IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 29, Issue 8, Series 8 (August, 2024) 59-62
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Evaluating The Suitability Of ICVs And EVs In The Indian Market

Vedang Kheria
Undergraduate Student At Le Bow School, Drexel University, USA

Date of Submission: 16-08-2024 Date of Acceptance: 26-08-2024

I. Introduction

The global shift towards sustainable energy has positioned Electric Vehicles (EVs) at the forefront of discussions about the future of transportation. Unlike traditional vehicles powered by internal combustion engines (ICVs), which rely on fossil fuels, EVs are propelled by electric motors drawing power from rechargeable batteries or alternative energy storage systems (U.S. Department Of Energy). This fundamental difference makes EVs a cleaner and more environmentally friendly option, aimed at reducing greenhouse gas emissions and decreasing reliance on finite natural resources.

India, one of the world's largest and fastest-growing automobile markets, is at a critical juncture in its transportation evolution. The Indian automotive industry is expected to become the third-largest globally by 2026, driven by a growing middle class, urbanization, and supportive government policies (IBEF). The Indian government has set ambitious targets to boost the adoption of EVs, including initiatives like the Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME) scheme, which aims to address infrastructure and affordability challenges (IBEF). However, despite these efforts, the market for ICVs remains robust, with substantial investments in traditional automotive manufacturing and a well-established infrastructure supporting ICVs.

This research paper evaluates whether the Indian government's goal of having 30% of all vehicles in India be EVs by 2030 is attainable, considering factors such as economic feasibility, infrastructure readiness, financing, consumer preferences, service challenges, high temperature variations, and environmental concerns. As of the latest data, EVs accounted for about 5% of total vehicle sales between October 2022 and September 2023 (Seetharaman et al.).

II. Issues Posed To Adoption Of EVs In India

One of the primary reasons why ICVs remain more suitable than EVs in India is the well-established and expansive infrastructure that supports ICVs, in contrast to the relatively underdeveloped infrastructure for EVs. The widespread availability of fuel stations across urban and rural areas ensures that ICV owners rarely experience "range anxiety," a significant concern for EV owners due to the limited charging infrastructure.

India's EV infrastructure is still in its nascent stages, with a stark discrepancy in the number of charging points available compared to other leading markets. For instance, India has roughly 200 EVs per commercial charging point, a figure alarmingly high compared to approximately 20 EVs per charging point in the United States and fewer than 10 in China (Seetharaman et al.). This shortage of charging stations exacerbates range anxiety among potential EV buyers and hinders the widespread adoption of electric vehicles. The need for both slow and fast-charging options further complicates the situation, requiring a significant expansion of the current infrastructure to meet the growing demand for EVs.

Battery swapping, an alternative solution being explored in select cases such as passenger three-wheelers and two-wheelers for last-mile deliveries, offers some potential to bridge the infrastructure gap (Seetharaman et al.). Companies like Sun Mobility and Battery Smart are pioneering these efforts, which could reduce upfront costs, minimize downtime, and increase flexibility for specific customer segments. However, the application of battery swapping is currently limited to niche markets and does not address the broader needs of the general automotive public.

In contrast, ICVs benefit from an established supply chain, extensive refueling infrastructure, and a market that has been optimized over decades. This existing network not only supports the widespread use of ICVs but also ensures reliability and convenience for consumers across the country. As a result, until the charging infrastructure for EVs is significantly improved and expanded, ICVs remain a more practical and reliable option for the Indian market, offering convenience and peace of mind that EVs have yet to match.

The economic viability of EVs in India faces several significant challenges when compared to ICVs. Although EVs offer potential long-term savings, their higher upfront costs remain a substantial barrier for many consumers. For example, models like the Tata Nexon EV are priced significantly higher than their ICV counterparts, with the price difference reaching up to INR 2.6 lakh for long-range variants (Anupam). Government incentives, such as those under the FAME II scheme, do help reduce this gap, but these subsidies often fall short of making EVs as affordable as ICVs, especially for middle-income buyers.

In terms of the total cost of ownership, EVs may seem attractive due to lower running costs—approximately INR 1-2 per kilometer compared to INR 12-17 per kilometer for diesel vehicles. However, the need for battery replacement every 3-5 years introduces a significant and often overlooked cost (Anupam). Despite recent declines in battery prices, this replacement cost can be substantial and may erode the long-term financial benefits of owning an EV. This challenge is particularly acute in India, where consumers are highly price-sensitive, and any unexpected expense can be a major deterrent.

Financing for EVs also presents unique challenges. Although interest rates on EV loans can be competitive with those for ICVs, there is considerable variation based on the model's popularity. Less popular EV models often attract higher interest rates due to the perceived risks associated with the nascent state of the Indian EV market (Anupam). Indian banks and financial institutions are still grappling with the uncertainties surrounding the residual value of EVs, which complicates loan terms and can make financing less accessible or more expensive for potential EV buyers.

