

Transport Sector and Climate Change in India: Forecast and Policy Recommendations



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Coverage

- An Overview
- Trends and Challenges
- Policy and Vision Framework
- Co-benefits and challenges
- Barriers to change
- Areas for further work



Transport energy at a glance, 2003/04

- Total transport sector energy consumption = 31.14 mtoe
 - Second largest consumer of energy (16%) after industry (43%)

- Overwhelmingly driven by IC engines and is the largest consumer of oil (32%)
 - Petroleum fuels 98% and electricity 2%
 - HSD (71%), Gasoline (27%), other fuels (<1%)

- Huge dependence on oil
 - Large crude import bill (26 billion US\$ in 2004/05)

- Road is the most dominant mode of transport
 - 80% of passengers are moved by road
 - 60% of freight are moved by road

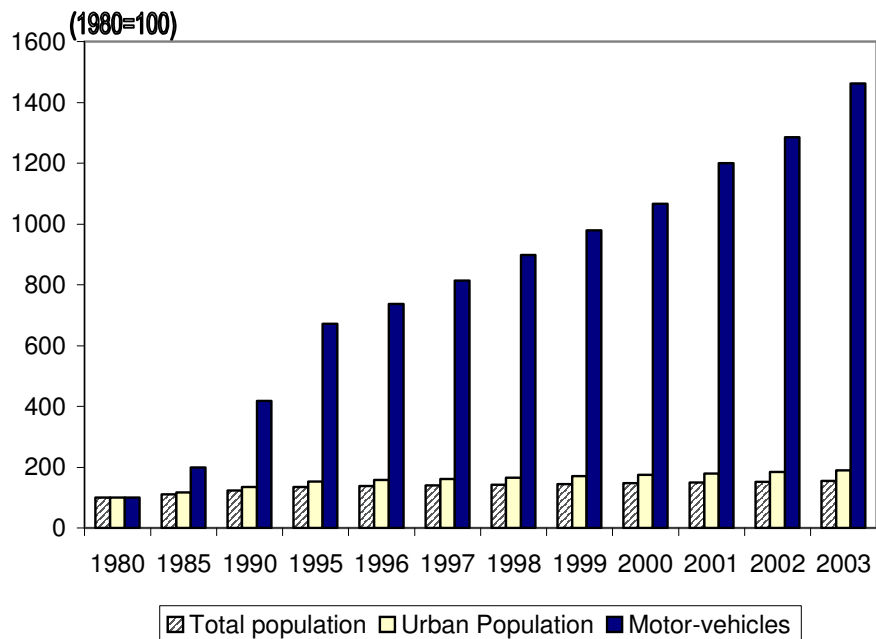


Transportation: the most challenging GHG problem

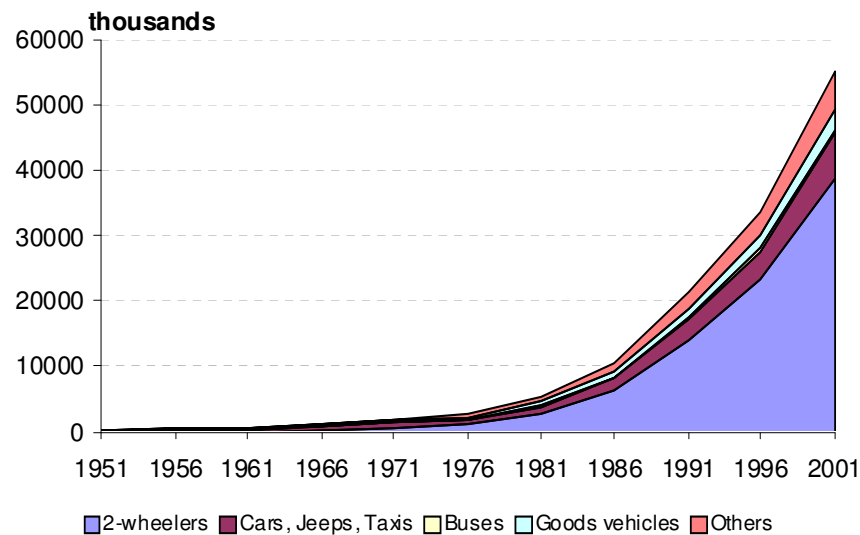
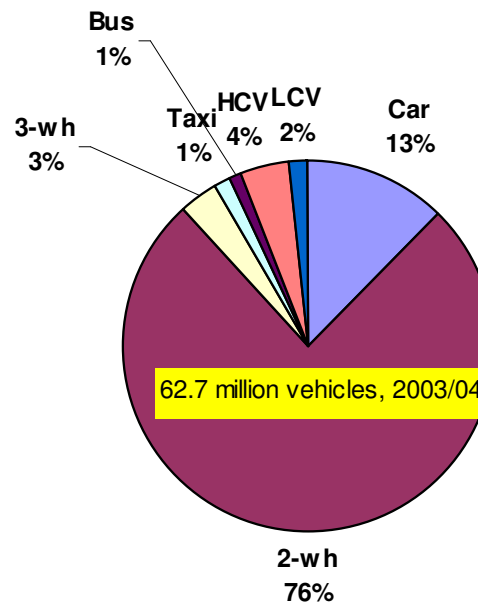
- Carbon emissions from road transportation are increasing most rapidly*
 - In 1994, total CO₂ emissions was 679.47 mt
 - 12% contribution was from transport sector
 - Road transport accounted for 90%
- Shift from rail to road
- Shift to personalized modes of transport in absence of good public transport system

*Source: India's Initial National Communication, MoEF, GoI, 2004

Growing urbanization and even faster motorization (1980-2003)



