

Electric Vehicles And Energy Sector Transformation In India: An Analytical Study

Jagdish W. Khobragade

Assistant Professor of Law

Maharashtra National Law University

Nagpur

(Received-15-July2025/Revised-30-July2025/ Accepted-10-August2025/ Published-30August2025)

Abstract

The energy sector in India is highly diverse, drawing on coal, natural gas, oil, hydro, lignite, nuclear power, wind, solar, agricultural residue, and domestic waste. By 2020, India had emerged as a global leader in renewable energy, ranking fourth in wind power, fifth in solar power, and fourth in overall installed renewable capacity. In parallel, India has progressed toward its climate commitments under the Paris Agreement (2015) and witnessed a rapid rise in the adoption of electric vehicles (EVs). Recent government policies, including targeted incentives, infrastructure development initiatives, and regulatory reforms, have significantly reshaped the landscape of both the EV sector and the broader energy ecosystem. This study critically examines the interrelationship between electric vehicle policies and India's evolving energy sector, with a focus on regulatory frameworks, institutional mechanisms, and the challenges that must be addressed to enable an effective transition toward cleaner and more sustainable mobility.

Keywords: Energy And PowerSector, Electric Vehicles, Government Policies.

Introduction

Nowadays, buying electric vehicles is fascinating, and people are excited to purchase electric cars. Electric Vehicles (EVs) offer remarkable acceleration, convenient home fueling, reduced fuel and maintenance expenses, as well as less noise and vibration compared to internal combustion cars. In India, retail sales of Electric Vehicles (EVs) reached 390,399 units in the first half of the calendar year 2022, indicating a 33.3% growth compared to the previous year when 90,102 units were sold in 2021.¹ It is the third-largest producer and second-largest consumer of electricity in the world. As of January 2022, India has installed a power capacity of 395.07 GW. The Indian Government has implemented policies focused on "Power for All." This

study specifically examines the government's policies aimed at achieving targets for Electric Vehicles (EVs), including 70% coverage of commercial vehicles, 30% coverage of private vehicles, and 80% coverage of two and three-wheelers by 2030.²

In terms of pollution, greenhouse gas emissions, and fuel efficiency, EVs are appealing. They present intriguing strategies to address some of the negative consequences of transportation while maintaining the mobility that people greatly value. It is fact that use of electric vehicles gain popularity in 19th Century.³ However, the number of electric cars (EVs) declined as internal combustion vehicles (ICVs) improved, gasoline became more affordable, and long-distance travel became more common during the "first era" of EVs in the late 19th century.⁴ With increasing concerns about environmental issues and rising oil prices, the "second era" of electric vehicles began in the 1960s, but there were limited advancements in electric batteries.⁵ The contemporary "third era" of electric vehicles is largely propelled by rising concerns over greenhouse gas (GHG) emissions and other environmental pollutants, coupled with significant technological progress, especially in advanced battery technologies.. Further, from a socio-environmental perspective, this study highlights two major concerns associated with mobility and energy use—vehicle exhaust emissions and climate change. These issues are discussed throughout the paper in the context of India's transition toward electric vehicles and the broader environmental goals under national and international frameworks.⁶

International Legal Framework And Electric Vehicles

By 2030, it is anticipated that India's large-scale adoption of EVs will increase overall electricity consumption to 69.6 terawatt-hours, generating an additional USD 11 billion in income for power providers.⁷ This transformation brought about by EVs will also reduce emissions by 40–50% and help the nation achieve its carbon emission reduction objectives.⁸ This study provides an overview of the EV landscape in the country and the prospective regulatory environment that will emerge, as the EV sector is crucial to boosting India's power industry.

Supported by the National Electric Mobility Mission Plan (NEMMP) of 2013 and the Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME) program of 2015, the proportion of electric vehicles (EVs) in the Indian transportation industry is increasing.⁹ The NEMMP aims to promote hybrid and electric vehicles in India to achieve national fuel security and plans to sell 6-7 million hybrid and electric vehicles annually starting from 2020. FAME, on the other hand, focuses on technological research, demand generation, pilot projects, and charging infrastructure to support the establishment of a market and manufacturing ecosystem for hybrid/electric cars.

