Air quality management in southern world: Challenges and solutions

Anumita Roychowdhury

Centre for Science and Environment

Workshop on Guidance Framework for Air Quality Management in Ethiopia:

Ministry of Environment and Forests and Climate Change with Centre for Science and Environment, India and UNEP
Addis Ababa: March 18, 2016
Why partnership in the global south?
Common areas of governance challenge in the global south

- Sustainable industrialisation
- Clean air and urban mobility
- Water pollution and water
- Energy access and renewable energy
- Mining sector and impacts
- Strengthening of environmental governance in the global south
- Strategy for resource efficiency

All of us in the global South going through the same phase of development – asking same questions and seeking same solutions with some unique challenges....
Our learning:

• Global and local action needs to be connected

• Resonance across developing south – Asia and Africa

• We value relevant experience in developing region

• Important to understand local capacity, governance issues & shared perspectives
Demand for action in all our cities

- Strengthen institutional capacities in environmental management
  - Mostly environment, regulatory agencies, select civil society groups
  - Identify policy gaps and capacitate public institutions to address these gaps

- Solve local environmental problems of pollution and resource efficiency
  - Build understand of the changes required
  - Need partnerships

- Shape public understanding and opinion -- engage with the multipliers
  - Enhance public understanding & supportive public opinion
Air quality challenge in global south
Should we Leave Delhi?

The Centre for Science and Environment (CSE), in its latest report, has delivered a grim warning. "The smog is here to stay. It has also warned that Delhi is in the grip of a multiplicity of pollutants, not only the ones that are visible."

Disadvantage Delhi: Smog here to stay

"Smog leaves Delhi gasping for breath."

Gains of Switch back to pre-CNG levels

"Delhi winter smog is not an act of God."

The resultant outbreak of smog, masks, scarves, and handkerchiefs to the nose and face, the skies turned a thick blanket of grey and dank. Cool, windy conditions are beginning to look out of the window. But the grey-white smog that has been enveloping the city has been a constant threat. As we breathe, the air becomes a source of pollution."

City enveloped in smog, Delhi winter smog is not an act of God.

During the first week of November, Delhi went under a thick blanket of smog. The breeze nearly stopped, and the skies turned a thick blanket of grey and dank. The resultant outbreak of smog, masks, scarves, and handkerchiefs to the nose and face, the skies turned a thick blanket of grey and dank. Cool, windy conditions are beginning to look out of the window. But the grey-white smog that has been enveloping the city has been a constant threat.
Media reportage on air pollution in cities of Africa...

Air, air, everywhere, nor a place to breathe in Lagos! By Ogaga Ifowodo
August 21, 2013 Premium Times

Aerial measurements shed light on pollution from Lagos
11 December 2009, by Tom Marshall

UK scientists have quantified for the first time the emission of air pollutants including carbon monoxide and volatile organic compounds (VOCs) around the African megacity of Lagos in Nigeria.

Let Nema explain cause of air pollution in city
By Editorial
Updated Wednesday, May 14th 2014 at 00:00 GMT +3

Measuring Africa’s Air Pollution
April 16, 2014
Green Column
When Jenny Linden, an air quality scientist, tried to measure the
Fifth largest killer in India......

More than 18 million healthy life years lost due to air pollution. Air pollution triggers stroke, cardiovascular and respiratory diseases, cancer.....

Air pollution is the 5th largest killer in India.......
Air quality: A national challenge in India

Nearly half of Indian cities have critical pollution levels. Majority of urban population exposed to unacceptable levels of pollution. WHO says there is no safe level for particles .... 95% of Indians are breathing air pollution levels above WHO guidelines

Source: Based on National Ambient Air Quality Status report for 2009 and 2012
Smaller towns are more polluted than big metros in India.
The human story…

Our health is at stake…yet risk perception is very poor…….

From its early stages, CSE’s Right to Clean Air campaign used a variety of communication tools — such as this poster — to put out its message to the public. It built support.
Link clean air action plan with mobility and transportation strategies

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.

Source: CSE
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.

