans



Source Addressed	Actions Listed	Implementation Status
Biomass Burning	Launching extensive drive against open burning of garbage, horticultural waste, dry leaves, etc	Listed in plans for Kurnool, Guntur, Nellore
	Checking and restricting the open burning of waste	In Guntur, all agricultural waste generated is directly placed in dumpyards. In Nellore, garbage is being collected from door to door.



Measured proposed in draft plans



Source Addressed	Actions Listed	Implementation Status
Biomass/Waste Burning	Ensuring that horticultural and agricultural waste is collected and disposed properly	
	Transportation of waste in covered systems	
	Gradually, ensure a ban on open burning of municipal and solid waste	



Further refinement of strategies



Enforce a complete ban on garbage burning in the 5 cities. Evolve a monitoring mechanism for this. Take stringent action against open burning of biomass / leaves / tyres etc to control such activities

Ensure proper collection of horticulture waste (biomass) and composting-cum-gardening approach; municipal zonal offices should be responsible for controlling burning of leaves and garbage on roads / parks. All horticulture agencies should have compost pits in parks.

Mandatory segregation of waste at source and decentralised recycling and re-use strategies

Need No landfill policy -- Make households and institutions accountable for decentralised management, segregation, and payment of waste they generate; Enforce solid waste management rules

Management of existing landfills for methane extraction

Charge and penalty



Construction and demolition waste

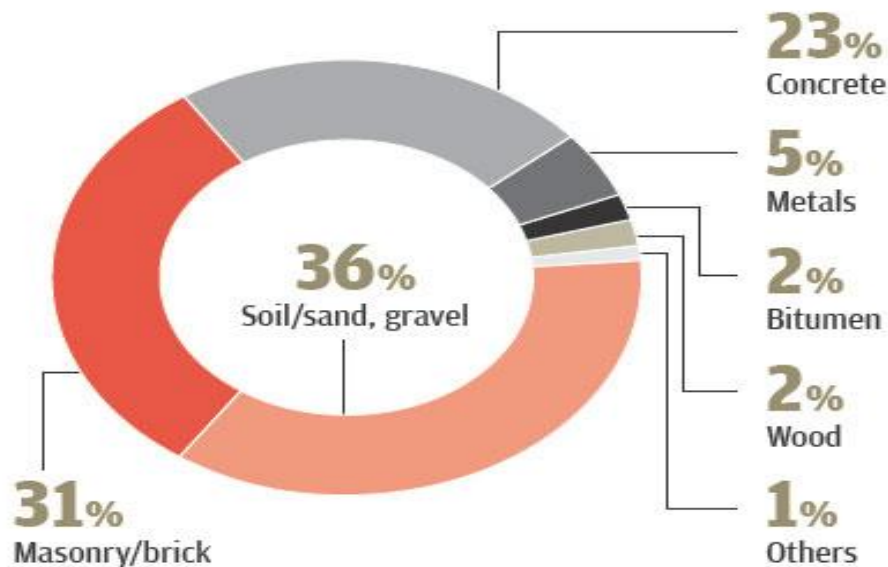


Dust Control from Construction and Demolition....



What constitutes building debris

Composition of construction and demolition waste in India as per Technology Information, Forecasting and Assessment Council



Fugitive dust from mismanaged construction and demolition (C&D) waste

Ministry of Environment and Forests and Climate Change has notified India's first ever rules construction and demolition waste management.

