

Evaluating the Adoption of Electric Vehicles in Malaysia: Challenges and Opportunities

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ABSTRACT – This paper examines the adoption of electric vehicles (EVs) in Malaysia from 2016 to 2024, with a focus on market trends, policy measures, and ongoing challenges. Although EV registrations have increased-especially since 2022 due to stronger government incentives and more affordable models-their market share remains low, reaching only about 1.8% in 2024, well below the 15% target set for 2030. Government initiatives such as the National Automotive Policy 2020, Low Carbon Mobility Blueprint, and National Energy Transition Roadmap have established ambitious goals for EV adoption and infrastructure, supported by tax exemptions and incentives for charging. However, key barriers persist, including insufficient charging infrastructure, high upfront vehicle costs, and limited consumer awareness. The paper highlights the need for continued policy support, expanded infrastructure, and public education to accelerate Malaysia's transition to electric mobility and achieve its environmental and economic objectives.

KEYWORDS: Electric Vehicles (EVs), Adoption, Malaysia, Growth Patterns, Government Policies, Infrastructure Development

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1. INTRODUCTION

The global automotive industry is experiencing a major transformation, driven by a rapid shift toward electric mobility. This change is fueled by increasing environmental pressures, including the urgent need to address climate change and improve air quality in cities, along with significant advancements in battery technology, vehicle performance, and charging infrastructure (Zaino et al., 2014). As a result, electric vehicles (EVs) are gaining a larger share of new vehicle sales worldwide, signaling a fundamental shift in personal and commercial transportation. In this global setting, the adoption of EVs holds critical relevance for Malaysia. Embracing electric mobility aligns directly with several national strategic objectives. First, it is key to fulfilling Malaysia's commitments under the Paris Agreement, especially the Nationally Determined Contribution (NDC) target to reduce the greenhouse gas (GHG) emissions intensity relative to GDP by 45% by 2030 compared to 2005 levels (Government of Malaysia, 2021). The transport sector, being the second-largest source of CO₂ emissions in the country (accounting for 23-30% of total emissions), offers a major opportunity for decarbonization through electrification (Asian Transport Outlook, 2024). Second, switching to EVs can improve air quality in crowded urban areas by reducing tailpipe emissions, thereby benefiting public health and making cities more livable (MESTECC, 2020). Finally, developing an EV ecosystem can create significant economic benefits, drive industrial change, attract investment, and generate high-quality jobs, as outlined in national plans like the New Industrial Master Plan (NIMP) 2030, and the National Automotive Policy (NAP) 2020 (Tham, 2023).

Despite growing interest and the implementation of supportive government policies, EV adoption in Malaysia, while increasing, still falls short of initial targets and the pace set by regional leaders. Several significant challenges remain, mainly related to the adequacy and accessibility of charging infrastructure, the relatively high upfront cost of EVs compared to traditional internal combustion engine (ICE) vehicles, and varying levels of consumer awareness and acceptance, including concerns such as range anxiety (Umair et al., 2024).

The adoption of electric vehicles (EVs) has gained significant attention in recent years due to environmental concerns and technological advancements. This article aims to evaluate EV adoption trends in Malaysia from 2016 to 2024, highlighting the growth patterns and comparing them with ICE vehicles. It will focus on analyzing vehicle registration and sales data, which can provide crucial insights into the pace and nature of EV adoption in Malaysia during this period.

2. MARKET TRENDS

From 2016 to 2024, the automotive market remains dominated by traditional ICE vehicles, but data reveals a distinct acceleration in EV adoption starting from 2022, coinciding with stronger policy support. As shown in Figure 1, while petrol-powered ICE vehicles still make up most registered vehicles in Malaysia, there has been a significant rise in electrified vehicle registrations after 2022 (Road Transport Department Malaysia, 2025). The Malaysian automotive market demonstrated resilience and growth in recent years, recovering strongly from the pandemic-induced downturn in 2020 and 2021. The Total Industry Volume (TIV), which indicates total new vehicle registrations, reached a record high of 816,747 units in 2024, crossing the 800,000 mark for the first time. This growth was driven by several factors: a resilient domestic economy with 5.2% GDP growth in the first three quarters of 2024, stable interest rates (OPR at 3.0%), pent-up demand from backlogged orders, successful new model launches, aggressive promotions by automakers, and a 45% increase in battery electric vehicle (BEV) sales, fueled by tax incentives and new model availability, especially from China (New Straits Times, 2025).