These programs were designed with the aim of ensuring that electric vehicles constitute 40% of annual vehicle sales in India by 2030. However, the country currently has a limited number of charging stations, which has restricted EV utilization. Due to the low density of charging infrastructure, private players remain hesitant to invest in setting up and operating such stations, as the expected returns on investment are presently low..¹⁰

At the end of FY 2016–17, India recorded annual sales of approximately 25,000 electric vehicles..¹¹ According to the Society of Manufacturers of Electric Vehicles, about 92 percent of all EVs sold were two-wheelers, while electric automobiles and four-wheelers accounted for less than 8 percent of total sales..¹² According to a survey conducted by the company, during the fiscal year 2016-17, Gujarat sold 4,330 EVs, West Bengal sold 2,846 EVs, Uttar Pradesh sold 2,467 EVs, and Rajasthan sold 2,388 EVs..¹³ While India has made significant strides in electric mobility, the absence of a coherent regulatory framework linking the EV sector with the power sector remains the single largest barrier to mass adoption. This paper argues that India needs an integrated, cross-sectoral regulatory strategy to ensure a smooth transition to sustainable electric mobility.. One debate revolves around whether charging stations should utilize any form of renewable energy. The power output from renewable resources is significantly lower in both quantity and consistency compared to non-renewable resources..¹⁴ As a result, there is significant

room for fluctuations in the electricity supply to charging stations, which could hinder the widespread adoption of EVs. It is crucial to determine what incentives could be provided to the renewable energy sector to avoid such issues or ensure the use of renewable energy partially for charging stations. Examples of such incentives include capital subsidies for solar-powered charging stations, viability-gap funding, concessional land allotment, time-of-day tariff benefits, accelerated depreciation for renewable energy assets, and tradable carbon or RPO credits for stations using renewable sources. Another challenge is that the current electrical distribution system infrastructure is inadequate to meet the extensive energy requirements of EVs.¹⁵ To support EVs on a large scale, grid infrastructure needs to be upgraded and expanded to handle the increased demand.¹⁶

Considering the additional strain that charging such cars would place on the power system, the introduction of EVs would create new demand for electricity. This would have additional implications for the already burdened assets in the electricity industry.

The Stockholm Conference 1972 and the Paris Agreement 2015

India plays a significant role in environmental and energy laws. In 1972, then Prime Minister Mrs. Indira Gandhi participated in the Stockholm conference. During the conference, Mrs. Gandhi delivered a speech highlighting concerns about environmental protection. This led to the introduction of many environmental laws in India. From the Stockholm conference in 1972 to the Paris Agreement in 2015, India has faced the challenge of dealing with energy and environmental issues.

Mrs. Indira Gandhi emphasized the underlying conflict between the demands on industrialized and poor nations. While poverty alleviation should be the top priority in underdeveloped nations, protecting the human environment must be given the highest priority in rich countries. Unrelenting poverty has been one of India's biggest problems since it gained independence from British domination. Even after 70 years of independence, 20% of its population still lives in poverty, as indicated by India's Poverty Profile in the World Bank Report of 2016.¹⁷ However, India's stand for Greenhouse Gas (GHG) emissions could be found through the initiatives after Paris Agreement 2015 in environmental protection through legislations.

The Paris Agreement 2015 set international climate policy goals to "achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" and "hold the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels."¹⁸ There is a strong and growing consensus that the electricity industry is crucial for the decarbonization of the economy. The production of electricity needs to transition to low-carbon technologies, employing various technical approaches (both centralized and decentralized), and a shift from direct combustion of fossil fuels to more energy-efficient power uses must take place. The specifics of this "low-carbon electrification" will vary depending on each country's terrain, resources, revenue, and existing infrastructure. According to the IEA's 2-degree compatible scenario (2DS), electricity consumption is projected to increase by 79% between now and 2050, with its share in the final energy mix rising from 18% to 28%. In this scenario, the demand for electricity in transportation would also increase significantly, accounting for over 7% of total electricity demand by 2050.

The opening of the Paris Agreement for signing by each nation was one of the tangible accomplishments of COP21. Some terms of the Paris Agreement justified why developing countries like India were eager to agree. Firstly, there was no longer a clear distinction between developed and developing countries.¹⁹ All nations pledged to make the greatest efforts possible to combat climate change. Secondly, for the first time, all nations are required to regularly publish their greenhouse gas (GHG) emissions and implementation efforts for international evaluation. In six areas (reduction of GHG emissions, adaptation, financing, technology transfer, capacity building, and transparency), all signatories made legally enforceable promises to contribute through nationally determined contributions (NDCs) and undertake domestic initiatives to achieve them. The NDCs must be presented every five years, with the expectation that they will progress from the previous submission. The United Nations Framework on Climate Change imposed obligations on wealthier countries, while developing countries made voluntary contributions (UNFCCC). The Paris Agreement extended the current objective of securing \$100

