# NAVIGATING THE EV TRANSITION: BARRIERS AND TOOLS FOR SHIFTING EUROPE TO LOW-CARBON MOBILITY

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**CEPS IN-DEPTH ANALYSIS**

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## SUMMARY

The European automotive industry stands at a critical juncture. The transition to electric vehicles (EVs) is crucial to the EU's climate targets in the transport sector. This transition requires a significant transformation of existing supply and value chains, which will also impact the types of labour and skills needed in the industry. The shifting revenues and cost structures as well as the competitiveness of the EU automotive industry will determine whether EV sales can offset the anticipated decline in internal combustion engine vehicle (ICEV) revenues.

This CEPS in-Depth Analysis takes stock of challenges the industry is facing, and explores potential avenues to support the EV transition, with a focus on passenger cars and vans – or light duty vehicles (LDVs). In particular, the report examines the revenue and cost dynamics of the shift to battery electric (BEVs) and its implication for the industry and policy. Further on, it highlights the risk of declining European value added unless critical value chains are scaled up while reflecting on persistent supply chain risks and potential cost implications for BEVs. The analysis then identifies financial tools to support and accelerate the transition, including targeted support for consumer uptake, innovation, infrastructure, and skills development.

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# EXTENDED SUMMARY

This CEPS In-Depth Analysis on the future of the automotive industry in Europe examines challenges the industry faces and financial tools to support the transition to electric vehicles (EVs). It focuses on passenger cars and vans – or light duty vehicles (LDVs). While hydrogen-based mobility may have a role in certain segments, this report concentrates on battery electric vehicles (BEVs) and the associated recharging infrastructure.

## *EU automotive industry in transition*

The car industry is an important pillar of the European economy. The broad automotive industry contributes approximately 7 % of GDP and provides employment to nearly 14 million people. The industry plays a central role in regional value chains and innovation research. It spends around 15 % of its gross value added on research and development (R&D). Although recent years have seen a decline in production and foreign sales, the EU continued to export more vehicles and car parts than it imported, maintaining a trade surplus of approximately EUR 90 billion in 2024.

The previous European Commission (2019-24) had set guardrails for reaching climate neutrality by 2050. The central EU legislation for the automotive industry is the regulation on $CO_2$ emission performance standards for new passenger cars and vans, which took effect in April 2023. The regulation mandates all newly registered passenger cars and vans to be 'zero-emission' vehicles (ZEVs) from 2035 onwards. While the European Commission confirmed in its March 2025 Automotive Action Plan, that the $CO_2$ emission performance standards will remain in place, it introduced flexibilities allowing manufacturers to offset target overshoots within a three-year period (2025-27) through 'overachievements in the other year(s)'.

The decarbonisation of the transport sector is essential if the EU is to reach its climate target, with battery electric vehicles (BEVs) expected to lead the transition in the passenger car and van segments. To do so, the shift towards electromobility will need to accelerate. In parallel, the transition – reinforced by trends towards digitalisation and automation – will result in a deep restructuring of automotive value chains, redefining competitiveness and with significant economic, political and social implications.

## *Challenges along the transition*

### ■ Market uncertainty and intensifying competition

BEV registrations in the EU – a proxy for consumer uptake – have increased significantly since the early 2020s. However, a temporary decline in registration rates in 2024 raised concerns about the pace and stability of the transition. This illustrates that the shift to electromobility may not follow a linear or fully predictable path, and further disruptions cannot be ruled out.

Lower-than-expected BEV registrations, as observed in 2024, amplify existing pressures on EU manufacturers who have been losing market share to both new entrants and more established international competitors. Taken together, such developments risk compounding the effects of already shrinking market shares through broader market contraction.

- **Balancing shifts in revenue streams**

The market dynamics directly affect the revenues of EU car manufacturers and their ability to balance the anticipated decline in internal combustion engine vehicle (ICEV) sales through increased BEV revenues during the transition.

