

# Supporting Small-to-Medium Fleet Operators in India to Adopt Zero Emission Trucks

- **A Model Roadmap with Just Transition Principles**



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## **Authors**

Jaideep Saraswat, Nikhil Mall, Varun B.R. and Tushar Katiyar

## **Reviewers**

Satish Vishvakarma (Vice President, Fleetx Technologies Private Limited); Akanksha Golchha (Fellow, Centre for Strategic and International Studies); Abhishek Mukherjee (Senior Manager, Fleetx Technologies Private Limited); Srinivas Krishnaswamy (CEO, Vasudha Foundation); Raman Mehta (Programme Director, Vasudha Foundation); Vrinda Sarda (Associate Director, Vasudha Foundation); and Raghav Pachouri (Associate Director, Vasudha Foundation).

## **Cover & Layout Design**

Santosh Kumar Singh

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and Vasudha Foundation are organizing a Conclave titled 'Zero Emission Truck (ZET) Transition for Small-to-Medium Fleet Operators in India', aimed at facilitating a seamless transition of the said fleet operators to zero-emission trucks, paving the way for a cleaner and healthier environment.

2. I believe the conclave will indulge in impactful discussions and come out with actionable strategies for the transition to ZETs, for the small-to-medium fleet operators, which form the bulk and backbone of India's trucking sector and are consequently very vital for accelerating the shift towards a cleaner, sustainable transportation.

3. The Ministry of Road Transport and Highways is working tirelessly to build infrastructure holistically and sustainably across the country, and is keenly encouraging capacity building to empower fleet operators to adopt zero-emission technologies. Systemic improvements, awareness campaigns, and collaborations with stakeholders can ensure a cohesive ecosystem for the transition.

4. I take this opportunity to congratulate and extend my best wishes to the All-India Motor Transport Congress and Vasudha Foundation for establishing the Center for Zero Emission Truck Transition Support for addressing the unique needs of the small and medium fleet operators.



(NITIN GADKARI)

New Delhi  
28<sup>th</sup> Oct, 2024



28<sup>th</sup> October, 2024

Dear Shri Singh ji,

I extend my heartfelt congratulations to the All India Motor Transport Congress (AIMTC) and the Vasudha Foundation for developing the Zero Emission Truck (ZET) Transition roadmap to support small and medium fleet operators. This roadmap is a timely response to the needs of a sector that forms the backbone of our nation's transportation industry, particularly those smaller operators who face challenges around profitability, financing access and the adoption of new technologies.

I am also pleased to recognize the launch of the Center for Zero Emission Truck Transition Support (CZETTS). The center's focus on raising awareness and providing structured assistance aligns well with our nation's ambitious climate goals and our commitment to global sustainability efforts. This dual initiative, combining strategic guidance with a support framework, underscores India's leadership in addressing climate change. I am confident that CZETTS will empower our operators with the resources and knowledge needed to smoothly integrate ZETs into their fleets.

I wish the AIMTC all the best in achieving the goals of these visionary projects and look forward to the positive impact it will bring to India's transport sector and environmental commitments. I also wish the AIMTC success in all its future endeavours.

With warm regards,

Sincerely,



**Piyush Goyal**

**Shri Bal Malkit Singh**  
Chairman, Core Committee and Former President  
All India Motor Transport Congress  
1/16 A Asaf Ali Road  
Delhi - 110002



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# List of Abbreviations

Abbreviation	Definition
AB-PMJAY	Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana
ACC	Advanced Chemistry Cell
AIDS	Acquired Immunodeficiency Syndrome
AIMTC	All India Motor Transport Congress
AITWA	All India Transporters Welfare Association
ASDC	Automotive Skill Development Council
BEE	Bureau of Energy Efficiency
BET	Battery Electric Truck
BS- VI	Bharat Stage Emission Standards 6
BSES	Bharat Stage Emission Standards
CO <sub>2</sub>	Carbon dioxide
COP26	26th Conference of the Parties
CPO	Charge Point Operator
CSR	Corporate Social Responsibility
DC	Direct Current
e-FAST	Electric Freight Accelerator for Sustainable Transport
EHCP	Education, Health and Care Plan
EMI	Equated Monthly Installment

Abbreviation	Definition
e-SHRAM	National Database of Unorganised Workers (NDUW)
ESI	Employees' State Insurance
ETI	Educational/Training Institutions
EU	European Union
EV	Electric Vehicle
FCET	Fuel Cell Electric Truck
FI	Financial Institutions
FTL	Full Truckload
FY	Financial Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoI	Government of India
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Systems for Mobile
GST	Goods and Services Tax
GVW	Gross Vehicle Weight
GWh	Gigawatt hour
H <sub>2</sub>	Hydrogen



Abbreviation	Definition
HDT	Heavy Duty Truck
HI	Health Institutions
HIV	Human Immunodeficiency Virus
IA	Industry Associations
ICE	Internal Combustion Engine
ILO	International Labour Organisation
INR	Indian National Rupee
KPI	Key Performance Indicator
MCS	Megawatt Charging System
MDT	Medium Duty Truck
MHDT	Medium/Heavy Duty Truck
MHI	Ministry of Heavy Industries
MNRE	Ministry of New and Renewable Energy
MoU	Memorandum of Understanding
MoRTH	Ministry of Road Transport and Highways
MP	Media Partners
NDC	Nationally Determined Contributions
NGO	Non-governmental Organisation
NHA	National Health Authority
NICDC	National Industrial Corridor Development Corporation
NITI	National Institution for Transforming India

Abbreviation	Definition
NLP	Natural Language Processing
NLP	National Logistics Policy
OECD	Organisation for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
PAN	Permanent Account Number
PLI	Production-Linked Incentive
PMJAY	Pradhan Mantri Jan Arogya Yojna
PMJJBY	Pradhan Mantri Jeevan Jyoti Bima Yojana
PMSBY	Pradhan Mantri Suraksha Bima Yojana
PP	Private Players
RTO	Regional Transport Office
RVSF	Registered Vehicle Scrapping Facility
SMF	Small-to-Medium Fleet Operators
SMS	Short Message Service
SOP	Standard Operating Procedure
TCO	Total Cost of Ownership
TPA	Third-Party Agencies
UNIDO	United Nations Industrial Development Organisation
WDV	Written Down Value
ZET	Zero Emission Truck
ZEV	Zero Emission Vehicle



# EXECUTIVE SUMMARY

India, as part of its Nationally Determined Contributions (NDC), has committed to reducing its emission intensity by 45 percent<sup>1</sup> by 2030 from its 2005 level. The transport sector is the third-highest Greenhouse Gas (GHG) emitting sector<sup>2</sup>. Within this sector, road transport is responsible for almost 90 percent of the total emissions<sup>2</sup>. Furthermore, the truck segment which constitutes a small percentage of on-road vehicles, is responsible for contributing over one-third of the total road transport emissions<sup>3</sup>. Thus, decarbonising the trucking sector in India is crucial to achieving decarbonisation of the transport sector.

Globally, Zero Emission Trucks (ZETs) are leading the way in truck decarbonization, with Battery Electric Trucks (BETs) currently being the most commercially and technically advanced option. However, the high upfront costs, limited range, and lower payload capabilities of ZETs, along with the underdeveloped infrastructure for charging and hydrogen refueling, pose challenges for fleet operators. This is particularly difficult for India's Small-to-Medium Fleet (SMF) operators, who own the majority of trucks in the country<sup>4</sup>, often operate with slim margins, and face limited access to finance and other barriers.

This roadmap provides a practical guide to help SMF operators transition to

<sup>1</sup> <https://unfccc.int/sites/default/files/NDC/2022->

<sup>2</sup> <https://iced.niti.gov.in/climate-and-environment/ghg-emissions/energy>

<sup>3</sup> <https://www.niti.gov.in/sites/default/files/2023-02/ZETReport09092022.pdf>

<sup>4</sup> <https://www.crisil.com/content/dam/crisil/our-analysis/reports/Research/documents/2018/november/crisil-research-opinion-road-turns-rough-for-small-fleet-operators.pdf>



ZETs. It begins with an overview of ZETs to highlight the long-term benefits of adopting these vehicles. Then, a stage-wise process is presented, starting with an assessment of the current fleet and workforce requirements, followed by a gap analysis and a list of potential interventions. The report also introduces financial models to support ZET adoption and includes a template for organizations to develop their customised roadmap. Key Performance Indicators (KPIs) are outlined to track progress and ensure successful implementation.

Crucially, the roadmap emphasizes a Just Transition for both SMF operators and their workforce, with a focus on five core areas: information symmetry, financial opportunities, equitable access, social dialogue, and workforce development. Finally, detailed interventions, along with the responsible stakeholders for each, are outlined to ensure that the transition benefits both fleet operators and their workforce.



# INTRODUCTION





# INTRODUCTION

India, as the fastest-growing major economy in the world, has set its sight on becoming a developed nation by the centenary of its independence<sup>5</sup>. A pivotal component in achieving this vision is the transport sector, which underpins various facets of economic growth, from industrial expansion to the efficient movement of goods and people. Within this sector, the trucking industry plays a fundamental role, forming the backbone of logistics and goods transportation across the nation.

However, the transport sector, which is integral to India's economic prosperity, also represents significant environmental challenges. It is the third highest GHG emitting sector in India, contributing approximately 14 percent of the country's annual CO<sub>2</sub> emissions<sup>6</sup>. Of these emissions, road transport is responsible for 90%, with medium and heavy-duty trucks (MHDT) accounting for 38 percent<sup>7</sup> of these emissions despite representing only 2 percent of the vehicle population<sup>8</sup>. This stark reality underscores the need for strategic interventions to mitigate the environmental impact of this essential sector.

The Indian trucking industry is characterized by its vast scale and diversity. With about 4 million MHDTs on the road and a market that adds approximately 0.3 million new trucks annually, it is one of the largest truck market globally<sup>9</sup>.

The sector serves a wide range of industries, including construction, mining, and logistics, with an extensive array of truck types and body configurations to meet varied industrial needs<sup>10</sup>. Despite this robust presence, the sector remains largely unorganised, and data gaps make it challenging to fully grasp the intricacies of the industry's challenges and opportunities.

In response to the climate crisis and India's commitment at COP26 to achieve net-zero emissions by 2070<sup>11</sup>, there is an urgent need to explore and implement pathways for the trucking sector's transition to zero emissions. ZETs which include battery-electric and hydrogen-powered trucks, represent a promising solution to reduce GHG emissions and align with climate goals. The techno-commercial advancements in BETs and the emerging potential of hydrogen-powered vehicles position ZETs as the cornerstone of a sustainable future for the trucking industry.

Nevertheless, the transition to ZETs is fraught with challenges, including high upfront costs, limited charging infrastructure, range anxiety, battery life concerns, and the need for comprehensive workforce training. A successful transition will require a collaborative approach that addresses these barriers and supports all stakeholders, particularly SMF operators who are critical to the industry's ecosystem.

SMF operators, constituting approximately 80% of trucking organizations in

5 <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2007105>

6 <https://www.niti.gov.in/decarbonising-transport-redefining-mobility-policies-india>

7 [https://www.researchgate.net/publication/350596826\\_Emissions\\_inventory\\_for\\_road\\_transport\\_in\\_India\\_in\\_2020\\_Framework\\_and\\_post\\_facto\\_policy\\_impact\\_assessment](https://www.researchgate.net/publication/350596826_Emissions_inventory_for_road_transport_in_India_in_2020_Framework_and_post_facto_policy_impact_assessment)

8 <https://www.theclimategroup.org/our-work/publications/early-market-outlook-report-electrification-medium-and-heavy-duty-trucks>

9 <https://vahan.parivahan.gov.in/vahan4dashboard/vahan/view/reportview.xhtml>

10 <https://trucks.cardekho.com/>

11 <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1961797>



India, face unique challenges compared to larger fleets. According to industry nomenclature, SMF operators are defined as those managing between 1 and 200 trucks<sup>12</sup>. They operate on narrow profit margins, struggle with high credit risks, and often lack access to advanced technologies and financial resources. Adopting ZETs will present significant benefits for SMF operators by reducing operational costs and enhancing long-term profitability. With lower fuel expenses and reduced maintenance needs due to fewer moving parts in electric vehicles, fleet operators can save substantially on day-to-day operations. Additionally, as governments begin to offer incentives like subsidies and tax breaks for ZETs, the initial cost barrier will be lowered, allowing these operators to transition more easily. ZETs also help operators align with future emission regulations, ensuring compliance while contributing to a cleaner environment. As such, a “just transition” for SMF operators—ensuring that the shift to ZETs is equitable and inclusive—is crucial for the success of the broader decarbonization effort. A just transition approach will provide these operators with the necessary support, resources, and training to navigate this change, thus ensuring that the benefits of ZETs are accessible to all sectors of the trucking industry.

In this context, a guiding document that allows SMF operators to tread this significant yet complex transition with ease is the need of the hour.

## Rationale for Roadmap

This roadmap is to offer a structured approach for planning, tailored to SMF operators as they develop their organisation-specific ZET transition roadmap. While technology aimed decarbonisation in the trucking sector undergoes a swift change, the roadmap which is designed to be flexible and adaptable to various contexts and fleet sizes is quite valuable.

<sup>12</sup> [https://theicct.org/sites/default/files/China\\_Freight\\_Assessment\\_English\\_20181022.pdf](https://theicct.org/sites/default/files/China_Freight_Assessment_English_20181022.pdf)

The model roadmap also acts as a shared source of truth, promoting effective communication and alignment among different stakeholders in the trucking value chain. It ensures that everyone is aligned, working towards the same objectives, and prevents confusion or misalignment.

Additionally, the roadmap serves to raise awareness about ZETs, highlights their benefits and the available policy support at both national and sub-national levels. It enables operators to analyse their existing fleet, consider the perspectives of their truck driving partners, and use these insights to develop a comprehensive ZET transition plan.



Figure 1: Key Characteristics of the Model Roadmap for SMF Operators

The roadmap provides information on both commercial and technological aspects, and ensures that the ZET transition aligns with the company’s overall strategy and vision. Furthermore, it facilitates the monitoring of milestones and





goals, making it easier to track progress and make necessary adjustments along the way to ensure that the transition doesn't become burdensome for the operators.

Finally, the roadmap provides a framework for SMF operators as a way forward to mitigate the challenges faced in the transition to ZET while ensuring fairness and equity for all the stakeholders involved. Figure 1 summarizes the key characteristics of the model roadmap.

## Structure of the Document

Broadly, the document has been structured into three parts-

**Part-I** To build an understanding of the forthcoming ZET transition and familiarise SMF operators with the key aspects surrounding ZETs, the document provides a background of ZETs. The rationale for undertaking the ZET transition and a business case through a total cost of ownership (TCO) analysis have been provided for the fleet operator's reference. Insights into the regulatory and policy landscape has been provided to familiarise with the key aspects where government intervention exists, with potential for expansion of similar policies to support ZET adoption. Further, a brief to understand the significance of ensuring a just ZET transition has been provided.

**Part-II** A stage-wise process has been laid out for the SMF operators to develop their own ZET roadmap. Methodology to conduct a comprehensive assessment of their current fleet, and gauging the requirements of truck driving partners to tailor upskilling modules have been provided. A template for developing their respective roadmap along with key remarks to guide them in populating the same has been provided. Further, as the journey to incorporating ZETs transcends over a few years, the key advancements to track in the ZET ecosystem have been highlighted. This will enable the operators to edit their roadmap in a way that maximises fleet operational efficiency, financial leverage, and upgrade to the best available technology.

**Part-III** Through the document we have emphasised the importance of undertaking a just ZET transition for SMF operators. In this section, we explore the key challenges they face and offer a framework that outlines the required actions while identifying the relevant stakeholders, to help operators implement their roadmap. This section aims to generate awareness among the SMF operators and the larger trucking ecosystem on the impending policy actions that will aid their transition.









## PART-I

# BACKGROUND OF ZERO EMISSION TRUCK (ZET) ECOSYSTEM





# PART-I: BACKGROUND OF ZERO EMISSION TRUCK (ZET) ECOSYSTEM

## Rationale for ZET Transition

Transitioning to ZETs in India is imperative given its status as the world's fifth-largest economy, with a GDP close to \$4.11 trillion<sup>13</sup>. In 2022, the country transported a staggering 2.2<sup>14</sup> trillion tonne-kilometres of freight domestically, a demand projected to surge to 9.6<sup>3</sup> trillion tonne-kilometres by 2050, driven by urbanization, population growth, and expanding e-commerce facilitated by rising income levels. Of the total freight handled, approximately 70% was catered by the road transport sector. Within this segment, heavy-duty trucks (HDTs) fulfilled 76% of the freight demand, with the medium-duty trucks (MDTs) segment trailing behind as a distant second, as depicted in Figure 2<sup>5</sup>.

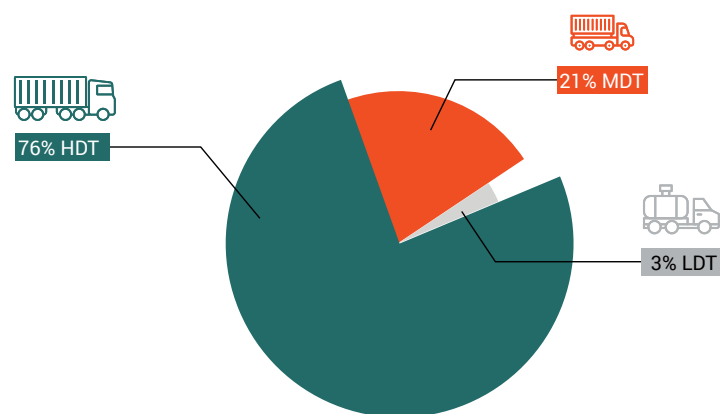


Figure 2: Modal Split for Road Freight Movement in 2022

<sup>13</sup> <https://www.forbesindia.com/article/explainers/gdp-india/85337/1>

<sup>14</sup> <https://openknowledge.worldbank.org/server/api/core/bitstreams/f2a9c192-12e7-5c1a-8594-b76919d50a6d/content>

This trend is expected to persist in 2050, with a stronger preference towards HDTs, projected to serve 83% of road freight transportation<sup>15</sup>.

**Given the trucking industry's pivotal role in domestic freight movement, it is evident that it will play a vital role in realizing India's ambitions of becoming one of the top three largest economies by 2025 and achieving a GDP of \$5 trillion<sup>16</sup>, with aspirations of becoming a developed country by 2047<sup>17</sup>.**

Going forward, it is projected that the number of trucks in India will quadruple by 2050<sup>3</sup>, escalating the nation's oil import dependency. Currently standing at around 89% in FY 22-23<sup>18</sup>, India's net energy import dependency on crude oil is already considerable. Continued reliance on ICE trucks will exacerbate this dependency, hindering India's aspirations of energy independence by 2047<sup>19</sup>.

**Thus, the ZET transition is also critical to safeguard fleet operators against the price volatility of fossil fuels.**

Furthermore, India's logistics sector performance, as indicated by the World Bank's Logistics Performance Index report 2023<sup>20</sup>, positions the country at 38

<sup>15</sup> <https://www.niti.gov.in/sites/default/files/2021-06/FreightReportNationalLevel.pdf>

<sup>16</sup> <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1549454>

<sup>17</sup> <https://www.investindia.gov.in/team-india-blogs/developed-india-vision-progress-towards-2047>

<sup>18</sup> [https://www.mospi.gov.in/sites/default/files/publication\\_reports/EnergyStatistics\\_India\\_publication\\_2024N.pdf](https://www.mospi.gov.in/sites/default/files/publication_reports/EnergyStatistics_India_publication_2024N.pdf)

<sup>19</sup> <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1755542>

<sup>20</sup> The LPI is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI 2023 allows for comparisons across 139 countries.





out of 139 countries<sup>21</sup>, with a score of 3.4<sup>22</sup>. While this score surpasses the global average, there remains substantial room for improvement as India endeavors to lead in this domain.

Considering these factors, it is evident that the trucking sector must chart a new course by transitioning to new technologies. Such a transition not only promises efficiency enhancements but also advocates for fuels generated within India, promoting sustainable growth and aiding in climate change mitigation.