- Population size doubled
- Vehicles went up 15-times

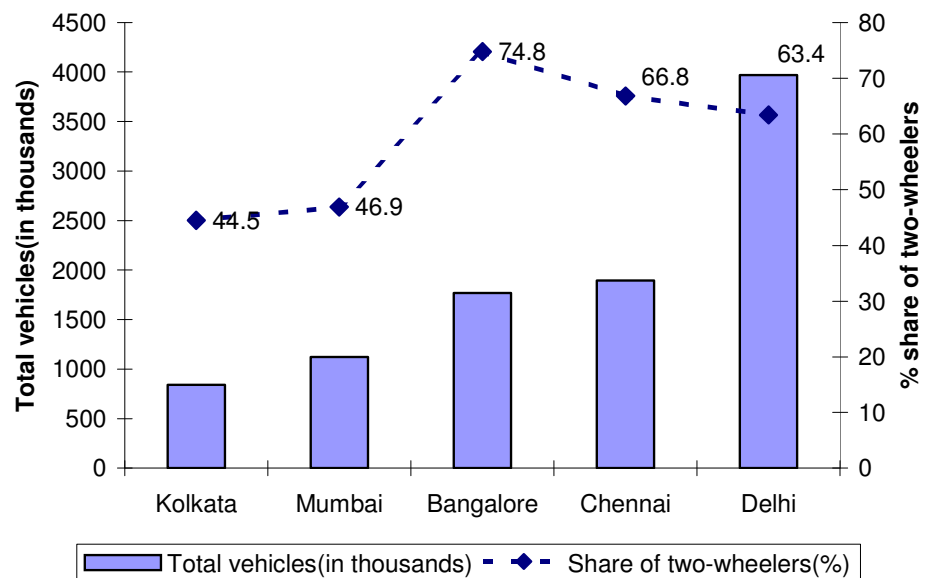
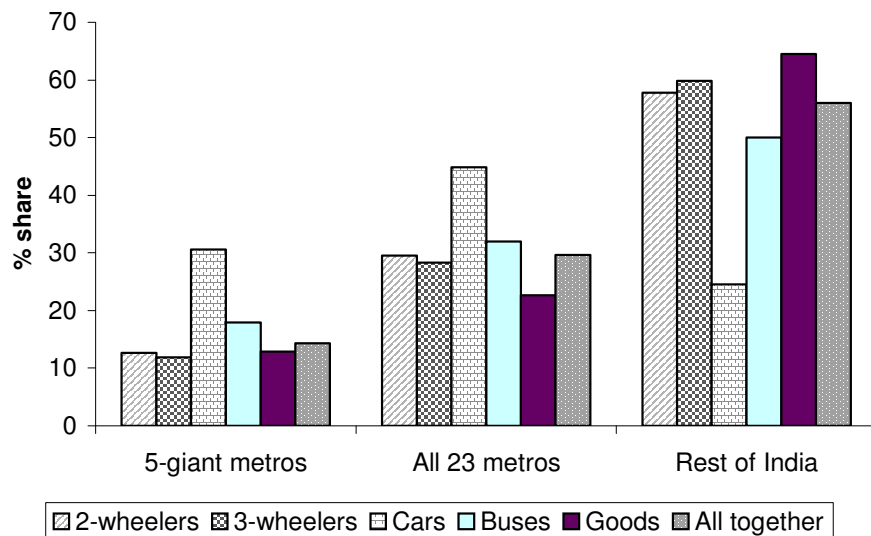


Domestic vehicles sales growth

Vehicle type	Govt. control regime (1992-2004)	Partial liberalization (1982-1992)	Post liberalization (1992-2004)
Car	0.80%	14.30%	11.70%
MUV	5.90%	7.60%	13.90%
Motorcycle	6.30%	12.00%	21.60%
Scooter	12.80%	12.40%	-0.20%
Moped	10.70%	3.40%	-3.20%
Auto-rickshaw	10.60%	9.30%	10.00%
LCV	-4.20%	7.40%	1.90%
M&HCV	5.30%	3.20%	4.70%
All vehicles	8.20%	9.10%	11.20%

Source: SIAM,2005. The Indian Automobile Industry: Statistical Profile – various issues

Heavy dependence on personal vehicles, 2003



- 1/3rd of the total vehicles are registered in 23 metros
- 45% of the total cars are confined to these metros

Large regional differences in share of personal motor vehicles



Transport scenario will be governed by

- Increasing urbanization
- Rapid economic development
 - Urban sector contribution to GDP 50-60%
- Rising income levels
- Rapid increase in motorization
- High vehicle density in urban areas
- Policies
 - National Urban Transport Policy, MoUD
 - Auto-Fuel Policy, MoPNG



Analytical approach

Step 1: Projection of on-road vehicles using econometric equations

- Number of registered non-commercial vehicles regressed with per capita income (GDP/capita)
 - Age of personal motor vehicles assumed as 15 years
 - 2-wheeler ownership to saturate at 300 vehicles/1000 people
- Number of registered commercial vehicles regressed with GDP

Step 2: Projection of travel demand and modal split by multiplying

- Number of on-road vehicles of different types
- Average distance moved by each type of vehicle
- Average occupancy/load levels by each type of vehicle

Step 3: Projection of energy demand and emissions

- Linear multiplicative model (“ASIF”) applied using LEAP software
 - Establishing baseline
 - Alternative case: Impact of strengthening bus transport