-- The levels of these biomarkers in children have been found to be higher in areas with high PM10 levels.
Alveolar macrophage - biomarker of air pollution

Exposed group; Kolkata taxi driver
Increase in AM number

Larger AM – particle laden

Control area: Sundarbans

NSE stained, x 400.

Source: CNCI
Alveolar macrophage: the biomarker of air pollution

Sputum cytology of a 14-year old girl in Delhi, showing abundance of particle laden AM
Jigsaw of health evidences from cities of Africa

Addis Ababa – High impact of vehicular pollution

- Out of the top 20 leading causes of out patient visit by region in all health centers and hospitals, the occurrence of acute respiratory infections is of prime concern. This is due to the noxious emissions of the vehicles.
- In a study of adults and children in an urban community in Jimma, Ethiopia, it was found that among 3,592 individuals living within 150 m of a road, the risk of wheeze increased significantly in linear relation to proximity to the road. This indicated that living in close proximity to road vehicle traffic is associated with an increased risk of wheeze.

Ghana:

Acute respiratory illness is among the top 10 causes of out patient hospital visit. The Africa is also reporting one of the highest death rates form non-communicable disease. Air pollution can exacerbate this.
Cities in African region: Health cost of air pollution

UN Economic Commission of Africa: cost of air pollution in a number of African cities can be as high as 2.7 per cent of GDP.

In Africa about 176,000 deaths premature deaths due to air pollution. The WHO -- pre-mature deaths in Africa is below world average. But data is also a barrier

University of Nairobi: The economic loss per year in Kenya of vehicle emissions is 115 million KSh from illnesses and deaths.

Nigeria -- Green Data Book 2015 - 94% of population exposed to PM2.5 exceeding WHO guidelines. Air pollution damage costs about 181% of Gross National Income.
Africa: One of the highest death rate from non-communicable diseases

• The African region is also reporting one of the highest death rates from non-communicable disease (NCD). Air pollution can exacerbate this.
• In Sub-Saharan Africa NCDs to surpass infectious diseases by 2030.
• NCDs are estimated to account for 24% of all deaths in Nigeria.
• Cancer risk is increasing in all regions.

Age-standardized Mortality Rates by Cause, WHO Regions, 2008
Wide range of health outcomes

Not just respiratory symptoms .... Also cardiovascular, eye disorders, cellular changes, cancer, premature deaths....

Diabetes: First large-scale population-based study links diabetes with air pollution. Increase in insulin resistance in lab test .... and an increase in markers of inflammation (which may contribute to insulin resistance) after particulate exposure.

Heart: Acute Effects of Fine Particulate Air Pollution on Cardiac Arrhythmia:Conclusion: PM2.5 exposure within approximately 60 min was associated with increased PVC counts in healthy individuals. (He F et al 2011 The APACR Study. Environ Health Perspect)

Blood pressure: Traffic-related Air Pollution and Blood Pressure in Elderly Subjects With Coronary Artery Disease: Found positive associations of systolic and diastolic BP with air pollutants. The strongest associations were with organic carbon, multiday average exposures, ect. (Delfino, Ralph J.a et al 2010,, Epidemiology, May 2010)

Effect on brain and foetus

Latent risk of cancer

Source: CSE
Need for early action....
Pollution and toxic threat grows with speed.

Cities in grip of toxic model of growth: Intensive use of energy and materials leading to huge amounts of waste -- pollution.

Major health impacts – toxic air causes one death per hour, ...

Where will the future growth take us? It all depends on the choices we make.

The price of wealth

In 20 years between 1975 and 1995 the GDP more than doubled in India, but the industrial pollution load went up 4 times.

Vehicular pollution load went up 8 times.

One person dies every hour in Delhi because of air pollution.

CSE
Do we know enough about our air quality?

• The WHO database on outdoor air pollution of 2013 has listed African countries that monitor particulates.

• Nigeria, Algeria, Botswana, Ghana, Madagascar, Mauritius, Senegal, South Africa, and Tanzania, Ethiopia and Zimbabwe.

• Egypt, Madagascar, Tunisia, and Morocco have published reports of PM monitoring data.