CEPS' estimates suggest that meeting the deployment levels of new BEV passenger cars and vans based on Fit for 55 policies would require an additional consumer spending of EUR 66 to 95 billion in 2025. This gives an indicative sense of the scale needed to accelerate the EV transition in the short term. The gap is likely to widen unless consumer uptake increases in line with projected BEV deployment required to meet EU climate targets. The timeline and additional consumer expenditure needed will depend on i) volumes of sales, i.e. customer uptake of BEVs, and ii) sales prices, i.e. willingness and ability to pay.

CEPS' estimates indicate that revenues – defined in a broad sense – from BEV passenger cars and vans are expected to surpass those from ICEVs by around 2030 in the EU. This shift will require the industry to increasingly rely on growing BEV sales and other revenue sources.

Extra revenues on the EU market are possible in theory by the sales of Plug-in Hybrid EV (PHEV) in light of their growing market share in the EU, expected to last until 2035. Possibly also through so-called extended-range EVs (EREVs), though minor in Europe to date but becoming more prominent in China. As export revenues from ICEVs are expected to decline amid a broader global EV shift in major markets, such as China, the development of alternative low-carbon mobility solutions may offer additional opportunities for the sale of EU-produced vehicles in foreign markets.

Emerging business models such as connected services or battery leasing and re-use offer opportunities for additional revenues in the future. However, they are more likely to materialise in the longer term.

### Price barriers, cost shifts and temporary margin pressures

The high price of BEVs, relative to ICEVs, is often cited as a central barrier to wider uptake in the EU. Reasons for the price differences include higher production costs of BEVs compared to ICEVs.

By 2030, this cost differential is projected to narrow, driven by increasing ICEV and declining BEV costs – the latter resulting primarily from advancements in battery technology and production processes. Available projections remain sensitive to factors such as inflation, supply chain cost increases or disruptions, and the pace of cost reductions driven by learning curves. All these elements could ultimately affect how soon cost parity between BEVs and ICEVs will be achieved.

Prices are shaped not only by production costs but also by factors such as producer margins, dealership markups, and taxes. Based on this CEPS analysis, average BEV prices of approximately EUR 45 000 will be necessary to maintain current pricing structures during the transition to EVs. This situation is expected to persist until cost reductions, driven by economies of scale and innovation, materialise. However, this amount is significantly higher than the current median willingness to pay for a BEV in the EU, which is EUR 20 000. To address this gap, a combination of demand-side measures, such as targeted incentives, and supply-side support will likely be necessary to accelerate cost reductions throughout the value chain. Pricing structures along the value chain may need to be adjusted.

### Risk of decreasing EU value added

If current trends continue, the transition to EVs could lead to a decrease in Europe's share of value added in vehicle production. This is partly because the BEV value chains in the EU are not yet fully developed.

Estimates suggest that the current European value added ranges between 85 and 90 % of the price for ICEVs, compared to 70-75 % for BEVs. The share drops further to 50-60% of the price for BEVs manufactured in Europe by foreign companies, and to approximately 20 % for fully imported BEVs. For some ICEV models, around 76 % of component parts are sourced within the EU, compared to 36 % for certain BEV models.

These shifts in value added reflect deeper structural changes in how BEVs are designed and manufactured compared to ICEVs as well as the state of related value chains in the EU. Producing BEVs generally requires fewer components and less labour compared to ICEVs. In BEVs, the complexity of combustion engines, fuel systems, and exhaust parts is replaced by batteries, wiring, and electric motors. As battery value chains remain underdeveloped compared to traditional ICEV supply chains in Europe, local value added in EU BEV production is currently limited.

### Economics of battery production and supply chain risks

Scaling up of European battery manufacturing is essential for enhancing EU value added during the EV transition but remains challenging. Estimates on the investment needed to meet future EU battery demand vary widely, reaching as high as EUR 380 billion by 2030. This variation largely depends on the level of self-sufficiency targeted and underlying assumptions. However, more than half of the announced investments to build or enhance battery production by 2030 are at risk of being cancelled or delayed. Moreover, high energy prices challenge the economics of European battery production.