Regression coefficients for vehicle projections

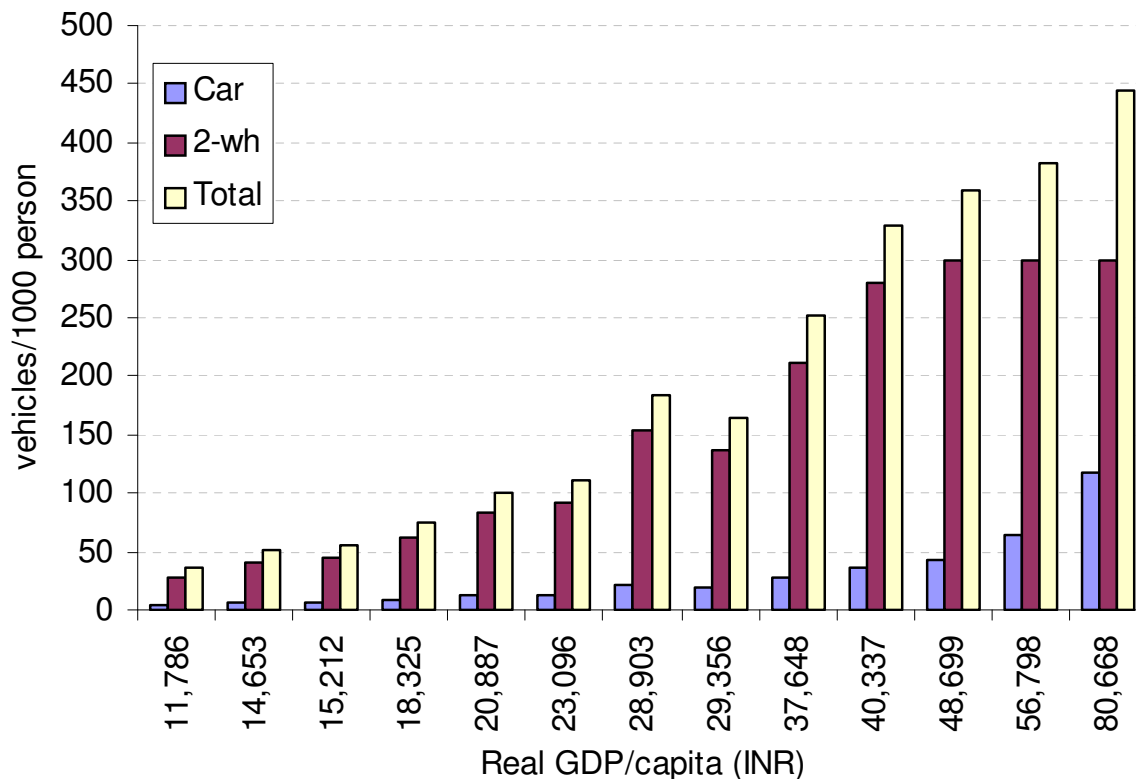
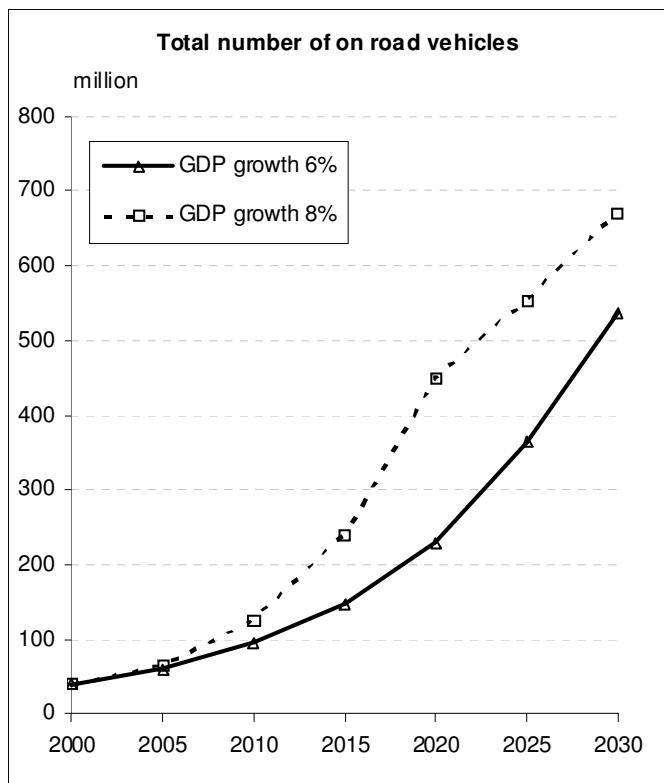
Endogenous variable	Intercept	Explanatory variable			AR(1) ^{***}	R ²	Durbin Watson
		Log (GDP)	Log (PCY)	GDP			
Log (car)	-	-	1.7 (44)**	-	0.94 (31)	0.99	1.42
Log (2-wheeler)	-	-	1.87 (129)	-	0.90 (57)	0.99	1.65
Log (3-wheeler)	-	1.033 (80)	-	-	0.90 (40)	0.99	1.52
Log (Bus)	-3.05	1.16 (32.4)	-	-	0.5 (3.17)	0.99	2.10
Log (Taxi)	-	1.04 (11.22)	-	-	0.97 (51)	0.99	1.30
Log (HCV)	-	1.04 (2.44)	-	-	0.80 (10.7)	0.98	1.74
D(LCV)*	-82059	-	-	0.15 (3.55)	-	0.42	1.70

Projection of motor vehicles on road and vehicle mix (thousand vehicles)

24 May 2006

Year	Car	2-wh	3-wh	Taxi	Bus	HCV	LCV	Total
2000	4,128	28,939	1,777	553	562	1,891	824	38,674
6% GDP growth rate per year								
2005	6,506	45,254	2,287	905	828	2,933	1,411	60,123
2010	10,477	71,722	3,251	1,378	1,163	3,978	2,479	94,449
2015	16,163	113,860	4,534	2,074	1,634	5,392	4,048	147,705
2020	24,779	178,955	6,248	3,090	2,296	7,306	6,286	228,959
2025	38,983	289,319	8,545	4,561	3,227	9,899	9,419	363,953
2030	62,041	424,973	11,635	6,675	4,534	13,411	13,751	537,020
8% GDP growth rate per year								
2005	7,100	49,452	2,377	941	865	3,050	1,425	65,208
2010	13,968	97,551	3,722	1,579	1,355	4,560	2,642	125,378
2015	26,241	191,347	5,718	2,621	2,123	6,812	4,623	239,485
2020	48,370	367,813	8,678	4,304	3,328	10,175	7,727	450,394
2025	89,014	410,785	13,073	7,003	5,216	15,195	12,480	552,766
2030	165,477	424,973	19,606	11,299	8,174	22,693	19,656	671,878

