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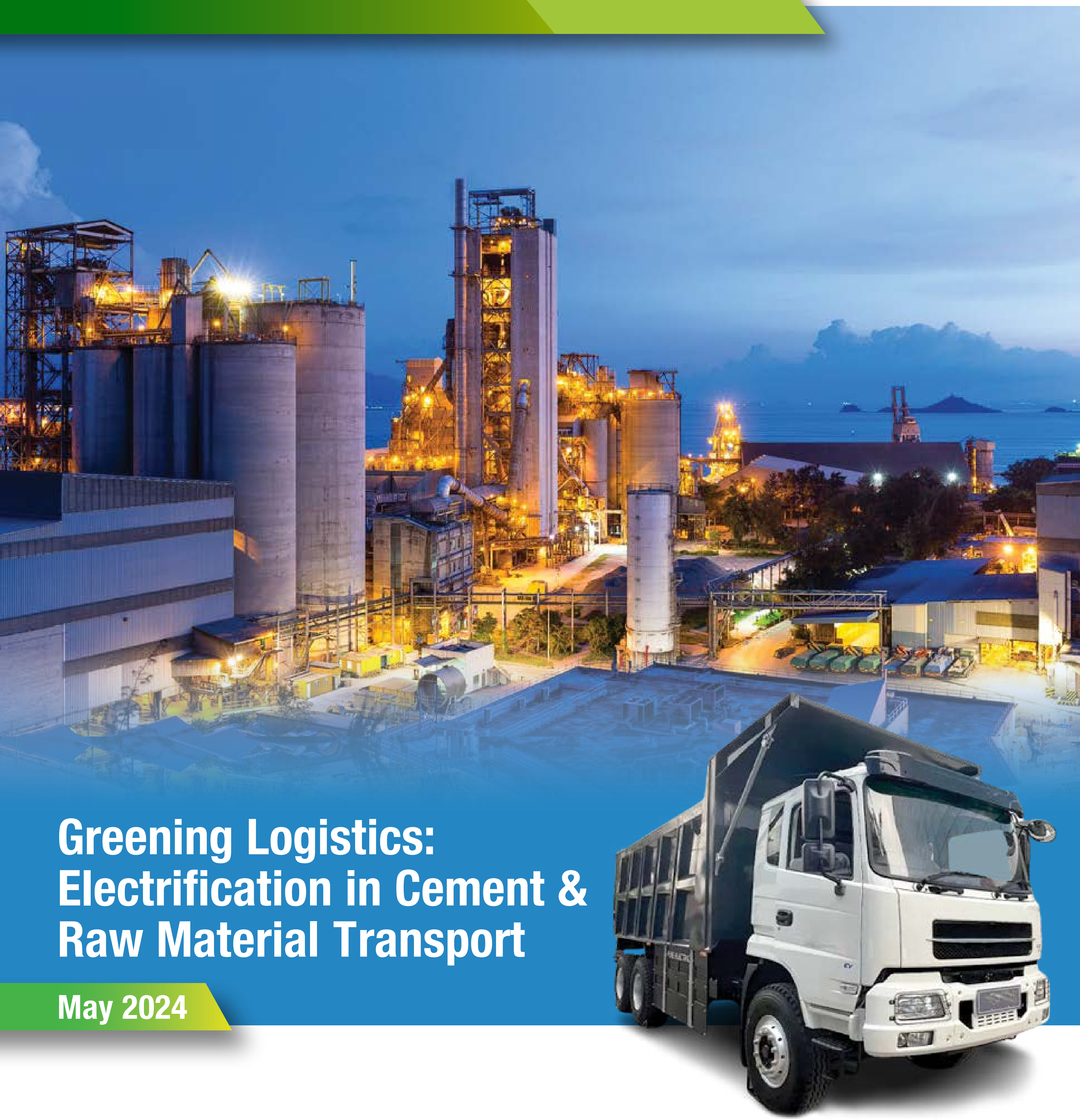

Greening Logistics: Electrification in Cement & Raw Material Transport

May 2024

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Message from the Chairman – Green Cementech 2024

Mr. Madhavkrishna Singhania
Chairman, Green Cementech 2024
Deputy Managing Director & CEO, JK Cement Ltd.

In response to the urgent imperative to tackle climate concerns, businesses spanning various industries, including the cement sector, are intensifying their efforts to curb greenhouse gas emissions. Among various contributors to emissions, road transport stands out significantly in India's energy-related CO_2 emissions. With the International Energy Agency (IEA) projecting a quadrupling of freight activity by trucks between 2021 and 2050, heavy freight trucking poses a considerable challenge as a "hard-to-abate" sector.

To tackle emissions from road transport in the cement industry, it's crucial to implement measures such as adopting cleaner transportation technologies like electric vehicles (EVs). The transition to electric trucks represents a pivotal moment for the cement sector, offering a transformative solution to mitigate carbon emissions and reduce our environmental footprint. Promoting the uptake of EVs and hybrid vehicles, improving logistics efficiency, and integrating renewable energy sources into transportation infrastructure are essential strategies to mitigate emissions and align with India's climate goals. Additionally, collaboration among cement manufacturers, transportation firms, and policymakers is pivotal for developing and implementing effective strategies to address emissions from road transport.

Despite challenges such as the higher cost of ownership, longer payback periods, and limited charging infrastructure, the cement sector has shown leadership by deploying EVs for material handling and dispatch operations, even on lead distance routes exceeding 100 kilometres. Recognizing the long-term benefits of reduced emissions, lower energy costs, and regulatory compliance, the sector is paving the way for sustainable industrial practices.

The release of this publication comes at an opportune time, offering valuable insights for the cement industry and other sectors to assess their logistic application & adoption of Electric trucks. We extend our appreciation to cement plants, technology suppliers, and contributors for sharing their case studies and insights, which have made this publication possible. I hope this publication serves as a catalyst for further discussions and actions towards promoting greener logistics. Let's continue working together towards a more sustainable future. We welcome your feedback on this publication at encon@cii.in.

Madhavkrishna Singhania

Message from the President, CMA

Mr. Neeraj Akhoury
President, Cement Manufacturers' Association (CMA)

It is my privilege to introduce this insightful publication on the adoption of electric trucks in the Indian cement sector. This document not only underscores the Cement Industry's commitment to sustainability but also highlights the innovative strides we are taking towards a greener future.

The Indian cement industry is actively exploring ways to achieve sustainability goals by implementing various latest technologies and best practices for reducing carbon emissions. The transition to electric trucks (E-trucks) represents a critical step in our journey towards reducing greenhouse gas emissions and achieving the broader goals of energy efficiency and sustainability. Electric trucks represent a transformative shift in the way we approach transportation within the cement sector. With their potential to significantly reduce carbon emissions and improve air quality, they align perfectly with our Industry's goal of achieving a more sustainable future.

This publication explores the practical implications, benefits, and challenges of integrating electric trucks (E-trucks) into our operations. The path to widespread adoption of E-trucks is not without its challenges. Issues such as high initial costs, need for robust charging infrastructure and the current limitations on vehicle range must be addressed.

The Cement sector has always been a cornerstone of India's infrastructure development. As we move forward, it is imperative that we also lead in sustainability. By pioneering the use of electric trucks, we are not just transforming our own Industry but also influencing the broader logistics and transportation sectors.

I am proud of the work that has gone into this publication and optimistic about the role it will play in guiding our members and stakeholders. Let this be a call to action for all of us within the Industry to embrace innovation, invest in sustainable practices, and work collaboratively towards a cleaner, greener future.

Neeraj Akhoury

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We extend our deepest gratitude to the entire Indian cement industry for their unwavering support and active participation in this initiative. Their insights and shared experiences regarding the implementation of electric trucks have been invaluable.

Their leadership and commitment to fostering sustainable practices within the industry have been instrumental in bringing this publication to fruition.

We also appreciate the cooperation and contributions of all the suppliers & cement plants who have shared their technological advancements and case studies. These contributions have enriched our discussions and enhanced the industry's understanding of the potential benefits of adopting electric trucks.

Furthermore, we are grateful to the Cement Manufacturers' Association for their support and contributions for this publication. Their inputs have significantly shaped the content and recommendations of this publication.

The interactions, discussions, and collaborations with industry suppliers, experts, and sector stakeholders have been thoroughly rewarding and enlightening for everyone involved.

Executive Summary

Freight vehicles, particularly medium and heavy-duty vehicles, are significant contributors to global greenhouse gas emissions. In India, although they represent merely 2% of all road vehicles, they are responsible for over 45% of road transport emissions[1]. This substantial impact positions them as a primary target for emission reduction initiatives. With India aiming for net-zero status by 2070, the decarbonization of transport is pivotal.

India stands as the world's second-largest cement producer with an installed capacity of ~670[2] Million tons per annum (MTPA). The significant reliance on internal combustion engine (ICE) trucks for the transportation of cement, clinker and other raw materials in India, where road transport accounts for 74-76% of all movement across an average distance of 300 km, contributes to a substantial environmental impact. Given the data on the extensive use of ICE trucks in the cement sector, the estimated carbon dioxide (CO_2) emissions through road transport amount to approximately 2.3 Million tons per annum (for cement and clinker transport). This figure underscores the critical need for the cement industry and associated logistics sectors to consider more sustainable transportation methods, such as electric trucks (E-trucks), which could drastically reduce these emissions, align with global environmental goals, and help India move closer to its net-zero ambitions. Transitioning to E-trucks not only supports environmental sustainability but also aligns with broader global trends towards reducing greenhouse gas emissions and mitigating climate change effects.