Before 2016, the government's stance on full battery electric vehicles was still developing. Although there were early experimental efforts like Perusahaan Otomobil Elektrik Malaysia (POEM) in 1997, these did not attract significant market interest (Jie & Ahmad, 2024). The primary policy focus remained on the broader EEV category under NAP 2014. The market was mainly dominated by ICE vehicles, with very few EV sales and little dedicated charging infrastructure. The foundation for a significant EV push was largely laid in the subsequent policy iterations and initiatives between 2016 and 2024.

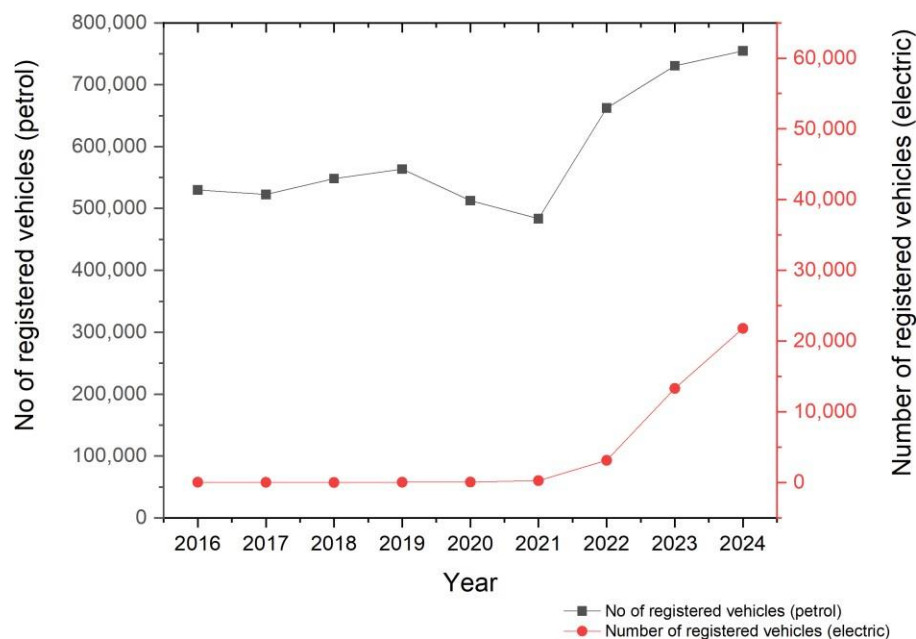


FIGURE 1: Annual registration of petrol and electric vehicles in Malaysia from 2016-2024 (source: Vehicle registration data from data.gov.my, 2025)

The Compound Annual Growth Rate (CAGR) figures clearly show the differing trajectories. While the overall TIV recovered and grew slightly after the pandemic, the growth rate for BEVs has been exceptionally high, though from a very small base. The jump from around 200 units in 2021 to over 20,000 units in 2024 represents a CAGR well beyond triple digits (Business Today, 2025). In contrast, the growth of the dominant ICE segment has been much slower, reflecting market maturity and saturation. Monthly data also reveals volatility, affected by factors like festive seasons (pre-Hari Raya buying pushes sales up), promotional campaigns, economic sentiment, and holiday periods (short working months reduce sales). The dramatic BEV growth clearly correlates with the timing of significant policy interventions, particularly the tax exemptions introduced effective in 2022.

While the electrified vehicle market share is growing, Malaysia's EV transition is still in its nascent phase. The proportion of pure electric BEVs rose from nearly zero to about 0.4% in 2022, then grew to approximately 1.3%-1.7% in 2023, reaching roughly 1.8% in 2024 (Malaysian Automotive Association, 2025). The Malaysian Automotive Association (MAA) projected that EVs would constitute 2% of the TIV in 2024, equating to 14,800 units, which closely matched the actual figures. Although these numbers demonstrate positive growth, they are still well below the government's target of achieving a 15% EV share by 2030 (MIDA, 2024). This highlights the substantial gap between current adoption levels and future aspirations, underscoring the scale of the challenge in accelerating the transition.

