In our name stands for triple bottom line sustainability of people, profit and planet that we want to bring in all our internal functioning, projects we do, and industries we support. It also keeps us prompt, progressive and partnership valuing.

Manifold represents abstraction of complex problems to smaller dimension, still preserving elements which matter and are available to influence/control and also measure the system dynamics. We are ‘small data’ company and take pride in collecting and analysing most relevant data to help our clients with decisions and actions.

Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India

D5 - ZE-MHDT Roadmap

Enabling Smart & Clean Tech Markets
Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India

ZE-MHDT Roadmap Methodology

Set Target

Identify Potential policy options (Fiscal/ Non-fiscal)

Carry cost-benefit analysis of fiscal & non-fiscal incentives

Develop ZE-MHDT Roadmap

Finalize ZE-MHDT Roadmap with Industry Consultants

Potential policy options

<table>
<thead>
<tr>
<th>Policy Elements</th>
<th>Sub-elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Side</td>
<td></td>
</tr>
<tr>
<td>EVs Targets</td>
<td>Define clear EV targets with timelines</td>
</tr>
<tr>
<td>Vehicle emission standards</td>
<td>Specify a required maximum level of emissions</td>
</tr>
<tr>
<td>eEV Mandate for OEMs</td>
<td>Mandate automakers to sell minimum share of light-duty eEVs</td>
</tr>
<tr>
<td>Financial Incentives for OEMs</td>
<td>Lower production cost</td>
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<tr>
<td>Public Charging Infrastructure</td>
<td>Standardization around Public chargers</td>
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<tr>
<td>Lower Charging setup and usage cost</td>
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</tr>
<tr>
<td>Power reliability Grid Management</td>
<td>Access to required electricity supply</td>
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<tr>
<td>Define Charging Standards</td>
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</tr>
<tr>
<td>Vehicle Scrapage Battery Re-use and Recycling</td>
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</tr>
<tr>
<td>Develop guidelines for vehicle scrappage</td>
<td></td>
</tr>
<tr>
<td>Develop guidelines for battery re-use and recycling</td>
<td></td>
</tr>
<tr>
<td>Local manufacture and/or assembly</td>
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</tr>
<tr>
<td>Incentive local manufacturing of EV components</td>
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<tr>
<td>Capacity Building</td>
<td>Support R&amp;D. (Capacitation of R&amp;D institutions/grants)</td>
</tr>
<tr>
<td>Important for local ownership and sustainability</td>
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</tbody>
</table>

IETEM Model for cost-benefit analysis

Policy Elements | Sub-elements
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Demand Side</td>
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<tr>
<td>Financial incentives for users</td>
<td>Provide subsidy to lower Purchase Cost</td>
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<tr>
<td>Ease of Approvals</td>
<td></td>
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<tr>
<td>Ease and lower cost of Financing</td>
<td></td>
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<tr>
<td>Reduction in fees, taxes to lower usage cost</td>
<td></td>
</tr>
<tr>
<td>Non-financial incentives for users</td>
<td>Provide Preference to EVs (parking zones)</td>
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<tr>
<td>Market Activation</td>
<td>Mandate Parastats, Government Arms and Departments to procure EVs as service vehicles</td>
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<tr>
<td>Accurate information deployment, communication strategies and media campaigns etc (To be infused in national strategies and policy frameworks)</td>
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<tr>
<td>Home, Work and urban city slow AC Charging Infrastructure</td>
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<tr>
<td>Provide financial incentive to lower cost to ZEV Charging</td>
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<tr>
<td>Penalties</td>
<td>Penalize behaviours to drive important changes</td>
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<tr>
<td>Discourage use of fuels that generate carbon emissions through carbon tax or cap-and-trade</td>
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<tr>
<td>Others</td>
<td>Others...</td>
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</tbody>
</table>
Supply Side Target Setting

**Annual VED Phase**
- **Phase 1: (19% CO₂)**
  - 2021-22: 1,592
  - 2022-23: 2,706
  - 2023-24: 4,232
  - 2024-25: 30,093
  - 2025-26: 41,628
  - 2026-27: 67,991
  - 2027-28: 82,637
  - 2028-29: 97,956
- **Phase 2: (62% CO₂)**
  - 2022-23: 1,600
  - 2023-24: 40,000
  - 2024-25: 646
  - 2025-26: 1,592
  - 2026-27: 2,706
  - 2027-28: 4,232
  - 2028-29: 30,093
  - 2029-30: 41,628
  - 2030-31: 67,991
- **Phase 3: (19% CO₂)**
  - 2023-24: 1,000
  - 2024-25: 10,000
  - 2025-26: 120,000
  - 2026-27: 40,000
  - 2027-28: 80,000
  - 2028-29: 120,000
  - 2029-30: 0
  - 2030-31: 40,000