The transition to E-trucks presents an opportunity to slash logistic costs by 25-40%. Vehicles that operate over 8,000 km per month can achieve profitability considering current energy and infrastructure costs. Additionally, E-trucks powered by renewable energy could cut CO_2 emissions by up to 100% when compared to ICE trucks, which emit approximately 6 kg of CO_2 per ton of cement transported over a 100 km range.[3]

Operational & fixed cost components	Monthly 6,000 km		Monthly 8,000 km		Monthly 10,000 km	
	5 years finance loan		5 years finance loan		8 years finance loan	
	EV	ICE	EV	ICE	EV	ICE
Total travel (km)	6,000	6,000	8,000	8,000	10,000	10,000
Vehicle mileage (km/kWh or kmpl)	0.6	2.5	0.6	2.5	0.6	2.5
Fixed cost (INR/km)	50.8	20.6	38.1	15.4	22.7	9.3
Total cost (INR/km)	70.1	66.2	57.4	61.0	42.0	55.0
% Reduction	-6%		6%		24%	
Tailpipe emissions (T CO_2)	0.0	77.2	0.0	102.9	0.0	128.6

The cement industry is proactively seeking ways to reach sustainability goals by minimizing carbon emissions and enhancing logistic efficiencies. Recent years have seen numerous initiatives within the Indian cement industry to reduce emissions, with an increasing number of companies deploying E-trucks for various applications to further reduce transportation-related emissions.

While the adoption of E-trucks offers significant benefits in terms of environmental impact and operational costs over time, several challenges still hinder their widespread adoption, particularly in sectors like cement such as higher cost of ownership, longer payback period, fixed & short routes of operation, charging infrastructure set up.

[1] https://economictimes.indiatimes.com/industry/renewables/treading-the-electric-truck-transition/articleshow/99519240.cms
[2] Cement Manufacturers' Association, India
[3] CII estimate

To accelerate the initiative, a coordinated approach involving financing, policy support, early bird recognition, and enabling actions from cement organizations is essential

Despite these challenges, the cement sector has been at the forefront in deploying E-trucks and E-tippers for material handling and product dispatch operations. The sector recognizes the long-term benefits of reduced emissions, lower energy cost, and compliance with increasingly strict environmental regulations. By pioneering the use of E-trucks, the cement sector is not only addressing their carbon footprint but also leading the transition towards sustainable industrial practices.

Overall, transitioning to electric trucks not only mitigates the environmental impact of road freight but also offers economic and health benefits, making it a strategic move for sectors like cement, where logistics form a significant part of the operational costs and environmental footprint.

This publication aims to highlight the benefits, challenges, successful case studies, potential enablers, and necessary policy support for the widespread adoption of electric trucks in the cement sector.

Chapter 01

Logistic & Transport Scenario in the Indian Cement Industry

India, a rapidly growing economy, has a robust cement industry that is a significant contributor to national economic development. As the world's second-largest cement producer, India has an installed cement capacity of ~670 Million tons per annum (MTPA[1]).

1.1. Types of Cement & Commodities Involved:

Blended cements constitute 70-75% of the total cement production in India, with Ordinary Portland Cement (OPC) making up the remaining 20-25%. The most commonly produced types of blended cement are Portland Pozzolana Cement (PPC), Portland Slag Cement (PSC), and Composite Cement (CC). In the fiscal year 2019-20, the sector utilized 57.88 MTPA of fly ash and 22 MTPA of slag.[2]

The logistics landscape within the Indian cement sector encompasses a variety of commodities:

- **Cement & Clinker:** Cement about ~74-76% transported by road. Clinker about ~15-20% transported by road.[3]
- **Limestone:** Transported from mines to the plant primarily by road, supplemented by other equipment like belt conveyors.
- **Slag:** A significant portion is transported by both rail and road.
- **Fly Ash:** Mainly transported by road.
- **Coal:** Primarily transported by rail.
- **Other Additives:** Transportation of additives such as clay, bauxite, iron ore, and red mud is predominantly by road.

1.2. Different Modes of Logistics in Cement Sector:

Efficient and seamless logistics management is essential for businesses to ensure timely service delivery and cost-effectiveness. In the cement industry, logistics expenses can account for up to 30-35%[4] of the total cost. It is crucial for cement manufacturers to adopt an efficient delivery model, which often involves optimizing technology, processes, and methods. Cement is typically transported using a combination of road, rail, and waterways, based on the connectivity between the manufacturing plants and the market. In the fiscal year 2020-2021, road transportation accounted for approximately 74-76% of total cement movement in India, followed by rail at 20-22%, and waterways at 1-3%. Roads are generally preferred for distances up to 250-300 km, while rail and waterways are more economical for longer distances.

[1] CMA, India
[2] Blended Cement Green, Durable & Sustainable-GCCA India report
[3] Railway Board Directorate, Industry estimates
[4] https://www.cmaindia.org/transitioning-towards-bulk-logistics

1.2.1. Rail Vs Road logistics scenario:

During the fiscal year 2020-2021, Indian Railways transported 121.3 Million tons (MT) of cement and clinker, while 418 Million tons were transported by road. Rail transport accounted for 22% of the overall cement and clinker traffic.[5]

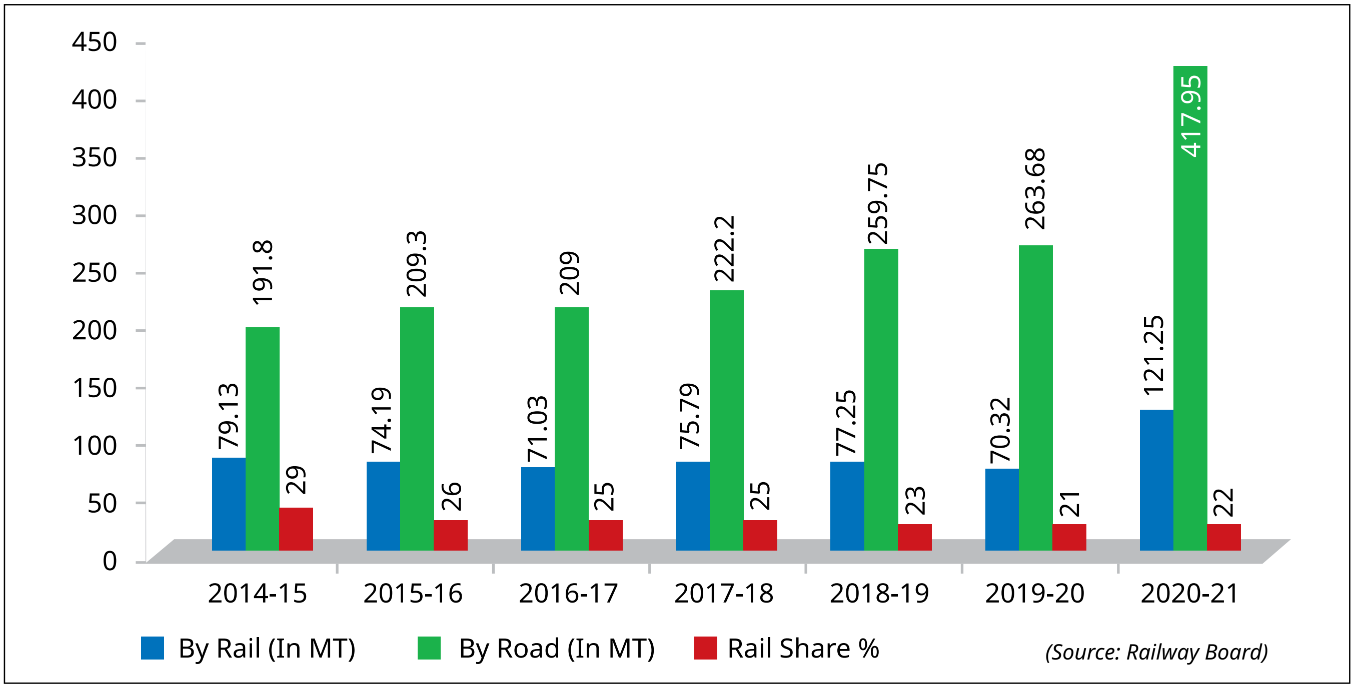


Figure 1: Rail vs Road Share in Cement Material Transport[6]

For short lead distances (up to 250 km), primary freight, secondary freight, and handling charges are typically lower for road transport compared to rail in the cement industry. Rail and road transport are complementary; cement companies prefer road transport for shorter distances due to cost efficiency, while opting for rail for longer distances to capitalize on cost savings.

Table 1: Comparison of Rail vs Road Transport Cost[7]

Lead distance (km)	Rail			Road			Variance
	Primary freight (INR/Ton)	Secondary freight & handling (INR/Ton)	Total cost (INR/Ton)	Primary freight (INR/Ton)	Secondary freight & handling (INR/Ton)	Total cost (INR/Ton)	
0-90	174	537	711	375	127	502	-209
91-150	230	537	767	486	127	613	-154
151-250	379	537	916	625	127	752	-164

Although the dedicated cement freight corridor projects of the Indian Railways, located near key cement clusters, will promote, and enhance the transportation of cement and raw materials by rail, road transport will continue to hold significant importance.

