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Master's Thesis: Market Structure and Competitive Dynamics of Electric Vehicle in Europe.

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INTRODUCTION

The rapid expansion of electric vehicles (EVs) has transformed the European passenger car market from a mature and technologically stable industry into one of the most dynamic arenas of industrial change in recent decades. Between 2015 and 2025, battery electric vehicles (BEVs) moved from marginal market presence to a central position in new vehicle registrations across several European countries. This transformation has not been limited to technological substitution. Rather, it represents a structural reorganization of market competition, cost structures, strategic behavior, and regulatory influence.

Historically, the European automotive industry operated as a relatively stable oligopoly dominated by established manufacturers such as Volkswagen Group, BMW Group, Mercedes-Benz Group, Renault, and Stellantis. Competition was shaped by brand reputation, incremental product innovation, economies of scale in combustion-engine platforms, and deep supplier networks. Entry barriers were high due to capital intensity, technological complexity, and distribution systems. However, electrification has disrupted many of these foundations. Battery technology, software integration, and digital capabilities have emerged as new core competencies, partially reducing the relevance of legacy engine expertise while increasing the importance of supply chain control and platform scalability.

At the same time, regulatory intervention has played a decisive role in accelerating this transformation. Unlike purely market-driven technological shifts, the European EV transition has been heavily shaped by fleet CO_2 standards, subsidy schemes, industrial policy, sustainability regulation, and trade measures. The tightening of emissions targets under the “Fit for 55” framework and the effective 2035 zero-emission requirement have anchored expectations of long-term electrification. Consequently, firms have not simply responded to consumer demand but to binding regulatory constraints that reshape production planning and capital allocation.

The entry and expansion of Tesla and Chinese EV manufacturers have further altered competitive dynamics. Tesla introduced a vertically integrated model centered on battery scale, standardized platforms, and software-defined vehicles. Chinese producers, supported by integrated supply chains and lower battery costs, have entered European markets with significant cost advantages. This has created asymmetric cost competition within a previously stable oligopolistic structure. European incumbents now face pressure not only from domestic rivals but from firms whose cost bases and innovation systems differ fundamentally from traditional European manufacturing models.

The result is a market characterized by high concentration combined with intensifying price competition, multi-dimensional product differentiation, and margin compression. EV production remains capital-intensive, with substantial fixed costs in battery plants, digital architecture, and dedicated BEV platforms. Yet, declining battery prices and aggressive pricing strategies by cost-advantaged competitors have reduced the ability of firms to maintain historical mark-ups. The interaction between scale economies, regulatory constraints, and global competition creates a complex industrial environment in which profitability depends increasingly on technological learning, vertical integration, and strategic positioning.

This thesis examines how the transition to electric vehicles has reshaped the structure and competitive dynamics of the European passenger car market. The central research question guiding the analysis is:

How has electrification transformed competition, cost structures, and profitability in the European automotive industry?

To address this question, the thesis integrates industrial organization theory with empirical evidence from institutional reports, academic studies, and firm-level financial disclosures. The analysis proceeds along three core dimensions: demand, supply, and external factors.

First, the demand side is examined through segmentation patterns, consumer behavior, price sensitivity, and the role of subsidies and charging infrastructure. EV adoption has been uneven across countries and income groups, heavily influenced by fiscal incentives and fleet-channel dynamics. Understanding demand elasticity and policy dependence is essential for interpreting pricing strategies and volume volatility.

Second, the supply side is analyzed through cost structures, economies of scale, barriers to entry, and vertical integration. Battery costs, raw-material sourcing, and platform standardization have become decisive cost drivers. The emergence of Chinese manufacturers with structural cost advantages challenges the competitiveness of European incumbents and reshapes the industry's value distribution.

Third, the thesis evaluates market concentration, strategic interaction, and profitability outcomes. While the European market remains oligopolistic, competitive pressure has intensified through price-based strategies, horizontal differentiation (e.g., SUV dominance), and vertical differentiation (e.g., premium positioning and software capabilities). Profitability in the EV segment remains structurally constrained, with most European manufacturers not yet achieving full margin parity between BEVs and ICE vehicles.

Finally, regulatory and technological external factors are assessed. CO_2 targets, the EU Batteries Regulation, the Critical Raw Materials Act, and trade measures introduce quantitative constraints that directly influence cost structures and competitive behavior. Simultaneously, technological evolution in batteries and software increases fixed investment requirements while lowering variable costs, reinforcing the importance of scale and innovation performance.

By combining these perspectives, this thesis aims to provide a coherent economic interpretation of Europe's EV transition. Rather than treating electrification as a purely environmental phenomenon, it is analyzed as a structural industrial transformation with profound implications for competition, profitability, and long-term strategic positioning.

Chapter 2: The Market Context

This chapter defines the framework for the analysis of the European electric vehicle (EV) market. The objective is to provide a structural overview, outlining the products, fundamental characteristics, and the market's position within the global and national context. Its historical evolution will be examined, along with current trends and growth forecasts, thereby establishing the foundation for the subsequent analysis of demand, supply, and economic dynamics.

2.1 Market Definition and Characteristics

To look at the European electric vehicle (EV) market, we first need to make sure we have precise terminology. The Eurostat/UNECE/ITF Glossary for Transport Statistics says that a "passenger car" is a road motor vehicle that is neither a moped or motorcycle and is meant to carry passengers. It can hold up to nine people, including the driver.

The market is currently going through a structural change in this wide category. This change is being pushed by the use of "alternative fuels," which are any type of motor energy that is not regular petrol or diesel, such as electricity, LPG, natural gas, and hydrogen.

There are three main types of electrified products on the market, each with its own technical and market features:

Battery Electric Vehicles (BEVs) are cars that only run on electricity and get their power from rechargeable battery packs. They can't move in any other way. This group is known for not having any tailpipe emissions, but they need more charging stations and stronger batteries to grow (Li et al., 2022).

Plug-in hybrid electric vehicles (PHEVs) have two types of engines: an electric motor and an internal combustion engine (ICE). A power source outside of the device can also charge their battery. People frequently think of them as a "transitional" technology that links traditional engines to full electrification (Higgins et al., 2023). They can travel a short distance on power.

Unlike other types of electric vehicles, hybrid electric vehicles (HEVs) can't be charged from the outside. Instead, they use regenerative braking and the combustion engine to charge a smaller battery. Recent trends show that HEVs are currently a well-established and popular technology. However, their market share is likely to drop over time when full electrification becomes the norm (Thiel et al., 2024).

The structure of the European market is distinct from that of other market.

To start, it is basically a "policy-driven market." The European automobile sector's trajectory is influenced by stringent regulatory procedures, particularly the EU's fleet-wide CO2 emission performance standards (Mock et al., 2022), in contrast to markets predominantly driven by organic consumer demand or industrial policy alone. These rules pretty much decide how fast models and supplies will be available.

Second, the market is going through a "technological transition," which makes things more unclear. The industry is moving from an old, stable technology (ICE) to a new, disruptive one (EV). This means that older car companies have to deal with two supply chains and investment strategies (Liao & Gonçalves, 2022).

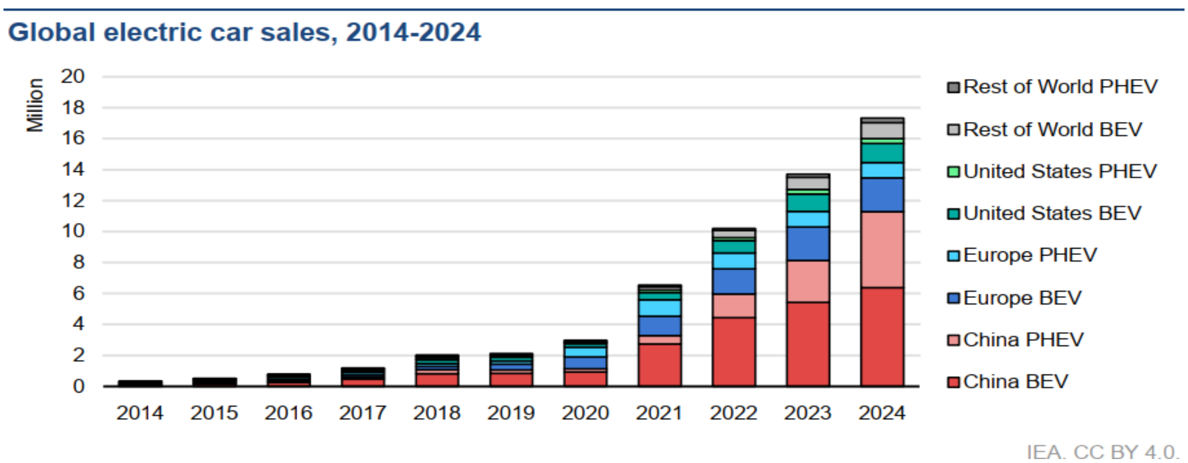
Third, the market has considerable "network effects." The usefulness of an electric car is directly related to how dense and reliable the charging network is. Academic study shows that adoption rates depend a lot on the availability of public and private charging infrastructure. This creates a feedback loop where infrastructure drives sales and sales justify infrastructure investment (Morrison et al., 2023).

Finally, one thing that sets this time period (2024–2025) apart is the "stop-and-go" dynamic.

Recent research shows that market growth isn't steady; it shifts when policies change (Haustein & Stein, 2024). This was very obvious in the first half of 2025, when manufacturers slowed down BEV sales because of the way EU rules were written. Automakers were able to "take their foot off the gas" when the 2025 CO2 targets were averaged over a three-year compliance period. This meant that there would be about 2 million fewer BEV sales between 2025 and 2027 than originally thought (Transport & Environment, 2025).

2.2 Global and National Overview

The European EV market operates within a rapidly expanding global context. In 2024, global electric car sales surpassed 17 million units, achieving a worldwide market share of over 20% (International Energy Agency, 2025). This underscores that the transition to electromobility global phenomenon, though adoption rates vary significantly by region.
China remains the dominant force in the global sector, accounting for nearly two-thirds of all electric cars sold worldwide in 2024 (International Energy Agency, 2025).



[Figure 2.1: Global electric car sales, 2014-2024. Source: International Energy Agency (2025)]

As shown in Figure 2.1, the disparity between regions is widening. While Europe is the world's second-largest market, structural differences are evident. Academic comparisons classify the European market as "policy-driven," prioritizing emission reduction targets. In contrast, the Chinese market is described as "industry-driven," supported by aggressive industrial policy and
supply quotas, while the United States market is "market-oriented," shaped largely by consumer tax credits and state-level mandates (Sperling & Zhang, 2023; Schreurs et al., 2023).
Furthermore, while Europe is considered a "policy leader" in setting sustainability standards (such as the battery passport), it is currently viewed as "technologically catching up" to China in terms of large-scale battery manufacturing and supply chain control (Steinhilber et al., 2022).

European and National Context

In 2024, the European market continued to have a sales share of about 20%, which means that one out of every five new cars sold was electric (International Energy Agency, 2025). However, this total number hides a lot of differences between countries, which is something that has been called "regional clustering" (Bakker et al., 2023).

Non-EU Nordic countries are in charge of the change. Battery Electric Vehicles (BEVs) made up 87.9% of new passenger car registrations in Norway in 2024 (Eurostat, 2025). Norway is still the only country in the world that does this. In Denmark, too, there has been a quick uptake, with more than 50% of new registrations being for vehicles that run on alternative fuels (Eurostat, 2025).

In 2025, the major European Union markets (EU-27) show a mix of growth and stagnation. The total EU car market was down 0.1% from the previous year as of August 2025 (Year-To-Date) (ACEA, 2025). In this stagnant setting, the adoption of BEVs was very different in the "Big Four" markets:

Germany saw a strong rise in BEV registrations of 39.2% (ACEA, 2025).

Belgium also had good growth of 14.4% (ACEA, 2025).

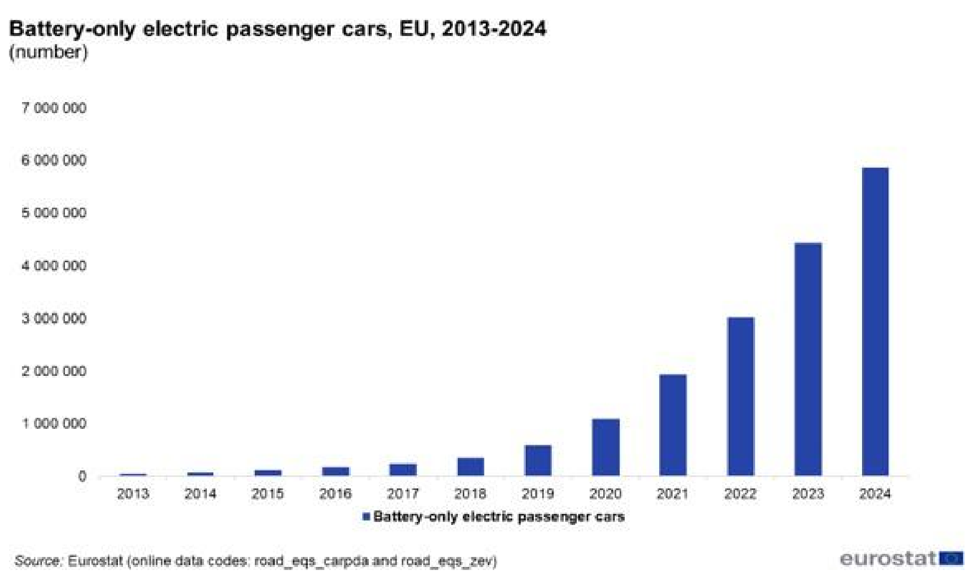
On the other hand, BEV registrations in France went down by 2.0% (ACEA, 2025).