Rise in income and growth in vehicles ownership

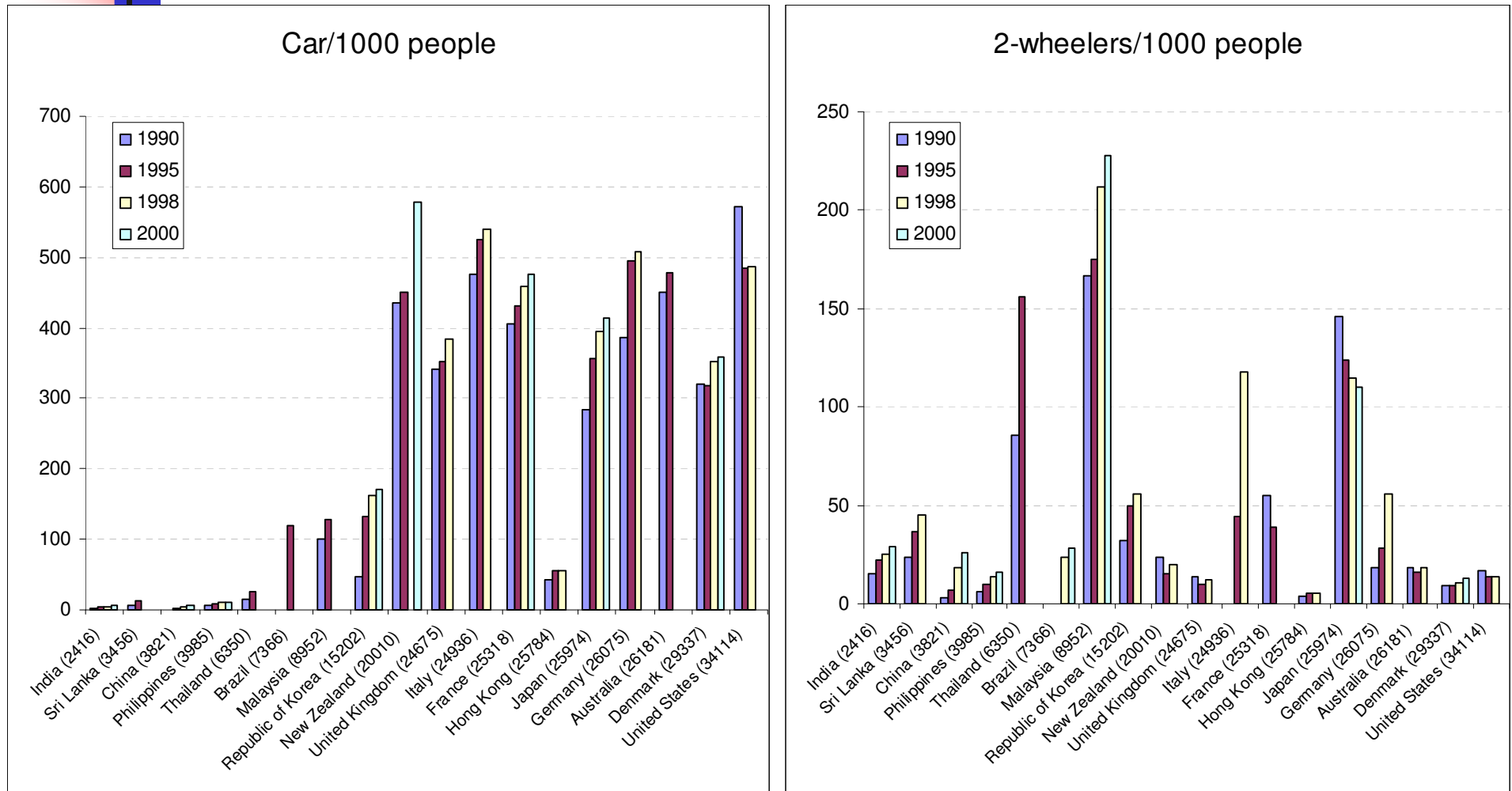


From 60 million vehicles in 2005

- 537 million in 2030 (9% annual growth)
- 671 million in 2030 (10% annual growth)

Per capita income and vehicle ownership level across countries

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India: 11 times increase in car and 2-wheeler ownership (2000-30)



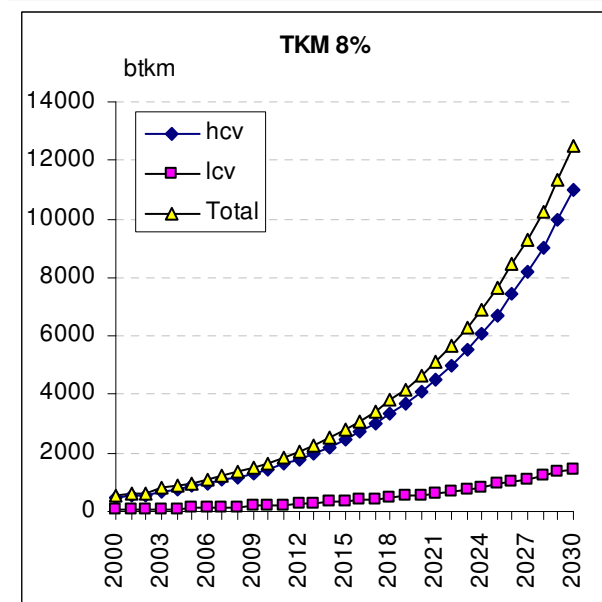
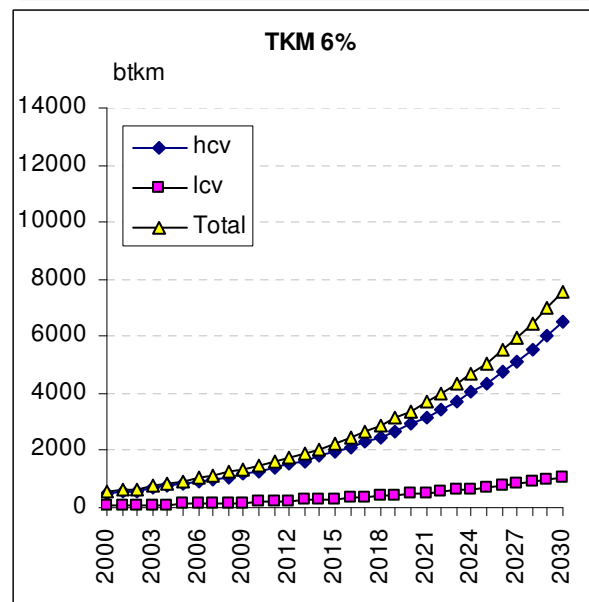
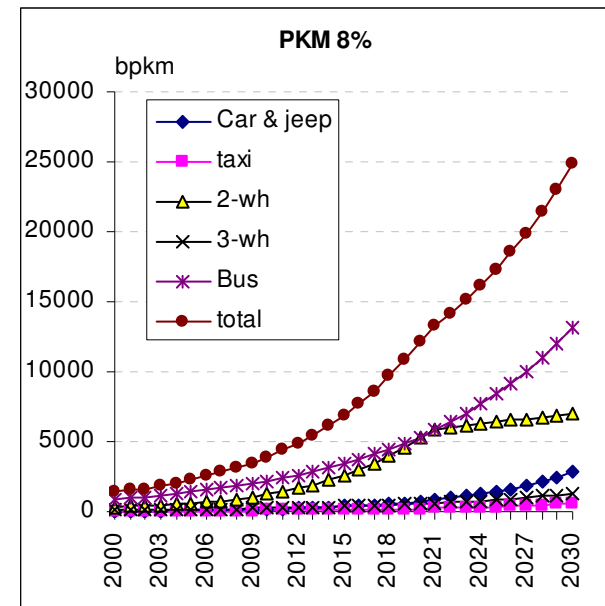
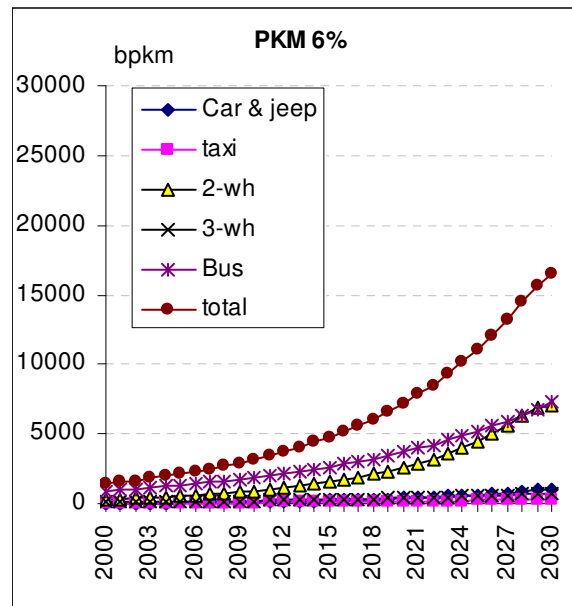
Source: World Development Indicators 2005. World Bank

