Sustainable Low Carbon Development and the Transport Sector in India

EMBARQ India
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Report Structure

1. Transport Sector Emissions in India
   • Current Estimates
   • Future Projections
   • Focus on Urban Transport
2. Urban Transport in India
   • The Situation Today
   • Key Challenges in the next 20 years
3. Sustainable Low Carbon Urban Transport - The International Context
4. Current Interventions
5. Findings from Stakeholder Interviews
6. Suggested Interventions
   • Suggestions from Interviews
   • Suggestions from Literature
7. Identifying Strategy for Future Interventions
   • Relative Impacts of different intervention types
   • Gap Analysis
8. Conclusions
1. Transport Sector Emissions in India

Current Estimates

In 2007, the Transport sector accounted for 7.5% of total CO2e emissions in India. It is one of the fastest growing sectors in terms of emissions – from 1994 to 2007, CO2 emissions from the Transport sector grew at an rate of 4.5% per annum.

The vast majority of emissions from the Transport sector, 87%, are due to the use of fossil fuels in internal combustion engines – Road Transport, in other words. The remaining emissions come from aviation (7%), railways (5%) and inland water navigation (1%).

Source: [1]
A number of studies have made projections of the growth in emissions from India’s transport sector over the next two decades. The projections listed here show the ‘Business-As-Usual’ scenario - the amount emissions are expected to increase to without any interventions to reduce the emissions intensity of the sector. These studies primarily use ‘bottom up’ approaches that model the growth in emissions based on growth in travel demand, and motorized trips, fuel efficiency of motor engines and fuel quality.

McKinsey 2009 estimates that in 2030 the transport sector will account for 12% of total emissions in India, whereas according to World Bank 2009 this figure will be 16% in 2031.

Note: Both studies look at emissions from the use of fossil fuels in internal combustion engines i.e. Road Transport only. Both studies include moderate expected increases in vehicle fuel efficiency in their models.

Source: [2], [3]
1. Transport Sector Emissions in India
   Focus on Urban Transport

Although no comprehensive estimates of the current share of urban transport in total sector emissions exist, it is likely to be a significant percentage. A forthcoming study in the India Infrastructure Report 2010 finds that road transport emissions from just 23 of the 35 million plus cities in India account for between 1/4th and 1/3rd of all road transport emissions in the country as a whole.

Trends in the size and growth of the motor vehicle fleet offer additional evidence of the importance that urban transport will play in any effort to reduce transport sector emissions. The motorization rate in urban areas is more than 4 times higher than that in rural areas. The private motor vehicle fleet is also growing at a faster rate in urban areas.

Schipper et al 2008 have projected that emissions from urban transport will grow more than 8 times between 2000 and 2030 in a Business-as-Usual scenario. Although this projection includes emissions from all modes of travel, road transport accounts for the lion’s share of emissions.

*It is clear that any strategy aimed at reducing the growth of emissions in India’s transport sector will have to pay special attention to reducing the emissions intensity of urban transport.*

*Source: [4], [5], [6]*
2. Urban Transport in India

The Situation Today

Public Transport
• Public Transport shares in India are relatively high compared to developed nations.
• Shares are higher in larger cities with well developed networks
• However, only 28% of million-plus cities in India have a public transport system, explaining the higher share of private transport in smaller cities.

Active Transport
• Most cities show very high use of active transport modes
• However, there is very little dedicated infrastructure for these modes in Indian cities.
• Where footpaths do exist, encroachment is a constant threat
• Many smaller cities have no footpaths at all, despite their higher than average share of active transport modes.

Source: [7]
2. Urban Transport in India

The Situation Today

Trip Lengths
- Trip length is a function of urban form and city area.
- As expected, residents in larger cities have longer trip lengths on average.
- Shorter trip lengths also correlate with higher use of active transport mode.
- These lengths will increase as smaller cities expand in both size and population.

2-Wheeler Motorization
- Indian cities have some of the highest 2-wheeler motorization rates in the world. 11 of the 12 cities shown have higher motorization than the average middle income Asian city.
- While higher use of 2-wheelers is better than car use from an emissions perspective, the experience of other Asian countries suggests a shift to cars as incomes increase.