**Annual Preparatory Phase**
- **L&IDT**
  - 2021-22: 20,000
  - 2022-23: 40,000
  - 2023-24: 80,000
  - 2024-25: 120,000
- **M&HDT**
  - 2021-22: 20,000
  - 2022-23: 40,000
  - 2023-24: 80,000
  - 2024-25: 120,000

**Charging**
- **L&IDT**
  - 2021-22: 120,000
  - 2022-23: 120,000
  - 2023-24: 0
  - 2024-25: 0
  - 2025-26: 0
  - 2026-27: 0
  - 2027-28: 0
  - 2028-29: 0
  - 2029-30: 0
  - 2030-31: 0
- **M&HDT**
  - 2021-22: 120,000
  - 2022-23: 120,000
  - 2023-24: 0
  - 2024-25: 0
  - 2025-26: 0
  - 2026-27: 0
  - 2027-28: 0
  - 2028-29: 0
  - 2029-30: 0
  - 2030-31: 0

*VED refers to Vehicle Engineering & Development activities*

*Each gun is 60kW and 120 kW charger will have two 60 kW Gun (modular approach)*
MHDT Projections, BAU & BTB Scenarios – Annual sales

### L&IDT Sales Projections
- **CAGR 10.5%**
- **CAGR 5.25%**

### M&HDT Sales Projections
- **CAGR 4%**
- **CAGR 2%**

### L&ID ZET Projections
- BAU numbers
- BTB numbers
- BAU ZET Share
- BTB ZET Share

### M&HD ZET Projections
- BAU numbers
- BTB numbers
- BAU ZET Share
- BTB ZET Share
Electrification of MHDT – On-road Stock

### Business-As-Usual (BAU)

- **2015:** Total no. of e-Truck on-road = 0
- **2020:** Total no. of e-Truck on-road = 500,000
- **2025:** Total no. of e-Truck on-road = 3,000,000
- **2030:** Total no. of e-Truck on-road = 7,000,000

### Target - Business-To-Be (BTB)

- **2015:** Total no. of e-Truck on-road = 0
- **2020:** Total no. of e-Truck on-road = 100,000
- **2025:** Total no. of e-Truck on-road = 2,000,000
- **2030:** Total no. of e-Truck on-road = 5,000,000

**e-Truck Mix of on-road truck (%)**

- **2015:** L&IDT = 0%, M&HDT = 0%
- **2020:** L&IDT = 0%, M&HDT = 10%
- **2025:** L&IDT = 0%, M&HDT = 20%
- **2030:** L&IDT = 0%, M&HDT = 30%
Impact on CO2 emission: BAU vs BTB vs No Electrification

Well to Wheel CO2 emissions from MHDT – BAU vs BTB vs No Electrification

Up to 2040, 340 Million Tons of cumulative CO2 reduction as compared to BAU, estimated cost of which is 2.6 quadrillion INR (34 Billion USD)
Benefits of Accelerated Electrification of MHDT over BAU

- **GHG emissions reduction**
  - Short Term (2021-23): 0 kTons
  - Medium Term (2024-27): 65 kTons
  - Long Term (2028-30): 7,800 kTons

- **Fuel Consumption Reduction**
  - Short Term (2021-23): 0 Million Litres
  - Medium Term (2024-27): 66 Million Litres
  - Long Term (2028-30): 7,000 Million Litres

- Electrification has a huge role...

- **Cost savings**
  - Short Term (2021-23): 6 Million USD saved
  - Medium Term (2024-27): 65 Million USD saved
  - Long Term (2028-30): 800 Million USD saved
## Barrier Analysis

**Economical barriers**
- High e-Truck purchase cost
  - High import duties on sub-system component
  - High battery costs
  - Low volumes with minimal demand aggregation

**Technology & Market barriers**
- Low energy and power density of batteries as compared to fossil fuels
- Lack of local supply chain for e-Truck manufacturing
- No e-Truck products available in market
- ZE-Range-extender technologies (fuel cells) not matured
- Long waiting time for charging