Projections of transport demand 2005-30

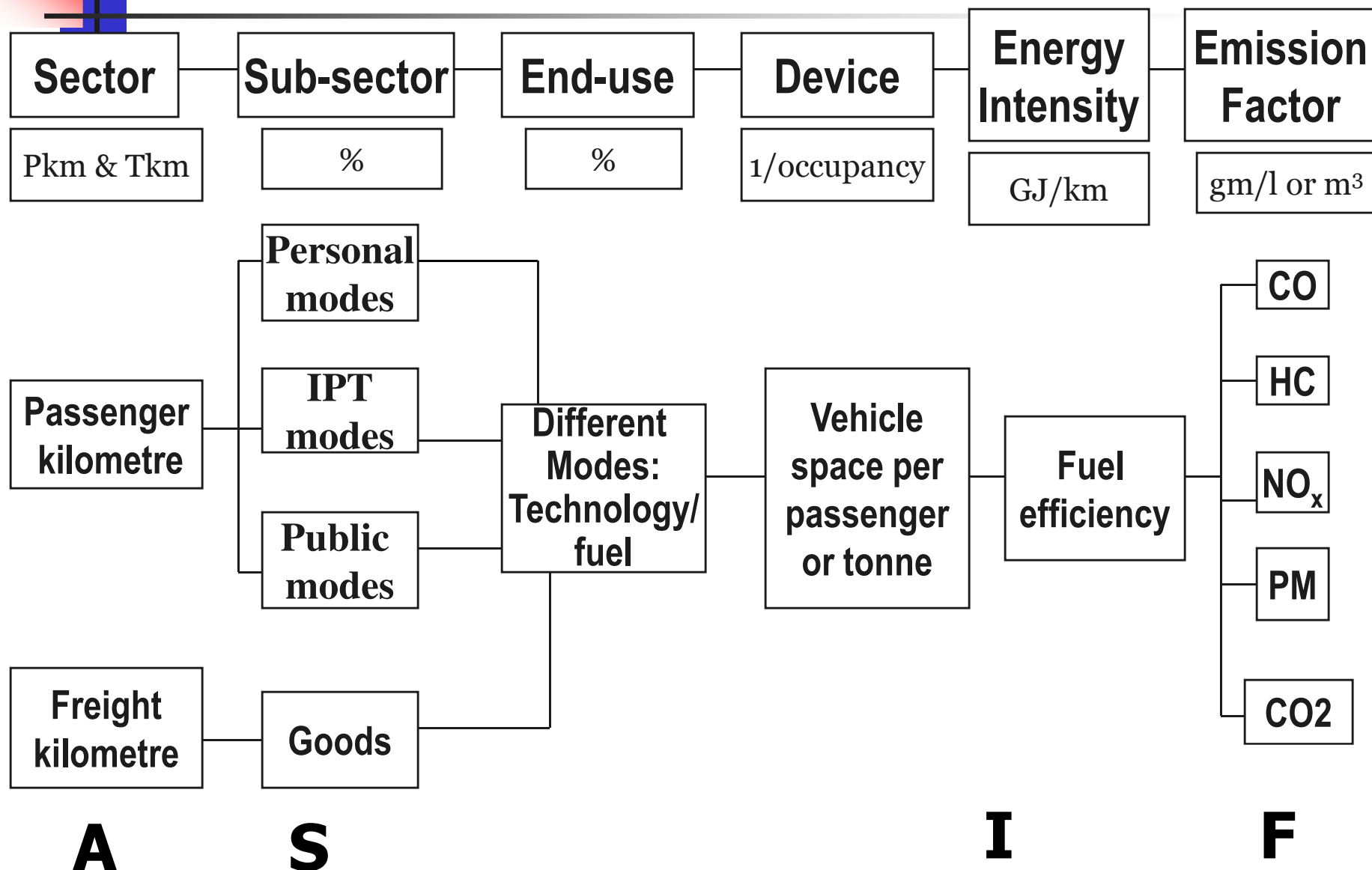
Travel demand would grow

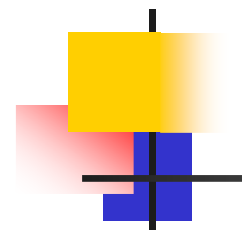
- 8.5% per year with low economic growth of 6%

