Intercity Rail Transport & Climate Change: Issues and Options

Key Messages from Case Studies

Intercity Passenger Transport (Case: HSR)
Freight Transport (Case: Dedicated Corridors)
Alternate Freight Infrastructure Choices (Case: Coal-by-Wire Option)
Adapting to Changing Climate (Case: Konkan Railways)

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Supported by:

Partner Organizations:

In collaboration with:
Transport and Climate Change: India’s INDCs

• Rail Transport
  – Enhancing the share of rail in total land transportation from 36 % to 45 %
  – Dedicated Freight Corridors will reduce 457 million tonnes of CO₂ over a 30-year period

• Coastal shipping and inland waterways
  – Implementation of a 1,620-km navigable channel for large commercial ships
  – Establish waterway transportation grid connecting existing and proposed waterways to roads, railways, and ports.
  – Improve and augment capacity in India’s ports, promoting efficient transportation of goods.
  – 7,000 km road network along the coast will provide further connectivity to these ports.

• Mass transit
  – Focus on moving people and therefore investments in mass transit

• Vehicle efficiency
  – First passenger vehicle fuel-efficiency standards from April 2016, set efficiency targets for new cars

• Alternate Fuels and Vehicles
  – Promote faster adoption & manufacturing of hybrid and electric vehicles by providing incentives.
  – Promoting Biofuels
Integrated Modeling Framework

DATABASES
Socio-Economic, Technologies, Energy Resources, Environment

- AIM CGE/GCAM
- ANSWER-MARKAL Model
- Modal Choice Model
- AIM (SDB) (Strategic Database)
- End Use Demand Model
Intercity Passenger Transport (Case: HSR)

http://www.unep.org/transport/lowcarbon/PDFs/Role_of_High_Speed_Rail_Final.pdf
Mode Share: Intercity Transport

BAU

Sustainable Mobility
Ahmedabad Mumbai HSR Corridor

- HSR between Ahmedabad and Mumbai
- Will connect large and intermediate cities
- Reduce travel time
- Financing through governmental funds, multilateral funding and by alternative means of resource mobilization, incl (PPP)
- Support from JICA
Mode Share for Ahmedabad

Mumbai corridor

- Compete with air and increase share of rail
- Reduced Energy Demand
- Connect small and medium cities promoting a balanced regional development
Share of railways in BAU and HSR Scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>16.1%</td>
<td>16.1%</td>
<td>14.4%</td>
<td>13.6%</td>
<td>14.1%</td>
</tr>
<tr>
<td>HSR Scenario</td>
<td>16.1%</td>
<td>16.1%</td>
<td>20.0%</td>
<td>25.0%</td>
<td>30.0%</td>
</tr>
</tbody>
</table>

CO2 Emissions (Million tCO2)
Key Messages

• Increased investments for improving the efficiency of railways and building high speed corridors are a way to **address the declining rail share** in total intercity transport kilometres.

• **Rail is more efficient compared to air and road** - increased share of rail delivers a very sizable reduction in energy consumption in the long-term and, therefore, **contributes to energy security**.

• Energy reductions lead to significant abatement of CO2 emissions. More significantly, **decarbonized electricity** contribute even more to CO2 abatement in HSR plus low-carbon scenario.

• **Compared to air, HSR can connect a number of small and medium cities** and deliver a more balanced development.
Freight Transport (Case: Dedicated Corridors)

Figure 18. Freight Transport Demand BAU and Per Capita Freight
Dedicated Freight Corridors

Figure 26. Freight Corridors in India

Figure 28. Comparison of Design features of existing and proposed DFC

<table>
<thead>
<tr>
<th>Feature</th>
<th>Existing</th>
<th>Moving dimension</th>
<th>On DFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>4.365 m</td>
<td></td>
<td>7.1 m for Western</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.1 m for Eastern</td>
</tr>
<tr>
<td>Width</td>
<td>3.20 m</td>
<td></td>
<td>3.66 m</td>
</tr>
<tr>
<td>Container stack</td>
<td>Single stack</td>
<td></td>
<td>Double stack</td>
</tr>
<tr>
<td>Train length</td>
<td>740 m</td>
<td></td>
<td>1500 m</td>
</tr>
<tr>
<td>Train load</td>
<td>4000 ton</td>
<td></td>
<td>15000 ton</td>
</tr>
</tbody>
</table>

Source: DFCCIL (2011)
Alternate Freight Infrastructure (Case: Coal-by-Wire)

http://www.unep.org/transport/lowcarbon/publications.asp
Coal Reserves & Power Generation

State Wise Coal Reserves
Total Proven Reserves 95.9 billion tonnes
- Madhya Pradesh 8%
- Maharashtra Others 5%
- Jharkhand 1%

Coal Transportation by Rail (billion ton km)
- BAU
- CBW

<table>
<thead>
<tr>
<th>Year</th>
<th>BAU</th>
<th>CBW</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>262</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>393</td>
<td>370</td>
</tr>
<tr>
<td>2020</td>
<td>486</td>
<td>449</td>
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<td>2025</td>
<td>550</td>
<td>505</td>
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<td>2030</td>
<td>516</td>
<td></td>
</tr>
<tr>
<td>2035</td>
<td>608</td>
<td>497</td>
</tr>
<tr>
<td>2040</td>
<td>626</td>
<td>500</td>
</tr>
<tr>
<td>2045</td>
<td>700</td>
<td>420</td>
</tr>
<tr>
<td>2050</td>
<td>782</td>
<td>313</td>
</tr>
</tbody>
</table>
CO2 and Co-benefits

**Figure 29. CO₂ Emissions Reduction by Sources – Sustainable Logistics**

**Figure 30. Energy Demand and Savings – Sustainable Logistics**
Key messages: Freight transport

• Freight is a smaller but growing share within the transport sector. Sustainable logistics can have an impact on the final energy demand from transport, especially in the long term.

• Large infrastructure projects, such as the proposed Dedicated Freight Corridors (DFCs), are critical drivers of the national economy and have major implications for achieving sustainability and low-carbon development goals.
Adapting to Changing Climate (Case: Konkan Railways)

Climate Change Impacts: Konkan Railways

- Time in Service
- Higher Impact Probability
- Infrastructure Maintenance Costs
- Repair and Maintenance Cost vs Time in Service
Economic Loss & Probability of Occurrence

- Reference scenario (RS)
- RS with adverse CCV and strongly favourable SDV
- RS with adverse CCV (SDV not considered)
- RS with adverse CCV and adverse SDV

Economic losses:
- Low
- Medium
- High

Probability of occurrence:
- Long-life assets commissioned now will have higher failure rates after several decades as they become old.
- Climate change shall exacerbate over the century. Hence, impact probability and costs on the infrastructure would increase significantly in later years.
Key messages:
Climate Change and Transport Infrastructures

• Transport infrastructures are log-life assets exposed to weather conditions. Climate change can add to the in-situ climate risks.

• It is wise to incorporate future climate conditions during the design stage and also include the expected future climate change in operations and safety plans.

• Climate insurance should be considered as an important aspect of assessing ‘liability’ vis-à-vis the risks from in-situ climate.

• Infrastructure projects impact assessment should include the ‘reverse matrix’, i.e. matrix of impacts on the project resulting from the changing climate (& the environment).