**Awareness and Promotional Barrier**
- EV technology apprehension

**Institutional Barriers**
- Limited local capacity on automotive R&M & services

**Infrastructure barriers**
- Lack of charging infra
- Low access to grid and poor power quality

**Regulatory & Policy barriers**
- Body-building standards not yet implemented
- Vehicle scrappages policy not yet implemented
- No Battery recycling/re-use policy existing for EV
- No vehicle salvage value assurance on loan default

*Source: Stakeholder consultation*
### 1. Pilot deployment across India for generating success stories

#### 1.1 Objective
- To establish that TCO parity is possible for certain application + segment
- Develop visibility with Central and State govt. to initiate ZET Policy measures
- Develop fiscal models for financing and risk mitigation

#### 1.2 Assumptions & Success Factors
- Government funding is not considered for deployment and running for this pilot
- Adequate funding is arranged to provide e-Trucks and charging facilities free of cost to fleet operators (except electricity tariff)
- Suitable project management firm to plan, execute, run, and close the pilot
- No Govt. policy or intervention is considered for the success of the pilot

#### 1.3 Application + Segment Selection Criteria
- Adequate range per charge (e-Truck capability)
- Adequate distance per day (application demand)
- e-Truck TCO ≤ 95% of diesel truck TCO
- Real estate and power availability for charging
- High share of annual CO2 emissions
- High share of volumes (stock and sale)
- Corporate drive for ZET (EV100+ signatories, etc.)
- Adequate size of fleet to back-up e-Trucks with ICE
Pilot deployment across India for generating success stories

- Fleet of 150 L&IDT 11 Tonnes e-Trucks
- Battery Size of 124 kWh
- Charger Size 60 kW

Estimated Cost for Pilot Deployment

- INR 102 Crores (Upto $14 Million)
- INR 123 Crores (Upto $16 Million)
- INR 164 Crores (Upto $22 Million)
- INR 205 Crores (Upto $30 Million)

20 per region
30 per region
40 per region
50 per region

Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India

21 March 2022
2. Fiscal Incentives

2.1 Direct Incentives
- Zero Emission Truck technologies. Eg: High energy and power density batteries, Hydrogen economy, aluminium air, etc

2.2 Financing Scheme
- Lower interest rates on e-Truck and chargers
- Extended tenure while managing battery life
- Framework for refinancing of NBFC loan
- Depreciated value assurance
Need for Fiscal Incentives

• ZET TCO expected to won’t get parity with ICE in 2024, to get TCO parity in 2024 financing intervention will be needed from 2024 till 2025.

• To prefer ZET over ICE trucks, ZET TCO should get parity with 90% of ICE TCO.

Proposed Financing Interventions

<table>
<thead>
<tr>
<th>Interest rate subsidy</th>
<th>Extended Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 %</td>
<td>7 years</td>
</tr>
</tbody>
</table>

Considerations

• Increasing cost of diesel
• Increasing cost of electricity
• Life-time of 7 Years
• Diesel Truck re-sale value
• e-Truck no re-sale value
• Subsidised electricity tariff
Cost Impact of Fiscal Incentives and Benefits

**Increased Electricity Demand**
- 1,250 Million kWh

**Reduced Emission**
- 1,654 kTons

**Reduced Fuel Consumption**
- 3,030 Million litres

**Phase-I and Phase-II Deployment of 62,384 e-Trucks by FY 2029**

**Charging Infrastructure Requirement**
- 17,800 Charging station

**Cost to Government**
- INR 7,717 Million

- 2024-25
- 2025-26
- 2026-27
- 2027-28
- 2028-29

- Previous ZET Stock
- New Sales
- Cost on Electricity Tariff subsidy
- Cost on Financing Schemes
- Annual Cost to govt

Increased Demand and Reduced Emission:
- 1,250 Million kWh
- 1,654 kTons
- 3,030 Million litres

Charging Requirement: 17,800 Charging station

Cost to Government: INR 7,717 Million

21 March 2022
Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India
### Proposed Interventions

#### 3. Government Standard & Regulations

**3.1 Regulatory Framework**
- E-Truck operation/charging safety and security regulations to assure demand side
- Step wise plan for phasing out ICE truck registrations (starting with critical cities, other cities and pan India like BS4)
- Framework for risk assurance and liability for enabling e-truck finance
- Free national permit for ZE-Trucks for 5 years (2024-29)

**3.2 Supply Side Standardization**
- Modular Batteries
- Common minimum e-Truck specification for regulated application
- Other standardization opportunities for demand aggregation
• Plunging air quality of multiple cities will necessitate ZET mandate, which should be anticipated and phased
• ICE Truck cost rises with stringent tailpipe emission regulations, which will accelerate e-Truck price parity with ICE
• Demand aggregation for e-Truck, e-Powertrain sub-systems and charging stations will bring down e-Truck price