ZETs represent the future of freight transportation, providing eco-friendly alternatives to traditional fossil fuel powered vehicles. In addition to efficiency improvements and technological advancements like telematics and intelligent routing, these vehicles have the potential to significantly reduce GHG emissions and improve air quality, aligning with India's ambitious economic and climate targets.

Moreover, transitioning to ZETs yields co-benefits beyond environmental considerations. It promises significant health benefits for both the general public and truck driving partners by reducing air pollution—a pressing issue in India, where ICE trucks are major contributors to harmful pollutants. By

prioritising sustainable transportation solutions, India can safeguard public health, foster economic resilience, and pave the way for a cleaner, more prosperous future.

## What Constitutes ZETs?

**ZETs refer to trucks that do not emit exhaust gas or other pollutants from the onboard source of power, including under all operational modes and conditions.** This means that ZETs are designed to operate without producing harmful pollutants, such as carbon dioxide (CO<sub>2</sub>), particulates, hydrocarbons, carbon monoxide, ozone, lead, and various oxides of nitrogen. They typically refer to battery electric vehicles and fuel cell vehicles running on green hydrogen, which emit zero GHG emissions and cause no air pollution. However, under the EU's Heavy Duty Vehicle CO<sub>2</sub> standards, combustion engine trucks running on green hydrogen are also considered Zero Emission Vehicles (ZEVs) as long as they emit less than 1 gCO<sub>2</sub>/kWh<sup>23</sup>. Table 1 provides more details on the comparison of ZETs.

<sup>21</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=2003541>

<sup>22</sup> <https://lpi.worldbank.org/>

<sup>23</sup> <https://www.transportenvironment.org/challenges/road-freight/trucks/zero-emission-trucks/>



**Table 1:** Comparison of ZETs<sup>24, 25, 26, 27, 28</sup>

Sr. No.	Facets	Battery Electric Truck (BET)	Hydrogen Fuel Cell Electric Truck (FCET)	Hydrogen ICE Truck
1	Description	These vehicles powered solely by electricity stored in rechargeable batteries. They produce zero emissions during operation and are charged by plugging into an electric power source.	Similar to BETs, except that the electrical energy is generated by hydrogen fuel through the use of fuel cells. These trucks emit only water vapor as a byproduct, making them a clean alternative to ICE trucks.	A vehicle that uses hydrogen fuel in a modified version of traditional fossil fuel powered engines.
2	Key Components	<ul style="list-style-type: none"> <li>• Larger Battery Pack</li> <li>• Electric Motors</li> <li>• DC-DC/DC-AC Converters</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel Cell Stack</li> <li>• Hydrogen Tank</li> <li>• Smaller On-board Battery</li> <li>• Electric Motor</li> <li>• DC-DC/DC-AC Converters</li> </ul>	<ul style="list-style-type: none"> <li>• Compression Ignition Engine operating on similar cycles as ICE engines, sharing similar components</li> <li>• Hydrogen Tank</li> <li>• Continuous Variable Transmission (CVT) System</li> </ul>
3	Regenerative Braking	Yes. Recoups energy spent during braking and is stored in the battery.		Not Present
4	Refueling Standards	Combined Charging System (CCS) Megawatt Charging System (MCS)	Not yet standardised	
5	Maximum Rating	CCS-up to 500kW MCS-up to 3.75 MW (Offering the charge rate necessary to realize widespread adoption in commercial vehicle market by maximizing the driving range gained for each minute spent charging)	Not Applicable	

24 <https://resources.environment.yale.edu/gillingham/hydrogenICE.pdf>

25 [https://tesla.o.aurooraobjects.eu/Combined\\_Charging\\_System\\_1\\_0\\_Specification\\_V1\\_2\\_1.pdf](https://tesla.o.aurooraobjects.eu/Combined_Charging_System_1_0_Specification_V1_2_1.pdf)

26 <https://www.sgn.co.uk/about-us/future-of-gas/h100nia/h100-nia-hydrogen-odorant-and-gas-detection>

27 [https://www.charin.global/media/pages/technology/knowledge-base/c708ba3361-1670238823/whitepaper\\_megawatt\\_charging\\_system\\_1.0.pdf](https://www.charin.global/media/pages/technology/knowledge-base/c708ba3361-1670238823/whitepaper_megawatt_charging_system_1.0.pdf)

28 <https://www.transportenvironment.org/discover/comparing-hydrogen-and-battery-electric-trucks/>



Sr. No.	Facets	Battery Electric Truck (BET)	Hydrogen Fuel Cell Electric Truck (FCET)	Hydrogen ICE Truck
6	Total Refueling Capacity	CCS- up to 12,000 kWh/ day MCS- up to 90 MWh/day (Based on Maximum Charger Capacity)	Around 6000 kg of green hydrogen/ day (Based on refuelling stations's storage tank capacity)	
7	Dispenser Flow Rate	CCS- up to 8.33 KW/min MCS- up to 62.5 KW/ min	3.6 to 7.2 kg of hydrogen/min	
8	Refueling Time	CCS-20 to 80 minutes MCS-20 to 80 minutes (The values are determined by the battery bank sizes of the BET models currently available in the market.)	5 to 15 minutes depending on the available spare capacity of the hydrogen tank.	
9	Fueling Station to ZET Communication	For CCS- Power Line Communiation (PLC) For MCS- TCP/IP	Not Applicable	
10	Refuelling Station Safety	IP XXB ensures a high level of touch safety for high voltages.	<ul style="list-style-type: none"> <li>• Autocut monitoring via sensors</li> <li>• Leakage Detection Systems at the fueling stations</li> <li>• Presence of Odorant for detection of leakage by Humans</li> </ul>	
11	Placement of the Connector on the Vehicle	Left-side, behind the most forward axle	Left-side	
12	Insertion/ Extraction Force for the Connector	Around 100 N	Not Applicable	

In the case of BETs, a higher battery capacity typically results in a greater range. However, there's a trade-off as increasing battery size doesn't necessarily lead to a proportional increase in payload due to the added weight of the battery. On the other hand, Hydrogen trucks offer fast refuelling comparable to ICE trucks,

enabling them to serve long-range routes and potentially service more trucks at hydrogen fueling station than fast-charging stations.

Yet, in practice, larger charging facilities like MCS can provide sufficient charging





within the waiting or resting time of truck driving partner. Each ZET technology has its own set of advantages and disadvantages. Ultimately, the choice depends on the user's requirements and the intended application. Nevertheless, all these technologies have the potential to decarbonise the trucking sector.

## Total Cost of Ownership (TCO) Analysis

TCO is crucial in vehicle purchasing decisions, as it helps determine the commercial viability compared to other powertrain types or how it deviates from existing alternatives. The TCO analysis conducted encompassed truck segments ranging from 5 to 55-ton Gross Vehicle Weight (GVW), categorized into four distinct groups: 5-12 GVW, 12-18 GVW, 28-40 GVW, and 40-55 GVW. The analysis takes into account parameters based on the average value within the range of GVW categories included in the roadmap. These divisions were selected to ensure a comprehensive evaluation across different vehicle weight classes, enabling a thorough comparison of cost factors at various levels of truck size and capacity.

The economic viability of three different ZET variants -BETs, FCETs, and Hydrogen ICE Trucks - was assessed using the TCO model in comparison to the diesel ICE trucks. The model considered fixed costs and operational expenses, including truck ex-showroom price, Goods and Services Tax (GST), road tax, registration charges, insurance, fuel costs, maintenance charges, salvage value, and more. This analysis considers the reduction of GST brackets, along with exemptions from road tax and registration charges, as incentives for ZETs, since these measures are common across India. For existing diesel ICE variants, details and values were sourced from primary research. The annual kilometres run were considered similar across all categories, while the remaining values and assumptions were derived from secondary research, as detailed in Annexure 1.

Initially, a TCO analysis was conducted for truck categories considering short regional travel, defined as trips with a daily distance of 200 km or less. Charging of vehicles was assumed to be carried out at both the source and destination, with charging infrastructure not within the scope of the SMF operators. Table 2 presents the TCO values in INR/km, assuming a truck lifespan of 8 years, with no consideration for battery replacement costs for BETs. The TCO values for diesel and BETs were found to be similar across all four categories. However, the TCO values for hydrogen options were notably higher, with Hydrogen ICE trucks exhibiting lower TCO compared to FCETs. The impact is more pronounced for the Truck GVW 12-18 tonne category, where the costs of BETs are **three percent** lower compared to its diesel counterpart already. Sensitivity analysis conducted on the annual km run for BETs revealed that the GVW 5-12 ton category achieves TCO parity with diesel vehicles at 72,000 km and 77,000 km for the GVW 40-55 ton category.

**Table 2:** TCO Comparison across GVW Categories for Vehicle Life of 8 Years

TCO (INR/km)				
Truck Type/ Weight Cat- egory	Truck GVW 5-12	Truck GVW 12-18	Truck GVW 28-40	Truck GVW 40-55
	(Annual run: 36000 km)		(Annual run: 72000 km)	
Diesel	26.87	46.01	46.53	46.82
Battery Electric	27.89	44.63	46.75	47.50
H2 FCET	44.44	60.74	48.19	56.47
H2 ICE	36.45	48.41	45.79	50.11

When keeping all other factors constant but increasing the truck lifespan to 15 years to incorporate battery replacement costs, the results depicted in Table 3 show that the battery electric version is the most economical across a 15-year time horizon compared to any other technology type. We observe that BETs are more economical compared to their diesel counterparts by 0.9 percent, 12.8 percent, 4.5 percent, and 6.2 percent for the weight categories of Truck GVW 5-12, Truck GVW 12-18, Truck GVW 28-40, and Truck GVW 40-55 tonnes, respectively. In this case, even hydrogen ICE technology becomes comparable to diesel vehicles.

**Table 3:** TCO Comparison across GVW Categories for Vehicle Life of 15 years

TCO (INR/km)				
Truck Type/ Weight Category	Truck GVW 5-12	Truck GVW 12-18	Truck GVW 28-40	Truck GVW 40-55
	(Annual run: 36000 km)		(Annual run: 72000 km)	
Diesel	24.44	42.92	46.33	45.88
Battery Electric	24.23	37.44	44.22	43.01
H2 FCET	35.79	48.15	41.27	46.76
H2 ICE	31.94	42.00	41.48	44.86

Furthermore, comparing the TCO of GVW 40–55 ton trucks with another BET version designed for long-haul tractor-trucking needs, capable of traveling 500 km on a single charge, it is evident that the TCO value of this variant is significantly higher than diesel counterparts as seen in Table 4. Clearly, the TCO of high-range BET exceeds that of their diesel counterparts by 43.9 percent over an 8-year horizon, and by 31.9 percent over a 15-year period. This underscores

the crucial role of government support, including upfront incentives, low-interest financing, tax exemptions, and the establishment of a battery manufacturing ecosystem, to accelerate the attainment of TCO parity for this variant. The sensitivity analysis conducted on annual kilometre driven revealed that this segment achieves TCO parity with diesel trucks at 216,000 km per year.

**Table 4:** TCO Comparison for Trucks GVW 40-55 tons with Long-range BET

TCO (INR/km)		
Truck Type/Weight Category	Truck GVW 40-55	
	(Annual run: 72000 km)	
	Life of Vehicle: 8 years	Life of Vehicle: 15 years
Diesel	46.82	45.88
Battery Electric (185 km range)	47.50	43.00
Battery Electric (600 km range)	84.10	67.40
H2 FCET	56.47	46.76
H2 ICE	50.11	44.86

Based on the tables provided earlier, it is evident that the transition to ZETs will occur at different timelines across various weight classes and with different ZET technologies. **Currently, all weight categories traveling short to regional distances are well positioned to transition to BETs.** Even BET with a GVW of 40-55 tons, originally suitable for short regional travel, can now cover long distances given the availability of charging infrastructure at strategic locations. For example, the availability of charging during loading and unloading, along



with enroute charging at highways or resting areas, presents a strong case for trucks with lesser battery capacity to cover longer distances. These chargers should be appropriately sized to align with the resting stops of truck driving partners, especially considering that routes for long-haul tractor-trucking are highly predictable.

For BETs equipped with larger battery banks for long-haul trucking and those utilising hydrogen drive trains, it is anticipated that the TCO would reach parity with diesel vehicles by 2027<sup>29</sup>. This is attributed to the decreasing prices of batteries, the ongoing enhancement of battery energy density, advancements in the rated power of fuel cell units, and the increasing size of hydrogen storage tanks. On the flip side, it is anticipated that the cost of diesel will rise in the future.

This analysis demonstrates that **while the upfront cost of ZETs may be higher, their operating costs are considerably lower than those of diesel trucks**. With the presence of government support, coupled with innovations by Original Equipment Manufacturers (OEMs) and appropriately sizing the battery banks based on applications, there is a significant opportunity to reduce ownership costs across a fleet of trucks in a competitive logistics sector. Commercial vehicle customers prioritize cost more intensely than passenger car owners, making it imperative to capitalise on such opportunities for cost reduction.

## India’s Policy and Regulatory Landscape for ZETs

The Indian automotive sector is one of the largest and fastest-growing sectors globally. MHTDs carry 70 percent<sup>3</sup> of India’s domestic freight demand, and

29 <https://www.adlittle.com/en/insights/viewpoints/hydrogen-trucking%E2%80%99s-alternative-fuel-future>

thus are critical to India’s economic growth. With the introduction of ZETs in India’s logistics sector, comprehensive policy backing is necessary to ensure the scaling of this technology without negatively disrupting the sector. At the national-level, there are a few key existing policies/missions relevant to the ZET ecosystem as described in Table 5.

**Table 5:** National-level Policies Relevant to ZET

Policy Aspect	Description
PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme	The Ministry of Heavy Industries (MHI) has released this scheme with a total outlay of INR 10,900 crore to promote electric mobility, including significant incentives for ZETs. Out of the INR 3,679 crore allocated for demand incentives, INR 500 crore has been allocated specifically for incentivizing ZETs. To qualify for these incentives, owners must present a scrapping certificate from Ministry of Road Transport and Highways (MoRTH) approved Registered Vehicle Scrapping Facility (RVSF).
National Green Hydrogen Mission <sup>30</sup>	The Ministry of New and Renewable Energy (MNRE) has launched a mission with the objective of transforming specific routes into hydrogen highways. These routes will be equipped with essential infrastructure such as Green Hydrogen production projects, distribution facilities, and refuelling stations. In February 2024, guidelines for implementing pilot projects utilizing green hydrogen in the transportation sector were released as part of this initiative <sup>31</sup> .

30 <https://mnre.gov.in/national-green-hydrogen-mission/>

31 <https://mnre.gov.in/hydrogen-schemes-guidelines/>



Policy Aspect	Description
Charging Standards <sup>32</sup>	Ministry of Power (MoP) has released guidelines and standards for charging infrastructure, emphasising the installation of public charging stations for long-range EVs and heavy-duty vehicles such as buses and trucks. These guidelines advocate placing charging stations every 100 kilometres on both sides of highways and roads. Additionally, the latest revision incorporates Indian Standards for EV charging infrastructure, including specific standards for truck charging.
Production-Linked Incentive (PLI) for Automobile and Auto components <sup>33</sup>	Around INR 26,000 crore outlay provided for improving manufacturing capabilities of advanced automotive products including battery electric and hydrogen fuel-cell vehicles. This investment may support OEMs in their efforts to manufacture ZETs.
National Programme on Advanced Chemistry Cell (ACC) <sup>34</sup>	National programme to increase manufacturing of ACC battery storage. This initiative will consequently facilitate the uptake of ZETs as the demand for approximately 4000 GWh of battery capacity by the ZET segment is projected by 2050.

Policy Aspect	Description
Fuel Efficiency Norms <sup>35, 36, 37</sup>	<p>Bureau of Energy Efficiency (BEE) has established the constant speed fuel consumption standard for heavy-duty commercial vehicles in categories M3 and N3 with a gross vehicle weight exceeding twelve tonnes. This standard complies with the Central Motor Vehicle Rules and BS-VI emission norms.</p> <p>For example, for an N3 category vehicle at 60 km/h, with GVW 12 tonnes and above and an axle configuration of 4x2, the equation for calculating fuel norms is <math>Y=0.788X+9.003</math></p> <p>Where, X = Gross Vehicle Weight (GVW) in tonnes Y = Normalized value (fuel consumption) in litres/100kms</p> <p>The rising stringency in emission norms directed by an urgency in emission reduction, acts as a catalyst for the OEMs to shift towards ZETs.</p>

There are also key initiatives under the aegis of NITI Aayog such as the e-FAST India (Electric Freight Accelerator for Sustainable Transport - India)<sup>38</sup> that are dedicated to accelerating freight electrification. It functions as a collaborative platform that aims to facilitate collaboration between governments, OEMs, logistics service providers, financial institutions, and EV charging players. This is critical to developing strategies that can achieve electrification at scale.

<sup>32</sup> <https://powermin.gov.in/>

<sup>33</sup> <https://heavyindustries.gov.in/pli-scheme-automobile-and-auto-component-industry>

<sup>34</sup> <https://heavyindustries.gov.in/pli-scheme-national-programme-advanced-chemistry-cell-acc-battery-storage>

<sup>35</sup> [https://beeindia.gov.in/sites/default/files/SO%202670%20\(E\).pdf](https://beeindia.gov.in/sites/default/files/SO%202670%20(E).pdf)

<sup>36</sup> [https://beeindia.gov.in/sites/default/files/SO\\_3215\(E\).pdf](https://beeindia.gov.in/sites/default/files/SO_3215(E).pdf)

<sup>37</sup> <https://beeindia.gov.in/sites/default/files/Amendment%20to%20HDV%20FE%20norms.pdf>

<sup>38</sup> <https://efastindia.org/>



At the State-level, we observe that a few of them - **Telangana and Goa have entered into an Memorandum of Understanding (MoU) for the Drive to Zero campaign with the goal to achieve 30% of new MHDT sales being zero-emission by 2030 and enable a complete transition to Zero Emission-MHDTs in new fleets by 2040.** Existing EV policies rolled out by the States have a large emphasis on the private vehicle segment constituting two and four-wheelers. Moreover, even public transport segments such as the three-wheeler and bus segments have ample incentives and regulatory provisions that enable increased adoption. In comparison, the focus on trucks and goods carriers has been lacklustre. While States do provide a few incentives that also encompass the truck segment, there is a need for dedicated provisions that prompt stakeholders to adopt ZETs. Table 6 shows the key provisions extended to the truck segments among the existing State EV policies.

**Table 6:** Policy Provisions Extended to Truck Segment in Existing EV Policies

	Permit Exemption	Capital subsidy incentive	Road and Registration Tax Exemption/Rebate	Reserve parking slots
Bihar	✓		✓	✓
Uttar Pradesh		✓	✓	

India has logistic policies outlined at the National level such as the National Logistics Policy (NLP) introduced in 2022. The objective of NLP is to address cost and inefficiency issues by formulating an overarching interdisciplinary, cross-sectoral, and multi-jurisdictional framework for the development of the entire logistics ecosystem. A few notable initiatives undertaken under NLP are as follows:

- **Integration of Digital System:** Various line departments in the logistics sector such as road transport, railways, aviation, commerce ministries, etc. will be digitally integrated under a single system.
- **System Improvement Group:** This group has been formed with the objective to monitor all logistics-related projects periodically.
- **Unified Logistics Interface Platform:** This platform is developed to streamline cargo movement and enables the exchange of information on a real-time basis. The data bank from the National Industrial Corridor Development Corporation (NICDC) has been integrated into this platform.

State governments have also introduced logistics policies that address operational and fiscal incentives, infrastructure support, and skill development opportunities to meet India's logistics demand. These provisions primarily focus on dedicated parking spots for truckers equipped with basic amenities and the allocation of land for developing infrastructure to support the logistics industry. Some state policies, such as the one in Goa, aim to promote environmentally friendly commercial carriers by implementing green logistics through the adoption of ZEVs. While the logistics policies do not explicitly include provisions for ZETs, existing measures could be extended to support their requirements. A total of 24 states and union territories have logistics policies in place. Table 7 showcases the relevant provisions that could be extended to support the adoption of ZETs, and the corresponding States from which they originate.