[5] *https://rdso.indianrailways.gov.in/uploads/TFC-105-Cement-Report.pdf*
[6] *https://rdso.indianrailways.gov.in/uploads/TFC-105-Cement-Report.pdf*
[7] *https://rdso.indianrailways.gov.in/uploads/TFC-105-Cement-Report.pdf*

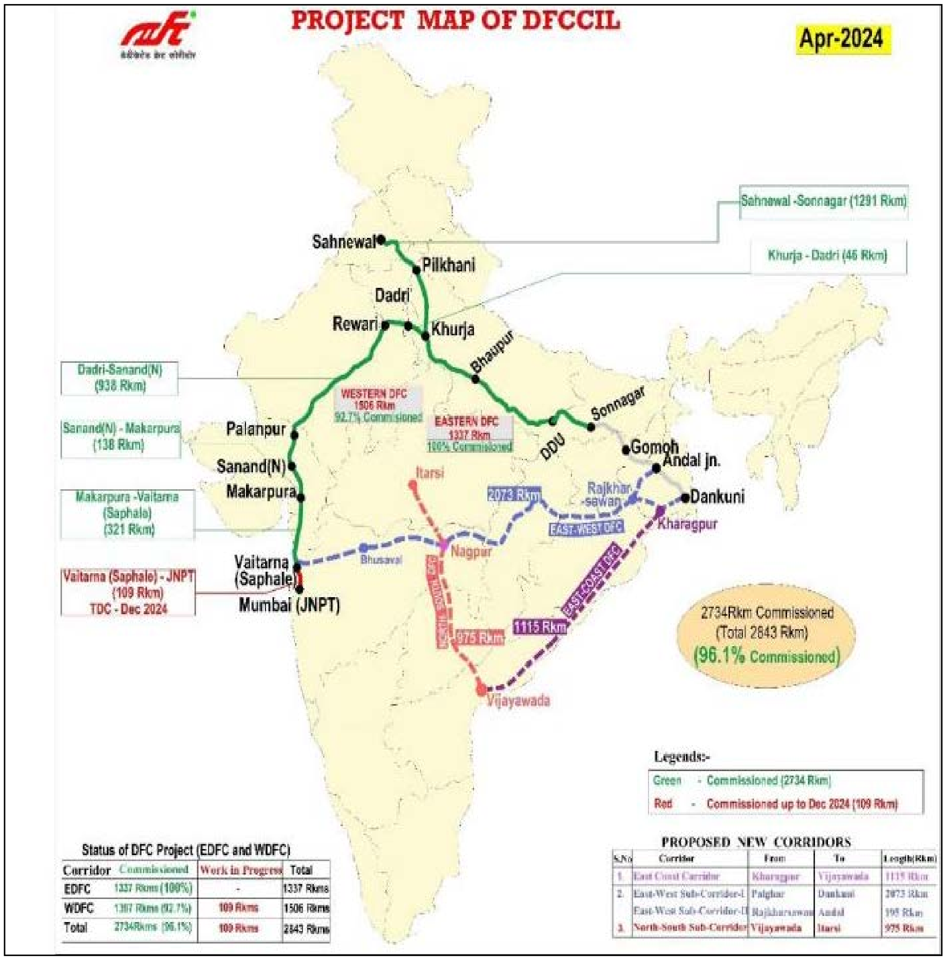


Figure 2: Railway Freight Corridor Map[8]

1.3. Magnitude & Impact of Road Transport in a Typical Cement Plant:

The cement industry faces significant challenges in reducing emissions, particularly in logistics, which include the transportation of raw materials and finished products. Logistics account for 30-35% of the total manufacturing costs in cement production. Traditionally, many cement companies have relied on internal combustion engine (ICE) trucks for transportation but are increasingly exploring ways to reduce carbon emissions and optimize logistics expenses. For example, a typical cement plant with a daily cement production capacity of 10,000 tons requires approximately 250 truck trips daily to dispatch cement, assuming a road share of 75%, with each truck covering a distance of 200-300 km per trip. Cement companies either own or lease these trucks, positioning them as pivotal in the transition to electric trucks. Furthermore, for a daily clinker production of 6,000 tons, about 9,000 tons of limestone are needed, typically sourced from 3-5 km away from plant.

[8] *https://dfccil.com/*

Table 2: Daily Truck Trips for an Integrated Cement Plant

Particulars	Plant capacity	Commodity	Production (TPD)	Road share Considered	Vehicle capacity (Tons)	No of vehicle trips involved (Nos)	Logistic type	% share
Clinker	6,000 TPD	Limestone	9,000	100%	30	300	Internal movement	49%
Cement	10,000 TPD	Cement	10,000	75%	30	250	Outbound	41%
Product Portfolio (OPC – 20% PPC – 50% PSC – 15% CC- 15%) Clinker factor: 0.65		slag (@ 63% in PSC /30% in CC)	1,395	30%	30	14	Inbound	2%
		Fly ash (@ 33% in PPC /25% in CC)	2,025	90%	40	46	Inbound	7%
Total trips						**610 Nos**		
Total km @ avg 60 km/trip						**36,571 km**		
Diesel consumption @ 2.5 kmpl						**14,628 Ltrs**		
CO_2 emission / day						**39,204 kg CO_2**		

Considering India's total cement and clinker production, alongside a road transport scenario where 75% of transportation is using internal combustion engine (ICE) trucks, the estimated CO_2 emissions are considerably significant, amounting to approximately 2.3 Million tons per annum (for cement and clinker transport only).

Table 3: Emission Scenario for ICE Truck in Cement Sector Transport

Particulars	Million Tons	Particulars		Unit
Cement Production	374.5	Mileage	2.5	kmpl
Cement transported through road (considering 75% road share)	281.2	Diesel/km	0.4	Ltr
Clinker production (@ 65% clinker factor)	243.8	Tailpipe emission	1.07	kg CO_2
Clinker export / transport (considering 50% of total production)	121.8	One-way average distance	100	km
Clinker transported through road (considering 75% road share)	91.4	Total distance covered	200	km
Total material (cement + clinker) transported through road	372.7	Total CO_2	214.4	kg
CO_2 emission		Pay load	35	MT
With 100% ICE vehicles	2.3	CO_2 emission	6.1	kg/ton
Reduction with 5% E-trucks	0.11			
Reduction with 10% E-trucks	0.23			
Reduction with 20% E-trucks	0.46			

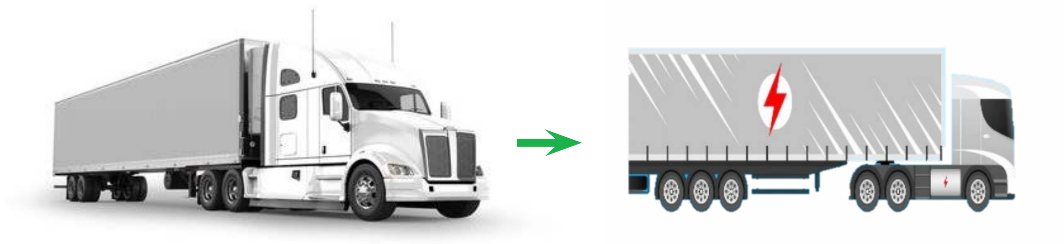
Assumptions:

- *Clinker factor considered – 0.65.*
- *Out of the total clinker produced, only 50% is considered for export with 75% road transport.*
- *One-way average distance considered – 100 km.*

Transition from Internal Combustion Engine (ICE) Trucks to Electric Trucks: Economic & Environmental Aspects

India is recognized as the sixth-largest market for medium and heavy-duty trucks (MHDTs), with over 200,000 vehicles sold in 2021[1]. With more than 4 Million trucks[2] operating on its roads, the vast majority, over 90%, are diesel-powered. Given the substantial number and environmental impact of these vehicles, transitioning to electric trucks (E-trucks) offers significant economic and environmental advantages.

Several operational challenges and complexities associated with ICE trucks can be addressed by adopting electric trucks:



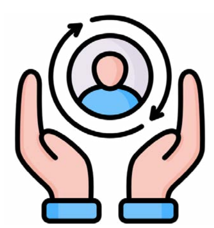
1. Cost Efficiency:

Increasing diesel costs, driven by dependence on imports and fluctuating global oil prices, underscore the cost-effectiveness of E-trucks. Operational expenses for E-trucks are also lower, due to reduced fuel and maintenance costs.

2. Regulatory Compliance:

With the Indian government enforcing stricter emission standards and providing incentives for low-emission vehicles, E-trucks are becoming an increasingly attractive option.

3. Driver Retention:



Approximately 25%[3] of freight vehicles in India experience driver shortages at some point in their operational cycle. The enhanced driver comfort, well-being, reduced fatigue, and ease of maintenance of electric vehicles can serve as key advantages on retaining drivers.

4. Reduced Logistics Costs:

E-trucks can potentially reduce logistics costs by 25-40% compared to ICE trucks. Scenarios indicate that operating E-trucks for more than 8,000 km per month is economically viable under current energy and infrastructure costs.

[1] *https://economictimes.indiatimes.com/industry/renewables/treading-the-electric-truck-transition/articleshow/99519240.cms*
[2] *Transforming trucking in India, NITI Aayog,RMI,September 2022*
[3] *https://globaldrivetozero.org/site/wp-content/uploads/2022/03/D2Z-India_Industry-Assessment_Fleet-Landscape.pdf*

Comparative studies between operational scenarios of E-trucks and ICE trucks demonstrate that E-trucks are profitable at higher monthly distances due to their lower operational costs. Furthermore, with advancements in battery technology and increased government support through incentives and infrastructure development, E-trucks are becoming an increasingly viable option.