- 10.1% per year with high economic growth of 8%

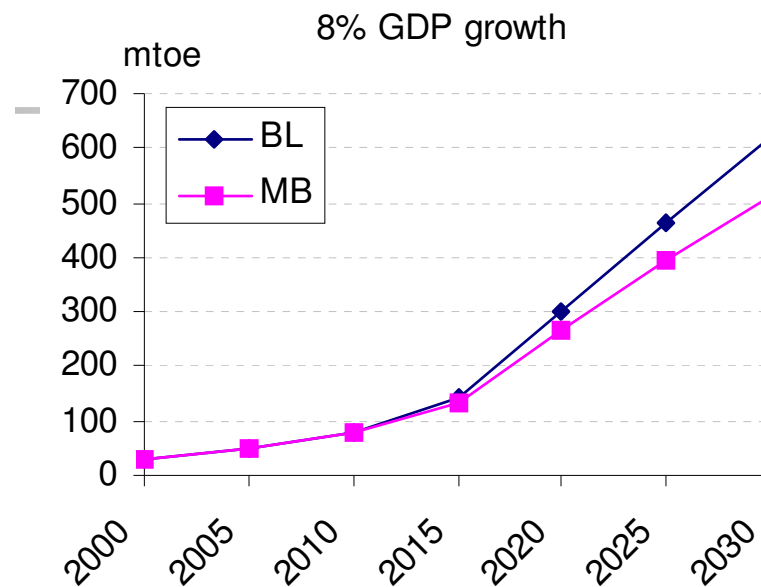
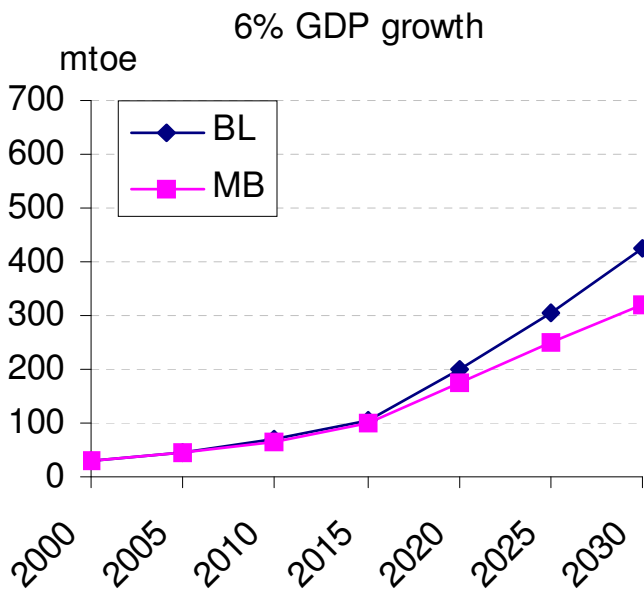


'ASIF' model in LEAP framework

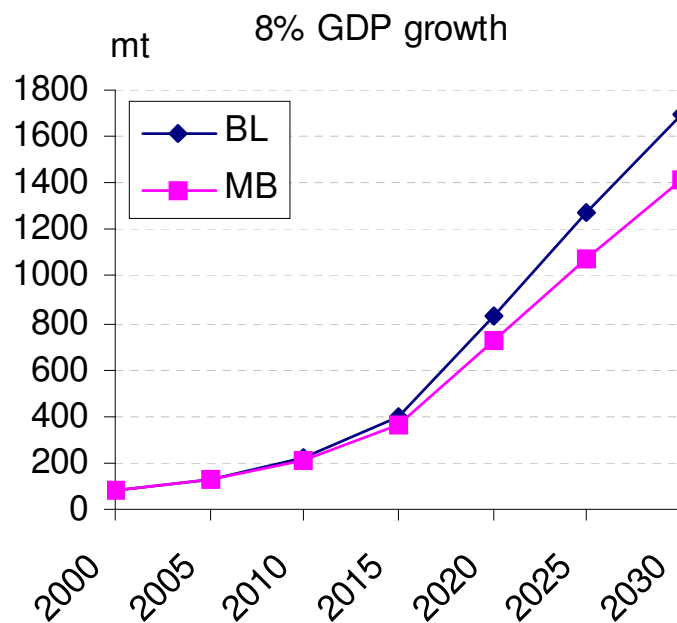
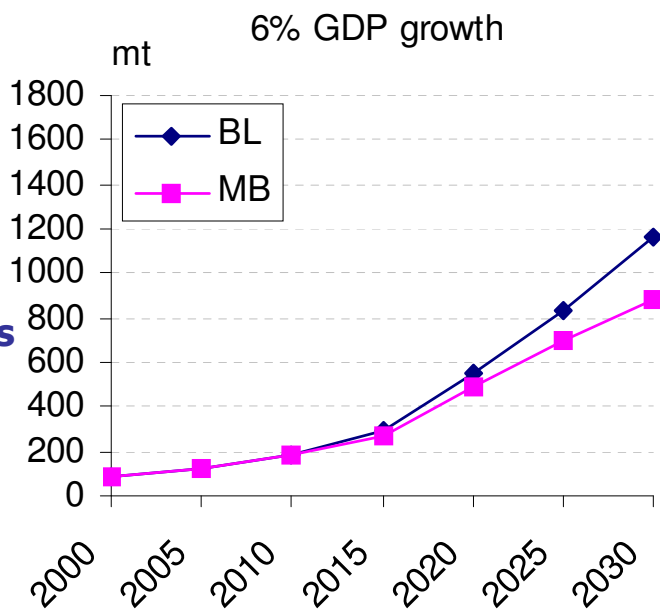




