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Viksit Bharat Under Transport Electric Mobility

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***Abstract* – Deep, coordinated reforms in the areas of energy, industry, cities, 6 and government are required by India's Viksit Bharat 2047 aim. According to this analysis, if policy, funding, and infrastructure all work together, electric mobility can be a potent, all-encompassing tool that creates new industrial jobs, cleaner air, reduced greenhouse gas emissions, and increased energy security. Based on government plans (NEMMP; FAME I & II; PM-E-Bus Sewa; PLI for Advanced Chemistry Cells), major institutional reports (IEA; NITI Aayog; CEEW; WRI; TERI; World Bank), lifecycle and grid studies, and evidence at the state level, the paper summarizes findings on emissions savings, total cost of ownership, depot and charging needs, battery supply-chain risks, and institutional capacity gaps. Research indicates that electrifying high-use vehicles, such as buses and three-wheelers, results in the greatest reductions in emissions and improvements in air quality per rupee spent; those electrifying depots and coordinating with DISCOMs is necessary for dependable bus operations; and that increasing domestic battery capacity is essential to reducing reliance on imports and generating green manufacturing jobs. High upfront costs for fleets and STUs, metro-concentrated charger networks, geopolitical dangers surrounding vital minerals, and inadequate coordination between ministries and utilities are still major challenges. The analysis concluded that if electric mobility isViksit Bharat, it needs be integrated into a long-term, 2047-aligned roadmap that integrates battery circularity, innovative finance, renewable energy growth, and STU capacity building.**

Keywords: **Electric Mobility; Public Transport Electrification; Battery Manufacturing; EV Infrastructure; Energy Security; Viksit Bharat 2047**

I. INTRODUCTION

Viksit Bharat 2047 is India's grand vision to be developed nation meeting all inclusive growth, modernization of industries, urban resilience, and climate responsibility besides headline GDP targets in the year 2047. Since mobility networks affect trade flows, labour access, urban structure, energy demand and quality of the local environment, transportation policy is found at the intersectional level of these objectives. The transport of passengers in India and freight traffic is almost 90 and 65 percent through the road system, respectively, which makes road transport the mainstay of everyday economic life and urban relations. NITI Aayog, 2026; Ministry of Road Transport & Highways, n.d.) - in the case of Road transport.

With urbanisation and the increase in wage, the motorization has spread at a very high rate in the subcontinent. The number of vehicles in the country has become hundreds of millions, and two-wheelers also occupy quite a large percentage of registered cars and personal mobility vehicles. According to public registries, transport dashboards, there is constant increase in car registration year-on-year which highlights the extent of the policy dilemma. Administration: Data Analytics Portal (2013).-- (Ministry of Road Transport and Highways, n.d.). The ecological impact of motorization happens to be counter-intuitive. Most of the 13-14 per cent contribution of the transportation sector to the greenhouse-gas emissions in India is through road transport. Large urban centres regularly surpass the urban air quality standards recently set by the World Health Organisation regarding particle matter (PM 2.5), with automotive emissions being the primary source of fine particulate matter (PM 2.5) and nitrogen oxide (NO 3). Not only transport decarbonisation is thus a two-fold focus, to both climate goals and the demands of a healthy population since the resulting pollution imposes measurable financial health burdens, undermines labour productivity, and causes a secondary fiscal toll on the health systems. (Observer Research Foundation, 2023), (Council on Energy, Environment and Water, 2023)

One more valid point that deserves reconsidering the mobility paradigms is energy security. At the prevailing circumstances, India is dependent on the importation of a large share of its crude oil requirements: recent estimates believe that it is to the mid-80s percent range that its dependability on imports. This dependency leaves the national economy vulnerable to fiscal strain in relation to balance-of-payments outflows, greater vulnerability to price volatility across markets, not to mention an occurrence of geopolitical perturbation of an increasing frequency. As a result, electrification of transport has both macro-economic and environmental payoffs in that it softens the demand pressure on petroleum. Electrification complements the resilience of systems in combination with a cleaner energy mix, and, as part of a broader change of the Hydrocarbon energy base of mobility to locally produced power, complements domestic industrial requirements through programmes including Make-in-India and Atma-Nirbh-Bharat (PRS Legislative Research, 2023).

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The electric mobility initiates a paradigm shift in the value chain and generates both industrial and employment-fold opportunities. As the incumbency of internal combustion engines by electric-drivetrains is established, the strategic value of battery cells, power-electronics modules, electric motors, software control systems, and of charging infrastructure itself accumulate, both in their role as creators of green-industrial employment and in their tendency to encourage local manufacturing and research and development. The Government of India Production-Linked Incentive (PLI) scheme of Advanced Chemistry Cells (ACC) is an illustration of an industrial-policy lever that should align mobility aspirations with manufacturing and employment goals, with its unique design specifically adding to the reduction of strategic reliance on imports, and the establishment of a new-scale production of batteries within the United States of America. (Ministry of Petroleum & Natural Gas, n.d.), (Ministry of Heavy Industries,

As a matter of fact, the policy regime on EV in India has gradually evolved as an indication of a fluid interaction between the political interests of jurisdiction and the learning through small-scale interventions.. To de-risk fleet electrification for State Transport Undertakings (STUs) and private operators, the PM E Bus Sewa initiative (announced and operationalized in the 2020s) introduced a PPP Gross Cost Contract model and a Payment Security Mechanism. The National Electric Mobility Mission Plan (NEMMP) established an early institutional framing for electrification. FAME I (2015–2019) provided initial demand signals and pilot support. FAME II (2019–present) scaled incentives with a clearer focus on high-utilization vehicles. Subsidies and pilots were used to provide market signals, while later instruments aimed to institutionalize procurement and operational models that lower operational and budgetary risk. These successive instruments demonstrate a pragmatic policy learning curve. (Ministry of Heavy Industries, n.d.) – for PLI scheme for ACC battery storage, (Ministry of Heavy Industries, n.d.) – for FAME II

However, speedy and equitable electrification cannot be ensured by policy design alone. For high-utilization fleets, such as buses, three-wheelers, and commercial delivery vehicles, the total cost of ownership (TCO) calculation frequently favor's electric cars because reduced energy and maintenance expenses balance out higher upfront capital expenditure over the course of the vehicle's lifetime. However, there are still significant barriers to replacing the fleet, including expensive upfront procurement costs, restricted access to long-term financing, and the shaky credit sheets of many STUs. Many public fleets may find it difficult to turn favorable lifecycle economics into actual acquisitions without creative financing options, blended capital, or institutional structures that transfer or reduce upfront risk. (Press Information Bureau, 2026)