billion in annual support from affluent nations from 2020 through 2025, with a higher objective to be decided after 2025. François Hollande, former President of France, summarized the efforts of COP21 leaders by saying, "Paris has seen numerous revolutions throughout the ages. A revolution against climate change has just been completed, and it is the most beautiful and peaceful movement ever" (The Independent, U.K., December 12, 2015, Tom Bawden, "COP21: Paris Climate Deal 'Our Best Chance to Save the Planet' Says Obama"). The Paris Agreement came into effect on the 30th day following the deposit of ratification, acceptance, approval, or accession documents by at least 55 Parties to the Convention, collectively responsible for at least an estimated 55 percent of total GHG emissions. Following India's ratification on October 2, 2016, which coincided with the birthday of the nation's father, Mahatma Gandhi, the Paris Agreement entered into force on November 4, 2016. Climate change poses serious risks to India, particularly in vital economic sectors and resources such as agriculture and water. The issue is exacerbated by widespread poverty and a significant portion of the population relying on climate-vulnerable industries. Over 72% of the world's GHG emissions come from the top 10 polluting nations, with India ranking third globally. More than 75% of India's GHG emissions stem from the country's energy sector. India made its first NDC declarations on October 2, 2015, demonstrating its willingness to comply with the terms of the Paris Agreement.²⁰

Judicial Pronouncements In Energy Sector

Judicial decisions in India have played an increasingly important role in shaping environmental governance and influencing policy reforms relevant to the energy sector and the transition towards electric mobility. Courts and tribunals have repeatedly intervened where legislative or executive action has been inadequate, thereby indirectly strengthening the regulatory environment in which EV adoption must occur. In *Rajat Kapoor, Advocate v. Union of India* (2017), the Delhi High Court issued notice to the Union and Delhi Governments seeking clarification on mandatory insurance for electric two-wheelers under Section 146 of the Motor Vehicles Act, 1988. Although primarily a motor vehicle compliance issue, the case reflects a larger regulatory gap: **as EV technology expands faster than legislation, courts are often required to address basic questions of safety, liability, and compliance.** Such gaps hinder the smooth integration of EVs into India's transportation system. Similarly, in *Sunil Dahiya v. Union of*

India, the National Green Tribunal (NGT) directed the Ministry of Environment, Forest and Climate Change (MoEFCC) to strictly follow environmental approval protocols for thermal power plants. This decision is significant for EV adoption because **thermal energy still contributes the majority of India's electricity supply**, meaning that weak oversight of coal-based plants undermines the environmental benefits expected from EVs. Judicial insistence on rigorous environmental scrutiny therefore contributes to a cleaner energy mix an essential precondition for meaningful decarbonisation of transport.

In *Ridhima Pandey v. Union of India* (2017), the NGT emphasized the obligation of the Central Pollution Control Board to take proactive, science-based measures to address climate change. This case underscores a broader institutional problem: **environmental regulators have struggled to keep pace with rising emissions and emerging scientific evidence**. For EV policy, this judicial insistence on climate-responsive regulation reinforces the need for a coordinated national framework addressing both transportation emissions and energy-sector externalities.

The Supreme Court's order in *M.C. Mehta v. Union of India* (2015), imposing an Environment Compensation Charge on commercial diesel vehicles entering Delhi, further illustrates how judicial intervention can push governments toward cleaner transport alternatives when policy measures lag. Coupled with the NGT's ban on older diesel and petrol vehicles later upheld by the Court the judiciary has effectively compelled transitions away from highly polluting internal combustion engines. **These decisions indirectly support EV adoption by restricting the use of dirtier alternatives and emphasising the principle of sustainable development**. The Delhi High Court's ruling in *Association of Radio Taxis v. Union of India* (2015), prohibiting the operation of diesel taxis in the capital, similarly highlights the judiciary's role in enforcing environmental priorities over commercial convenience. The judgment reiterates that **economic growth cannot override the constitutional mandate to protect the environment**, a principle that aligns with India's long-term shift toward low-emission mobility.

Finally, in *Gauri Grover v. NCT of Delhi* (2018), the Court directed municipal bodies to improve solid waste management practices, noting the severe health impacts of improper waste disposal and its contribution to methane emissions a potent greenhouse gas. Although not directly concerned with EVs, the decision reflects a broader judicial logic: **environmental degradation must be addressed holistically**, and emissions from all sectors including waste, transport, and

power generation affect India's overall climate trajectory. A stronger environmental governance framework ultimately supports the EV transition by creating an aligned regulatory context for emissions reduction. Conjointly, these cases demonstrate that judicial intervention is not merely remedial but has become an essential component of India's environmental and energy governance architecture. For the EV sector, this jurisprudence highlights systemic regulatory weaknesses fragmented enforcement, outdated legal definitions, and inadequate pollution control that must be addressed for India to achieve meaningful decarbonization in the transport and energy sectors.