Source: BloombergNEF
Impact of ZET Favourable Regulations & Standards

**Demand of Diesel and Electricity**

- E-Truck adoption will decrease the consumption of diesel fuels, but total fuel consumption is still expected to grow over the years but at a slower rate. This may have impact on government revenue linked with fuel sales.
- Power distribution companies will have another source of revenue through sale of electricity for e-Truck charging.
- By 2035, the demand for diesel will fall by 60% compared to 2015 under BTB scenario.
- YOY, Well to Wheel Emission of Diesel vehicle is increasing and that of electric is decreasing, which is strongly phasing need towards electrification.
Proposed Interventions

4. Supply side plan for transition to ZET

4.1 Technology development
- Technology Road map
- International partnership with OEMs and governments
- ZET technology supplier development

4.2 Upscaling capacity
- Leveraging existing ICE truck manufacturing with e-powertrain assembly glide paths
- Decentralized assembly
- Key partnership for after market cabin and load body building

4.2 Upskilling resources
- Engineering teams for adapting and integrating ZE powertrains
- Marketing teams for effective communication of ZET benefits
- After market teams for infield support to ZET
Impact of Technology on ZET

- Higher **Energy Density** batteries → less loss of e-Truck payload capacity with respect to ICE Truck
- Higher the **Thermal runaway temperature** → safer battery
- Cheaper battery → higher e-Truck **TCO** advantage over ICE Truck
- Higher **cycle life** of battery → lower battery replacement cost over e-Truck lifetime
Proposed Interventions

5. Awareness Campaigns

5.1 Awareness Program & e-Truck Campaign

- e-Truck awareness program for Demand Side (individual, fleet) e.g., EV100+
- e-Truck awareness program for supply side
- E-Truck awareness program for Finance and insurance

5.2 Success Stories

- Forums for sharing pilots' success stories in regional language From global experiences
Requirement of effective communication

For word of mouth to happen people must talk and people will talk from listening or looking to practical experience.

India is hanging on to coal but its EV education campaign is visionary

India may appear to be stalling on climate goals, having fought to maintain coal use at the COP26 summit and setting faraway targets for cutting emissions. But it’s got one thing right: building awareness about electric vehicles.

Last week in Glasgow, India unveiled E-Amrit, a government-run portal that’s a one-stop shop for all your electric vehicle questions. From subsidies for drivers and manufacturers to charging facility locations and financing options, the goal is to boost consumer knowledge.

This is a masterstroke of sorts and will shape the EV adoption story globally. The more drivers know about their options—and the more governments can address worries about how far EVs can travel—the less likely they will be to resort to old, fossil-fuel driven habits. It’s not just about making the technology available, but equipping potential buyers with the tools to make informed decisions.

No doubt, there’s plenty of information online. But relying on various reviews, news articles and disparate sources isn’t necessarily the cleanest or easiest mode of getting details. In India, where a significant portion of oil consumption goes to motor fuel, this education campaign has the chance to make a big difference. There is a better, cleaner alternative—at the same price.

E-Mobility at a Glance

India stands at the cusp of a game-changing revolution in Electric Mobility.

ALSO READ
COP26 Glasgow 2021: What can India hope to achieve? Global banks: new decarbonisation initiative at COP26 is a step backwards UN chief says outcome of COP26 “not enough” CIL Q4 net marginally down at Rs 4.58% on declines Rs 3.5 final dividend Coal India arm NCL dispatches 36% tonnes of highest-ever coal in one day

WORD OF MOUTH...
Natural conversation between real people
ZE-MHDT Roadmap

Supply side plan for transition to ZET

1.1 Technology Development
1.2 Upskilling Resources
1.3 Upscaling Capacity

Government Standard & Regulations

2.1 Regulatory Framework
2.2 Develop Standards
2.3 Impetus to ZET Finance

Fiscal Incentives

3.1 Direct Incentives
3.2 Special Financing Schemes

Pilot deployment across India

4.1 Development Phase
4.2 Deployment Phase
4.3 Execution & Monitoring Phase

Awareness Campaigns

5.1 Awareness campaigns

<table>
<thead>
<tr>
<th>Year</th>
<th>ZE-L&amp;IDT (GVW ≤12 T)</th>
<th>ZE-M&amp;HDT (GVW &gt;12 T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021-22</td>
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<td>2029-30</td>
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<tr>
<td>2030-31</td>
<td></td>
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</tr>
</tbody>
</table>