3. POLICY FRAMEWORK AND INCENTIVES FOR EV ADOPTION

3.1 National Automotive Policy (NAP) 2020

Launched in February 2020, the National Automotive Policy (NAP) 2020 marked a significant update, aiming to enhance Malaysia's automotive industry in the era of digital transformation. Building on the EEV foundation of NAP 2014, it introduced key new elements: Next Generation Vehicles (NxGV), Mobility-as-a-Service (MaaS), and the integration of Industrial Revolution 4.0 (IR4.0) technologies. An NxGV was defined as a vehicle that meets EEV criteria and possesses at least Level 3 Conditional Automation capabilities (Ministry of Investment, Trade and Industry, 2020).

Key objectives of NAP 2020 encompassed the development of an integrated NxGV technology ecosystem that intends to establish Malaysia as a regional manufacturing hub, expanding participation in the MaaS sector, ensuring industry readiness for IR4.0, and reducing vehicular carbon emissions through improved fuel economy by the year 2025. Specific initiatives outlined included the development of standards for NxGVs with a target market penetration by 2025, as well as the creation of pivotal centers such as the Electric Vehicle Interoperability Centre (EVIC), which concentrates on charging protocols, energy management systems, and component safety. These measures reflect a strategic commitment to adopting advanced vehicular technologies, including electrification and automation.

3.2 Low Carbon Mobility Blueprint (LCMB) 2021-2030

Approved in 2021, the Low Carbon Mobility Blueprint (LCMB) serves as a crucial policy framework for decarbonizing Malaysia's transportation sector. Overseen by the Ministry of Environment and Water (formerly KASA, subsequently NRECC), and partially operationalized through the Malaysian Green Technology and Climate Change Corporation (MGTC), its primary objective is to reduce transport emissions in line with Malaysia's commitments, ultimately envisioning a phase-out of ICE vehicles. The blueprint reportedly outlines four focus areas, ten strategies, and 45 action plans covering aspects such as fuel efficiency enhancement, EV adoption, the utilization of alternative fuels, and modal shifts (MGTC, 2021).

3.3 National Energy Transition Roadmap (NETR) & New Industrial Master Plan (NIMP) 2030

Launched in 2023, these broader national strategies further integrate EV adoption into Malaysia's long-term development plans. The National Energy Transition Roadmap (NETR) sets ambitious long-term targets for the share of EVs in the national fleet. New Industrial Master Plan (NIMP) 2030 adopts a mission-based approach, positioning EV development within its "Pushing for Net Zero" mission while also recognizing its contribution to advancing economic complexity and technological upgrading. NIMP 2030 explicitly highlights the potential for EV development to stimulate growth in related sectors such as plastics, metals, E&E, textiles, rubber, and chemicals (especially for batteries) (Afandi, 2023).

3.4 Key Targets

These policies establish ambitious targets for EV adoption and infrastructure development in Malaysia. The LCMB and NETR aim to have electrified vehicles constitute at least 15% of the TIV by 2030. Furthermore, a target of 100,000 EVs, including 2,000 electric buses, is set to be achieved by the same year. In terms of infrastructure, the LCMB targets 10,000 public EV charging stations nationwide by 2025, initially comprising 9,000 AC chargers and 1,000 DC fast chargers. Given the importance of fast charging, the number of DC chargers was under review early 2024. To create demand, government fleet electrification targets include achieving 10% BEV penetration in new government vehicles by 2022, rising to 50% CKD BEVs by 2030, with similar goals for Government-Linked Companies.

3.5 Fiscal Incentives

Recognizing the significant cost barriers, the government introduced a series of fiscal incentives, with substantial enhancements in the Budgets for 2022 and 2023. Demand-side incentives for EV buyers in Malaysia include extended exemptions from full import duty and excise duty for fully imported (CBU) BEVs until the end of 2025, as well as comprehensive excise duty and sales tax exemptions for locally assembled (CKD) EVs through 2027. Moreover, exemptions from import taxes on CKD EV components have been prolonged to promote local assembly. Additional measures include road tax exemptions for all BEVs until the end of 2025, and individual income tax relief for expenses related to EV charging. A summary of some Malaysian EV policies, targets, and incentives is presented in Table 1.