Equally important is infrastructure readiness. The preparedness of infrastructure is also very crucial. The modern-day system of the public charging infrastructure is heavily concentrated in big cities, thus leaving peri-urban corridors, Tier 2 and Tier 3 urban localities significantly under-provided. Bus depot electrification is a well-developed and capital-intensive task that requires to work closely with distribution utilities (DISCOMs), reasonable land use, and significant improvements in transformer and substation modernization. This is compounded in the matter of electrification of buses. With proper planning and management, incorporation of smart charging protocols, active time-of-day pricing and vehicle-to-grid (V2G) technologies can make electric vehicles multi-purpose grid contribution providers. On the other hand, unregulated charging practise may lead to the occurrence of local peak loads that cause great load pressures on the distribution networks. As a result, power utilities, municipal authori

The thought of institutional cooperation just keeps returning me to the perception that cooperating within institutions is a significant theme in both practise and literature we read. As an example, the big ministries of the government such as Heavy Industries, Power, Road Transport, Housing and Urban Affairs must collaborate with the local governments, city organisations, DISCOMs and companies to break such issues as depot renovations, charging networks and stable operations. There is still much broader reform missing, such as good governance, capacity building at state and local, and the area of clear bidding and monitoring in case we want to go large scale with electrification. As in the case of PM E Bus Sewa, we could see even its Payment Security Mechanism and Gross Cost Contract model in the real life examples of the institutional innovation that can assist in reducing the operational risk and ensure the private operators receive the payment on time. (Press Information Bureau, 2025)

The real meaning behind electrification, other than the technical specifications or policy obstacles, is the buzz that is so much on campus regarding how India is going green in its industry whilst it achieves growth and climate goals. The authors of the report we read get to buzz that electric mobility is turning into a large-scale move that can address air pollution in cities, the dependency on oil, industrial modernization, and the destruction of the environment in a single action. We reviewed the same article in school, which mentioned such policy tools as NEMMP, FAME I & II, PM-E-Bus Sewa, and the PLI Scheme as the brightest evidence that India is concerned with constructing an electric transport ecosystem. It is electrification, according to those lines, not simply a technological decision, but a means of changing the system, in which case the Viksit Bharat narrative that I have been considering perfectly fits. (Accamma and co., Viksit Bharati, Transport Electric Mobility)

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Ok, and there we have a look at the alignment of the technical, economic, governance sides. This paper in essence approaches electric mobility as a structural push towards Viksit Bharat 2047, rather than a facade technology replacement.

The target is to determine the largest infrastructure and institutional bottlenecks, estimate the environmental and economic co-benefits, consolidate the policy reforms and recommend combined efforts that can be forestalled to ensure electrification is equitable throughout India. These interventions will target the nuts and bolts related to financing, industrial policy, grid planning and workforce development. This paper will consist of an extensive literature review, international comparisons, a thematic examination of how policies have developed and their effects on the environment, a close look at the industrial and macroeconomic impacts, a case study of the states, and a final set of policy recommendations and conclusions to provide you with a clear 2047 roadmap.

II. REVIEW OF LITERATURE

Then transport electrification is the new big game the sustainability of the mobility revolution. The International Energy Agency report on Global EV Outlook (IEA, 2023) says that the world is getting closer to electric cars due to things such as tax breaks, declining battery prices and climate pledges. Electric vehicles are even cheaper than conventional gas-powered vehicles since the price of batteries has fallen by some 85 percent since 2010 (IEA, 2023).

The rapid electrification of the national fleet of public buses in China, particularly in Shenzhen, where more than 16,000 buses have already been electrified demonstrates that a rapid transition is completely achievable given a good industrial policy and a sound state backing (IEA, 2022).

Similarly, the move towards EVs in Norway, over 80% of which reported new car purchases, is an illustration of how subsidies, an extensive charging system, and increased consumer awareness can indeed speed up the transition (European Environment Agency, 2022).

The National Electric Mobility Mission Plan (NEMMP) 2013 marked the beginning of scholarly discussion in India. Its goal was to promote hybrid and electric vehicles in order to ensure national fuel security. The Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme, which was introduced in 2015, was the first policy framework to introduce structured financial incentives for the adoption of EVs (Ministry of Heavy Industries, 2015).

A 2019 study by NITI Aayog highlighted that because of their high usage rates, electrifying public transportation—especially buses and three-wheelers—would have the greatest positive effects on the environment and the economy. According to research by the Council on Energy, Environment, and Water (CEEW, 2021), electric buses are more expensive initially, but they become cost-comparable to diesel buses in 6–8 years because they require less fuel and maintenance.

In 2022, WRI India conducted an analysis of the adoption of electric buses in Indian cities, which found that lifetime emissions might be decreased by 25–35% depending on the mix of electrical sources. Moreover, TERI (2022) argues that the expansion of renewable energy must align with the rollout of EVs in order to maximize the advantages of carbon reduction.

Actually there are a few structural hitches pointed out in literature. As per the World Bank (2024), most of the charging stations are city-centric and the infrastructure readiness varies greatly from state to state in India. Strategic risks result from the fact that the supply chain of batteries is highly import-dependent, in particular being dependent on lithium and rare earths (IEA, 2023). There's also a concern about the long term viability of the policy especially with the budget constraints around the subsidies under FAME 2.0 (NITI Ayog, 2023).

Kinda feels like all the existing research just zooms in on economic feasibility/ emissions cut policy/ review one at a time. But I've noticed there's a gap it doesn't plug (throw electric mobility into the big picture of India's long-term plan for development, in particular, the Viksit Bharat 2047 vision). We really need to view transport electrification as more than just a green tweak - the rhetoric must support that in a big way of structural whole change which then mesh together with our national development goals. So, this study attempts to address this gap in the literature by putting electric mobility within the Viksit Bharat next, and examining the broad-scale economic and structural implications.

Electric mobility research spans the fields of energy systems, transportation economics, industrial policy, urban health, and governance. Electrification is increasingly framed in the literature as a structural shift that alters value chains, urban life, and national energy strategy, rather than as a limited technical solution. In order to highlight what we know, what remains unclear, and where future research should concentrate, this review integrates national policy evaluations (NEMMP; FAME I & II; PM-E-Bus Sewa; PLI for ACC), lifecycle assessments, and empirical studies on costs and grid impacts. Many people consider electric mobility as a single intervention that can address industrial modernization, pollution, and oil reliance all at once. Policy packages like the PLI for batteries, FAME, and NEMMP are examples of how that concept is put into practice.

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There are four factors which are always important when making a comparative analysis of countries and they include: local industry capabilities, financial incentives, availability of charging infrastructure and clear policy signals. During the past ten-years, the battery prices fell sharply, and EVs became much more competitive. However, price reductions are not sufficient to do it. Shenzhen has achieved its faster electrification of its buses due to the combination of local battery manufacturers, the local procurement, and solid policy support alignment; in Norway, the passenger EV explosion demonstrates that a comprehensive network of charging stations and sustained financial incentives can transform choices of consumers. According to Indian analysts, supply side programmes such as PLI of ACC should be accompanied by demand side subsidies such as FAME, where it is necessary to enhance the domestic sector as well as mitigate the risk of imports.

