Potential Transportation Pathways in India

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Indian transport at a glance

- Transport sector second largest consumer of commercial energy after industry

- Total energy consumed in 2000/01 = 170.53 mtoe
  
  Industry (42.4%); Transport (19.7%); Residential (13%); Agriculture (8.9%); Other energy uses (5.6%); Non-energy uses (10.4%)

- HSD and petrol or gasoline contribute to 98% of energy consumed in the transport

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

- Increasing dependence on personal modes of transport which are highly energy intensive
Freight Traffic: Inter modal share

- Continuous erosion in the share of Railways in freight movement and increase in share of less efficient road transport
- Rail:Road = 30:70 (2003/04)
- GDP growth rate = 6.5% pa (2001-36)

Source: TEDDY 2003-04, p304
Passenger traffic: Inter modal share

- Substantial shift from rail to road
  Ø Rail dominates long-haul
  Ø Road dominates short-haul
- Rail:Road = 15:85 (2003/04)
- Population growth rate = 1.11% pa (2001-36)
- Urban popn. growth rate = 2.27% pa (2001-36)

TERI estimate (10^9 passenger-km)

Source: TEDDY 2003-04, p304
Urban transport scenario

§ Large urban population
§ High vehicle density in urban areas
§ Inadequate public transport
§ No urban transport policy
§ Diffused institutional arrangements
§ Implications for economic sustainability
§ Cities are vertices of continued growth
Growth of population, urbanisation and motorisation

Index: 1951=100

Total population
Urban population
Regd. motor vehicles
Growth of motor vehicles

- Over 1/3rd of the total vehicles are registered in 35 million plus cities.
- Among large sized cities, Delhi, Bangalore, Hyderabad have large share of cars compared to Mumbai & Kolkata.
- Most of the medium and small sized cities have very large number of 2-whs.
- Public transport vehicles are confined to only major cities.
## Contribution of auto exhaust in emissions

<table>
<thead>
<tr>
<th>Country/City name</th>
<th>CO</th>
<th>PM</th>
<th>NO\textsubscript{x}</th>
<th>SO\textsubscript{2}</th>
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<tbody>
<tr>
<td>Mumbai</td>
<td>92%</td>
<td>4-16%</td>
<td>60%</td>
<td>2-4%</td>
</tr>
<tr>
<td>Delhi</td>
<td>76-90%</td>
<td>3-22%</td>
<td>32-74%</td>
<td>5-12%</td>
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<tr>
<td>UK</td>
<td>90%</td>
<td>-</td>
<td>51%</td>
<td>2%</td>
</tr>
<tr>
<td>USA</td>
<td>70%</td>
<td>28%</td>
<td>39%</td>
<td>5%</td>
</tr>
<tr>
<td>EU Countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>63%</td>
<td>15%</td>
<td>46%</td>
<td>0.80%</td>
</tr>
<tr>
<td>1995</td>
<td>60%</td>
<td>16%</td>
<td>44%</td>
<td>1.50%</td>
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<tr>
<td>2000</td>
<td>52%</td>
<td>13%</td>
<td>40%</td>
<td>1.10%</td>
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</tbody>
</table>

Policy response in India

§ Largely technology based response
  Ø Vehicle emissions
  Ø Fuel quality
  Ø Mandating alternative fuels

§ Inadequate attention to demand management
  Ø NMT – not recognized
  Ø Land use development haphazard
  Ø Public transport not encouraged
Directions for change

§ Passenger transport
  Ø Reduce travel demand
    § Increase public transport share
    § Restrict personal vehicles usage
  Ø Reduce emissions per km
    § Improved technologies & fuels
    § Alternative fuel options

§ Freight Transport
  Ø Increase capacity in rail, water, & pipeline
  Ø Focus on interconnectivity, multi-modalism
  Ø Improve truck & rail technology
  Ø Improved management and information technology applications
Assumptions for the interventions