TABLE 1: Description of variables in the govt car registration dataset

Policy/ Initiative	Key Focus Area	Specific Target/Incentive Detail	Timeframe	Relevant Agencies
NAP 2014	Vehicle Standards	Introduced Energy Efficient Vehicles (EEV) definition based on fuel consumption/emissions	2014 onwards	MITI, MARii
NAP 2014	Demand Incentive	Temporary import/excise duty waivers for Hybrids/EVs	Ended 2017	MITI, MOF
NAP 2020	Vehicle Standards / Ecosystem	Introduced Next Generation Vehicles (NxGV = EEV + Level 3 Auto), MaaS, IR4.0 focus. Established EVIC	2020 onwards	MITI, MARii
LCMB 2021-2030	TIV Target	≥15% EV share of TIV by 2030.	By 2030	NRECC, MGTC
LCMB 2021	Charging Target	10,000 public charging points (9,000 AC / 1,000 DC initially, DC target under review)	By 2025	NRECC, MGTC, CPOs, MITI, PLANMalaysia
NETR / NEP 2022-2040	TIV Target	38% xEV share by 2040.	By 2040	Economy Ministry, NRECC
Budget 2022/23 & Extensions	Demand Incentive (CBU BEV)	100% Import & Excise Duty exemption.	Until Dec 31, 2025	MOF, Customs
Budget 2022/23 & Extensions	Demand Incentive (CKD BEV)	100% Excise Duty & Sales Tax exemption.	Until Dec 31, 2027	MOF, Customs
Budget 2022/23 & Extensions	Demand Incentive	Road Tax Exemption for BEVs.	Until Dec 31, 2025	JPJ, MOF
Budget 2022/23	Demand Incentive	Income tax relief for EV charging expenses.	Ongoing	LHDN, MOF
Various Initiatives	Ecosystem Support	GTFS funding, MEVnet monitoring, Standards development.	Ongoing	MGTC, PLANMalaysia, SIRIM, etc.

4. CHALLENGES HINDERING EV ADOPTION

Despite the positive momentum and supportive policies, widespread adoption of electric vehicles in Malaysia faces several significant hurdles. These challenges include infrastructure limitations, economic factors, and consumer perceptions, which often reinforce each other and slow the pace of transition.

4.1 Charging Infrastructure Deficit

Perhaps the most frequently cited barrier is the inadequacy of the public EV charging infrastructure. The government's Low Carbon Mobility Blueprint targets 10,000 public EV charging points by 2025, but progress is slow, with only about 3,354 chargers installed by October 2024, leaving two-thirds of the goal unmet (BERNAMA, 2024). The original plan called for 9,000 AC (slow) and 1,000 DC (fast) chargers; by October 2024, 2,398 AC and 956 DC chargers were in place, with DC deployment nearly on target but AC lagging (MIDA, 2025). Chargers are mainly concentrated in urban areas and major corridors, while coverage is sparse along highways such as the East Coast Expressway and in states such as Pahang, Terengganu, and Kelantan, limiting the practicality of EVs outside cities (Yeo, 2025). The growth of EV charging points has been significant since 2021, as shown in Figure 2.