• Ethiopia and Nigeria have established urban air quality monitoring systems.
Can we do this differently?
UNEP Affordable air quality monitoring system

- UNEP’S affordable AQ monitoring system for measuring PM, other key pollutants costs (USD 1500/unit)

- The UNEP AQ Unit can be deployed across different terrains. It can be linked in real-time to meteorological stations, county and national offices via wireless and telecommunication networks or run off-line.

- UNEP will publish the blueprint for the UNEP AQ Monitoring Unit as a global public good. This will enable governments and organisations to purchase, assemble or fabricate the units themselves. This opens up opportunities for innovation.

- The UNEP AQ Unit includes an Optical Particle Counter sampling every 2 seconds, two gas sensors - SOx and NOx, GPS and T and Rh sensor. Additional sensors for Ozone and VOCs can be added.

- This can be used as a fixed station or mobile unit. The units are GSM enabled and designed to operate as nodes in a network to allow inter-calibration.

- Explore this possibility....
Map pollution and reduce integrated exposure

- Need exposure mapping across micro environment
How much pollution we breathe in Delhi?

Average exposure to PM2.5 ranged between 192 to 642 micrgramme per cum. Peaks as high as 457 to 1170. The average ambient level ranged between 191 to 277.

Source: Based on CSE exposure monitoring and DPCC data for ambient levels
Air quality management taking root in Ethiopia

The country has adopted national ambient air quality standards

Emissions standards for all categories of air polluting industry are in place

Air quality monitoring is taking shape

Vehicle emissions inspection programme has started

Unleaded petrol has been introduced

Public transport initiatives are being scaled up

And more…..
Lessons from Delhi…
What has Delhi achieved?

First generation action 1998-2008

- Enforced Euro II emissions standards in 2000, five years ahead of schedule, Euro III in 2005; unleaded petrol
- Mandated pre-mix petrol to two- and three-wheelers
- Implemented largest ever CNG programme: Largest ever public transport bus and three-wheeler fleet on natural gas
- Capped the number of three-wheelers
- Phased out 15 year old commercial vehicles
- Strengthened vehicle inspection programme (PUC)
- Efforts made to bypass transit traffic
- Relocated polluting industry; Stricter action on power plants; two power plants on natural gas; Ban on open burning

Second generation action 2008 - 2014

- Metro system expanded
- Close to 6000 new buses
- Euro IV standards in 2010; upgraded PUC tests
- Air Ambience Fund in 2009
- 40 km of cycle tracks with new footpaths in 2010
- Marginal increase in parking prices in NDMC area
Delhi has lost its gains. After a short respite pollution curve turns upward

Particulate pollution decline and rise again due to rapid increase in vehicle numbers

Based on CPCB data

PM10 levels in microgramme per cubic metre

NO2 levels rising steadily

PM10 reduces despite vehicles increase

Massive increase in PM10 levels post 2007
Beijing: Pollution emergency measures on red alert days:
-- Kindergartens, primary and middle schools will close;
-- About 80 per cent of government-owned cars have to be taken off the roads;
-- Private cars will be allowed on alternate days according to numbers plates;
-- Freight vehicles and those transporting material for construction sites will be barred;
-- Polluting factories have to cut emissions or shut down when the orange warning signal is issued;
-- Construction sites will have to halt excavation and demolition operations;
-- Ban on barbeques and fireworks on heavily polluted days.

US cities: Rule 701 of air pollution emergency contingency actions (for PM and ozone):
-- Industrial units reduce combined emissions by at least 20 per cent of normal weekday operations.
-- For vehicles, it asks to reduce fleet vehicle miles;
-- Promotes ridesharing and telecommuting.
-- Liquid or solid fossil fuels cannot be burned in electric power generating systems unless a force majeure natural gas curtailment is in effect.
-- It also recommends all non-emergency driving be discontinued.

Paris: red alert day
-- Restricts vehicle entry into the city
-- Does not allow diesel cars inside the city during smoggy days
What happens when we remove cars?

Winter of 2015-16 with odd and even

2015-16

- ECC introduced
- Diwali

2014-15

- Diwali

Source: CSE
Other impacts of the scheme

Overall petrol and diesel sales have dropped by 4.7% and 7.8% from December 2015 to January 2016.

