

EV takes the centre stage in India's Net-Zero 2070 strategy

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Introduction

The 2024 Union Budget of India highlights the electric vehicle (EV) sector as a central component of the country's sustainable development agenda. Key measures include plans to support EV manufacturing, expand charging infrastructure, and emphasize the electrification of public transport. These initiatives align with India's broader goal of **achieving net-zero emissions by 2070**. Finance Minister Nirmala Sitharaman announced a substantial ₹1 lakh crore fund to support R&D in emerging sectors, including EVs, aimed at stimulating innovation and attracting private sector investment through long-term, low-interest loans.

Nitin Gadkari, Minister for Road Transport and Highways, outlined a transformative vision for India's electric mobility future. He targets **30% EV penetration in private car sales by 2030, with higher targets for commercial vehicles and two- and three-wheelers**. Gadkari also emphasized the need for an extensive EV charging network along national highways and introduced the concept of electric highways for long-haul trucks and buses. His vision extends beyond individual vehicles to an overarching shift in transportation infrastructure, emphasizing sustainability, efficiency, and alignment with environmental goals. This approach is expected to drive substantial growth in India's EV sector, advancing the country's goal of achieving a 100% EV market in the coming decades.

In this paper we will first dissect the Indian automobile market, focusing on its segmentation and the associated viability gaps basis of which we will try to assess EV applicability for the segments. Next, we'll delve into the challenges, particularly in terms of cost of production and governance issues. Finally, some relevant questions are discussed briefly with our thoughts on the future of EV landscape.

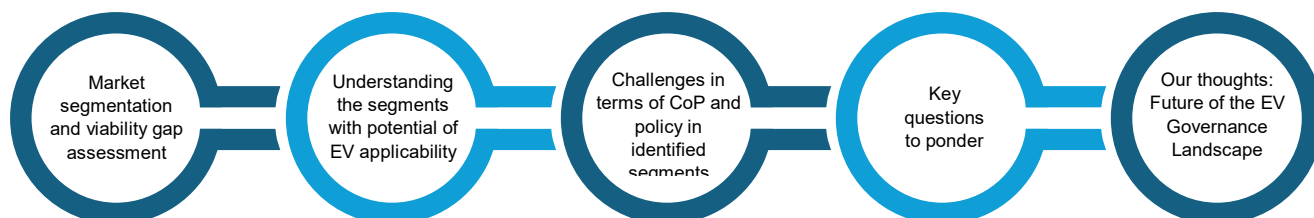


Figure 1: Key module and area of discussion

Market segmentation and viability gap assessment:

To understand the complexities of the Indian automobile market and how electric vehicles (EVs) can play a transformative role, we need to categorize the market based on product types and their applications, avg. fuel consumption, and some other crucial parameters. By doing so, we can **identify the viability gaps that each segment is associated with**.

Category	Segment	Average annual distance ('000 km)	Average annual fuel consumption ('000 L)	Technological Availability	Type of benefit
Passenger vehicle	Compact Car				
	Sedan				
	SUV				
	Luxury Car				
	Cab (Taxi, Ola, Uber)				
Commercial vehicle	LCV				
	HCV				
	Bus				
	Auto-Rickshaw				
Two-wheelers	Motorcycle/Scooter				
Agri vehicle	Tractor (Agri)				

Table 1: Segmentation of Indian automobile market

Legend 1

Distance ('000 km)	Code	Fuel consumption ('000 L)	Code	Tech availability	Code	Type of benefit	Code
Above 15		Above 5		Limited/absent		Public	
10 to 15		1 to 5		Emerging		Private	
Below 10		Below 1		Readily available			

Incentivization to encourage EV adoption would be meaningful for those segments which **covers a very high annual distance** (logically would be on top of the list in terms of fuel consumption and emission), **lagging in terms of EV tech availability** (and hence continuing with the existing petrol/ diesel/ hybrid models), and most importantly **provides a larger public benefit** (and not just limited to private usage).

As per the brief assessment, **Commercial space is the major area with considerably high viability gap, along with other segments such as Cab** (passenger vehicle, used commercially).

Understanding the segments with potential of EV applicability:

As electric vehicle (EV) technology becomes increasingly accessible, it is essential to prioritize sectors that offer the greatest potential for public benefit, emissions reduction, and cost-efficiency – and **adopt EV especially where public usage and environmental savings are highest. By targeting these high-impact sectors, governments and the businesses can achieve faster returns on investment** and accelerate the shift to a more sustainable future.