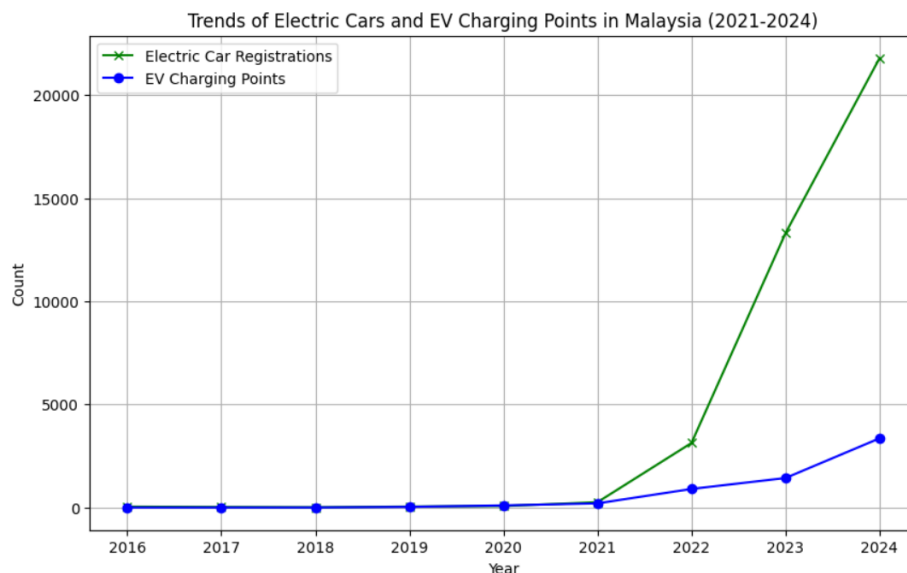


FIGURE 2: Trends of electric cars and EV charging points in Malaysia (2021-2024) (Source for EV charging points: Various news sources citing data from MEVnet dashboard)

To address these gaps, the government launched the Malaysia Electric Vehicle Charging Network (MEVnet), a centralized digital platform developed by PLANMalaysia. MEVnet streamlines the planning, coordination, and monitoring of EV charging infrastructure by integrating data from federal, state, and local authorities. It enables more strategic site selection and helps identify underserved areas, aiming to ensure a fairer and more efficient rollout of chargers nationwide. This system is crucial for aligning infrastructure development with spatial planning policies and accelerating the shift towards sustainable mobility. An overview of the MEVnet dashboard interface, which visualizes charger distribution and planning zones, is shown in Figure 3.

Private Charge Point Operators (CPOs) dominate the market, supported by government incentives, but the fragmented landscape, which requires multiple apps and payment methods, frustrates users. The government is pushing for greater interoperability, yet industry-wide cooperation remains essential. As of October 2023, Malaysia had about 20.7 EVs per public charger, worse than the global average and behind countries like China and Singapore, highlighting infrastructure strain as EV adoption grows (Wong, 2024).

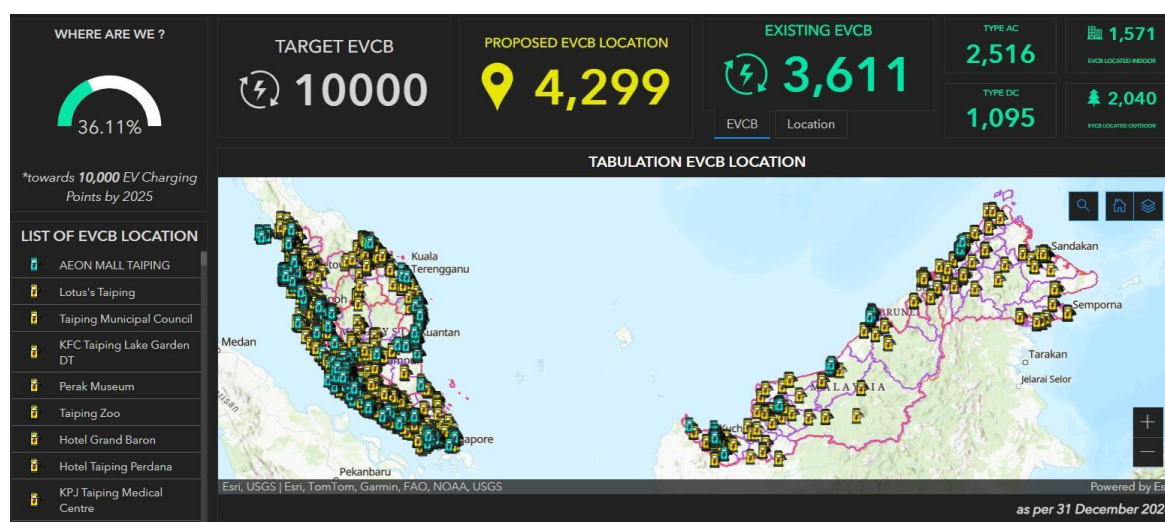


FIGURE 3: Progress of Electric Vehicle Charging Infrastructure (EVCI) in Malaysia
(source: www.planmalaysia.gov.my)

4.2 Economic Barriers

Cost is a significant barrier to widespread EV adoption in Malaysia. Despite tax exemptions, EVs generally have higher initial prices than comparable ICE vehicles, discouraging many middle-income buyers. Although more affordable Chinese brands have entered the market, genuinely budget-friendly EV models are still limited. The Ministry of International Trade and Industry's (MITI) 2024 proposal for direct purchase subsidies highlights that existing incentives may not sufficiently improve affordability (Cheng et al., 2024).