**Table 7:** State Logistics Policy Provisions Applicable to ZETs

	Development of a Multi-modal logistics park	Land allocation for logistics infrastructure	Subsidy on GPS devices	EV cargo vehicles for last-mile delivery	Development of Truck Terminal	Fiscal and land incentives for trucker park	Reimbursement of vehicle registration and national permit cost
Assam	✓	✓					
Haryana	✓					✓	✓
Himachal Pradesh	✓	✓			✓		
Jammu and Kashmir	✓				✓		
Uttarakhand	✓	✓			✓		
Punjab	✓						
Odisha	✓						
Tamil Nadu	✓	✓					
Goa			✓	✓	✓		
Gujarat					✓		
Rajasthan					✓		
Manipur					✓		
Telangana						✓	✓



# Contextualizing Just Transition for Small-to-Medium Fleet (SMF) Operators

## Understanding Just Transition

A just transition represents a comprehensive approach to navigating societal and economic shifts towards sustainability, particularly in industries heavily reliant on fossil fuels. It aims to minimise the negative impacts on workers, communities, and vulnerable populations while maximising the positive outcomes of transitioning to a low-carbon economy. Key elements include ensuring fair treatment of workers by providing retraining opportunities and facilitating access to new, green jobs. It also involves fostering inclusive decision-making processes that incorporate the voices of affected communities and stakeholders. Environmental justice is central, aiming to mitigate pollution and environmental degradation that disproportionately affect marginalised groups. Moreover, a just transition emphasizes the redistribution of economic benefits to ensure that all sectors of society benefit equitably from the transition, promoting resilience and social cohesion in the face of systemic changes. In essence, it seeks to achieve sustainable development goals while upholding principles of equity, fairness, and social justice for all.

## The Vital Role of Just Transition in Shifting from ICE Trucks to ZETs

The shift towards clean energy technologies is no longer a question of if, but rather when and how. Ensuring this transition isn't solely about reducing emissions but also focusing on creating a resilient and just society for all is crucial. To achieve this, it is necessary to put people at the centre of transition. It is particularly important in the trucking sector, where the move from ICE

trucks to ZETs must consider the socioeconomic impacts on those directly involved.

A just transition approach here will ensure that the shift to ZETs considers an operational viability of fleet operators and livelihoods of workers. It will resonate positively across the sector, assuring small organisations, their workforce, and associated communities that their conditions and concerns will be taken into account. The goal is to foster an inclusive environment where the transition does not negatively impact the stakeholders, but rather uplifts and integrates them into the new green economy.

## What Just Transition Means for SMF Operators

A just transition for SMF operators means addressing the specific challenges and barriers they face to ensure a fair and equitable shift to ZETs. This includes:



**Lack of Financing:** SMF operators, who own the majority of MHTs in India, often face significant financial barriers. Securing financing for new trucks, particularly ZETs, is challenging due to the high upfront costs and the slim operating margins of these operators. They typically have less capital available and are considered high-risk credit entities, making loans and tax credits less accessible. This financial strain highlights the need for upfront incentives and tailored financial support to facilitate their transition to ZETs.



**Information Asymmetry:** SMF operators generally lack access to informational resources on ZETs. The time and capacity required to research how these vehicles would fit into their fleets are often beyond their reach. Furthermore, most of the pilots and initiatives around ZETs in India involve large, established players, creating an information asymmetry to the disadvantage of SMF operators. The results and learnings from these pilots are not adequately shared with smaller operators,





exacerbating their challenges. Additionally, government schemes and policies are usually published in English and Hindi, which may not be accessible to all SMF operators, especially in regions with different primary languages.



**Exclusion from Policy and Decision-Making:** SMF operators are often excluded from decision-making processes for schemes and policies that impact their work. Their specific needs, such as upfront incentives due to their lower available capital, are often overlooked. Current policies give insufficient consideration to fleet size, which is a critical factor for SMF operators who constitute a large portion of the trucking sector. Ensuring their involvement in policy-making is essential for a just transition.



**Concerns about New Business Models:** There is apprehension among SMF operators that the ZET transition will bring about new business models, such as 'truck as a service', where large organisations purchase trucks and lease them out. This could reduce ownership among SMF fleets and increase their operational dependence on larger entities. Ensuring that SMF operators retain ownership and control over their operations is crucial for maintaining their viability in the industry.



**Concerns about Charging Infrastructure and Costs:** The transition to ZETs for SMF operators also hinges on the availability and affordability of charging infrastructure. SMF operators will be more dependent on public charging infrastructure due to their limited financial capability to install high-capacity depot chargers. This dependence underscores the importance of regulating charging prices to avoid significantly impacting these operators. Further, SMF operators are primarily based out of Tier-2 and Tier-3 cities where

charging infrastructure networks are yet to be developed. Alternatively, a potential intervention could be to suggest clients of these fleet operators to consider deploying charging infrastructure at loading and unloading sites, ensuring that vehicles are ready for trips immediately after charging. In this case, the government may offer capital support for the clients to establish these charging stations.

A just transition for SMF operators also encompasses just transition of the workforce. This includes organisational staff and truck driving partners. Ensuring that the workforce is adequately supported and prepared for the transition to ZETs is critical for the overall success of the shift.

## Impact on Key Personnel

### Organisational Staff

The staff associated with the fleet operators are involved in the day-to-day fleet operations. Specific roles such as fleet supervisor, maintenance supervisors will need to be upskilled to adapt to the changes introduced by ZET induction. Activities such as monitoring the fleet, payment and accounting for charging/fueling expenses, vehicle repair and maintenance, etc., will differ. A few key areas where SMF operators will need assistance to upskill their staff are discussed below.



**Technical Knowledge and Training:** The introduction of ZETs necessitates new skills and knowledge among organisational staff. Fleet supervisors, maintenance supervisors, and other staff members must become proficient in battery State of Charge (SoC) management, charging infrastructure, and vehicle diagnostics. Specialized training programmes are essential to bridge the initial skill gap and equip staff with the expertise required to maintain and operate ZET components, which differ significantly from traditional ICE vehicles.







**Real-Time Monitoring:** The implementation of telematics in ZETs transforms fleet monitoring and management. Staff members will need to learn how to use this technology to track various aspects of ZET performance, such as battery health, energy consumption patterns, and charging status. Enhanced real-time communication capabilities and the ability to analyse telematics data will improve overall operational efficiency.



**Operational Adjustments:** Adapting to ZETs will require updates to maintenance and troubleshooting protocols. Staff will need to regularly assess battery health, cooling systems, and regenerative braking systems. This may involve recruiting professionals with expertise in ZET technology and providing additional training for the existing maintenance workforce. Moreover, route planning will need to consider the availability of charging/refuelling infrastructure, requiring staff to strategically schedule deliveries and manage potential delays caused by recharging stops.



**Regulations and Policies:** Compliance with new regulations related to ZETs, such as emissions standards and charging infrastructure requirements, will necessitate continuous engagement with regulatory bodies. Staff must stay informed about policy changes and subsidies or incentives for SMF operators. Participation in industry bodies and coalitions will also be crucial for influencing policies that support ZET adoption.

## Truck Driving Partners

Truck-driving partners adapting to ZETs is critical for the freight and logistics sector. The practices ingrained in truck driving partners will significantly shift as the fleet operators transition to ZETs. Some of the major shifts relevant to the truck driving partners are discussed below.



**Operation and Maintenance of ZETs:** Truck driving partners will face a learning curve with the operation and maintenance of ZETs, which differ significantly from ICE trucks. For example, BETs offer automatic transmission, eliminating the need for a gear system, and are associated with higher torques requiring measured acceleration. Driving partners will need to adapt their driving patterns to manage the vehicle's range and plan for vehicle charging stops. Training will be necessary to understand the technical aspects and maintenance requirements of BETs.



**BET Charging:** The process of refuelling BET differs from that of a ICE truck. Driving partners must learn to identify suitable chargers and understand the longer time required for charging. Safe charging practices will be a critical aspect of the training.



**Refuelling Charges/Energy Tariff:** In tandem with learning the method of charging the BET, truck driving partners will also be required to understand how the tariffs are calculated for charging their truck. Driving Partners will need to learn about technical specifications of charging infrastructure, such as voltage and power, as well as tariff elements like Time-of-Day charging. Adhering to these criteria will support efficient fleet operations.



**Changes to Driving Route/Pattern:** While the truck driving partners might continue to operate between familiar destinations, the route taken might differ with a BET. This is owing to the availability and location of the charging infrastructure. Further, the frequency of rest stops and their location might also shift for the driving partner due to range limitations. Thus, it is necessary to support the driving partner with appropriate telematics to locate charging infrastructure, and also ensure access to basic amenities such as toilets, and affordable eateries at these charging rest stops. This is critical to ensure adherence to the optimal routes and timely delivery of goods.





**Vehicle Breakdown Protocol:** Servicing and repair of ZETs require a skilled workforce. In the event of a vehicle breakdown during transit, the driving partner will need to access a skilled service expert to diagnose the issue. In the nascent stages of the ZET ecosystem, breakdown protocols must be defined to ensure a timely response in attending to the ZET. This may include stationing service personnel

at charging facilities. Considering all these factors, the transition to ZETs should not only be a technological shift but also lead to a more inclusive trucking sector in India. A just transition framework will ensure SMF operators and their workforce—both organisational staff and truck driving partners—are supported and integrated into transition, ultimately contributing to a more resilient and equitable industry.



**PART II**  
**BUILDING YOUR  
ZET ROADMAP**  
PROCESS AND  
CONSIDERATIONS





# PART-II: BUILDING YOUR ZET ROADMAP

## PROCESS AND CONSIDERATIONS

### Process Overview

This section aims to equip SMF operators with a structured framework to evaluate their current fleet performance, identify opportunities for improvement, and navigate strategic decisions effectively. By meticulously examining critical parameters, our goal is to deliver practical insights that enhance fleet operations and boost overall efficiency. The section unfolds in four distinct stages, guiding operators through a comprehensive journey towards adopting ZET and embracing sustainable practices in the trucking industry. The transition has been divided into two parts- one dedicated to transitioning the current fleet and the second looking into workforce transition under Stages 1 & 2, respectively. Stage 3 provides an overview for SMF operators to structure their unique roadmaps followed by Stage 4 which delves into monitoring the progress.

#### Stage-1

### Transitioning the Current Fleet

#### Data Collection

#### Fleet Data Template

We propose utilising a standardised template covering essential parameters such as vehicle type, model, mileage, monthly distance travelled, average trips per month, trip duration, service type (Full Truck Load/Less Than Truck Load), vehicle telematics, and more. This template would serve as an unified tool for data

collection across all SMF operators. It's imperative to emphasize the importance of centralised data management to streamline information gathering and enhance operational oversight. Refer to Annexure 2 to access this data template.

#### Definitions of Parameters

It is recommended to use the following parameters for the fleet data template:

- Vehicle Type - Specifies the category of the vehicle, such as open body, trailer, tanker, bulker, etc.
- Manufacturer - Indicates the OEM that produces the vehicle.
- Year of Purchase - Denotes the year when the vehicle was acquired.
- Engine Class - Defines the classification of the engine based on Bharat Stage Emission Standards (BSES).
- Fuel Type - Specifies the type of fuel used by the vehicle, such as diesel, gasoline, or alternative fuels.
- Area of Operation - Describes the geographical region where the vehicle primarily operates.
- Details of Operational Region - Provides specific information about the regions where the truck is permitted to travel through the provision of state or national permits.
- Route Data - Includes details about the specific routes generally travelled by the vehicle, including origin, destination, and waypoints.
- Average Time Spent on Road - Indicates the average duration spent on the road during each trip.



- Type of Service (FTL/LTL) - Specifies whether the vehicle provides Full Truckload (FTL) or Less Than Truckload (LTL) services.
- Average Distance Travelled/Day - Calculates the average distance covered by the vehicle per day.
- Average Number of Trips/Month - This represents the average frequency of trips made by the vehicle within a month.
- Days to Complete Each Trip - Indicates the number of days required to complete each trip.
- Average Distance Travelled/Month - Specifies the average distance covered by vehicle in a month.
- Mileage (km/litre) - Measures the efficiency of the vehicle in terms of distance travelled per unit of fuel consumed.
- Payload Nature - Describes the type of cargo carried by the vehicle, such as perishable goods, hazardous materials, or general freight.
- Payload - Specifies the weight or volume of cargo carried by the vehicle.
- Payload Loading/Unloading Time - Indicates the time taken to load and unload cargo onto/from the vehicle.
- GVW (Gross Vehicle Weight) - Represents the total weight of the vehicle, including cargo, passengers, and fuel.
- Telematics - Yes/No - Indicates whether the vehicle is equipped with telematics technology for remote monitoring and management.
- Driving Partner Monitoring System - Yes/No - Specifies whether the vehicle is equipped with a system to monitor driving partner behaviour and performance.

Additionally, the following parameters are necessary to gauge the sufficiency of number of driving partners:

- Total number of trucks in fleet
- Total number of driving partners
- Number of non-operational trucks

Driving partner availability is a common recurring problem faced by fleet operators. By gauging the average shortage in number of driving partners, fleet operators will be better placed to plan hiring to maximise fleet operations. The process of streamlining driving partner hiring is discussed in the sections ahead. Annexure 2, along with data templates, includes a few rows of sample data to offer a clearer understanding.

## Data Assessment

After collecting comprehensive data about the fleet, next step is to analyse the information to gain insights and identify areas for improvement. The following points elaborate on the data assessment process with examples:

### Truck Body Type

Analysing truck body types allows operators to understand their fleet composition and suitability for different types of cargo. The analysis helps in optimising fleet utilisation by matching trucks with appropriate loads, thus improving efficiency and reducing operational costs.

- Example: Analysing the fleet composition reveals that 40 percent of the fleet consists of tankers, which are underutilised for their intended purpose. This insight can lead to better allocation of tankers to suitable routes, improving efficiency and reducing costs.

### Trucks By Manufacturer

Understanding the distribution of trucks by manufacturer provides insights into the fleet's diversity, reliability, and potential maintenance patterns. It aids in strategic procurement decisions, warranty management, and vendor relationship management for operators.

- Example: Understanding that 60 percent of the fleet consists of trucks from a single manufacturer can help in negotiating better maintenance contracts and bulk purchasing agreements in the future.



## Year of Purchase and Corresponding Manufacturer

Analysing the year of purchase alongside manufacturers reveals insights into the fleet's preference for specific manufacturers and allows for comparisons between manufacturers within the same year.

- Example: Noticing that trucks from a specific manufacturer purchased in 2010 have higher maintenance costs can inform decisions about replacements or upgrades and influence future purchase decisions.

## Type of Truck Compared with Tonnage and Manufacturer

Matching truck types with tonnage requirements and manufacturers helps optimise fleet capabilities, ensuring the right equipment for the job while minimizing operational inefficiencies and maximising payload capacities.

- Example: Analysis of MDTs within the fleet shows a strong preference for models with a high reliability rating and fuel efficiency, reflecting their popularity in this segment.

## Truck Engine Class and Year of Purchase

Analysing engine class in relation to the year of purchase informs operators about fleet fuel efficiency, emission standards compliance, and potential maintenance needs.

- Example: Analysing engine class and year of purchase can highlight trucks that may soon need retrofitting or replacement.

## Fuel Type of Trucks

Understanding the fuel types used by trucks aids in evaluating fleet sustainability, operational costs, and environmental impact. It informs decisions on fuel procurement strategies, alternative fuel adoption, and efficiency improvement measures.

- Example: Identifying that 80 percent of the fleet runs on diesel can highlight opportunities for cost savings and emissions reductions by transitioning to electric or alternative fuels.

## Average Distance Travelled per Day by Area of Operation

This analysis helps operators assess regional demand, optimise resource allocation, and identify growth opportunities in specific geographic areas. It guides route planning, fleet deployment, and market expansion strategies.

- Example: Noticing that trucks in urban areas travel shorter distances but consume more fuel due to traffic can inform decisions on where to deploy ZETs first.

## Payload Nature Matched to Truck Type

Matching payload nature with truck type ensures compatibility, safety, and regulatory compliance. It helps in optimizing cargo handling processes, minimizing damage risks, and enhancing customer satisfaction.

- Example: Ensuring that perishable goods are carried by refrigerated trucks can reduce spoilage and improve customer satisfaction.

## Loading and Unloading Time of Payloads

Analysing loading and unloading times identifies operational bottlenecks, inefficiencies, and potential areas for process improvement. Efficient optimisation of loading and unloading times can reduce turnaround times and enhance overall fleet productivity.

- Example: Longer loading and unloading times can be effectively utilised for charging BETs.

## Fixed Routes vs. Flexible Routes

Differentiating between fixed and flexible routes helps operators assess the balance between scheduled operations and adaptability to dynamic market demands. This analysis guides route optimization strategies, resource allocation,



and responsiveness to changing customer needs.

- Example: Finding that 70 percent of the fleet operates on fixed routes allows for better planning of charging infrastructure and maintenance schedules.

### Telematics Integration by Truck Type

Integrating telematics by truck type enables real-time monitoring, fleet tracking, and performance optimisation. It enhances safety, efficiency while providing valuable data for strategic decision-making.

- Example: Trucks equipped with telematics show improvement in fuel efficiency due to better route planning and driving partner behaviour monitoring.

### Truck Monitoring and Issue Resolution Protocol

Establishing monitoring protocols and issue resolution procedures ensures proactive maintenance, timely repairs, and minimised downtime. It improves fleet reliability, customer service levels, and overall operational resilience for small fleet operators.

- Example: Implementing a proactive maintenance schedule based on telematics data can reduce breakdowns significantly.

### Gap Assessment

Conducting a gap assessment is a crucial step as it helps in identifying the discrepancies between the current state of operations and the desired future state, enabling targeted interventions for improvement. Therefore, it is essential to benchmark current operations against industry best practices, identify specific gaps, and prioritise them based on their impact.

### Benchmark Against Best Practices

Compare current operational practices with industry standards and best

practices, ensuring that each benchmark is tailored to specific truck types and their applications. For example, assess whether the decision to purchase new MDTs aligns with market share trends among manufacturers. Evaluate if the daily driving distances for fixed routes meet or exceed national averages based on the truck's intended application.

- Identify benchmarks for fuel efficiency, maintenance costs, customer satisfaction, and technological adoption.

### Identify Gaps

- Use the analysed data points to identify areas where current operations fall short of industry standards.
- Look for gaps in vehicle performance, route optimisation, fuel efficiency, maintenance practices, and digital tool usage.

### Prioritise Gaps

- Rank the identified gaps based on their impact on operational efficiency, cost savings, regulatory compliance, and customer satisfaction.
- Focus on high-priority gaps that offer the most significant benefits when addressed.

### Brief of Potential Solutions

SMF operators can significantly enhance their operations through two key solutions: digital transformation and transitioning to ZETs. Here is a brief of potential solutions:

### Digital Transformation

- Streamline Labour-Intensive Processes:
  - » Implement fleet management software to automate scheduling, dispatching, and route planning.





- » Use digital platforms for inventory management, reducing manual errors and improving efficiency.
- » A sample image of a fleet management software dashboard is provided in Figure 3.



Figure 3: Sample Fleet Management Software Dashboard

- Improve Operational Efficiency:
  - » Analyse fleet composition and retire underutilised or inefficient vehicles to optimize the size and capabilities of the fleet.
  - » Integrate telematics systems for real-time monitoring of vehicle performance, fuel consumption, and driving partner behaviour.
  - » Utilise data analytics to identify underutilised assets and optimise fleet usage.
  - » A sample image of a vehicle efficiency dashboard is provided in Figure 4.