Baseline (BL)
- Trip length increases rapidly
- Share of public transport 54%, IPT 20%
- 25% improvement in fuel efficiency on an average by 2050
- Diesel share in personal vehicles 35%, IPT 50%

Alternative (ALT)
- At least 60% of the urban travel demand should be catered to by public transport, IPT to 23%.
- 50% fuel efficiency improvement by 2050
- Diesel share in personal vehicles 15%, IPT 25%
- The share of vehicles powered by CNG (compressed natural gas), ULSD (Ultra Low Sulphur Diesel), and cleaner gasoline, to rise to about 25% of the total
- The share of zero-emission vehicles, such as those powered by fuel cells, should rise to about 25% of the total personal and IPT vehicle fleet by 2050—again, the present trend will take it to only about 5% by 2050.
- Finally, the entire urban bus fleet will run on CNG or ULSD.
Impacts of the suggested interventions on transport energy demand and CO₂ emissions

Source: DISHA, Green India 2047, TERI, 2001, pp209 for energy demand estimates. CO₂ figures are estimated separately.
Two case studies
According to a transport study in Delhi*,

§ Air quality improvement is predominantly pursued via technical improvements

§ Locally motivated programmes have very limited effect on the global environment

§ Motorization and GHG emissions from transportation will increase sharply (4 times in LE/HC and 2 times in HE/LC) in 2020

§ Large potential to dampen GHG increases – huge difference between high and low scenarios

§ Many strategies and policies to reduce GHG emissions are consistent with strategies to create a more economically efficient, equitable, and low-polluting transportation system

Strengthening the penetration level of Public Transport from 62% to 80% in Bangalore in 2020 would lead to…

<table>
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<th>Parameters</th>
<th>Unit</th>
<th>Reduction potential over Baseline</th>
<th>% reduction over Baseline</th>
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<tbody>
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<td>Total fuel demand</td>
<td>$10^3$ TOE</td>
<td>765.32</td>
<td>20.80</td>
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<tr>
<td>Total number of vehicles</td>
<td>number</td>
<td>642,328</td>
<td>22.99</td>
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<tr>
<td>Total passenger car units</td>
<td>number</td>
<td>418,210</td>
<td>21.24</td>
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**Emissions**

<table>
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<th>Parameters</th>
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<th>Reduction potential over Baseline</th>
<th>% reduction over Baseline</th>
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<tbody>
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<td>CO</td>
<td>$10^3$ t</td>
<td>53.73</td>
<td>40.08</td>
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<td>HC</td>
<td>$10^3$ t</td>
<td>24.48</td>
<td>45.95</td>
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<td>$NO_x$</td>
<td>$10^3$ t</td>
<td>3.54</td>
<td>6.26</td>
</tr>
<tr>
<td>PM</td>
<td>$10^3$ t</td>
<td>1686.47</td>
<td>28.58</td>
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<tr>
<td>$CO_2$</td>
<td>$10^3$ t</td>
<td>2054.04</td>
<td>20.64</td>
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<tr>
<td>Cumulative CO2 (2005-20)</td>
<td>$10^3$ t</td>
<td>12225.00</td>
<td>12.76</td>
</tr>
</tbody>
</table>
Recommended strategies

§ Setting up of stricter standards on emissions and fuel quality
§ Augmentation of public transport and increased ridership
§ Need for an effective I&M program for in-use vehicles
§ Implement traffic management measures
§ Introduce restraint and demand management measures
§ Phasing out of 2-stroke technology
§ Promote infrastructure facilities for NMT
§ Raise public awareness
Opportunities for cooperation

§ Fuel efficiency improvements
  Ø Body, engine technologies
  Ø Engine management systems
  Ø Alternative options: Hybrid powertrains and fuel cell vehicles

§ Emission control devices as OEMs
  Ø Advanced catalysts and trap systems

§ Electronics in automobiles

§ Greater role in product development for Indian market
Thank you