

EV Battery Cost Competitiveness and Price Parity: Global Trends and Implications for India

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ABSTRACT

Geopolitical strategies and insecurities over minerals like oil have highlighted the increasing dependence on resources for growth. This paper sheds light on how resources for electric vehicle (EV) batteries also affect international trade. We see, lithium-ion batteries' price is declining, while sodium-ion batteries are emerging, in both cases China leads globally. The year 2025 showcases an inflection point, which is an important landmark in the global EV transition as lithium-ion battery costs cross the long-awaited barrier for price difference with internal combustion engine (ICE) cars. The aspects of battery cost competitiveness in 2025 are explained in this paper: (i) technological drivers achieving breakthrough with the \$100/kWh cost for lithium-ion battery (ii) existence of price differences between Western economies and China; (iii) inference for EV-ICE price concurrence with in specific regards to India. The research signifies how systems' excess capacity in China and technological changes, especially the emergence of sodium-ion battery and Lithium Iron Phosphate (LFP) chemistry, are changing battery and vehicle freight economics at world level. It does this by utilizing secondary data from BloombergNEF, the International Energy Agency, and policy documents.

Keywords: Battery Costs, Electric Vehicles, LFP Batteries, Price Parity, Trade Policy

Journal of Economic Literature (JEL) Classification: F01, O13, O31, O33, R11, R41, R42, R49, R58.

1. Introduction

It has long been known that the most significant factor influencing the affordability of electric vehicles is battery cost. According to some estimates, battery packs make about 30–50% of an EV's overall manufacturing costs (Karolina, 2025), hence cutting costs is essential to widespread adoption. The \$100/kWh battery pack pricing (McKerracher, 2025) has been identified by experts as the turning point at which EVs may rival gasoline-powered cars without subsidies for more than ten years. At the worldwide level, this criterion has essentially been met in 2025, although other areas and segments have fallen considerably short of it. Thus today we see recent policy discussions in the UK regarding taxation of EVs reflect the changing fiscal dynamics as EV adoption increases ("Britain Will Tax Electric Cars More Heavily. Good," 2025).

However, different locations are making different strides toward cost parity. Although broad EV-ICE price parity has already been attained in China, structural, technological, and policy-related issues continue to drive up battery costs in Western nations. The worldwide battery cost change offers both possibilities and problems for developing nations like India, where affordability, energy security, and industrial development converge. The following research questions are addressed in this paper:

What factors made battery prices surpass \$100/kWh in 2025?

Despite worldwide cost reductions, why do notable regional pricing disparities still exist?

How will the convergence of battery prices affect the adoption of electric vehicles in India and other developing nations?

2. Review of Literature

According to Mojumder et al. (2025), Electric vehicles (EVs) are crucial for reducing emissions and dependence on fossil fuels, though their adoption faces challenges such as high costs, insufficient charging infrastructure, and range anxiety. These challenges differ globally, with wealthy nations implementing supportive policies while developing countries and least developed countries (LDCs) struggle with policy frameworks. The paper assesses cost-efficiency of EV technologies while addressing issues like grid stability, cybersecurity, and renewable energy use. It discusses government incentives and financing, predicts battery costs to drop to US\$105/kWh by 2024, and an increase in charging stations to 12.5 million.

Status of Battery Demand and Supply – Batteries and Secure Energy Transitions – Analysis (n.d.) mentions how batteries are increasingly vital in the evolving fuel landscape, particularly in electric vehicles (EVs) and energy systems, as their costs decrease and renewable energy usage rises. Since 2010, lithium-ion battery costs have dropped by 90%, with EVs accounting for over 90% of the 2,400 GWh of batteries in the energy sector in 2023. The storage capacity expanded significantly, with more than 40 GW added in the same year. Global investments in EV batteries reached USD 150 billion, primarily led by China, Europe, and the United States. However, fluctuations in resource prices necessitate greater investment and diversification within the industry.

