URBAN AIR QUALITY AND SUSTAINABLE TRANSPORT :

Issues, Instruments and Strategies

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Workshop on Low-Carbon Comprehensive Mobility Plans for Indian Cities, April 12, 2012

URBAN AIR QUALITY ISSUES

- Urban air pollution is a serious problem worldwide and is responsible for more than two million premature deaths every year.
- While cities in developed countries have generally resolved air quality problems, cities in developing countries have alarming levels of air pollution
- Rising incomes, population and urbanization have led to an increase in urban energy use and travel demand, mainly by private vehicles
- Problem is more serious in cities in developing economies as they have limited resources and development goals assume priority over air pollution concerns
- The health effects of air pollution are also greater as a large part of the population is poor and does not have access to basic infrastructure

SUSTAINABLE URBAN TRANSPORT

- Characteristics of a 'Sustainable Urban Transport System' –
  - Adequate, accessible and affordable
  - Provides choice and freedom to travel safely and comfortably
  - Ensures equity of access for all sections
  - Conserves energy and does not harm the environment

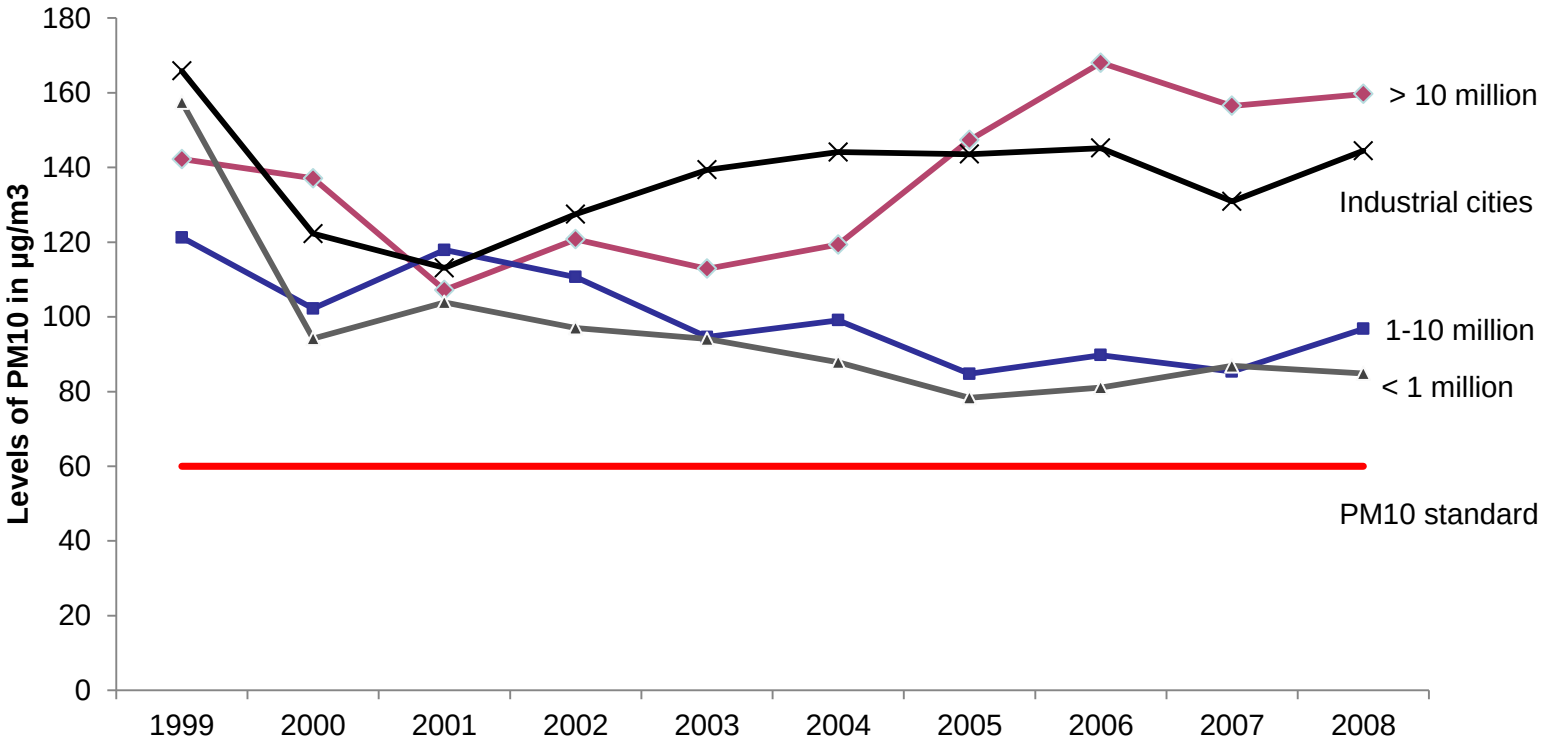
- Local air pollution and congestion are the two major policy challenges for urban transport