Figure 4: Sample Vehicle Efficiency Dashboard

- Reduce Fuel Costs and Minimise Vehicle Downtime:
  - » Employ predictive maintenance tools to anticipate and address vehicle issues before they lead to breakdowns.
  - » Optimise routes and reduce idling time through advanced route planning algorithms.
  - » A sample image of the route optimisation software is provided in Figure 5

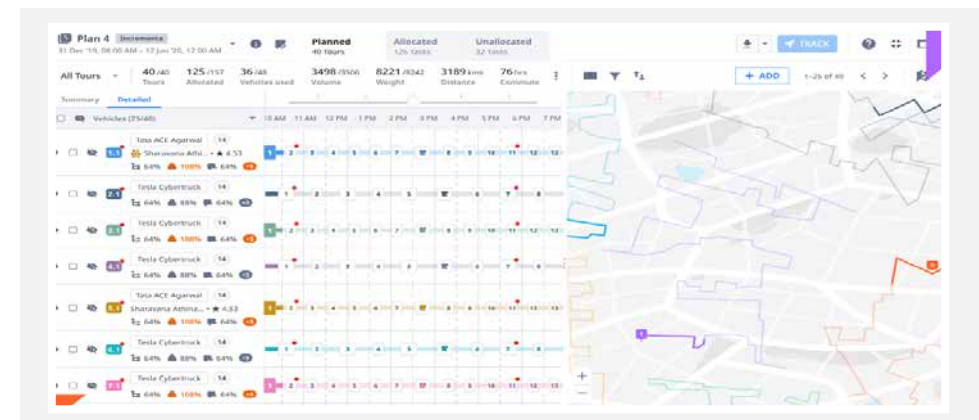


Figure 5: Sample Route Optimization Software



- Enhance Customer Experience and Build Trust:
  - » Provide real-time data insights to customers, improving transparency and trust.
  - » Offer personalised services based on customer preferences and behaviour analysis.

### Transition to ZETs:

- Reduce Operating Costs:
  - » Transition to ZETs could result in an average operational cost reduction of approximately INR 7-9 per km due to reduced fuel and maintenance expenses<sup>3</sup>.
  - » Explore incentives and subsidies for ZET adoption to further reduce costs.
- Align with Regulatory Requirements:
  - » Ensure compliance with emission standards and regulations, avoiding penalties and benefiting from potential government incentives.
  - » Stay ahead of future regulatory changes by adopting sustainable technologies early.
- Introduce Advanced Safety Technologies:
  - » ZETs are often equipped with advanced safety features such as collision avoidance systems, lane-keeping assist, and driving partner fatigue monitoring.
  - » Enhance the safety of driving partners, cargo, and road users, reducing accident rates and insurance costs.
- Enhance Fleet Efficiency:
  - » Utilize ZETs' regenerative braking systems and efficient energy management to extend vehicle range and reduce energy consumption.
  - » Plan charging infrastructure strategically to support seamless operations and minimise downtime.

- Improve Sustainability and Competitiveness:
  - » Position the fleet as a leader in sustainability, attracting environmentally conscious customers and partners.
  - » Gain a competitive edge in the market by offering green logistics solutions.

## Financing the Solutions

### Digital Transformation

Incorporating digital transformation solutions can revolutionise fleet management for SMF operators, offering streamlined processes and improved efficiency through modular software packages. These solutions encompass a range of functionalities essential for modern fleet operations:

- Real-time Monitoring and Intervention
- Predictive Analytics
- Inventory Management
- Reminders Module
  - » Service Reminders
  - » Vehicle Renewal Reminders
  - » Contact/Driving Partner Renewal Reminders
- Tyre Management
- Driving Partner and Trip Expense Management
- Driving Partner Performance Mapping
- Fuel Management (Theft & Mileage)
- Compliance Management



These modules are crucial for addressing operational gaps identified within the fleet, ensuring regulatory compliance, and optimizing resource utilization. Vendors such as Fleetx Technologies Pvt. Ltd. offer comprehensive solutions tailored to meet these specific needs. Recently, significant technical advancements and rapid digitalization across the country have led to these services being offered at competitive prices that are affordable for SMF operators. Typically, the cost to implement these services starts at around INR 599 per month per truck, making it a feasible investment for SMF operators<sup>39</sup>.

Studies indicate a rapid return on investment for these digital solutions, with an average payback period of approximately two months<sup>40</sup>. Such an affordability underscores their suitability for SMF operators, eliminating the need for extensive financial support from external actors.

## Transition to ZETs

For SMF operators to embrace the adoption of ZETs, the development of innovative financing schemes and business models is paramount. These initiatives serve as catalysts within the market, igniting widespread deployment by addressing the upfront capital expenditure hurdles and enabling access to ZETs' superior operational expenditure and TCO advantages.

It is important to emphasise that these financing models are contingent upon certain expectations from stakeholders like governments, financial institutions, and more. Factors such as loan tenure and interest subvention play a crucial role in shaping the viability of these models. To expedite the deployment of ZET and ensure their swift integration into the transportation ecosystem, it is imperative that the government and other stakeholders provide incentives at the earliest. A proactive approach will ensure that ZETs 'hit the road' as soon as

possible, translating intentions into tangible actions. Since BETs are comparable to or outperform ICE trucks in terms of TCO, this section primarily focuses on financing options for BETs. The intersection of various financing models may create synergies, making owning a BET even more attractive. A few financing models have been described below:

## Base Case – Self Owned

In the self-owned model, the fleet operator purchases the BETs outright, covering initial costs like the capital cost of the vehicle, taxes, and other statutory costs. Operating expenses for this model include the cost of charging, insurance, as well as repairs and maintenance. Revenue is generated through transporting goods.

## Battery Leasing (Operating Lease)

In the battery leasing (operating lease) model, the fleet operator doesn't purchase the BET's battery outright but instead leases it from the OEM or a separate entity. This arrangement reduces the initial investment required in the truck by shifting the upfront capital expenditure of battery. The fleet operator pays a monthly rental for the battery. Operating expenses still include electricity for charging, insurance, and other ongoing costs, while revenue is generated through transporting goods. In addition, the variable expenses per year in terms of the rent for the battery is also added. On the other hand, the depreciation and interest cost are reduced. The key advantage of this model is that it reduces initial investment and provides predictable monthly costs.

## Interest Subvention

In this model, the concept of interest subvention is introduced to the base case scenario. Interest subvention involves a subsidy or discount on the interest rate charged for the loan taken to purchase the electric truck. This subsidy is typically provided by a governmental or financial entities to encourage investment in environmentally friendly vehicles and technologies.

<sup>39</sup> Based on the vendor's proposal as of June 2024

<sup>40</sup> <https://www.lifecell.ua/en/business-big-lifecell/services/m2m/fleet-monitoring/>



In this model, the fleet operator still purchases the BET outright and owns it. However, the interest rate on the loan used to finance the truck’s purchase is subsidized, resulting in lower interest expenses for the fleet operator. This reduction in interest costs can significantly decrease the overall financial burden of owning the BET and improve the project’s viability. It also reduces the monthly outflow of loan repayment and interest cost. All other assumptions remain same as in the case of self-owned model.

Credit Risk Guarantee

Here, a credit risk guarantee is introduced to mitigate the risk for financial institutions lending to fleet operators purchasing BETs. This guarantee is typically provided by a third party, such as a governmental agency or private insurer, which agrees to cover potential losses incurred by the lending institution in case of default by the borrower.

In this scenario, the cost of debt is reduced because the third party assumes the risk associated with the loan. As a result, the effective interest rate on the loan is significantly lower compared to the base case scenario. This reduction in the cost of debt translates to lower annual expenses on interest payments and Equated Monthly Installments (EMIs) for the fleet operator.

By offering a credit risk guarantee, the model aims to make financing more accessible and affordable for fleet operators looking to invest in BETs. All other assumptions remain same as in the case of self-owned model.

Government Grant

In this model, the government offers upfront grants to fleet operators to incentivize the adoption of BETs. This one-time subsidy aims to lower the initial investment required by fleet operators when purchasing the vehicle.

By offering subsidies based on battery capacity, the model encourages the adoption of electric vehicles with larger batteries, which typically have longer range and greater utility for fleet operations. This reduces the upfront investment, EMIs, as well as the interest and depreciation expenditure.

Income Tax Incentives

In this model, the provision of income tax incentives aims to encourage the adoption of BETs by reducing the effective income tax rate for fleet operators.

By reducing the income tax burden on fleet operators, this model effectively increases their after-tax profits, making investments in BETs more financially attractive. The reduced tax rate incentivizes fleet operators to transition to electric vehicles by enhancing the overall return on investment.

Performance-based Financing

In the performance-based model, three key parameters are considered: savings in fuel cost, savings in maintenance cost, and improvement in operational efficiency. Specific targets are set for each parameter, indicating the desired level of performance as seen in Table 8.

Table 8: Performance Parameters and their Respective Targets

Parameter	Target (in comparison to ICE trucks)	% Reduction in Rate of Interest
Savings in Fuel Cost	20%	1.00%
Savings in Maintenance Cost	30%	1.00%
Improvement in Operational Efficiency	10%	1.00%



The business owner stands to benefit from meeting these performance targets through a reduction in the effective rate of interest on their loan. Essentially, the better the business performs in terms of fuel and maintenance cost savings, as well as operational efficiency improvement, the greater the reduction in the interest rate that they pay on their loan.

It's important to note that these parameters are mutually exclusive, meaning that meeting the target for one parameter does not necessarily affect the targets or benefits associated with the other parameters. This incentivizes the business owner to focus on improving performance across all three areas to maximize their overall benefit in terms of reduced loan costs.

Stage-2

## Supporting Workforce Transition

### Organisational Staff

The ZET is a technologically different vehicle. Operations and maintenance (O&M) surrounding the ZET are bound to differ, and require training programmes for the organisational staff to familiarise and adapt to the nuances of the vehicle. Thus, it is necessary to first identify the specific activities that will differ with the operation of ZETs compared to ICE trucks, and gather detailed insights on their day-to-day functions. Table 9 is a suggestive template to aid the trucking organisation in capturing the key process flows for all major activities. The same table filled with sample data is provided in Annexure 5.

**Table 9:** Template to Capture Process Flows of Major Activities Performed by Organisational Staff

Staff Designation:					
Process Name:					
Process Trigger	Per- formed By (Role)	Input provided by (Role)	Process Activity/Task (including technology involved)	Output	Output shared with (Role)

By tracing the existing flow of activities, fleet operators will be able to determine the key areas where protocols for ZET might differ, and correspondingly develop training modules to upskill their staff. Some of the indicative activities typically associated with organisational staff are listed below:

- Monitoring of fleet during trips
- Truck refuelling process (including billing)
- Protocol for vehicle breakdown management
- Hiring third-party vehicle to meet consignment demand
- Billing and booking of freight orders
- Advance payments for fuel, etc.

A sample process flow diagram for monitoring trucks during their trip has been provided in Figure 6.

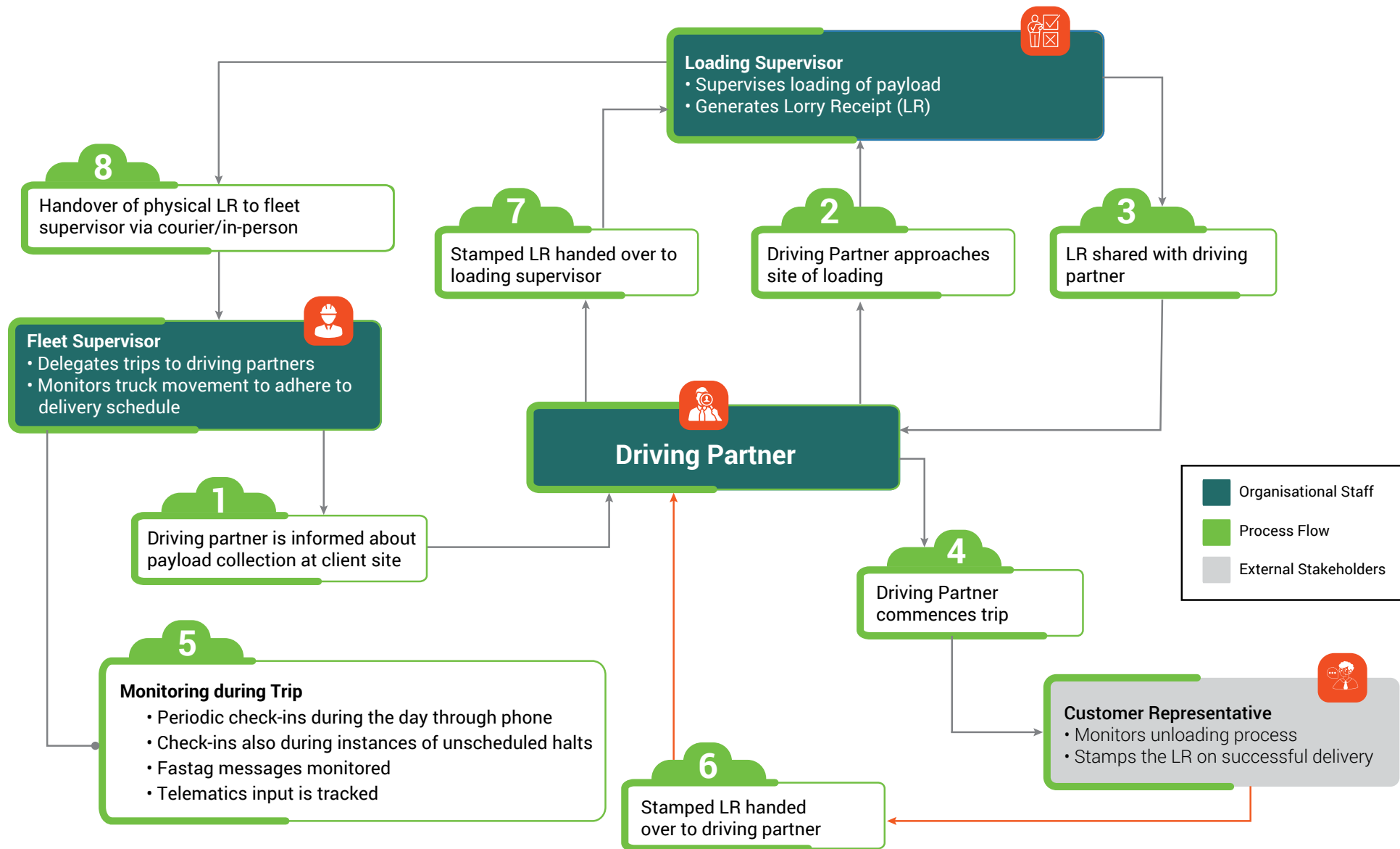


Figure 6: Sample Process Flow Diagram for Monitoring Trucks during Trips





Further, the staff will also require knowledge transfer sessions that are necessary to carry-out their updated job functions with the incorporation of ZETs. The training modules must provide essential information surrounding the following themes:

- Comprehensive details on new vehicles, their operation and maintenance, and differences from existing trucks
- Guidance for a smooth transition
- Information on charging/re-fueling infrastructure and maintenance for ZETs
- Detailed understanding on route planning for ZETs
- Best practices for integrating ZETs into existing fleet.

## Truck Driving Partners

On the path towards realising the adoption of ZETs, truck driving partners are key, and it is necessary to provide them with requisite training and upskilling opportunities. Currently, India's trucking sector is largely unorganised which has resulted in unsatisfactory working conditions for the driving partners. With the trucking industry expected to grow multi-fold in the years to come, there is a need to bring about interventions that improve the working conditions of truck driving partners, and thereby create an ecosystem that attracts more workforce to the trucking industry. By prioritizing the well-being and livelihoods of truck driving partners, we can guarantee a fair and equitable transition

that safeguards their interests while embracing the benefits of zero-emission technologies.

In order to assess the socio-economic impact on truck driving partners and identify areas of support vis-a-vis the ZET transition, a reference questionnaire is provided. Fleet operators will be responsible for surveying their truck-driving partners. Discussions with various SMF operators have revealed that they are struggling with a shortage of truck-driving partners. Many operators choose not to operate their trucks when a driving partner is on leave rather than hiring a new one, given the severity of the shortage. Therefore, during the potential transition to ZETs, it will be advantageous for them to train their existing partners and address their concerns. An indicative list of parameters to analyse the data has also been given. Further, this stage delves into the potential interventions to improve the working conditions of truck driving partners.

## Data Collection

### Questionnaire

The questions have been formulated over relevant themes as shown in Table 10. Subject to pre-existing information available with the fleet operators, the questionnaire may be modified suitably.



**Table 10:** Questionnaire to Assess Requirements of Truck Driving Partners

Section	Questions	Remarks
Basic Information	Age (in number of years)	-
	Driving Experience (in number of years)	-
	Educational Qualification	-
Health Profile	Suffering from any diseases/illness/recurring issue?	List of health issues mentioned for respondents to identify as applicable – Backaches; joint/muscle pain; gastrointestinal issues; fatigue; sleep disorder; vision-related issues; respiratory issues; oral cavity issues; chronic diseases (HIV/AIDS); skin diseases;
	Truck driving partners are eligible to receive Pradhan Mantri-Jan Arogya Yojana (PM-JAY) e-cards from the nearest All India Transporters Welfare Association (AITWA) Highway Hero Centre. Have you availed this facility? Any other scheme such as ESI is availed?	-
	What is your preferred mode of receiving information?	Potential sources mentioned – online; employer; family/friends; government source; fellow driving partners
	If any private Insurance availed?	Yes/No
Induction to Trucking Industry	Did you undergo any formal training before getting a driving license?	Yes/No
	How many attempts did it take for you to get your driving license (number of attempts)?	-
	Along with driving, were you also taught any maintenance or service activity for truck?	Yes/No
	If yes, who provided you with the training?	Potential sources mentioned – Employer; Mechanic/Expert; Family/friends; Fellow driving partner
	What other skills do you possess along with driving?	Recorded as subjective text response





Section	Questions	Remarks
Road Incident History	Have you faced any accident in your driving career?	Yes/No
	If Yes, number of accidents	-
	Are you part of any truck driving partner union?	Yes/No
	Do you approach them for grievance redressal? If not, what are your go-to avenues for the same?	Recorded as subjective text response
Transition to ZETs	Climate change is a global phenomenon that has an adverse effect on the planet. As a result, which of the following climate change impacts have you experienced?	Indicative impacts provided - Increased temperatures and extreme heat in summer; Rising air pollution causing breathing troubles; Lower visibility on highways because of smog; Delays in consignment delivery due to storm/cyclone conditions
	Temperatures have been rising in the past few years. Has this made heat unbearable while driving? What measures do you take to control the heat?	Recorded as subjective text response
	All diesel/petrol vehicles contribute to air pollution. Trucks are only 2 percent of all vehicles on the road. How much share of the total pollution is caused by trucks? (Select from the following options)	Percentage ranges provided to respondents. This is primarily to gauge their understanding of emission impact attributed to trucks.
	Are you familiar with zero-emission/battery-electric/hydrogen trucks?	Yes/No
	What challenges/ concerns would you have if ZETs replaced diesel trucks? Select from the options below-	Options provided - Range anxiety; Road-side breakdown management; Daily Maintenance (Truck wash, etc.); Safety of operation; Vehicle performance/capability
	ZETs have automatic transmission, hence there is no clutch. Do you have experience with driving automatic transmission vehicles?	Yes/No
	Unlike ICE trucks, BETs cannot be refuelled at petrol pumps. Do you know where and how to charge them?	Yes/No



Section	Questions	Remarks
	Are you willing to undertake training for operating and maintaining ZET?	Yes/No
	If modern trucks are introduced (with AC cabin, power steering, clutch-less driving), will it attract more driving partners to join this industry?	Recorded as subjective text response
	What expectations do you have from the following stakeholders - Employer, Government, and Transport Unions, regarding support or incentives during the transition to ZET?	Subjective text responses recorded for each stakeholder separately.

### Mode of Conducting Survey

Apart from In-person interviews of truck driving partners, owing to their fluctuating working hours and dispersed availability at their base location, phone-based surveys posit as an alternate mode of data collection. Interviews can be scheduled with truck driving partners during their rest stops. Additionally, for themes common to all driving partners such as working conditions, expectations from stakeholders, and impacts of rising temperatures, focus group discussions are an effective way to gather responses. As our primary research indicates, truck driving partners were more receptive to questions that were posed to them as a group.

Conducting this survey will benefit fleet operators without imposing a significant cost burden, as it can be carried out online via phone calls, ensuring that the driving partners' work remains uninterrupted. Moreover, for SMF operators, the smaller scale of their operations allows them to complete the survey efficiently and in a short amount of time.