According to Trends in Electric Car Affordability – Global EV Outlook 2025 – Analysis (n.d.), the cost of electric vehicles (EVs) became lower than internal combustion engine (ICE) vehicles in 2024, primarily due to reduced gasoline and maintenance needs. However, high initial purchase prices remain significant barriers, particularly in Europe. Despite a 25% drop in battery costs since 2023, pricing parity persists. In China, the average price of battery-electric SUVs fell by 10%, but similar reductions are not seen in the U.S. and Germany. Widespread EV adoption requires more affordable models; in 2024, a significant percentage of battery electric vehicles (BEVs) in China were priced under \$25,000, while U.S. and European options remained costlier than ICE models. Plug-in hybrid electric vehicles (PHEVs) experienced regional pricing variances, with Germany seeing price increases versus decreases in China. Chinese EVs are gaining traction in emerging markets like Brazil and Thailand, where the price gap with ICE vehicles is narrowing. Conversely, India prefers lower-priced domestic vehicles, limiting

the availability of Chinese EVs due to high import taxes. The impending EU emissions regulations may push for more affordable EV options.

Hertz (2025) highlighted the most recent research by BloombergNEF (BNEF), prices for lithium-ion battery packs have dropped to an average of \$108 per kilowatt-hour (kWh), marking an 8% decrease from 2024, despite rising costs for essential metals. This decline is attributed to enhanced hedging techniques, the rapid adoption of lithium iron phosphate (LFP) chemistries, and overcapacity in cell manufacturing. Battery electric vehicle (BEV) packs in the EV market typically cost \$99/kWh, maintaining stability below \$100, suggesting it could serve as a price floor. Regional price disparities exist: the average Chinese pack costs \$84/kWh, while North American and European prices are 44% and 56% higher, respectively, due to import costs and other factors. Furthermore, BNEF predicts further price reductions by 2026, spurred by the expansion of low-cost LFP and improved production efficiency, as the industry transitions toward corporatization requiring regionalized planning.

According to Kumar et al. (2024), High battery prices significantly contribute to the higher initial costs of Battery Electric Vehicles (BEVs) compared to Internal Combustion Engine Vehicles (ICEVs) in India, despite existing government subsidies. This analysis compares the total cost of ownership for 2 and 4 wheeler BEVs against ICEVs in Mumbai and Delhi, highlighting that while 2 wheeler BEVs could become more cost-effective with adequate subsidies, 4 wheeler BEVs remain expensive even with support. The current subsidy distribution favors 4 wheelers, potentially disadvantaging 2 wheeler buyers. By 2030, the financial burden on the Indian government may reach ₹146,062 crores annually. Recommendations include promoting tailored subsidy policies for 2 wheelers and addressing overlooked aspects like battery cost reduction and favorable regulations to achieve the critical \$100/kWh battery cost target for a financially viable electric vehicle market.

Even if geographical disparities in the reasonability of EV are known, the building association between the continuing geographical price parity and world level battery supply systems—such as production over potentials, trade obstacles, and battery chemistry options—is not yet fully examined. Moreover, study for the Indian economy focuses on vehicle subsidies and total cost of possession, with some considerations for bridging parity of worldwide battery prices and novel battery techniques in India's EV transformation plan. With descriptive examination of geographical disparities, battery cost combativeness at world level, and influence of EV price difference in India, this paper bridges the gaps. The research showcases advantages of large-scale, technological transformation, and hands-on learning as the main factors responsible for reduction in battery cost. Since 2010, the cost of lithium-ion batteries has decreased by about 90%, according to studies by BloombergNEF and the IEA. According to recent studies, battery chemistry decisions—specifically, the switch from Nickel-Manganese-Cobalt (NMC) to Lithium Iron Phosphate (LFP)—are becoming increasingly important in lowering expenses and sensitivity to fluctuating metal prices. The literature on trade and industrial policy indicates that tariffs, local content regulations, and strategic subsidies are increasingly influencing regional cost disparities. Although the goal of protectionist measures is to increase local capacity, academics caution that higher consumer costs may result in short-term welfare losses. Indian research highlights how important government incentives are the Production Linked Incentive (PLI) scheme and

FAME subsidies, in bridging the cost gap during the transition phase. But looking at central government stopping the 3-wheeler EV subsidies, as its targets are reached, the study opens to rethink on the penetration of EV as it makes only 20-30% in whole India, and centre rests the job of increasing EV on state (Bhattacharya, 2025).

3. Methodology and Data Sources

Based on secondary data, this study uses a descriptive and analytical research design. BloombergNEF's Global Lithium-Ion Battery Price Survey (2025) is the main source of battery price data. The International Energy Agency, industry publications, and policy briefs from the US, EU, and India are the sources of further data.