For the scenarios considered, the following observations have been made:

- **Profitability Thresholds:** Operating electric trucks (E-trucks) for more than 8,000 km per month is profitable under current energy and infrastructure costs. When the monthly distance exceeds 10,000 km, profitability becomes significantly higher.
- **Financing Options:** Securing a finance loan for six years or longer, with a monthly operation of 10,000 km, shows significant potential for the adoption of E-trucks.
- **Impact of Renewable Power:** Utilizing renewable power sources, or benefiting from subsidized power tariffs, can greatly enhance the reduction in operational costs and accelerate the capital cost recovery period.

Table 4: Comparative Analysis of E-truck Adoption for Different Operational & Financing Scenarios

Operational & fixed cost components	Monthly 6,000 km 5 years finance loan		Monthly 8,000 km 5 years finance loan		Monthly 10,000 km 8 years finance loan	
	EV	ICE	EV	ICE	EV	ICE
Total travel (km)	6,000	6,000	8,000	8,000	10,000	10,000
Vehicle mileage (km/kWh or kmpl)	0.6	2.5	0.6	2.5	0.6	2.5
Price of Electricity/Fuel (INR)	7	100	7	100	7	100
Total operating cost (INR)	70,000	240,000	93,333	3,20,000	116,667	400,000
Total operating cost for fuel /km	11.7	40	11.7	40.0	12	40
Total fuel cost – annual (INR)	840,000	2,880,000	11,20,000	38,40,000	1,400,000	4,800,000
Tyre cost /km	3.1	3.1	3.1	3.1	3.1	3.1
Maintenance cost including AMC	4.5	2.5	4.5	2.5	4.5	2.5
Total Running cost (INR/km)	**19.3**	**45.6**	**19.3**	**45.6**	**19.3**	**45.6**
Fixed cost (INR/km)	50.8	20.6	38.1	15.4	22.7	9.3
Total cost (INR/km)	**70.1**	**66.2**	**57.4**	**61.0**	**42.0**	**55.0**
Annual Cost (INR/Year)	5,048,268	4,764,718	55,11,268	58,59,718	5,042,761	6,596,447
Profit (INR/Year)	(283,550)		3,48,450	-	1,553,686	-
Yearly EMI (INR)	3,119,268	1,199,718	31,19,268	11,99,718	2,187,761	841,447
Road tax, Other Expense & Crew salary (INR)	540,000	280,000	5,40,000	2,80,000	540,000	280,000
Total Fixed cost	3,659,268	1,479,718	36,59,268	14,79,718	2,727,761	1,121,447
Tailpipe emissions (Tons CO_2)	0	77	0	103	0	129

2.1. Key Features & Enablers for Adoption

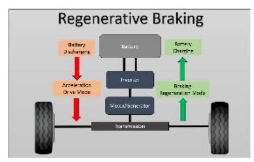
Electric trucks are becoming a significant part of the transportation industry, especially with the increasing focus on reducing carbon emissions and improving air quality.

2.1.1. Key Features of Electric Trucks:

Zero Tailpipe Emissions: Electric trucks produce no tailpipe emissions, crucial for reducing urban pollution.

Reduced Noise Pollution: Quieter operations compared to diesel trucks make them suitable for residential areas and nighttime operations.

Lower Operating Costs: Operating costs for electric trucks are typically lower due to reduced fuel and maintenance expenses.



Regenerative Braking: This feature allows electric trucks to recover energy during braking, recharging the battery and extending the vehicle's range.

High Torque Performance: Electric motors deliver high torque at low speeds, which is beneficial for heavy-duty vehicles starting with heavy loads.

Advanced Connectivity and Technologies: Incorporation of advanced technologies such as enhanced telematics, autonomous driving capabilities, and sophisticated fleet management software.

2.1.2. Enablers for Adoption:

Government Policies and Incentives: Subsidies, tax benefits, and grants, alongside emission regulations and low-emission zones, can reduce upfront costs and drive adoption.

Charging Infrastructure: Essential investments in charging infrastructure, including rapid charging stations at strategic locations, support the feasibility of electric trucks.

Battery Technology and Costs: Advances in battery technology that enhance energy density and reduce costs are critical. Lower battery costs help make electric trucks competitive with ICE trucks.

Range and Efficiency: Increasing the range to match that of ICE trucks, through better batteries and more efficient drivetrains and vehicle designs, is a significant enabler.

Industry Collaboration: Partnerships among truck manufacturers, tech companies, energy providers, and governments can develop standardized solutions that facilitate integration and adoption**.**

Payload Capacity: Innovations in design and regulatory adjustments to address payload capacity concerns due to heavy batteries are essential for broader acceptance in the logistics and transportation sectors.

Utility Rates and Electricity Pricing: Favorable pricing for commercial fleet charging, with possible discounts during off-peak hours, encourages fleet transition to electric.

Public Perception and Awareness: Educational campaigns that promote the benefits of electric trucks can enhance public and corporate acceptance.

2.1.3. Future Trends in Electric Truck

The future of electric trucks appears promising, bolstered by technological advancements, and supported by robust regulatory frameworks. However, their widespread adoption will depend on continuous improvements in battery technology, the development of more efficient charging infrastructure, and increasingly compelling economic benefits that lower the total cost of ownership compared to traditional internal combustion engine (ICE) trucks. As these elements align, electric trucks are poised to play a crucial role in transforming the transportation industry towards sustainability.

2.2. Retrofit as an Option

Retrofitting existing ICE trucks to electric is becoming an increasingly attractive option for businesses aiming to reduce their carbon footprint and operating costs without the need for a full fleet renewal. This approach can extend the life of current vehicles and expedite the shift to electric mobility, especially as new electric truck models gradually become more widely available and economically viable.

Some of the key aspects and considerations regarding retrofitting for electric trucks are:

2.2.1. Benefits of Retrofitting

Environmental Impact: Converting ICE trucks to electric significantly reduces greenhouse gas emissions, air pollutants, CO, SOx, NOx, unburnt, Pb etc., which support environmental goals and compliance with tightening emissions standards.

Cost-effectiveness: Retrofitting can be more economical than purchasing new electric trucks, particularly when considering the high initial cost of new electric vehicles**.**

Regulatory Compliance: For regions with strict emission regulations, retrofitting offers an efficient solution to meet new standards without a complete fleet replacement.

Extended Vehicle Life: Retrofitting can prolong the operational life of existing vehicles, maximizing the return on the original investment in the vehicle chassis and body.

Faster Transition: Allows companies to shift to electric vehicles without waiting for further infrastructure development or the arrival of new vehicle models.

2.2.2. Challenges in Retrofitting:

Technical Complexity: Retrofitting requires significant modifications, including the removal of the ICE engine and installation of electric components, demanding expertise and extensive testing for safety and reliability.

Weight and Space Constraints: The heavy and bulky nature of batteries for electric trucks necessitates careful integration to maintain vehicle balance and cargo capacity.

Range and Performance: Retrofitted trucks may have different performance characteristics, particularly in terms of range and load capacity, depending on battery technology and placement.

Certification and Compliance: Meeting regulatory standards and safety requirements for retrofitted electric trucks can be challenging and requires meticulous engineering.

Battery Cost: Although retrofitting avoids the cost of a new vehicle, the high price of batteries remains a significant expense. However, as battery technology improves, these costs are expected to decrease.

Service Provider Availability: The retrofit market is emerging, and locating experienced and reliable service providers can be difficult.

2.2.3. Key steps for Retrofit adoption:

Government and Industry Support: Subsidies or incentives aimed specifically at retrofitting can reduce barriers to adoption and encourage more projects.

Advancements in Modular Retrofit Kits: Developing standardized, modular retrofit kits for different truck models and sizes can simplify the retrofit process, reduce costs, and enhance reliability.

Partnerships between Stakeholders: Collaboration between truck manufacturers, retrofit specialists, battery producers, and fleet operators can yield improved retrofit solutions and wider adoption.

Training and Development: Investing in training for technicians and engineers specializing in electric vehicle retrofitting can address the shortage of qualified professionals.

R&D in Battery Technology: Ongoing research into battery technology that achieves higher energy density, faster charging, and longer life will directly benefit retrofit projects.

Retrofitting offers a viable pathway to electrify existing fleets where new electric trucks might not be practical due to cost, availability, or specific operational needs. As technology progresses and economic incentives become aligned, retrofitting is poised to become a significant component of sustainable transportation strategies.

