Infrastructure for Low-Carbon Transport in India:

A Case Study of the Delhi - Mumbai Freight Corridor

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Workshop on Developing Policies and Strategies for Low Carbon Transport in India, August 24, 2012

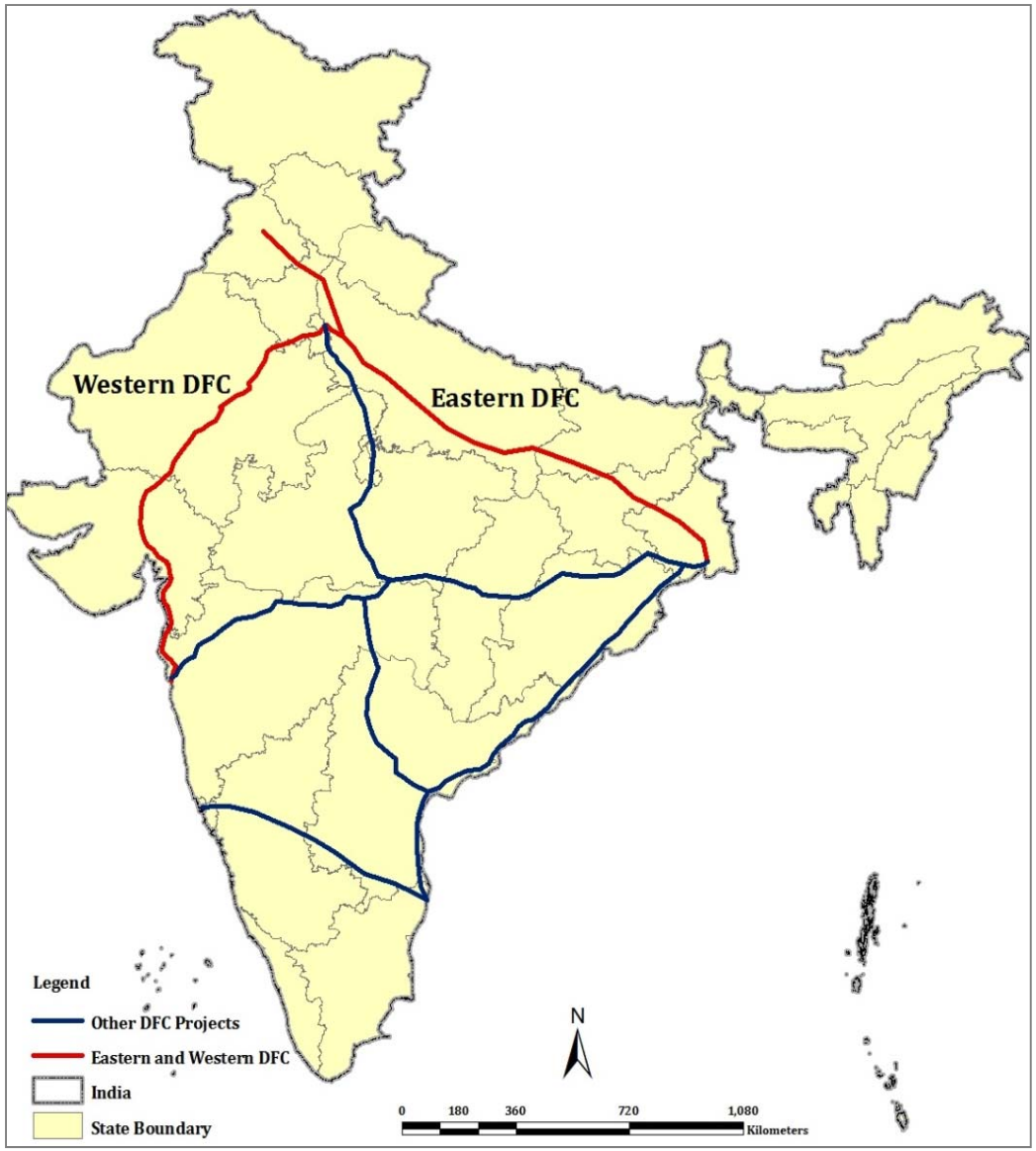
Infrastructure for Low-Carbon Transport

- Transport and development have a symbiotic relationship. A robust development strategy needs strong transport infrastructure, and conversely, investments in transport infrastructure are key determinants of development outcomes.
- The proposed dedicated rail freight corridors would greatly strengthen the transport infrastructure, but the development outcomes would be largely determined by the regional development strategy as well as energy and environment policies.
- Low-carbon transport infrastructure decisions have to be aligned with low-carbon sustainable development actions on several fronts in order to maximize social welfare gains.
- This case study takes a long-term perspective of infrastructure development while recognizing that implementation horizon of specific projects has to be short-term.

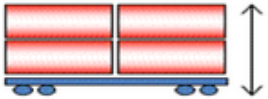
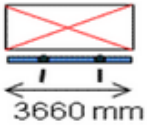
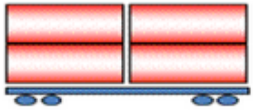
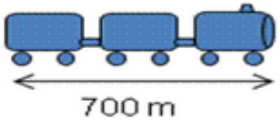
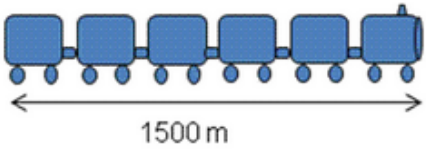
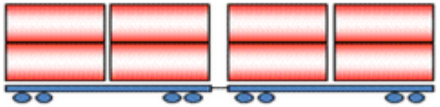
Proposed Dedicated Freight Corridors

- In 2006, the Ministry of Railways adopted a long-term strategic plan to develop six high capacity, high speed dedicated freight corridors along the “golden quadrilateral” and its diagonals.
- The Dedicated Freight Corridor Corporation of India Limited (DFCCIL) was established for construction, operation and maintenance of the proposed dedicated freight corridors.
- The Eastern Dedicated Freight Corridor (1839 km) and the Western Corridor (1483 km) are being implemented by DFCCIL. Both corridors will be commissioned by 2016-17.