High-utilization vehicles, such as buses, three-wheelers, and delivery fleets, tend to become less expensive to operate over the course of their lifespan despite having higher purchase prices due to reduced electricity and maintenance expenses compared to internal combustion engine vehicles, according to empirical studies on total cost of ownership. This result clarifies why public and commercial fleets are given priority in current Indian regulations.

The results of lifespan and air-quality studies show two distinct points. First, EVs reduce tailpipe emissions, which immediately enhances the quality of the air in crowded urban areas. Secondly, the advantages to the climate are contingent on the cleanliness of the electricity supply. According to Indian lifecycle studies, electric buses can reduce lifecycle carbon emissions by between 20–35% when compared to diesel buses, with the gains increasing as the grid becomes more environmentally friendly. Where the electric buses operate, monitoring the city indicates that the level of NOx and particle concentrations is significantly reduced, which, in turn, can be translated into discernible benefits in the health of the population. In essence, however, adding renewable energy sources and switching to EVs reinforce each other; they complement each other.

That is why there are three key elements that determine whether you will be able to roll-out a charging network: the location of the chargers, the capacity of the bus depots, and the capacity of the grid to deal with the additional load. Studies indicate that the big metro areas concentrate a high number of public charges leaving behind smaller cities and towns. You require land, transformer modernization and earnest liaison between the utility companies--a capital-consuming procedure when electrifying a depot. The uncontrolled charging may cause local peaks in the suffering of the network, whereas the smart charging, time-of-use rates, and vehicle-to-grid technologies have the capability to calm the demands and even provide grid services. Because of this, the literature continues to indicate that transportation agencies, DISCOMs, and city authorities have to make concerted efforts in planning.

Battery supply chain strategic fragility is a constant concern to me and even most of my classmates. The supply shocks affect countries with little domestically available reserves especially due to the high spatial concentration of the critical minerals and the manufacturing of cells. PLI of the Advanced Chemistry Cells in India is not only a law but also meant to bring it to our country so that we depend less on imports.Scholars also emphasise the fact that it is critical to diversify the technology including solid-state or sodium-ion batteries and develop markets in recycling and second-life to bridge the material loop. They believe that policy instruments like recycling incentives and the extension of producer responsibility are likely to be essential in order to transform a circular economy into a viable economic process.

State transportation projects often meet the same practical deadlocks that conceptualise the electrification process, such as poor balance sheets, difficulty in securing long-term funding, and lack of the technological expertise required to manage batteries and to electrify the depot. Regulations have recently attempted to remedy this, with the Gross Cost Contract under the PM,-E-, SeuraSewa and the Payment Security Mechanism an attempt to mitigate the operational and financial risk to which the privately operated and STUs are exposed. Nevertheless, the literature continues to call out the need to have additional innovative sources of finance, including green bonds, blended finance, multilateral funding, and up-skilling, including procurement knowledge, performance-based contracting, and battery-care training to jump over the cost barrier at the front end.

Private purchasers continue to face behavioural hurdles, such as range anxiety, worries about battery life, and concerns about resale value. Concerns about equity are also prevalent: electrification runs the danger of exacerbating regional imbalances if charging infrastructure and incentives continue to be concentrated on large cities. To increase demand and confidence across socioeconomic levels, the research suggests public awareness campaigns, incentives for non-metropolitan areas, and focused pilots.

III. PROBLEM STATEMENT

One of the main causes of the nation's urban air pollution, greenhouse gas emissions, and fossil fuel consumption is the transportation industry. The main causes of the increase in cars on the road, particularly diesel-powered buses and private automobiles, are urbanisation, population growth, and the need for mobility. According to the CPCB (2022), the degradation of air quality in the

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cities of the country, which is an environmental health concern, is primarily caused by transport pollution. At that, I have witnessed how our economy and energy security in the country are at stake due to the fact that we continue to rely on the imported crude oil.

The Indian government has introduced a number of programmes to encourage the use of electric vehicles within the country. Various electric car initiatives have been introduced by the Government of India, including the Production Linked Incentive (PLI) and the Faster Adoption and Manufacturing of Electric Vehicles (FAME) (Ministry of Heavy Industries, 2019; Government of India, 2021). Electric vehicles, in particular, the use of electric buses can be seen as one of the key solutions to the transport issue faced by the nation and potentially benefit the country in the long run. The electric buses could be more beneficial in the long term (The International Energy Agency, 2022).

The expensive price of electric vehicles, the inadequacy of infrastructure, technological hiccups, the debt crisis which public transportation organisations struggle with, and the alignment between state and federal policies are only some of the obstacles that electric buses and the vehicles must avoid despite the pushing by the government. The process of the implementation of electric buses in urban areas is still on its initial piano exercise, and the adoption progress is rather variable.

This study is really important to understand how the law of electric-mobility is working in the reality and how the implementation of the electric buses is going in the cities of India. We have already read a tonne on the policy framework and tech breakthroughs but still there is a huge missing piece of this how it all works on the ground whether in cities like Delhi, Mumbai, and Telangana and how the country moves to electric other than normal fuel.

IV. ANALYSIS & DISCUSSION

This paper to examine the real-life experiences of electric mobility policies in India using illustrations of three cities of Delhi, Mumbai, and Telangana. Through these cities, I will be able to observe the process of the introduction of electric buses and get an idea of how legislation, finances, and new infrastructure are pushing the population towards a cleaner means of transportation.

The Electric Vehicle Policy of Delhi, which was implemented in 2020, actually predetermined the electric mobility in this city. It addresses electric car incentives, subsidies on charging stations and electric bus purchase targets. All these pieces culminate in the policy, and it becomes a very illustrative example of how a city can advance to the electric transport.As mentioned by the Delhi Transport Department (2023), the city is currently striving to reduce diesel consumption and air pollution by intensively reaching its key routes with more electric buses. The aim is to ensure that the use of public transport is clean, efficient, and less pollutant.According to the deployment reports, these electric buses have reduced the operating emissions and provided the commuters with a smoother and quieter ride. It is a practical advantage that will demonstrate how the policy affects the daily travel.The success storey of Delhi highlights the importance of coordination of institutions, the existence of financial incentives, and the need to remain institutionally dedicated to having a truly serious approach towards policy. I think that these are the reasons which allow making a successful transition to electric public transport.
This paper examines the way the electric mobility policies are being realized in India, based on a handful of case studies of Delhi, Mumbai and Telangana. With these cities as a target, I will be able to identify multiple aspects where the acceptance of electric buses takes place and get a clearer sense of how legislation, budget, and new infrastructure are pushing individuals towards more eco-friendly transportation.