There was a huge increase in Plug-in Hybrid (PHEV) registrations in Italy, up 62.6% (ACEA, 2025).

This information backs up the idea that the European market is not one big thing, but a group of national markets that respond differently to local incentives, economic conditions, and the availability of infrastructure.

2.3 Historical evolution, current trends, and growth forecasts

The European EV market has been growing at an exponential rate over the long term. The rise in global sales from 2023 to 2024 alone (3.5 million units) was more than the total number of electric cars sold in 2020 (International Energy Agency, 2025). By the end of 2024, this speedup would have raised the total number of electric automobiles in the world to around 58 million (International Energy Agency, 2025). You can see this growth in the fleet statistics for the European Union. The number of battery-only electric passenger cars went from a tiny 0.02% in 2013 to approximately 5.9 million by the end of 2024 (Eurostat, 2025). This is a 117-fold rise over the last ten years, with the biggest jumps happening between 2019 and 2021.

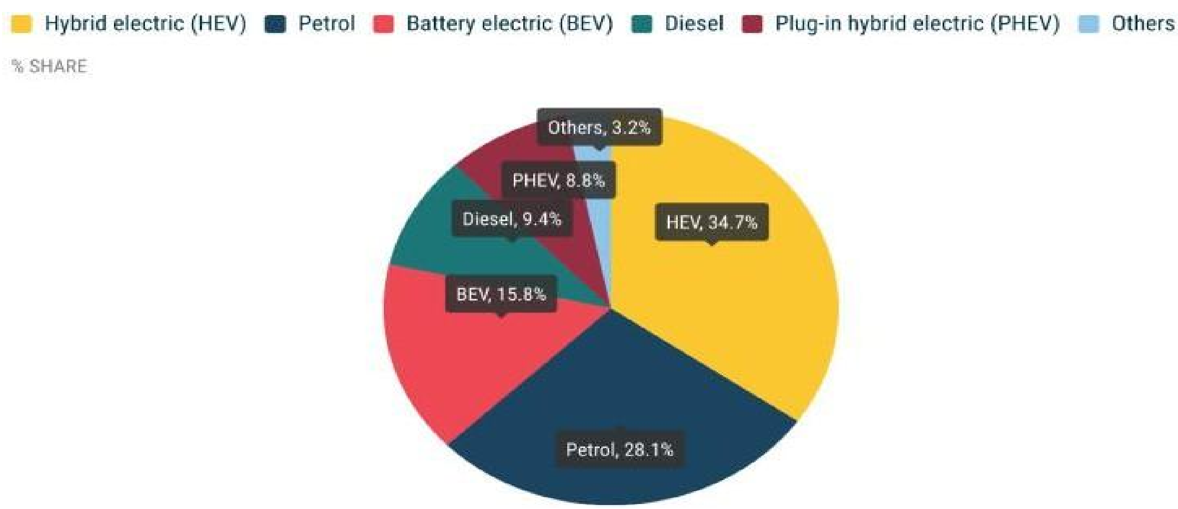


[Figure 2.2: Battery-only electric passenger cars in the EU, 2013-2024. Source: Eurostat (2025)]

As illustrated in Figure 2.2, the stock of EVs has moved past the early adopter phase and is now entering the mass market, although BEVs still represented only 2.3% of the total passenger car fleet on EU roads in 2024 (Eurostat, 2025).

Current Trends

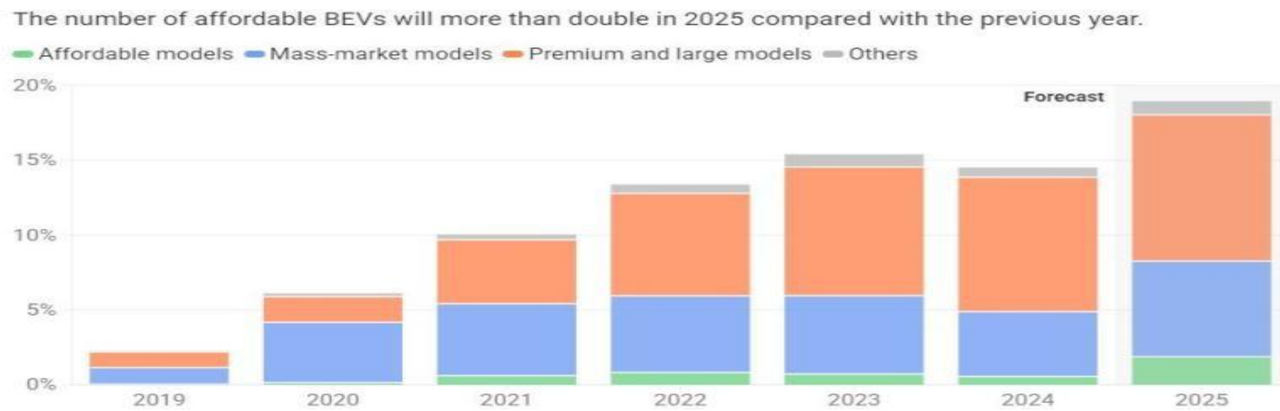
The past has been good, but the market in 2024 and 2025 is showing a complicated "stop-and-go" pattern. the 2024 Stagnation: The market had some problems in 2024. For example, new BEV registrations in the EU fell by 6.1% from 2023 (Eurostat, 2025). The removal of purchase subsidies in important markets like Germany and a lack of rules between CO2 compliance targets caused this stagnation. The 2025 Powertrain Shift: Data from 2025 shows that the automotive market is going through a historic change. Hybrid Electric Vehicles (HEVs) took over as the most popular powertrain in August 2025, making up 34.7% of the market (ACEA, 2025). This increase comes at the direct cost of traditional fuels. The market share of petrol (28.1%) and diesel (9.4%) together dropped to just 37.5% of new sales, down from 47.6% the year before (ACEA, 2025).



[Figure 2.3: New EU car registrations by power source, January-August 2025. Source: ACEA (2025).]

As shown in Figure 2.3, the market is now diversified. BEVs hold a 15.8% share, while PHEVs account for 8.8% (ACEA, 2025). The 2025 Recovery: Despite the slow start to the year, recent months indicate a recovery. In August 2025 alone, BEV registrations grew by 30.2% year-over-year (ACEA, 2025). Furthermore, the market share of BEVs rose from 13.2% in the first seven months of 2024 to 16.6% in the same period of 2025 (Transport & Environment, 2025).

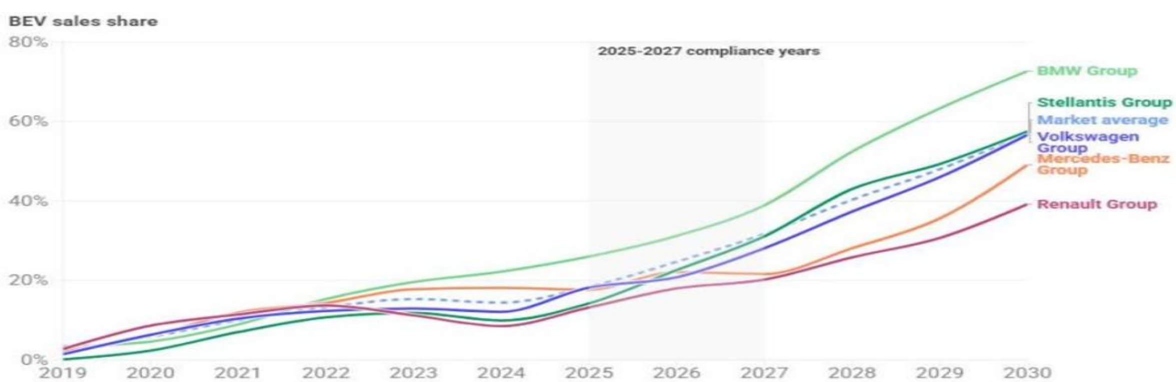
The Rise of Affordable Models: A critical driver of this recovery is the introduction of affordable electric models. Projections indicate that sales volumes of BEVs priced below €25,000 will double in 2025 compared to 2024 (Transport & Environment, 2025). This shift addresses a primary barrier to adoption and signals the market's move from premium segments to mass-market accessibility.



[Figure 2.4: Sales forecast of affordable BEV models (sub-€25k) in Europe. Source: Transport & Environment (2025)]

Growth Forecasts

The European EV market looks strong as we move near 2030, thanks to strict rules like the ban on internal combustion engines in 2035. Major institutions' forecasts all point to a path of big growth: The International Energy Agency (2025) says that electric cars would make up 25% of all car sales in Europe by 2025 and over 60% by 2030. Transport & Environment (2025) predicts a similar trend, with a BEV market share of 18% in 2025 and more than 55% by 2030. Academic syntheses validate these statistics, forecasting a cumulative EV (BEV + PHEV) market share of 60-75% by 2030 (Whitehead et al., 2024).



[Figure 2.5: BEV sales share forecast to 2030. Source: Transport & Environment (2025).]

While growth rates in mature markets like Scandinavia are expected to stabilize, a "catch-up" effect is anticipated in Southern and Eastern Europe, driven by infrastructure expansion and targeted policy interventions (Trommer et al., 2023).

Chapter3 - Demand Analysis

3.1 Product Segmentation

This section analyses the segmentation of the European electric passenger car market from a product-market perspective, focusing on how EV supply is structured across powertrain technologies, vehicle classes and sales channels.

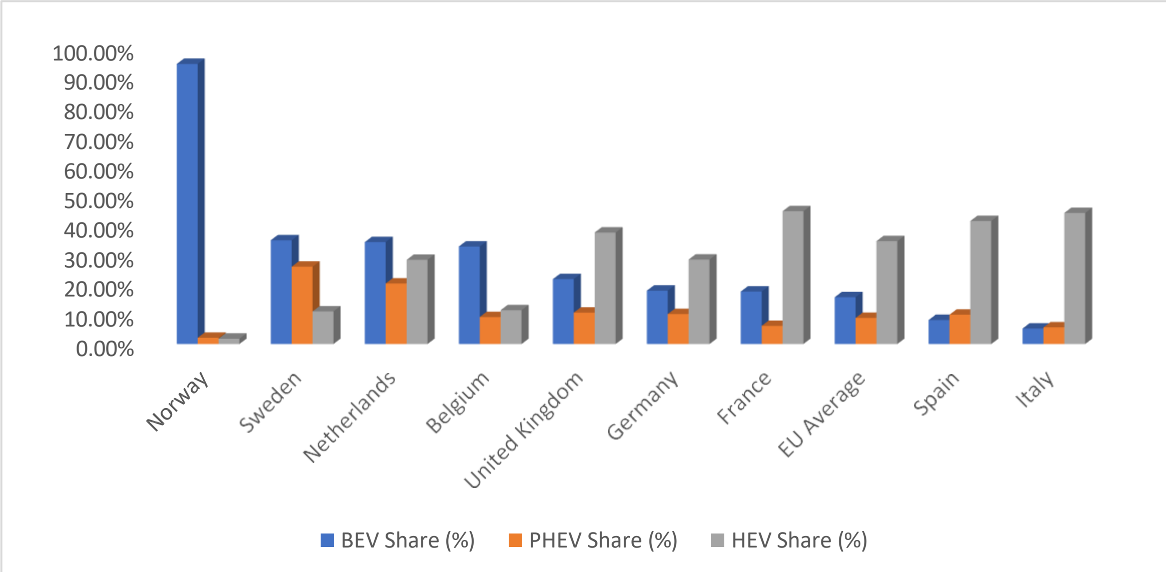
3.1.1 Segmentation by Powertrain Technology

From a product and regulatory perspective, the European electric passenger car market is primarily segmented by powertrain into battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). BEVs, which rely exclusively on grid-charged batteries, have become the dominant zero-emission technology in new registrations, accounting for around 17% of EU passenger car sales in 2025, while PHEVs represented approximately 7% in 2024 (European Automobile Manufacturers' Association, 2025; European Environment Agency, 2025).

PHEVs increasingly occupy a transitional segment within the product mix. While they played an important role in the early diffusion of plug-in vehicles and allowed manufacturers to adapt existing combustion platforms, their strategic relevance has declined as BEV model availability expands and regulatory scrutiny of real-world emissions tightens. EU-level evidence shows a rising share of BEVs within total plug-in registrations and a stabilisation or decline of PHEV volumes following the adjustment of national incentive schemes (International Energy Agency, 2024; Transport & Environment, 2025).