- The two corridors on completion would cost about Rs. 80,000 crore in 2016-2017. Funding is through combination of debt from bilateral/multilateral agencies, equity from Ministry of Railways and Public Private Partnerships.

Proposed Dedicated Freight Corridors



Design Features of DFC

Feature	Existing	On DFC
Moving Dimensions		
Height		 7.1 m for Western DFC 5.1 m for Eastern DFC
Width		
Container Stack	 Single Stack	 Double Stack
Train length		
Train Load		

Currently, it takes a freight train about 50 hours to cover the 1400 km Delhi to Mumbai stretch. Once the freight corridor is commissioned, it would take 17 hours to travel the same distance

The Delhi-Mumbai Dedicated Freight Corridor

- One of the largest transport infrastructure projects being implemented in India
- Would increase the relative share of rail in the freight transport sector
- Capacity of the existing rail network is saturated on most of the trunk routes and the road network is also highly congested
- More energy efficient, environment-friendly and less carbon-intensive mode of transport
- Crucial role in sustaining national economic growth and inducing regional economic development

Case Study of the Delhi-Mumbai DFC

- Premise
  - Large infrastructure projects, such as the proposed DFC, are critical drivers of the national economy and have major implications for achieving low-carbon development goals.
- Purpose
  - To provide a framework for long-term assessment of CO_2 emission reduction from transport infrastructure projects like the proposed Delhi-Mumbai DFC.
  - To examine the implications of the proposed DFC project for achieving the twin goals of sustainable development and low-carbon growth.
- Scope
  - Focus on CO_2 emissions (during operations phase of the project)
  - Focus on long-term assessment (and macro transitions)