Available Options of E-trucks in India

3.1. Available E-trucks & E-tippers in India

The product portfolio of electric trucks (E-trucks) and electric tippers (E-tippers) is gradually gaining momentum in the Indian mid and heavy segment vehicle market. Prominent automobile giants and reputable technology suppliers, known for their rich heritage and legacy, are actively participating, and the presence of electric trucks is notably increasing in the cement sector. Below are some of the available models:

IPL Tech - IPLT Rhino 5536[1]

Model Specification	IPLTech Rhino 5536
Gross Vehicle Weight	55,000 kg
Payload Capacity	25,000 kg – 27,600 kg
Battery	Lithium-ion phosphate battery
Capacity	258.08 kWh
Charger	160 kW fast-charger
Maximum Power	360 HP @1200 RPM
Maximum Torque	2,400 Nm @600 RPM
Clutch	430 mm dia dry friction
Transmission	12 Speed AMT (Automated Manual Transmission)
Front Axle	Meritor - 7T Heavy Duty Forging Type
Rear Axle	Meritor - 21T SRT Tandem Axle
Suspension	Front - Parabolic Leaf Spring, Rear - Hendrickson Bogie Suspension
Frame	Ladder Type, Heavy Duty Frame (285 mm x 65 mm x 7 mm)
Cab/ Cowl	Sleeper Cabin
Tyres	295/90R20 Radial Tube Tyres
Ventilation	Blower & Air Conditioning Options
Wheelbase	3,850 mm
Charging Time	90 min
Distance	185 km
Maximum Speed	90 kmph

[1] https://ipltelectric.com/rhino

Olectra Greentech - Meghaetron Electric 6x4 Tipper[2]

Model Specification	Meghaetron Electric - 6X4 Tipper
Gross Vehicle Weight	28,000kg
Battery	Lithium-ion phosphate battery
Capacity	450 - 540 kWh
Charger	180 kW DC Dual Gun
Rated Power	362 HP(270 kW)
Maximum Torque	2,400 Nm @600 RPM
Brake System	Drum Brake
Transmission	Automatic Transmission
Load Body Volume	14 / 16 m^3 – Rock Body 16 / 18 m^3 – Box Body
Gradeability	18%
Suspension	Front – HD semi-elliptical and Rear – HD Bogie
Frame	8770 x 2550 x 3978 – Rock Body 8625 x 2525 x 3678 – Box Body
Cab/ Cowl	Meeting AIS 093 Specification with Air Conditioning
Tyres	12 R 20.00
Steering System	Power-assisted
Wheelbase	4,975 mm
Charging Time	120 min
Distance	120 -150 km
Maximum Speed	80 kmph

[2] *https://olectra.com/meghaetron-28t-electrictipper/*

BYD - BYD Q1R[3]

Model Specification	BYD Q1R Pure Electric
Gross Combination Weight (GCW) Max.	75,000 kg
Battery	Lithium-ion phosphate battery
Capacity	255 kWh
Charging Power	AC 40 kW / DC 120 kW
Maximum Power	210 kW
Maximum Torque	4,500 Nm @600 RPM
Brake System	Pneumatic Disc Brake, ABS optional, Regenerative Braking
Wheelbase	3,550 mm
Gradeability	20 %
Suspension	Front – Less leaf springs and double-tube hydraulic shock absorbers and Rear – More leaf springs and double-tube hydraulic shock absorbers
Frame	L = 6,200 mm, W = 2,550 mm, H = 3,110 mm
Gross combination weight rating (GCWR)	40,000 kg
Tyres and Wheel rim parameters	Radial tire: 11.00R20-18PR & Steel rim: 8.5-20
Approach/ Departure Angle	13° / 30°
Turning Radius	7,000 mm
Charging Time	7 hr (40 kW) / 2.5 hr (120 kW)
Distance	200 km
Maximum Speed	85 kmph
Axle load parameters	Front axle/ Rear axle 4,496/3,880 at No load Front axle/ Rear axle 5,570/12,430 at Full load

[3] *https://www.team-bhp.com/news/scoop-byd-q1-electric-trucks-arrive-mumbai-port*
https://sg.byd.com/wp-content/uploads/2021/11/Brochure-Q1R-eTruck-NOV-21.pdf

Propel Industries Pvt. Ltd - Propel EV- Dumper Truck[4]

Model Specification	Propel EV- Dumper Truck - 470 MEV & HEV
Gross Vehicle Weight	45,000 kg
Battery	Lithium-ion battery
Capacity	163 kWh
Axle	Front : Steerable, 9.5T heavy duty I Beam, Rear : 37T Tandem, Hub Reduction cast axle
Maximum Power	350 kW
Maximum Torque	2,800 Nm @600 RPM
Brake System	Service Brake : Dual line air brakes with ABS, Parking Brake : Pneumatic Hand Control Valve, Hill Start assist: Integrated with service brake
Transmission	7 speed AMT without clutch
Body Volume	18 CuM Rock Body with Hardox steel
Gradeability	30%
Suspension	Parabolic Leaf Spring with Shock Absorber, Inverted Semi Elliptical inverted Bogie
Overall Frame Size	8,275 x 2,800 x 3,650 (L x W x H)
Cab/ Cowl	Sleeper Cabin, Tiltable, Air suspended driver seat
Tyres	12x20 Mining tyre
Steering System	Hydraulic integral power steering, Tiltable steering column
Wheelbase	4,300 mm
Charging Time	60 min
Turning Circle Diameter	16.5 m
Maximum Speed	40 kmph

Emerging Trends and Innovations:

The adoption of electric trucks and tippers is bolstered by continuous advancements in battery technology, supportive government incentives, and an increasing demand for environmentally friendly transportation options. Crucial to the broader deployment of these vehicles are the ongoing development of charging infrastructure and the reduction of battery costs. Additionally, industry collaboration and public-private partnerships play essential roles in standardizing technologies and integrating new electric vehicles into existing fleets.

[4] *https://www.propelind.com/products/ev-dumper-truck/*
https://www.mojo4industry.com/propel-industries-launches-indigenous-ev-dump- trucks-at-excon-2023/

Chapter 04

Successful Case Studies in Electric Freight Transport

The Indian cement sector has positioned itself as a leader in decarbonization and technological adoption. This commitment is highlighted by several successful case studies demonstrating the deployment of electric trucks across various applications.

The use of electric trucks and tippers in the cement industry is predominantly seen in raw material handling, both within plant operations and from mines to plants, as well as in transporting raw materials from sources to plants or between integrated units and grinding units. Although fixed routes and short distances are generally preferred, some plants have successfully utilized electric trucks for transport exceeding 300 km, supported by en route battery charging infrastructure. High-frequency trips and extensive monthly distances (more than 8,000 km/month), coupled with green channel facilities at both loading and unloading points, can significantly accelerate the successful deployment of electric trucks in the cement sector.

4.1 Case Studies - E-truck Deployment in Cement Sector

Case Study 1: Cement Bag Transport

Application: Transportation of cement bags from manufacturing plant to distribution hub.

Route: 45 km one way.

Number of E-trucks Deployed: 2.

Payload: 40 metric tons.

Battery Capacity: 258 kWh.

Mileage: Approximately 0.6 km/kWh.

Approximate Monthly Travel per E-truck: 3,000 km.

Benefits/Pros Experienced:

- **Operational Cost Savings**: Savings of INR 20 per km.
- **Improved Driver Wellbeing**: Benefits from automatic transmission and mandatory charging breaks.
- **Higher Depreciation Value**: 40% for E-trucks compared to 30% for ICE trucks.
- **Environmental Benefits**: Significant reduction in greenhouse gas emissions and local pollutants.

Challenges Faced:

- **Finance Cost Recovery**: Requires an average running distance of 8,000 to 10,000 km per E-truck per month.
- **Charging Infrastructure**: Necessity for robust charging infrastructure to support long trips and high mileage.
- **Reduced Payload**: Compromised due to the large size and weight of the battery.
- **Maintenance:** Need for skilled maintenance personnel familiar with EV technology.

Case Study 2: Clinker Transport

Application: Transportation of clinker from a manufacturing plant (integrated unit) to grinding unit.

Route: 250+ km one way.

Number of E-trucks Deployed: 5.

Payload: 40 metric tons.

Approximate Monthly Travel per E-truck: 6,500 km.

Benefits/Pro's Experienced:

- **Lower Operating Expense**: Significant reduction in operating costs compared to ICE trucks.
- **Reduced CO_2 Emissions**: Substantial decrease in carbon emissions, contributing to environmental sustainability.
- **Driver Well-Being**: Improved due to less noise, vibrations, and automatic transmission features.

Challenges Faced:

- **Delayed Vehicle Registration**: Complications and delays in the registration process of new electric vehicles.
- **Lack of Charging Infrastructure**: Insufficient charging facilities along the route hinder long-distance operations.
- **Longer Payback Period & Unpredictable Secondary Market**: Financial returns take longer than anticipated, and the resale market for used EVs is not yet reliable.
- **Fixed Route Limitations**: The necessity to operate within predetermined routes due to charging station locations.

Enablers for the Initiative:

- **Charging Infrastructure**: Installation of charging stations at the plant and along the route.
- **Adequate Remuneration for Drivers**: Ensuring driver satisfaction and retention through competitive pay.
- **Provision of Green Channel or Improved Turnaround Time (TAT):** Streamlining operations to reduce wait times and enhance efficiency.
- **Monitoring of Trips & TAT**: Implementation of tracking systems to optimize logistics and turnaround times.

Case Study 3: Slag Transport

Application: Transportation of slag from the source plant to a cement manufacturing unit.

Route: 40 km one way.

Number of E-trucks Deployed: 22.

Payload: 35-40 metric tons.

Approximate Monthly Travel per E-truck: 5,550 km.

Benefits/Pro's Experienced:

- **Lowest Operating Cost**: Marked reduction in operating expenses compared to traditional ICE trucks.
- **Lower Emissions**: Significant decrease in environmental pollutants.
- **High Powertrain Efficiency**: Enhanced efficiency of electric powertrains contributes to better performance and fuel economy.
- **Wellbeing of Drivers**: Improved conditions due to quieter operations and less vibration.
- **Lesser Maintenance:** Reduced mechanical complexity leads to fewer maintenance requirements.

Challenges Faced:

- **Limited Range & Fixed Routes**: Constraints in operational flexibility due to range limitations and dependency on established charging points.
- **High Maintenance Downtime & Spare Availability**: Challenges in obtaining spare parts and longer downtime for maintenance.
- **Additional Charging Infrastructure Costs**: Financial burden of installing and maintaining additional charging stations.
- **Reluctance from Service Providers**: Hesitation in deploying high-value assets without assured returns.

Enablers for the Initiative:

- **Long-term Association with Service Providers**: Building stable, long-term relationships with service providers to ensure reliability and service continuity.
- **Battery & E-trucks Annual Maintenance Contracts (AMC):** Ensuring the longevity and performance of the fleet through comprehensive maintenance contracts.
- **Dedicated Routes with Charging Infrastructure at Both Ends**: Establishing dedicated routes with sufficient charging facilities to ensure efficient operations and mitigate range anxiety.