Busy roads experienced about 30 to 50% increase in speeds during the odd-even fortnight.

Average occupancy in personal cars increased from 1.4 to 2.1 during the odd and even period at major nodes.
Vehicle numbers in cities of Africa are comparatively less than Indian metro cities... but poised for rapid growth...

Kenya: 2013, Kenya registered 2.25 million vehicles. Nearly 30% are in Nairobi. Kenya imports around 200,000 every year. As much as 85.5% registered vehicles are personal – motorcycles and cars. Nairobi’s car fleet to double in just six years.

Lagos: If ownership rates grow from 0.05 per capita to 0.06 over the period from 2010 to 2025 there will be an 80% increase in the numbers of vehicles -- to around 850,000.

Addis Ababa: Base numbers are still small. But growth rate to increase… Last year, a total of 30,128 cars were imported, -- an increment of more than 7,000 cars than the previous year. In June 2014 the total stock of registered cars in the nation was 519,816.
Leapfrog technology roadmap

Need stringent and preventive action and decision here to influence the future stock -- several times higher than the legacy stock.

Example from India

The legacy stock in India is much smaller than the new vehicle stock that will roll out in the future.

The new motorisation must happen on the basis of best available technology and fuels.

Source: CSE
Technology roadmap in India
10-15 years behind current emissions standards in Europe

Diesel car PM norms in g/km

EU
USA
India selected cities
India rest of the country

Good news: India will skip Euro V and leapfrog to Euro VI in 20202

Source: India, Europe compiled from Diesel Net, USA
data provided by Axel Friedrich, Germany

Note: Europe has additionally introduced particle number standards at Euro V level
Future norms of US and Europe are tightening NOx norms for diesel more
Diesel cars are legally allowed to emit more particulate and nitrogen oxide than petrol cars.

Diesel emissions are branded as class I carcinogen for strong link with lung cancer.

Black carbon emissions from diesel vehicles are several times more heat trapping than CO2.

CO2 emissions from the upstream diesel refining process are high:

**Rebound Effect:** Diesel fuel has higher carbon content than petrol. If more diesel is burnt encouraged by its cheaper prices and more driving, more heat-trapping CO2 will escape.

Nullifies marginal greenhouse gas reduction benefit of diesel car ……
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 Netherland lower than EU average.

**Brazil** Sales of diesel passenger cars and commercial vehicles below 1,000 kg are banned

**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.

**Delhi:** Banned registration of diesel cars with 2000 cc engines to stop misuse of low tax diesel for luxury consumption.
The Auto Fuel Policy Committee 2014 has proposed the following:
Special fuel upgradation cess of 75 paise per litre on petrol and diesel. This can generate Rs 64,000 crore over 7 years
Equalise retail price of Bharat Stage III and IV fuels. The excess collected from the repricing of Bharat Stage III to be called ‘high sulphur cess’. Revenue from these sources to be spent on refinery upgrades.

Union Budget of 2016-17: Differentiated taxes on gasoline and diesel cars

Delhi: Pollution tax on per litre of diesel sold in city. Created Air Ambience Fund from its revenue

Environment compensation charge on each truck that enters Delhi – revenue goes to clean air fund
Import of old vehicles... a special challenge in the region....
Import of used vehicles dominate: Huge pollution concern

Significant proportion of vehicles in African region are imported used vehicles.

There is no age restriction for import in most countries.

Ageing of used vehicles emit hugely to pollution.

This locks in enormous pollution and cannot be reversed.

