Dedicated Freight Corridors & High Speed Rail

India’s Ultra Low Carbon Mega Rail Projects

- Anjali Goyal

Executive Director Finance (Budget), Ministry of Railways, India
Approach adopted

1. Rail Transport Scenario in India

2. Dedicated Freight Corridor & High Speed Rail – setting the context

3. Complexities in going low carbon in transport sector

4. Structuring DFC and HSR as low carbon projects

5. Launching the projects as a brand

6. Conclusion – suggestions on the way forward
Freight Cargo Scenario in India:
Boom in traffic versus serious capacity constraints

- Railways set to carry 1 billion ton by 2011, 1.5 billion ton by 2017
- Rail share <38%
- Freight movement growth (2002-06)
  - Road 48%+ Rail 35 % +
- Road Commercial carriers- low payloads & fuel efficiency
- Bulk of IR’s traffic moves on the overstretched Golden Quadrilateral
  - Speeds of 26 km/hr, Limited flexibility
- Capacity constraints will kill the surge
Need to drive down India’s rail tariff

Capture larger market share

Cited in New Tigers of Asia, Morgan Stanley, July 04
Dedicated Freight Corridors

- **Eastern Corridor**: 1805 km from Ludhiana to Kolkata

- **Western Corridor**: 1515 km from Mumbai (J.N. port) to Dadri

- Liberal Moving Dimensions
  - Higher payload/axle
  - Suitable for heavy haul trains (65 fr. Cars)

- Higher HP & tractive effort locomotives

- Higher capacity freight cars

- Speed: 100 - 120 kmph+
DELHI MUMBAI INDUSTRIAL CORRIDOR

High Impact Development

- 20 industrial clusters in regions/areas (newly planned)
- Delhi-Mumbai industrial corridor, another 200 km
- Two 450 km long HSR corridors (planned)
- 15 cities of pop. 1 million+ to 10 million+
- 19 rail links and 26 road links for port connectivity
- 38,500 km existing rail lines in region
- Four international airports, 9 domestic
- 6000 km+ of existing freeways/expressways
- 20 industrial clusters in regions/areas (newly planned)
- Two 450 km long HSR corridors (planned)
- 19 rail links and 26 road links for port connectivity
- 38,500 km existing rail lines in region
- Four international airports, 9 domestic
- 6000 km+ of existing freeways/expressways
- 45 logistics parks/hubs
- 159 SEZs, end to end OFC connectivity
- 6 major ports, 15 impex sea ports, 7 new ports
Efficient supply chain relationships

- Convergence of industrial activities
- Tremendous potential for high value, end to end logistics solutions provider services-
  - Temp controlled warehouses and other logistics inputs
  - Tapping seamless intermodal potential

These hinge on the special features of DFC as a new rail transport service product
DFC v/s Competing modes - efficiency scorecard
India’s Passenger Transportation Landscape

- Fast Mobility transport modes on the rise
- Cars/airlines growing at 15-20%
- Nearly 2 million cars p.a.
- Set to go up when Nano cars hit the market
- So will the emissions

IR carries 7 billion
India’s Freeways Today
Nano Cars Yet To Hit The Roads
Market Requirements

- New growth centres:
  - More spread of economic activity
  - Dramatic increase in urban population

Change in Population

<table>
<thead>
<tr>
<th>% change in population (2005-2015)</th>
<th>Level of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50%</td>
<td>High</td>
</tr>
<tr>
<td>25-50%</td>
<td>Medium</td>
</tr>
<tr>
<td>0-25%</td>
<td>Low</td>
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</table>
## Highway Traffic-Delhi Amritsar Corridor -Summary Volume Counts