Bureau of Indian standards finalised specifications for recycled material

Challenge – implement new rules



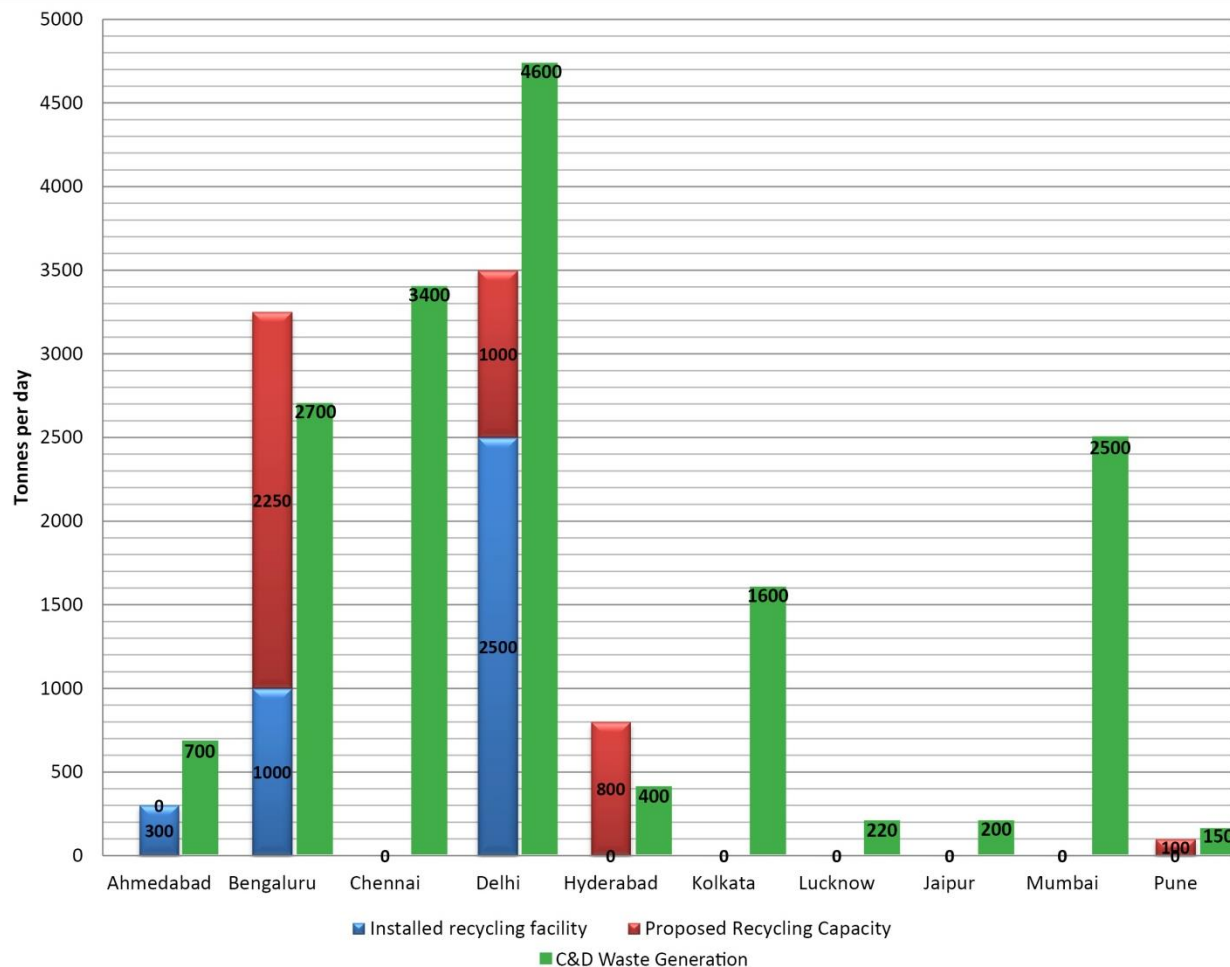
Measured proposed in draft plans



Source Addressed	Actions Listed	Implementation Status
Construction Dust and Construction and Demolition waste	Covering of construction site and transport of construction material in covered systems.	Kurnool's plan does not list construction dust as a source The municipal corporations of Guntur and Nellore have been directed to enforce the C&D waste guidelines
	Control fugitive emissions from emission handling	
	Restriction on storage of construction material alongside roads	
	Enforcement of C&D guidelines	



C&D Recycling Infrastructure



Delhi has installed capacity to recycle **50-60% of C&D Waste**
Ahmedabad -- **42%**
Bengaluru – **37%**

Government mandates use of a minimum of 2% Recycled products from construction waste in all future contracts for building works and 10 per cent recycled products for road works



Further refinement of strategies



Prepare detailed checklist for inspection of dust control in construction sites (buildings and infrastructure). Regulators should inspect construction practices, against a comprehensive checklist

Impose penalty for non-compliance (per day basis)

Guidelines for material handling

In-situ segregation of C&D waste and in-situ recycling

Developers to be made accountable for transport, proper disposal of C&D waste. It should be obligatory on part of the developers to provide evidence of debris on-site recycling and/or disposal at designated sites

Set up facilities for recycling of C&D waste

Implement central C&D Rules and Regulations; Mandate use of recycled material in building and infrastructure construction

The governments/ULBs must ensure measures are taken to mitigate dust pollution from construction. The preventive measures should be strictly enforced.



Dust Control from construction and demolition waste



V City has **developed a circular economy of waste**. It has minimised generation, effectively collects, recycles and uses all the generated waste.

IV City has dedicated C&D waste management system and infrastructure in place. It **collects and recycles most of the waste generated**.

III City has developed a dedicated system of collection and disposal of C&D waste and **it is implemented as pilot in some portion of the city**.

II City has initiated a dedicated system of C&D waste collection and disposal. But it has **not piloted the system**.

I City does not have a dedicated C&D waste policy and its **infrastructure to effectively handle and utilize C&D waste is minimal**.