Source: [7]
## 2. Urban Transport in India

### Key Challenges in the next 20 years

<table>
<thead>
<tr>
<th>Urbanization</th>
<th>Rapid Motorization</th>
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</thead>
<tbody>
<tr>
<td>India’s population is urbanizing at a rapid rate – decadal growth in urban population is estimated to be 40%. By 2030, the total share of the country’s population living in urban areas is set to increase to 40%, from 28% in 2001. In absolute numbers, this means that around 300 million people will be added to India’s cities. The number of million plus cities will increase to 68 in 2030, from the present 35. This increase in urban population will place enormous strain on existing transport infrastructure.</td>
<td>India is experiencing a rapid increase in the rate of motorization. Between 1990 and 2003, the total number of registered private vehicles increased 15-fold, and grew at an annual rate of 12.4%. By one estimate, the vehicle fleet will grow from the present 45.7 million (40m 2 wheelers, 5.7m cars) to 353 million (273m 2-wheelers, 80m cars) by 2030. The motorization rate (vehicles/1000 people) will increase from 41.5 in 2007 to 238.8 in 2030. This means that the 2-wheeler fleet size will increase more than 6-fold, whereas the car fleet size will increase 14-fold.</td>
</tr>
</tbody>
</table>

### Increasing Travel Demand

In addition to the increase in the absolute number of trips due to an expanding urban population, per capita demand for travel is also set to increase in coming years. There are three factors underlying this increase in travel demand:
- As per capita and household incomes rise, the demand for trips increases.
- As more and more women join the workforce, the travel demand from this previously ‘inactive’ population increases.
- With industrial restructuring towards a service oriented economy, workers no longer tend to live close to the sites of factories, leading to higher trip rates and longer trip lengths.

### Urban Sprawl

Most Indian cities currently have high densities, which is good from the point of view of public transport systems. In the absence of strong urban planning guidelines and enforcement, however, much of new development takes place at the urban periphery. This is especially true in smaller cities that are growing rapidly, where there is little rejuvenation of land. Regional development authorities also tend to focus on developing peri-urban land. As cities increase in size, this leads to an increase in trip lengths. Longer trip lengths in turn make the use off Active transport less feasible.

Source: [2], [3], [6], [7], [8]

International climate change discussions have increasingly come to focus on the contribution and impact of the transport sector on global greenhouse gas and carbon emissions. Globally, the transport sector accounts for 16% of total greenhouse gas emissions. Transport related CO2 emissions are expected to increase by 57% between 2005 and 2030, with the majority of this increase coming from developing countries. Recent efforts have focused on including transport sector specific interventions in Nationally Appropriate Mitigation Actions (NAMAs) and in existing climate change mitigation funding schemes such as the UNFCCs Clean Development Mechanism.

In 2008, a group of international transport experts came together to develop the ‘Avoid—Shift-Improve Framework’ for identifying and implementing transport sector intervention that will reduce the sector’s emissions impacts.

<table>
<thead>
<tr>
<th>Description</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td>Interventions that result in avoiding the need for motorized trips</td>
<td>Transport—Oriented Development</td>
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<tr>
<td></td>
<td>High quality pedestrian and cycling infrastructure</td>
</tr>
<tr>
<td>Shifting trips to more efficient modes, such as from private motor vehicles</td>
<td>High Quality Public transport</td>
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<tr>
<td></td>
<td>Park-and-Ride facilities</td>
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<tr>
<td>Improving existing technologies (engines, for example) or systems (a bus</td>
<td>Fuel efficiency norms</td>
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<tr>
<td>service) to realize efficiency gains</td>
<td>Better engine technology</td>
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<td></td>
<td>Alternative Fuels</td>
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</tbody>
</table>

Source: [9]
4. Current Interventions
Classifying existing policies and other interventions