Differences across manufacturers further reinforce powertrain-based product segmentation. European OEMs have adopted heterogeneous BEV–PHEV portfolio strategies depending on platform investments, brand positioning and CO_2 compliance pathways, leading to differentiated competitive positions along the powertrain dimension (Brugger and Kollegger, 2023; International Energy Agency, 2024).

The evolution of the EU powertrain mix in new registrations provides a direct representation of this product segmentation and its direction over time (European Automobile Manufacturers' Association, 2025; European Environment Agency, 2025)



[Figure 3.1: Market Share of Electrified Powertrains (BEV, PHEV, HEV) in Selected European Markets (Jan- Aug 2025). Source: Author's elaboration on ACEA (2025) data.]

Figure 3.1 shows the increasing dominance of BEVs within the European plug-in market and the declining relative importance of PHEVs. This confirms that powertrain technology constitutes a primary axis of product segmentation, with BEVs emerging as the core long-term technology and PHEVs remaining a shrinking intermediate segment (International Energy Agency, 2024; Transport & Environment, 2025).

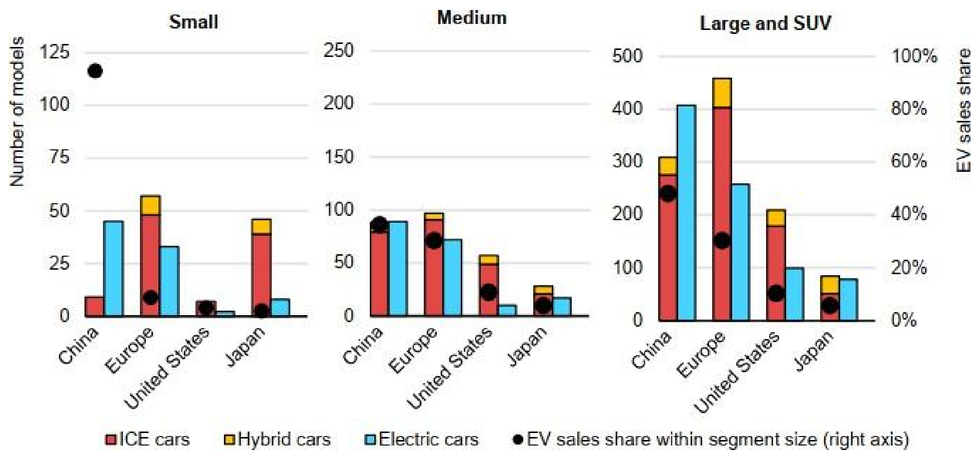
3.1.2 Segmentation by Vehicle Class (Size and Price Tier)

Another important feature of product segmentation is vehicle class, especially how BEVs and PHEVs are spread out over different size and price ranges. At first, manufacturers focused on higher-margin sectors to make up for the increased costs of batteries (Hardman and Tal, 2021; International Energy Agency, 2024). This led to early EV adoption in Europe being mostly in larger, more expensive vehicle classes, such as premium sedans and SUVs.

Evidence from registrations and model availability shows that SUVs make up more than half of new passenger car registrations in Europe and a larger share of BEV and PHEV offerings than they should. Smaller A- and B-segment EVs have not been well represented in the past (International Energy Agency, 2024; JATO Dynamics, 2025).

Recent product debuts indicate a steady expansion of electric vehicle (EV) options into smaller categories and lower price ranges. This is making it easier to tell the difference between premium EVs that are mostly in larger vehicle classes and a new mass-market category that is starting to grow in smaller sizes. Affordability is still the most important part of this system, but Section 3.3 looks at how demand changes when prices vary. (International Energy Agency, 2024; McKinsey & Company, 2024).

A useful way to visualize this segmentation is to compare, by vehicle size segment, both the availability of EV models and the realized EV sales share in Europe (International Energy Agency, 2024).



[Figure 3.2 – Availability of passenger car models by powertrain and EV sales share by vehicle size segment in Europe, 2024, Source: International Energy Agency (2024), Global EV Outlook.]

Figure 3.2 highlights that EV model availability and sales penetration are substantially higher in large and SUV segments than in small vehicle classes. This indicates that electrification in Europe remains concentrated in larger vehicle classes, while small segments continue to lag in both product availability and market uptake (International Energy Agency, 2024).

3.1.3 Segmentation by Sales Channel (Private vs Fleet)

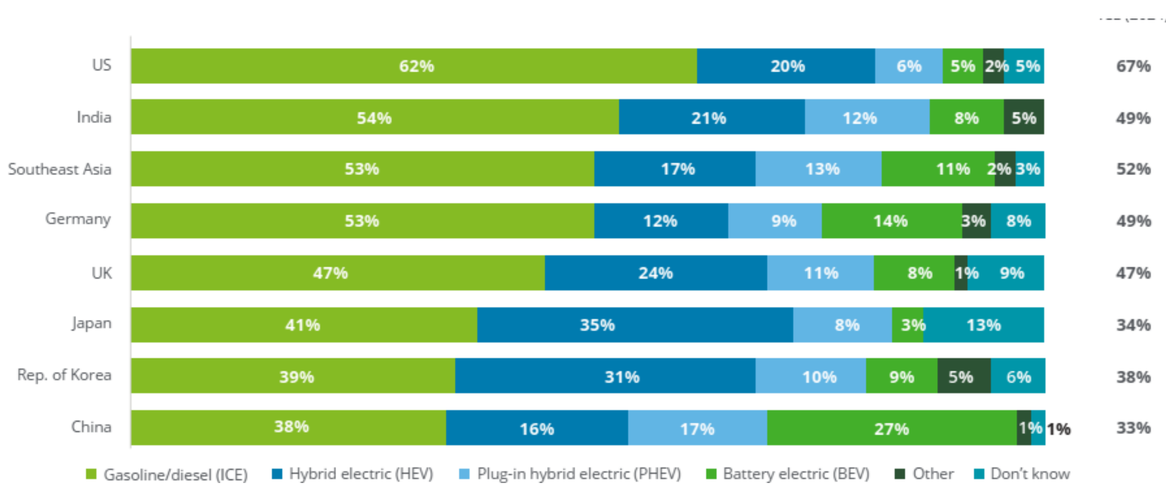
The third way to divide products is by sales channel. This is especially true for automobiles that are sold directly to private households and those that are supplied to corporate and fleet markets. The company-vehicle and leasing channel is a big part of new passenger car registrations in Europe and is a key part of the spread of BEVs and PHEVs (European Automobile Manufacturers' Association, 2024; International Energy Agency, 2024).

The mix of products that manufacturers offer is affected by fleet and leasing demand. This is because vehicles sold via these channels are replaced more regularly and are often in line with tax and regulatory incentives that favor electrified powertrains. Because of this, BEVs and PHEVs make up a larger percentage of business registrations in some EU member states. This has an effect on both new car sales and the future makeup of the used car market. (International Energy Agency, 2024; European Environment Agency, 2025).

From a product-market perspective, this creates a dual structure in which EVs are initially absorbed through fleet channels before diffusing into private ownership via the used-vehicle market. Sales-channel segmentation therefore interacts with powertrain and vehicle-class segmentation, reinforcing heterogeneity in the European EV market structure (European Automobile Manufacturers' Association, 2024; International Energy Agency, 2024).

3.2 Consumer Behavior and Preferences

Consumer behavior in the European electric passenger car market reflects a combination of stated intentions, practical constraints and psychological factors that shape the translation of interest in electrification into actual purchase decisions. Unlike conventional vehicles, electric vehicles (EVs) require behavioral adaptation in terms of refueling practices and reliance on complementary infrastructure, which increases heterogeneity in consumer responses across population groups and usage contexts (Hardman and Tal, 2021).



[Figure 3.3 – Consumer preferences for powertrain type in next vehicle purchase across selected markets, Source: Deloitte (2025), Global Automotive Consumer Study.]

Figure 3.3 reports stated preferences regarding the powertrain of the next vehicle purchase among European consumers. The figure indicates a growing intention to adopt electrified powertrains, with battery electric vehicles (BEVs) attracting substantial interest, while plug-in hybrid electric vehicles (PHEVs) and hybrid electric vehicles (HEVs) remain relevant transitional options. At the same time, the persistence of internal combustion engine preferences highlights the gap between stated intentions and realised adoption, underscoring the role of non-price constraints and behavioural barriers in shaping market outcomes.

3.2.1 Socio-economic and spatial determinants of consumer choice

Empirical studies show that EV adoption intentions and outcomes differ significantly across socio- economic groups. Higher-income and better-educated consumers are more likely to express interest in BEVs, reflecting greater familiarity with new technologies and a higher tolerance for perceived risks related to range, charging and resale value (Danielis et al., 2020; Rezvani et al., 2015). These consumers are also disproportionately located in urban and suburban areas, where daily mobility patterns are more compatible with current EV performance characteristics.

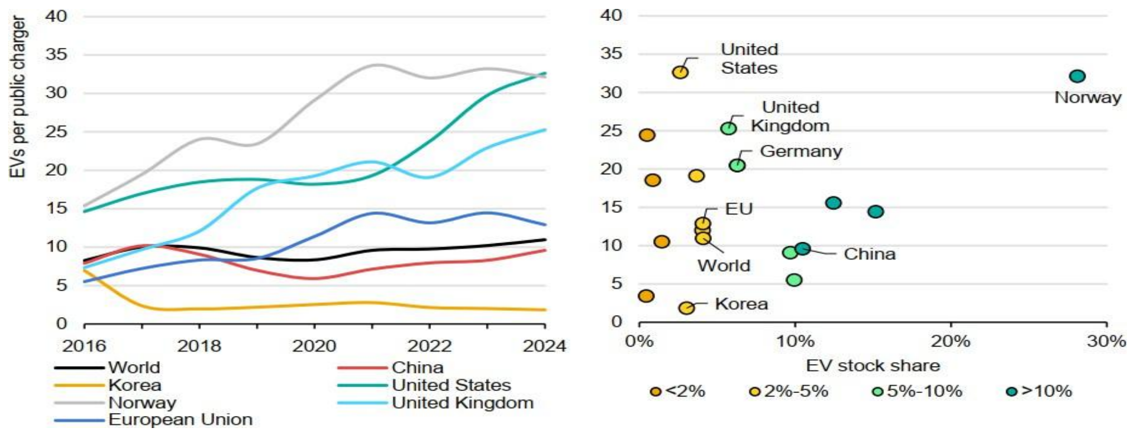
Spatial context further conditions consumer behaviour. Urban residents typically benefit from shorter trip distances and greater exposure to EVs, while rural households face longer travel requirements and more limited access to charging infrastructure. These factors reduce the attractiveness of BEVs in rural settings and increase reliance on alternative powertrains, even when stated preferences for electrification are present (Hardman and Tal, 2021).

3.2.2 Housing characteristics and access to charging infrastructure

Access to charging infrastructure is a big factor in whether people actually adopt the preferences they say they have. Households that have access to private parking and home charging facilities are far more likely to embrace BEVs since home charging makes things less confusing and less inconvenient (Danielis et al., 2020). On the other hand, people who live in apartments without designated parking confront structural problems that make it harder to purchase an electric vehicle.

So, the availability of public charging helps shape how people act. Even people who say they want to buy BEVs may wait to do so if they think charging access is inconsistent or cumbersome. This shows how important it is to have the right infrastructure in place for people to adopt EVs (Rezvani et al., 2015).

Access to charging infrastructure is a critical enabling condition that determines whether people who say they want to buy an electric car actually do. In Europe, households that can't charge their own cars at home, especially those who live in apartments, rely more on public charging. This makes the number of public chargers a key element in how people behave (Hardman and Tal, 2021; Rezvani et al., 2015). Consequently, variations in public charging infrastructure can lead to diverse adoption outcomes, even across countries with comparable economic levels and environmental perspectives (International Energy Agency, 2024).



[Figure 3.4 – Electric light-duty vehicles per public charging point and EV stock share in selected regions, Source: International Energy Agency (2025), Global EV Outlook.]

Figure 3.4 indicates that the number of electric vehicles compared to the number of public charging outlets varies a lot from one location to the next. This is because the market is at different stages of development, the population is more or less dense, and the types of homes are different. The average ratio of about one public charger for every 13 electric vehicles in the European Union in 2024 shows that infrastructure investment is fairly balanced compared to markets with fewer chargers (International Energy Agency, 2024). This evidence supports the idea that having enough charging stations makes it easier for people to switch to BEVs, especially for people who can't charge their own cars. On the other hand, gaps in infrastructure can slow down adoption even when people say they want to switch.