Insurance costs further compound the economic challenges of owning an EV. While some dealers may offer slightly lower insurance premiums for EVs, most independent providers charge significantly more—often 25-60% higher than for ICVs (Anupam). This is largely due to the higher cost of replacement parts and the limited availability of specialized repair services for EVs in India, which increases the perceived risk for insurers. These higher insurance premiums add to the overall cost of owning an EV, making them less economically attractive, especially for budget-conscious consumers.

The maintenance and service challenges associated with EVs in India are significant, particularly when compared to the well-established support network for ICVs. According to the 'SIAM EV Skill Gap Study,' India faces a substantial gap in the availability of EV-ready workers (PTI). To achieve 100% localization of EV components, the country needs to add 30,000 EV-ready workers per year until 2030, up from the current rate of 15,000 per year. This shortage of skilled labor directly impacts the availability and quality of maintenance and repair services for EVs.

The report further highlights that 43% of the technical competencies required for EVs have minimal overlap with those for ICVs, necessitating the fresh skilling of talent. This means that a large portion of the current Indian workforce, trained primarily on ICV technology, cannot be directly transitioned to work on EVs without significant additional training. Moreover, even for the 27% of technical competencies that do overlap, re-skilling of existing talent is required. The estimated cost for hiring and training this specialized workforce is projected to be around INR 13,552 crore, including INR 7,671 crore for hiring and INR 5,881 crore for training.

These figures underscore the massive investment needed to build a competent workforce capable of servicing and maintaining EVs at scale. Until this gap is bridged, EV owners are likely to face higher maintenance costs, longer service times, and limited access to skilled technicians, particularly in less urbanized areas. In contrast, the ICV market benefits from decades of accumulated expertise, with a vast network of trained mechanics and readily available spare parts across the country. This makes ICVs a more practical and reliable choice for consumers who prioritize ease of maintenance and service accessibility.

Another significant challenge facing the widespread adoption of EVs in India is their sensitivity to extreme weather conditions, particularly high temperatures. Studies have shown that while EVs generally function normally in warm climates, they can experience a substantial reduction in range when exposed to extreme heat. For instance, a recent study found that EVs can lose up to 30% of their total range in extremely hot weather, depending on the geographic location and climate (Roberts). This range loss is primarily due to the additional energy required by the vehicle's battery to maintain optimal operating temperatures and to cool the cabin, particularly when temperatures exceed 90 degrees Fahrenheit (Voelcker).

In India, where summer temperatures often exceed 100 degrees Fahrenheit (37.8 degrees Celsius), especially in regions like Rajasthan, Gujarat, and the central plains, the impact on EV efficiency could be even more pronounced. The study mentioned above indicates that EVs retain about 95% of their range in temperatures up to 90 degrees Fahrenheit, but as the mercury rises beyond this point, the range reduction becomes more noticeable (Voelcker). This reduction in range is due to the battery's need to divert energy to keep itself cool, alongside additional energy demands for air conditioning, which is essential for driver comfort in such extreme heat.

Given that India's climate frequently sees temperatures well above 90 degrees Fahrenheit, the efficiency and reliability of EVs could be significantly compromised during the hotter months. This temperature-induced range loss not only exacerbates range anxiety but also limits the practicality of EVs in large parts of the country

where high temperatures are the norm for extended periods. While some EVs offer Eco modes that can help mitigate this by reducing acceleration and cabin cooling, this comes at the cost of driving performance and passenger comfort (Voelcker).

In contrast, ICVs are less affected by high temperatures and have a well-established track record of operating efficiently in India's diverse climate conditions. This makes ICVs a more reliable choice for consumers, particularly in regions where extreme heat is common. The climate sensitivity of EVs, therefore, presents a significant barrier to their widespread adoption in India, as consumers may be reluctant to invest in a vehicle that could underperform during the hottest parts of the year.

While EVs are often promoted as a greener alternative to ICVs, a closer examination reveals several environmental challenges that complicate this narrative. A significant concern is that the electricity used to charge EVs is often generated from fossil fuels, particularly coal, which diminishes the environmental benefits of using EVs. The more EVs there are, the greater the pressure on power grids, leading to increased fossil fuel consumption. This situation is exacerbated by the fact that many charging stations, especially in less urbanized areas, rely on diesel generators, further contributing to carbon emissions (Yadav).

Moreover, EVs have their own sources of pollution that are not present in ICVs. According to a study by Emission Analytics, the heavier weight of EVs results in significantly higher particulate matter emissions from tire and brake wear compared to modern gasoline-powered cars with efficient exhaust filters. In fact, the study suggests that EVs could emit up to 1,850 times more particulate matter due to tire deterioration, which is accelerated by the added weight of the batteries. This particulate matter includes harmful chemicals released into the atmosphere, and since most tires are made from synthetic rubber derived from crude oil, this creates an additional environmental burden (Mahale).