<table>
<thead>
<tr>
<th>AVOID motorized travel</th>
<th>Policy</th>
<th>Projects</th>
<th>Capacity</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>• National Urban Transportation Policy (NUTP)</td>
<td>• JnNURM funded BRTS projects • JnNURM funded Bus Fleet Expansion in 61 Indian cities. • Metro rail projects in major metropolises</td>
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<td>SHIFT motorized travel to more efficient modes</td>
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<tr>
<td>IMPROVE existing operations and technologies</td>
<td>• Bharat Stage III and IV emissions norms • Actions through Environment Pollution Control Authority (EPCA) and Bureau of Energy Efficiency (BEE)</td>
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</table>
## 5. Findings from Stakeholder Interviews

### Who we Spoke to

<table>
<thead>
<tr>
<th>Government</th>
<th>Barriers to Low Carbon Urban Transport in India</th>
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<tbody>
<tr>
<td>S.K. Lohia, MoUD</td>
<td>There are currently no policies in place to promote low carbon transition in the transport sector. No financial disincentives for car use. Existing planning guidelines prioritize cars over public transport</td>
</tr>
<tr>
<td>Vijayalaxmi, MMRDA</td>
<td>No constraints – Indian manufacturers are mature and have the technical capacity to produce efficient engines. However, the lack of national norms mean they face little pressure to do so.</td>
</tr>
<tr>
<td>R Ramanna, MMRDA</td>
<td>The availability of financial resources in general is not a barrier, but the allocation is heavily biased towards private vehicles. A dedicated fund for sustainable transport investments is needed.</td>
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<table>
<thead>
<tr>
<th>NGOs/ International Orgs/Experts</th>
<th>Three main constraints - a lack of awareness of low carbon transport at all levels of government, lack of technical capacity to implement projects and a fragmented authority structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partha Bosu, CAI-Asia (India)</td>
<td>Perceptions of status and the aspirational nature of car ownership are major barriers. Using sustainable modes such as bicycling is looked down upon, whereas owning a car is a sign of success.</td>
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<tr>
<td>Kaushik Deb, IDFC</td>
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<tr>
<td>Dario Hidalgo, EMBARQ</td>
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<tr>
<td>Cornie Huizenga, SLoCaT</td>
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<td>Rakesh Kumar, NEERI</td>
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<tr>
<td>Sophie Punte CAI-Asia</td>
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<td>Ashok Srinivas, Prayas</td>
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<td>Shivanand Swamy, CEPT University</td>
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</tbody>
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### Business & Industry

- K.K. Gandhi, SIAM
- Narayan Iyer, Bajaj Auto (Ret.)
- Prasanna Patwardhan, Purple Bus

### Source: [10]
6. Suggested Interventions

Suggestions From Stakeholder Interviews

<table>
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<td>• PMV Usage Restrictions</td>
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<td>• Integrate NMT in new Urban Developments</td>
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<td></td>
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<tr>
<td><strong>SHIFT</strong> motorized travel to more efficient modes</td>
<td></td>
<td>• Promote awareness of Sustainable Transport concepts at State, Local Levels</td>
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<tr>
<td>• Integrate NMT in new road infrastructure</td>
<td></td>
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<tr>
<td>• Integrate Public Transport in Planning Guidelines</td>
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<tr>
<td><strong>IMPROVE</strong> existing operations and technologies</td>
<td></td>
<td>• Workshops to improve public transport performance</td>
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<td>• Waive/reduce fuel tax for public transport operators</td>
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<tr>
<td>• Waive /reduce annual registration tax for public transport vehicles</td>
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Source: [10]
6. Suggested Interventions
Suggestions from Literature Review

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<tr>
<td></td>
<td>• National Emissions norms</td>
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<tr>
<td></td>
<td>• Other efficiency gains</td>
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<td></td>
<td>• Enhanced share of public transport in passenger movements</td>
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<tr>
<td></td>
<td>• Enhanced share of rail in freight movement</td>
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<td></td>
<td>• Promote use of Bio-Diesel</td>
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<td></td>
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<td></td>
<td>• Promotion of CNG use</td>
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</tbody>
</table>

Source: [2], [3], [6], [11]
The literature on projected emissions from India’s transport sector also estimated emissions savings from a variety of interventions. Some of these interventions include improve engine technology and efficiency, introduce alternative fuels, promoting public transport for passenger movement, promoting rail for freight movement, improving active transport infrastructure and so on. These interventions, and their impacts, were classified according to the ‘Avoid-Shift-Improve’ framework in order to better understand the relative impacts of the three different strategies. The graphs above suggest that ‘Avoid’ and ‘Shift’ interventions have greater potential for emissions reduction than ‘Improve’ interventions.