Case Study 4: Cement Bag Transport

Application: Transportation of cement bags from the grinding unit to the cement depot and return loads of slag from the steel plant.

Route: 35-40 km one way, totalling 75-80 km per trip.

Number of E-trucks Deployed: 2.

Payload: 38-40 metric tons.

Approximate Monthly Travel per E-truck: 3,500 km.

Benefits/Pro's Experienced:

- **Lowest Operating Cost**: Significant reduction in operational expenses compared to conventional ICE trucks.
- **Lower Emissions**: Considerable decrease in carbon and pollutant emissions, enhancing environmental sustainability.
- **Wellbeing of Drivers:** Improved due to less noise, reduced vibrations, and automatic transmission features.
- **Easy Maintenance Upkeep:** Simplified maintenance due to fewer mechanical components in EVs.

Challenges Faced:

- **Lower Number of Trips**: High detention times at depots for unloading and at the steel plant for loading reduce trip frequency.
- **Battery Limitations**: Restrictive battery capacity limits the feasibility of two out of three potential return routes.
- **Forced Short Trips:** Lack of adequate owned or third-party charging infrastructure in nearby cities confines the trucks to shorter trips.

Enablers for the Initiative:

- **Green Channel at Slag Source Plant**: Implementation of a green channel can significantly increase the number of trips and encourage further EV deployment.
- **Owned Fleet and Driver Retention Control:** Owning and effectively managing the fleet enhances control over vehicle operations and helps in retaining skilled drivers.
- **Charging Infrastructure at Slag Source End**: Establishing dedicated charging facilities at the slag source end to support efficient turnarounds.

Case Study 5: Clinker Transport

Application: Transportation of clinker from an integrated unit to a grinding unit.

Route: 35 km one way.

Number of E-trucks Deployed: 5.

Payload: 40 metric tons.

Monthly Travel per E-truck: More than 6,000 km.

Benefits/Pro's Experienced:

- **Lower Operating Cost**: Notable reduction in operational expenses compared to ICE trucks.
- **Own Control Over Fleet**: Enhanced operational control and flexibility due to ownership of the fleet.
- **Return Loading**: Efficient utilization of vehicles with return loads from the grinding unit, optimizing logistics.

Challenges Faced:

- **Extended Payback Period**: The payback period is approximately 4 years longer compared to ICE vehicles, due to higher initial costs.
- **Secondary Market Unpredictability**: Uncertainty in the resale market for electric trucks impacts long-term investment decisions.
- **Short and Fixed Route**: Limited route flexibility. Operational interruptions, like stock status changes and plant stoppages, significantly affect truck utilization and financial returns.

Enablers for the Initiative:

- **Charging Infrastructure Installation at Both Plants**: Essential to support continuous operations and minimize downtime.
- **Owned Fleet and Driver Retention Control:** Owning the fleet provides better management of operations and aids in retaining skilled drivers.
- **Flexible Utilization of Trucks**: Deploying trucks for alternative uses such as cement transport when clinker transportation demands are low, thereby maximizing vehicle usage and efficiency.

4.2 Case Studies - E-truck Deployment in Other Sectors

Case Study 1: Transition to Electric Vehicles in Mining Operations

A leading metal sector company in India has integrated the Normet Agitator SmartDrive EV into its underground mining operations at a world-class silver-rich zinc mine in Rajasthan, renowned for its state-of-the-art infrastructure and best-in-class mechanization. Committed to sustainable practices, the company aims to replace or convert approximately 900 diesel-run mining vehicles to battery-operated ones within the next five years, with an investment of over $1 Billion earmarked for this period.[1]

Reports indicate that the adoption of electric vehicles (EVs) will bring considerable benefits, including significant savings on high-speed diesel (HSD) and reduced vehicle maintenance costs. These SmartDrive electric vehicles are equipped with 90 kWh lithium-ion batteries and feature advanced technologies such as energy recuperation technology and hydraulic dual-circuit oil-immersed brakes, enhancing braking power and overall efficiency.

Case Study 2: Pioneering Electric Trucks in Global Mining Operations:

Vale, a global mining company founded in 1942 and operating across 20 countries, has positioned itself as the first major mining company to test 100% electric 72-tonne trucks. These trials, involving vehicles from XCMG Mining Machinery Co. Ltd.,[2] were conducted at the Agua Limpa site in Minas Gerais, Brazil, and Sorowako in Indonesia. This initiative marks a significant advancement in reducing environmental impact, as these trucks emit no CO_2, replacing diesel with electricity sourced from renewable energies. Additionally, they offer the benefit of reduced noise pollution, lessening the impact on nearby communities.

The vehicles, produced by XCMG Mining Machinery Co. Ltd.—a subsidiary of Xuzhou Construction Machinery Group Co. Ltd, China's largest machinery manufacturer—are models XDR80TE. These 72-tonne electric off-highway trucks are integral to Vale's Power Shift program. The trucks are equipped with batteries capable of storing 525 kWh, allowing them to run for up to 36 cycles or just over a day along the established routes without recharging. They feature energy regeneration capabilities during descents, which minimizes mechanical brake use, reduces maintenance needs, and decreases vibration, thereby enhancing operational comfort for drivers. Additionally, these machines are equipped with temperature control technology, enabling operation under various extreme conditions such as high temperatures, humidity, and challenging weather scenarios.

Diesel-powered off-highway trucks currently account for approximately 9% of Vale's total scope 1 and 2 emissions. The Power Shift program, initiated by Vale, aims to replace fossil fuels with clean energy sources across its operations. This program is driving innovative solutions to electrify the company's mines and railroads, including a strategic partnership with industry peers BHP and Rio Tinto to further its operational equipment electrification strategy.

Case Study 3: Electrification of Fleet in the Nonalcoholic Beverage Sector

A leading Indian company in the nonalcoholic beverage industry, with operations spanning 20 states, has initiated the transition to electric vehicles (EVs) by deploying three electric trucks. These trucks are currently used for inter-unit material transfers and deliveries to storage warehouses, covering a one-way lead distance of 26 km. In line with its commitment to sustainability, the company has set an ambitious goal to convert its entire fleet to electric vehicles within the next three years. Additionally, the installation of 35 EV charging stations is planned to support this transition, ensuring adequate infrastructure for efficient operations.

[1] *HZL deploys Normet SmartDrive unit at Sindesar Khurd - a BEV first for India - International Mining (im-mining.com)*
[2] *https://im-mining.com/2022/08/18/xcmg-72-t-battery-electric-trucks-start-up-at-vale-operations/*

Case Study 4: Sustainable Transition in Steel Manufacturing

A prominent steel manufacturing organization in India has implemented electric trucks (E-trucks) for material transport between its manufacturing plant and stockyards. The trucks cover a lead distance of 38 km and have a minimum carrying capacity of 35 tons. In a significant move towards sustainability, the organization plans to deploy a total of 27 electric vehicles, which will be shared between two manufacturing units.[3]

The electric vehicles being introduced are equipped with a 2.2-ton 230.4 kWh lithium-ion battery pack, featuring an advanced cooling system and a battery management system. This setup enables the trucks to operate efficiently in ambient temperatures of up to 60 degrees Celsius. The battery packs are charged using a 160-kWh charging setup, capable of fully charging the battery from 0 to 100% in just 90 minutes. With zero tailpipe emissions, each electric vehicle is expected to reduce the greenhouse gas (GHG) footprint by more than 125 tCO_2e annually.

[3] *https://www.tatasteel.com/media/newsroom/press-releases/india/2021/tata-steel-pioneers-the-deployment-of-electric-vehicles-for-transportation-of-finished-steel-in-the-country/*

Chapter 05

Barriers & Challenges for E-truck Deployment

While many industries have initiated the deployment of electric trucks (E-trucks), the transition is not yet widespread. Several challenges emerge during the initial phase that must be addressed:

5. 1 Major Challenges Faced:

5.1.1 Cost of Ownership & Business Model

i. **High Procurement Cost:** The initial purchase price of EVs is almost three times that of ICE trucks. Operational savings exist, but a 5–6 year period, running ~8,000 km/month, is needed for cost recovery.

ii. **Battery Cost and Maintenance:** High costs of batteries, approximately Rs. 12,000-15,000/kWh, with a required 400 kWh for 200-250 km range, lead to substantial initial investments (around Rs. 40 Lakhs). Battery annual maintenance contracts (AMC) are also costly.

iii. **Fleet Ownership Challenges:** For organizations with their own fleet, capital expenditures are more manageable compared to third-party fleets, which face higher asset value risks without long-term contracts, difficulties in redeployment during plant downtimes, and maintenance or battery performance concerns.

iv. **Lack of Flexible Payment Models:** There is an absence of deferred payment or operating expense-based business models.

5.1.2 Operational Challenges

i. **Reduced Payload:** Heavy battery sizes reduce payload capacity by 2-2.5 tons.

ii. **Route Limitations:** Fixed or shorter routes are necessary due to range anxiety and inadequate charging infrastructure.

iii. **Logistical Delays:** In cement transport, vehicle detention for secondary logistics or unloading delays challenges the battery endurance of E-trucks.

iv. **Driver Retention and Tracking:** Improved driver well-being notwithstanding, retaining skilled drivers and tracking vehicles online are essential.

v. **Charging Time:** Charging times of 1-2 hours reduce the number of possible trips, impacting profitability, especially in mining or raw material handling.