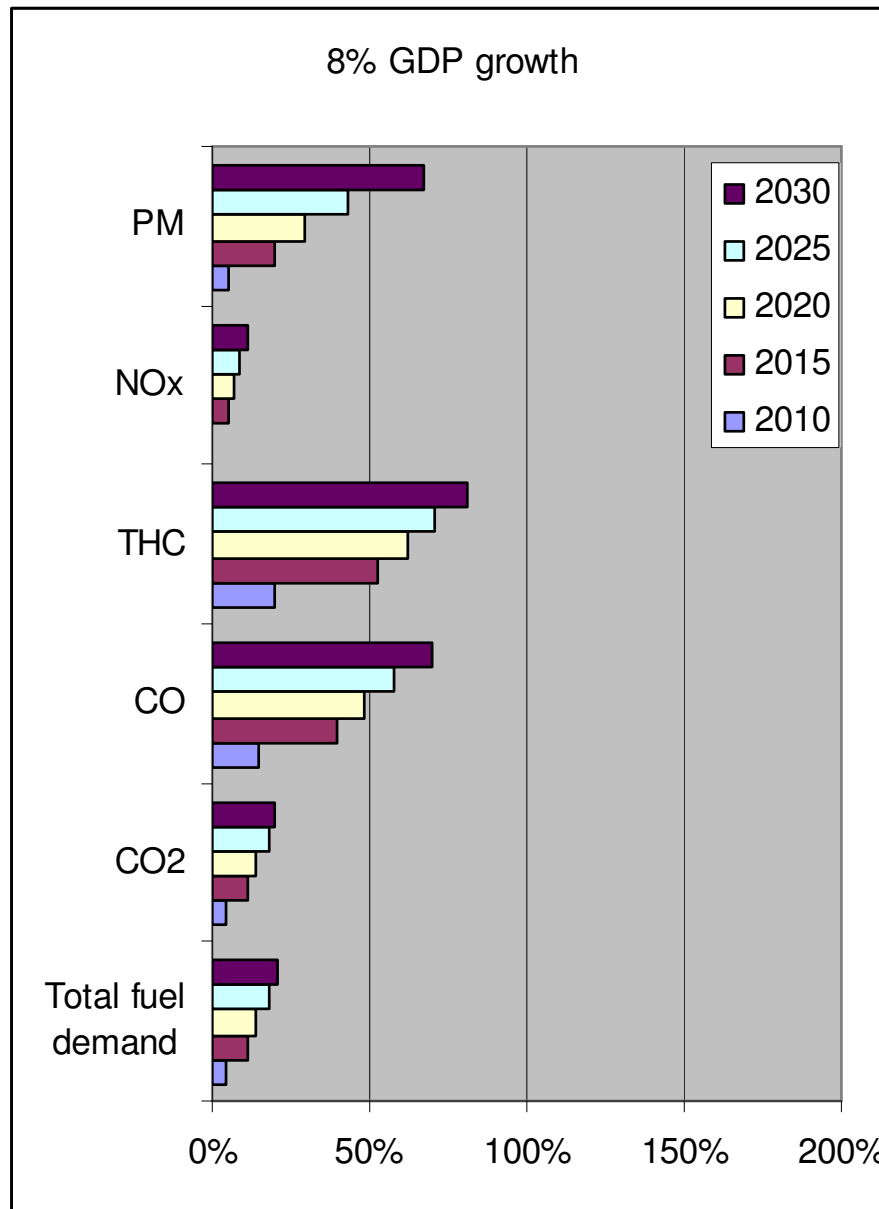
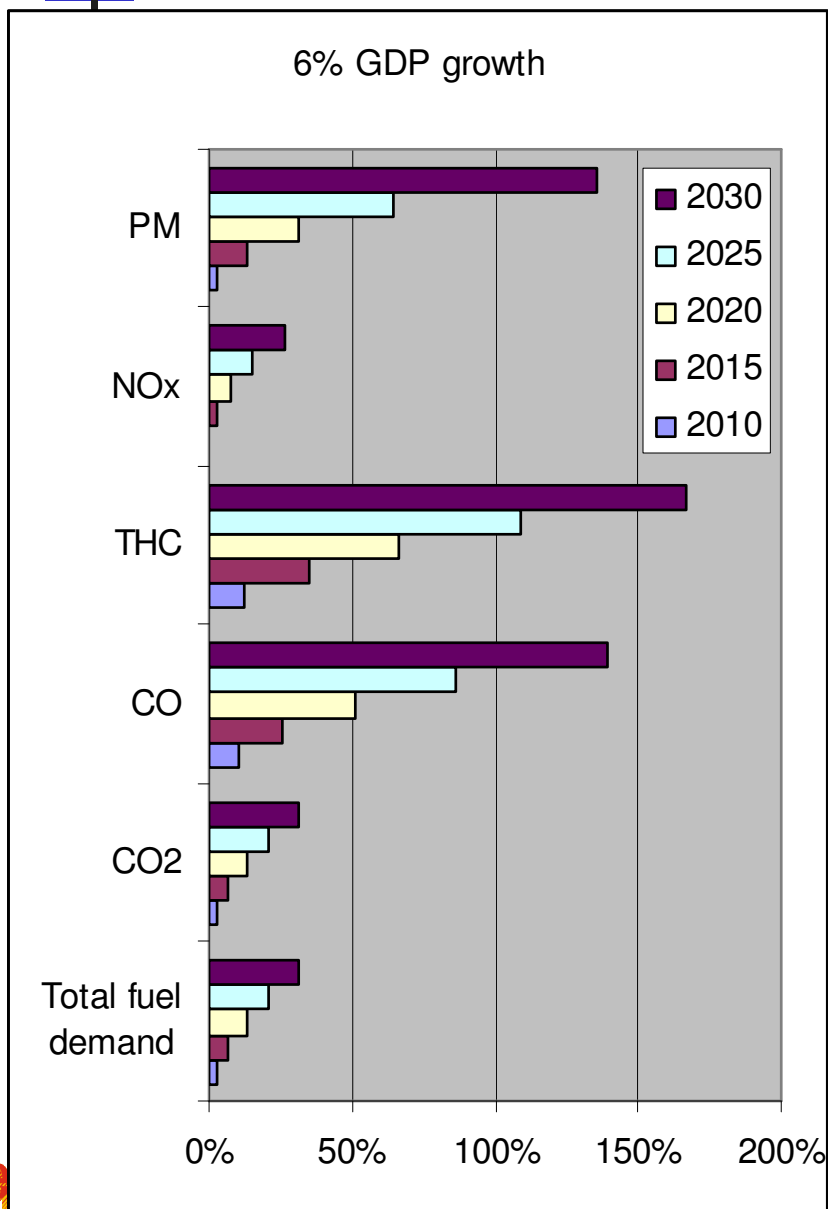
**Energy demand:
9 to 13
times
increase
(2000-30)**



**CO2
emissions:
9 to 13
times
increase
(2000-30)**



Impact of increasing bus share





Delhi case study on GHG scenarios



GHG Scenarios from Road Transportation in Delhi

- Large and rapidly expanding population
 - From 1.7 million in 1951, to over 13 million in 2001
- Large land area (appx. 1500 square kilometers)
- Extensive road network
- A number of flyovers have been built
- Urban rail network under construction in phases
- Average household income: \$850/yr (2000)
- Very high vehicle ownership rates (1 in 5)
 - 2/3 of vehicles are small scooters and motorcycles
 - 1/4 of vehicles are cars
- Inadequate public transport system
- Poorly developed non-motorized transport systems
- Increasing traffic congestion
- Rapid growth in travel
 - doubled between 1990 and 2000
 - fivefold increase projected from 2000 to 2020
- Uncoordinated management of urban land use /transportation
- Supreme Court is de facto planner