The Total Cost of Ownership (TCO) for electric vehicles (EVs) involves multiple factors: while EVs benefit from lower fuel and maintenance expenses, they are offset by higher insurance premiums, potential battery replacement costs, and depreciation. Research indicates that, in the absence of substantial incentives, EVs face challenges in competing with ICE vehicles in Malaysia, partly due to the influence of low subsidized petrol prices reducing fuel savings. Consequently, government interventions such as tax breaks and subsidies are essential to bridging this gap. Anticipated policy adjustments, including the proposed revision of the Open Market Value calculation in 2026, may further elevate EV prices. Notably, battery costs remain the predominant component of the initial purchase price. Although global trends show declining battery prices, concerns persist regarding battery lifespan, degradation, and replacement expenses. Malaysia's developing battery recycling industry introduces additional environmental and economic uncertainties; nevertheless, ongoing efforts aim to advance this sector.

4.3 Consumer Awareness and Acceptance

Psychological and perceptual barriers significantly affect EV adoption in Malaysia. Range anxiety—the fear of running out of battery before finding a charger—remains a major concern, closely linked to limited charging infrastructure and the range of some EV models. Many consumers also lack awareness and understanding of EV technology, benefits, and maintenance, which leads to misconceptions and hesitation. Concerns about reliability, battery safety and longevity, maintenance complexity, and resale value continue to persist, fueling skepticism.

While environmental concerns matter, practical factors like affordability, ease of use, and perceived value are stronger drivers of consumer decisions. Social influence and recommendations also play a role, but Malaysian buyers tend to prioritize cost and convenience over environmental benefits once basic needs are met (Khazaei and Tareq, 2021).

5. OPPORTUNITIES PRESENTED BY EV ADOPTION

The transition towards electric vehicles, despite its challenges, offers significant opportunities for Malaysia across environmental, economic, and strategic aspects. Seizing these opportunities is crucial for reaching national sustainability goals and boosting economic competitiveness.

5.1 Environmental Benefits

Widespread EV adoption can significantly reduce greenhouse gas emissions, as EVs produce zero tailpipe emissions and have lower overall lifecycle GHG footprints than ICE vehicles. This is vital for Malaysia to reach its 2030 NDC target of a 45% reduction in emission intensity and its 2050 net-zero goal. EVs also improve urban air quality by eliminating pollutants like NO_x and PM_{2.5}, leading to public health benefits. Moreover, EVs offer higher energy efficiency, converting 85-90% of energy into motion compared to 20-50% for ICE vehicles, thereby reducing overall energy consumption (Tham, 2025).

5.2 Economic Advantages

EVs offer lower operating costs due to cheaper electricity and reduced maintenance needs. Malaysia has attracted significant foreign investments in EV assembly, component manufacturing, and infrastructure, with major global players participating. The sector is expected to create 30,000–50,000 skilled jobs in manufacturing, R&D, and maintenance. Malaysia's robust Electrical and Electronics sector supports the development of a local EV supply chain, including advanced batteries and recycling. Successfully establishing this ecosystem positions Malaysia as a regional export hub aligned with national export goals (The Star, 2024).

5.3 Alignment with National Strategies

EV adoption aligns with Malaysia's broader strategic frameworks, including NIMP 2030, NETR, and the Low Carbon Mobility Blueprint, by promoting economic diversification, energy transition, and sustainable development. Overcoming barriers to EV adoption, such as cost, infrastructure, and awareness, is essential to boost domestic demand, attract manufacturing investments, and unlock the full economic and environmental benefits of the EV transition.