The electric mobility in Delhi was literally inaugurated in 2020 with the launch of its Electric Vehicle Policy. It includes the electric cars incentives, electric charging stations subsidies, and electric bus purchase targets. All those compositions culminate in the policy, which can be seen as a good illustration of how a city can go on with the application of electric transport.As the Delhi Transport Department (2023) notes, the city has been actively attempting to reduce the consumption of diesel and enhance air quality by bringing a larger number of electric buses to the major routes. The idea is to transform transit into complying with clean air and make it efficient besides minimizing pollution.

According to the deployment reports, these electric buses have reduced operating emissions and provided commuters with a smoother and quiet ride. It is a practical reward that demonstrates the effective implications of the policy on the daily commute.The success story of Delhi highlights the significance of the institutions coordination, the existence of financial incentives as well as remaining firmly obligated to policy. To my mind, these aspects are what allow shifting to electric public transport smoothly.

V. RESEARCH GAP

The corpus of literature on the topic of electric mobility in India has three major gaps:

- First , To begin with preponderance of studies examines EV adoption independently by either analyzing a fiscal cost-benefit appraisal or examining the opportunities of mitigating the emission. Viksit Bharat 2047's larger developmental narrative does not adequately incorporate electric transportation.
- Second, although it is acknowledged that electrification of public transport is essential, little research has been

done on the institutional governance issues that State Transport Undertakings (STUs) face during this shift.
- Third, the simultaneous contributions of electric mobility to industrial strategy, job creation, and energy diversification are not adequately evaluated.

Thus, the goal of this study is to present a multifaceted assessment of electric mobility as a tool for development.

Objectives of the Study

The primary objectives of the research are: 1. To analyze the environmental impact of transport electrification. 2. To evaluate the economic and industrial implications of EV adoption. 3. To study the contribution of electric mobility toward achieving Viksit Bharat, 2047.

VI. METHODOLOGY

The qualitative research design used in this study is bolstered by the analysis of secondary data. The approach comprises a methodical evaluation of:

- Government policy documents (PLI ACC Scheme, PM-E-Bus Sewa, FAME I & II)
- Reports from institutions (NITI Aayog, CEEW, WRI India, TERI, IEA)
- Publications from scholarly journals about sustainability and transportation economics
- verified national news outlets.

Thematic analysis was conducted in five analytical categories:

- The Development of Policies and Governance
- The effects on the environment
- Impact on Industry and the Economy
- Infrastructure as well as Grid Readiness
- Challenges in Institutions and Implementation

In order to guarantee the veracity of the data from several sources, triangulation was used.

VII. EVOLUTION OF INDIA'S ELECTRIC MOBILITY POLICY FRAMEWORK

India's electric mobility did not appear overnight; rather, it developed over time as a result of a staged policy architecture influenced by industrial strategy, environmental challenges, and energy security concerns.

10.1. Mission Plan for National Electric Mobility (NEMMP), 2013

India's first comprehensive plan to promote electric and hybrid vehicles was the National Electric Mobility Mission Plan (NEMMP) 2020. The Ministry of Heavy Industries launched the NEMMP in 2013 with the goal of lowering the use of liquid petroleum in the transportation sector in order to achieve national fuel security.

Three significant structural issues were identified by the policy:

- Growing reliance on oil imports
- Growing emissions from vehicles
- The necessity of competitive domestic manufacturing

NEMMP established the institutional framework for subsequent initiatives by designating electric mobility as a national priority, despite the program's initial lack of strong financial support.

FAME I (2015–2019)

With an initial investment of ₹895 crore, the Faster Adoption and Manufacturing of Electric Vehicles (FAME I) program was launched in 2015 (Ministry of Heavy Industries, 2015). The plan was centered around:

- Encouragement of demand for electric buses, three-wheelers, and two-wheelers
- Projects to pilot charging infrastructure
- Development of technical platforms

Despite encouraging early adoption, FAME I's influence was limited because:

- Insufficient consumer awareness
- High initial prices for cars
- Inadequate facilities for charging

It did, however, act as a catalyst for the development of early market signals and the promotion of private sector involvement.

10.3 FAME II (2019 – PRESENT) India's EV policies underwent a structural change with FAME II. Financial incentives were greatly enhanced, especially for the electrification of public transport, with an expenditure of 10,000 crore (Ministry of Heavy Industries, 2019).

Key attributes:

- Incentives for more than 7,000 electric buses
- Encouragements for one million electric motorcycles
- financial assistance for charging infrastructure
- Pay attention to shared mobility and commercial vehicles.

FAME II acknowledged that, compared to electrifying individual cars, electrifying high-utilization vehicles like buses and three-wheelers will result in a larger pollution reduction per rupee spent.

According to NITI Aayog (2022), FAME II significantly increased the number of electric two-wheelers, which accounted for more than half of all EV registrations in 2023. Subsidy changes in 2023, however, revealed the vulnerability of demand-driven incentives, underscoring the necessity of long-term policy certainty.

PM-E-Bus Sewa Scheme (2023)

One of the most comprehensive electrification initiatives for public transport in India is the PM-E-Bus Sewa scheme. It was announced in 2023 and uses a Public-Private Partnership (PPP) approach to deploy 10,000

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electric buses in 169 cities (Ministry of Housing and Urban Affairs, 2023).

Distinctive Qualities

- The Gross Cost Contract (GCC) model
- Mechanism for Secure Payments (PSM)
- focused electrification in cities in tiers two and three
- Prioritize inclusive urban mobility

In contrast to previous programs, PM-e-Bus Sewa reduces financial risk exposure for State Transport Undertakings (STUs), emphasizing operational sustainability. Investor trust is increased since the Payment Security Mechanism guarantees prompt payments to private operators. This signifies a shift from adoption fueled by subsidies to institutionalized electrification.

Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells

The development of the EV ecosystem is heavily reliant on battery manufacture. Currently, China is the main source of India's significant reliance on imported lithium-ion cells (IEA, 2023).

In order to tackle this issue, the government launched the ₹18,100 crore Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells (Government of India, 2021).

The PLI program seeks:

- Encourage the production of cells within the country.
- Reduce reliance on imports
- Increase the level of industrial competition
- Create jobs

Electric mobility is more relevant to Viksit Bharat thanks to this industrial policy integration, which also ties it with Make in India and Atma Nirbhar Bharat goals.

VIII. ENVIRONMENTAL IMPACT OF TRANSPORT ELECTRIFICATION

Reduction in Greenhouse Gas Emissions Transport is responsible for 13-14% of India's total greenhouse gas emissions (Mo EFCC, 2021). Almost 90% of these emissions are caused by road transport alone.

