Summary of the Draft Report

Carbon Footprint of Dedicated Freight Corridor

GHG Emission Analysis - Background

The economic growth of India has put a huge pressure on the rail freight transportation network, one of the most affordable modes of transport in the country. It will be difficult for Indian Railways alone to cater to the projected freight transportation demand of India for the next 25-30 years even if it pursues ambitious capacity growth plan. At the same time global endeavor for a low carbon economic growth is emphasizing on low carbon infrastructure and energy efficient transport system. Considering the ever increasing freight traffic movement between the metros, Indian Railways is mulling to introduce Eastern and Western Dedicated Freight Corridors (DFC). The implementation of the DFC is expected to generate two major impacts on the freight movement: shift of freight from road to the low carbon intensive mode rail transport and inherent improvement in energy efficiency of freight rail through adoption of improved technologies..In this context, DFC had undertaken a detail study on Green House Gas (GHG) emission forecasting for 30 year period under two scenarios where one scenario represents implementation and operation of DFC and the other represents absence of DFC and transportation of freight through a mix of existing rail and road network. The key purpose behind initiating this study was

- To establish, through an objective and independent analysis, that DFC is a more climate-friendly way of freight transportation since it reduces GHG emissions w.r.t freight transportation by existing rail and road system
- To develop a long-term low carbon road-map which will enable DFC to adopt more energy efficient and carbon-friendly technologies, processes and practices

Methodology

This GHG emission quantification, monitoring and reporting has been performed following internationally accepted guidelines such as GHG Accounting Protocol of World Business Council of Sustainable Development and ISO 14064.

The fundamental premise of the analysis is based on conceptualization of the two distinct scenarios:

1. The first scenario called the 'DFC scenario' talks about construction, implementation and operation of dedicated freight railway and associated infrastructure. As planned the Eastern DFC will carry 1975 billion tonne-km of freight while the Western DFC will cater to 3241 billion tonne-km of freight on a cumulative basis over the period of 30 years starting from 2016-17. While the Eastern DFC will mainly carry coal, iron & steel and empties, the Western DFC will cater to container, fertilizer and POL. GHG emissions under DFC scenario will primarily come from electricity consumption in locomotives during freight movement and fossil fuel and electricity usage in support infrastructure of DFC.

2. The second scenario, called the 'No-DFC scenario' represents the most plausible alternative mode of freight transport if the DFC would not have come up. This would consist of the current transport infrastructure available *i.e.* primarily freight trains operated by the Indian Railways and freight transport by road based commodity carriage heavy duty trucks. GHG emissions under No-DFC scenario will include CO_2 emissions from:

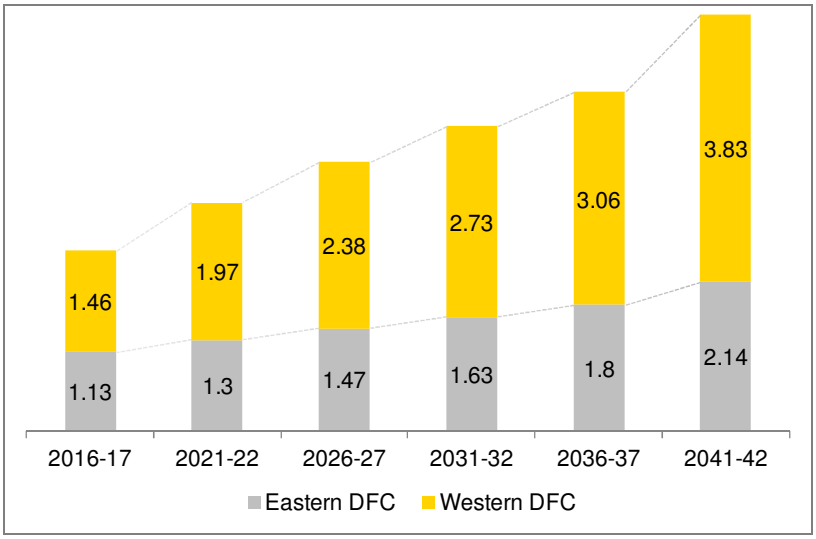
- Diesel and electricity consumptions in locomotives during freight movement through rail with axle load 22.9 T catering to the equivalent volume of freight as in case of DFC
- Diesel and electricity consumptions in locomotives during unplanned halting[1] of freight trains due to congestion on rail routes.
- Diesel consumption in heavy duty trucks during freight movement through road whenever modal shift happens from rail to road due to inadequate freight carrying capacity of the railway
- Fossil fuel and electricity usage in associated infrastructure[2].