Focusing on critical vehicle segments presents a valuable opportunity to drive EV adoption in India. These segments, which have high public usage and substantial emissions reduction potential, align well with India's sustainability goals. However, EV adoption must also be economically viable for end-users, as high Total Cost of Ownership (TCO) can create a barrier. Government intervention may be necessary to address high TCO and promote adoption in these areas.

Category	Segment	ICE TCO	EV TCO (Estimated)	Rationale
Passenger vehicle	Cab (Taxi, Ola, Uber)	1x	0.9x - 1.1x	Lower due to reduced fuel and maintenance costs, but higher upfront cost. May vary based on daily usage
Commercial vehicle	LCV	1x	1.1x - 1.3x	Higher due to expensive battery tech and limited model availability. Benefits from lower operational costs but needs high daily usage to break even
	HCV	1x	1.3x - 1.5x	Significantly higher due to large battery requirements, limited range, and lack of widespread fast-charging infrastructure
	Bus	1x	0.7x - 0.9x	Lower TCO for high daily usage routes. Initial cost higher but offset by lower operational costs over time
	Auto-Rickshaw	1x	0.8x - 0.9x	Lower due to significantly reduced fuel costs and government incentives. Upfront cost slightly higher
Agri vehicle	Tractor/Farm Equipment	1x	1.4x - 1.6x	Higher due to limited EV options, high battery costs, and need for robust charging infrastructure in rural areas

Table 2: Vehicle segments with potential of EV applicability

Adopting electric vehicles (EVs) in India's agriculture sector, despite a Total Cost of Ownership (TCO) estimated to be 1.4x to 1.6x higher than traditional vehicles, is crucial for long-term sustainability. **EVs, particularly electric tractors, offer significant savings on fuel and maintenance, which can offset the higher initial costs over time.** Additionally, electric farm vehicles reduce emissions and noise pollution, benefiting both the environment and the health of rural communities. **As battery technology improves and production scales up, TCO gap will become narrow**, making EVs a more cost-effective and eco-friendly option for Indian farmers in the near future – and hence, this segment has been added in the table above.

Issues related to Cost of Production (CoP):

The high cost of production remains a significant barrier to EV adoption in India. Factors like expensive battery technology and the need for advanced materials and components often

lead to higher prices for consumers. Understanding the production cost challenges across different segments is crucial to making EVs more economically viable.

Category	Cost of production related issues
Light Commercial vehicle	<ul style="list-style-type: none"> • Battery Production Costs: Developing medium-sized batteries for LCVs is expensive, and scaling production is challenging without mass demand • Component Supply Issues: Limited production of electric drivetrains and control systems raises the cost of these specialized parts • R&D Expenses: Significant investments are required to optimize range, payload, and efficiency, increasing production costs • Supply Chain Costs: Reliance on imported EV components adds costs through tariffs, logistics, and exchange rates
Heavy Commercial vehicle	<ul style="list-style-type: none"> • High-Capacity Battery Costs: Producing large batteries for HCVs is costly due to material requirements and limited scale of production • Specialized Heavy-Duty Components: Developing heavy-duty motors and inverters for HCVs demand higher production costs • Reinforced Design Costs: Building stronger chassis and suspension systems to handle heavy batteries adds to manufacturing costs • Charging Infrastructure Investment: Producers often bear part of the infrastructure costs, which drives up the total production expense
Agri vehicle	<ul style="list-style-type: none"> • Limited Availability of Components: Specialized components like high-torque electric motors and power management systems for agri-vehicles are costly due to limited production • R&D Investment: Significant R&D is needed to ensure electric agri-vehicles can handle varied terrains and heavy loads, increasing production costs • Limited Demand and Economies of Scale: Low initial demand for electric agri-vehicles makes scaling production difficult, keeping costs high

Table 3: Vehicle segments and cost of production related issues

Issues related to Governance/Policy:

The effectiveness of EV adoption in transforming India's automobile sector is deeply linked to governance and policy. Key issues such as regulatory frameworks, infrastructure development, and government incentives significantly impact EV adoption. Examining these governance-related challenges reveals gaps in current policies and highlights areas where effective governance could enable EV adoption. The table below consolidates these issues by vehicle segment.