Electric buses have zero tailpipe emissions. Although the mix of electricity generation determines indirect emissions, India's renewable capacity has surpassed 170 GW (Ministry of New and Renewable Energy, 2023), improving the grid electricity's emission intensity.

WRI India (2022) estimates that replacing a diesel bus with an electric bus can cut lifecycle carbon emissions by 20-35%, depending on the extent of renewable integration.

Due to their dominance in urban mobility, electrification of two- and three-wheelers produces even stronger proportional benefits.

Urban Air Quality Improvement

Particulate matter (PM2.5) and nitrogen oxides (NOx), two of the main causes of respiratory disorders, are greatly increased by vehicle emissions.

According to the Central Pollution Control Board (CPCB, 2022), transportation-related pollutants are responsible for around 25–30% of urban PM concentrations in major Indian cities.

In high-density corridors, electric buses directly improve air quality by eliminating exhaust emissions from combustion.

According to the Delhi Transport Department (2023), the implementation of electric buses in Delhi under the Delhi Electric Vehicle Policy (2020) has shown quantifiable improvements in local air quality along important routes.

Alignment with India's Net Zero 2070 Commitment

India pledged to attain net zero emissions by 2070 at COP26. In order to meet intermediate goals under India's Nationally Determined Contributions (NDCs), transport electrification is essential.

Rapid EV adoption coupled with the increase of renewable energy could considerably slow India's oil demand growth trajectory, according to the IEA (2023).

Therefore, electric mobility serves as a tool for climate diplomacy in addition to being an urban policy intervention.

Economic and Industrial Impact of Electric Mobility

Electric vehicles are more than just an environmental change. According to the Viksit Bharat framework, it is a structural economic change that can impact employment creation, industrial growth, macroeconomic stability, and technological aptitude.

Reduction in Oil Import Dependency and Macroeconomic Stability

More than 85% of India's crude oil is imported (Ministry of Petroleum and Natural Gas, 2023). Almost 40% of the nation's petroleum product use is related to transportation. Due to this structural dependence, the Indian economy is vulnerable to pressures from trade imbalances, geopolitical concerns, and fluctuations in the price of oil globally.

For instance, India's current account deficit grows, inflationary pressures rise, and fiscal subsidies put a burden on public finances during times of global petroleum price surges. The demand for petrol and diesel

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decreases when transportation is electrified, increasing energy diversification.

Widespread EV adoption might cut total oil imports by billions of dollars by 2030, claims NITI Aayog (2023). Long-term energy sovereignty is improved when electric mobility is combined with the growth of renewable energy. Under the Viksit Bharat vision, energy independence is a critical pillar. Therefore, transport electrification contributes directly to macroeconomic resilience.

Total Cost of Ownership (TCO) Advantage

The high initial cost of capital is one of the main objections to electric mobility. For instance, the initial cost of purchasing an electric bus is substantially more than that of a diesel bus. Lifecycle economic study, however, paints a different image. CEEW (2021) compared the total cost of ownership of diesel and electric buses during ten to twelve years of operation. Results show:

- Reduced fuel expenses per kilometer
- lower maintenance costs because there are fewer moving components
- Reduced wear and tear on mechanics
- Decreased downtime

When it comes to long-term operations, electric buses are more cost-effective than diesel buses, sometimes even more so.

Similarly, because power costs per km are lower than those of gasoline, electric two-wheelers exhibit significant TCO advantages (NITI Aayog, 2022). Though the capital initial investment cost may still be significant, the economics of operation are increasingly agreeing on the use of electrification, especially on high-utilisation fleets like bus and parcel delivery vehicles.

Industrial Development and Manufacturing Ecosystem

Industrial policy is closely related to electric transportation. Value creation is shifted as a result of the switch from internal combustion engine to electric vehicles toward:

- Production of batteries
- Electronics for power
- Integration of software
- Manufacturing of charging infrastructure
- Systems for storing energy

Establishing indigenous battery manufacturing capacity is the goal of the ₹18,100 crore Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells (Government of India, 2021). This improves technological competitiveness and lessens reliance on imports. In order to draw in investment, a number of governments have also implemented EV manufacturing policies, such as Tamil Nadu, Karnataka, and Maharashtra.

By 2030, the EV industry in India is expected to provide millions of direct and indirect jobs in the manufacturing, research, battery recycling, and charging infrastructure sectors, according to Invest India (2023).

As a result, electric mobility supports structural industrial modernisation under Viksit Bharat and is consistent with the "Make in India" and "Atma Nirbhar Bharat" programs.

Employment Generation Potential

The automobile industry's employment landscape is altered by the move toward electric mobility. Although employment in traditional ICE production may eventually decrease, new opportunities arise in:

- Manufacturing of batteries
- Installation of charging infrastructure
- Telematics services and software
- Systems for fleet management
- Engineering integration for renewable energy

The EV ecosystem has the potential to create significant green job possibilities if skill development programs are encouraged, according to the Skill Council for Green Jobs (2022).

To prevent the displacement of workers who are now reliant on the ICE manufacturing and maintenance industries, workforce transition planning is still crucial.

Infrastructure and Grid Readiness

Electric mobility cannot scale without parallel infrastructure expansion. Charging infrastructure and grid integration remain critical determinants of adoption success.

Infrastructure Development for Charging

According to the Ministry of Power (2023), the majority of India's public EV charging stations are located in major cities like Delhi, Mumbai, Bengaluru, and Hyderabad. Cities in Tiers 2 and 3 have infrastructure deficiencies.

The following depot-based charging infrastructure is necessary for electric buses:

- Distribution of land
- Capacity of transformed
- Installing apparatus for charging

Project financing approaches under PM- E-Bus Sewa include some integration of charging infrastructure charges. However, coordination of the power supply and land acquisition continue to be implementation difficulties. The Ministry of Power's updated charge rules (2023) encourage time-of-day prices to maximize electricity usage and allow private sector involvement.

Difficulties with Grid Integration

The demand for power rises with extensive electrification. Long-term forecasts indicate a considerable increase in the

load on distribution firms (DISCOMs), despite the fact that EV penetration is still relatively low at the moment.

In many states, the electricity distribution industry in India is already experiencing financial strain. EV demand spikes could put a burden on infrastructure in the absence of smart charging solutions and grid upgrades.

Demand balancing is possible, though, thanks to controlled charging, vehicle-to-grid (V2G) technologies, and renewable energy integration.

Coordinated grid planning, according to NITI Aayog (2022), can turn EVs from load stresses into assets that stabilize the system.

State-Level Case Studies
Delhi Delhi's 2020 Electric Vehicle Policy is regarded as one of India's most innovative state-level regulations. The city has implemented incentives for electric two-wheelers and a growing fleet of electric buses. (Government of NCT of Delhi, 2020; NITI Aayog, 2022).