Approach and Methodology

- The study provides long-term assessment of CO_2 emissions during the operations phase of the project over a 30-year time period
- Two business-as-usual (BAU) scenarios based on continuation of current trends of freight movement, technologies and energy mix at the national level
- Third scenario based on a low-carbon (LC) pathway at the national level, supported by a carbon tax, aimed at achieving the global CO_2 stabilization target (corresponding to 2°C global average temperature rise until the year 2100)
- Key steps in the study methodology:
  - Alternative scenarios
  - Future traffic projections
  - Projections of future energy demand
  - CO_2 emission factors (Integrated Energy-Economy model for India - IIMA)
  - Estimated future CO_2 emissions

- Scenario 1: BAU (Without DFC)
  - In the absence of the DFC, freight traffic would be transported on the existing rail network shared with passenger traffic. At the macro level, current trends (demand for freight movement, modal split, electrification, and changes in the energy mix) would continue.
- Scenario 2: BAU (With DFC)
  - Most of the freight traffic would shift to the DFC. Current trends at the macro level would continue (as in Scenario 1). Additional supply-side interventions for greater operational and energy efficiency.
- Scenario 3: LCT (With DFC)
  - A conventional low-carbon path at the national level to achieve the global CO_2 stabilization target. Policy instruments, such as a carbon tax, to achieve the CO_2 reduction target and additional interventions at the project level to improve energy efficiency and energy intensity.

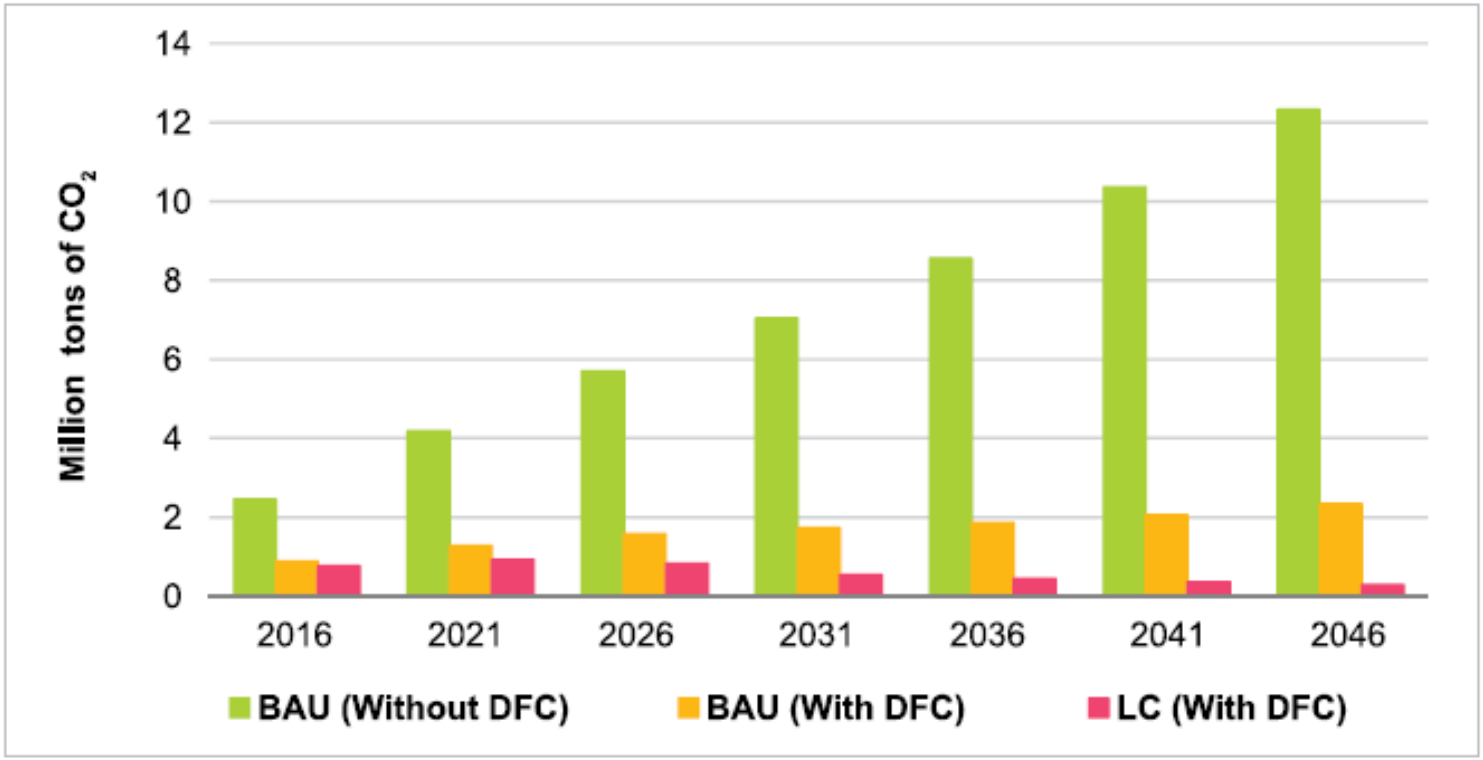
Annual GHG Emissions from Freight Movement