Furthermore, the environmental impact of EVs extends beyond their use phase to the extraction and processing of raw materials required for battery production. Lithium-ion batteries, which power most EVs, depend on materials such as cobalt, lithium, and rare earth elements. The mining and processing of these materials have been linked to severe environmental degradation and human rights abuses. For instance, cobalt mining, particularly in the Democratic Republic of Congo, is associated with hazardous conditions, including exposure to toxic metals and the use of child labor in unregulated artisanal mines. Additionally, the extraction of lithium in South America is highly water-intensive, leading to significant depletion of water resources, which adversely affects local farming communities. The production of EVs is, therefore, about 50% more water-intensive than the manufacturing of traditional ICVs, further complicating the environmental benefits of EVs (Tabuchi and Plumer).

In regions where electricity generation is heavily dependent on coal, such as in parts of India, the overall climate impact of EVs can be worse than that of modern hybrid vehicles, which combine gasoline engines with battery power to optimize fuel efficiency. As coal remains a critical factor in the energy mix, the supposed climate benefits of EVs can be significantly reduced, and in some cases, EVs may even contribute more to air pollution than some ICVs (Tabuchi and Plumer).

III. Conclusion

While EVs present a promising alternative to ICVs, several significant challenges must be addressed before they can be widely adopted in India. The underdeveloped charging infrastructure, high upfront costs, and maintenance issues pose substantial barriers to EV adoption. Additionally, the sensitivity of EVs to extreme weather conditions and the environmental impact of their production and operation complicate the narrative that they are a universally better option than ICVs.

Given India's current economic, infrastructural, and environmental conditions, ICVs continue to offer a more practical and reliable solution for most consumers. For India to achieve its ambitious EV targets, considerable investments will be required to overcome these challenges, particularly in expanding charging infrastructure, reducing the upfront cost of EVs, and addressing environmental concerns related to EV production and use. Until these issues are adequately resolved, ICVs will likely remain the more viable choice for many Indian consumers.

For India to realistically reach its 2030 EV target, considerable investments and policy interventions will be necessary to overcome these challenges. These must include expanding charging infrastructure, making EVs more economically accessible, and addressing the environmental implications of EV production and use. Until such measures are effectively implemented, ICVs will likely continue to be the more practical and reliable choice for many Indian consumers, making the 30% EV adoption goal a challenging but not impossible task.

Works Cited

[1] Anupam, Suprita. “Evs Vs Ice Vehicles In India — What Costs More?” Inc42 Media, 19 Oct. 2023, Inc42.Com/Features/Evs-Vs-Ice-Vehicles-In-India-What-Costs-More/.

[2] Ibef. “Automobile Industry In India, Indian Automobile Industry, Sector, Trends, Statistics.” Www.Ibef.Org, 2022, Www.Ibef.Org/Industry/India-Automobiles.

[3] Mahale, Sneha. "Evs Worse For The Environment Than Diesel And Petrol Cars, Claims Study." Moneycontrol, 10 Mar. 2024, Www.Moneycontrol.Com/News/Environment/Evs-Worse-For-The-Environment-Than-Diesel-And-Petrol-Cars-Claims-Study-12430871.Html.
[4] Pti. "Auto Industry Needs 2 Lakh Skilled People By 2030 To Meet 30 Pc Ev Adoption Target: Siam." The Economic Times, Economic Times, 16 July 2024, Economictimes.Indiatimes.Com/Industry/Auto/Auto-News/Auto-Industry-Needs-2-Lakh-Skilled-People-By-2030-To-Meet-30-Pc-Ev-Adoption-Target-Siam/Articleshow/111779580.Cms?From=Mdr. Accessed 13 Aug. 2024.
[5] Roberts, Jennifer. "How Do Electric Vehicles Perform In The Heat? Here Are The Results From One Study. " Spectrumlocalnews.Com, Spectrum News 1 Charlotte, 21 June 2024, Spectrumlocalnews.Com/Nc/Charlotte/News/2024/06/21/Report-Examines-How-Extreme-Heat-Impacts-Electric-Vehicles-#:~:Text=Although%20more%20people%20are%20investing. Accessed 13 Aug. 2024.
[6] Seetharaman, Mahadevan, Et Al. "India Electric Vehicle Report 2023." Bain, 7 Dec. 2023, Www.Bain.Com/Insights/India-Electric-Vehicle-Report-2023/.
[7] Tabuchi, Hiroko, And Brad Plumer. "How Green Are Electric Vehicles?" The New York Times, 2 Mar. 2021, Www.Nytimes.Com/2021/03/02/Climate/Electric-Vehicles-Environment.Html.
[8] U.S. Department Of Energy. "Alternative Fuels Data Center: Electric Vehicle (Ev) Definition." Afdc.Energy.Gov, 3 June 2021, Afdc.Energy.Gov/Laws/12660.
[9] Voelcker, John. "How Is An Ev Affected By Hot Weather?" Car And Driver, Car And Driver, Aug. 2024, Www.Caranddriver.Com/Features/A61678587/How-Is-An-Ev-Affected-By-Hot-Weather/. Accessed 13 Aug. 2024.
[10] Yadav, Medha Dutta. "The Problem With Evs." The New Indian Express, 15 Dec. 2023, Www.Newindianexpress.Com/Magazine/2023/Dec/16/The-Problem-With-Evs-2641532.Html.