Outcome of the Study

2016-17 is considered as the Base Year for forecasting and modeling GHG emissions for a 30 year period (i.e. 2016-17 to 2045-46, however since each 5 year period has been denoted by its reference year in this study, the 30 year period is denoted as between 2016-17 to 2041-42).
Some of the key outcomes of the study are as below:

- In 2016-17, in absence of DFC (i.e. 'No-DFC scenario') GHG emissions would have been **8.7 million ton CO_2** while those in case of DFC would be **2.59 million ton CO_2**.
- According to the projection, in 2041-42, GHG emissions under 'No-DFC scenario' would have been **33.2 million ton CO_2** while those in case of DFC scenario would be **5.97 million ton CO_2**.
- The GHG emission GAP between No-DFC scenario and DFC scenario increases from 6.11 million ton CO_2 in 2016-17 to 27.23 million ton CO_2 in 2041-42 i.e. almost by 4.5 times.
- Cumulative GHG emissions over the 30 year period in the No-DFC scenario would have been **582 million ton CO_2** while in the DFC scenario it would be **124.5 million ton CO_2**. This demonstrates that in absence of DFC implementation approximately 4.5 times more GHG would be emitted in 30 year period for freight transportation in the Eastern and Western Corridor.

Exhibit 1: Trend of total projected GHG emissions due to freight transportation by DFC (in million ton CO_2)[3]



[1] The DFC track would be dedicated only for freight train movements and hence no unplanned halt due to passenger trains.
[2] Baseline support infrastructure primarily includes rail stations, workshops, wagon sheds, signaling system, staff quarters, administrative buildings, *etc* with facilities and features presently found in Indian Railways.
3 Freight projections have been taken from the IL&FS Report for DFCC.
4. Grid electricity emission factor has been estimated based on future power generation capacity addition projections by the Planning Commission and various agencies

The Eastern DFC would produce less GHG emissions as compared to the Western DFC since the Western DFC would cater to a higher volume of traffic load than the Eastern DFC. Coal and iron-ore transportation are the major contributors to the GHG emissions of the Eastern DFC while container and RO-RO transportation are the major contributors of the GHG emissions of the Western DFC.

Exhibit 2: Trend of total projected GHG emissions due to freight transportation in absence of DFC-Corridor-wise (in million ton CO_2)[4]

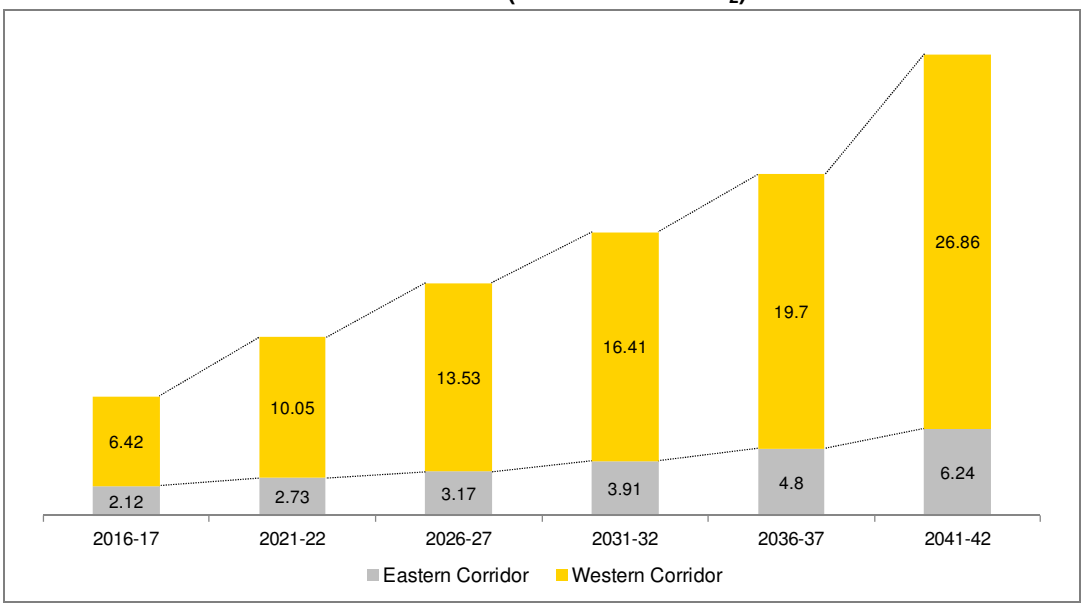
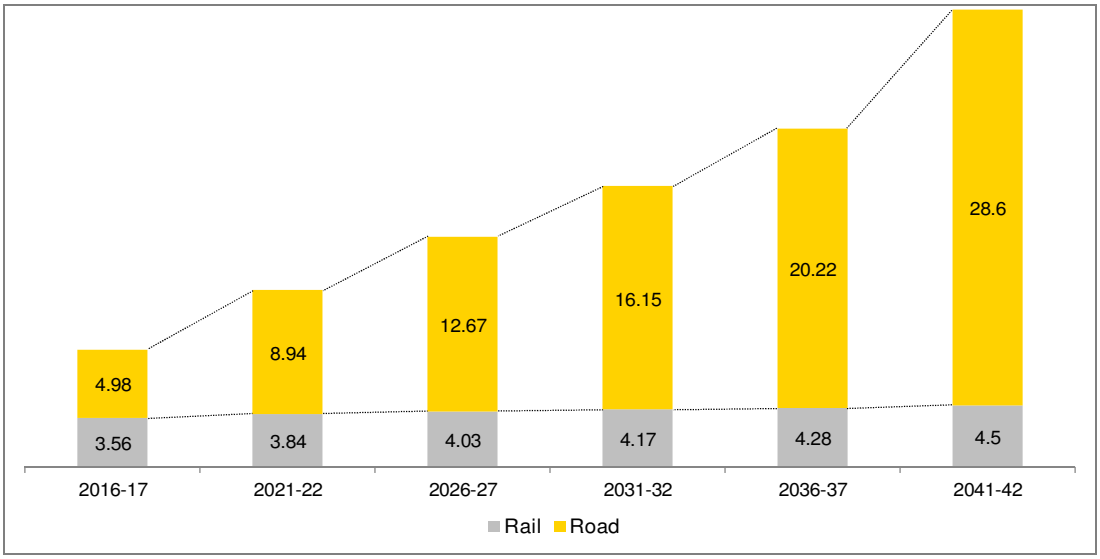


