Project Advisory Committee Meeting Report

Decarbonising Freight in India

(Feasibility of Electrification of MDVs and HDVs)

Introduction to the Project

Medium and heavy-duty trucks (MDV/HDV) are indispensable to our economic growth as they facilitate transportation of goods at city, state or national level. However, they pose a significant environmental burden as they contribute disproportionately to pollution. Besides greenhouse gas GHG emissions - truck fleets also contribute heavily to local air pollution, particularly oxides of nitrogen and particulate matter which have adverse outcomes for respiratory and cardiovascular health, especially in areas where such fleets are concentrated. Thus, the towns and villages nearest to truck hubs and corridors, which are often populated by low-income individuals, bear a disproportionate share of these burdens.

While global concerns regarding air quality and transport emissions have been rising, plans regarding decarbonisation of the logistics sector have been rather obscure in India. Since the 1990s India has witnessed unprecedented growth in the road freight sector - an almost ten-fold increase in heavy-duty vehicles, and this growth is expected to be maintained, as the truck population is expected to grow strongly. The Petroleum Conservation Research Association estimates that the truck fleet will grow at an average of 8.9 percent per annum leading up to 2025. This has led to a growing push for zero-emission trucks in a bid to decarbonise the logistics sector.

Given the fact that the truck sector is a major contributor to air pollution - the adoption of battery operated vehicles in this sector could be the key to decarbonisation, as electric vehicles (EVs) with their zero tailpipe emissions; and significantly lower long term operational costs could prove to be a viable alternative to the existing technology. In March 2022, the Indian government announced the construction of electric highways with the idea that EVs would not just be limited to small road vehicles - rather buses, medium, and heavy-duty trucks shall also be electrified in due time, once the necessary ecosystems is in place. In line with the idea of electrifying the public transport and road freight sector, the government has been inviting foreign investments in constructing the first-ever electric highway in the country between Delhi and Jaipur, followed by the Delhi- Mumbai stretch. However, since EVs and the associated charging ecosystem are in a nascentnt stage in India, the viability of decarbonisation of HDVs and MDVs remains to be seen. Further, a feasibility of this transition in terms of the cost burden on the vehicle-owners, who in this case are mostly private entities, would also need to be conducted in order to gauge the operational challenges and strategies.

Thus, the proposed project aims to explore the feasibility of electrification of the HDV and MDV vehicle segments operating across the proposed electric corridors of India. Additionally, it aims to identify the potential routes for initiating decarbonisation efforts in terms of introducing electric trucks using a pilot study.

For developing a better understanding of opportunities and limitations associated with freight decarbonisation, a project advisory committee (PAC) was formed which included several stakeholders from industry and research institutes. Subsequently, a meeting was organised on 26th September 2022 to brainstorm over the execution strategy for this project. Following are the major highlights from the meeting:

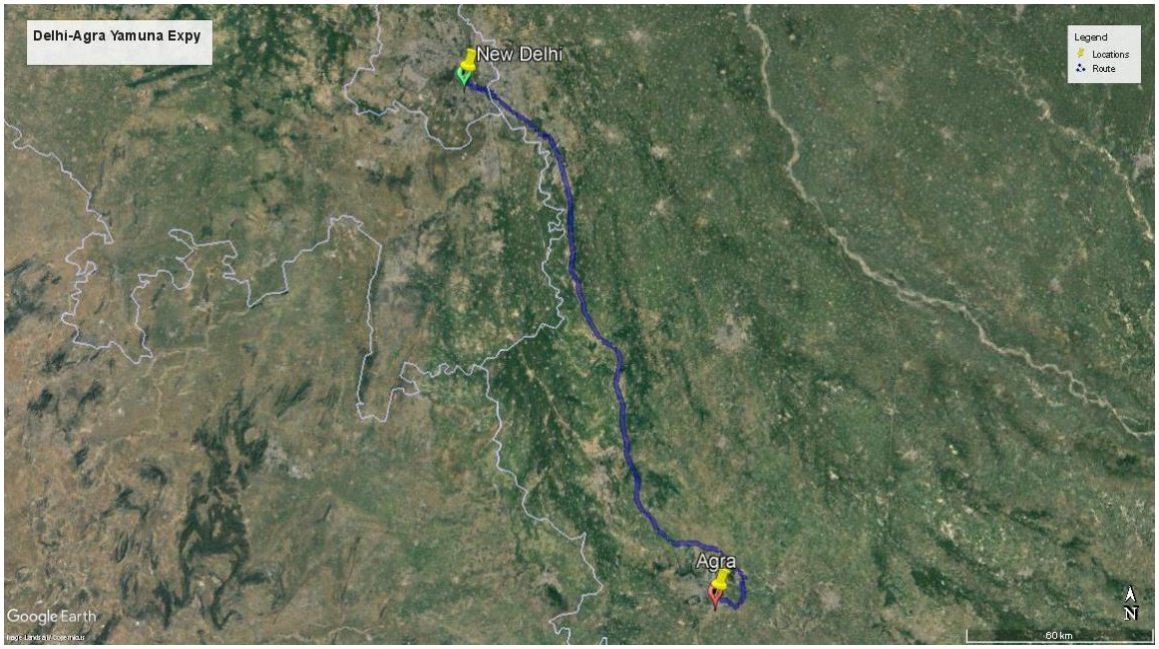
Key Discussion Points

1. Importance of MDV and HDV electrification

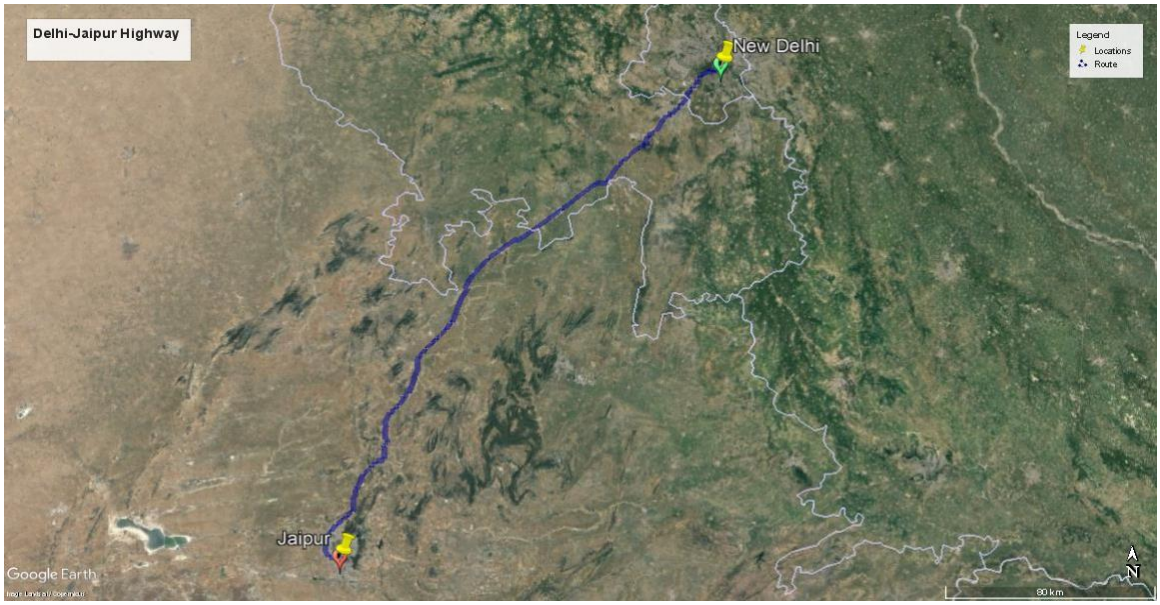
In India, MDV and HDV trucks comprise only 2 percent of the total vehicle population but contribute to 30 percent of the overall vehicular road transport emissions. Given this disproportionate share of GHG emissions, there is a critical need for a faster transition for MDVs & HDVs. Accelerated EV uptake across industry sectors and vehicle types are essential for India to achieve targets under its Nationally Determined Contributions (NDCs).

A clear demand for MDV/HDV vehicle electrification from businesses in India in key vehicle applications can jumpstart a transition. Being the third-largest truck market after China and the United States, India's early adoption of zero-emission trucks can be instrumental in not only accelerating its domestic climate imperatives but also supporting global climate action.

2. Selection of Corridors



Yamuna Expressway



Delhi-Jaipur Highway

The corridors selected for scoping visits are 1. Delhi-Agra National Highway, the first e-highway of India with necessary charging infrastructure ecosystem. Govt. and private players are now installing fast chargers on the expressway to ease the range anxiety and push the use of EVs on the green corridor. The length of the highway is 210 Kms and it has 20 charging stations along its way. And 2. Delhi-Jaipur National Highway, the second e-highway of India. The length of the highway is 258 kms and has 20 charging stations. Judicious selection of corridors for the pilot was a priority and since both these highways have had trial runs of EVs operated on them, it would be much convenient to gather necessary information by conducting a pilot in these corridors.