### Data Assessment

A few key parameters that aid in understanding the specific requirements of the truck driving partners attached to the fleet are provided below. These parameters provide insights to develop suitable training modules and incorporate other measures that will improve their working condition and ultimately increase driving partner retention.

#### Average Age of Truck Driving Partners

Analysing the age of truck driving partners is necessary to determine the number of driving years remaining for the majority of the cohort. A lower average age of truck driving partners indicates their longevity in the sector. Primary research indicates that only about 28 percent<sup>41</sup> of people employed as truck driving partners were below the age of thirty. This highlights the need for trucking operators to hire younger driving partners in order to avoid a dearth later. Thus, the fleet operator may design appropriate training modules along with social security measures, which can result in strategic long-term retention of their upskilled workforce.

<sup>41</sup> Vasudha Foundation Analysis



- Example: If the average age of the truck driving partners is found to be 35, this suggests that these driving partners potentially have another 25-30 years of driving ahead. This data can help the company focus on long-term investments in training and health benefits to retain these driving partners.

### Level of Education

Nature of driving and maintaining ZETs differs from ICE trucks. Determining the level of education of truck driving partners can aid in tailoring the training modules to operate and maintain the ZET. Primary research indicates that around 56 percent<sup>39</sup> of truck driving partners were educated only up to primary level or below. Furthermore, this may also have implications in designing protocols for ZETs in instances of vehicle breakdown.

- » Example: If many driving partners have only completed primary education, training modules should include fundamental technical explanations and use more visual aids. For those with higher education levels, more detailed and technical training could be effective.

### Years of Driving Experience

ZETs are acquired at a high upfront cost. Analysing the driving experience of the truck driving partners will help identify seasoned driving partners to switch to ZET operation on priority.

Example: Driving Partners with over 10 years of experience might be prioritized for ZET training due to their extensive on-road expertise, ensuring that the new technology is handled by the most experienced hands.

### Awareness of Government Health Schemes

Schemes such as the PM-JAY have recently been extended to the transport industry for enrolment as beneficiaries. As our primary research indicates, the uptake and awareness of such schemes is low among truck-driving partners where merely 20 percent of people have availed this scheme while around

30% are not even aware about it<sup>39</sup>. Given, the multitude of benefits of such schemes, it becomes important to provide support to the driving partners for enrolment into similar schemes.

- » Example: If a survey reveals that only 20 percent or 30 percent of driving partners are aware of PM-JAY, the company could organize camps/sessions to increase enrollment and ensure driving partners benefit from the scheme.

### Frequency of Accidents

Adoption of ZETs presents an opportunity to incorporate driving partner safety systems such as lane assist and front-collision avoidance systems. A total of 10,584 persons were killed in truck accidents in the year 2022<sup>42</sup>. A study on the condition of truck driving partners revealed that over-speeding is the primary cause (43 percent), followed by fatigue and sleepiness (39 percent)<sup>43</sup>. By gathering insights into the frequency and nature of accidents, fleet operators can choose the suitable technology package to ensure the safety of their driving partners.

- » Example: If data shows that a significant number of accidents occur due to driving partner fatigue on long hauls, the fleet could implement driving partner alert systems that monitor driving partner behaviour and alert them when they show signs of fatigue, ensuring they take necessary breaks.

### Impact of Climate Change

Understanding the key challenges induced by climate change can aid the fleet operator in devising strategies that improve the fleet operations. Protocols in case of severe natural calamities such as cyclones, and smog, can streamline consignment deliveries. Further, impacts on truck driving partners such as exposure to extreme heat conditions can also be addressed.

<sup>42</sup> [https://morth.nic.in/sites/default/files/RA\\_2022\\_30\\_Oct.pdf](https://morth.nic.in/sites/default/files/RA_2022_30_Oct.pdf)

<sup>43</sup> <https://savelifefoundation.org/wp-content/uploads/2020/02/design-single-page-27th-feb-2020.pdf>



- Example: If driving partners report an increase in heat-related illnesses, operators can develop a Standard Operating Procedure (SOP) for managing these conditions and provide regular health check-ups during peak summer months.

### Experience of Driving Automatic Transmission Vehicles

This is necessary to identify training needs of driving partners to operate ZETs.

- Example: Primary research indicates that almost 90 percent<sup>39</sup> of the driving partners have zero experience with driving automatic transmission. Thus for the transition to ZETs, the fleet owners will have to provide specific training to acclimatize the driving partners with automatic transmission.

### Outlook Towards ZETs

Given that adaption to ZETs requires dedicated training, buy-in from truck driving partners is necessary to provide the required support. In a study conducted by Vasudha Foundation with ZET driving partners, two-thirds cited range anxiety as the main concern while driving the vehicle. Further, insights into their outlook on ZETs will help in tailoring the modules to suit the driving partners associated with the fleet.

- Example: If the majority of driving partners express concerns about the reliability of ZETs, the training modules could include comprehensive sessions on the reliability and maintenance aspects of ZETs, along with testimonials from current ZET driving partners.

### Gap Assessment

Based on the data assessment, several areas where truck driving partners need assistance can be identified, including health insurance, life insurance, training for ZETs, and adapting to climate change. By systematically assessing these gaps and implementing targeted solutions, fleet operators can significantly improve the well-being and performance of their truck driving partners.

## Brief of Potential Solutions

### Portal for Driving Partner Procurement

Enrolment on platforms such as *'Drivers in India - Desh ke Sarathi'* which is a marketplace for truck driving partners could support streamlining the hiring process. The platform has been developed with the mandate to improve the livelihood of truck driving partners and address the Indian Transport Industry's crisis of driving partner shortage. These online platforms can be downloaded as an application over any smartphone. The truck driving partners are onboarded free of cost onto the platform and enables access to potential employers. Further, the platform also provides information on driving partners training schools, costs and regulatory procedures for obtaining requisite licenses, etc. Integration with such platforms can instil a sense of stability in fleet operations by availing driving partners on demand.

### Enabling Access to Health Insurance – PMJAY

Ayushman Bharat-Pradhan Mantri Jan Arogya Yojna (AB-PMJAY) stands as the Government of India's (GoI) flagship scheme, extending coverage of up to INR 5 lakh annually per family for secondary and tertiary care hospitalization, benefiting over 10.74 crore vulnerable entitled families. This initiative ensures cashless and paperless access to healthcare services for beneficiaries right at the point of service. With an MoU inked between the National Health Authority (NHA) and the AITWA, truck driving partners can now avail themselves of this scheme. To apply, individuals can visit the National Health Authority portal or seek assistance from any Education, Health and Care Plan (EHCP). Required documentation includes the Aadhaar card, PAN card, and ration card.

### Provision of Life insurance

Implement measures to provide death coverage in the event of accidents for truck driving partners: Accidents are an unfortunate reality in the realm of truck driving. It is important to provide comprehensive support, not only during their time on the road but also in the unforeseen and tragic event of accidents.



That's why there is a need to implement measures to ensure that the truck driving partners are covered in the event of accidental death, offering financial protection and peace of mind to both them and their loved ones.

Gol has implemented measures to deliver social security services to the workforce attached to the unorganised sector in India via the e-SHRAM initiative. This scheme is extended to truck driving partners as well and the following benefits can be availed upon enrolment:

- **Social Security Benefits:** Gain access to government social security schemes designed to help in times of need. For example - Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) & Pradhan Mantri Suraksha Bima Yojana (PMSBY)
- **Life Insurance Cover under PMJJBY:** This is a one-year term life insurance scheme that is renewable annually, providing life insurance coverage of up to INR 2 lakh for death resulting from any cause.
- **Accidental Death Benefit under PMSBY:** Receive INR 2 lakhs in case of accidental death for financial support to your loved ones through PMSBY.
- **Simplified Access to Schemes:** One time registration on e-SHRAM for potential eligibility to various social welfare programmes offered by Central and State governments, eliminating the need for multiple registrations.
- **Nationally Valid e-SHRAM Card:** A single, government-issued e-SHRAM card as proof of registration, facilitating access to benefits across India.
- **Future Initiatives:** Potential access to additional benefits and programmes as the e-SHRAM platform develops.

### Rewards and Recognition Programme

A rewards programme for recognising good driving practice of the truck driving partners can enhance safety and reduce road accidents. To establish a rewards or

recognition programme for truck driving partners who consistently demonstrate safe driving practices and adherence to company policies, the following steps are provided for consideration-

- Identify KPIs such as accident-free driving days, compliance with traffic regulations, on-time deliveries, and more.
- Offer rewards either as a single payout reward or a per kilometre reward for the next month of driving the vehicle. The single payout reward could be a cash bonus, while the per kilometre reward could be additional earnings for each safe kilometer driven.
- Apart from monetary measures, the following measures can also be employed:
  - » Extra time-off: Additional vacation days
  - » Formal recognition via certificates, plaques and trophies
  - » Health expense coverage for a prescribed amount and duration
  - » Electronics and home goods: Provide gifts that cater to their personal requirements
- Felicitate top-performing truck driving partners
- Share images and success stories with all truck driving partners to inspire healthy competition and motivate others to excel in their performance.

### Training for ZETs

Conducting comprehensive training sessions for truck driving partners is crucial for a successful transition to ZETs. Basic training can be delivered by the SMF operators, who will receive training themselves through workshops organized in collaboration with associations like AIMTC. Additionally, OEMs will also play a crucial role in training, offering instruction to driving partners at the time of vehicle delivery, at no additional cost. Below are the key components and steps involved in the training process:



- Familiarity with the Basic Construct and Features of ZETs
  - » Overview Sessions: Provide an introduction to the structure, components, and unique features of ZETs.
  - » Technical Details: Explain the differences between ZETs and traditional ICE trucks, focusing on battery systems, electric drivetrains, and regenerative braking.
  - » Operational Benefits: Highlight the environmental and economic advantages of using ZETs, such as lower emissions and reduced fuel costs.

- Ride and Drive Events

- » Driving Sessions: Organise practical sessions where driving partners can operate ZETs under supervision, allowing them to get a feel for the new vehicles
- » Feedback Sessions: After the driving experience, conduct feedback sessions to address any concerns or questions the driving partners may have.

- SOPs

*Regular Maintenance Checks:*

- » Routine Maintenance Training: Teach driving partners how to perform regular checks on battery health, tire pressure, and other critical components of ZETs.
- » Preventive Maintenance: Emphasize the importance of preventive maintenance to ensure vehicle longevity and reliability.

*Vehicle Breakdown Protocols:*

- » Emergency Procedures: Develop SOPs for what driving partners should do in case of a vehicle breakdown, including contacting support and ensuring safety.

- » Troubleshooting Guides: Provide driving partners with troubleshooting guides to handle common issues they might encounter on the road.

*Vehicle Fire Procedures:*

- » Safety Protocols: Create SOPs for handling vehicle fires, including evacuation procedures and using fire extinguishers.
- » Fire Safety Training: Train driving partners on how to identify potential fire hazards and respond appropriately.

- Charging Infrastructure

*Basics of Charging Infrastructure:*

- » Introduction to Charging Stations: Provide an overview of the types of charging stations (Level 1, Level 2, DC fast chargers) and their differences.
- » Locating Charging Stations: Teach driving partners how to locate and access charging stations using various tools and apps.
- » Charging Procedures: Demonstrate how to connect and disconnect the truck to/from a charging station safely.

*Dos and Don'ts*

- » Safe Charging Practices: Educate driving partners on the importance of following manufacturer guidelines for charging.
- » Avoiding Overcharging: Explain the risks of overcharging and how to avoid it.
- » Charging Etiquette: Encourage driving partners to practice good charging etiquette, such as not occupying a charging spot longer than necessary.





## Financing the Transition

### Organisational Staff

#### Financing staff training

Developing training modules and disseminating information to staff requires subject matter experts capable of customising content. Fleet operators can access preliminary EV courses on government-backed websites like the Automotive Skill Development Council (ASDC)<sup>44,45</sup>. ASDC offers free courses in English and Hindi covering basics of EVs and introduction to EV charging. Additional curated courses specific to ZETs are anticipated from ASDC soon.

Alternatively, organisations can engage professional training institutes listed in resources as mentioned in Table 11. These institutes offer tailored training sessions for a one-time fee, typically ranging from INR 5,000 to 10,000 for up to 30 employees. Consultancies associated with these institutes may also customise courses to suit specific organizational needs. SMF operators can collaborate with these entities to organize joint training sessions, potentially securing discounted rates.

44 <https://courses.asdc.org.in/course/basics-of-electric-vehicle-english>

45 <https://courses.asdc.org.in/course/introduction-of-ev-charging>

**Table 11:** Sample List of Private Consultants Offering EV Training<sup>46</sup>

Company	Location	Website Link
AutoBot India	Noida	<a href="https://www.autobotindia.com/index.php">https://www.autobotindia.com/index.php</a>
EV Masterclass	Hyderabad	<a href="https://evmasterclass.com/">https://evmasterclass.com/</a>
DIYGuru	Gurugram	<a href="https://diyguru.org/p/specialization-course-electric-vehicle/">https://diyguru.org/p/specialization-course-electric-vehicle/</a>
Pragyatmika	Ghaziabad	<a href="https://pragyatmika.co.in/">https://pragyatmika.co.in/</a>
Prudent Consultants	Bengaluru	<a href="https://www.prudentc.com/">https://www.prudentc.com/</a>
Academy of EV Technology	Howrah, West Bengal	<a href="https://aevt.org/">https://aevt.org/</a>
Skill Shark	Hyderabad	<a href="https://www.skillshark.in/">https://www.skillshark.in/</a>
Tesla EV Academy	Pune	<a href="https://teslaevacademy.com/ev_courses.php">https://teslaevacademy.com/ev_courses.php</a>

Alternatively, the fleet operators can also reach out to local not-for-profits to arrange for similar pro-bono training sessions to impart ZET knowledge to the staff. Various think tanks and autonomous institutes in their vicinity will also be able to guide and support them in executing the ZET training programmes.

46 <https://evreporter.com/ev-training-providers-in-india/>

## Truck Driving Partners

### Portal for Driving Partner Procurement

These online portals generally work on a subscription-based revenue model. For example, ‘Apna’ offers three plans to an employer to post a job and access its database. These range from INR 300 to INR 2100.

### Enabling Access to Health Insurance – PMJAY

PMJAY, a Union government scheme, provides INR 5 lakh coverage per family every year, and beneficiaries can avail the Ayushman Bharat card for free. The driving partners would require enrolment support which would mostly be non-monetary or at a negligible cost.

### Provision of Life Insurance

- PMSBY: A premium of INR 20 per annum per member will be charged.
- PMJBY: The premium payable is INR 436 per annum per subscriber.

### Rewards and Recognition Programme

While monetary rewards such as cash bonuses and salary increments can be provided at the discretion of the fleet operators, there are also other non-monetary measures such as certificates, additional paid time-off, etc. Typically, cash bonuses which are a percentage of the salary, have direct financial benefits to the employees.

### Training for ZETs

OEMs such as EVAGE Motors have stepped up to offer free training to the fleet’s driving partners, facilitating a smoother transition and addressing initial concerns. Going forward it is expected of all OEMs to follow the footsteps of these ZET pioneers in providing training for driving partners of fleet operators.

## Stage-3

# Structuring the Roadmap

Developing a structured roadmap is crucial for ensuring a smooth transition to ZETs and addressing the gaps identified in previous stages. This roadmap should be broken down into three phases: short term (2 years), medium term (next 2 years), and long term (beyond 4 years). The roadmap aims to provide a clear, actionable plan for SMF operators to follow, ensuring they can address gaps efficiently and effectively.

## Overview of Roadmap Template

To assist in developing this roadmap, please refer to Table 12. This table includes a suggestive list of gaps identified in the previous stages and maps them to solutions that can address these challenges.

Table 12: Gap Analysis and Solutions

S.No.	Identified Gaps	Solutions	Interventions
1	Lack of real-time monitoring of vehicles	Digital Transformation	Implement real-time monitoring systems using GPRS-GSM modules or smartphone applications provided by vendors like FleetX for continuous vehicle tracking.



S. No.	Identified Gaps	Solutions	Interventions
2	Inefficient resource utilization	Digital Transformation	Utilize real-time monitoring systems to identify underutilized vehicles or driving partners over timeframes and take necessary corrective actions.
3	Difficulty in compliance with regulations	Digital Transformation	Implement a Document Master to manage data on pollution certificates, permits, vehicle fitness, and service records, generating timely reminders for renewals.
4	Shortage of truck driving partners	Digital Transformation	Register on platforms like HumaraTruck to advertise job openings and select suitable candidates efficiently.
6	Inefficient decision making	Digital Transformation	Introduce regular status reports on key metrics (daily, weekly, monthly) to facilitate informed decision-making processes.

S. No.	Identified Gaps	Solutions	Interventions
7	Inefficient spare part strategy	Digital Transformation	Implement Natural Language Processing (NLP) modules on vehicle logs to optimize spare parts inventory management for repairs.
8	Lack of monitoring of truck driving partners	Digital Transformation	Implement systems to monitor driving behaviours, including rapid acceleration and GPS fence crossings, to improve driving partner oversight.
9	Sporadic and costly O&M	<ul style="list-style-type: none"> <li>Digital Transformation</li> <li>Transition to ZETs</li> </ul>	Implement predictive maintenance techniques and consider transitioning to ZETs for reduced operational and maintenance costs.
10	High number of vehicle accidents	<ul style="list-style-type: none"> <li>Digital Transformation</li> <li>Transition to ZETs</li> </ul>	Implement driving partner behaviour monitoring systems and promote ZET adoption for enhanced safety features such as lane assist and regenerative braking.



S.No.	Identified Gaps	Solutions	Interventions
11	Higher fuel costs	Transition to ZETs	Transition to ZETs to mitigate rising fuel costs compared to ICE trucks.
12	High number of run-ins with police and law enforcement authorities	Transition to ZETs	Adopt ZETs to eliminate the need for pollution certificates and permits, reducing interactions with law enforcement and traffic officials.
13	Adverse health impact on driving partners	Transition to ZETs	Promote ZET adoption to improve cabin air quality and reduce health risks associated with diesel emissions.
14	Lack of social security for driving partners	Provision of Insurance	Encourage driving partners to enroll in health and life insurance schemes through online registration processes, providing assistance as needed.
15	Lack of awareness on ZETs	Training on ZETs	Organize training sessions for driving partners and staff on ZET benefits, including ride and drive events and professional training programmes.

S.No.	Identified Gaps	Solutions	Interventions
16	Inefficient re-registration and permit application process for existing ICE trucks	Transition to ZETs	Simplify vehicle re-registration processes by transitioning to ZETs, avoiding the complexities associated with ICE vehicle permits and renewals.

Here's how to structure the roadmap:

## Prioritize Gaps

### Rank the Identified Gaps

- Evaluate each gap based on its impact on operational efficiency, cost savings, regulatory compliance, and customer satisfaction.
- Rank the gaps in order of priority, focusing on those that offer the most significant benefits when addressed.

### Focus on High-Priority Gaps

- Concentrate on high-priority gaps in the first phase (short term). These gaps should be addressed within the first year to ensure immediate improvements.
- Distribute the solutions for these high-priority gaps across the phases, ensuring a balanced and systematic approach.



## Phases of the Roadmap

To assist in populating this roadmap, a blank template is provided in Annexure 3.

### Short Term (2 Years)

- Focus on addressing high-priority gaps identified in the data assessment and gap assessment stages.
- Implement solutions that offer quick wins and immediate benefits to operational efficiency and cost savings.
- Example: Introducing health and life insurance for truck driving partners, initiating training programmes for ZETs, and setting up basic digital transformation modules.

### Medium Term (Next 2 Years)

- Continue addressing medium-priority gaps that require more time and resources.
- Implement solutions that build on the foundation laid in the short term and lead to sustained improvements.
- Example: Carrying out a ZET pilot within the fleet to evaluate performance, identify operational challenges, and gather data for a broader rollout. Expand digital transformation efforts and enhance driving partner training programmes.