- The transport sector in cities across the world accounts for a high share of energy consumption and is also a major potential contributor to climate change. Indian cities will soon face international pressure to reduce GHG emissions.

AMBIENT AIR QUALITY TRENDS IN INDIAN CITIES (Study of 8 major cities by CPCB, 1995-2005)

- SO_2
  - Levels are below national standards
  - May be due to reduction in sulfur in diesel, use of LPG instead of coal and CNG in vehicles
- NO_2
  - Levels have decreased below national standards
  - May be due to stricter vehicle emission norms
- RSPM and SPM
  - Standards exceed in most cities, decreasing in some
  - Depends on measures taken for vehicular and industrial pollution control

PM_{10} levels in different categories of Indian cities



Data from 78 cities

AIR QUALITY IMPROVEMENTS IN DELHI

- From being a highly polluted city in the 1980s, Delhi has come a long way
- A PIL by MC Mehta in 1995 triggered the process of AQM in Delhi.
- Judicial interventions led to a number of policy reforms dealing with air quality improvements spanning over two decades
- Key policies that changed Delhi air were:
  - Conversion of all public transport to CNG
  - Phasing out of older vehicles (> 15 years)
  - Relocation of industries away from the city
  - Enforcement of Euro-equivalent emission standards
  - Extensive public transport augmentation with metro and BRTS

CHRONOLOGY OF KEY EVENTS RELATED TO AQM IN DELHI

Sector	Measure implemented
Private Transport	**1987** – Fine for owners of polluting vehicles introduced but failed **1995** – catalytic converters made compulsory **1998** – Phase out of commercial vehicles older than 15 years
Fuel Quality Improvement	**1995** – Unleaded petrol introduced **1996** – Diesel with 0.5 % S introduced **2005** – Diesel with 0.05 % Sulfur introduced
Emission Norms	**2003** – Euro II equivalent norms for gasoline and diesel passenger cars introduced **2005** – Euro III equivalent norms for all cars
Public Transport	**2002** – All public transport converted to CNG **2006** – Completion of Phase I of Metro **2008** – BRT becomes operational
Industry	**1997** – 1160 industries closed or relocated including hot mix plants, arc induction furnaces, brick kilns). **2001** – Hazardous industry closure/relocation continues: total of 2,210 closed/relocated between 1998-2001

RELOCATION OF INDUSTRIES

- In 1996, a SC directive ordered 168 category ‘H’ industries to move out of Delhi to suitable locations or close down.
- Relocation process began, but did not progress much. Government was found to be dragging its feet.
- Supreme Court put its foot down and gave a deadline of 2000 when all polluting industries, should relocate or shut down.
- This led to riots and arson across the capital where three persons died and hundreds were injured.
- Finally, after much delay, a large number of industries were moved out of the city area.

PHASING OUT OF OLDER VEHICLES

- Phasing out of older vehicles in Delhi is one of the most controversial stories in Delhi's history of air pollution mitigation.