3.2.3 Psychological factors and range anxiety

Psychological factors, like how people see risk and range anxiety, also affect how people act. Despite advancements in battery capacity and charging speed (Shrestha et al., 2022), range anxiety continues to be a significant concern for potential EV purchasers. People who have used electric vehicles for a long time say they feel less anxious than people who don't own one. This suggests that learning effects and familiarity reduce perceived risks over time.

Concerns about battery life, technology becoming outdated, and long-term reliability also affect choices, especially for people who need to be able to move around easily or who don't have easy access to charging stations. These mental blocks help explain why people don't always start using EVs right away when they have a positive attitude about them (Rezvani et al., 2015).

3.2.4 Private versus corporate users: behavioral differences

People who use company cars or fleet vehicles behave differently than people who live in private homes. Corporate purchasing decisions are often influenced by financial incentives and fleet policies. However, individual users within corporate schemes make their choices based on practical factors, such as the availability of charging at home or work and how well the product meets their daily mobility needs (Hardman and Tal, 2021). Consequently, expressed preferences obtained from household surveys may not accurately represent behavior within the company-car segment.

This distinction accounts for the discrepancies between survey-based metrics of consumer interest and the actual adoption trends reflected in registration data, wherein corporate demand is a significant factor.

3.3 Price Elasticity of Demand

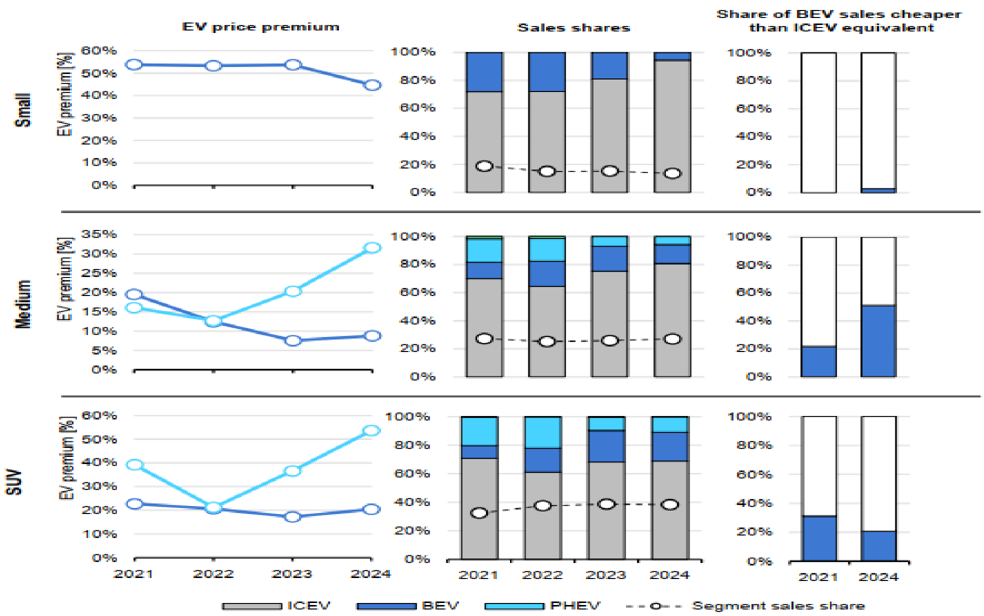
Price elasticity is a key part of EV demand because the price of the vehicle is still one of the biggest barriers to adoption. Empirical research consistently demonstrates that the demand for electric vehicles (EVs) exhibits greater price elasticity compared to conventional vehicles, indicative of heightened perceived risk and increased uncertainty associated with emerging technologies (Sierzchula et al., 2014).

Cross-country studies in Europe show that lowering effective purchase prices, whether through subsidies, tax breaks, or other price-equivalent measures, leads to a big rise in EV registrations (Sierzchula et al., 2014). Panel data from across the EU shows that the price of the BEV is still the most important factor in whether or not people buy one, even when income and infrastructure availability are taken into account (Neves et al., 2025).

Discrete choice experiments yield supplementary insights by assessing consumers' willingness to pay for electric vehicle attributes. Italian evidence indicates that environmentally conscious consumers display heightened sensitivity to purchase price and necessitate substantial compensatory benefits regarding range, charging convenience, or operational cost savings to acquiesce to elevated prices (Danielis et al., 2020). Meta-analytic evidence substantiates that although consumers appreciate enhancements in range and charging speed, their implied willingness to pay frequently fails to completely bridge the existing price disparity between numerous BEVs and ICE vehicles (Bergstad et al., 2024).

The costs of running a business also affect the effective price elasticity, along with the purchase price. When gas prices go up, more people are interested in electric vehicles (EVs), which means that when gas prices go up, people are less likely to buy ICE vehicles (Yang et al., 2020). On the other hand, high electricity prices can make EVs seem less cost-effective to run, especially for people who can't get off-peak rates (Shariatzadeh et al., 2025). Price sensitivity varies among income groups, with lower-income households demonstrating markedly greater elasticity than their wealthier counterparts (Danielis et al., 2020).

Price differentials between electric and conventional vehicles remain a key determinant of demand. Figure 3.5 illustrates the price premium of electric vehicles relative to internal combustion engine vehicles by segment, together with corresponding powertrain sales shares in Germany over the period 2021–2024.



[Figure 3.5 – Electric vehicle price premium and powertrain sales shares by segment in Germany (2021– 2024), Source: International Energy Agency (2025).]

The figure shows that battery electric vehicles continue to exhibit a positive price premium in most segments, particularly in small and SUV categories, which helps explain the relatively high price sensitivity of EV demand documented in the literature. At the same time, the increasing share of BEVs priced below comparable ICE vehicles in certain segments indicates that price parity is gradually being reached, which may reduce demand elasticity over time and support broader adoption beyond early adopter groups.

3.4 Substitutes and Complementary Goods

The demand for EVs is influenced by the substitution patterns of competing powertrain technologies and the availability of complementary goods. Discrete choice experiments demonstrate that battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), hybrid electric vehicles (HEVs), and internal combustion engine (ICE) vehicles constitute a distinct choice set, wherein substitution is contingent upon relative prices, range, and charging conditions (Hoen and Koetse, 2014). PHEVs and HEVs often work as temporary replacements for full electrification when charging options are limited or range anxiety is high (Danielis et al., 2020).

Data from Northern European markets shows that as the range of BEVs gets better and the charging infrastructure gets bigger, BEVs are replacing ICE vehicles more and more instead of just adding to existing fleets (Yang et al., 2020). Registration data indicate that electrified vehicles predominantly replace conventional cars rather than prompting an increase in vehicle ownership, signifying authentic substitution within the passenger car market (Gnann et al., 2018).

Charging infrastructure and the ability to charge at home are two important complementary goods. Having access to private charging makes BEVs much more practical and appealing. Public fast-charging infrastructure, on the other hand, makes long-distance travel possible and makes people less dependent on PHEVs or ICE vehicles (Shariatzadeh et al., 2025). Electricity pricing structures further condition this complementarity by influencing charging costs and convenience, thereby shaping the relative attractiveness of electric versus conventional powertrains.

Chapter 4- Supply Analysis

Supply Analysis

Following the demand-side analysis, this chapter turns to the supply dynamics of the European electric vehicle market. The industry is currently undergoing a structural transformation driven by stringent environmental regulations and intensified global competition. This section investigates the changing competitive landscape, the evolution of production costs, and the strategic reconfiguration of the value chain. By examining these factors, the analysis highlights the key supply-side constraints from raw material dependency to manufacturing scalability that will define the pace of Europe's transition.

4.1 Principal Actors & Market Structure

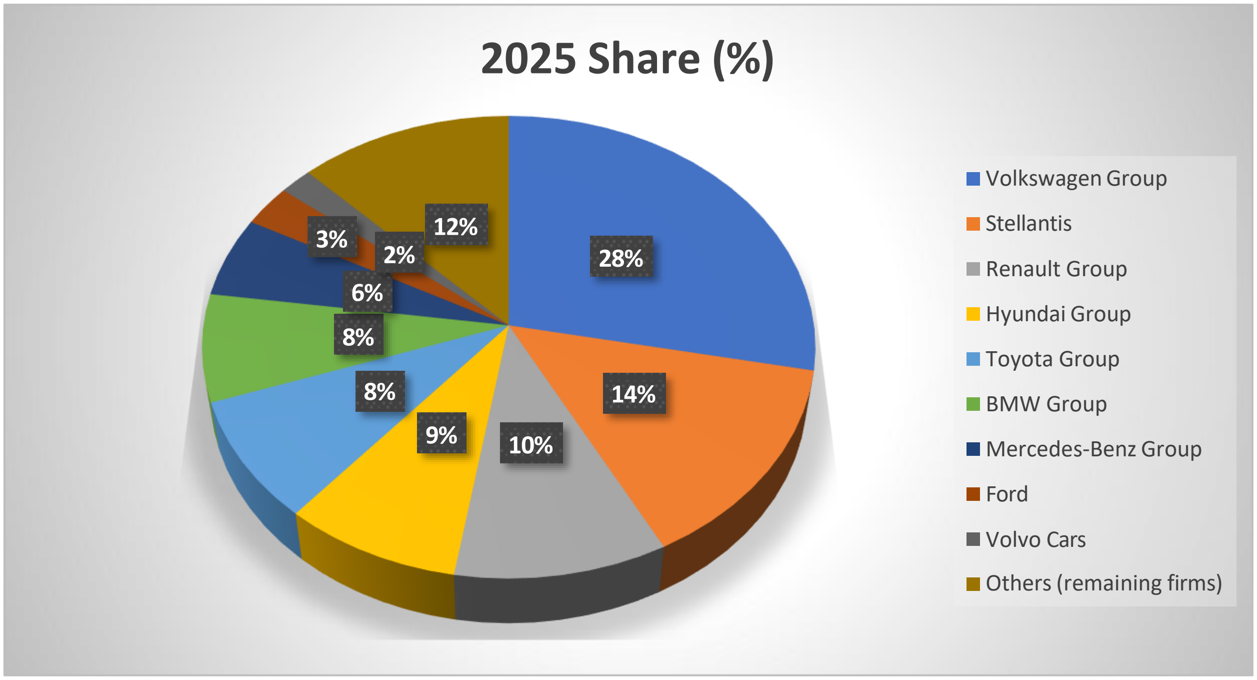
Recent scholarly research and strategic industry evaluations indicate that the European automotive sector remains significantly concentrated and oligopolistic; however, the shift towards electric vehicles (EVs) is disrupting the established internal combustion engine (ICE) oligopoly and fostering new strategic alliances centered on electrification capabilities (Brugger and Kollegger, 2023; Lee and Malerba, 2023; McKinsey & Company, 2024a). Evidence at the firm level in Germany and France shows that a small group of established manufacturers—Volkswagen Group, Stellantis, Renault, BMW, and Mercedes-Benz—still dominate production and employment. However, they are now taking different approaches and paths as they move toward battery electric vehicles (BEVs) (Brugger and Kollegger, 2023). A technological analysis of internal combustion and battery-electric architectures shows that BEVs have a more modular and electronics-focused structure. This makes it easier for new, specialized companies to enter the market, even though final vehicle assembly is still concentrated (Lee and Malerba, 2023).

The concept of "strategic groups" offers a valuable framework for characterizing the current competitive environment, wherein established European OEMs, US pure-play EV companies, and Chinese manufacturers coexist and interact within the European EV sector (Brugger and Kollegger, 2023; Guérin and Rubini, 2025; McKinsey & Company, 2024a). Brugger and Kollegger (2023) analyze the German and French automotive sectors, differentiating between European incumbents that aggressively commit to BEV production and those pursuing more incremental electrification pathways. They argue that these strategic differences have significant implications for investment and employment along national supply chains. At the same time, McKinsey & Company (2024a) says that there are three main groups of companies competing in the European BEV market: (i) traditional European OEMs; (ii) US pure-play EV manufacturers like Tesla; and (iii) a fast-growing group of Chinese companies like BYD, SAIC, and Geely that use cost advantages, vertically integrated battery supply chains, and quick product cycles. According to a scenario analysis by McKinsey & Company (2024a), if something bad happens, European OEMs' share of BEV sales in Europe could drop from about 60% in 2023 to about 45% in 2035 as Tesla and Chinese brands gain market share.

This changing structure has led to discussions about whether the European market is breaking up or changing into a "oligopoly plus challengers" model. McKinsey & Company (2022) says that many Chinese and new EV companies use different go-to-market strategies, like selling directly to consumers, using subscription models, or setting up asset-light import structures. However, they still rely on partnerships with established European dealer and service networks, which adds competitive pressure without immediately changing the dominance of the incumbents. Guérin and Rubini (2025) describe the industry as entering a period of "structural contestability," where foreign EV competitors and Tesla are lowering the prices and profits of established companies in the EV market, but they have not yet taken over their overall dominance in production and employment. These studies collectively affirm the perspective that the European automotive market retains an oligopolistic structure, characterized by an expanding cohort of non-European EV specialists rather than a completely fragmented competitive landscape (Brugger and Kollegger, 2023; Guérin and Rubini, 2025; McKinsey & Company, 2024a).