Source: CSE based on data provided by Addis Ababa Transport Authority.
Vehicle import policies in Countries: Opportunity to influence and harmonize policies on vehicle’s emission norm and road-worthiness and age

- **Angola**: Motor companies not allowed to import used vehicles; individuals allowed to import regardless of age
- **Botswana**: Maximum of 100,000 kms on the vehicle
- **Burkina Faso**: No import restrictions on vehicle age basis
- **Mali, Malawi, Zambia, Central African Republic, Democratic Republic of Congo, Cameroon**: No import restrictions on vehicle age basis
- **Chad**: vehicle inspection upon importation
- **Côte d’Ivoire**: A fine of FCFA 150,000 is imposed on vehicles older than 10 years and an additional FCFA 10,000 for every year.
- **Gabon**: Used vehicles must be less than four years old
- **Ghana**: Used vehicles over five years old pay graduated penalty according to year of manufacture and capacity
- **Seychelles**: Used vehicles must be less than five years old
- **Sudan**: Imported second-hand vehicles are illegal, except for immigrants, vintage and racing cars, vehicles adapted for physically disabled, and donated vehicles for welfare organizations
- **The Gambia**: Import of second hand vehicles restricted through taxation – increases in vehicles exceeding 10 years and roadworthiness must be proven before import
- **Mauritius**: Has a three year age restriction
- **Zimbabwe**: Banned importation of vehicles older than 8 years old

Import policy and taxation

Change of fuel consumption in Sri Lanka (in litres)

Design import policy

- Ideally ban import of used cars
- Use stringent tax measures to discourage import of used cars
- Fix age – not more than 2-3 years
- Lower taxes on import of new cars
- Tax exemption to hybrid and electric cars
- Fix emissions standards

Vehicle inspection system – visual tests

- There are 19 vehicle inspection centres across Kenya including one at Likoni Road, Nairobi.

- Mainly public service vehicles and commercial vehicles – matatus, buses, tuk-tuks, taxis and trucks come for annual inspection.

- From January 2015, all private vehicles more than 4 years to undergo the inspection.

- Only visual tests are done. Its basically seen if the vehicles are fitted with a speed governor and are in good mechanical condition.

- Emissions testing -- limited.
Challenge of the car bulge
More roads are not the answer
...Lesson from Delhi

Source: On the basis of Economic Survey, Delhi Govt
Roads not designed for public transport walking and cycling can lock in more pollution.

Engineering changes once made cannot be reversed easily... It permanently decides our travel choices.
It is possible to transform streets to make them people friendly.

- Streets of Delhi retrofitted.

Source: CSE
Lot depends on how we design our cities

Mumbai: High density development -- cars 1.6%, Walk 56%

Johannesburg: More sprawled cars 37%, walk 31%

Source: Urban Age
Need integrated public transport system

- The two LRT lines totaling 32 km, with 32 stations, 10 of which being hub stations, are under construction.

- One BRT line of around 12 km is in the planning stage with a further six possible lines identified.

- ICCT’s estimates suggest that a BRT system in Addis Ababa will result in considerable overall health benefits in the range of $41 to $45 million per year in 2035.
Protect and organise intermediate public transport systems:
*Mini bus taxis – lifeline of affordable public transport*

**Modal share of public transport modes**

<table>
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<tr>
<th>PT-mode</th>
<th>Seating Capacity</th>
<th>Fleet size</th>
<th>Passenger Carried daily</th>
<th>Share %</th>
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<td>11</td>
<td>10,500</td>
<td>1.6 million</td>
<td>73%</td>
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<tr>
<td>Midi Bus (Higer)</td>
<td>25</td>
<td>439</td>
<td>180,000</td>
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<td>Anbessa Bus</td>
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<td>750</td>
<td>420,000</td>
<td>19%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>2.2 million</strong></td>
<td><strong>100%</strong></td>
</tr>
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</table>
Lagos is more sustainable than Los Angeles
These are high frequency services with very high throughput of passengers.

Provides the most reliable and frequent service both during peak and non-peak hours.

Can penetrate deep into neighbourhoods and provides the most efficient last mile and first mile connectivity.

Involves least interchange and therefore allows lower cost of travel.

Demand for this service will remain strong in cities with high population densities.

In Delhi introduction of formal mass transport systems like metro rail or big bus service has not reduced their demand. Delhi is increasing their numbers.
Design roads for all road users
Give priority to clean mode of transport to protect public health

Moving vehicles vs. moving people
More than one third of the country’s population live in Addis Ababa.

91% of people walk and use public transport.
Compact and closely built city design allow shorter travel distances.