Electric buses operate on important routes, lowering diesel usage and enhancing the commuter experience.(Delhi Transport Department, 2023).
Delhi's model exhibits a strong dedication to politics and a coherent set of policies. (WRI India, 2022).

Mumbai, the BEST Project Under FAME II incentives, the Brihanmumbai Electric Supply and Transport (BEST) Undertaking has steadily increased the number of electric buses in its fleet. (Ministry of Heavy Industries, 2019; Asian Development Bank, 2020).The electrification model of Mumbai places a strong emphasis on public transport system financial restructuring and integration with urban development. (WRI India, 2022).

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Comparative Analysis Internationally
China, Shenzhen Within a few years, Shenzhen powered all its public buses thanks to a robust industrial policy and the ability to produce batteries (IEA, 2022).

The achievement shows how crucial coordinated policy, robust local manufacturing, and fiscal support are.

The Norwegian Fiscal incentives, the growth of charging infrastructure, and consumer knowledge are the main drivers of Norway's EV adoption success (European Environment Agency, 2022).

Norway can serve as a good example of the efficacy bestowed by the long-term and stable policy frameworks, despite the fact that one is compelled to admit the significantly different economic conditions under which India was operating. The worry about the availability of charging infrastructure, battery duration, residual value, and range anxiety are also an issue of concern and major impediments to consumers. The improvement in confidence within the industry requires incorporation of powerful public awareness initiatives and specific demonstration programmes.

Critical Challenges and Structural Barriers
Although the benefits of electric mobility, both economical and environmental, are manifold, there are many structural barriers to the broad adoption of electric mobility in India. This makes it necessary to avoid over-confident speculations and make a strong, critical evaluation of the secret difficulties breathing.

Expensive Initial Capital Expenses
When it comes to procurement, electric buses are substantially more expensive than diesel buses. State Transport Undertakings (STUs) frequently have debt loads and liquidity issues, despite potentially cheaper lifespan costs. Due to their financial losses, many STUs are unable to invest in new technologies without central support (NITI Aayog, 2023).
Innovative PPP concepts and long-term finance strategies are therefore crucial.

Battery Supply Chain Dependence India is mostly dependent on imports for lithium-ion cells since it lacks substantial lithium reserves (IEA, 2023). Dependency on raw materials persists as a risk despite the PLI scheme's objective to support indigenous industry.

Strategic risk is created by the geopolitical concentration of rare earth and lithium resources in a small number of nations. Battery recycling, alternative chemistries, and multinational collaborations are therefore essential.

Infrastructure Inequality for Charging
Metropolitan areas continue to have the majority of charging infrastructure. Semi-urban and rural regions are lagging behind.In the absence of fair infrastructure distribution, electric mobility may turn into an urban-centric change that restricts Viksit Bharat's inclusive development objectives.

Financial Stress in Grid and DISCOM
A number of states are experiencing financial shortfalls in their power distribution businesses (DISCOMs). EV adoption on a large scale raises electricity demand and can necessitate system modifications.

Electrification could lead to localized grid stress if smart charging, load control, and renewable integration measures are not put into place.

Coordination Gaps in Institutions

Multiple ministries are involved in the electric mobility policy:

Implementation delays may result from coordination gaps between

- Ministry of Heavy Industries,
- Ministry of Power,
- Ministry of Road Transport,
- Ministry of Housing
- Urban Affairs in state governments.

Cities that come under the jurisdiction of state governments constitute a contentious field of academic research, where the interactions of city policy meet with extended state-wide control systems. The confidence of investors requires timely payment of subsidies and introduction of open tendering systems, which will ensure that the environment is created in a way that promotes long-term inflow of capital.

Social and Behavioral Barriers

Fears regarding charging accessibility, charge life, resale value, and range anxiety are still barriers to consumers. Public awareness efforts and demonstration projects must be conducted in order to build some confidence.

Policy Recommendations

The effective merging of strategic reforms is critical to the achievement of the goal that electric transport makes significant contributions to the proposed Viksit Bharat 2047.

Long-Term Integrated EV Roadmap. India wants a roadmap aligned with 2047 that includes EV adoption, renewable energy expansion,battery recycling ecosystems, and grid modernization. To attract long-term private investment, policies must be stable.

Strengthening Domestic Battery Ecosystems

- Accelerate installation of PLI.
- Encourage solid-state and sodium-ion battery research.
- Create structures for the recycling and circular economy.
- Promote strategic international alliances in the mining industry
- Reducing reliance on imports improves economic resilience.

Innovation in Finance Introduce green mobility bonds, multilateral climate finance, and blended financing options to alleviate the budgetary pressure on government budgets. Large-scale electrification of public transport can be supported by international financial institutions.

Capacity Building for State Transport Enterprises. Educate technicians on fleet optimization, battery management, and EV maintenance. The transition will go more smoothly if institutional competency is strengthened.

Expanding Equitable Infrastructure Ensure that charging infrastructure is deployed beyond urban areas into tier 2 and tier 3 cities. Encourage private industry involvement in charging networks.

Integration with Renewable Energy Encourage solar-powered depots, time-of-day rates, and vehicle-to-grid trial initiatives. This lessens grid strain and improves the environmental impact.

One of the main causes of the nation's urban air pollution, greenhouse gas emissions, and fossil fuel consumption is the transportation industry. The main causes of the increase in cars on the road, particularly diesel-powered buses and private automobiles, are urbanisation, population growth, and the need for mobility. According to the CPCB (2022), the degradation of air quality in the cities of the country, which is an environmental health concern, is primarily caused by transport pollution. At that, I have witnessed how our economy and energy security in the country are at stake due to the fact that we continue to rely on the imported crude oil.

The Indian government has introduced a number of programmes to encourage the use of electric vehicles within the country. Various electric car initiatives have been introduced by the Government of India, including the Production Linked Incentive (PLI) and the Faster Adoption and Manufacturing of Electric Vehicles (FAME) (Ministry of Heavy Industries, 2019; Government of India, 2021). Electric vehicles, in particular, the use of electric buses can be seen as one of the key solutions to the transport issue faced by the nation and potentially benefit the country in the long run. The electric buses could be more beneficial in the long term (The International Energy Agency, 2022).

The expensive price of electric vehicles, the inadequacy of infrastructure, technological hiccups, the debt crisis which public transportation organisations struggle with, and the alignment between state and federal policies are only some of the obstacles that electric buses and the vehicles must avoid despite the pushing by the government. The process of the implementation of electric buses in urban areas is still on its initial piano exercise, and the adoption progress is rather variable.