Studies suggest that batteries accounted for around 40 % of the direct costs of a compact-class BEV in the EU in 2020, declining to 27% by 2030. Assuming a linear trend, this implies a share of around 34 % in 2025. Additionally, European battery prices are estimated to be around 20 % higher than in China. While there are limitations to these studies, they present a conundrum: without European batteries, a large share of the European value added in vehicle manufacturing is at risk, yet relying at the current state of prices on European batteries could increase production costs and, if passed on to consumers, may dampen adoption.

Irrespective of how successful the scale-up of European battery production may be, supply chain risks particularly for CRMs will persist for the foreseeable future. There are specific dependencies for both primary and refined materials, primarily concerning imports and reliance on single suppliers, along with broader supply chain risks and vulnerabilities.

### Availability of charging infrastructure

The charging infrastructure for BEVs has steadily expanded over the past few years, showing a positive correlation with the increase in BEV adoption. Investment needs are estimated to range from EUR 98 billion to EUR 172 billion by 2030, with the largest portion expected to be allocated for private charging infrastructure.

While the deployment of charging infrastructure is being driven by private investment, challenges exist regarding the regulatory framework. These bottlenecks include the absence of standardised procedures and timelines, unpredictable costs due to varied local authority fees and grid connection charges, and insufficient collaboration between public authorities and Distribution System Operators alongside a lack of integrated planning between authorities.

### Readiness of electricity grids

The roll-out of charging infrastructure must be complemented by improvements to electricity grids, which will vary by region due to differences in grid readiness, EV uptake, and residential charging needs. Equally important is the regulatory framework for access to charging and bidirectional charging, not only for ensuring access to charging but also to make use of EVs as a flexibility source and therefore reduce total electricity systems costs.

### Charging costs and implications for total cost of ownership

Charging prices significantly affect the total cost of ownership (TCO) of an EV. High charging prices hinder consumer adoption, along with upfront costs and value depreciation. Some BEVs outperform ICEVs in TCO at higher usage, but ICEVs are more cost-effective in lower price segments and for infrequent drivers.

EV users often rely on private and public charging, resulting in price variability and competition but also greater complexity for consumers. Costs depend on the charging connector type and power level. Home charging is the most cost-effective, while high-power fast charging is the most expensive.

Charging prices at home or work are influenced by varying electricity costs, taxes, levies, and network charges by region. In many EU Member States, variable electricity pricing has become common to manage demand peaks and prevent grid congestion, making off-peak charging more cost-effective. Workplace charging costs vary; some companies offer free charging while others charge a fee.

At-home and workplace charging prices for EVs within the EU-27 at the beginning of 2023 varied significantly, ranging from EUR 0.11 to EUR 0.48 per kWh. Western and Northern European countries generally exhibit higher charging costs compared to Southern and Eastern Europe.

### Shifts in required skills and jobs

The EV transition will significantly impact employment and skills in the automotive sector. The transition occurs alongside broader trends toward automation and digitalisation, increasing demand for digital skills and decreasing need for manual labour. BEV manufacturing needs less labour than ICEV production, raising questions about future jobs and skills. The restructuring impacts the entire value chain, causing job losses in some areas and job creation in others, possibly across borders.

There is evidence that both car manufacturers and their suppliers have invested strongly to adapt to the transition to EVs, leading to a stronger vertical integration in the examined vehicle manufacturers, notably in electric drivetrain technology, battery cell production, and software capabilities, that may help reduce the employment impact of the transition. These investments are feasible mainly for companies with substantial finances, raising concerns about offsetting expected job losses in regions reliant on the automotive sector and highlighting potential additional needs for upskilling and reskilling.

Studies show that workers in ICEV supply chains and production lines possess transferable skills for jobs in sectors such as industrial gas production and electric motor manufacturing. They also find that active labour market policies, including worker training programmes, can have a positive effect on employment during the EV transition.