Average trip length in most African cities less than 5 km. This makes city very accessible and walkable.

Congestion have increased share of walking in our cities…It is faster to walk.
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.

Source: Delhi Traffic Police
In Indian city of Bhubaneswar: Space for vending built into road design

Eye on the street: Activities make public space safe

Raj path road, Bhubaneswar, India

Source: CSE
What’s going wrong with parking?

- **Parking: wasteful use of cars:** For about 90 to 95 per cent of the time a car is parked.

- **Insatiable demand for land:** Annual registration of cars generate demand for land bigger than 310 football fields in Delhi! Land is expensive and can be used for other social and public amenities.

- **In Addis Ababa the parking demand of the existing car fleet is equivalent to 110 football fields.**

- **Inequitous use of land:** A car is allotted 23-26 sq m for parking. In Delhi only 18-25 sq m allotted to very poor families in Delhi.

- **Parking takes away walkspace, urban common, green spaces, etc.**
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 percent 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

Grosvenor square, London

Source: TRL in ITDP (2011): Europe’s Parking U-Turn
World bank study in India: Buses pay more taxes

In Delhi:

- Buses pay at least Rs 13,000 per year as road tax
- Cars: One time road tax works out to be a mere Rs 300 per year
World Bank assessing similar approach in other cities…((Yet to be released study)

Potential revenue in billion units
Fares – 35 billion units
Rent on property – 40
Parking -- 30
Station naming rights – 5
Betterment – 75
Fuel tax – 15
Vehicle registration – 2
Advertisement -- 3

Generates a lot more than the target of meeting the O&M cost of 93 billion units

(Source: OP Agarwal, UMI)
Account for cost and benefits in decision making

**Is green growth affordable?**

- 10% reduction in PM10: 0.33
- 30% reduction in PM10: 0.7

% loss in GDP wrt BAU in 2030:
- % loss in average annual GDP wrt BAU

**Savings from Reduced Health Damages**

- 10% reduction in PM10:
  - Lower estimate: 24
  - Upper estimate: 54
- 30% reduction in PM10:
  - Lower estimate: 47
  - Upper estimate: 105

**CO2 Emission Reduction (%)**

- 10% reduction in PM10:
  - Lower estimate: 10
  - Upper estimate: 20
- 30% reduction in PM10:
  - Lower estimate: 30
  - Upper estimate: 60

**World Bank study (July, 2013):**

- Outdoor air pollution is 29% of the total environmental damages
- Health cost of PM10 – 3% of GDP
- PM10 mitigation cost less than 1% of GDP
- Annual savings from health benefits can be more than USD 100 billion
- CO2 emissions can be reduced by upto 60%

*Source: Based on (Diagnostic Assessment of Select Environmental Challenges in India A World Bank 2013)*
Action on other sources

Reduce emissions from vehicles
   Leapfrog emissions standards
   Reinvent mobility – link with urban planning and design

Reduce emissions from power plants
   Tighter control on coal based power plants
   Set new standards for NOx and air toxics; reuse flyash
   Shift to natural gas for power

Reduce emissions from air polluting industry
   Review industrial emissions and control measures; industrial fuel

Reduce emissions from generator sets
   Tighter emission standards for generator sets
   Siting and acoustic measures for big gen sets
   Energy efficiency measures to reduce electricity demand

Action on open burning
   Adopt strong waste management practices. Monitor and awareness

Provide clean fuel for household cooking; reduce wood burning

Road dust and construction activities
   Adopt dust control measures for construction industry, roads, and traffic

City based and regional plans
Prepare pollution-source-wise action plan with time line

Develop indicators to assess if all cross sector action are delivering on clean air and energy efficiency

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
Whiff of change
Abuja drafting cycling policy
Car free day Kampala, Uganda

http://www.fabio.or.ug/page19.php
Cities are moving away from car centric infrastructure.

Seoul’s Cheonggyecheon restoration project

Cities that have destroyed roadways

San Francisco
Milwaukee
New York
Portland
Toronto
Seoul
Dutch Minister visits the queen on a bicycle

Source: GIZ
Thank You