### Long Term (Beyond 4 Years)

- Focus on addressing long-term gaps that align with the overall strategic goals your organisation.
- Implement solutions that ensure long-term sustainability, regulatory compliance, and competitive advantage.
- Example: Phased transition to ZETs and advanced telematics integration.

## Flexibility in Roadmap Phases

- SMF operators have the flexibility to adjust the duration of each phase based on their specific needs and priorities.
- Operators can prioritize interventions according to their unique operational challenges and strategic goals.
- It is essential to provide a placeholder for all interventions acting as solutions to the identified gaps to have a holistic roadmap in place.

## Self-Implementation vs. Support-Required Solutions

### Self-Implemented Solutions

- While populating the interventions, consider solutions that can be implemented independently by the SMF operators.
- Example: Basic training programmes for driving partners, initial digital transformation steps, and more.

### Support-Required Solutions

- Identify solutions that require external support, such as government subsidies, vendor partnerships, or technical expertise.
- Example: Large-scale ZET integration, charging infrastructure deployment, and more.

## Sample Roadmap

- A sample filled roadmap is provided in Annexure 4 for reference.
- This sample demonstrates how to prioritize gaps and distribute solutions across the different phases.
- SMF operators can use this sample as a guide to develop their customised roadmap.



## Stage-4

# Monitoring Progress

Evaluating the progress of the organisation-specific roadmap at regular intervals is essential for SMF operators. The roadmap document should be treated as a dynamic document and should be revised regularly, preferably every year, to accommodate changes in technology and the policy ecosystem. To measure the impact of the roadmap based on the identified gaps, adopted solutions, and implemented interventions, the following table provides a suggestive list of Key Performance Indicators (KPIs) that SMF operators can use to measure the effectiveness of their actions.

## Key Performance Indicators (KPIs)

Category	Key Performance Indicators
Organizational	Reduction in vehicle downtime
	Reduction in cost per km per tonne
	Reduction in running cost per km per tonne
	Reduction in maintenance cost per km
	Reduction in total turnaround time
	Improvement in fuel efficiency of the fleet
	Reduction in cost associated with vehicle part inventories
	Reduction in regulatory compliance faults
Workforce based	Percentage decrease in driving partner attrition
	Reduction in number of interactions with the traffic police/law enforcement agencies
	Reduction in number of accidents

Category	Key Performance Indicators
	Number of sessions conducted for organizational staff on training for ZETs
	Number of ride-and-drive events conducted for driving partners
	Increase in the number of driving partners with health/life insurance cover
	Percentage increase in the number of driving partners feeling secure

## Data Sources for KPI Measurement

- Digital Transformation Database: Data directly flowing from the database created for digital transformation interventions
- Bills from Fuel and Charging Stations: Documentation and receipts from fuel stations and charging stations
- FASTag Details: Toll transaction records that provide insights into minimum distance covered by the vehicles
- Bills from Service Centers: Maintenance and repair records to track servicing costs
- Yearly Surveys: Surveys conducted annually with driving partners to gauge changes in their lives and overall satisfaction.

## Revisiting the Roadmap

Based on the results of the KPIs, SMF operators should revisit the roadmap to adjust interventions as necessary. If an intervention is not yielding the expected benefits, it may be beneficial to rejig the approach or drop the intervention altogether. This ensures that the roadmap remains effective and responsive to both technological advancements and policy changes.





**PART III**

# **FRAMEWORK TO ENSURE A JUST ZET TRANSITION FOR SMF OPERATORS**





## PART-III: FRAMEWORK TO ENSURE A JUST ZET TRANSITION FOR SMF OPERATORS

The transition to ZETs presents a historic opportunity to foster a more sustainable and inclusive trucking industry. However, ensuring that SMF operators are not left behind requires a carefully crafted framework that addresses the unique challenges they face. This section outlines a comprehensive framework designed to measure and enhance the justness of the ZET transition for SMF operators.

### Framework Overview

The framework is structured around five key indicators, each addressing a crucial area for a just transition. Each parameter has several sub-categories that capture the nuances of these broader parameters.

- **Information Symmetry:** Ensuring that all stakeholders have access to accurate and timely information about the transition, technologies, and regulations.
- **Enhancing Financial Opportunities:** Creating financial mechanisms and opportunities that support SMF operators in the transition to ZETs.
- **Providing Equitable Access:** Guaranteeing fair access to resources, infrastructure, and opportunities, regardless of the size or location of the fleet.
- **Fostering Social Dialogue:** Promoting inclusive and continuous dialogue among all stakeholders to address concerns, share knowledge, and build consensus.
- **Promoting Workforce Development:** Providing training, education, and career development opportunities to equip the workforce with the skills needed for the new ZET landscape.

It then examines the current state of affairs and projects the expected transition, evaluating the justness of this anticipated change. The framework identifies specific interventions needed to achieve the expected transition,

along with the actors that will facilitate these interventions. Table 13 captures the list of the actors involved. This framework ensures that as SMF operators develop their organisation-specific ZET roadmaps, it creates an environment for a just transition across the entire ecosystem. By informing all stakeholders of their respective roles and responsibilities, it promotes a fair transition. This approach guarantees inclusive historic shift in the trucking industry, leaving no one behind, and fostering a more sustainable and equitable trucking sector.

**Table 13:** List of Actors in Trucking Ecosystem in India

List of Actors	Abbreviations
Government Bodies	Gov
Financial Institutions	FI
Industry Associations	IA
Original Equipment Manufacturers	OEM
Non-Governmental Organisations	NGO
Media Partners	MP
Educational/Training Institutions	ETI
Small-to-medium Fleet Operator	SMF
Health Institutions	HI
Third-Party Agencies (Certified by Gov)	TPA
Digital Technology Providers	DTP
Private Players	PP



## Detailed Analysis

Sl. No.	Key Indicator	Current State	Expected Transition
1	Information Symmetry	<p>SMF operators in the trucking sector face significant challenges in accessing essential information on policies, regulations, technological advancements, market conditions, and best practices<sup>47</sup>. Their demanding work schedules, involving logistics management, client interactions, and timely deliveries, leave little time for staying updated, leading to missed opportunities for efficiency, cost savings, and competitiveness<sup>48</sup>. This results in reliance on outdated methods and equipment, hindering growth in a rapidly evolving market.</p> <p>Additionally, the lack of centralized, vernacular resources on policies means many operators miss out on government initiatives, subsidies, training programmes, and opportunities for growth<sup>49</sup>. This knowledge gap limits compliance with new regulations and reduces participation in policy discussions. Challenges like these contribute to India's high logistics costs, currently at 14-18% of GDP, far above the global benchmark of 8%<sup>50</sup>.</p>	<p>The expected transition aims to create an environment where SMF operators can easily access and adopt new technologies without compromising their operational schedules. This involves integrating technology research and training into their routine activities, providing them with user-friendly tools and platforms that save time and enhance productivity. By doing so, operators can stay competitive, reduce operational costs, and improve service quality, resulting in a more tech-savvy trucking sector where even SMF operators benefit from the latest innovations.</p> <p>Additionally, the transition aims to create a well-informed trucking community where SMF operators are fully aware of and actively engage with government targets and schemes. This can be achieved by establishing efficient communication channels that regularly update operators on relevant policies, benefits, and compliance requirements. The transition should ensure that operators are equipped with the knowledge needed to access government support, align with regulatory changes, and participate in policy-making processes, leading to a more robust and compliant trucking sector where SMF operators thrive alongside larger entities.</p> <p>According to a survey, preferred communication modes for fleet operators include WhatsApp, phone calls from trusted government agencies, trucking associations, or fellow operators<sup>51</sup>.</p>

<sup>47</sup> AIMTC

<sup>48</sup> Bombay Goods Transport Association

<sup>49</sup> [https://www.graduateinstitute.ch/sites/internet/files/2022-08/Project\\_56\\_Connect.pdf](https://www.graduateinstitute.ch/sites/internet/files/2022-08/Project_56_Connect.pdf)

<sup>50</sup> <https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf>

<sup>51</sup> <https://www.aitd.net.in/pdf/studies/13.%20TRUCKING%20OPERATIONS%20IN%20INDIA.pdf>



### What is 'Just' About it

**Inclusivity:** Ensuring that all operators, regardless of size, have access to the same information.

**Transparency:** Providing clear, accurate, and timely information to all stakeholders.

**Equal opportunity:** Providing operators with the tools and knowledge they need to succeed.

### What to do (Proposed interventions to achieving the transition for SMF operators)

- **Develop a One-Stop Portal-** Create a centralized, easily accessible online portal for all the operators including SMF operators. (Gov, NGO, DTP)
- **Facilitate Training Programmes:** Organize regular training and workshops to educate operators on how to access and utilize these information portals effectively. (Gov, ETI, NGO, TPA)
- **Partner with Industry Experts:** Collaborate with industry experts and organisations to build capacity, and provide information on new technologies. (SMF, IA)
- **Leverage Technology:** Utilize technologies like SMS alerts and WhatsApp groups to disseminate important information quickly and efficiently to operators who may not have access to advanced digital platforms. (Gov, DTP)
- **Establish Industry Networks:** Facilitate the creation of industry networks and forums where information, experiences, and best practices can be shared with SMF operators. (NGO, MP, IA)
- **Implement Feedback Mechanisms:** Implement channels for operators to provide feedback on the information provided, ensuring continuous improvement and relevance. (Gov, TPA, IA)



Sl. No.	Key Indicator	Current State	Expected Transition
2	Enhancing Financial Opportunities	SMF operators in India operate with limited capital and thin profit margins of 10-15%, lower than the global average <sup>52</sup> . They face difficulties in securing finance due to limited credit history, lack of collateral, and smaller scale, leading financial institutions to consider them high-risk <sup>53</sup> . This financial exclusion hampers their ability to invest in new vehicles, access bulk purchasing discounts, maintain fleets, and adopt new technologies, stifling growth and efficiency <sup>48, 54</sup> . It also limits their capacity to save for future needs or handle financial shocks, leaving them vulnerable to market fluctuations and at a competitive disadvantage compared to larger companies.	The expected transition aims to establish a supportive financial environment where SMF operators can enhance their operational efficiencies, leading to increased profit margins. Moreover, they will have access to affordable and tailored financing options to meet their business needs. This includes specialized loan products, government subsidies, and grants specifically designed for SMF operators <sup>55</sup> . This transition will result in more financially resilient operators capable of sustaining and growing their businesses while reaping the environmental benefits of ZETs.

<sup>52</sup> [https://globaldrivetozero.org/site/wp-content/uploads/2022/03/D2Z-India\\_Industry-Assessment\\_Fleet-Landscape.pdf](https://globaldrivetozero.org/site/wp-content/uploads/2022/03/D2Z-India_Industry-Assessment_Fleet-Landscape.pdf)

<sup>53</sup> [https://dream.org/wp-content/uploads/2022/08/Dream.Org\\_SmallFleet\\_1.pdf](https://dream.org/wp-content/uploads/2022/08/Dream.Org_SmallFleet_1.pdf)

<sup>54</sup> <https://www.aitd.net.in/pdf/studies/13.%20TRUCKING%20OPERATIONS%20IN%20INDIA.pdf>

<sup>55</sup> [https://changing-transport.org/wp-content/uploads/2021\\_IDN\\_Truck-Modernisation.pdf](https://changing-transport.org/wp-content/uploads/2021_IDN_Truck-Modernisation.pdf)





## What is 'Just' About it

**Affordability:** Making financing and new technologies accessible to all operators.

**Risk Mitigation:** Reducing financial risks for SMF operators through tailored financial products and guarantees.

## What to do (Proposed interventions to achieving the transition for SMF operators)

- **Develop Specialized Financial Products:** Collaborate with banks and financial institutions to create loan products and credit lines tailored to the unique needs of SMF operators. (FI, NGO)
- **Implement Credit Guarantee Schemes:** Establish government-backed credit guarantee schemes to reduce the risk for lenders and encourage them to extend credit to SMF operators. (Gov, FI)
- **Promote Microfinance:** Encourage the growth of microfinance institutions that can provide small-scale loans with less stringent requirements. (FI)
- **Enhance Financial Literacy:** Conduct financial literacy programmes and workshops to educate operators on managing finances, understanding loan terms, and improving creditworthiness. (FI, NGO, MP)
- **Promote Government Grants and Subsidies:** Increase awareness and accessibility of government grants and subsidies available to SMF operators. (Gov, MP)
- **Facilitate Bulk Purchasing:** Organise collective purchasing agreements through industry associations to help SMF operators buy fuel, vehicles, and spare parts at discounted rates. (IA, OEM)
- **Implement Cost Reduction Strategies:** Promote adoption of fuel-efficient technologies and best practices for maintenance. (DTP, TPA, MP)



Sl. No.	Key Indicator	Current State	Expected Transition
3	Providing Equitable Access	<p>SMF operators in India, representing about 80% of the truck fleet, lack targeted subsidies or financial incentives based on fleet size, hindering their adoption of new technologies and best practices<sup>48</sup>. As clients and regulators emphasize sustainability, these operators risk losing business to larger firms with ZET fleets<sup>56</sup>. They also struggle with transitioning to ZET operations due to reliance on outdated business models, requiring changes like charging schedules and route planning. In Tier 2 and Tier 3 cities, the lack of charging infrastructure further complicates EV adoption. These challenges place SMF operators at a disadvantage compared to larger firms that can more easily absorb technology adoption costs.</p>	<p>The expected transition involves the implementation of targeted policy provisions that provide support to SMF operators proportionate to their share in the total truck fleet and fleet size. These incentives should be upfront to address the immediate needs of SMF operators and make the transition to ZETs more feasible. Mechanisms should be developed to ensure that SMF operators can access incentives in a timely manner. Investment in the development and expansion of charging infrastructure in Tier 2 and Tier 3 cities is crucial to enable SMF operators to transition to ZETs like larger industry players.</p> <p>This comprehensive approach will level the playing field and ensure that all operators, regardless of fleet size, can benefit from the shift to more sustainable transportation options.</p>

<sup>56</sup> <https://www.teriin.org/sites/default/files/2021-02/sustainable-freight-initiatives-report.pdf>



## What is 'Just' About it

**Inclusivity:** Ensuring that all operators, regardless of size, have access to the same information, breadth of charging infrastructure network, avenues for financial support, and upskilling opportunities for workforce

**Equal opportunity:** Providing access to charging networks commensurate to their operations, and training programmes to the SMF operators

## What to do (Proposed interventions to achieving the transition for SMF operators)

- **Develop Targeted Subsidy Programmes:** Design subsidy programmes that offer higher financial support for SMF operators, taking into account their limited resources. (Gov, IA, SMF)
- **Implement Tiered Incentives:** Introduce tiered incentives based on fleet size, ensuring that SMF operators receive proportionally more support. (Gov)
- **Offer Training and Support:** Conduct training programmes to educate SMF operators on sustainability practices and the benefits of ZET adoption. (ETI, TPA, NGO)
- **Facilitate Client Engagement:** Create platforms for SMF operators to engage with clients and showcase their sustainability efforts. (Gov, DTP)
- **Promote Certification Programmes:** Develop certification programmes that recognize and reward SMF operators for their sustainability initiatives. (Gov)
- **Monitor and Adjust Programmes:** Continuously monitor the effectiveness of subsidy programmes and make adjustments as necessary to ensure they are meeting the needs of SMF operators. (Gov)
- **Expand Charging Network:** Invest in the development of a comprehensive charging network in tier 2 and tier 3 cities. (Gov, ETI)
- **Develop Mobile Charging Solutions:** Introduce mobile charging units that can provide on-the-go charging services. (Gov, ETI)
- **Collaborate with Local Authorities:** Work with local governments to identify strategic locations for charging stations and streamline the installation process. (Gov)



Sl. No.	Key Indicator	Current State	Expected Transition
4	Fostering Social Dialogue	<p>SMF operators in India are often excluded from key policy discussions, resulting in policies that overlook their unique challenges. A study in Haryana highlighted government negligence towards these operators as a significant issue<sup>57</sup>. Lacking collective bargaining power, they struggle to negotiate favorable terms with clients, suppliers, and regulatory bodies, facing higher costs and reduced competitiveness. Their fragmented nature limits their negotiating strength compared to larger firms. Additionally, they lack access to effective conflict resolution mechanisms, leading to prolonged disputes, operational disruptions, and financial losses. This absence of advocacy further hampers their ability to influence regulations affecting their operations.</p>	<p>The expected transition aims to ensure the active and meaningful participation of SMF operators in policy discussions. This involves creating formal mechanisms for their inclusion in regulatory dialogues, such as advisory boards, committees, and public consultations. By having a seat at the table, they can contribute their insights and perspectives, ensuring that policies are more representative and responsive to their needs. Additionally, the transition should provide sufficient training to SMF operators on the benefits of demand aggregation and active participation in state or regional level chapters of SMF operators.</p> <p>This will enhance their competitiveness and allow them to enjoy benefits similar to larger firms. Furthermore, the establishment of accessible and effective conflict resolution mechanisms is crucial. This includes creating mediation and arbitration services, setting up grievance redressal committees, and providing legal support to help resolve disputes quickly and fairly. Improved conflict resolution processes will minimize disruptions, reduce costs, and maintain smoother operations for small operators.</p>

<sup>57</sup> <https://www.gkv.ac.in/wp-content/uploads/2023/12/2-Paper.pdf>



## What is 'Just' About it

**Inclusivity:** Ensuring that all operators, regardless of size, have access to the same information.

## What to do (Proposed interventions to achieving the transition for SMF operators)

- **Create Feedback Mechanisms:** Implement systems where operators can voice their concerns and provide feedback on policies. This could include regular surveys, focus groups, and town hall meetings. (Gov, TPA, SMF)
- **Establish Advisory Committees:** Create advisory committees specifically for operators to provide input on policy matters at both national and state levels as existing ZET committees do not include SMF operators and only operate at a national level. (Gov, IA)
- **Facilitate Public Consultations:** Organize regular public consultations and forums where operators can voice their concerns and suggestions. (IA, MP)
- **Encourage Representation:** Ensure that operators are represented in industry associations and policy-making bodies. (Gov, SMF)
- **Provide Training on Advocacy:** Offer training programmes to operators on how to effectively advocate for their interests and engage in policy discussions. (ETI, NGO, TPA)
- **Use Digital Platforms:** Utilise digital platforms to facilitate participation and gather feedback from SMF operators. (DTP, Gov)
- **Provide Negotiation Training:** Offer training programmes to enhance the negotiation skills of SMF operators. (NGO, ETI, TPA)
- **Facilitate Bulk Purchasing:** Organise bulk purchasing agreements to help SMF operators access discounts on goods and services. (IA, TPA, OEM)
- **Promote Legal Support:** Provide access to legal support and resources to assist in contract negotiations. (Gov, IA, TPA)
- **Establish Mediation Services:** Create mediation services that offer neutral third-party assistance to resolve disputes amicably. (Gov, IA, TPA)
- **Create Grievance Redressal Committees:** Form committees to address and resolve grievances raised by SMF operators. (Gov)
- **Promote Awareness:** Educate SMF operators about available conflict resolution mechanisms and how to access them. (Gov, TPA, MP, OEM, IA)



Sl. No.	Key Indicator	Current State	Expected Transition
5.	Promoting Workforce Development	<p>The trucking profession, especially for SMF operators, is marred with social stigma and lacks recognition. The perception of trucking as a low-status job with poor working conditions hampers the attractiveness of the profession. A study conducted on truck driving partners highlighted the lack of social dignity as one of the top 5 reasons for job dissatisfaction<sup>58</sup>. This social perception discourages new entrants, particularly the younger generation, from pursuing careers in the trucking industry, leading to workforce shortages and a lack of skilled driving partners.</p>	<p>Social Acceptance- The transition from ICE trucks to ZETs can significantly enhance the social dignity and acceptance of truck driving partners. ZET trucks, equipped with advanced technology and sophisticated safety features, portray driving partners as skilled professionals adept at handling cutting-edge vehicles, thereby improving their social image. The improved health outcomes from reduced exposure to noise and air pollution, coupled with better ergonomics and modern facilities at charging stations, create a more comfortable and respectable work environment. Scheduled charging breaks also promote regular rest periods, enhancing job satisfaction. Additionally, the transition to ZETs can provide stable employment opportunities and potential for career advancement, contributing to driving partner's economic stability and social standing. Community engagement and recognition programmes that highlight the driving partner's contributions to the ZET transition can further foster a positive public image, promoting greater dignity and respect for the profession. By elevating the profession's status and making it more appealing, the industry can attract a younger, more skilled workforce, ensuring a sustainable supply of driving partners and operational staff.</p>

<sup>58</sup> [https://pphfglobal.org/wp-content/uploads/2023/01/Report-On-The-Study-Of\\_The-Health-And-Well-Being-Of-Truck-Drivers-In-India.pdf](https://pphfglobal.org/wp-content/uploads/2023/01/Report-On-The-Study-Of_The-Health-And-Well-Being-Of-Truck-Drivers-In-India.pdf)

<sup>59</sup> <https://www.india.com/women/meet-yogita-raghuvanshi-lawyer-turned-truck-driver-fighting-gender-stereotypes-and-corruption-at-state-borders-6333169/>





### What is 'Just' About it

- **Decent Work:** Ensures fair and stable employment opportunities.
- **Dignity:** Enhances social respect and professional recognition for truck driving partners.