2. Understanding Technical and Financial constraints

It is important to understand the technical specifications related to e-MDVs and HDVs especially in charging infrastructure space. Charging standards, interoperability of charging points, charging time, cost of vehicles etc. Charging time is essential for adopting the e-truck, as waiting time can disrupt the supply chain operation. High cost of electric MDVs and HDVs poses another challenge. The relatively high cost of e-trucks as compared to electric buses makes it financially unviable for potential buyers and poses high credit risk for financiers, even after accounting for lower running costs.

- **Technical constraints**

  Heavy vehicles require relatively more power with significant load carrying capacity. Power requirement for heavy duty trucks is 1.1-1.3 KWh per km depending on the type of vehicle, and 1 KWh/km or less for medium duty as compared to 0.2 Kwh/km for light duty vehicles.[1]

[1] https://www.benchmarkminerals.com/energy-density-and-the-challenges-of-electrification-for-heavy-duty-vehicles/

For Heavy duty this equates to a battery size of around 800-1,000 KWh to deliver 800 kms of range. The weight and space considerations, at current energy densities, would be in a region of 5,000-6,000 Kgs, equivalent to a payload loss of 5-10 percent as compared to diesel. In addition, charging time would also be in order of several hours using current fast charging technology.

- **Financial constraints**

High cost of electric trucks is attributed to high fixed cost except battery and since there are no subsidies yet on the prices of the e-trucks, it will remain higher in near future than a combustion engine trucks. The cost of a lithium-ion Battery ranges from INR15,000 - 20,000 per kW. For a battery size of 800-1,000 kW, the cost would be around INR1-1.5 crores which implies a huge net cost for vehicle. Though Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme has largely aided India's EV drive, it doesn't include any support for electric trucks. More than 2,000 electric buses are currently operating on Indian roads. A lot of this is due to support from FAME. Inclusion of trucks in Fame scheme would support the original equipment manufacturers spending on research and development for e-trucks.

The following table is compares a 49 ton gross combination weight HD diesel truck in India with electric truck from a total cost of ownership standpoint:

Conventional Diesel Truck		Electric Truck	
Fixed Cost (in INR million)		**Fixed Cost (in INR million)**	
Net Price	3.50	**Net Price Except Battery**	11.70
Cost of Capital	0.32	**Cost of Capital**	1.08
Tax	0.96	**Tax**	0.96
Insurance	0.96	**Insurance**	0.96
Battery Cost	-	**Battery Cost**	13
Total Fixed Cost	**5.74**	**Total Fixed Cost**	**27.35**
Variable Cost (in INR million)		**Variable Cost (in INR million)**	
Tyres	1.65	**Tyres**	1.65
Repair & Maintenance	0.96	**Repair & Maintenance**	0.48
Fuel	19.01	**Cost of Electricity**	6.23

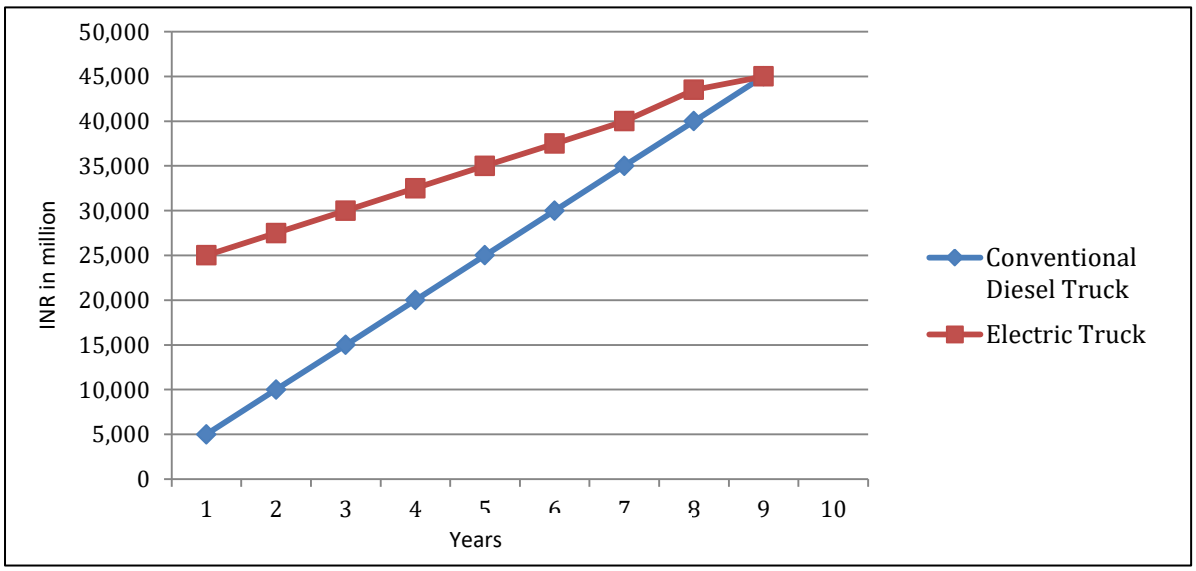
Urea	0.67	**Urea**	-
Engine Oil	0.09	**Engine Oil**	-
TM Oil	0.06	**TM Oil**	-
Coolant	0.01	**Coolant**	-
Cost of Driver	1.92	**Cost of Driver**	1.92
Total Variable Cost	**24.36**	**Total Variable Cost**	**10.28**
Total Cost of Ownership	**30.1**	**Total Cost of Ownership**	**37.62**