- Launch
- Periodic Data collection and analysis
ZE-MHDT Roadmap

Supply side plan for transition to ZET

- Technology Development
- Upskilling Resources
- Upscaling Capacity

Government Standard
- Regulations for ZET charging, operational safety and security
- Develop standards for battery modularity & min ZET specs

Pilot deployment across India
- Deployment Phase
- Execution and Monitoring of Large-scale experimental ZET Deployment

Fiscal Incentives
- Tax exemptions on R&D
- Special tariff for ZET Charging
- Subsidy on Purchase (Capital/Lending rate)

Government Standard
- Regulations for ZET charging, operational safety and security
- Develop standards for battery modularity & min ZET specs

Fiscal Incentives
- Tax exemptions on R&D
- Special tariff for ZET Charging
- Subsidy on Purchase (Capital/Lending rate)

ZE-MHDT Roadmap

2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031

<table>
<thead>
<tr>
<th>Year</th>
<th>L&amp;IDT</th>
<th>LI&amp;MHDT</th>
<th>L&amp;IDT</th>
<th>LI&amp;MHDT</th>
<th>L&amp;IDT</th>
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</table>

Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India

21 March 2022

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Annexure
# Methodology for GHG Emissions Calculations

Based on the estimated MHDT growth and e-Truck mix, the GHG emission (or CO\textsubscript{2} emission) is calculated for the three scenarios (i.e., No electrification, BAU and BTB). The parameters considered in sequence for calculation of GHG emissions are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IETEM Modelling</th>
</tr>
</thead>
</table>
| Vehicle kilometres travelled (VKT) | For all scenarios:  
- VKT (for L&IDT and M&HDT) = vehicle stock x annual distance travelled  
**VKT** is the measure of the total annual distance travelled by the vehicle stock in a given year |
| Vehicle technology/fuel mix (petrol, diesel, and electricity) | Vehicle segment wise percentage distribution across fuel mix is  
- Assumed 0% electrification of truck across L&IDT and M&HDT is used up to 2035  
- Based on projection and EV sales target across L&IDT and M&HDT, the fuel mix percentage distribution is used up to 2040 as  
For BAU scenario  
- Based on EV sales target across L&IDT and M&HDT, the fuel mix percentage distribution is used up to 2040 as  
For BTB scenario  
- Based on EV sales target across L&IDT and M&HDT, the fuel mix percentage distribution is used up to 2040 as |
| Vehicle fuel efficiency | For all scenarios, vehicle fuel efficiency for the base year (2021) is shown below.  
**Fuel Efficiency**

<table>
<thead>
<tr>
<th>Year</th>
<th>ICE diesel (km/Litre)</th>
<th>BEV (km/kWh)</th>
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</thead>
<tbody>
<tr>
<td>L&amp;IDT</td>
<td>5.00</td>
<td>1.25</td>
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<tr>
<td>M&amp;HDT</td>
<td>2.50</td>
<td>0.67</td>
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</tbody>
</table>

The efficiency of vehicle in ICE will see an improvement of 0.5% Y-o-Y for every L/100km and 0.2% Y-o-Y for electric for every kWh/100km

## Methodology for GHG Emissions Calculations

<table>
<thead>
<tr>
<th>Year</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
<th>2031</th>
<th>2032</th>
<th>2033</th>
<th>2034</th>
<th>2035</th>
<th>2036</th>
<th>2037</th>
<th>2038</th>
<th>2039</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>L&amp;IDT</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
<td>13%</td>
<td>16%</td>
<td>20%</td>
<td>24%</td>
<td>28%</td>
<td>30%</td>
<td>36%</td>
<td>45%</td>
<td>54%</td>
<td>62%</td>
<td>74%</td>
<td>88%</td>
</tr>
<tr>
<td>M&amp;HDT</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0.4%</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>8%</td>
<td>12%</td>
<td>14%</td>
<td>19%</td>
<td>24%</td>
<td>30%</td>
<td>36%</td>
</tr>
</tbody>
</table>

## Well to Tank emission factor (Refer next slide)

For diesel: Emission factor is increasing due to increased energy use per barrel of crude  
For electricity: Emission due to electricity will vary based on the renewable and non-renewable share in the country

## Tank to Wheel emission factor (Refer next slide)

For diesel: Emission (KgCO\textsubscript{2} per unit (i.e., Litre (L))) is derived using the calorific value for the liquid fuel (diesel) and this is constant over year  
For electricity: It has no operational emission. Hence Tank to Wheel emission factor will be 0
Well to Tank and Tank to Wheel Emission Factor