### *Financing tools to support the transition*

Targeted financing instruments can accelerate the EU's vehicle fleet transition alongside regulatory measures.

#### Demand side support

Consumer incentives will remain critical pull factors in the years leading up to cost parity with ICE models, especially in lower-price segments. In light of the high fragmentation and emerging cases of discontinuation across the EU, a stronger coordination and a gradual, uniform phase-out of incentive schemes may enhance their EU-wide effectiveness. In addition to national schemes, targeted EU support could create a more consistent price signal across the EU. Starting in 2026, the ETS2 revenue-based Social Climate Fund, with a budget of EUR 86 billion, will be well positioned to support measures for vulnerable transport users, like purchase subsidies or social leasing schemes. Member States' EUR 195 billion from ETS2 auction revenues could in principle also be used for the same purpose. Along with direct demand support, measures to accelerate electrification of private and public fleets will remain critical demand-side levers.

#### Research and innovation

EU manufacturers need transformative investments in product and process innovation — especially in emerging areas such as next-generation batteries, autonomous driving, and software-defined vehicles — to improve cost-efficiency, retain EU-based value creation and restore competitive margins against global producers. The EU automotive industry leads in private research and innovation (R&I) spending, but much of this investment has focused on incremental improvements of incumbent technologies. Targeted public support can attract private capital to EU innovators and de-risk investments in disruptive innovations.

At basic R&I level, Horizon Europe offers channels to drive public and private investments in automotive transition research, including European Partnerships. Under Pillar II of Horizon Europe, around EUR 4 billion in co-investments are mobilised for mobility and battery Partnerships. However, limited coordination with other EU ecosystems (e.g., industrial alliances) and the misalignment of research  with regional competitive advantages—may undermine the effectiveness of these instruments. Horizon Europe's budget for high-risk, high-reward innovation remains relatively limited, with the EIC Pathfinder and Transition calls as notable exceptions.

### First industrial deployment and scale-up

The EU faces a notable funding gap at the early commercial deployment and scale-up stages of innovative technologies. This is particularly the case for clean technologies like batteries, which due to higher capital intensity, higher technological-regulatory risks and high operating costs may require substantial public support to scale – both at CAPEX and OPEX level. The recent EUR 3 billion-worth *Battery Booster package* shows the Innovation Fund is emerging as the most important EU financing tool to support new battery manufacturing projects, yet financing needs remain largely unmatched by its funding capacity. Unless (or until) new dedicated tools to support cleantech (battery) manufacturing were to be set up as part of the next MFF, mechanisms to cost-efficiently channel and coordinate resources from other EU budget instruments (e.g., STEP) and/or national budgets ('auction-as-a-service' model) versus Innovation Fund projects should be strengthened or replicated. Longer term, expanding its size beyond the current ETS-revenues allocation should be considered.

The European Investment Bank (EIB) can also be instrumental in bridging the financing gap between R&I and scale-up for various automotive technologies through venture debt, guarantees, or private equity, including under the InvestEU framework. EIB initiatives like the 'fund-of-funds' European Tech Champions Initiatives, or the more sectoral focused Cleantech Co-Investment Facility, are examples of mechanisms that could be expanded and/or more strategically targeted at mobility innovation. The upcoming TechEU investment programme has already been indicated as strategically positioned to mobilise investments in disruptive innovations and scaleups in the automotive and battery sectors. In the absence of dedicated EU budget funding, EIB tools will also be crucial to support EU-based CRM extraction projects.

At the Member States level, state aid remains essential for supporting technology development and deployment—from basic R&D (under the R&D&I Framework), through to direct cleantech manufacturing support (via the TCTF), and the transformation of existing production capacities (e.g., under regional aid guidelines). Current state aid spending is however unevenly distributed across Member States, often favouring greater fiscal capacity over real competitive advantages. Furthermore, its complex, politically driven approval process may undermine spending efficiency. While the upcoming CISAF offers an opportunity to streamline and optimize state aid support, IPCEIs can be further leveraged to channel national resources towards projects of strategic relevance in a cost-efficient manner. These should be simplified, accelerated, and possibly expanded to areas like software-defined vehicles, autonomous driving, and compact EV production.