The National Green Tribunal has recently intervened by closely scrutinising the EIAs for some projects. For instance, the NGT heard a challenge from local people disputing the government's clearance of diverting 17.7 hectares (about 44 acres) of forest land for the development of a 130 MW hydropower project in Paryavaran Sanrakshan Sangharsh Samiti, Lippa v. Union of India (2016). There are 200 hydropower projects being built nearby right now.²¹

The EIA report's inadequate consideration of the cumulative impacts of existing and proposed hydropower projects was questioned by the National Green Tribunal (NGT). The Tribunal directed the State authorities to place the complete project plan before the Gram Sabhas of the affected villages, in compliance with the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, and required village bodies to negotiate with project developers to mitigate adverse consequences. Similarly, concerns about the "rubber-stamping" of coal-mining approvals where the Ministry of Environment, Forest and Climate Change (MoEFCC) granted a high volume of clearances without adequate environmental scrutiny highlight major systemic weaknesses in India's environmental governance framework. These examples are directly relevant to the EV-energy discussion because weak environmental assessment and regulatory oversight in the energy sector undermine India's transition to cleaner mobility. Effective EV policies require an integrated regulatory approach that addresses the environmental impacts of all energy sources, both renewable and non-renewable.²²

Conclusion

India's transition to electric mobility is unfolding within a uniquely complex energy landscape marked by diverse power sources, uneven regulatory capacity, and competing developmental

priorities. While it remains difficult to predict the exact trajectory of EV penetration, several trends are evident. India is likely to adopt an evolutionary—not disruptive—path to large-scale EV adoption, influenced by rising private vehicle ownership, expanding travel demand, and gradual improvements in technology and infrastructure. Yet, India’s strong record of technological adaptation, coupled with its vast domestic market, positions it to exert substantial influence on global EV innovation, manufacturing, and supply chains. The pace of adoption will depend significantly on declining battery costs, improved charging infrastructure, and targeted public policy interventions. As subsidies become less decisive over time, market forces—particularly fleet electrification, competitive pricing, and private investment—will play a larger role. At the same time, international developments, especially China’s rapid expansion in BEV production and exports, will shape global cost curves and accelerate India’s own transition.

However, meaningful electrification of India’s transport sector cannot occur in isolation from reforms in the energy sector. Weak environmental regulation, inconsistent implementation of the EIA framework, and continued dependence on coal dilute the climate benefits of EVs. Stronger environmental governance, transparent permitting processes, and integration of renewable energy in EV charging systems are therefore essential preconditions for sustainable mobility. Likewise, policies such as “Make in India,” while economically beneficial, must not compromise environmental safeguards or worker protections, as such trade-offs undermine long-term sustainability goals. Finally, India’s commitment to its Paris Agreement obligations provides a critical foundation for aligning energy and mobility transitions. Real progress will require a coordinated national strategy that links EV deployment with power-sector reforms, grid modernization, renewable energy expansion, and environmental compliance. If India succeeds in strengthening these institutional and regulatory pillars, it can not only accelerate domestic EV adoption but also emerge as a global leader in affordable, low-carbon mobility.

References

1. News, E. (2023) 'BYD Auto News Monitoring, BYD Auto News Monitoring Service & Press Release Distribution - Electric Cars News Today - EIN Presswire', Available at: <https://electriccars.einnews.com/news/byd> [23 June 2023].
2. FICCI, *Power – Industry Overview of India: Installed Capacity 395.07 GW as of January 2022*, FDI Invest (Feb. 2022) <https://fdiinvest.com/power-sector-in-india>.