This study is really important to understand how the law of electric-mobility is working in the reality and how the implementation of the electric buses is going in the cities of India. We have already read a tonne on the policy framework and tech breakthroughs but still there is a huge

missing piece of this how it all works on the ground whether in cities like Delhi, Mumbai, and Telangana and how the country moves to electric other than normal fuel.

Analysis & Discussion

This paper to examine the real-life experiences of electric mobility policies in India using illustrations of three cities of Delhi, Mumbai, and Telangana. Through these cities, I will be able to observe the process of the introduction of electric buses and get an idea of how legislation, finances, and new infrastructure are pushing the population towards a cleaner means of transportation.

The Electric Vehicle Policy of Delhi, which was implemented in 2020, actually predetermined the electric mobility in this city. It addresses electric car incentives, subsidies on charging stations and electric bus purchase targets. All these pieces culminate in the policy, and it becomes a very illustrative example of how a city can advance to the electric transport.As mentioned by the Delhi Transport Department (2023), the city is currently striving to reduce diesel consumption and air pollution by intensively reaching its key routes with more electric buses. The aim is to ensure that the use of public transport is clean, efficient, and less pollutant.According to the deployment reports, these electric buses have reduced the operating emissions and provided the commuters with a smoother and quieter ride. It is a practical advantage that will demonstrate how the policy affects the daily travel.The success storey of Delhi highlights the importance of coordination of institutions, the existence of financial i

This paper examines the way the electric mobility policies are being realized in India, based on a handful of case studies of Delhi, Mumbai and Telangana. With these cities as a target, I will be able to identify multiple aspects where the acceptance of electric buses takes place and get a clearer sense of how legislation, budget, and new infrastructure are pushing individuals towards more eco-friendly transportation.

The electric mobility in Delhi was literally inaugurated in 2020 with the launch of its Electric Vehicle Policy. It includes the electric cars incentives, electric charging stations subsidies, and electric bus purchase targets. All those compositions culminate in the policy, which can be seen as a good illustration of how a city can go on with the application of electric transport.As the Delhi Transport Department (2023) notes, the city has been actively attempting to reduce the consumption of diesel and enhance air quality by bringing a larger number of electric buses to the major routes. The idea is to transform transit into complying with clean air and make it efficient besides minimizing pollution.

According to the deployment reports, these electric buses have reduced operating emissions and provided commuters with a smoother and quiet ride. It is a practical reward that demonstrates the effective implications of the policy on the daily commute.The success story of Delhi highlights the significance of the institutions coordination, the existence of financial incentives as well as remaining firmly obligated to policy. To my mind, these aspects are what allow shifting to electric public transport smoothly.

Research Gap

The corpus of literature on the topic of electric mobility in India has three major gaps:

First , To begin with preponderance of studies examines EV adoption independently by either analyzing a fiscal cost-benefit appraisal or examining the opportunities of mitigating the emission. Viksit Bharat 2047's larger developmental narrative does not adequately incorporate electric transportation.

Second, although it is acknowledged that electrification of public transport is essential, little research has been done on the institutional governance issues that State Transport Undertakings (STUs) face during this shift.

Third, the simultaneous contributions of electric mobility to industrial strategy, job creation, and energy diversification are not adequately evaluated.
Thus, the goal of this study is to present a multifaceted assessment of electric mobility as a tool for development.

Objectives of the Study

The primary objectives of the research are: 1. To analyze the environmental impact of transport electrification. 2. To evaluate the economic and industrial implications of EV adoption. 3. To study the contribution of electric mobility toward achieving Viksit Bharat, 2047.

Methodology

The qualitative research design used in this study is bolstered by the analysis of secondary data. The approach comprises a methodical evaluation of:

- Government policy documents (PLI ACC Scheme, PM-E-Bus Sewa, FAME I & II)
- Reports from institutions (NITI Aayog, CEEW, WRI India, TERI, IEA)
- Publications from scholarly journals about sustainability and transportation economics verified national news outlets.

Thematic analysis was conducted in five analytical categories:

- The Development of Policies and Governance
- The effects on the environment
- Impact on Industry and the Economy
- Infrastructure as well as Grid Readiness
- Challenges in Institutions and Implementation

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In order to guarantee the veracity of the data from several sources, triangulation was used.

Evolution of India's Electric Mobility Policy Framework

India's electric mobility did not appear overnight; rather, it developed over time as a result of a staged policy architecture influenced by industrial strategy, environmental challenges, and energy security concerns.

Mission Plan for National Electric Mobility (NEMMP), 2013

India's first comprehensive plan to promote electric and hybrid vehicles was the National Electric Mobility Mission Plan (NEMMP) 2020. The Ministry of Heavy Industries launched the NEMMP in 2013 with the goal of lowering the use of liquid petroleum in the transportation sector in order to achieve national fuel security.

Three significant structural issues were identified by the policy:

- Growing reliance on oil imports
- Growing emissions from vehicles
- The necessity of competitive domestic manufacturing

NEMMP established the institutional framework for subsequent initiatives by designating electric mobility as a national priority, despite the program's initial lack of strong financial support.

FAME I (2015–2019)

With an initial investment of ₹895 crore, the Faster Adoption and Manufacturing of Electric Vehicles (FAME I) program was launched in 2015 (Ministry of Heavy Industries, 2015). The plan was centered around:

- Encouragement of demand for electric buses, three-wheelers, and two-wheelers
- Projects to pilot charging infrastructure
- Development of technical platforms

Despite encouraging early adoption, FAME I's influence was limited because:

- Insufficient consumer awareness
- High initial prices for cars
- Inadequate facilities for charging

It did, however, act as a catalyst for the development of early market signals and the promotion of private sector involvement.

FAME II (2019 – PRESENT) India's EV policies underwent a structural change with FAME II. Financial incentives were greatly enhanced, especially for the electrification of public transport, with an expenditure of 10,000 crore (Ministry of Heavy Industries, 2019).

Key attributes:

- Incentives for more than 7,000 electric buses
- Encouragements for one million electric motorcycles
- financial assistance for charging infrastructure
- Pay attention to shared mobility and commercial vehicles.

FAME II acknowledged that, compared to electrifying individual cars, electrifying high-utilization vehicles like buses and three-wheelers will result in a larger pollution reduction per rupee spent.

According to NITI Aayog (2022), FAME II significantly increased the number of electric two-wheelers, which accounted for more than half of all EV registrations in 2023. Subsidy changes in 2023, however, revealed the vulnerability of demand-driven incentives, underscoring the necessity of long-term policy certainty.

PM-E-Bus Sewa Scheme (2023)

One of the most comprehensive electrification initiatives for public transport in India is the PM-E-Bus Sewa scheme. It was announced in 2023 and uses a Public-Private Partnership (PPP) approach to deploy 10,000 electric buses in 169 cities (Ministry of Housing and Urban Affairs, 2023).