- Under pressure from the Supreme Court, the Delhi government announced a policy to phase out older vehicles in October 1997. However, this policy was withdrawn in February, 1998.

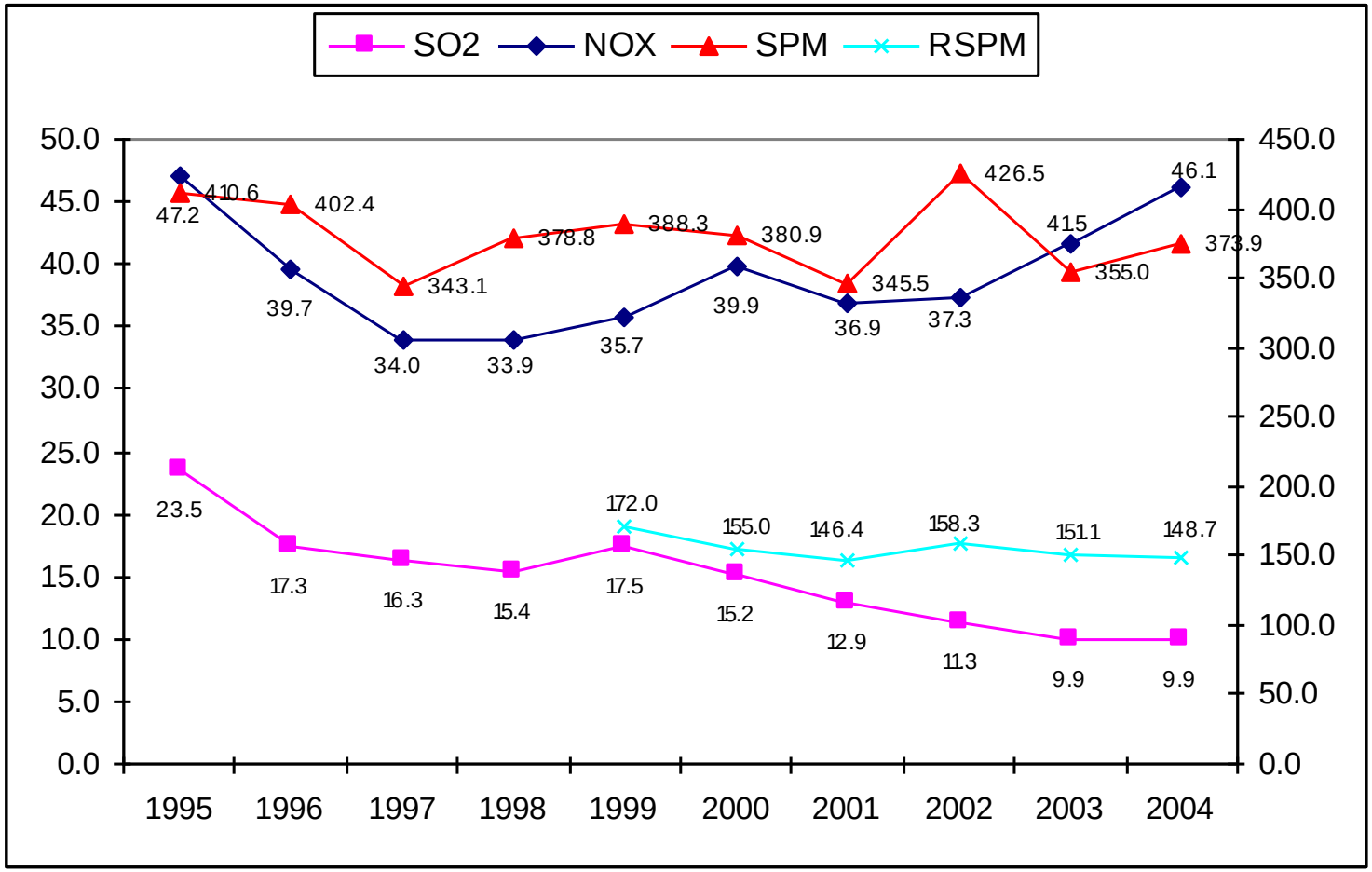
- The Supreme Court remained firm and set a deadline of October 1998. The deadline was extended on the government's request.