In this environment, fleet carbon dioxide (CO_2) regulation and related pooling arrangements have become unique ways to compete. Under European Union (EU) fleet CO_2 targets, manufacturers can form CO_2 pools to meet emission limits together. This lets manufacturers share the costs of compliance and lets EV-strong manufacturers make money from extra low-emission capacity (International Energy Agency, 2024). The International Energy Agency (2024) says that pools and credit trading let some smaller or less advanced companies avoid big fines by working with manufacturers who sell more EVs than they need to. This gives EV-focused companies another way to make money. Policy analysis shows that pooling affects product planning and pricing strategies, even though firm-level pooling contracts are usually private. This is because OEMs have to think about how much money they can make by selling high-emission vehicles compared to how much it costs to buy credits or join pools with BEV-leading partners (International Energy Agency, 2024; Brugger and Kollegger, 2023). This means that CO_2 pooling is both a way for existing companies to share risk and a way for EV-specialist companies to get ahead by selling compliance capacity (International Energy Agency, 2024).

Theoretical frameworks indicate a contestable market, yet empirical evidence substantiates a continual concentration of power. The European market is still an oligopoly controlled by legacy incumbents as of late 2025, even though new players are starting to take away their traditional market shares. Figure 4.1 shows how new passenger car registrations are spread out by manufacturer group. It shows that the top three European players are still in charge.



[Figure 4.1: European New Passenger Car Market Share by Manufacturer Group (Aug 2025). Source: Author's elaboration on ACEA (2025) data.]

The data reveals that the Volkswagen Group and Stellantis alone control a substantial portion of the market, validating the 'strategic group' theory discussed earlier. However, the expanding 'Others' slice— driven largely by the rise of Tesla and new Chinese entrants like SAIC (MG) demonstrates the increasing fragmentation of the supply side. This structural shift signals that while barriers to entry remain high, the 'moat' protecting legacy OEMs is narrowing in the face of specialized electric competition.

4.2 Cost Structure

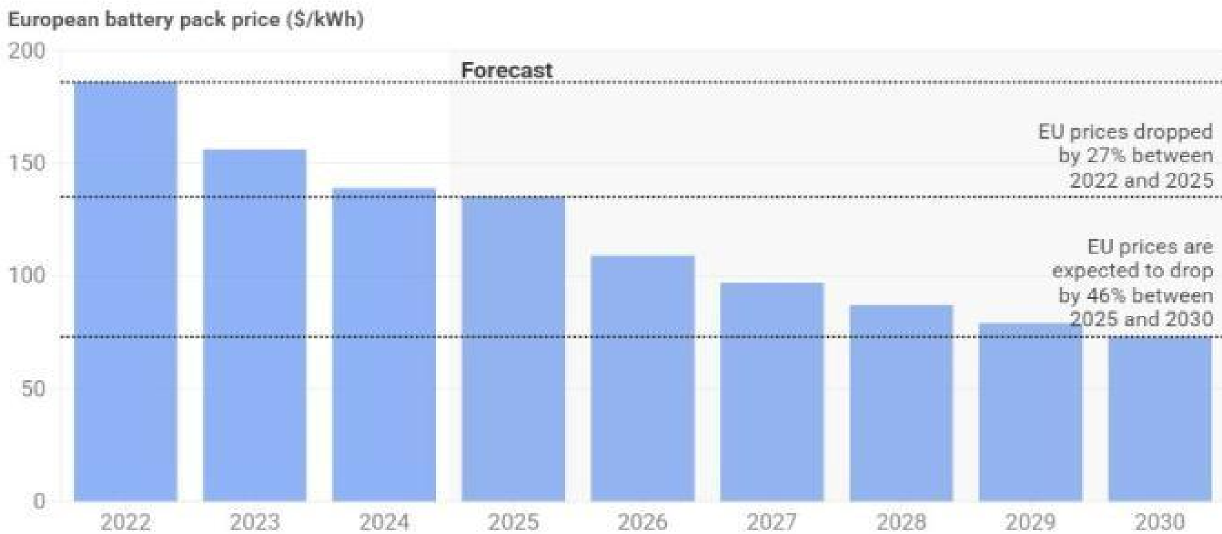
Across recent Tier-1 industry reports and policy analyses, battery packs remain the single largest cost component of BEVs manufactured in Europe, with software, power electronics, labour and energy constituting substantial additional cost drivers (BloombergNEF, 2024; International Energy Agency, 2024; McKinsey & Company, 2024a; Transport & Environment, 2025). BloombergNEF (2024) reports that the global average lithium-ion battery pack price fell by about 20 percent in 2024 to around 115 USD per kilowatt-hour, driven by lower raw material prices and improved manufacturing efficiency, yet pack prices in Europe remained roughly 50–60 percent higher than in China because of higher production costs, more expensive energy and reliance on imported processed materials. Building on these data, Transport & Environment (2025) estimates that battery packs account for approximately 20–25 percent of the total bill-of-materials (BoM) cost of a typical compact or mid-size BEV produced in Europe, with variations by segment and battery size. The International Energy Agency (2024) similarly notes that, although declining battery costs are narrowing the cost gap with ICE vehicles, battery packs still represent around one-fifth to one-third of BEV manufacturing cost, depending on the model and reliance on imported cells.

Beyond batteries, the shift to BEV architectures raises the relative importance of software, electronics and integration costs. Analysing product architectures and innovation patterns, Lee and Malerba (2023) show that BEVs transfer technological complexity from mechanical subsystems to power electronics, battery management systems and software-defined vehicle platforms, increasing both the strategic and cost significance of electronic control units and software stacks. McKinsey & Company (2024a) estimates that software and electronics can account for roughly 10–15 percent of the BoM cost of modern BEVs, with an additional portion of fixed costs allocated to software development, connectivity infrastructure and cybersecurity. Labour and energy costs also weigh more heavily in Europe than in key competitor regions, because industrial electricity prices and wage levels are comparatively high and environmental compliance standards are more stringent (McKinsey & Company, 2024a; BloombergNEF, 2024). These factors increase both variable and fixed costs for European EV production relative to East Asian competitors.

A widely cited figure in recent strategic analyses is the 20–30 percent production cost gap between European and Chinese BEV manufacturing, which arises from differences in battery supply chains, labour costs, plant scale, energy prices and vertical integration (McKinsey & Company, 2024a; BloombergNEF, 2024; Transport & Environment, 2025). McKinsey & Company (2024a) argues that Chinese OEMs benefit from highly integrated domestic cell and battery material industries, lower capital costs and larger, fully utilised plants, together generating cost advantages of around 20–25 percent for comparable BEV models compared to European production. BloombergNEF (2024) provides corroborating evidence at the component level by showing that battery pack prices in Europe were approximately 56 percent higher than in China in 2024, reflecting both higher input costs and lower utilisation of relatively new European gigafactories. Transport & Environment (2025) concludes that even if all announced European cell plants come online, Europe will struggle to fully close the cost gap with China without substantial reductions in industrial energy prices and more integrated domestic midstream (cathode, anode, precursor) industries.

Synthesizing these sources, typical 2024–2025 cost breakdowns for BEVs in Europe allocate roughly 20–30 percent of total cost to the battery pack, around 10–15 percent to power electronics and e-drivetrains, and approximately 10–15 percent to software and electronics, with the remaining cost distributed across body-in-white, interior, assembly, labor, overheads and compliance costs (International Energy Agency, 2024; McKinsey & Company, 2024a; Transport & Environment, 2025). As battery pack costs decline, the International Energy Agency (2024) notes that non-battery components and fixed development costs (including software, R&D and tooling) account for a growing share of total BEV cost, particularly in high-wage regions such as Europe. This evolving cost structure underpins the strategic emphasis on localizing battery manufacturing, reducing energy costs and improving supply-chain integration in order to sustain competitive EV production in Europe (McKinsey & Company, 2024a; Transport & Environment, 2025).

A granular analysis of the electric vehicle cost structure identifies the battery pack as the single largest component of the Bill of Materials (BoM), historically accounting for 30-40% of the total vehicle cost (International Energy Agency, 2025). However, this cost burden is subject to a rapid deflationary trend driven by technological improvements in cell chemistry specifically the shift to Lithium Iron Phosphate (LFP) and manufacturing economies of scale. As illustrated in Figure 4.2, the unit cost of lithium-ion battery packs in Europe has followed a consistent downward trajectory, effectively lowering the breakeven point for electrification (Transport & Environment, 2025).



[Figure 4.2: Evolution of Lithium-Ion Battery Pack Prices in Europe ($/kWh). Source: Transport & Environment (2025).]

The data in Figure 4.2 forecasts a significant reduction in costs, with European battery prices expected to drop by 46% between 2025 and 2030 (Transport & Environment, 2025). This sharp decline is primarily attributed to the increasing adoption of Lithium Iron Phosphate (LFP) chemistry, which is cheaper than traditional NMC batteries. The report highlights that while China has already achieved a 67% LFP market share giving it a current cost advantage Europe is rapidly catching up, with LFP expected to account for 50% of European battery production by 2030 (Transport & Environment, 2025).

4.3 Barriers to Entry

The shift to electric vehicles hasn't gotten rid of the usual barriers to entry in the auto industry; instead, it has changed them to focus on high capital requirements, battery and software technology, economies of scale in manufacturing, and access to important raw materials (Hardman and Tal, 2021; Lee and Malerba, 2023; International Energy Agency, 2024). The International Energy Agency (2024) says that announced investments in EV and battery supply chains around the world total hundreds of billions of dollars. A single large-scale battery cell plant can cost between 2 and 5 billion euros to build. Such high capital requirements make it very hard for new European car makers or cell producers to get in without a lot of money or public support. Economies of scale in vehicle assembly and especially in cell manufacturing make these barriers even higher. This is because unit costs drop sharply when production is standardized and usage is high, which benefits companies that already have large domestic or export markets (BloombergNEF, 2024; Transport & Environment, 2025).

Technological lock-in and capability barriers are notably significant in batteries and software. Lee and Malerba (2023) compare internal combustion and battery-electric innovation systems and say that the move to BEVs changes but does not get rid of the cumulative learning advantages of incumbents: Legacy OEMs still know how to integrate systems and follow the rules, while the top cell manufacturers, most of which are based in China and Korea, have a lot of knowledge and intellectual property in electrochemistry, manufacturing processes, and battery management systems. This concentration makes it very hard for European companies to get into cell manufacturing late in the game if they don't have strong partnerships or licensed technologies (Lee and Malerba, 2023; Transport & Environment, 2025). At the same time, Hardman and Tal (2021) point out that EVs are becoming more dependent on integrated digital platforms for connectivity, charging ecosystem integration, and over-the-air updates. This requires a lot of software investment and organizational change, and the intangible capital in software and data makes it hard for smaller new entrants that don't have these capabilities to compete.

In the production of battery cells, economies of scale are especially important because high utilization and large plant capacities are needed to keep costs competitive around the world (BloombergNEF, 2024; Transport & Environment, 2025). BloombergNEF (2024) says that Chinese cell factories work at high load factors and benefit from standardized chemistries and deep local supply chains. On the other hand, many European projects are still in the ramp-up phase or are running at lower utilization, which makes their unit costs higher. Transport & Environment (2025) says that European gigafactories will have a hard time competing with imported cells, even with help from industrial policy, unless they get big enough and secure midstream processing (cathode and anode materials). As a result, scale and vertical integration become barriers that help each other: companies with large volumes and integrated supply chains can offer lower prices and reinvest in capacity, making it harder for new companies to get in (McKinsey & Company, 2024a; Lee and Malerba, 2023).

Vertical integration in important raw materials and midstream processing makes it harder for new European companies to compete with established Chinese ones (Institute for European Policymaking at Bocconi University, 2024; Institute for European Environmental Policy, 2023; International Energy Agency, 2024). The EU's own reports and independent policy briefs show that China controls most of the world's refining and midstream processing for important battery minerals like lithium chemicals and synthetic graphite. The EU, on the other hand, relies heavily on imports (Institute for European Environmental Policy, 2023; Institute for European Policymaking at Bocconi University, 2024). Recent estimates show that the EU was only able to produce about 19 percent of its own lithium, 19 percent of its own cobalt, and only about 1 percent of its own natural graphite in 2022. This means that the EU had to import 81 to 99 percent of these materials (Institute for European Environmental Policy, 2023; European Commission, 2023). Because of this imbalance, Chinese battery and EV makers can use integrated domestic mining, refining, and midstream industries. European companies, on the other hand, have to sign long-term supply contracts in markets that are already tight, which is often more expensive and risky (Institute for European Policymaking at Bocconi University, 2024; Transport & Environment, 2025). From a European point of view, this means that upstream vertical integration and special access to important raw materials are strong barriers to entry in the EV value chain (Lee and Malerba, 2023; International Energy Agency, 2024).