GHG emissions: 2000-20

- 4 times in BL
- 2 times in low-GHG scenario



General Findings and Solutions

- Large increases in road transport-related GHG emissions are unavoidable in future

- Key Strategies
 - Improve technology (scooters, cars, advanced technology)
 - Manage growth in vehicle use (with “carrots” and “sticks”)
 - Enhance/improve travel alternatives to serve diversity of needs and desires
 - Coordinate government strategies and activities (transport and land use, infrastructure investments, industrial policy and transport, etc)



General Findings and Solutions (cont'd)

- Large potential to dampen GHG increase – huge difference between high and low carbon scenarios
- Many inexpensive and attractive options are readily available to restrain growth in emissions
- Many GHG control strategies are identical to attractive economic, social, and environmental strategies
- Strong local expertise and strong commitment to planning and management are needed to meet transportation challenges (and to restrain GHG emissions)



Emission reduction strategies

- Reduce vehicle kilometres
- Use less fuel per vehicle kilometre
- Generate less pollution per unit of fuel

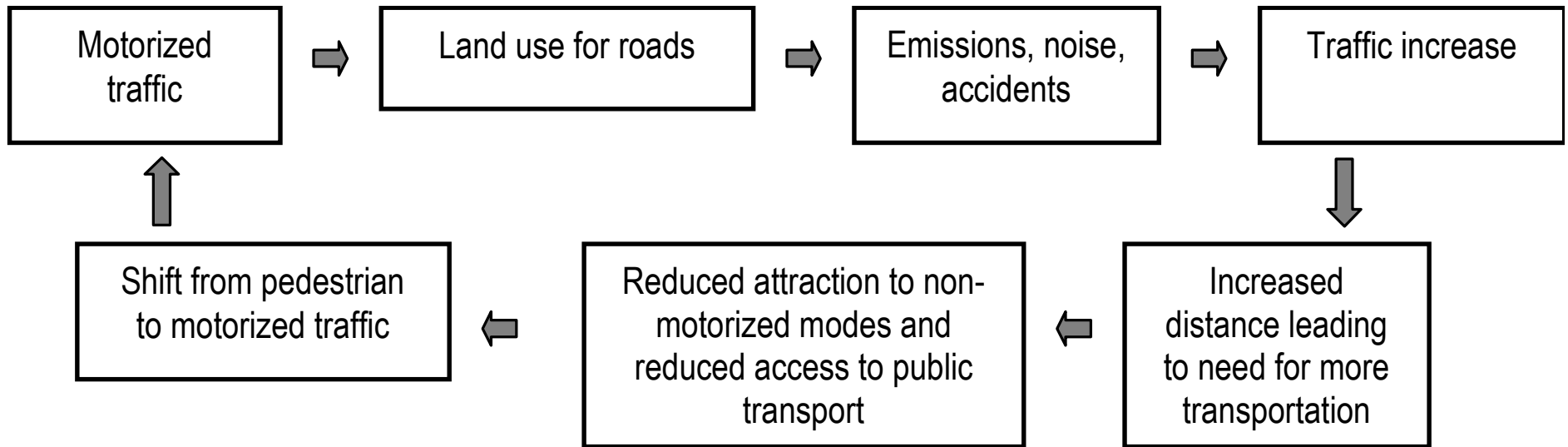


Policies and measures

- Enhancement of knowledgebase and capacity building
- Improving access and reducing transport demand
 - Integrate land use and transport planning
- Using less fuel per passenger or freight kilometre
 - Fiscal and control measures
 - Priority to good public transport
 - Promoting use of NMT modes
- Implement fuel economy standards for new vehicles
 - Fuel efficiency standards
 - Emission standards
 - Fuel quality standards
- Reducing emissions from in-use vehicles
 - Inspection and Certification
 - Retrofit programme

Integrating land use and urban transport planning

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Guiding principles:

- Reduce the need to travel
- Reduce trip distances
- Reduce growth of trips
- Support public transportation, walking and cycling
- Enhance healthy living conditions



Begin with pilot demonstration projects

- Develop dedicated bus corridors with high capacity modern BRT system
- Enhance use of NMT modes on dedicated lanes
- Reinforce TDM measures and enforcement skills
 - efficient pricing of road use (including external costs)
 - co-ordinated land use and infrastructure investment policies
- Develop retrofit programme ECDs
- Setting up of I&C model test centres



Non climate policies

- Co-benefits
 - Examine synergies and trade-offs
- Privatization leads to
 - Shift from large to small size buses in absence of well managed competition
- Transport and fuel subsidies
 - Lower the cost of road transportation
 - Decrease the incentive to economize on fuel
 - Problem of adulteration



Co-benefits

- Improve access to means of personal mobility
- Equity in access
- Appropriate mobility infrastructure
- Increase fuel efficiency
- Reduce
 - congestion
 - air pollution
 - traffic accidents
 - noise levels
 - demand for non-renewable energy
 - GHG emissions



The Challenge

Each region must capture synergies and avoid tradeoffs in creating a sustainable transportation system.





Stakeholders

- The International Development Community
- National Government
- State Governments
- Local, City and Municipal Governments
- NGOs and Community Groups
- Private Enterprise and Investors



Investment and financing

- Establish a clear and transparent legal and fiscal framework

- Encourage Public-Private partnership
 - Creation of dedicated public transport and NMT infrastructure
 - Setting up of a number of modern I&C centres

- Seek financial support under GEF

- Currently, CDM is not favourable for transport related projects



Barriers to change

- Weak empowerment and linkages between urban planning, transport planning, traffic management and enforcement
- Lack of public transport alternatives and political unwillingness to enforce TDM measures
- Access to huge capital to implement public transport systems and I&C centres
- Absence of a comprehensive framework to evaluate true cost of externalities of road transport
- Inadequate knowledge of the cost-benefit or cost effectiveness of various measures



Areas need additional work

- Number of vehicles on road
- Mobility audits in large and second order cities
- Public transport ridership and WTP for better services
- Short and long-run price elasticity of transport demand
- Cost effectiveness of alternative policies
- Transport-planning models
- CO₂ baselines
- Methods for monitoring and verification of carbon mitigation projects
- Training needs and capacity building



Thank you