Category	Governance/policy related issues
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Light Commercial vehicle	<ul style="list-style-type: none"> • Lack of Targeted Subsidies for LCVs • Minimal Support for Fleet Electrification • Inconsistent Regulatory Frameworks Across States • Underdeveloped Urban Charging Networks
Heavy Commercial vehicle	<ul style="list-style-type: none"> • Inadequate Financial Incentives for HCVs to offset the high upfront costs • Slow development of high-capacity charging infrastructure • Lack of clear policies for alternative fuels • Taxation favours diesel over EVs
Agri vehicle	<ul style="list-style-type: none"> • Lack of targeted subsidies for electric farm equipment • Minimal support for retrofitting existing agri-vehicles • Limited awareness and accessibility in rural areas • Lack of incentives for manufacturers to produce electric agri-vehicles • Insufficient support for research and development in EV farming technology

Table 4: Vehicle segments and governance issues

Key questions to ponder:

The existing gap in the government's policies and the high cost of production for electric vehicles in the commercial and agricultural sectors are closely intertwined, presenting significant challenges to widespread EV adoption. Addressing these areas in tandem, are crucial for creating a sustainable and scalable EV ecosystem. The following critical questions aim to explore solutions that can bridge these gaps, reduce production costs, and accelerate the transition to electric mobility across key industries.

Category	Key Questions
Light Commercial vehicle	<ul style="list-style-type: none"> • How can the high production costs of batteries and components be lowered? • What policies can be implemented to reduce supply chain costs and reliance on imports? • How can India harmonize EV policies to streamline regulatory frameworks and promote consistent adoption of LCVs nationwide? • What measures can be taken to accelerate the development of urban charging infrastructure?
Heavy Commercial vehicle	<ul style="list-style-type: none"> • What financial incentives can be introduced to offset the high upfront costs of HCVs? • How can India speed up the development of high-capacity charging infrastructure to make HCV electrification more viable? • How can taxation policies be reformed to make EVs more financially attractive than diesel-powered HCVs, both for manufacturers and fleet operators?

Agri vehicle

- What targeted subsidies or financial support schemes can be introduced to increase the adoption of electric agricultural vehicles?
- How can policies be implemented to encourage the conversion of existing diesel agri-vehicles to electric, making the transition more accessible for farmers?
- What steps can be taken to increase awareness and accessibility of electric agricultural vehicles in rural areas?
- How can the government incentivize local manufacturers to produce e-agri vehicle components?
- What R&D grants, or funding can be introduced to support the development of efficient and affordable electric farming technology suited for India's diverse agricultural needs?

Table 5: Key Questions

Our thoughts - Future of the EV Governance Landscape:

In line with India's vision for net-zero emissions by 2070, the government has introduced multiple schemes and policies to promote e-mobility and reduce fossil fuel reliance. For Light Commercial Vehicles (LCVs), the Indian government introduced the Production-Linked Incentive (PLI) Scheme for Advanced Chemistry Cell (ACC) Battery Storage to boost domestic battery manufacturing, although some phases of this scheme have concluded. On the buyer side, the FAME India Scheme Phase II, which has largely been implemented, focused on supporting the electrification of public and shared transportation, indirectly benefiting LCVs by subsidizing vehicle costs and infrastructure. For Heavy Commercial Vehicles (HCVs), the government, through reports like NITI Aayog's "Transforming Trucking in India," emphasized the need for coordinated actions between the private and public sectors to scale up zero-emission trucking and expand charging infrastructure. Direct incentives for buyers were limited, with support primarily provided indirectly through initiatives like the Auto PLI Scheme, which is no longer ongoing, and the PM-eBus Sewa Scheme, which continues to facilitate the electrification of public fleets but not specifically HCVs.

For Agricultural Vehicles, the Indian government's policies for electrification are still in a nascent stage compared to those for other vehicle segments. The Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM-KUSUM) scheme, while primarily focused on promoting the use of solar energy in agricultural operations, such as for irrigation pumps, indirectly supports the reduction of diesel reliance in the sector. However, direct government incentives for the electrification of tractors and other agricultural vehicles remain limited.

To accelerate EV adoption in key vehicle segments such as Light Commercial Vehicles (LCVs), Heavy Commercial Vehicles (HCVs), and agri-vehicles, a combination of enhanced financial and infrastructure incentives is crucial- on the supply side as well as the buyer side.