6. COMPARATIVE PERSPECTIVE: MALAYSIA IN THE ASEAN CONTEXT

Malaysia's progress in EV adoption, while improving, lags behind regional leaders like Thailand and Singapore. As of 2024, Malaysia's BEV market share is around 1.8%, much lower than Thailand's >10%, despite Malaysia having the highest vehicle ownership rate per capita in ASEAN. Thailand is leading the region with strong government policies, production incentives, and ambitious targets, while Indonesia is rapidly expanding its market by leveraging its nickel resources for battery manufacturing. Singapore focuses on dense infrastructure and early adoption incentives, and Vietnam's growth is driven by its domestic player, VinFast (PwC Malaysia, 2025).

Policy approaches across ASEAN differ, but all aim to boost EV adoption through incentives, infrastructure targets, and industrial strategies. Malaysia's approach focuses on tax exemptions, infrastructure goals, and leveraging its electrical and electronics (E&E) sector for high-value EV components but faces challenges in scaling domestic market growth and infrastructure deployment. Charging infrastructure remains a bottleneck across the region, with Singapore leading in charger density and Malaysia lagging in vehicle-to-charger ratios (Farmer et al., 2022).

The competitive landscape is also shifting, with Chinese EV brands rapidly gaining market share and challenging well-established Japanese manufacturers. For Malaysia to fully leverage its E&E strengths and attract investment, faster market growth and more effective infrastructure deployment are needed to stay aligned with regional leaders.

7. CONCLUSION

The recent adoption of electric vehicles in Malaysia in recent years presents a narrative of rapid advancement, driven by progressively supportive governmental policies, yet hindered by enduring obstacles. The analysis reveals several key takeaways:

- **Policy-Driven Growth:** The Malaysian EV market reached a pivotal point around 2022, with sales surging dramatically following the introduction of comprehensive tax exemptions for EV purchases and components. This illustrates the strong influence of fiscal incentives in boosting initial demand.
- **Emerging Market Share:** Despite significant percentage growth, the actual number of EVs, particularly BEVs, remains small compared to the dominant ICE vehicle sector. The market share of EVs (~1.8% BEV in 2024) is still far short of the ambitious national target of 15% by 2030, indicating the transition is still in its early phase.
- **Infrastructure Bottleneck:** The deployment of public charging infrastructure has fallen significantly short of government targets (10,000 points by 2025). This deficit, particularly in AC chargers and in areas outside major urban centers, remains the most critical barrier, directly contributing to consumer range anxiety.
- **Persistent Cost Barrier:** High upfront purchase prices continue to discourage mass-market adoption, even with tax exemptions. Although TCO may be favorable under certain conditions (high mileage, long ownership), achieving cost parity remains challenging, especially considering Malaysia's comparatively low petrol prices.
- **Consumer Perceptions:** Range anxiety, combined with limited awareness of EV technology, benefits, and charging practicalities, significantly hinders consumer acceptance. Economic and practical factors currently appear to outweigh environmental concerns in the purchasing decisions of many Malaysians.
- **Economic Opportunities:** Significant opportunities exist to leverage Malaysia's E&E strengths to develop a local EV supply chain, attract substantial FDI, generate high-skilled jobs, and potentially establish a regional hub for components and specialized manufacturing.
- **Policy Effectiveness:** Government interventions have effectively stimulated initial demand but are less successful in ensuring timely infrastructure deployment. A potential gap exists in long-term incentive planning and dedicated consumer awareness initiatives.
- **ASEAN Context:** Malaysia falls behind regional leaders like Thailand in EV market penetration, highlighting the competitive landscape and the need for effective policy implementation to close the gap.

Malaysia stands at a crucial juncture in its transition towards electric mobility. The positive sales trends seen in recent years, driven by government support, demonstrate a growing market appetite for EVs. However, realizing the full potential – achieving ambitious national targets, gaining significant environmental benefits, and capturing key economic opportunities – requires decisive and ongoing action. The immediate focus must be on tackling the critical bottlenecks of insufficient charging infrastructure and high initial costs. Implementing the policy recommendations outlined above, focusing on accelerated infrastructure development, optimized financial incentives, enhanced consumer awareness, and strategic ecosystem development, can help Malaysia overcome challenges and firmly establish itself on the path towards a sustainable and prosperous electric mobility future in the vibrant ASEAN region.

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