- Finally, by December 1998, all commercial vehicles over 15 years of age were phased out.

CONVERSION OF PUBLIC TRANSPORT VEHICLES TO CNG

- Supreme Court's landmark directive mandating conversion of all public transport vehicles to CNG by April, 2001.
- The order was received with massive protests from key stakeholders. The bus transport lobby went on strike protesting against unavailability of CNG.
- While the CNG debate was still on, the Indian government appointed the Auto Fuel Policy Committee (Mashelkar Committee)
- A significant recommendation of the committee was "to prescribe emission standards and fuel quality standards and leave the choice of fuel and technology to manufacturers and consumers"
- Despite the protests and delays, the Supreme Court stood firm and by 2002 all public buses, autos and taxis were converted to CNG.

TRENDS OF MAJOR AIR POLLUTANTS IN DELHI



DIESEL – CNG DEBATE

- Diesel vehicles emit more SPM and NO_x and lesser CO_2 and HC compared to CNG vehicles.

- The Diesel-CNG debate was centered on the issue of whether regulations should address emissions or the type of fuel.

- While CSE advocated mandating the use of CNG for public transport vehicles, the Auto Fuel Policy Committee favoured adoption of Euro equivalent standards for vehicles and fuels.

- Eventually the SC decided to mandate CNG for all public transport vehicles in Delhi.

- Diesel vehicles are gaining more acceptance in a number of European countries after reduction of sulphur content and use of effective emission control devices.

PUBLIC TRANSPORT

- The supply of transport infrastructure and services is improving with the introduction of new buses, Metro and BRTS.
- However, mere scaling up of public transport infrastructure may not reduce the number of private vehicles on road.
- Innovative approaches are required to facilitate a modal shift from private to public transport. MRTS and BRTS have a last mile problem.
- Needed responses:
  - Demand side measures to limit growth of private vehicles
  - Improve right of way for non motorized transport
  - Urban planning responses (compact cities, infrastructure to support intermodal integration, better road designs and maintenance)

NON-MOTORIZED TRANSPORT

- Create greater mobility options for low income groups
- Improve rights of way for pedestrians and cyclists
- Provide matching funds from central and state governments for creation of facilities
- Use Innovative Mechanisms – bicycle renting schemes, transport allowance for NMT users
- Pedestrianise central business districts (CBDs) and other commercial nodes

CONTROLLING USE OF PRIVATE VEHICLES – EXAMPLES

City	Instrument	Impacts
London	Congestion Charge	• Traffic fell by 25% • Congestion went down by 30% • Air pollution emissions decreased • Peak time bus speeds increased
New York	Toll road and corridor approach Fee for Single occupant vehicles on high occupancy lanes	• $ 2 million revenue collected • Used to fund transit service express lanes
Shanghai	Vehicle quota system Aggressive public transport	• Restricted new car registrations
Singapore	Major investment in public transport Vehicle quota system Congestion charging	• Car ownership and use have been restricted • All air pollutants are safely within USEPA standards

Source: Down to Earth, 2010

CONGESTION PRICING

- Congestion pricing is a charge levied on automobiles that enter a pre marked congestion zone of a city, mostly the CBD or a traffic dense road.