Distinctive Qualities

- The Gross Cost Contract (GCC) model
- Mechanism for Secure Payments (PSM)
- focused electrification in cities in tiers two and three
- Prioritize inclusive urban mobility

In contrast to previous programs, PM-e-Bus Sewa reduces financial risk exposure for State Transport Undertakings (STUs), emphasizing operational sustainability. Investor trust is increased since the Payment Security Mechanism guarantees prompt payments to private operators. This signifies a shift from adoption fueled by subsidies to institutionalized electrification.

Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells

The development of the EV ecosystem is heavily reliant on battery manufacture. Currently, China is the main source of India's significant reliance on imported lithium-ion cells (IEA, 2023).

In order to tackle this issue, the government launched the ₹18,100 crore Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells (Government of India, 2021).

The PLI program seeks:

- Encourage the production of cells within the country.
- Reduce reliance on imports
- Increase the level of industrial competition
- Create jobs

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Electric mobility is more relevant to Viksit Bharat thanks to this industrial policy integration, which also ties it with Make in India and Atma Nirbhar Bharat goals.

Environmental Impact of Transport Electrification
Reduction in Greenhouse Gas Emissions Transport is responsible for 13-14% of India's total greenhouse gas emissions (Mo EFCC, 2021). Almost 90% of these emissions are caused by road transport alone.

Electric buses have zero tailpipe emissions. Although the mix of electricity generation determines indirect emissions, India's renewable capacity has surpassed 170 GW (Ministry of New and Renewable Energy, 2023), improving the grid electricity's emission intensity.

WRI India (2022) estimates that replacing a diesel bus with an electric bus can cut lifecycle carbon emissions by 20-35%, depending on the extent of renewable integration. Due to their dominance in urban mobility, electrification of two- and three-wheelers produces even stronger proportional benefits.

Urban Air Quality Improvement
Particulate matter (PM2.5) and nitrogen oxides (NOx), two of the main causes of respiratory disorders, are greatly increased by vehicle emissions.

According to the Central Pollution Control Board (CPCB, 2022), transportation-related pollutants are responsible for around 25–30% of urban PM concentrations in major Indian cities.

In high-density corridors, electric buses directly improve air quality by eliminating exhaust emissions from combustion.

According to the Delhi Transport Department (2023), the implementation of electric buses in Delhi under the Delhi Electric Vehicle Policy (2020) has shown quantifiable improvements in local air quality along important routes.

Alignment with India's Net Zero 2070 Commitment
India pledged to attain net zero emissions by 2070 at COP26. In order to meet intermediate goals under India's Nationally Determined Contributions (NDCs), transport electrification is essential.

Rapid EV adoption coupled with the increase of renewable energy could considerably slow India's oil demand growth trajectory, according to the IEA (2023).

Therefore, electric mobility serves as a tool for climate diplomacy in addition to being an urban policy intervention.

Economic and Industrial Impact Of Electric Mobility

Electric vehicles are more than just an environmental change. According to the Viksit Bharat framework, it is a structural economic change that can impact employment creation, industrial growth, macroeconomic stability, and technological aptitude.

Reduction in Oil Import Dependency and Macroeconomic Stability
More than 85% of India's crude oil is imported (Ministry of Petroleum and Natural Gas, 2023). Almost 40% of the nation's petroleum product use is related to transportation. Due to this structural dependence, the Indian economy is vulnerable to pressures from trade imbalances, geopolitical concerns, and fluctuations in the price of oil globally.

For instance, India's current account deficit grows, inflationary pressures rise, and fiscal subsidies put a burden on public finances during times of global petroleum price surges. The demand for petrol and diesel decreases when transportation is electrified, increasing energy diversification.

Widespread EV adoption might cut total oil imports by billions of dollars by 2030, claims NITI Aayog (2023). Long-term energy sovereignty is improved when electric mobility is combined with the growth of renewable energy. Under the Viksit Bharat vision, energy independence is a critical pillar. Therefore, transport electrification contributes directly to macroeconomic resilience.

Total Cost of Ownership (TCO) Advantage
The high initial cost of capital is one of the main objections to electric mobility. For instance, the initial cost of purchasing an electric bus is substantially more than that of a diesel bus. Lifecycle economic study, however, paints a different image. CEEW (2021) compared the total cost of ownership of diesel and electric buses during ten to twelve years of operation. Results show:

- Reduced fuel expenses per kilometer
- lower maintenance costs because there are fewer moving components
- Reduced wear and tear on mechanics
- Decreased downtime

When it comes to long-term operations, electric buses are more cost-effective than diesel buses, sometimes even more so.

Similarly, because power costs per km are lower than those of gasoline, electric two-wheelers exhibit significant TCO advantages (NITI Aayog, 2022). Though the capital initial investment cost may still be significant, the economics of operation are increasingly agreeing on the use of electrification, especially on high-utilisation fleets like bus and parcel delivery vehicles.

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Strengthening Domestic Battery Ecosystems

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- Create structures for the recycling and circular economy.
- Promote strategic international alliances in the mining industry
- Reducing reliance on imports improves economic resilience.

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Integration with Renewable Energy Encourage solar-powered depots, time-of-day rates, and vehicle-to-grid trial initiatives. This lessens grid strain and improves the environmental impact.

IX. CONCLUSION

The goal of Viksit Bharat 2047 is a transformative national aspiration. Infrastructure, industry, and environmental governance all need to undergo structural modernization in order to become developed nations. Rather than being a sector-specific adjustment, transport electrification appears to be a foundational change inside this larger developmental framework.
Electric mobility simultaneously tackles several structural issues:

- Reduces greenhouse gas emissions.
- Improves urban air quality.
- Reduces oil import dependency.
- Stimulates domestic manufacturing.
- Generates green employment.
- Enhance technological capabilities.

NEMMP, FAME I and II, PM- E-Bus Sewa, and the PLI Scheme are examples of policy tools that show India's dedication to creating an ecosystem for electric transportation. Nonetheless, there remain a myriad of practical challenges, such as physical constraints, vulnerability of battery supply chains, perpetual budget issues, and institutional coordination issues, to reflectively consider.

I believe that electric mobility will be able to enhance the industrial, environmental, and economic sectors completely in case we implement it strategically. It provides us with superior energy independence and aligns reasonably well with India in terms of Net Zero 2070 objectives.

Electrifying transport is one of the components of Viksit Bharat at the end of the day, and it incorporates economic modernization as well as sustainability. In addition to the policy speeches, 2047 in particular will require a consistent implementation process, technological growth, interinstitutional cooperation, and more diversified infrastructure.

Therefore, electric mobility means a lot more to me than a vehicles fringe to a nationwide transformation.

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