<table>
<thead>
<tr>
<th>Section</th>
<th>Non-AC Small Cars</th>
<th>AC Small Cars</th>
<th>AC BigCars</th>
<th>Mini Bus Ordinary</th>
<th>Mini Bus Deluxe</th>
<th>Mini Bus AC</th>
<th>Normal Bus Ordinary</th>
<th>Normal Bus Deluxe</th>
<th>Normal Bus AC</th>
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<tbody>
<tr>
<td>Delhi-Sonipat</td>
<td>4015</td>
<td>10509</td>
<td>9996</td>
<td>73</td>
<td>89</td>
<td>7</td>
<td>1250</td>
<td>240</td>
<td>58</td>
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<tr>
<td>Sonipat-Panipat</td>
<td>894</td>
<td>7710</td>
<td>9309</td>
<td>70</td>
<td>84</td>
<td>50</td>
<td>1252</td>
<td>265</td>
<td>87</td>
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<tr>
<td>Panipat-Ambala</td>
<td>2346</td>
<td>7651</td>
<td>9013</td>
<td>180</td>
<td>117</td>
<td>60</td>
<td>1187</td>
<td>298</td>
<td>285</td>
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<tr>
<td>Ambala-Ludhiana</td>
<td>1435</td>
<td>5737</td>
<td>6993</td>
<td>128</td>
<td>220</td>
<td>29</td>
<td>688</td>
<td>296</td>
<td>74</td>
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<tr>
<td>Ludhiana-Jalandhar</td>
<td>2961</td>
<td>8305</td>
<td>7975</td>
<td>168</td>
<td>161</td>
<td>12</td>
<td>1105</td>
<td>668</td>
<td>21</td>
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<tr>
<td>Jalandhar-Amritsar</td>
<td>1961</td>
<td>4466</td>
<td>5772</td>
<td>196</td>
<td>90</td>
<td>14</td>
<td>635</td>
<td>218</td>
<td>34</td>
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<tr>
<td>Ambala-Chandigarh</td>
<td>2022</td>
<td>6593</td>
<td>7767</td>
<td>82</td>
<td>53</td>
<td>27</td>
<td>1880</td>
<td>472</td>
<td>293</td>
</tr>
</tbody>
</table>

* Daily Figures based on survey
Car User Preferences

- Lesser Time: 40%
- Cheaper Mode: 13%
- Availability of train tickets: 22%
- Facilities provided: 7%
- Closer to home: 9%
- Other Modes (unavailable): 1%
- Safer Mode: 8%
Car Passenger Preferences

- 97% preferred
  - three hour or shorter journey on Delhi – Amritsar Corridor
  - HST to be frequent, rather than one train in the morning one in the evening.

- Willing to pay more for time saving

- 93% preferred a restaurant with price of a meal in the range 100 to 200 Rupees

- Current car passengers wanted facilities, like, pre-recorded video programmes, cable TV and shop on the train.
Why the entry of India and China in HSR is important for the world

- High carbon emissions of developed and fast developing countries a major worry
- Per capita emissions in India & China low but total emission volumes high - Rising fast
- Both countries will (and should) accelerate their GDP growth
- Both economies automobile industry driven - Low fuel efficiency
Cars per 1000 Persons

- **India**: 8 (2007), 382 (2050)
- **China**: 15 (2007), 363 (2050)
- **Brazil**: 137 (2007), 645 (2050)
- **USA**: 500 (2007), 555 (2050)

*PWC study*
The number of cars is increasing alright. But I think stopping people buying cars is not the right way. Helping people to use their cars in a different manner is the way to go.

-Nicholas Stern in an interview – Down to Earth 30, Nov. 2007
Complexities in going low carbon in Transport Sector

- Peoples Mobility- a matter of personal choice
Complexities in going low carbon in Transport Sector

- Peoples Mobility- a matter of personal choice
- Freight Transportation decisions - driven by cost competitiveness, supply chain commitments
- CDM- rewards/ offsets mostly for investors- nothing much for users
- Apprehensions of the stakeholders in business as usual carbon based transport infrastructure
### Stakeholders

- Automobile industry
- Passenger cars, SUVs,
- Commercial vehicles
- Commercial Truck operators
- Locomotive manufacturers
- Investors/ banks/ lending institutions
- Rail shippers, Rail passengers, Car passengers, Logistics players
- Oil companies
- Coal based thermal power producers
- Airlines, air craft manufactures