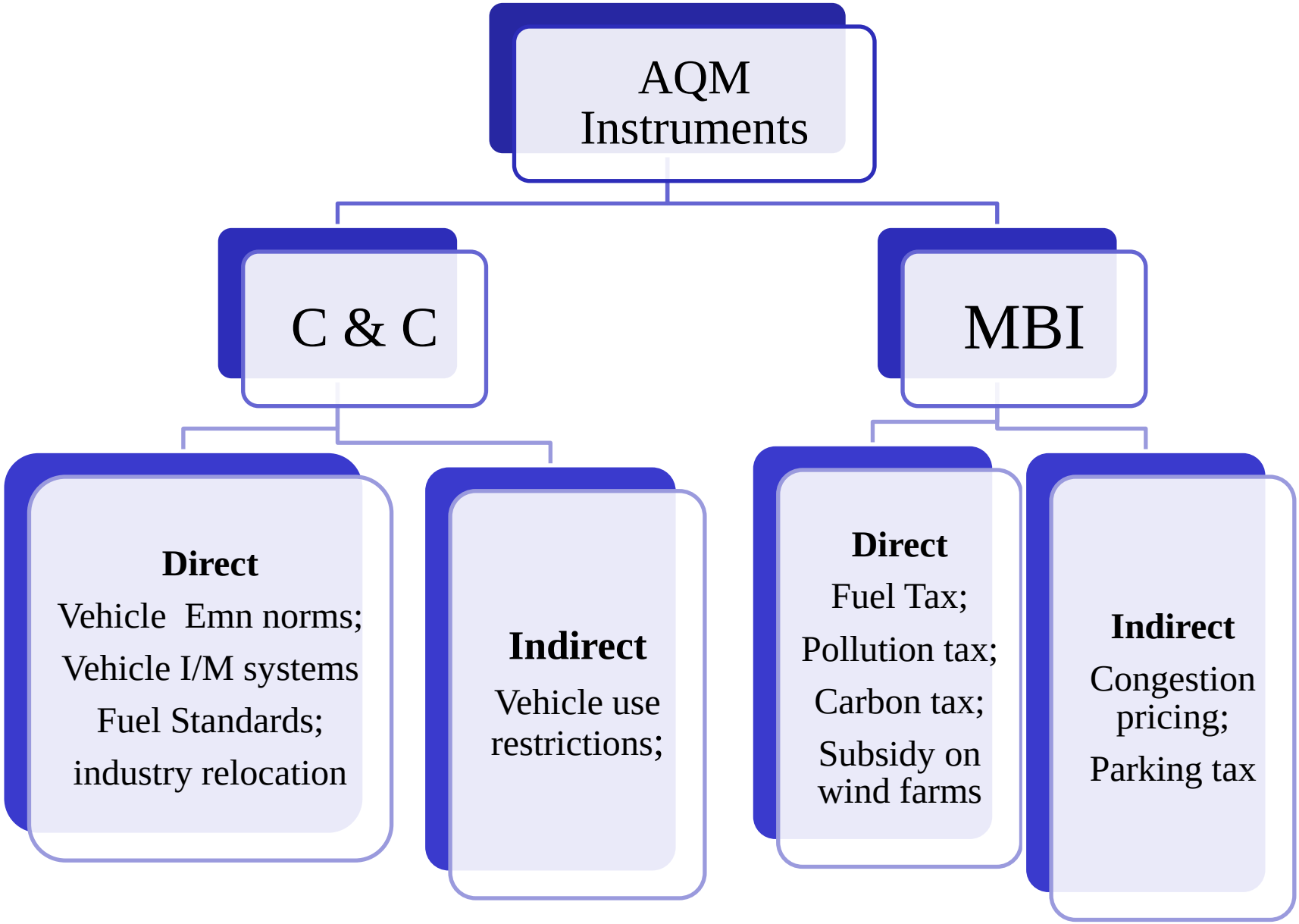
- It has been successfully implemented in a number of cities including London, Singapore, Seoul.

- Delhi plans to introduce congestion tax in two areas initially.