5.1.3. Infrastructure Challenge

i. **Charging Infrastructure Costs:** High costs and the non-universality of chargers across different E-truck models complicate the ease of operation.

ii. **Sparse Charging Stations:** A lack of charging stations along major goods transport routes hinders widespread adoption.

iii. **Lack of Green Channel Facilities**: Absence of fast-track services for E-trucks at critical points like cement plants & raw material source plants.

iv. **Renewable Energy Availability**: The absence of on-site renewable energy sources increases the payback period for E-trucks.

v. **Evolving Maintenance Ecosystem:** Although spare parts are becoming more available, the maintenance network needs to mature to reassure large fleet operators.

5.1.4. Future Predictability

i. **Dependency on Imports**: A heavy reliance on imported batteries and spare parts.

ii. **Uncertain Resale Market:** No predictable secondary market for used E-trucks.

iii. **Vulnerability to Technological Advancements:** Innovations such as regenerative braking or alternative fuels like LNG may reduce the current operational gains of E-trucks.

iv. **R&D Impact on Investment:** Continuous research aiming to lower battery costs may jeopardize the recovery of current investments if cheaper technologies emerge.

Chapter 06

Existing Policies for Electric Vehicle and Policy Support Required for E-truck Adoption in Cement Sector

The Government of India (GOI) has implemented several initiatives aimed at fostering a sustainable and clean transportation system through the adoption of electric vehicles (EVs). These policies support the development of infrastructure, purchase, and use of EVs across the nation.

6.1. Existing National Level Policy in India

The Government of India has announced several promotional initiatives over the past ten years to accelerate the adoption of electric vehicles (EVs). The major initiatives include tax breaks for EV owners and the expansion of public EV charging infrastructure.

The timeline for various initiatives taken by policymakers has been illustrated in figure 3.

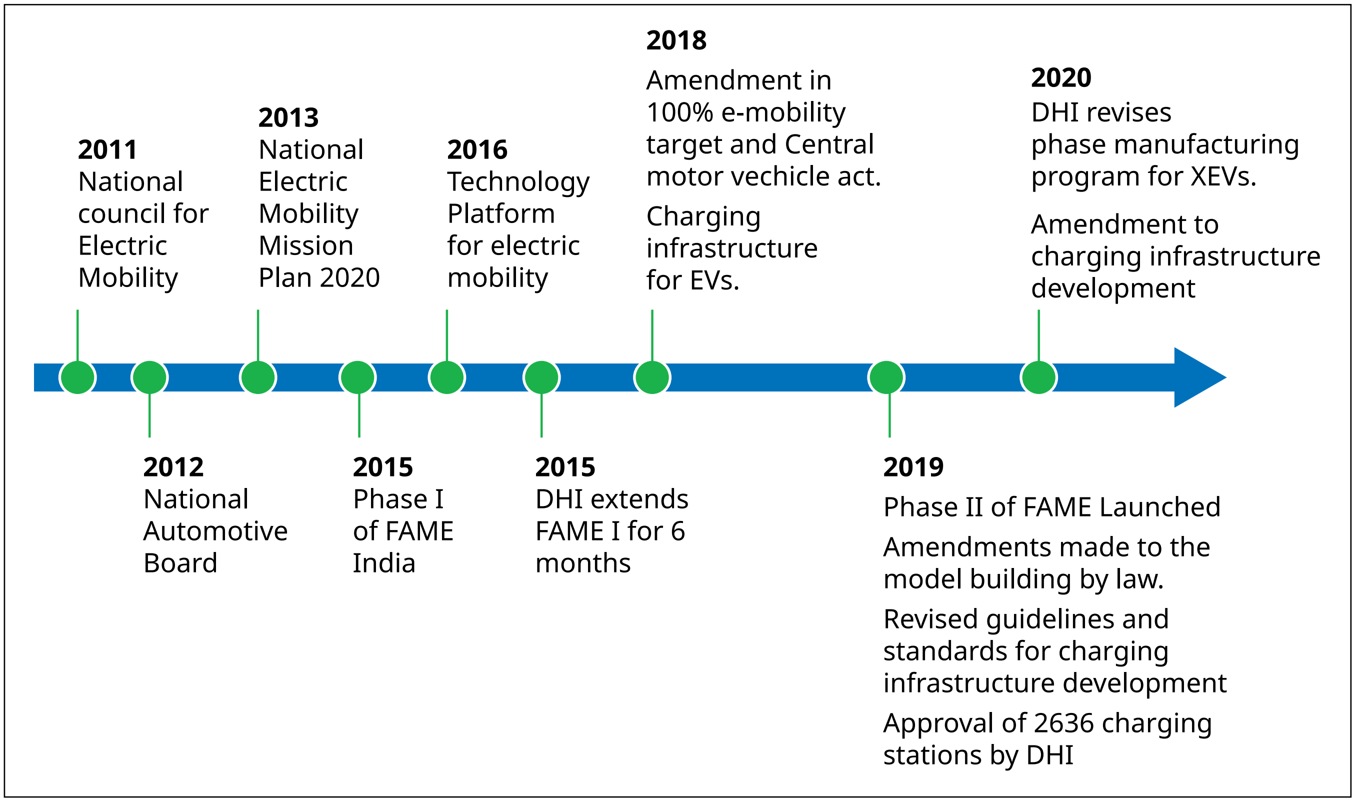


Figure 3; Timeline for Various Initiatives Taken by Policymakers and Regulators[1]

[1] *https://e-amrit.niti.gov.in/national-level-policy*

Over the past decade, the central government has introduced various promotional initiatives to accelerate EV adoption:

1. **National Electric Mobility Mission Plan (NEMMP)[2]:** Launched in 2013 by the Department of Heavy Industry (DHI), targeting 6-7 Million EV sales by 2020 to enhance national fuel security.
2. **FAME India Scheme [3](Faster Adoption and Manufacturing of Electric Vehicles in India):** FAME India is a flagship program which aimed at promoting the adoption of electric and hybrid vehicles in the country. It provides incentives for purchasing electric vehicles and supports the establishment of charging infrastructure. This flagship program is divided into two phases:
    - FAME I: Started in April 2015, focusing on demand creation, technology platforms, pilot projects, and charging infrastructure, extended until March 2019.
    - FAME II: Launched in April 2019 with a budget of ₹10,000 crore over three years to support the purchase of various types of electric vehicles.
3. **State EV Policies[4]:** Notified in 28 states, offering incentives like subsidies and tax exemptions to boost EV adoption.
4. **GST Rate Reduction[5]:** Lowered from 12% to 5% to make EVs more affordable.
5. **Charging Infrastructure Development:** Focus on establishing charging stations along major highways.
6. **Custom Duty Reduction:** Reduced duties on parts used in EV manufacturing to lower costs and promote domestic production.

The Go Electric campaign, the Shoonya campaign, and the exemption of registration fees for electric vehicles are just a few of the additional initiatives that actively support the EV ecosystem in India.

6.2. EV Charging Infrastructure in India[6]

In 2018, the Ministry of Power set regulations for public charging infrastructure, requiring a minimum density of charging stations along highway corridors and urban areas. EV charging has been deregulated, allowing more private investment. As per the regulations, at least one EV charging station shall be available in a grid of 3 km X 3 km. Furthermore, one EV charging station shall be set up at every 25 km on both sides of highways/ roads.

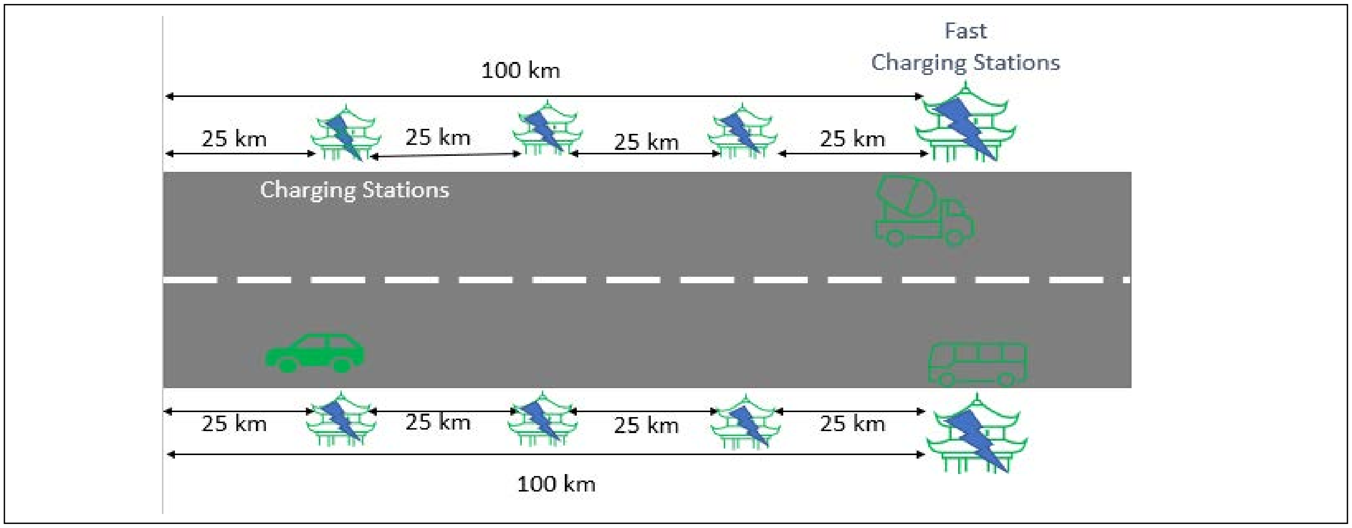


Figure 4: Charging Infrastructure on National Highways

[2] https://evyatra.beeindia.gov.in/central-govt-initiative-details/dhi-2/
[3] https://heavyindustries.gov.in/fame-ii
[4] https://evyatra.beeindia.gov.in/state-ev-policies/
[5] https://gstcouncil.gov.in/gst-council
[6] https://e-amrit.niti.gov.in/national-level-policy