3. David Roos, “*Electric Vehicles Have Been Around Since the 19th Century: Timeline*”, History.com, 15 Apr. 2024, <https://www.history.com/articles/electric-vehicles-automobiles-timeline> accessed 20 Nov. 2025. HISTORY
4. Kondo, Y., Kato, H. and Matsushashi, K. (2010) 'Evaluation of electric vehicles based on long-term travel activity data of passenger cars', *World Electric Vehicle Journal*, 4(4), pp. 787–792. Available at: doi:10.3390/wevj4040787.
5. Li, S. et al. (2022) 'Trajectory, driving forces, and mitigation potential of energy-related greenhouse gas (GHG) emissions in China's primary aluminum industry', *Energy*, 239, p. 122114. Available at: doi:10.1016/j.energy.2021.122114.
6. Turan B, Pedarsani R and Alizadeh M, 'Dynamic Pricing and Fleet Management for Electric Autonomous Mobility On Demand Systems' (2020) 121 *Transportation Research Part C: Emerging Technologies*.
7. 'INDIA'S ELECTRICITY DEMAND FROM EVS MAY REACH 69.6 TWH BY 2030: STUDY - ET AUTO', ET Auto, Available at: <https://auto.economictimes.indiatimes.com/news/passenger-vehicle/cars/indias-electricity-demand-from-evs-may-reach-69-6-twh-by-2030-study/64584576> [last visited Jul 13, 2022].
8. The Associated Chambers of Commerce and Industry of India (ASSOCHAM) & Ernst & Young LLP (EY), *Electrifying India: Building Blocks for a Sustainable EV Ecosystem* (2018) (“By 2030, EVs are expected to reduce emissions by 40-50 per cent, compared to ICE vehicles in an aggressive renewable energy scenario.”) <https://auto.economictimes.indiatimes.com/news/india-s-electricity-demand-from-evs-may-reach-69-6-twh-by-2030-study/64584576> accessed 20 Nov. 2
9. Elgowainy, A. (2021) 'Electric, hybrid, and fuel cell vehicles: Introduction', *ELECTRIC, HYBRID, AND FUEL CELL VEHICLES*, pp. 1–4.
10. NITI Aayog, *Electric Vehicles in India* (2025) p. 5: “India seeks to attain a 30% share of electric vehicles in the total vehicles sold, by 2030.”
11. Society of Manufacturers of Electric Vehicles (SMEV), *EV Sales Report 2016–17* (2017), stating that “the EV industry sold around 25,000 units in FY 2016–17, of which nearly 92% were electric two-wheelers.”
12. Ewert, A. et al. (2021) 'Small electric vehicles—benefits and drawbacks for Sustainable Urban Development', *SMALL ELECTRIC VEHICLES*, pp. 3–15.
13. Electric vehicle sales: Only 5 states excel, Gujarat tops with 4,330 units' (2017), *Business Standard*, Available at: https://www.business-standard.com/article/companies/electric-vehicle-sales-only-5-states-excel-gujarat-tops-with-4-330-units-117112301229_1.html.

- 14.VC Green, “Renewable Energy vs. Non-Renewable Energy” (blog, 11 August 2025) <https://vcgreen.in/blog/-Renewable-Energy-vs-Non-Renewable-Energy/> accessed 20 Nov. 2025 (“Non-renewable sources provide on-demand power, allowing for consistent energy production regardless of weather conditions or time of day.”)
- 15.Hafez, O. and Bhattacharya, K. (2017) 'Optimal design of Electric Vehicle Charging stations considering various energy resources', 107 RENEWABLE ENERGY, pp. 576–589.
- 16.NITI Aayog & IIT Bombay et al., *Integration of Electric Vehicles Charging Infrastructure with Distribution Grid: Global Review, India’s Gap Analyses and Way Forward* (2023) (“With the anticipated rise in the number of electric vehicles (EVs) on the roads ... additional generation capacity and enhanced transmission and distribution systems will be required.”) <https://www.niti.gov.in/sites/default/files/2023-03/Integration-of-Electric-Vehicles-Charging-Infrastructure-with-Distribution-report2.pdf> accessed 21 Nov. 2025.
- 17.'Introduction', MONITORING GLOBAL POVERTY: REPORT OF THE COMMISSION ON GLOBAL POVERTY, pp. 1–4 (2016).
- 18.United Nations Climate Change Conference, 2015, Article 2 and 4.
- 19.Ramji, A. (2018) 'Paris Agreement and Climate Change in India', in THE IMPLEMENTATION OF THE PARIS AGREEMENT ON CLIMATE CHANGE, pp. 222–231.
- 20.'INDIA GREENHOUSE GAS (GHG) EMISSIONS 1990-2022', MacroTrends, Available at: <https://www.macrotrends.net/countries/IND/india/ghg-greenhouse-gas-emissions> [last visited Jul 13, 2022].
- 21.The National Green Tribunal has recently intervened by closely scrutinising the EIAs for some projects... in ParyavaranSanrakshan Sangharsh Samiti, Lippa v. Union of India (2016).”¹
- 22.ParyavaranSanrakshan Sangharsh Samiti, Lippa v. Union of India, O.A. No. 125/2013, National Green Tribunal (PB), Judgment dated 04 May 2016.