- Issues:
  - Implementation problems (elasticity, chargeability, alternatives)
  - Enforcement issues
  - Equity (would hit low-income groups more)
  - Technical capacity

OTHER INSTRUMENTS FOR AIR QUALITY MANAGEMENT

- Emission taxes on vehicles
- Road and registration charges
- Fuel taxes
- Tightening vehicle emission standards
- Vehicle inspection and maintenance systems
- Air quality monitoring and emission inventories
- Alternative fuels and vehicle technologies
- Traffic management


AQM Instruments
C & C
MBI
Direct
Vehicle Emn norms;
Vehicle I/M systems
Fuel Standards;
industry relocation
Indirect
Vehicle use restrictions;
Direct
Fuel Tax;
Pollution tax;
Carbon tax;
Subsidy on wind farms
Indirect
Congestion pricing;
Parking tax

STRATEGIES FOR URBAN AQM

Sector	Initial Stage	Transition	Mature Stage
Industry	Relocation	Exhaust emission control	Cleaner fuels & energy efficient technologies
Private Transport	Emission control technologies	Introduction of alternate vehicle technologies	Demand side management Zero emission vehicles
Public Transport	Supply side: Basic infrastructure	MRTS , BRTS, subsidies Conversion to CNG	Integration of modes Long term strategies (reducing GHG emissions)
Fuel Quality & Vehicle Emission Standards	Adopting basic standards for fuels and vehicles	Progressive tightening, based on international norms	Stringent standards Effective I/M systems
Air Quality Monitoring	Setting up of basic air quality monitoring system	Expansion of monitoring (networks and pollutants) Emissions inventories	Automated monitoring Source apportionment

TRANSPORT PROJECTS AND CDM

- Three domains of emission reduction possibilities
  - Mode Switch
    - Switch from a mode of transport with high emissions per transported passenger to one of low emissions
    - Reduced usage of private cars and increased usage of public transport or projects favouring bikes
  - Usage of larger units
    - Changing to a public transport system using large buses instead of microbuses
  - Improved occupation rates (for e.g. car-pooling projects)
    - Possible projects in this field include car-pooling projects
    - Organizational improvements in managing public transport
    - Optimizing the load factor of buses.

- Public Transport Projects

  - Bus Rapid Transportation (BRT)

    - large no of projects coming up

    - relatively large emission reductions per project

  - Rail based Public Transport

    - Significant GHG reductions as compared to buses

    - Actual reductions depend on the efficient management of operations (occupation rate), technology used and the carbon factor of electricity of the respective country.

BARRIERS FOR CDM TRANSPORT PROJECTS

- Methodology
  - Difficulty in proving additionality, Establishing baselines and project boundaries, Lack of recognition of co-benefits, Project ownership

- Costs
  - High transaction, monitoring and abatement costs (both real and perceived), Volatile carbon price for investors, Relatively low cost effectiveness of the mechanism with revenues often representing less than 1% of total project costs

- Awareness
  - Lack of knowledge and guidance at local level, Need for capacity building.

REGISTERED PUBLIC TRANSPORT CDM PROJECTS FROM INDIA

Project Owner	Delhi Metro Rail Corporation	Delhi Metro Rail Corporation	Mumbai Metro One Pvt Ltd
Project Type	Transport, Rail: Regenerative Braking	Transport, Mode shift: road to rail	Transport, Mode shift: road to rail
Status	Registered	Registered	Registered
Credit period	10 years	7 years	10 years
PDD Consultant	Delhi Metro Rail	Grütter Consulting AG	Grütter Consulting AG
Project Validator	TUV- Nord	SQS	SQS
Credit Buyer	Japan Carbon Finance Ltd., Japan	Switzerland (Grütter Consulting)	Switzerland (Grütter Consulting)
Expected CERs	41160 tCO2e/yr	529000 tCO2e/yr (avg over credit period)	196000 tCO2e/yr (avg over credit period)
CER Price	$ 6.62/ CER (1 kg CO2e) received	$ 17.69/ CER (1 kg CO2e) anticipated	$ 25/ CER (1 kg CO2e) anticipated
Revenue Generation	Rs. 2.4 Crores on sale of 82,000 CERs	Rs. 47 Crores annually for 7 years, anticipated	Rs. 86.05 Crores annually for 10 years, anticipated