6.3. Policy Support Required for Electric Truck Adoption:

To accelerate the adoption of E-trucks in the cement sector, further supportive measures are essential:

1. **Extend FAME Policy Subsidies:** Currently targeted primarily at personal and light commercial vehicles, extending these to E-trucks would boost their adoption in heavy industries like cement.
2. **Develop Specific Incentives for Retrofitting:** Promote the conversion of existing ICE trucks to electric with targeted incentives.
3. **Enhance Driver and Fleet Owner Benefits:** Implement policies that provide direct benefits to operators, such as reduced toll charges and favorable insurance and loan terms.
4. **Battery Replacement Subsidy:** Introduce subsidies specifically for battery replacements in E-trucks.
5. **Support for Battery Manufacturers & Recyclers:** Strengthen the battery manufacturing and recycling sectors with targeted policies.
6. **Promote Renewable Energy at Charging Stations:** Incentivize the use of renewable energy for powering EV charging stations.
7. **Standardized Charging Protocols:** Establish uniform standards for charging systems to streamline operations and reduce costs.

These targeted policies are crucial for addressing the specific needs and challenges of deploying heavy-duty E-trucks in sectors like cement, aiming to achieve broader environmental and economic goals.

Chapter 07

Way Forward

As the adoption of electric trucks and tippers gradually increases across the cement sector, a coordinated approach involving all stakeholders—end users, technology providers, and policymakers—is essential to accelerate this transition. Here are some strategic recommendations to enhance the adoption of electric vehicles (EVs) in the industry:

7.1. Financing

- **Mandate Green Financing:** Encourage banks to offer green loans at reduced rates through mandatory policy measures.
- **Insurance Guidelines:** Implement favourable insurance guidelines to mitigate risks associated with electric vehicle investments.
- **Extended Vehicle Loan Period:** Consider extending vehicle loan periods to 8-10 years from the current norm of 4 years to ease financial burdens and stimulate purchases.

7.2. Policy

To accelerate electric truck adoption in cement sector, policy support is required for expanding FAME policy subsidies to encompass commercial EVs, introducing subsidized toll charges for EVs, implementing battery replacement subsidies, supporting domestic battery manufacturing and recycling industries, and subsidizing power generation costs at charging stations. Furthermore, offering incentives in carbon trading policies for E-truck adopting organizations and establishing standardized charging protocols, including battery swapping systems, are recommended to enhance EV infrastructure and promote widespread adoption across the sector.

7.3. Early Bird Recognition

- **Faster Approval from State Electricity Boards:** Streamline the process for setting up charging infrastructure by ensuring faster approvals from state electricity boards.
- **Faster RTO Registration:** Facilitate quicker registration processes through Regional Transport Offices (RTOs) for EVs.
- **Special Category Status:** Grant special category status to commercial EVs to avail various benefits such as expedited services and exemptions.
- **Scaling Up Charging Infrastructure:** Urgently expand charging infrastructure along cement freight corridors.
- **Payload Compensation/Relaxation:** Offer payload compensation or relaxation in line with battery weight.

7.4 Enabling Initiative from Cement Organizations:

- **Long-term Contracts & Remuneration Increment for Crew:** Accelerate E-truck adoption by logistic service providers.
- **Charging Infrastructure at Plant Premises**: Utilize renewable power to decrease the vehicle payback period.
- **Green Channel for E-trucks:** Facilitate a higher number of trips.
- **Priority-based Loading of E-trucks:** For short distances or direct dispatch.
- **Bulk Loading/Other Mechanized Loading Systems**: Reduce loading time for raw material handling E-trucks.
- **Exploration of Battery Swapping Technologies:** Reduce charging time and the requirement for en-route charging infrastructure.

7.5 Probable Preferred Business Models

Most cement organizations operate with two business models:

a. **Capex Model:** Ownership of the EV vehicle fleet.

b. **Opex Model:** Logistic service provider owns the E-truck with long-term contracts and some green subsidies/channel facilities from the cement organization.

EV manufacturers are also interested in providing logistic partner support equipped with E-trucks for cement companies, subject to mutual agreements on several factors. Innovative business models like “Pay-per-use” or “Transport-as-a-Service” can help navigate cost issues and allow for customized truck models for specific applications.

7.6 Maintenance Offering from Technology Suppliers

To convince fleet operators and driver partners of the viability of electric trucks, technology suppliers offer:

- Attractive long-term annual maintenance contracts and guarantees.
- Comprehensive warranties for all parts except consumables.
- Deputation of service personnel with critical spares for every 10 trucks deployed.
- On-air service and consultancy for troubleshooting.
- Special pricing on batteries and charging infrastructure for certain number of truck deployments.

Conclusion

The transition to electric trucks in India is not merely a transport activity but a transformative movement impacting millions of lives and livelihoods. Ensuring a just transition is paramount, as is creating decent work opportunities and leaving no one behind. The vision of E-trucks traversing remote hinterlands is set to become a reality, reducing GHG emissions and transforming lives for the better.

Abbreviations

AIS	Automotive Industry Standard
AMC	Annual Maintenance Contract
AMT	Automated Manual Transmission
CAPEX	Capital Expenditure
CC	Composite cement
CO_2	Carbon dioxide
DHI	Department of Heavy Industry
EV	Electric Vehicle
FAME	Faster Adoption & Manufacturing of Hybrid & Electric Vehicles
GHG	Green House Gases
GOI	Government of India
GST	Goods and Services Tax
GVW	Gross Vehicle Weight
HD	Heavy Duty
HDT	Heavy-Duty Trucks
hp	Horse Power
HSD	High Speed Diesel
ICE	Internal Combustion Engine
INR	Indian rupee
kg	Kilogram
km	Kilometer
kmph	Kilometer per hour
kmpl	Kilometer per litre
kWh	Kilo watt hour
LI-ION	Lithium Ion
LNG	Liquid Natural Gas
MHDVs	Medium and heavy-duty freight vehicles
MT	Metric Ton
MTPA	Million Tons Per annum
NEMMP	National Electric Mobility Mission Plan
OEM	Original Equipment Manufacturer
OPC	Ordinary Portland Cement
OPEX	Operating expenses
PPC	Portland Pozzolana Cement
PSC	Portland Slag Cement
R&D	Research & Development
RPM	Rotation per minute
SRT	Static Roll Threshold
TAT	Turn Around Time
RTO	Regional Transport Office
TPD	Tons per day
XEV	Electric vehicles and their extended variants

Confederation of Indian Industry

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For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. With its extensive network across the country and the world, CII serves as a reference point for Indian industry and the international business community.

As India strategizes for the next 25 years to India@100, Indian industry must scale the competitiveness ladder to drive growth. CII, with the Theme for 2023-24 as 'Towards a Competitive and Sustainable India@100: Growth, Livelihood, Globalisation, Building Trust' has prioritized 6 action themes that will catalyze the journey of the country towards the vision of India@100.

With 65 offices, including 10 Centres of Excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 350 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.

CII-Sohrabji Godrej Green Business Centre (CII-Godrej GBC)

CII-Sohrabji Godrej Green Business Centre (CII-Godrej GBC), one of the centres of excellence of CII, was established in the year 2004, as CII's Developmental Institute on Green Practices & Businesses, aimed at offering world class advisory services on conservation of natural resources. For more information https://www.greenbusinesscentre.com/

The services of CII-GBC include - Energy audits, Projects related to climate change, Green Company rating, Renewable Energy, GHG accounting, LCA, Green Product Certification, Waste Management and Green Buildings ratings. CII-Godrej GBC has been supporting Indian Industry in improving the energy efficiency levels. CII-GBC, as part of its efforts to promote environmentally sustainable development of Indian industry and demonstrate that green makes good business sense, is playing a catalytic role in promoting World Class Energy Efficiency initiative in cement industry with the support of all stakeholders.

Confederation of Indian Industry,
CII - Sohrabji Godrej Green Business Centre,
Survey No 64, Kothaguda Post, Hyderabad, Telangana- 500 084 (India).
Tel: +91-40-44185111, Fax: 91-40-44185189,
Email: encon@cii.in; Web: www.greenbusinesscentre.com

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Reach us via CII Membership Helpline Number: 1800-103-1244

The Cement Manufacturers’ Association (CMA) is the apex representative body of large cement manufacturers in India. Representing almost 75% of the Cement sector by installed Cement capacity, CMA is the consolidated voice of the Cement Industry on policy matters that impact the Industry in India.

Cement Manufacturers' Association
3rd Floor, Shri Sharda Institute of Indian Management Research (SSIIM),
7 Institutional Area, Vasant Kunj, Phase-II, New Delhi, Delhi 110070
Tel: +91 11 71600630
Email: contactcma@cmaindia.org; Web: www.cmaindia.org

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Confederation of Indian Industry

CII - Sohrabji Godrej Green Business Centre
Survey No 64, Kothaguda Post, Hyderabad 500 084
Tel: +91 40 44185152; Fax: +91 40 44185189
Email: kiran.ananth@cii.in / k.muralikrishnan@cii.in
Website: www.greenbusinesscentre.com / www.cii.in