Notes: McKinsey 2009 projections are for all road passenger transport
Schipper et al 2008 projections are for urban transport only and include all modes

Source: [2], [6]
6. Identifying Strategy for Future Interventions

**Gap Analysis**

<table>
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• Metro rail projects in major metropolises  
• Enhanced share of public transport in passenger movements  
• Enhanced share of rail in freight movement |
| | | • Promote use of CNG  
• Production of Electric Two-Wheelers  
• Electric Vehicles in Public Transport  
• Promotion of CNG use |
| | | • National Capacity Building Initiative  
• Promote awareness of Sustainable Transport concepts at State, Local Level  
• Workshops to improve public transport performance |

After combining existing and suggested interventions, the majority focus on the SHIFT and IMPROVE strategies.
6. Identifying Strategy for Future Interventions

**Gap Analysis**

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**AVOID** motorized travel
- PMV Quantity Restrictions
- PMV Usage Restrictions
- Integrate NMT in new Urban Developments

**SHIFT** motorized travel to more efficient modes
- National Urban Transportation Policy (NUTP)
- Integrate NMT in new road infrastructure
- Integrate Public Transport in Planning Guidelines
- Promote two-wheeler motorization

**IMPROVE** existing operations and technologies
- Bharat Stage III and IV emissions norms
- Actions through Environment Pollution Control Authority (EPCA) and Bureau of Energy Efficiency (BEE)
- Waive/reduce fuel tax for public transport operators
- Waive/reduce annual registration tax for public transport vehicles
- National Fuel Efficiency norms
- National Emissions norms

**Projects**
- JnNURM funded BRTS projects
- JnNURM funded Bus Fleet Expansion in 61 Indian cities.
- Metro rail projects in major metropolises
- Enhanced share of public transport in passenger movements
- Enhanced share of rail in freight movement

**Capacity**
- National Capacity Building Initiative
- Promote awareness of Sustainable Transport concepts at State, Local Level

Suggestions in the AVOID category are in the form of broad thoughts, rather than concrete programs and projects

Centre for Sustainable Transport

EMBARQ® NETWORK
It is clear from the classification of mitigation measure impacts that AVOID and SHIFT strategies will yield the biggest gains in emissions reductions. The gap analysis also shows that few AVOID interventions have thus far been attempted. Focusing on AVOID and SHIFT programs and projects is therefore necessary.
7. Conclusions

1. Lack of technical capacity at the city government level is a major problem. Engineers and planners have been trained to build roads and implement projects focused on improving conditions for private motor vehicles – similar skills in sustainable transport modes such as bus-based public transport, pedestrianisation and cycling are lacking.

2. There is a lack of awareness about concepts of sustainable transport and the impacts of negative externalities from a system of transport focusing on private motor vehicles. There is some evidence of awareness of such issues at the national level, but none at state and city level.

3. Accurately measuring, reporting and verifying (MRV) the impacts of various interventions to reduce transport sector emissions is a problem. It is easier to do with ‘improve’ interventions, less so with ‘shift’ interventions and difficult with ‘avoid’ interventions. Methodologies to improve MRV will need to be developed.

4. The current perception is that the solution to the growth of emissions in transport lies in improving technologies – developing better engines and fuels. This is perhaps because improving technologies is seen to be easier to accomplish. However ‘shift’ and ‘avoid’ will provide the greatest savings in emissions. Although some ‘shift’ interventions are being attempted, ‘avoid’ solutions are largely being ignored.
References

10. Structured Interviews with Transport sector stakeholders and experts