(Million tCO_2)

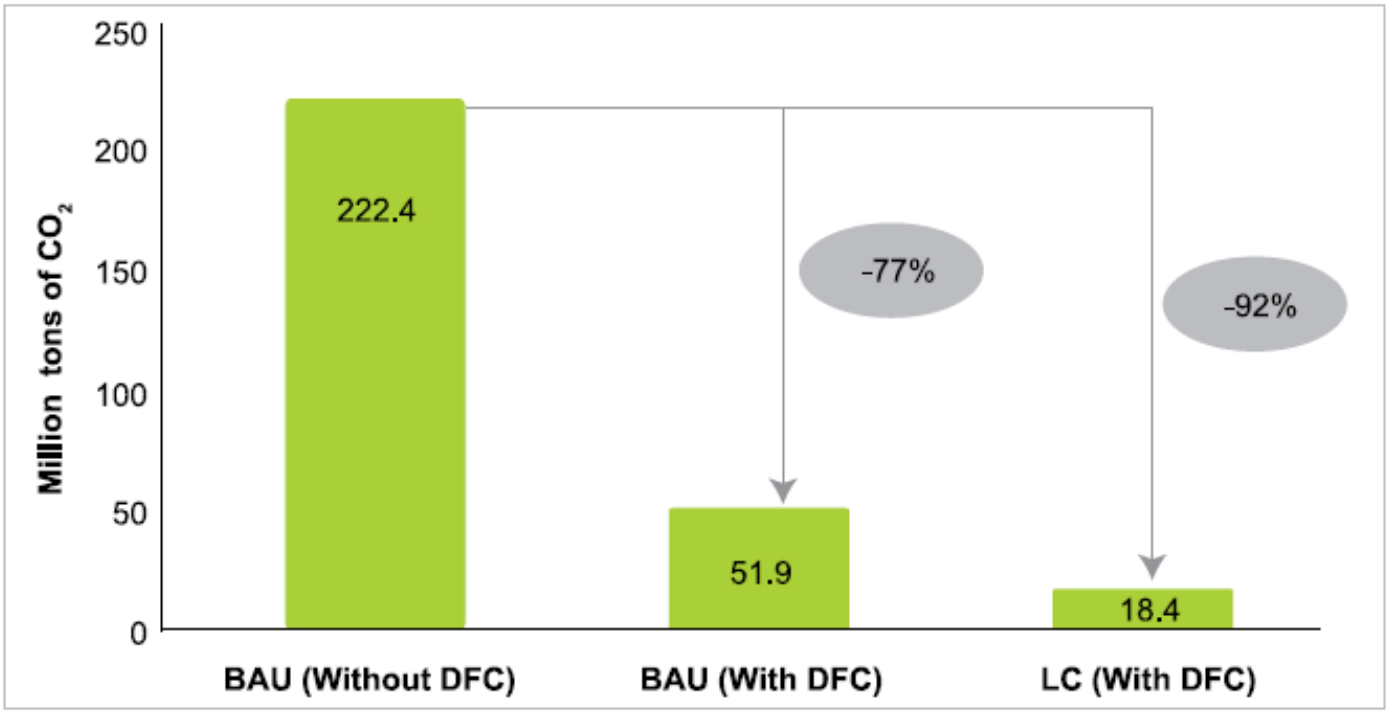
Scenario	2016	2021	2026	2031	2036	2041	2046	Cumulative (2016-2046)
BAU (With DFC)	0.88	1.28	1.58	1.72	1.85	2.05	2.33	51.9
BAU (Without DFC)	2.45	4.18	5.69	7.03	8.55	10.36	12.32	222.4
LC (With DFC)	0.76	0.92	0.83	0.53	0.43	0.36	0.28	18.4