4.4 Value Chain & Supply

The European EV value chain is being rapidly reshaped around battery gigafactories and associated midstream industries, but remains characterized by high external dependence for critical raw materials used in lithium-ion batteries (International Energy Agency, 2024; Transport & Environment, 2025). Mapping exercises by the International Energy Agency (2024) and Transport & Environment (2025) identify a growing pipeline of operational, under-construction and planned battery cell plants across the EU, United Kingdom and EFTA countries. As of the mid-2020s, major operational gigafactories include Northvolt Ett in Sweden, CATL's plant in Germany, LG Energy Solution and SK On facilities in Poland and Hungary, and various Stellantis, Renault and Volkswagen-linked projects in France, Germany and Spain (International Energy Agency, 2024; Transport & Environment, 2025). Under more optimistic scenarios where all announced projects are completed and operate at high utilisation, Transport & Environment (2025) estimates that Europe could cover around two-thirds of its projected battery cell demand for electric vehicles by 2030; under more conservative assumptions that consider only low-risk projects, this share drops to approximately one-quarter, underscoring significant execution and financing risks.

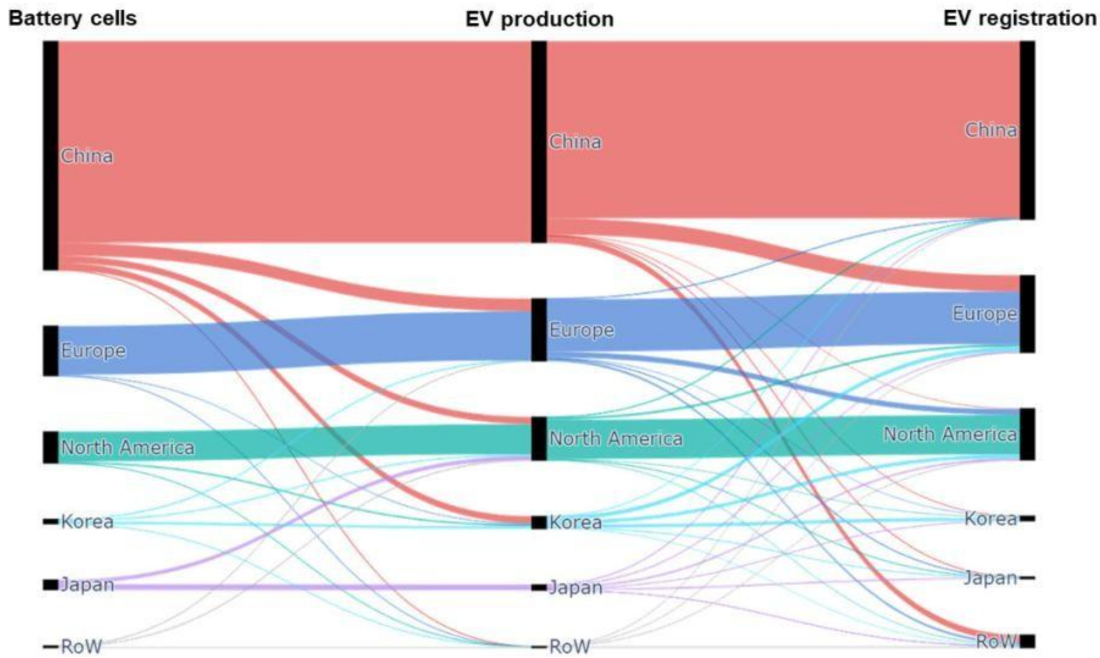
Despite progress on cell manufacturing capacity, the EU remains highly dependent on imports for key critical raw materials such as lithium, cobalt and graphite. According to the 2023 *Study on the Critical Raw Materials for the EU*, the Union's self-sufficiency in 2022 was roughly 19 percent for lithium, 19 percent for cobalt and about 1 percent for natural graphite, meaning that between 81 and 99 percent of these inputs came from outside the EU (European Commission, 2023). The Institute for European Environmental Policy (2023) notes that demand for lithium for EV batteries in the EU is expected to increase by a factor of about 18 by 2030 and 60 by 2050 relative to current supply, while cobalt demand is projected to rise by factors of roughly 5 and 15 over the same horizons. The Institute for European Policymaking at Bocconi University (2024) emphasises that China plays an especially dominant role in midstream processing, accounting for a large majority of global refined graphite and significant shares of lithium chemical and cathode material production, thereby concentrating supply risk outside the EU.

The EU's Critical Raw Materials Act (CRMA) responds to these vulnerabilities by setting indicative targets that by 2030 at least 10 percent of annual consumption of strategic raw materials should come from EU extraction, at least 40 percent from EU processing and at least 15 percent from recycling, while no more than 65 percent of any strategic material should originate from a single third country (European Commission, 2023; Institute for

European Environmental Policy, 2023). However, existing assessments stress that the EU is currently far from meeting these targets for lithium, cobalt and graphite, given the limited scale of domestic mining projects, the early stage of many processing investments and technical challenges in scaling battery recycling (Institute for European Environmental Policy, 2023; International Energy Agency, 2024). The European Commission's raw-materials monitoring also highlights that extraction and refining of these materials are geographically concentrated in a few non-EU countries— including Australia, Chile and the Democratic Republic of Congo for mining, and China for much of the refining and processing—creating systemic supply risks for the European EV industry (European Commission, 2023; International Energy Agency, 2024).

In addition to raw materials, the midstream production of cathode active materials (CAM) and precursor CAM (pCAM) remains heavily externalised. Transport & Environment (2025) estimates that as of the mid-2020s, the EU imports around 88 percent of its CAM and 96 percent of its pCAM, meaning that even where cell manufacturing occurs in Europe, much of the value added and supply risk resides upstream in non-EU jurisdictions. This configuration leads the International Energy Agency (2024) to characterise the European EV supply chain as an emerging regional manufacturing hub based on a still highly internationalised and vulnerable upstream. In summary, Europe's EV value chain in 2025 can be described as one in which rapid expansion of gigafactory capacity is occurring on top of continued high import dependency for lithium, cobalt, graphite and midstream battery materials, with the CRMA providing a framework but not yet having fully altered the underlying material reality (European Commission, 2023; Institute for European Environmental Policy, 2023; Transport & Environment, 2025; International Energy Agency, 2024).

Although this thesis focuses on Europe, the battery supply chain for electric vehicles is globally integrated, making Europe's supply position dependent on international production and trade patterns. Battery manufacturing is largely concentrated near major demand centers, yet cross-regional trade in battery cells and electric vehicles remains significant due to differences in upstream integration and production capacity (IEA, 2024). Figure 4.3 illustrates global trade flows for lithium-ion batteries and electric cars in 2023, highlighting Europe's position relative to other major regions.



[Figure4.3-Global trade flows for lithium-ion batteries and electric cars,2023 Source: International Energy Agency (2024).]

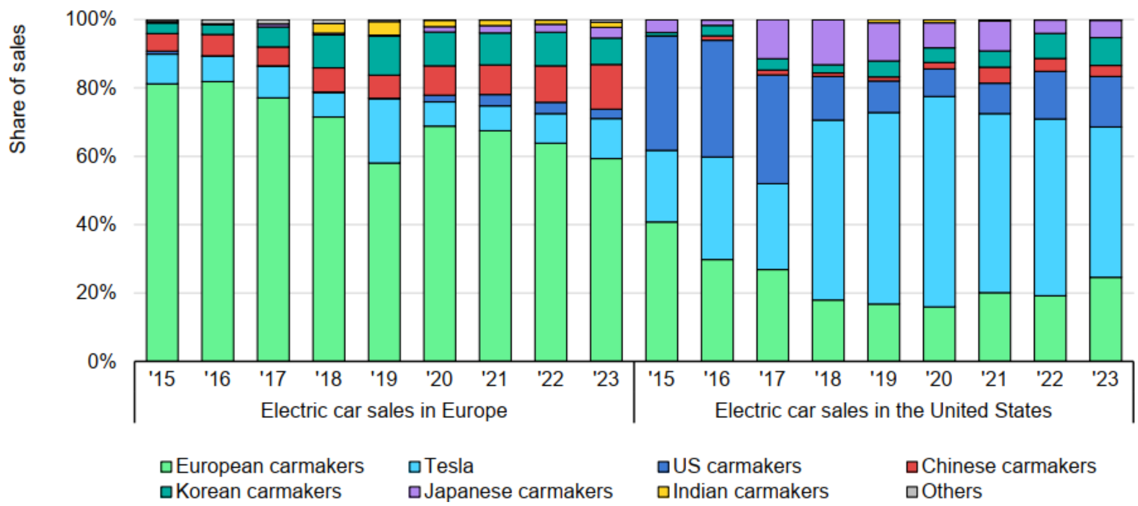
Figure 4.3 shows that, despite growing battery production capacity in Europe, the region remains partially dependent on imported battery cells, reflecting weaker upstream integration compared with China. China occupies a central position in global trade flows, supported by its dominance in upstream stages of the battery value chain, while Europe relies more heavily on international suppliers to meet EV battery demand. These patterns indicate that recent European investments have reduced, but not eliminated, strategic supply-chain dependencies (IEA, 2024).

Chapter 5 - Economic–Financial Market Analysis

5.1 Market size and market shares / concentration

The European electric passenger car market has expanded rapidly over the last decade and today represents one of the largest regional EV markets worldwide. In 2023, Europe accounted for a substantial share of global battery-electric vehicle (BEV) registrations, reflecting both strong policy support and the historical strength of its automotive industry (International Energy Agency, 2024). However, beyond aggregate growth, the distribution of sales across manufacturers reveals a market characterized by a high degree of concentration, with incumbent automotive groups continuing to play a dominant role.

Figure 5.1 shows the breakdown of electric car sales in Europe by company or country of headquarters over the period 2015–2023. The figure highlights that European manufacturers remain the largest contributors to EV sales in their home market, although their combined market share has gradually declined from over 80% in the mid-2010s to around 60% in 2023 (International Energy Agency, 2024). This reduction reflects the growing presence of non- European competitors rather than a collapse of incumbent positions.



[Figure 5.1 here – Breakdown of electric car sales in Europe by company or country of headquarters, *Source: International Energy Agency (2024),* Global EV Outlook 2024]

Tesla has become the most important non-European competitor, making up about a quarter of all European BEV sales in the last few years. Chinese manufacturers are becoming more and more important around the world, but they still only make up a small part of all BEV registrations in the European Union. The IMF says that cars made in China made up more than 20% of new BEV registrations in the EU in 2023. However, Chinese brands only made up about 7–8% of the BEV market. This means that a lot of Chinese-made cars are sold under brands that are not Chinese (International Monetary Fund, 2024).

The evidence indicates that the European EV market is predominantly oligopolistic, characterized by a small number of major manufacturers that control sales, production capacity, and distribution networks. New companies have mostly entered the market at the edges, and this has not changed the concentration of market power in any major way. This shows how important scale economies, capital intensity, regulatory compliance, and brand reputation are in the automotive industry (Brugger and Kollegger, 2023; International Energy Agency, 2024).

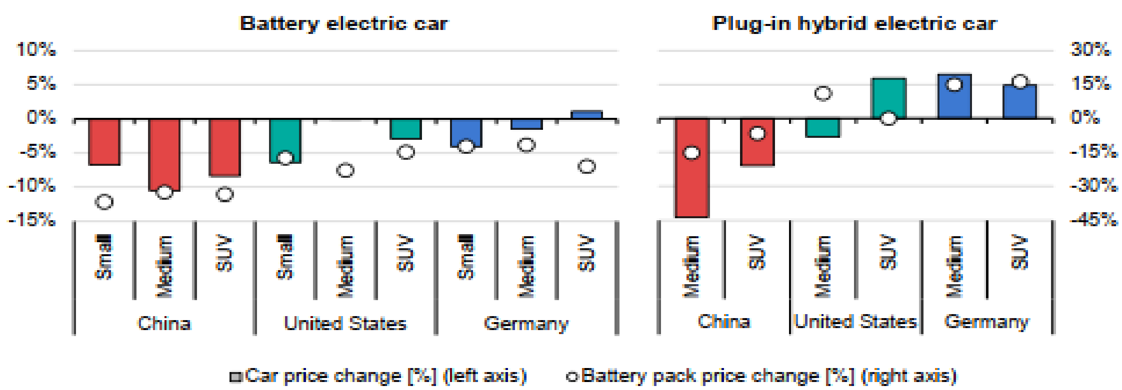
5.2 Type of competition and pricing strategies

Competition in the European EV market is shaped by a combination of price-based rivalry and multi-dimensional product differentiation, consistent with oligopolistic market structures. Firms compete not only on price, but also on vehicle size, driving range, brand positioning, software integration, and perceived quality, resulting in both horizontal and vertical differentiation across market segments (Hardman and Tal, 2021).