### What to do (Proposed interventions to achieving the transition for SMF operators)

- **Public Awareness Campaigns:** Launch initiatives to educate the public about the trucking industry's importance and the contributions of truck driving partners, while highlighting the new technologies and advancements in ZETs that they will utilise<sup>59</sup>. (Gov, MP, TPA, OEM)
- **Showcase Success Stories:** Highlight successful driving partners and their achievements through various media channels to inspire and attract new talent. For instance, share stories like that of India's first female truck driving partner, Yogita Raghuvanshi, to promote and celebrate the profession's diversity and success. (Gov, MP, TPA, OEM)
- **Improve Working Conditions:** Enhance working conditions for driving partners by providing better facilities at charging stations and truck terminals, ensuring fair compensation, and implementing safety measures to improve job satisfaction and social perception. (Gov, SMF)
- **Recognise and Reward Contributions:** Implement recognition programmes to celebrate the contributions of driving partners to the ZET transition, fostering a sense of pride and accomplishment within the profession. (Gov, MP)



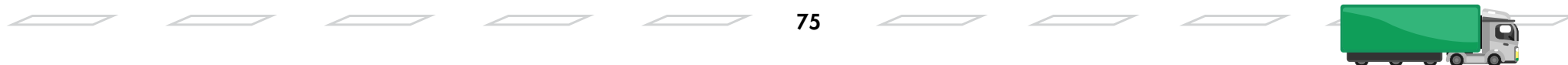
Sl. No.	Key Indicator	Current State	Expected Transition
	Promoting Workforce Development	<p>Truck driving partners working for SMF operators in India often face the dual challenges of inconsistent and low wages. Over 70 percent of respondents in a survey claimed low and irregular wages as the main reason for job dissatisfaction<sup>60</sup>.</p> <p>Income variability stems from fluctuating freight rates and irregular work availability, preventing SMF operators from providing a predictable and stable source of income. This issue is exacerbated by the fact that SMF operators in India operate on thin margins, making it difficult to offer decent salaries for truck-driving partners.</p>	<p>The expected transition aims to create a more stable and fair wage environment for truck driving partners. This will be achieved once SMF operators transition to new technologies that lead to operational efficiencies, resulting in higher profit margins. Increased profit margins will enable SMF operators to offer more consistent and adequate wages that reflect the true value of their work, thereby enhancing their financial stability and overall well-being.</p>
	Promoting Workforce Development	<p>Most truck driving partners working for SMF operators in India lack access to essential social protection measures, such as health insurance, accidental insurance, life insurance, retirement benefits, etc. According to a survey, around 94 percent of truck driving partners had no social security benefits of any kind<sup>61</sup>. This leaves driving partners vulnerable to financial hardship in the event of illness, injury, or retirement, exposing them and their families to significant risks and uncertainties. The absence of these protections undermines their long-term financial stability and well-being</p>	<p>The expected transition aims to introduce comprehensive social protection schemes for truck driving partners. This includes implementing health insurance plans, accidental insurance, life insurance plans, retirement benefits, and other essential protections. The goal is to ensure that all driving partners have access to a basic level of social security, providing a safety net against various risks and enhancing their overall quality of life.</p>

<sup>60</sup> <https://savelifefoundation.org/wp-content/uploads/2020/02/design-single-page-27th-feb-2020.pdf>

<sup>61</sup> Survey by Vasudha Foundation



What is 'Just' About it	What to do (Proposed interventions to achieving the transition for SMF operators)
<p><b>Fair Wages:</b> Ensures that basic needs of truck driving partners and their dependents are met.</p>	<ul style="list-style-type: none"> <li>• <b>Rationalise Driving Partner Salaries:</b> Align salaries with increasing profit margins to ensure fair compensation that reflects the driving partners' contributions and enhances their financial stability. (SMF, IA)</li> <li>• <b>Financial Literacy Programmes:</b> Provide financial literacy training to help driving partners manage their income, budget effectively, and plan for financial stability. (Gov, MP, SMF, NGO)</li> <li>• <b>Enrolling in Government Schemes:</b> Encourage driving partners to enroll in government schemes, reducing their expenditure on health and other social security aspects and increasing their savings. (TPA, NGO, SMF)</li> <li>• <b>Create Employee Emergency Fund:</b> Use increased profit margins to create an employee emergency fund to support truck driving partners in times of crisis, ensuring their loyalty and retention during challenging times. (SMF, IA)</li> </ul>
<p><b>Social Protection-</b> Ensuring social security and stability for driving partners.</p>	<ul style="list-style-type: none"> <li>• <b>Promote Existing Schemes:</b> Raise awareness about existing social protection schemes like PMJAY, PMJJBY, and PMSBY. Ensure that driving partners understand the benefits and process of enrollment. Preferred modes of receiving information include through friends and family followed by online means. (Gov, MP, TPA, NGO)</li> <li>• <b>Provide Assistance with Enrollment:</b> Set up help desks and support centres at truck terminals, rest stops, and other strategic locations to assist driving partners with the enrollment process for social protection schemes. (TPA, NGO)</li> </ul>



Sl. No.	Key Indicator	Current State	Expected Transition
	Promoting Workforce Development	<p>Truck driving partners face significant health issues due to unscheduled and prolonged working hours. The top problems include backaches (77%), joint/muscle/neck pain (58%), and gastrointestinal issues (40%). These arise from continuous driving, poor posture, and frequent eating at local eateries. Additionally, 35.5% experience headaches and dizziness from lack of sleep, 28% have vision problems, and 24% suffer from stress and hypertension<sup>62</sup>.</p> <p>They are regularly exposed to high levels of noise and air pollution, both of which pose significant health risks. The constant noise from engines, traffic, and industrial areas can lead to hearing loss, stress, and sleep disturbances. Similarly, prolonged exposure to air pollution from vehicle emissions, especially in urban areas, increases the risk of respiratory diseases, cardiovascular problems, and other chronic health conditions. In addition to these environmental hazards, driving partners often face a lack of access to basic sanitation facilities. The scarcity of clean toilets and washing facilities along routes contributes to poor hygiene, increased susceptibility to infections, and overall deterioration in health. These health hazards are exacerbated by the lack of protective measures and health awareness among driving partners, contributing to a decline in their overall well-being and quality of life.</p>	<p>The transition from ICE trucks to ZETs is expected to bring several health and wellness benefits for truck driving partners. ZETs are significantly quieter, reducing noise pollution and thereby lowering stress levels, improving sleep quality, and reducing the risk of hearing loss. With zero tailpipe emissions, they contribute to better air quality, reducing respiratory issues and cardiovascular problems associated with pollution. The smoother ride of ZETs, due to their design and electric drivetrain, can alleviate physical strain, reducing backaches, joint pain, and muscle soreness. As per the Vasudha Foundation's survey, almost 100 percent of ZET driving partners claimed reduction in health impacts due to ZETs<sup>63</sup>. Modern trucks often feature improved ergonomics and cabin designs, offering more comfortable seating and better layouts, which can lead to better posture and fewer musculoskeletal problems.</p> <p>Additionally, the deployment of new infrastructure includes modern charging stations with better amenities, such as clean restrooms and resting areas, enhancing hygiene and comfort. Furthermore, the scheduled charging periods for ZETs may encourage regular rest breaks, improving sleep quality and reducing fatigue. Overall, these changes can significantly enhance the quality of life and overall well-being of truck driving partners.</p>

<sup>62</sup> <https://savelifefoundation.org/wp-content/uploads/2020/02/design-single-page-27th-feb-2020.pdf>

<sup>63</sup> Results yet to be made public

<sup>64</sup> <https://m.economictimes.com/news/india/govt-to-build-1k-modern-facilities-for-truck-drivers-on-highways-pm-modi/articleshow/107368638.cms#:~:text=Prime%20Minister%20Narendra%20Modi%20on,drinking%20water%20for%20the%20drivers.>



### What is 'Just' About it

**Improved health:** Enhancing well-being by reducing exposure to pollutants and providing better working conditions.

### What to do (Proposed interventions to achieving the transition for SMF operators)

- **Implement Protective Measures:** Provide driving partners with protective equipment, such as noise-canceling earplugs and air filters, to reduce exposure to pollutants. (SMF, IA)
- **Improve Sanitation Facilities:** Construct and maintain clean and accessible toilets and washing facilities along major truck routes. The government has already begun work on this front by promising to build 1000 modern facilities across the National Highways<sup>64</sup>. (Gov)
- **Health Monitoring and Support:** Establish health monitoring programmes for driving partners to regularly check and address their health concerns related to pollution and sanitation exposure. (HI, Gov)
- **Promote Health Awareness:** Conduct awareness campaigns to educate driving partners about the risks of noise, air pollution, poor sanitation, and the importance of protective measures. (HI, MP, TPA, Gov)



Sl. No.	Key Indicator	Current State	Expected Transition
	Promoting Workforce Development	Truck driving partners in India face significant personal safety challenges, including the risk of road accidents, exposure to crime, and lack of access to emergency services. Many driving partners work long hours under strenuous conditions, often driving at night on poorly maintained and poorly lit roads. Around 66% of truck driving partners in a survey found the job unattractive due to safety and security issues on the road <sup>43</sup> . Additionally, rest areas are often unsafe or non-existent, increasing the risk of theft, assault, and other crimes. The absence of reliable support systems further exacerbates these risks. This precarious environment not only endangers the driving partner's lives but also affects their mental health and job satisfaction.	The expected transition aims to create a safer working environment for truck driving partners by addressing the various risks they face. This involves improving road infrastructure, enhancing rest area safety, providing comprehensive safety training, and establishing robust support systems. The goal is to ensure that driving partners can perform their duties without fear for their personal safety, thereby improving their overall well-being and productivity. A safer working environment will also contribute to reduced accident rates and enhanced operational efficiency in the trucking sector.
	Promoting Workforce Development	Truck driving partners working for SMF operators in India often lack access to formal training and skill development programmes. Many enter the profession with minimal training, learning primarily through on-the-job experience. One study found that over 92% of surveyed truck driving partners did not receive any formal training before obtaining a license <sup>65</sup> . This lack of access to skilling opportunities limits their ability to improve driving skills, learn about new technologies, and stay updated with industry standards. Consequently, they may not be aware of best practices for fuel efficiency, vehicle maintenance, or safety protocols. This skills gap can lead to lower productivity, increased operational costs, and higher accident rates, ultimately affecting the overall efficiency and competitiveness of the trucking sector. Adding to this is the	The transition from ICE trucks to ZETs requires truck driving partners to have access to skilling opportunities. ZETs incorporate advanced technologies and systems distinct from ICE trucks, necessitating knowledge in battery management, charging protocols, regenerative braking systems, and software updates. Understanding new safety procedures for handling high-voltage electrical systems is crucial to prevent accidents and ensure safe operation. Additionally, while EVs have fewer moving parts, driving partners must be adept at basic maintenance and troubleshooting to reduce downtime and increase efficiency. Effective route planning, considering charging station locations and times, and energy management techniques like optimizing regenerative braking, are vital for operational efficiency and cost reduction.

<sup>65</sup> <https://savelifefoundation.org/wp-content/uploads/2020/02/design-single-page-27th-feb-2020.pdf>



What is 'Just' About it	What to do (Proposed interventions to achieving the transition for SMF operators)
<p><b>Safe Working Environment-</b> Provision of safe working conditions and reduced risk of harm.</p>	<ul style="list-style-type: none"> <li>• <b>Improve Road Infrastructure:</b> Invest in the maintenance and enhancement of roads and highways to reduce accident risks, particularly in rural and high-traffic areas. Ensure that major highways are well-lit with adequate lighting infrastructure. (Gov)</li> <li>• <b>Enhance Rest Area Safety:</b> Develop and maintain secure rest areas equipped with proper lighting, surveillance, and amenities to ensure the safety and comfort of driving partners during breaks. (Gov)</li> <li>• <b>Provide Safety Training:</b> Implement comprehensive safety training programmes for driving partners that cover self-defence training, emergency response, and personal security measures. (Gov, ETI, SMF, TPA)</li> <li>• <b>Establish Emergency Services:</b> Ensure the availability of reliable emergency services along major trucking routes, including medical assistance and roadside support. (Gov, OEM)</li> <li>• <b>Promote Safety Awareness:</b> Conduct awareness campaigns to educate driving partners about the importance of personal safety and the measures they can take to protect themselves. (Gov, OEM, TPA, NGO, HI)</li> </ul>
<p><b>Accessibility-</b> Provision of equal skilling opportunities</p>	<ul style="list-style-type: none"> <li>• <b>Establish Training Programmes:</b> Develop and offer formal training programmes covering essential skills for truck driving, including safety, vehicle maintenance, and fuel efficiency. For example, American companies like Holman have developed extensive EV driving courses. (ETI, OEM)</li> <li>• <b>Promote ZET Training:</b> Provide specialized training on the operation and maintenance of electric vehicles, preparing driving partners for the transition to cleaner technologies. (ETI, OEM, NGO, Gov, TPA)</li> <li>• <b>Government and Industry Collaboration:</b> Encourage collaboration between government agencies, industry associations, and training institutions to create and fund skilling programmes. (Gov, IA, OEM)</li> <li>• <b>Subsidized Training Opportunities:</b> Offer subsidized or free training programmes for driving partners to ensure accessibility. (Gov)</li> </ul>





Sl. No.	Key Indicator	Current State	Expected Transition
		apprehension among truck driving partners that the transition to new technologies is difficult and unsupported.	
	Promoting Workforce Development	<p>In India, the presence of female truck driving partners is virtually non-existent, as evidenced by Vasudha Foundation's survey of over 300 driving partners which found no women. Similarly, in the United States, despite its developed status, only 6.9 percent of truck driving partners were women in 2023. The trucking industry is heavily male-dominated, with cultural perceptions and safety concerns acting as significant barriers for women. There is a severe underrepresentation of females due to the prevailing view that trucking is a male profession. The existing ICE technology, followed by the absence of supportive infrastructure, makes it more physically challenging and difficult for women to participate. Safety issues, including inadequate facilities for female driving partners at rest stops and on the road, further discourage women from entering the field.</p>	<p>A carefully planned transition can enhance sustainability and gender equality, boosting economic growth by reducing resource use and addressing social inequalities. Women's economic empowerment, shown to increase productivity and diversify economies, is crucial. A United Nations Industrial Development Organisation report highlights the potential for gender-inclusive green policies to unlock women's roles as leaders and professionals, driving sustainable growth. The International Labour Organisation (ILO) projects that the green transition could create up to 24 million new jobs. However, an Organisation for Economic Cooperation and Development (OECD) report reveals that women currently hold only 28 percent of 'green jobs'. The transition to ZETs offers a chance to tackle gender disparities in the trucking sector by promoting and supporting women participation. With ZETs, the requirement of physical strength reduces significantly, which adds an advantage for gender equity. This shift aims to diversify the industry and create more inclusive job opportunities for women, particularly among SMF operators transitioning from ICE trucks to ZETs.</p>

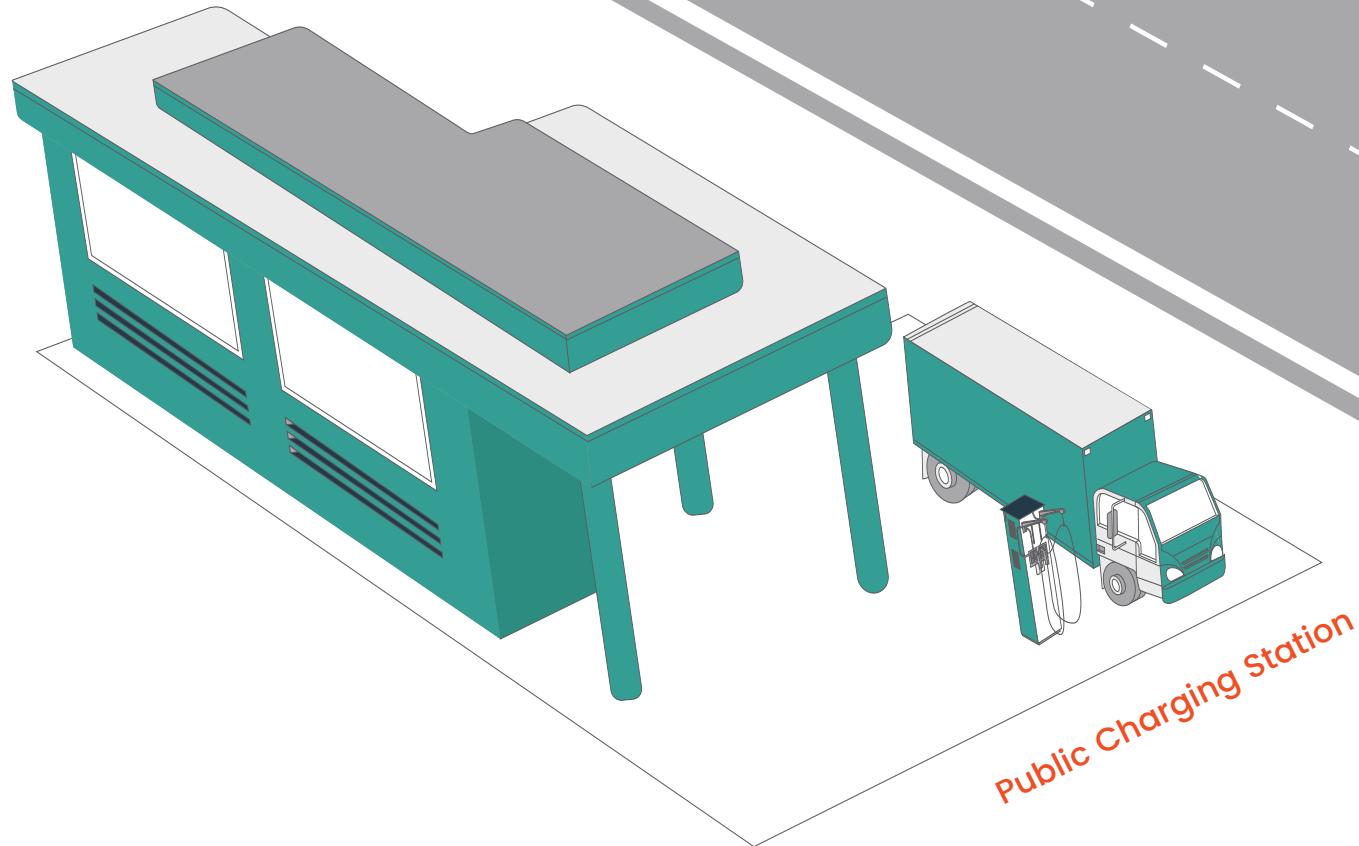
66 <https://bangaloremirror.indiatimes.com/bangalore/others/more-power-to-indian-women-truck-drivers/articleshow/98130782.cms>