Annual GHG Emissions from Freight Movement

(Million tCO_2)



Reduction in Cumulative CO_2 emissions (2016-2046)



Potential for CO_2 Emission Reduction from the Western DFC

Scenarios	Annual CO_2 emissions in 2016-17 (Million tons)	Annual CO_2 emissions in 2046-47 (Million tons)	Reduction in cumulative CO_2 emissions, 2016-2046 (Million tons)	Notional value of reduction in cumulative CO_2 emissions* (Billion Rs.)
BAU (Without DFC)	2.45	12.32	–	–
BAU (With DFC)	0.88	2.33	170.5	46.37
LC (With DFC)	0.76	0.28	204	55.48

**** Price of carbon is assumed to be €4 per ton (approximate prevailing price in 2012) and the currency conversion rate is taken as Rs. 68/€ (as of March 30, 2012).***

Key Findings

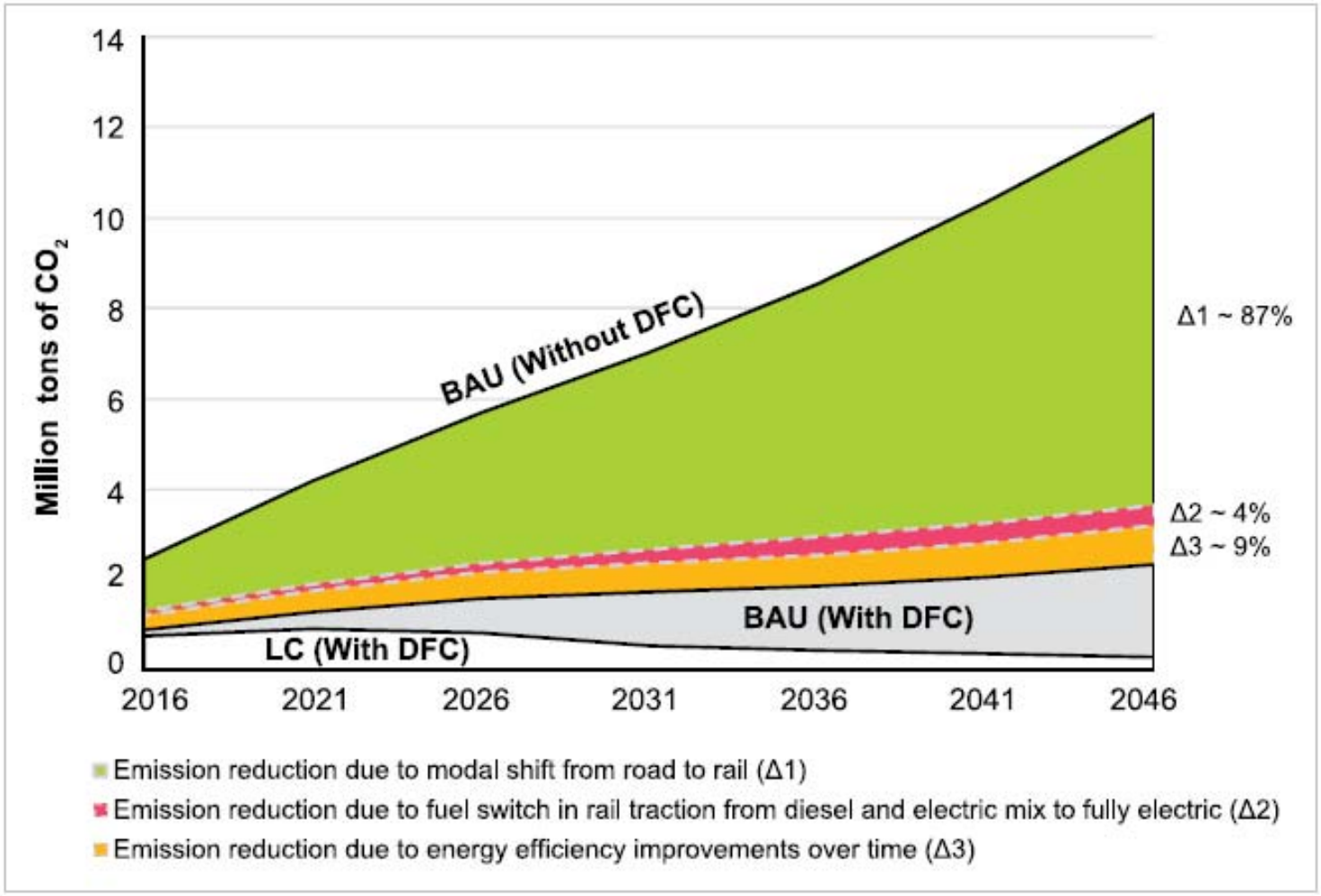
- By 2046-47, the Western DFC project would reduce annual CO_2 emissions by nearly 81% under the business-as-usual scenario and by 97% under the low-carbon scenario compared to the level of emissions in the absence of the DFC