Well to Tank Emission Factor

Tank to Wheel Emission Factor
### Number of Chargers Estimation

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
<th>2031</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total e-Truck Sales (Nos)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L&amp;IDT</td>
<td>3</td>
<td>1,015</td>
<td>2,500</td>
<td>4,250</td>
<td>8,360</td>
<td>18,464</td>
<td>33,000</td>
<td>63,217</td>
<td>92,644</td>
<td>1,25,831</td>
</tr>
<tr>
<td>M&amp;HDT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1,610</td>
<td>8,371</td>
<td>16,000</td>
<td>36,217</td>
<td>51,790</td>
<td>73,331</td>
</tr>
<tr>
<td><strong>Total no. of Trucks shared per charging point</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L&amp;IDT</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>M&amp;HDT</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total no. of Chargers to be Installed</strong></td>
<td>646</td>
<td>1,592</td>
<td>2,706</td>
<td>3,548</td>
<td>20,705</td>
<td>28,035</td>
<td>43,226</td>
<td>53,005</td>
<td>61,889</td>
<td></td>
</tr>
<tr>
<td>L&amp;IDT (60 kWh)</td>
<td>646</td>
<td>1,592</td>
<td>2,706</td>
<td>2,865</td>
<td>11,318</td>
<td>14,442</td>
<td>18,462</td>
<td>23,374</td>
<td>25,822</td>
<td></td>
</tr>
<tr>
<td>M&amp;HDT (120 kWh)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>683</td>
<td>9,387</td>
<td>13,593</td>
<td>24,764</td>
<td>29,631</td>
<td>36,067</td>
</tr>
<tr>
<td><strong>Estimated No. of Gun</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L&amp;IDT</td>
<td>646</td>
<td>1,592</td>
<td>2,706</td>
<td>2,865</td>
<td>11,318</td>
<td>14,442</td>
<td>18,462</td>
<td>23,374</td>
<td>25,822</td>
<td></td>
</tr>
<tr>
<td>M&amp;HDT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1,367</td>
<td>18,774</td>
<td>27,185</td>
<td>49,529</td>
<td>59,262</td>
<td>72,134</td>
</tr>
</tbody>
</table>

*Each gun is 60kW and 120 kW charger will have two 60 kW Gun (modular approach)*

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
<th>2031</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cumulative No. of Chargers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L&amp;IDT (60 kWh)</td>
<td>646</td>
<td>2,238</td>
<td>4,944</td>
<td>8,492</td>
<td>29,198</td>
<td>57,233</td>
<td>1,00,459</td>
<td>1,53,465</td>
<td>2,15,353</td>
<td></td>
</tr>
<tr>
<td>M&amp;HDT (120 kWh)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>683</td>
<td>10,071</td>
<td>23,663</td>
<td>48,428</td>
<td>78,059</td>
<td>1,14,126</td>
</tr>
</tbody>
</table>

### Assumption

- Average charging time for L&IDT and M&HDT is 2 hours.
- Total no. of Trucks shared per charging point = (Charging Utilization x 24)/ (Average charging time)
- Charging event is based on Charging frequency and time required for daily usage as per application
- Total No. of Chargers to be installed = (Total no. of e-Truck Sales x Charging event)/ Total no. of Trucks shared per charging point
- It is assumed that chargers should install a year ago before e-Truck deployment
Industry Assessment & Roadmap for Zero-Emission Medium and Heavy-Duty Trucks in India

TCO Trends of use-cases

11T On Road Tipper accounting 0.04% CO2 annually

11T Water Tanker accounting 0.52% CO2 annually

11T LPG Cylinder accounting 0.12% CO2 annually

19T Water Tanker accounting 0.51% CO2 annually

19T On Road Tipper accounting 0.05% CO2 annually

19T Milk Tanker accounting 0.46% CO2 annually

[Graphs showing trends of TCO (INR/ton-km) for different truck types and years]
TCO Trends of use-cases

- **29T Milk** accounting 0.88% CO2 annually
- **19T Petroleum Tanker** accounting 0.39% CO2 annually
- **19T Fish** accounting 0.94% CO2 annually
- **29T Petroleum Tanker** accounting 2.52% CO2 annually
- **40T Coal and Minerals** accounting 0.68% CO2 annually
- **29T Coal and Minerals** accounting 0.72% CO2 annually

TCO (INR/ton - km) for different use-cases over 2027 to 2030.