Competition in the European EV market between 2020 and 2025 increasingly reflects oligopolistic rivalry with asymmetric cost structures. Cost-advantaged firms—most notably Tesla and Chinese manufacturers—have relied on successive price reductions and penetration pricing to expand market share, leveraging lower battery and manufacturing costs to undercut European incumbents by an estimated 20–30 per cent in comparable segments (International Monetary Fund, 2024). Tesla's 2023–2024 price cuts can be interpreted as a volume-maximizing strategy consistent with Bertrand competition, forcing higher-cost European OEMs to rely on targeted discounts and financing incentives rather than broad list-price reductions in order to defend margins (International Energy Agency, 2024; McKinsey & Company, 2024). The result is intensified price pressure and growing dispersion in mark-ups across firms and segments.

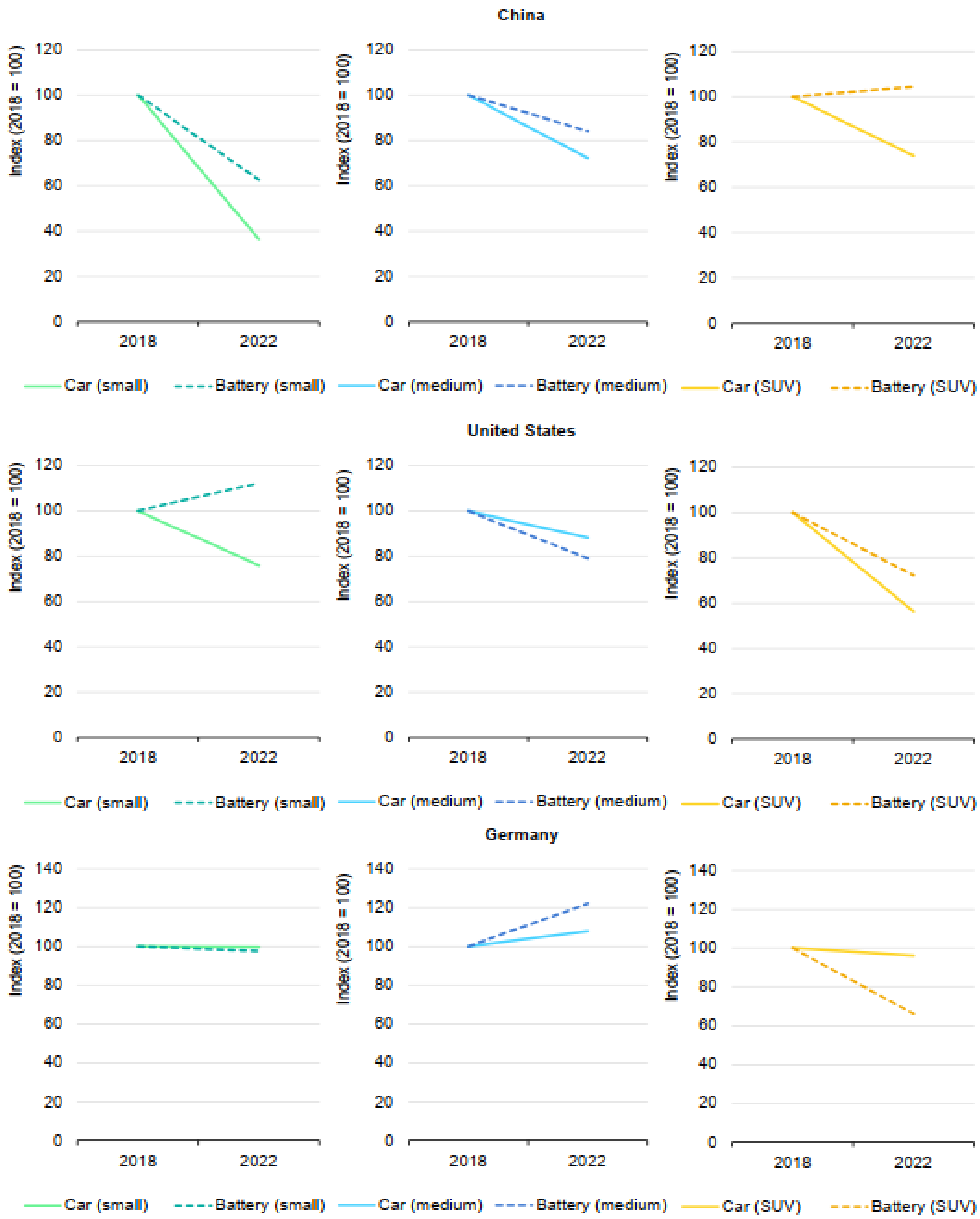
At the same time, firms mitigate direct price competition through horizontal and vertical differentiation. Electrification initially concentrated in SUV and higher-segment vehicles, where willingness to pay is greater and battery costs can be absorbed more easily (Hardman and Tal, 2021; International Energy Agency, 2024). Premium manufacturers such as BMW and Mercedes-Benz pursue quality-based vertical differentiation to sustain mark-ups, while Tesla emphasises software integration and technological positioning; mass-market groups such as Volkswagen and Stellantis balance affordability and scale through platform standardisation and multi-brand portfolios (BMW Group, 2024; Tesla, 2024). Chinese entrants combine lower prices with relatively high feature content, narrowing differentiation gaps and intensifying competitive pressure. Overall, strategic outcomes in the European EV market depend on the interaction between cost position, scale and differentiation capacity, with profitability increasingly conditioned by firms' ability to sustain mark-ups under rising price competition (Lee and Malerba, 2023; International Monetary Fund, 2024).

Recent declines in battery pack prices and intensifying competition have increased the scope for price-based competition in the electric vehicle market. However, the extent to which cost reductions are reflected in final vehicle prices varies across regions and manufacturers, depending on competitive intensity and strategic pricing choices. Comparing recent changes in battery costs and vehicle prices therefore provides insight into pricing strategies and competitive behaviour in major EV markets (International Energy Agency, 2024).



[Figure 5.2 here – Electric car price and battery system price changes in selected countries, 2023–2024, *Source: International Energy Agency (2024),* Global EV Outlook 2024]

Figure 5.2 shows that the prices of battery packs dropped sharply between 2023 and 2024 in China, the United States, and Germany. However, the prices of vehicles changed in very different ways in each region. Prices for battery-electric vehicles in China went down in all categories, which shows that costs are being passed on and prices are very competitive. In Germany, on the other hand, price cuts were less common, even though battery costs were also going down. This suggests that European manufacturers are being more careful with their pricing to protect their margins. The United States has a middle-of-the-road pattern, with price cuts happening in some areas but not others. The figure shows that lower battery costs lead to lower EV prices, but the final prices are still affected by the way the market is set up and the strategies of competitors, not just by changes in costs (International Energy Agency, 2024). Figure 5.3 shows the link between production costs and vehicle prices even more clearly by comparing the average battery pack prices with the average BEV prices weighted by sales between 2018 and 2022.



[Figure 5.3 here – Sales-weighted average BEV price and average battery price, *Source: International Energy Agency (2024),* Global EV Outlook 2024]

While battery pack prices declined sharply over this period, vehicle prices fell much more slowly, indicating incomplete cost pass-through. The International Energy Agency (2024) attributes this pattern to rising costs in other components, including raw materials, logistics, compliance with environmental standards, and investments in new vehicle platforms. From a competitive perspective, this suggests that European manufacturers have absorbed part of the cost reductions to mitigate margin erosion rather than engaging in aggressive price competition.

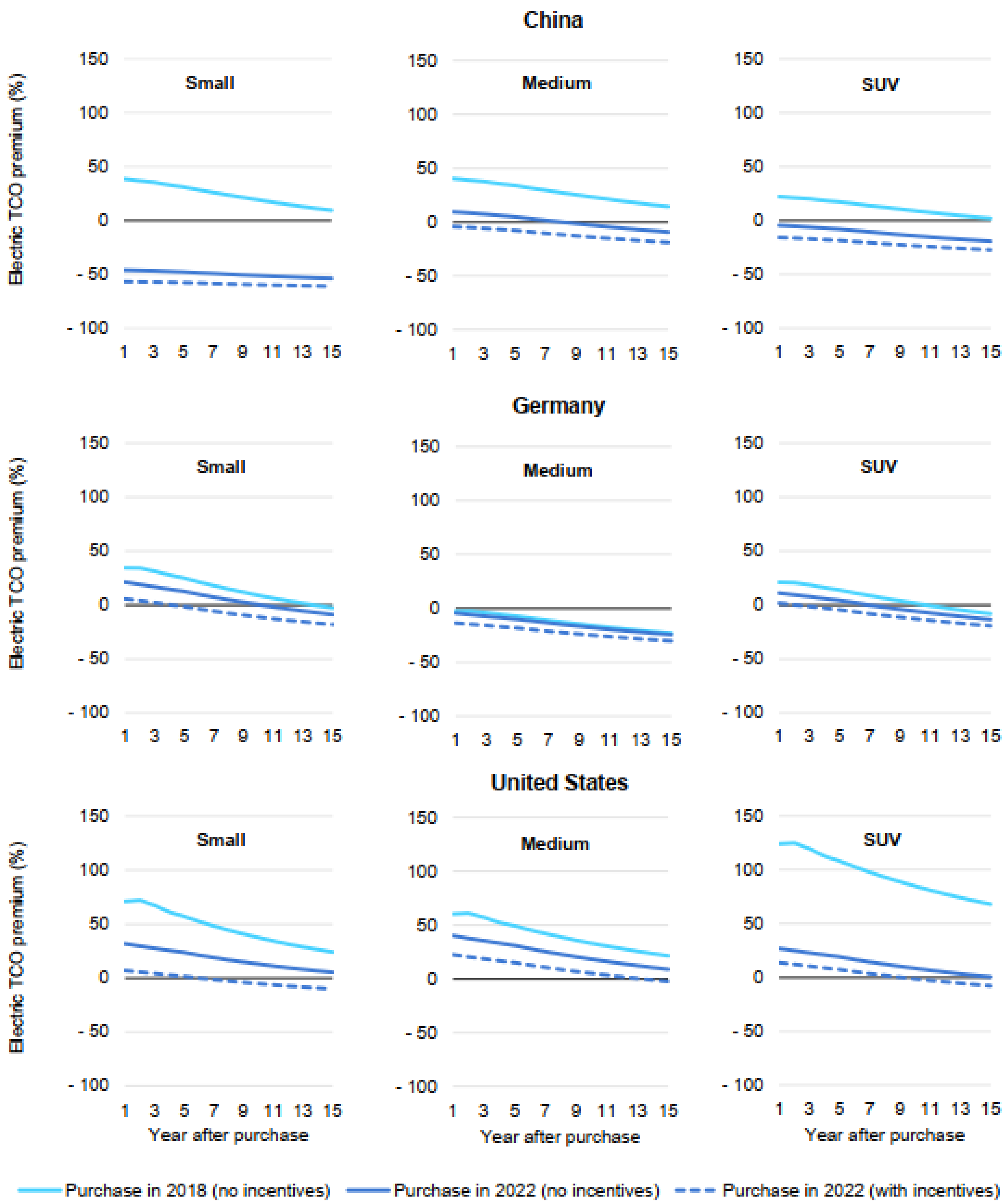
As a result, competition in the European EV market combines moderate price competition in volume segments with stronger differentiation in premium segments, where brand, quality, and technological features allow manufacturers to retain some pricing power. This hybrid competitive regime reflects both cost constraints and strategic positioning within an increasingly contested market (Hardman and Tal, 2021; International Monetary Fund, 2024).

5.3 Margins and corporate profitability

Even though EV sales are growing quickly, companies in the electric vehicle segment are still having trouble making money. Manufacturers can't keep their profit margins as high as they used to be in the internal combustion vehicle markets because they have to spend a lot of money on fixed investments in battery production, software development, and new manufacturing platforms, and competition is getting tougher (International Energy Agency, 2024).

Battery packs still make up a large part of the cost of making BEVs, and European manufacturers have to pay more than their competitors in places with more integrated battery supply chains and easier access to cheaper materials (International Energy Agency, 2024). New entrants and established competitors are also lowering their prices strategically, which makes things even worse for price-sensitive segments by squeezing margins even more.