4. The \$100/kWh Milestone in 2025

4.1 Global Battery Price Trends

The average price of lithium-ion battery packs fell to about \$108/kWh by late 2025, a decrease of almost 8% year over year. More significantly, typical packs for battery-electric vehicles (BEVs) dropped below the crucial \$100/kWh mark. This accomplishment supports long-held hypotheses that EVs may eventually become more affordable than ICE cars under specific market conditions.

4.2 Role of LFP Technology

Although lithium nickel manganese cobalt oxide (NMC) batteries continue to hold a 60% global market share, lithium iron phosphate (LFP) batteries have greatly expanded the market for them in the electric vehicle (EV) sector, going from a measly 6% worldwide market share in 2020 to 30% by the end of 2022. The resources used directly have an impact on the price of EV batteries, which account around 30–40% of car costs. Like NMC batteries, which employ scarce and more costly nickel and cobalt, LFP batteries use available and budget friendly components like iron and phosphates.

Because of their get-at-ability, these batteries are produced at reasonable costs and have a good supply. Moreover, these batteries have environmental benefits because their resources are readily accessible, which reduces the need for harmful mining methods. LFP batteries have a longer lifespan than NMC batteries which improves performance. When rapidly charged with Level 3 chargers, these can almost bear five times as many discharged cycles and are more impenetrable to deterioration. To sum up, LFP chemistry is better than its competitors in the EV industry. According to studies, lithium iron phosphate batteries further add on to the safety aspect, making electric vehicles (EVs) just as safe as petrol/gas based cars. The batteries are less likely to overheat (which can lead to fire) than nickel-cobalt batteries. When an internal short circuit occurs, nickel-cobalt batteries may emit oxygen, posing a risk of self-generating fire. LFP batteries are less likely to catch fire even when they break down because they don't contain oxygen (ChargeLab, 2024). The mean pack price for stationary storage systems dropped to \$70/kWh, emphasizing a 45% decrease from 2024 and setting it up as the lowest-priced for the first time. This decline is primarily accredited to aggressive competition in China, which is a living example of a significant production in battery cells tailored for stationary storage. In 2025, China's manufacture of stationary storage cells was projected to reach 557 GWh, having out of this

world level of installations in the sector by more than 2 times (McKerracher, 2025). The extensive adoption of LFP chemistry has been very important in attaining this breakthrough. LFP batteries remove the need for costly and geo-politically sensitive resources such as cobalt and nickel, offer better cycle life and safety characteristics.

5. Regional Price Gaps: China, the West, and India

5.1 China's Cost Leadership

China has been leading the world in battery cost competitiveness, with an average pack price of approximately \$84/kWh in 2025 (McKerracher, 2025). This benefit is primarily due to economies of scale i.e. its superiority in manufacturing, integration throughout the distribution system and benefit of being the first producer in the LFP sector, which generates nearly all of the output in the world. Increased domestic competition brought about by excess capacity has led to aggressive price reductions.

The pricing of CATL's new Naxtra sodium-ion "salt" EV battery is only \$10–\$19/kWh, which is around a tenth of what lithium-ion batteries now cost (~\$100–\$115/kWh). It charges at up to 5C (full in around 12 minutes), maintains 85% capacity after 3.6 miles, and goes from 30 to 80% in 30 minutes even at –30 °C with about 93% usable capacity. The affordability and durability of EVs could be revolutionized by their long lifespan, low cost, and cold-weather performance (EVWORLD.COM - The Future in Motion Since 1998 TM, n.d.).

5.2 North America and Europe

Battery prices in North America are approximately 44 percent higher than in China, while European prices are nearly 56 percent higher (McKerracher, 2025). slower adoption of LFP chemistry, heavy reliance on NMC batteries (Electric Vehicle Batteries – Global EV Outlook 2025 – Analysis, n.d.), higher labor and energy costs, contribute to these disparities. Trade barriers, including tariffs, further insulate domestic markets from global price declines.

5.3 Implications for India

In the world of batteries, India is in the middle. Although it has access to cheaper Asian supply networks, local battery production is still in its infancy. Reducing reliance on imports and promoting EV adoption are the goals of government programs like the FAME incentives and the PLI scheme for Advanced Chemistry Cells. However, mass-market adoption is still hampered by greater upfront costs and inadequate charging infrastructure. India has a strategic opportunity to increase adoption while increasing domestic capacity without undue protectionism thanks to declining global battery prices.