### Employment and skills

The EU provides tools to tackle employment and skills challenges in the automotive transition. The European Globalisation Adjustment Fund (EGF) can support workers affected by restructuring in the automotive industry, but its budget is too limited for the transition's short-term employment impacts. A larger, ad-hoc (or permanent) SURE-like mechanism may be needed. On a more structural level, Just Transition Mechanism funding could support the transition of ICEV manufacturing-heavy regions, provided administrative and funding absorption issues are resolved. EU instruments like ESF+, Digital Europe, and the Cohesion Fund support reskilling and upskilling initiatives, with an increasing focus on green and digital skills. Initiatives like STEP could be steered to improve the strategic alignment of these tools and address urgent automotive skills gaps. An Automotive Skills Academy could be instrumental in coordinating public-private initiatives at local or regional level.

### Charging infrastructure

Finally, while the gradual EV penetration makes private investment in charging stations increasingly attractive, public support for charging infrastructure remains necessary in areas with limited EVs adoption hence low economic returns. The Alternative Fuels Infrastructure Facility (AFIF), transport arm of the Connecting Europe Facility (CEF), is the main EU funding source for public charging infrastructure and should be properly budgeted. Cohesion policy instruments however could be more widely used to compensate regional disparities in public charging infrastructure deployment. This could be achieved by increasing the 'Cohesion envelope' of AFIF, as well as directly mobilizing resources from ESI funds, Just Transition Fund, Modernisation Fund or the upcoming Social Climate Fund.

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# ABBREVIATIONS

| Abbreviation | Term |
|---|---|
| AC | Alternating current charger |
| ACEA | European Automobile Manufacturers' Association |
| AFIF | Alternative Fuels Infrastructure Facility |
| AFIR | Alternative fuels infrastructure regulation |
| BEV | Battery electric vehicle |
| CCAM | Connected, Cooperative, and Automated Mobility |
| CEDEFOP | European Centre for the Development of Vocational Training |
| CEF | Connecting Europe Facility |
| CINEA | European Climate, Infrastructure and Environment Executive Agency |
| CISAF | Clean Industrial Deal State Aid Framework |
| CoR | European Committee of the Regions |
| CRMs | Critical raw materials |
| CVC | Corporate Venture Capital |
| DC | Direct current charger |
| DFI | Development Finance institutions |
| DSOs | Distribution system operators |
| EAFO | European Alternative Fuels Observatory |
| EBRD | European Bank for Reconstruction and Development |
| EGF | European Globalisation Adjustment Fund |
| EIB | European Investment Bank |
| EIC | European Innovation Council |
| EIF | European Investment Fund |
| EIT | European Institute of Innovation and Technology |
| EREV | Extended-range electric vehicle |
| ESF | European Social Fund |
| ESI funds | European Structural and Investment Funds |
| ETCI | European Tech Champions Initiative |
| ETUI | European Trade Union Institute |
| EV | Electric vehicle |
| ETS | Emissions Trading System |
| ICE | Internal combustion engine |
| ICEV | Internal combustion engine vehicle |
| ICCT | International Council on Clean Transportation |
| ICT | Information and communication technology |
| IEA | International Energy Agency |
| IF | Innovation Fund |
| IfW Kiel | Kiel Institute for the World Economy |
| IoT | Internet of Things |
| IMF | International Monetary Fund |
| IPCEI | Important projects of Common European Interest |
| JTF | Just Transition Fund |