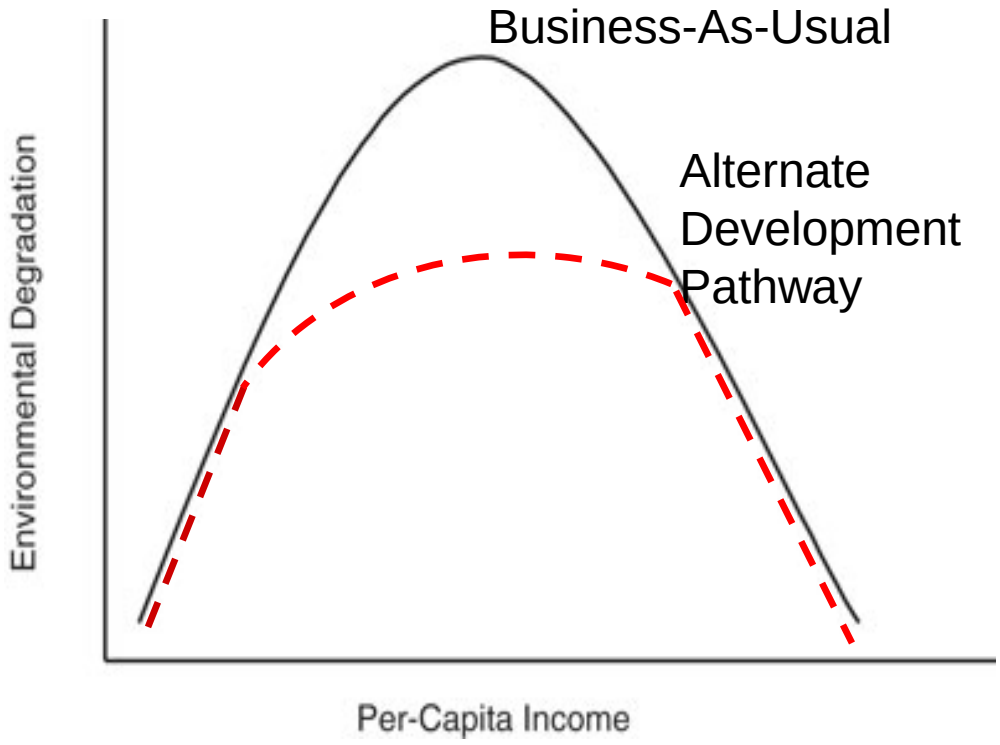
URBAN AIR QUALITY AND GLOBAL CLIMATE CHANGE

- Urban Transport accounts for a major share of both local air pollutants and GHG emissions in Indian cities
- There are co benefits of addressing these two issues simultaneously
- Urban transport policies should focus on reducing both types of emissions by --
  - Improving energy efficiency
  - Fuel switching
  - Improving public transport
  - Better land-use planning

- Sustainable low-carbon transport strategies should include the following:
  - Mass rapid transit systems
  - Integration between different modes
  - Segregated bicycle lanes and safe walkways (esp. for shorter trips)
  - Transport – oriented urban development
  - Urban development policies to encourage compact cities and mixed land uses
  - City- level policies to restrict use of private vehicles, reduce travel demand, facilitate shift to cleaner fuels and enhanced financing options to make public transport affordable and inclusive

ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY

- EKC proposes that as the per capita income of a country increases, its environmental quality degrades up to a point.
- From that point, environmental quality begins to improve with increase in income.
- Wealthier nations have more resources to invest in cleaner technologies and can implement more stringent control measures
- Also, at higher stages of development, citizens demand better environmental quality leading to environmental reforms at local and national level



Environmental Kuznets' Curve

Thanks !