### Common Apprehensions On Carbon Mitigation in Transport

- Stricter emission norms- Better technologies not yet developed- High cost R&D
- Adverse impact on sales/ expansion
- High taxes and penalties
- High cost of clean fuel technologies
- Large scale Solar, Wind power - costly, not yet commercially viable
- Too fragmented CO₂ savings proposals
- CO₂ reduction strategies not yet clear /backed by clear government policies
Breaking the barriers

- Need to launch CO₂ mitigation strategies with
  - a new image
  - a new platform for a popular movement

- New business opportunities - taken to scale

- Rewards offset to address these influencing elements

- People’s participation through branding

- IR’s proposed two Ultra low carbon mega rail projects
  - best platform to launch CO₂ emission reduction as a popular movement and brand
Structuring of India’s Ultra Low Carbon Mega Rail Projects

- HSR & DFC- new transport projects will cause carbon emissions- Owning the footprints
- Identify and measure actions which create emissions
- Adopt clean energy/ technologies/ waste reductions
- Neutralize/ Offset emissions to maximum extent
- Own the costs of emission reductions
- Encourage users to avail the benefits of clean public transport
- Document and Communicate
Ultra Low Carbon Rail Projects
-CO$_2$ Reduction Strategies

Primary – neutrality objective
- Power requirement – non fossil fuel
- Traction/ Operation
- Rolling Stock
Power Quality Management
High Voltage Transmission Lines

Dynamic Load Management

Unity Power Factor
Harmonics Management
Intelligent Train Scheduling
Intelligent Train Operation

Efficient Traction Power Conversion
Intelligent Auxiliary Power Conversion
Hotel Load Management

Electricity Grid
Traction Substation
Overhead Alignment
Rolling Stock
Track
Ultra Low Carbon Rail Projects
-CO\textsubscript{2} Reduction Strategies

Primary – neutrality objective
- Power requirement – non fossil fuel
- Traction/Operation
- Rolling Stock
- FEMU for light cargo
- LEED rated energy efficient terminal buildings & Logistic Parks
- Warehouses PV panels- roof, outer walls
- Land use-no farmers land

Consequential
- Mode Shift
  - Inter city ridership
    - Cars/Buses/Air to HSR
  - Trucks to DFC freight trains
    - Shift by choice and piggy back rides
**Product Design**
- Sourcing 30% of energy requirement from clean power
- Only fuel efficient 3 phase locomotives with regenerative braking- kinetic energy supply to grid -10%
- FEMU services for time sensitive light cargos.
- Hybrid cars and efficient trucks

**Inter-modal Shift**
- Rail bridging through road-railers and piggy back services
- Value added services through mega logi parks
- Time-tabled open access movement
- Earn Diamond Miles

**CO₂ savings**
HSR: Changing Market Tectonics

Product Design
- Substantially carbon neutral – traction power source-non fossil fuels based Swap/barter strategy
- High Speed Regenerative locomotives- kinetic energy recovery
- HSR on PPP mode- partners eligibility based on owning new small hydel power plants
- Hybrid cars for hire at terminals

Inter- Modal Shift
- Fare Structure - less than car usage costs, low priced air tickets
- 1000 passengers per trip
- Drastic cut in travel time (compared with road travel)
- Improve on board ambience and quality of services on HSR- at par with air craft and luxury cars
- Safe & fast transit
- Carbon miles for non use of personal cars- park your car at HSR terminal, travel by HSR

CO₂ savings
The Pacala and Socolow Wedge Theory and India’s mega Rail projects

Business as Usual
Stabilization Wedge
Stabilization Wedge
Stabilization Wedge
Stabilization Wedge
Stabilization Wedge
Stabilization Wedge

Stabilization Trajectory

Gt of carbon per year

2004
2054
Wedge #1&2

Double Fuel Efficiency
&
Cut Distances to half
Through vehicle displacement alone, the two DFC s expected to save 347 -500 million tonnes of CO2 by 2027 (cumulative).