| | |
|---|---|
| KICs | Knowledge and Innovation Communities |
| LDVs | Light duty vehicles |
| LFP | Lithium iron phosphate |
| MFF | Multiannual Financial Framework |
| NGEU | Next Generation EU |
| NMC | Lithium nickel manganese cobalt oxide |
| NZIA | Net-Zero Industry Act |
| P(#) | Pricing scenario |
| PHEV | Plug-in hybrid electric vehicle |
| PPP | Public-private partnership |
| R&D | Research and development |
| R&I | Research and innovation |
| RRF | Recovery and Resilience Facility |
| SCF | Social Climate Fund |
| STEP | Strategic Technologies for Europe Platform |
| SURE | Support to mitigate Unemployment Risks in an Emergency |
| TCO | Total cost of ownership |
| TCTF | Temporary Crisis and Transition Framework |
| T&E | Transport and environment |
| TEN-T | Trans-European Transport Network |
| VET | Vocational education and training |
| ZEV | Zero-emission vehicle |

# INTRODUCTION

The automotive sector is an important pillar of the European economy. According to the European Commission the broad automotive industry contributes approximately 7 % of the EU's GDP and provides employment to nearly 14 million people in the EU[1]. The Draghi report of September 2024[2] further highlights the sector's role in regional value chains, innovation and research, creating demand for goods and services both upstream and downstream and spending around 15 % of its gross value added on research and development (R&D). Although recent years have seen a decline in production and foreign sales, the EU continues to export more vehicles and car parts than it imports, reflecting its importance within global trade networks. In 2024, the EU exported 5.4 million vehicles and imported around 4.0 million, resulting in a trade surplus of approximately 1.4 million vehicles. The EU exported cars worth approximately EUR 38.9 billion to the United States, while importing around EUR 8.4 billion from there. The total value of EU vehicle exports reached EUR 165.2 billion, compared to EUR 75.9 billion in imports[3,4]. The United States and the United Kingdom were the main export destinations, while China and Japan were the largest sources of imports.

During the previous European Commission mandate (2019-24), several policies and regulations were introduced for the European transport sector, with a particular focus on establishing guidelines to reach climate neutrality by 2050. The central legislation for the automotive sector in the EU is the Regulation on $CO_2$ emission performance standards for new cars and vans, which took effect in April 2023. The Regulation mandates all newly registered passenger cars and vans to be 'zero emission' vehicles (ZEVs) from 2035 onwards and illustrates the intention to phase out traditional internal combustion engines in the EU – making way for alternatively fuelled vehicles, such as electricity or hydrogen[5,6]. Although the European Commission confirmed in its March 2025 Automotive Action Plan, that the $CO_2$ emission performance standards will remain in place, it introduced flexibilities allowing manufacturers to offset target overshoots within a 3-year period (2025-27) by compensating through 'overachievements in the other year(s)'[7].

Passenger cars and commercial vans make up the largest share of the EU vehicle fleet. Within this group, electric vehicles (EVs)[i] — particularly battery electric vehicles (BEVs) — have experienced the strongest growth among alternatively fuelled vehicles in recent years and are expected to drive the transition in this segment[8].

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[i] Including all vehicles powered by electricity, such as battery electric vehicles , plug-in hybrid electric vehicles, and fuel cell electric vehicles.

The trend towards EVs is redefining the automotive sector as it is requiring significant adjustments in production processes and supply chains[9]. Within the EU, important value chains, such as battery production for EVs, are less developed than those for cars with internal combustion engines (ICEs). As a result, the share of EU value added for EVs is currently lower than for ICEVs[10]. Additionally, reliance on external suppliers for critical raw materials (CRMs) like lithium, cobalt, and nickel raises concerns about supply chain vulnerabilities, particularly in light of geopolitical uncertainties[11].

The EV transition must be seen as part of other trends, such as increasing automation and the integration with circular and digital value chains. Together, this affects the skills and labour needed in the sector[12, 13].

This multiple transition is reshaping revenue streams for vehicle manufacturers and may call into question the ability of the sector to financially sustain current and future investments. The challenge is to balance declining sales from ICEVs with the increasing adoption of EVs. In parallel, emerging business models such as shared mobility and software-related connected services are creating new opportunities both for revenues, new value chains and employment[14, 15].