Solid fuels for cooking and Diesel generator sets Road dust

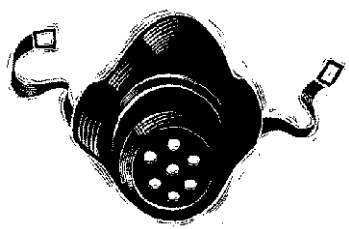




Measured proposed in current draft plans



Source Addressed	Actions Listed	Implementation Status
Use of solid fuels	Maximise LPG/CNG usage at domestic and commercial set ups to achieve a target of 100 per cent coverage	
Diesel Generator sets	Compliance of guidelines on D.G. sets and action against violation	



Access to clean energy

Health Ministry Committee -- Make clean fuel available: Make LPG affordable and accessible for the poor. Restructure subsidies for clean fuel to target poor better. Recommends mission on smokeless villages

Government of India's 'Give It Up' campaign -- Households that earn more than Rs. 10 lakh per annum to surrender LPG subsidy. To cover 1.5 crore households below poverty line in 2016-17 and 5 crore more below poverty line households in next two years. To achieve universal coverage of cooking gas. About 75 lakh households have given up LPG subsidies.

Delhi: about 90% households have access to LPG. Kerosene use fallen to 5% of households (But migrants are not accounted for)

Energy access and electricity for cooking

Biogas: encourage innovation -- Address last mile problems to ensure quicker uptake

Need rural air quality monitoring



Further refinement of strategies



Maximise LPG/CNG usage at domestic and commercial set ups to achieve a target of 100 per cent coverage

In slums and low-income neighbourhoods, as well as roadside eateries/dhabas/ restaurants etc. promote and give access to LPG and electricity. Link commercial license to clean fuels.

Prohibit use of coal in hotels and restaurants, eliminate use of kerosene for cooking in and incentivize move to LPG.

A targeted programme can be developed for wider distribution of LPG

Carry out rural air quality monitoring



Diesel generator sets



Source of high exposure: 6-8% of all diesel consumed for power generation. This includes grid connected diesel based power plants of more than 10 MW, captive plants and DG sets

Focus on emissions and energy efficiency

Revised emissions standards are equivalent to Euro Stage IIIA for all size classes in Europe until 2010. Europe has further tightened the standards since then for all size classes. Stage IV in Europe in 2015

Energy efficiency: Average energy efficiency levels fall short of the global benchmark – percentage difference of about 7-8% (Shakti study)

Bureau of Energy Efficiency proposal for energy efficiency standard and labelling

Enforcement mechanism and energy audits to improve operation and maintenance

Real solution – reliable access to electricity – address the gap between power generation and supply and other reforms; interface with rooftop solar programme



Further refinement of strategies



Compliance of guidelines on D.G. sets and action against violation

Ensure that only those DG sets that meet the standards are allowed to operate

Only approved fuel should be allowed

During episodic high pollution days, diesel generator sets should not be used in social events (if a case arises in Andhra Pradesh.)

Alternate power systems should be promoted in cell towers, and use of DG sets discouraged



Road dust Strategy



Implement street design guidelines for footpaths and cycle tracks with adequate vegetative buffers, soft and hard paving, mechanised sweeping

Take steps for blacktopping / pavement of road shoulders to avoid road dust

Enclosures and gravel paving; Rules and guidelines for truck loading and unloading

Sprinkling of recycled water (without compromising other uses); introduce water fountains at major traffic intersections, wherever feasible.

Green cover

Maintain pot hole-free roads for free flow of traffic to reduce emissions and dust.

Enforcement of air pollution control in concrete batching (use of water spray and wind breakers, bag filter at silos and enclosures, hoods, curtains etc)