- Compared to the BAU (Without DFC) scenario, cumulative emissions are expected to reduce by 77% under BAU (With DFC) and by 92% under the LC (With DFC) scenario

- The maximum cumulative reduction expected from the six proposed DFCs, over the 30-year period, is 1168 million tons of CO_2. This could be used to leverage substantial climate financing

- Thus, there are significant direct benefits (in terms of reduction of CO_2 emissions and energy savings) of the proposed DFCs, making these a sustainable transport solution

Decomposition analysis

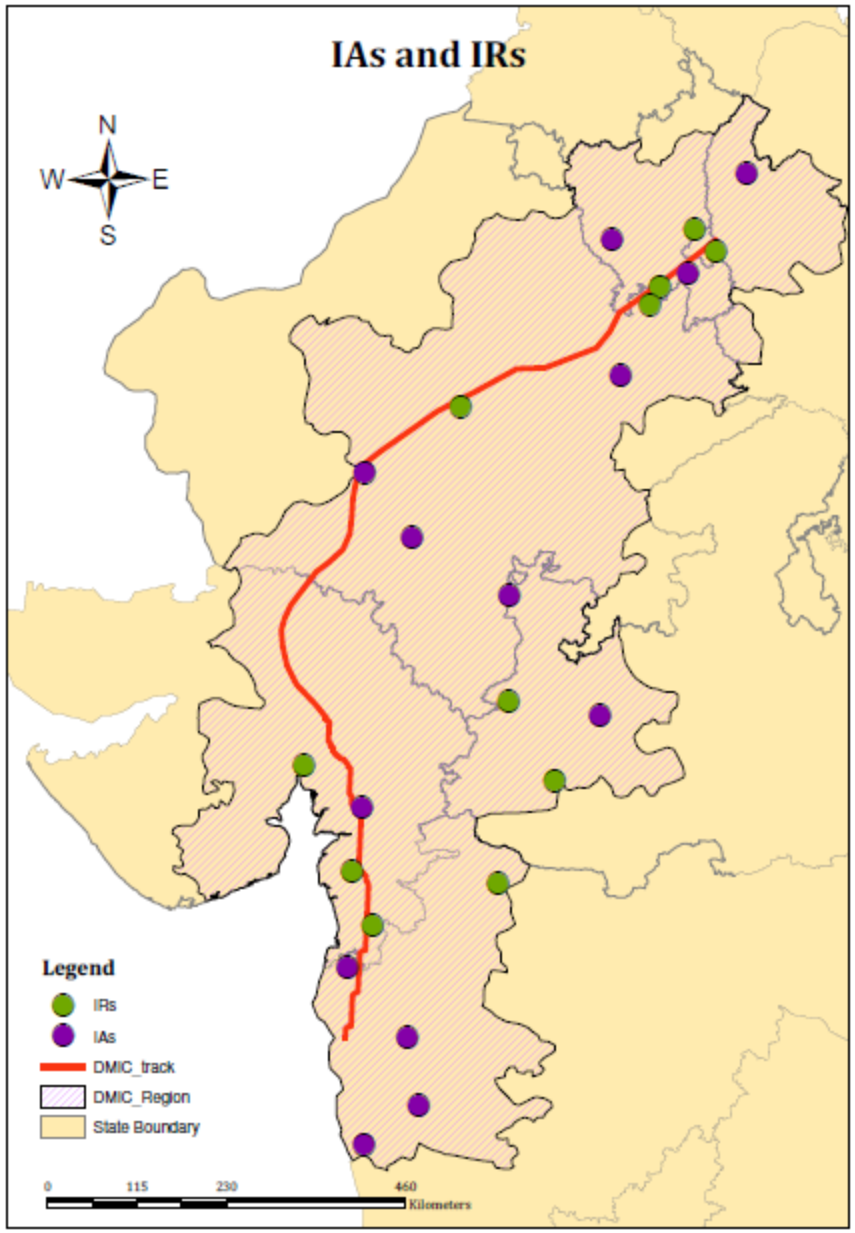


Delhi Mumbai Industrial Corridor (DMIC)

- After the Western DFC was sanctioned, the Government of India announced plans to develop an industrial corridor on both sides of the DFC alignment
- This was seen as an opportunity to attract investments in the surrounding region and induce regional economic development
- In 2008, the DMICDC was established as the project development agency to undertake development of the Delhi-Mumbai Industrial Corridor
- The main stakeholders of the DMICDC are the Department of Industrial Policy and Promotion, LIC and HUDCO
- This mega project, costing US $90 billion, is being implemented with financial and technical aid from the Government of Japan

- The DMIC strategy is to develop high impact development nodes for which 24 market-oriented centres have been identified.
- Industrial and physical infrastructure at each node with connectivity to the DFC, regional ports and hinterland markets.
- Seven eco-friendly cities to serve as models for sustainable urban development.
- The plans for eco-cities would emphasize energy efficiency, resource conservation, waste efficiency, waste management and sustainable transport.
- Crucial rail and road links to ports, airports and the DFC.

DMIC - Planned Developmental Nodes



- Twenty-four market oriented centers
- 13 nodes as Industrial Areas (IA) with a minimum area of 100 sq km
- 11 nodes as Investment Regions (IR) with a minimum area of 200 sq km.
- 7 Self-sustaining, energy efficient and eco-friendly cities with well developed public transport system

Policy Recommendations

1. The project has the potential to generate large CO_2 reductions with significant co-benefits. Ensure time bound completion.

2. Matching support infrastructures, such as freight terminals, special wagons, stack containers etc., should be adequately provided and become part of a comprehensive plan.

3. Concurrent implementation of the DMIC project would maximize secondary development benefits.

4. Accelerated implementation of the remaining five DFCs would yield maximum economic returns in the long-run.

5. Long-range planning to make the national freight transport system low-carbon and conducive to sustainable development.


Thanks !