Source: Author's analysis

The assumptions for the cost calculation were:

- Monthly running of 8,000 kms with 10 years of operation
- Average maintenance & repair cost of electric truck was taken as 40 percent of conventional truck due to absence of engine and other moving automotive components

Total Cost of Ownership over lifetime



The total cost of ownership with an electric truck breaks even in 09 years and from then on the lower operation cost would yield more revenues with each ferrying of goods.

3. Impact on the grid

There is limited knowledge and experience about the interaction and compatibility between the charging infrastructure and the grid. It is important to understand the challenges and

impacts that the charging associated with electric mobility poses to the power system, mainly exploring availability of electric power system and power system capacity on the grid, grid infrastructure at points to support heavy load. The capacity of electric power system is essential to examine to predict whether the charging demand from electric mobility can be accommodated in the existing power system considering the involved challenges.

- Integration of EV, charging of large fleets connected to low voltage networks will impact the power system planning and operation. With increase in EV penetration in the distribution system, the power drawn by the system will be more, which in turn requires additional system infrastructure to be developed.
- EVs' charging can impact the network voltage problems such as voltage drop and voltage fluctuations. Uncoordinated EV charging may cause excessive voltage drops in heavily loaded lines.
- Integration of EVs can negatively affect voltage stability of the grid, which depends on the location, penetration level, EV charging time. Uncertainty of EV connection point, level of penetration, and the period of connection and disconnection cause increased level of load demand.
- Large no. of vehicles connected during off peak timings could prove to be another problem since it would disrupt the generation and supply cycle.

4. Availability of MDVs and HDVs

According to a study, in order to reach net-zero emissions, the share of electric trucks to overall freight trucks should be at least around 80 percent by 2070. [2]

- As of now, India has very few models of e-MDV and HDV (Which are of gross vehicle weight above 3.5 tons) readily available in the market. The dilemma of the industry is whether to launch a product to create demand or let the demand drive the production capacity
- One of the major reasons include no clear financial incentive that may propel the consumer towards new EVs, especially heavy duty vehicles like trucks
- There is a common doubt on competence of trucks in carrying the heavy loads and also about the maintenance they may need
- The unorganised state of the sector makes it hard to target the consumers. More than 80 percent of the overall logistics expenditure in India goes to the unorganised sector.[3] The trucking market is highly unorganised and three-quarters of the fleet is operated by those who have five or fewer trucks. The high upfront cost of electric buses is being tackled by operating them under a lease model as opposed to outright purchase by the state transport

[2] https://www.ceew.in/sites/default/files/ceew-study-on-implications-of-net-zero-target-for-indias-sectoral-energy-transitions-and-climate-policy.pdf
[3] https://www.financialexpress.com/infrastructure/roadways/is-demand-enough-to-bring-scale-for-the-logistics-sector/2272977/

undertakings (STU). The STUs are mitigating the technological risks of these buses by asking the manufacturers to operate the buses
The same cannot be applied to trucks as operators are small and fragmented. The technical and financial risks are enormous to be tested by these operators. So, there is a need to identify innovative business models and public-private partnerships that enable smaller truck operators to afford electric trucks

- Incorporation of Electric Trucks in FAME scheme would provide the necessary policy which is the most important component for introducing any novel concept

Conclusion and the Way Forward

The primary aim should be to understand the feasibility of electrification of the HDV and MDV vehicle segments in the selected corridors. It shall analyse gaps in the electrification of freight and corridors, including the standards and capacity of the existing charging infrastructure and subsequently strengthen the discourse around introducing mandates for electrification of the logistics and freight sector in the Indian context.

As next steps, the following action points are to be considered:

- Scoping visit to the corridors for anlaysing existing charging infrastructure in terms of volume, charging capacity, interoperability standards and other technical constraints related to MDVs and HDVs
- Key Informant Interviews with charging service providers, OEMs and logistic companies operating on those corridors and data collection to assess operational cost and benefits in terms of total cost of ownership in transitioning to an electric fleet for freight.

List of Participants

SI.No	Name	Designation & Organisation
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