Emissions saved through locomotives with regenerative braking an additional 3 million tonnes.

Through swap/barter strategy an additional 9 million tonnes.
Reduction in CO₂ Emission due to HST on Carbon Neutral Electricity *

Reduction of CO₂ in 15 Years = 14.679 Million Ton
<table>
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<th>Implementation</th>
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<tr>
<td>Cutting carbon emission from buildings</td>
<td>Freight &amp; HSR Terminals and Logi cities will cut carbon emissions by 25% - LEED rated buildings</td>
</tr>
<tr>
<td>700 fold Expansion of photovoltaic solar energy</td>
<td>Logi cities - Confluence of Warehouses, Trade and Commercial complexes, malls, Hotels- encouraged to draw power from solar sources- especially from large solar farms in Rajasthan, Gujrat, Maharashtra.</td>
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<td>Halting of current deforestation</td>
<td>Rail uses less land than road</td>
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<th><strong>Research on biofuels, cellulosic ethanol</strong></th>
<th><strong>Complementary role of airlines-partnering HSR</strong></th>
<th><strong>Mega logistic parks- intermodal hubs-truckers parks,Hybrid cars</strong></th>
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<td>Road railers, Piggy back riders through inter-modal movement</td>
<td>Hybrid Diesel locos, regenerative batteries, bio diesel</td>
<td>Possibility of lower fares / lower tariff - high through put HST / heavy haul faster freight trains</td>
<td>Large scale solar power in logistics cities &amp; HSR terminals</td>
</tr>
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**New Business Opportunities in Carbon Mitigation**

**Areas of Convergence in specially crafted low carbon projects**

- **Dedicated Freight Corridor**
- **Logistics Parks**
- **High Speed Trains**
Changing Perceptions

- Climate Change in itself bad news
- Despair, Gloom, Catastrophe
- IR’s proposed two Ultra low carbon mega rail projects best platform to launch co 2 emission reduction as a popular movement and brand
Low carbon brand personality

DFC: Freight Vehicles displacement

HSR: Motorized Passenger Vehicle displacement

Power generation from hydel/solar plants

Locomotives-regenerative

Logistics Parks - substantial use of solar panels

HSR Terminals - low carbon, green buildings

Conserving on farmers land acquisition
Position Indian HSR with an ultra low carbon brand personality - an endearing symbol - no lifestyle loss in public transport.

HSR ridership – India’s giant population HSR market size: opens with 7 million passengers/ corridor.

Huge Market potential huge: Indian ad market to cross USD 6 billion in 2011.
- 0.40 million+ (true green) 30 seconds ad spots per year (estimated).

Vast Out of Home (OOH), premium ad space in HSR terminals.

Net “true green ad” revenues can support HSR’s debt servicing.

Vast potential for real estate development.
Another Ultra Low Carbon Brand Personality
- DFC & Mega Logistic Cities

- Heavy haul freight corridor with a brand personality
- Partly user-funded rail project
- Baptism for high carbon sinner industries - freight carbon miles - possibilities of convertibility into carbon credits?
- Carbon credits for clean energy warehouses - to be shared with warehouse users as benefits
Acceptability of Mitigation Strategies

- GDP growth retardation - developing countries
- Erosion in quality of lifestyles
- Punitive taxes - regressive,
- Misgivings on trading in carbon credits
- CDM - rewards/offsets mostly for investors - nothing much for users
- Availability/ Costs of renewable energy
- Quantum reduction not possible - lack of scale of technological breakthrough
- Bio fuel impact on agri land and food prices,
- People’s participation important for success - Rewards offset will have to address these influencing elements
- Points for pondering - should this dictate approach for future policy
Way Forward

- Carbon Mitigation Rating for Transport Sector Projects
- Setting Pre-qualification Benchmarks for low carbon projects - Facilitate Convergence
- Concessional Funding
- Mechanism for sharing benefits - investors and users - maybe even the brand builders & advertisers too
- Diamond grams reward scheme for rail users – Payment card schemes to benefit too.
THANK YOU