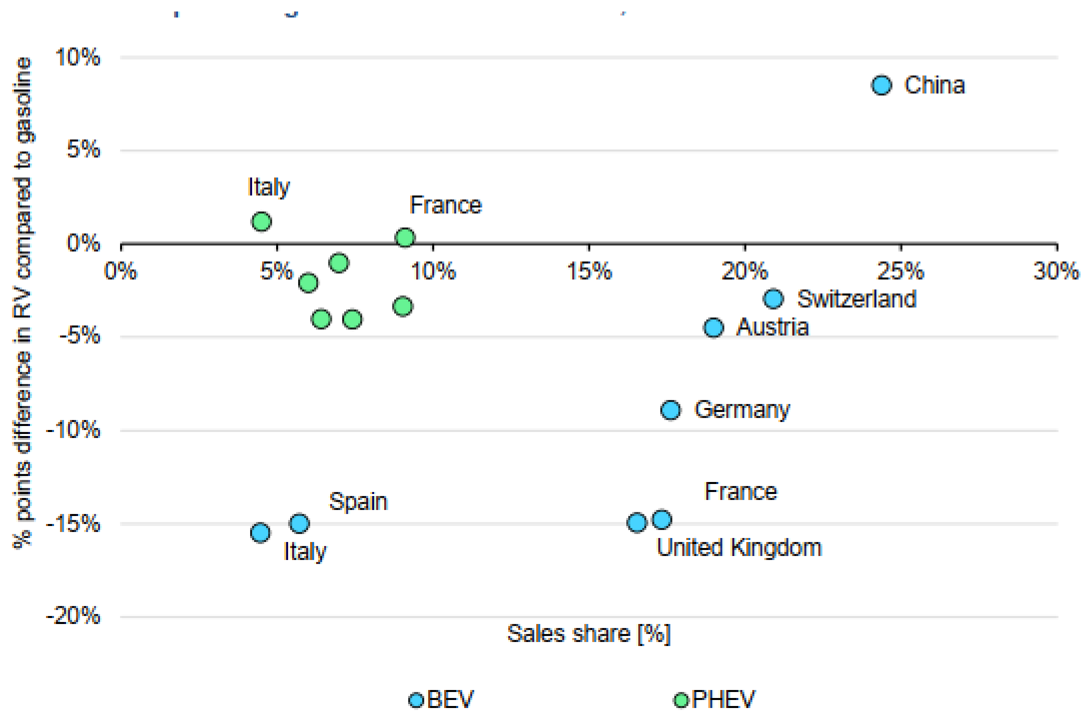
From the point of view of the consumer, profitability and total cost of ownership (TCO) are closely related. Figure 5.4 shows how much more it costs to own a BEV than an ICE vehicle in each country and year after purchase.



[Figure 5.4 here – Difference in total cost of ownership between BEV and ICE vehicles, *Source: International Energy Agency (2024),* Global EV Outlook 2024]

The figure indicates that BEVs often reach TCO parity or advantage within a few years, driven by lower fuel and maintenance costs. However, TCO parity does not imply higher manufacturer profitability, as it reflects lifecycle consumer costs rather than production margins. Instead, it highlights the tension faced by manufacturers between improving affordability and preserving margins.

A further determinant of profitability is the evolution of residual values and second-hand markets. Figure 5.5 presents the difference in relative resale values of BEVs and plug-in hybrid vehicles compared to gasoline cars in 2023.



[Figure 5.5 here – Difference in relative resale value of BEVs and PHEVs compared to gasoline cars, *Source: International Energy Agency (2024),* Global EV Outlook 2024]

While Figure 5.5 reflects relative resale values observed in 2023, more recent evidence indicates that battery-electric vehicle (BEV) residual values in Europe have normalised and, in some segments, deteriorated during 2024–2025. Analysts and leasing-sector disclosures link this shift to aggressive new-car price cuts—particularly by Tesla and Chinese manufacturers—alongside intensifying competition and rising supply of ex-fleet BEVs, which have reset price expectations in used-car markets and increased residual-value risk for lessors (International Energy Agency, 2024; Arval, 2024). As a result, while resale values for BEVs remain broadly comparable to or slightly above those of internal combustion vehicles in some markets, their volatility has increased, constraining leasing margins and reinforcing the pressure on manufacturers' profitability in an already cost-intensive EV transition (Transport & Environment, 2023; Motor Finance Online, 2025).

Overall, the European EV market is characterized by rising volumes but constrained profitability, particularly for incumbent manufacturers financing the transition away from internal combustion technologies. Sustained profitability will depend on achieving greater scale, reducing battery and supply-chain costs, and developing complementary revenue streams, rather than on price competition alone.

Chapter 6 - Regulation and External Factors

6.1 Government policies and incentives

Government policies and tax breaks, in addition to binding regulations, have had a big impact on how the European EV market works and how much money it makes. Purchase subsidies, tax breaks, and lower registration fees helped speed up the adoption of BEVs and plug-in hybrid electric vehicles (PHEVs) in places like Norway, Germany, and the Netherlands (International Energy Agency, 2024; Langbroek et al., 2016). Evidence from the real world shows that these incentives have big effects on the economy. For example, a €1,000 increase in the value of a purchase subsidy is linked to a 13% increase in EV registrations across countries. Also, a 10% increase in the net present value of fiscal incentives can make EV adoption 30–50% more likely, depending on the specification (Sierzchula et al., 2014; Langbroek et al., 2016). These actions lowered the effective purchase prices and lessened the range and cost uncertainties during the early diffusion phase.

But the gradual withdrawal or sudden end of subsidies in some EU countries, especially Germany's cancellation of the Umweltbonus in late 2023, has made the market more volatile. Before they ended, Germany's direct purchase grants could be as much as €6,750 for eligible BEVs. Empirical studies show clear "stop-and-go" effects, with EV registrations rising sharply before incentives end and then falling sharply after. For example, in Germany, PHEV registrations dropped by more than 40% in the months after subsidies were cut (Haustein and Jensen, 2024). The International Energy Agency (2024) also says that the end of subsidies in big EU markets caused BEV sales to slow down for a short time in 2023–2024. As government funding decreases, OEMs are more and more dependent on price cuts and dealer incentives to keep sales up. This puts pressure on margins at a time when capital spending on electrification is still high (McKinsey & Company, 2024; International Monetary Fund, 2024).

In Europe, where corporate fleets make up a large part of new vehicle registrations, taxes on company cars and leasing incentives have a big impact. Low-emission vehicles get special tax breaks, which has led to a lot of BEVs being sold to fleets. This has sped up the growth of the market, but it has also made early adopters mostly come from higher-income and corporate groups (European Automobile Manufacturers' Association, 2024; Hardman and Tal, 2021). Public investment in charging infrastructure further interacts with demand incentives. Empirical analysis reveals that a 10% rise in public charging density correlates with a 4–6% increase in EV adoption, underscoring the supportive function of infrastructure in promoting market growth (Sierzchula et al., 2014). In general, the shift from growth driven by subsidies to a more market-exposed environment makes it even more important for policies to be stable and well-designed in order to keep demand and profits high.

6.2 Environmental impact and sustainability considerations

Environmental and sustainability constraints operate as economic parameters within which firms compete in the European EV market. Lifecycle assessments confirm that BEVs sold in Europe produce substantially lower lifetime greenhouse-gas emissions than comparable internal combustion engine vehicles, particularly as the EU electricity mix decarbonises (Ellingsen et al., 2016; International Energy Agency, 2024). At the same time, battery production remains resource- and energy-intensive, making upstream emissions and material sourcing central determinants of cost and compliance.

The EU Batteries Regulation (Regulation (EU) 2023/1542) transforms sustainability objectives into binding economic constraints. From 2031, EV batteries must contain minimum recycled-content shares of 16% cobalt, 6% lithium and 6% nickel, rising by 2036 to 26% cobalt, 12% lithium and 15% nickel. In addition, mandatory carbon-footprint declaration requirements apply to batteries placed on the EU market, with maximum carbon-intensity thresholds to be phased in subsequently. These requirements increase compliance costs through reporting, certification and supply-chain restructuring, potentially favouring large, vertically integrated firms with established recycling and lifecycle-management capabilities (European Commission, 2023a; International Energy Agency, 2024). Smaller entrants may face disproportionately higher compliance burdens, reinforcing scale advantages and market concentration.

Sustainability considerations also extend to raw-material security. Under the Critical Raw Materials Act, the EU aims by 2030 to source at least 10% of its annual strategic raw-material consumption from domestic extraction, 40% from domestic processing and 15% from recycling, while limiting dependence on any single third country to no more than 65% at each stage of the value chain (European Commission, 2023c). These benchmarks highlight Europe's current vulnerability to external supply shocks and price volatility in lithium, cobalt and graphite markets. Such exposure increases strategic uncertainty and may amplify cost asymmetries relative to Chinese producers with more integrated supply chains. Consequently, sustainability regulation simultaneously raises compliance costs and reshapes competitive dynamics through supply-chain restructuring and strategic resource positioning.

6.3 Technological evolution and the role of innovation

Advancements in battery technology, platforms, and software are key factors that affect costs, economies of scale, and long-term profitability in the European electric vehicle (EV) market. In 2023, the price of lithium-ion battery packs around the world dropped to about USD 140/kWh. If current policies stay the same, they could drop to USD 100/kWh by 2030 (International Energy Agency, 2024). However, there are still big differences between regions. For example, the cost of battery packs in Europe is thought to be 50–60% higher than in China because of higher energy prices, labor costs, and less developed supply chains (BloombergNEF, 2024). These differences are part of a bigger gap in production costs. Some estimates say that it costs 20–30% less to make BEVs in China than in Europe (McKinsey & Company, 2024). As battery prices go down around the world, competition gets tougher, and companies are more likely to pass on the savings to customers in the form of lower prices instead of keeping them as higher margins.

Platform standardization and specialized BEV architectures let manufacturers take advantage of economies of scale across many models and brands. But these kinds of plans need a lot of money up front for battery plants, digital infrastructure, and assembly lines that have been changed. Companies that don't make enough products risk staying in high-cost structures (Lee and Malerba, 2023). This dynamic makes it harder for new businesses to get in and gives companies that can combine size with vertical integration a stronger position.

Digitalization changes the way competition works even more by turning vehicles into software-defined platforms. Over-the-air updates, advanced driver-assistance systems, and integrated digital ecosystems make it possible to make money from services, but they also raise fixed development costs (Hardman and Tal, 2021; McKinsey & Company, 2024). More and more, the key to getting ahead of the competition is to combine low costs with unique technology. In general, technological progress lowers variable costs but raises the amount of fixed investment needed. This makes scale, learning effects, and innovation ability more important in determining long-term competitiveness in the European EV market.

CONCLUSION

The transition to electric vehicles has fundamentally reconfigured the competitive landscape of the European automotive industry. While electrification has accelerated market growth and technological innovation, it has also intensified structural pressures on cost structures, pricing strategies, and profitability.

The analysis of demand dynamics shows that EV adoption in Europe remains highly policy-sensitive and segmented. Purchase subsidies, tax incentives, and charging infrastructure density have played critical roles in accelerating early diffusion. However, the gradual withdrawal of fiscal support has revealed underlying price sensitivity and generated "stop-and-go" demand volatility. This volatility complicates production planning and reinforces the need for competitive pricing strategies in a market where cost parity has not yet been fully achieved across all segments.

On the supply side, electrification shifts the industry's core cost drivers from engine engineering to battery production and software integration. Battery pack costs remain higher in Europe than in China, contributing to an estimated structural cost disadvantage of approximately 20–30% relative to Chinese manufacturers. Although global battery prices are declining, competitive dynamics ensure that much of the cost reduction is passed through to consumers rather than retained as higher margins. Consequently, achieving profitability depends less on short-term pricing power and more on long-term scale economies, vertical integration, and supply chain optimization.

Market concentration remains high, confirming that the European EV industry retains oligopolistic characteristics. However, the nature of competition has evolved. Price-based rivalry intensified between 2022 and 2025, particularly following Tesla's global price reductions and the expansion of Chinese manufacturers into European segments. European incumbents have responded through selective discounting, product differentiation, and portfolio diversification. Horizontal differentiation—particularly through SUV models—has allowed firms to target higher-margin segments, while vertical differentiation through brand positioning and software features aims to preserve pricing power. Nevertheless, margin compression remains evident across firms, and publicly disclosed financial data indicate that full BEV profitability parity with ICE vehicles has not yet been consistently achieved.

Regulatory factors exert a dual influence. CO_2 fleet targets and the effective 2035 zero-emission requirement create a binding long-term framework that forces electrification. Simultaneously, sustainability regulations and trade measures reshape cost structures and competitive incentives. While these policies aim to level the playing field and secure supply chains, they also increase compliance costs and reinforce the importance of scale. Smaller entrants may face proportionally higher regulatory burdens, potentially reinforcing market concentration.

Technological evolution introduces further complexity. The shift toward software-defined vehicles increases fixed investment requirements but opens potential new revenue streams through digital services. Innovation performance and platform scalability therefore become critical determinants of long-term competitiveness. Firms that successfully integrate battery cost reductions, digital capabilities, and global scale are more likely to sustain profitability under intensifying competition.

Overall, the European EV market can be characterized as a cost-asymmetric oligopoly under regulatory pressure and global competitive disruption. Electrification does not dismantle industrial concentration but redistributes competitive advantage toward firms with battery scale, supply-chain integration, and software competence. The long-run outcome will depend on whether European manufacturers can close structural cost gaps, stabilize policy environments, and achieve scale sufficient to sustain positive margins in a market increasingly exposed to global competition.

The EV transition is therefore not merely a technological shift but a decisive test of Europe’s industrial competitiveness. Its success will be measured not only by emission reductions and sales volumes but by the ability of European firms to maintain strategic autonomy, profitability, and innovation leadership in a rapidly evolving global automotive industry.

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