6. Battery Costs and EV–ICE Price Parity

6.1 Parity Achieved in China

Even while minerals are the new oil, their extraction doesn't add value on its own. These minerals only become valuable in batteries after they are refined, components are made, and cells are produced on a daily basis. China has outperformed the majority of nations in this area. Lithium liquid-electrolyte lines

are still being doubled in the majority of nations. China, on the other hand, is pursuing a multi-lane strategy, industrializing semi-solid as a workable bridge to fully solid-state, scaling sodium-ion where abundance and pricing fit, and maintaining lithium lines.

To encourage early developments, China's strategy combines price-capping bids with a sodium-ion norm. It currently controls the majority of solid-state cell production capacity and uses a practical semi-solid growth and risk management strategy. The US and EU, on the other hand, are concentrating on all-solid-state lithium devices, and businesses like QuantumScape are making progress in this area. This has allowed "good enough" chemistries like LFP to dominate today while maintaining options for sodium-ion, semi-solid, and solid-state chemistries. Having resources is not everything, mindfully investing where it makes sense is the rule. Set clear standards, prioritize bottlenecks, and scale what is currently effective. When riskier next-generation chemistries are ready, keep the door open and bank the lessons learned (Debates, 2025).

In the majority of categories, EVs and ICE cars have reached unsubsidized price parity in China. EVs can compete on both upfront prices and total cost of ownership due to lower battery costs and fierce competition (Executive Summary – Global EV Outlook 2025 – Analysis, n.d.) (Lu, 2025).

6.2 Prospects for the U.S., Europe, and India

In the United States and Europe, EV price parity remains incomplete in 2025. In India, parity is emerging first in two-wheelers and commercial fleets, where operating cost advantages outweigh higher initial prices. Continued battery cost declines are expected to extend parity to passenger vehicles over the medium term. The dependence on lithium as a resource of countries in China is also a bottleneck to achieve growth in the electric automobile sector.

7. Conclusion

A key milestone has been the decline in lithium-ion battery prices to around \$100 per kWh—a threshold widely considered the point at which EVs achieve cost parity with internal combustion engine (ICE) vehicles. Crossing this benchmark reduces the total cost of ownership for EVs, making them economically viable for mass adoption without heavy subsidies. Even more transformative is the emergence of sodium-ion batteries, which promise drastically lower costs—potentially as low as \$19 per kWh. Since sodium is more abundant and cheaper than lithium, this innovation could democratize EV adoption, particularly in cost-sensitive markets.

However, adoption patterns remain uneven across regions due to structural, economic, and policy differences. Western economies such as the United States and European nations face a strategic dilemma: whether to prioritize domestic battery manufacturing (industrial strategy) or focus on making EVs affordable for consumers through imports and subsidies. Domestic production often involves higher costs in the short run but enhances energy security and reduces dependence on foreign supply chains.

In contrast, China provides a compelling case study of how low battery costs can transform an entire industry. Through strong government support, vertical integration, and economies of scale, China has successfully reduced battery prices and built a globally dominant EV ecosystem. This has enabled rapid EV adoption, widespread infrastructure development, and global competitiveness in battery exports.

India stands at a crucial juncture in this transition. With falling global battery prices and supportive policy frameworks such as production-linked incentives (PLI), India has a unique opportunity to develop its domestic battery manufacturing capabilities. This can reduce import dependence, create employment, and accelerate EV adoption in a price-sensitive market. If leveraged effectively, India could position itself as a key player in the global battery value chain.

Going forward, further research and policy focus are needed in several areas:

- **Long-term pricing competitiveness:** Understanding how emerging technologies like sodium-ion will scale and compete with lithium-ion batteries.
- **Global industrial policy:** Examining how different countries balance trade-offs between protectionism, subsidies, and open markets.
- **Strategic positioning in value chains:** Analyzing how countries can secure access to raw materials, technology, and manufacturing capabilities in the evolving global battery ecosystem.

Overall, the transition to EVs is no longer just a technological shift but a complex interplay of economics, policy, and geopolitics, where battery costs serve as the central driving force.

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