Exhibit 3: Trend of total projected GHG emissions due to freight transportation in absence of DFC-Mode-wise (in million ton CO_2)[5]



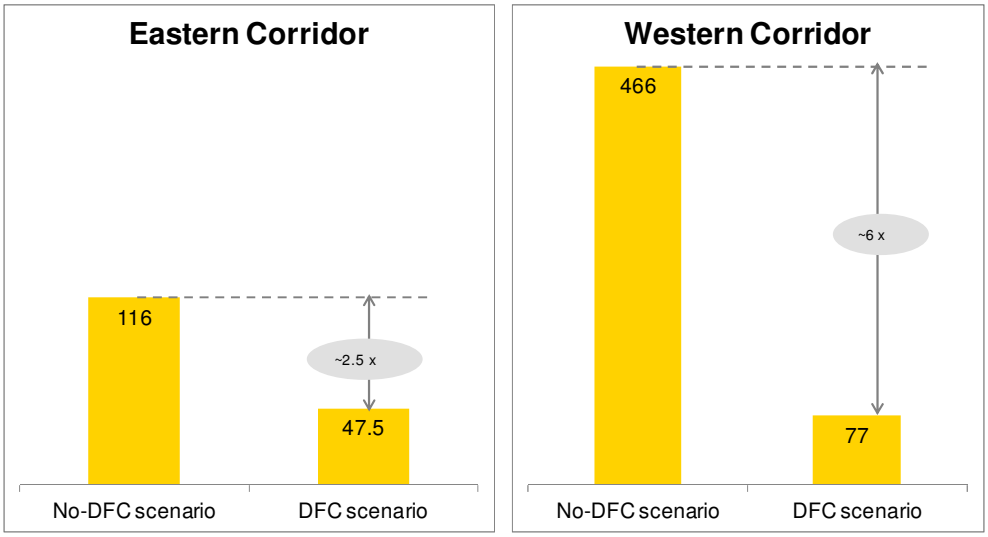
4 Freight projections have been taken from the IL&FS Report for DFCC.

5 Modal shift has been taken based on the saturation of present railway sections as per JICA Report for DFC. GHG emissions from road transport have been estimated based on average emission factor of diesel and mileage of heavy duty commodity carriages.

From the above Exhibit it is evident that under 'No-DFC scenario' GHG emissions from rail becomes almost constant from 2026-27 onwards as the saturation sets in railway sections and more and more freight shifts to road. This leads to increased GHG emissions from road based freight transport since road transport is more GHG-intensive than rail transport.

On a cumulative basis (over 30 years), in the Eastern Corridor, the No-DFC scenario produces 2.5 times more GHG emissions than the DFC scenario while for the Western Corridor, the No-DFC scenario produces 6 times more GHG emissions than the DFC scenario.

Exhibit 4: Cumulative GHG emissions over 30 years (2016-17 to 2041-42): No-DFC scenario vs. DFC scenario (in million ton CO_2)[6]



Initiatives by DFC for low carbon intensity

DFC intends to follow a low carbon path adopting various technological options which can help DFC to operate in a more energy efficient fashion and at the same time explore options to offset its own GHG emissions by investing in low carbon assets such as solar power, wind power and afforestation. Some of the interventions which could reduce GHG emissions are communication based train control (CBTC),driver advice system, regenerative braking, aerodynamic profiling in rolling stock and on-board lubrication system. DFC project team is working closely with various experts and technology suppliers to assess feasibility of implementing these ideas for low carbon growth.

[6] Cumulative emissions are arrived at by summing GHG emissions of each reference year emission and multiplying with 5.