Category	Type	Suggested Measures	Level
Light Commercial Vehicle	Supply-side	<ul style="list-style-type: none"> Enhanced R&D Grants: Increase funding for R&D in high-capacity battery technologies specifically suited to LCVs. Manufacturing Hubs: Develop battery manufacturing hubs with subsidized land and reduced tariffs on raw materials. Policy Harmonization Initiative: Introduce a central framework that aligns EV policies across states, reducing regional regulatory barriers for LCV adoption. 	Central & State
	Buyer side	<ul style="list-style-type: none"> Extended Subsidies: Offer direct subsidies for the purchase of electric LCVs, focusing on high daily usage routes Low-Interest Financing: Partner with financial institutions to provide low-interest loans or lease options for electric LCVs 	State & Private
Heavy Commercial Vehicle	Supply-side	<ul style="list-style-type: none"> ZET Manufacturing Incentives: Introduce specific incentives for Zero Emission Truck (ZET) manufacturing, including tax breaks and subsidies for setting up high-capacity battery production lines. Charging Infrastructure: Invest in high-capacity charging infrastructure along highways and in logistics hubs. 	Central
	Buyer side	<ul style="list-style-type: none"> Toll Exemptions: Offer toll exemptions for electric HCVs to reduce operational costs. Priority Lanes/Parking: Provide priority lanes and parking for electric HCVs to encourage adoption. EV-Favorable Taxation Policy: Reform existing tax structures to impose higher taxes on diesel-powered HCVs while providing tax credits for electric HCV purchases. 	Central & State
Agri-vehicle	Supply-side	<ul style="list-style-type: none"> R&D Grants: Increase funding for developing high-power, long-range EV technology for agri-vehicles. Local Manufacturing Hubs: Subsidies for setting up local manufacturing hubs to produce EV agricultural vehicles and battery systems. Retrofitting Incentives: Provide financial and technical support for retrofitting existing diesel-powered tractors and other agricultural vehicles. 	Central, State & Private

	Buyer side	<ul style="list-style-type: none"> • Power Tariff Reductions: Offer reduced power tariffs for EV charging in rural areas. • Low-Interest Financing: Partner with banks and financial institutions to provide affordable loan options for EV agricultural machinery. • Leasing Models: Provide government-backed leasing options to reduce the upfront costs for small and medium-sized farmers. 	Central, State & Private
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Table 6: Suggested government interventions

Conclusion

India stands at a transformative moment in its journey towards electrification in the automobile sector. The challenges and opportunities across vehicle segments reveal a complex interplay of governance, production costs, and infrastructure gaps. Addressing these requires a nuanced approach that leverages India's strengths while learning from global best practices.

The governance and policy framework in India, though supported by schemes like FAME II, remains inconsistent across states, creating fragmentation in the EV market. Harmonizing these policies at a national level could significantly boost adoption by reducing regulatory barriers and fostering a unified market. Similarly, policies on import duties and incentivization can address high production costs, encouraging domestic manufacturers to scale operations and achieve economies of scale.

The production cost challenges, particularly in batteries and advanced EV components, underscore the importance of investing in local R&D and creating a robust manufacturing ecosystem. China's dominance in EVs, driven by government-backed subsidies and a strong local supply chain, provides a blueprint for India. Targeted support for battery production and fostering collaboration between government and private sectors could significantly reduce costs while boosting innovation.

India's strength in the two-wheeler market, as one of the largest adopters globally, is a positive indicator of its potential. However, the gaps in rural penetration, awareness, and infrastructure need immediate attention. Expanding the charging network through public-private partnerships, as demonstrated by California, can provide a scalable solution. Similarly, agricultural EV adoption, though nascent, presents immense promise. Electric tractors and farm equipment can deliver long-term savings and environmental benefits, despite their current higher TCO. Strategic subsidies and awareness campaigns targeted at rural areas could catalyse demand in this sector. Moreover, India must take inspiration from Norway's comprehensive consumer-centric incentives and Germany's R&D investments to bridge gaps in its EV ecosystem. A strong focus on research in battery technology, coupled with a consistent nationwide push for EV adoption, will position India as a global competitor in this space.

In summary, India's path to EV leadership requires harmonizing policies, scaling local production, and investing in infrastructure and innovation. By adopting lessons from global EV leaders and tailoring them to local needs, India can overcome its challenges and unlock the full potential of electric vehicles across all sectors. A strategic and sustained effort will not only accelerate India's transition to sustainable mobility but also establish it as a key player in the global EV market, driving economic growth and environmental stewardship.