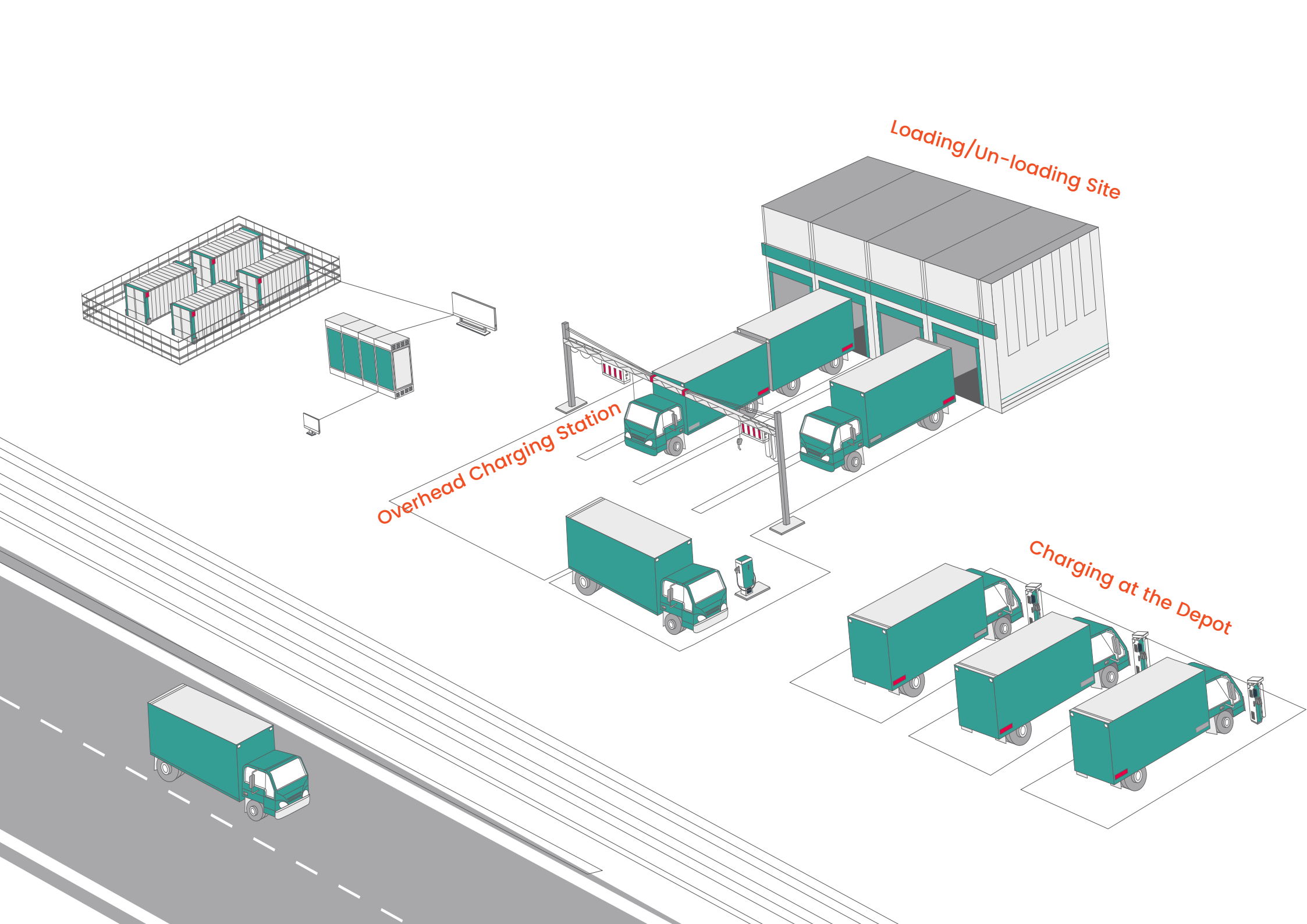


What is 'Just' About it	What to do (Proposed interventions to achieving the transition for SMF operators)
	<ul style="list-style-type: none"> <li>• <b>Certification and Recognition:</b> Implement certification systems that recognize and validate the skills acquired by driving partners, enhancing their employability and professional standing. (Gov, ETI)</li> <li>• <b>Hands-on Workshops:</b> Conduct practical workshops that provide hands-on experience with ZETs, helping driving partners to become familiar with new technologies. (OEM)</li> <li>• <b>Partnerships with OEMs:</b> Collaborate with OEMs to provide comprehensive training directly from those who develop and understand the technology best. (SMF, IA, OEM)</li> </ul>
<p><b>Gender Mainstreaming -</b> Promoting gender equality and inclusivity in the trucking industry.</p>	<ul style="list-style-type: none"> <li>• <b>Pilot Programmes under CSR:</b> Corporates, especially those working in the transport sector, can conduct pilot programmes for female truck driving partners. For example, Baton Transport has recently hired 20 female driving partners as part of their CSR initiative. They plan to train the driving partners in collaboration with various NGOs and then provide selected women with jobs<sup>66</sup>. (PP)</li> <li>• <b>Implementing Targeted Training Programmes:</b> Develop specialized training initiatives tailored to the needs of female driving partners, focusing on skills development, safety protocols, and career advancement opportunities. (Gov, ETI, NGO, TPA)</li> <li>• <b>Improving Infrastructure:</b> Upgrade truck stops and rest areas to include facilities that cater to the needs of female driving partners, such as secure parking, well-maintained restrooms, and adequate lighting. (Gov)</li> <li>• <b>Fostering Supportive Policies and Practices:</b> Implement policies that promote gender diversity, including zero tolerance for harassment and family-friendly policies to support work-life balance. (Gov)</li> </ul>



# BET CHARGING LANDSCAPE









# ANNEXURES







# Annexure 1

The following assumptions have been taken for the TCO Model-

## General Assumptions

- The depreciation rate for all trucks is taken as 16.21%. (Source: Companies Act, 1965)
- The down payment for financing all trucks is assumed to be 30%. [https://www.niti.gov.in/sites/default/files/2023-02/Banking-on-EV\\_web\\_2.0a\\_0.pdf](https://www.niti.gov.in/sites/default/files/2023-02/Banking-on-EV_web_2.0a_0.pdf)
- The fuel cost of diesel is assumed to be INR 92.85 per litre. (source: Primary Research)
- The cost of electricity for charging BETs is assumed to be INR 16 per kWh (Source: Based on discussion with CPOs)
- The fuel cost of hydrogen is assumed to be INR 315 per kg and is expected to decrease over the vehicle lifetime. <https://www.vasudha-foundation.org/reducing-the-cost-barrier-between-green-and-grey-hydrogen-in-india/>
- <https://www.adlittle.com/en/insights/viewpoints/hydrogen-trucking%E2%80%99s-alternative-fuel-future>
- The rate of interest for all loans is assumed to be 10%. (source: Primary Research)
- The tenure of the loan is assumed to be 5 years. (source: Primary Research)
- The annual insurance cost for all trucks is assumed to be 1.5% of its purchase price per annum. <https://www.sciencedirect.com/science/article/pii/S2405844022037057>
- The annual maintenance cost for a diesel truck across all weight categories is assumed to be INR 240000. (source: Primary Research)
- The maintenance cost for a BET is assumed to be 88% per annum of its diesel GVW counterpart. <https://theicct.org/wp-content/uploads/2023/04/tco-alt-powertrain-long-haul-trucks-us-apr23.pdf>
- The maintenance cost for an H2 FCET truck is assumed to be 15% more per annum than its diesel GVW counterpart. <https://mobilitynotes.com/h2-ice-truck-cost-of-ownership-vs-diesel-and-fuel-cell-vehicles/>
- The maintenance cost for an H2 ICE truck is assumed to be 83% more per annum than its diesel GVW counterpart. <https://mobilitynotes.com/h2-ice-truck-cost-of-ownership-vs-diesel-and-fuel-cell-vehicles/>
- The registration and road tax charges for diesel trucks across all weight categories are assumed to be INR 200500 over the lifetime of the vehicle. (source: Primary Research)
- The registration and road tax charges for battery electric, H2 FCET, and H2 ICE are taken to be zero. <https://e-amrit.niti.gov.in/electric-vehicle-incentives>
- The annual run for 5-12 & 12-18 ton GVW categories is taken as 36000 km (source: Primary Research)
- The annual run for 28-40 & 40-55 ton GVW categories is taken as 72000 km (source: Primary Research)
- Battery cost reducing at 7% per annum till 2030 and then by 3% from 2030 till 2038. (Source: Vasudha Foundation)
- Fuel price increasing by 2% per annum (Source: Vasudha Foundation)



# Vehicle Price and Mileage Assumptions

## Diesel Trucks

- The base price of diesel trucks including 28% GST from 5-12 ton GVW category is assumed to be INR 2554880. (source: <https://trucks.tractorjunction.com/en/eicher-truck/pro-2095xp>)
- The mileage of diesel trucks from 5-12 ton GVW\* category is assumed to be 7 km/l. (source: <https://trucks.tractorjunction.com/en/eicher-truck/pro-2095xp>)
- The base price of diesel trucks including 28% GST from 12-18 ton GVW category is assumed to be INR 3789861.12 (source: Primary Research)
- The mileage of diesel trucks from 12-18 ton GVW category is assumed to be 3.75 km/l. (source: Primary Research)
- The base price of diesel trucks including 28% GST from 28-40 ton GVW category is assumed to be INR 4288000. <https://trucks.tractorjunction.com/en/ashok-leyland-truck/avtr-4120-hg>
- The mileage of diesel trucks from 28-40 ton GVW category is assumed to be 2.8 km/l <https://trucks.tractorjunction.com/en/ashok-leyland-truck/avtr-4120-hg>

## Annexure 2

### Truck Fleet Data Collection Template

The data provided is a sample and does not in any way, shape or form reflect real data.

S. No.	Vehicle Type	Manufacturer	Year of Purchase	Engine Class	Fuel Type	Area of Operation	Details of Operational Region
1	Trailer	Tata	2018	BS VI	Diesel	West India	Maharashtra, Gujarat
2	Tanker	Ashok Leyland	2019	BS VI	Diesel	West India	Gujarat, Maharashtra, Madhya Pradesh
3	Flatbed Truck	Mahindra	2020	BS VI	Diesel	South India	Chennai, Coimbatore



Route Data	Average Time Spend On Road (in Hrs)	Type Of Service (FTL/ LTL)	Average Distance Travelled/Day (Km)	Average Number of Trips/Month	Days to Complete Each Trip	Average Distance Travelled /Month (Km)	Mileage (km/liter)	Payload Nature	Payload (Kg)	Payload loading/ unloading time	GVW (Kg)	Telematics - Yes/No	Driving Partner Monitoring System - Yes/No
Mumbai to Pune	8	FTL	400	20	1	8,000	4.5	Perishable	20,000	2	25,000	Yes	Yes
Ahmedabad to Surat	6	LTL	300	22	1	6,600	3.5	Liquid	18,000	1.5	22,000	No	Yes
Chennai to Coimbatore	7	FTL	350	24	1	8,400	4	Bulk	25,000	3	30,000	Yes	No



# Annexure 3

## ZET Roadmap Template:

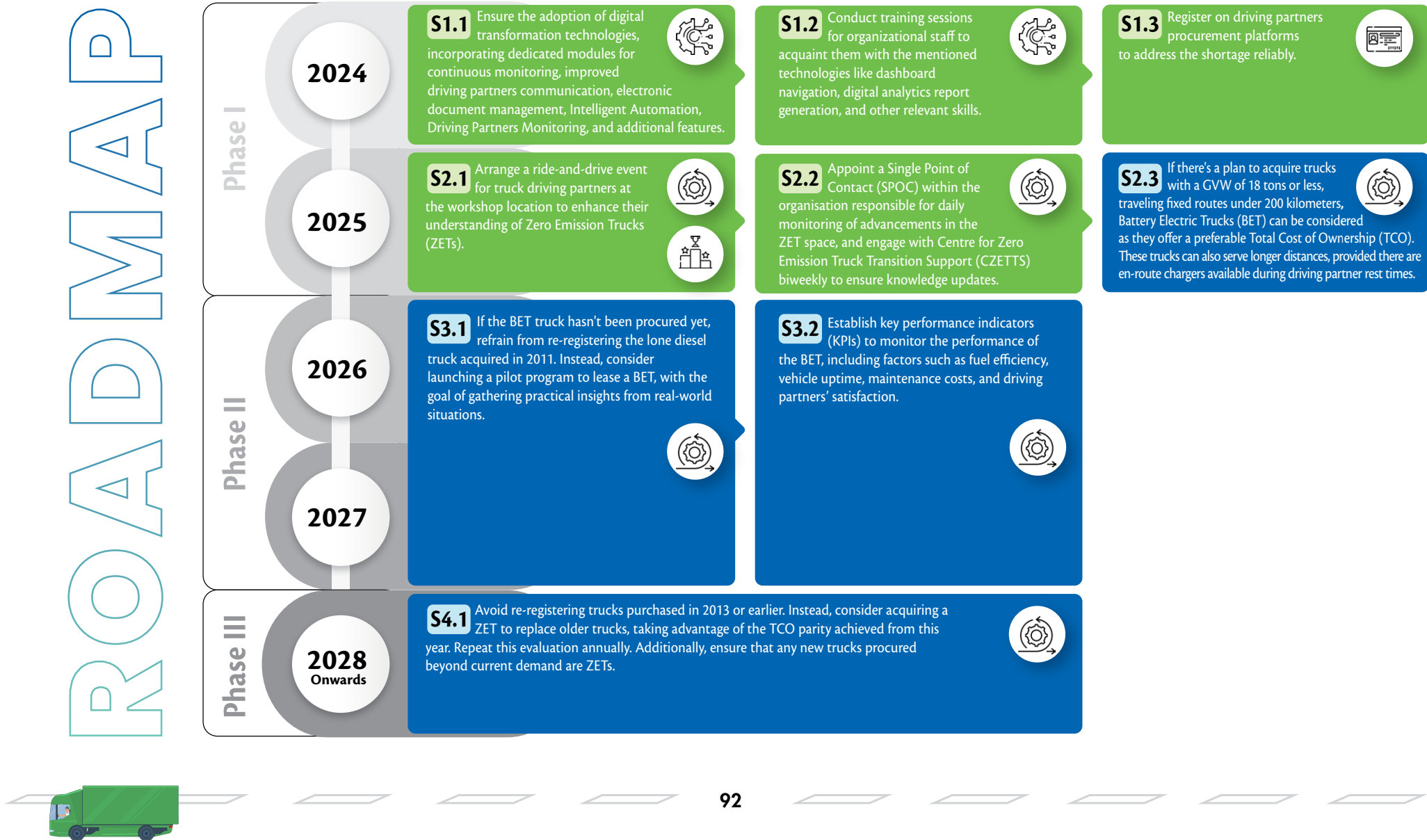
Phases					
I		II		III	
2024	2025	2026	2027	2028 Onwards	

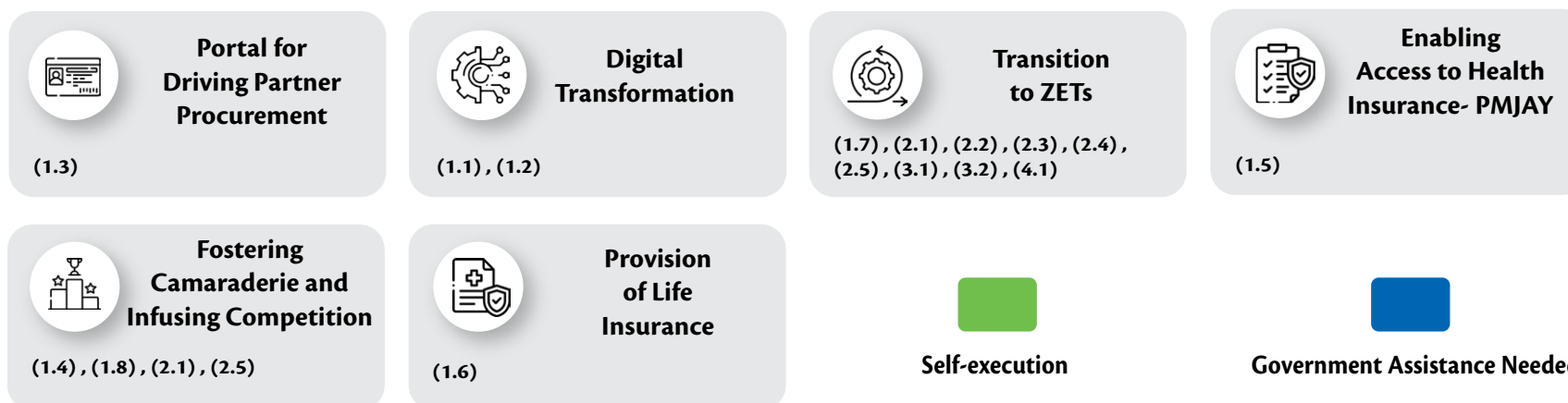
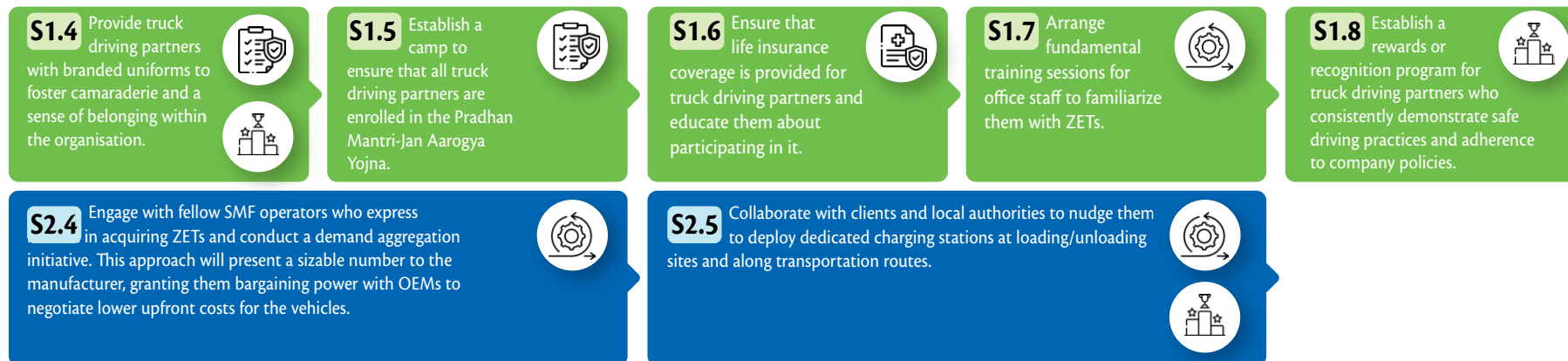


Phases					
I		II		III	
2024	2025	2026	2027	2028 Onwards	

# Annexure 4

## Sample Roadmap







# Annexure 5

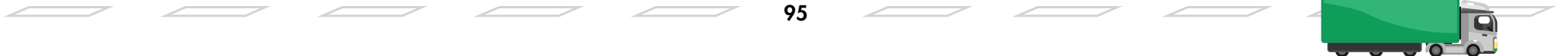
## Sample Process Flow for a SMF Operator

This is a sample table, only to be used as a reference.

Staff Designation:					
Process Name:					
Process Trigger	Performed By (Role)	Input provided by (Role)	Process Activity/Task (including technology involved)	Output	Output shared with (Role)
Vehicle stalled/ Breakdown	Mechanic	Driving Partner, Maintenance supervisor	<div>1. Nearest mechanic/ OEM/ own garage mechanic is availed for rectifying the vehicle issue as decided by the maintenance supervisor corresponding to the severity of issue.</div> <div>2. Temporary bill is given by the company for approval.</div> <div>3. Service completed.</div>	Expense bill	Payment processor and then with the accounts department



## NOTES



## NOTES







## ABOUT **AIMTC**

All India Motor Transport Congress, a non-political and not-for-profit organisation established in 1936, represents over 3,500 talukas, districts, and state-level transport associations, with over 20 crore individuals directly and indirectly involved in this sector.



## ABOUT **VASUDHA FOUNDATION**

Vasudha Foundation is a non-profit organisation set up in 2010. Our mission is to promote environment friendly, socially just, and sustainable models of energy by focusing on renewable energy and energy-efficient technologies as well as sustainable lifestyle solutions.