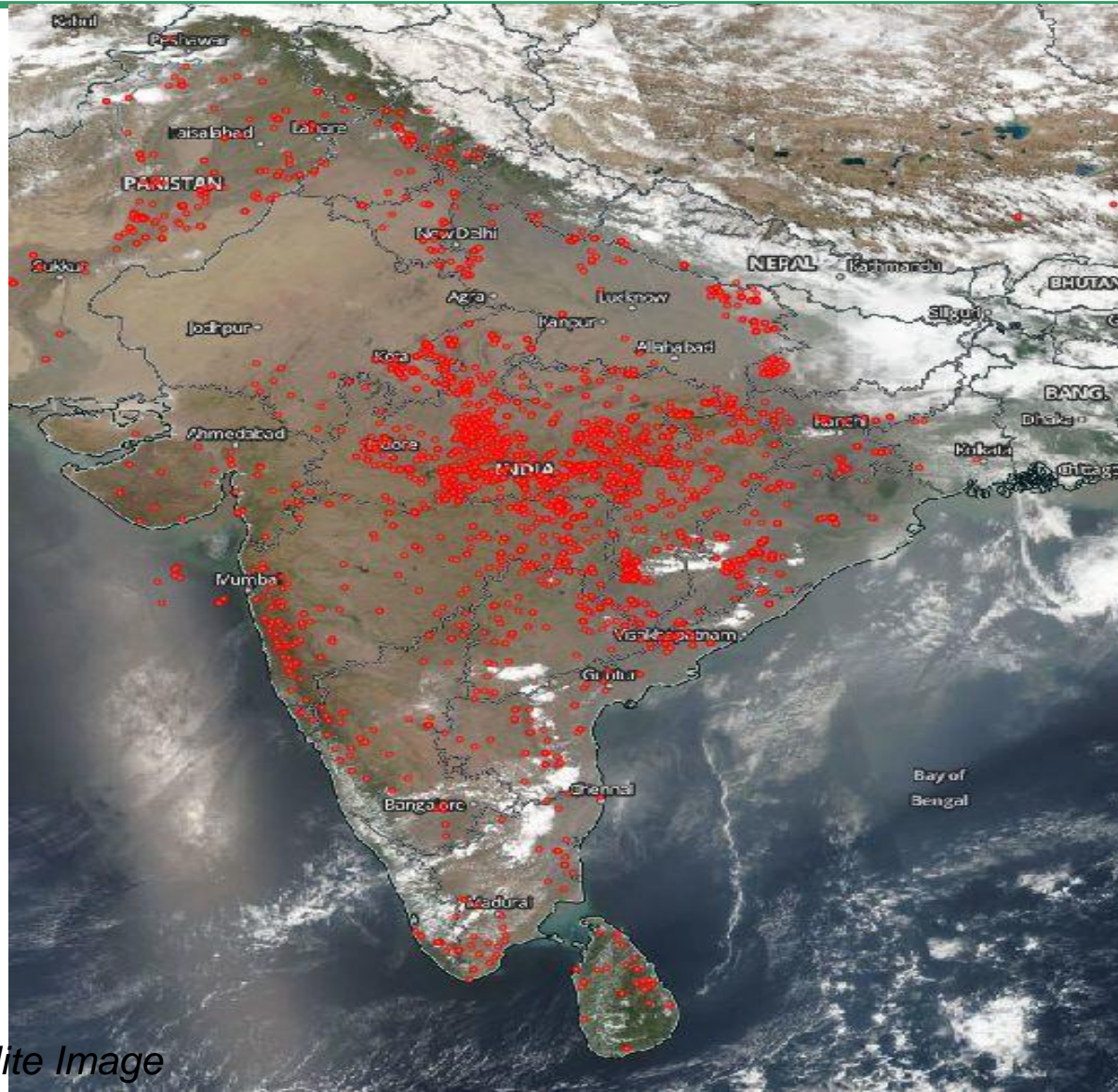


Crop fire



Crop fires: India burning

April 20th 2017



Source: NASA Satellite Image



Crop burning



Sub-committee under PMO: Short and long term solutions

Provide farmers with alternatives and educate them on stubble burning

Easy subsidy at 50-75% for machinery to put the residue back in soil while tilling

In field solution

Mulch and mix with soil; Can reduce fertiliser cost for farmers

Ex-situ solution

Promote biomass-based power plants

Production of biofuels and fertilizers

Biomass pellets and other uses

R&D and crop diversification

Uniform decentralized mechanism for the collection, storage and commercial sale of crop residue





Technical Session V: Fiscal and institutional strategies



Set up institutional process for clean air action



Need institutional coordination between departments for cross-sector action – vehicles and transport; industry and power plants; waste management; construction; domestic sources etc

List action with time line and attribute it to the ministry/department responsible for implementation

Harmonise action across departments

Set up inter-departmental task force to monitor implementation

Take stock periodically to further refine and upgrade the plan.

Adopt strong legal framework for implementation and compliance

Capacity audit and improvement of implementing agencies

Need impact monitoring



Fiscal strategies



NCAP funding for air quality monitoring and some support for studies and plans

Align CAP principles and guidelines with the budget of all line departments – leverage existing line funding

Mobilise resources based on polluter pay principles to create dedicated funds – Eg from Delhi – Environment Compensation Charge on trucks and big diesel cars and SUVs; Air Ambience cess on each litre of diesel etc. Sector specific funds

Bilateral and multilateral funding

Reform based funding



Fiscal Measures to bring change



V

City applies **polluter pay principal** to change citizen behaviour and commuting choices.

Cleaner technology and commute options are the cheapest.

IV

City has advance fiscal system based on polluter pay principal and **has removed perverse incentive to dirty technologies.**

III

City has **aggressive environmental tax** on polluting technologies and commute options and has minimised skewed distortion in technology pricing.

II

City **has green tax on dirty fuels and dedicated funds** to incentivize cleaner technologies and modes of commute.

I

City has no fiscal intervention with skewed distortion in fuel and commute option prices providing perverse incentive to dirty technologies