Implications of the EV transition extend beyond production processes, R&D and innovation. The uptake of EVs also requires the deployment of complementary charging infrastructure, be it private or public.

The EV transition is redefining global and European markets. Although EV adoption has been growing in the EU over the past years, it has been surpassed by the growth in EV demand in third markets, notably China[16]. Non-European vehicle manufacturers have captured market shares in EV markets and are also gaining ground in the EU[17]. Meanwhile, European producers are facing challenges related to labour and energy costs, which are affecting their price competitiveness with foreign rivals[18]. They are also falling behind in terms of innovation, with 6 of the top 10 automotive innovators[ii] in 2023 being based outside Europe and 45 % of innovations originating from Chinese manufacturers[19].

The ’rapid rise in low-priced exports’ of EVs from China to the EU triggered an anti-subsidy probe in 2024 which led to the introduction of countervailing duties on BEV imports from foreign competitors, which were found to have received unfair subsidies[20]. This is happening against the backdrop of current global trade tension, notably between the EU, China and the US. The announcement of the US ‘fair and reciprocal trade plan’[21], citing discriminatory treatment by trading partners, such as the EU, and pledging new trade measures to address this, has further escalated tensions. In response, the EU has stated

[ii] The ranking is based on an individual assessment of 512 innovations implemented in mass-produced electric vehicles by the Centre of Automotive Management (2024).

its intention to react 'firmly and immediately' to such measures, signalling a potential intensification of trade disputes in the future[22]. The willingness to employ and/or enhance trade measures that could affect vehicle imports and exports has been underlined in the Automotive Action Plan[23]. The 25 % tariffs on imports of automotives and their parts to the US announced by the White House on 26 March 2025 are only one step further towards a spiralling escalation of trade measures affecting the automotive industry[24].

Energy prices and costs are a central theme in the European debate on competitiveness. For the car industry, challenges can be broken down into the following areas: energy prices and costs for manufacturing including batteries, EV charging infrastructure extending also to the grid, electricity market regulation and finally, electricity charging prices. All impact the future of the car industry in Europe although to different degrees. While energy and energy market regulation pose challenges, they can also be part of the solution.

The debate on energy prices and costs is not new. Energy prices have always been higher than in other regions. In the past, the perceived or actual price gap has been compensated by higher efficiency and by relatively cheap energy imports, notably natural gas. The Russian invasion of Ukraine signalled the end of 'cheap gas', triggering an unprecedented energy price crisis. While such a crisis is not expected to repeat itself, Europe's industrial retail prices – according to the Draghi report – are more than two times higher than those of the US. Some of this gap can be explained by better natural endowment, many other causes are at work. They include higher costs for operation and maintenance of existing energy assets, taxes, carbon pricing, charges linked to grid congestion, wholesale rents and contractual arrangements[25]. In a highly competitive environment with relatively high European labour and regulatory costs, high energy prices add an additional cost factor to car manufacturing. Premium car makers may find it easier to pass on costs to consumers than volume producers. Cost differentials however are fundamental when it comes to battery production.

### *Overview of the report*

This report explores the key aspects of the EV transition, focusing on the challenges and opportunities in vehicle manufacturing, battery production, and charging infrastructure. In light of these challenges, the report examines financial tools to support the transition to EVs. It focuses on passenger cars and commercial vans.

The report begins by discussing the development of revenue streams and emerging business models associated with the transition. Section 2 discusses batteries, including the estimated financing needs for scaling up European production. This is part of a larger discussion about the potential trade-offs between the goal of increasing European value added, reducing battery costs, and addressing supply chain risks. Section 3 examines the role of charging infrastructure in the adoption of EVs and identifies potential market failures in its deployment. This is linked to an analysis of regulatory barriers. Section 4 analyses the implications of the transition to EVs and broader trends such as automation and digitalisation on jobs and skills within the sector. It outlines potential future developments and emphasises the need for support from both public and private sectors. Lastly, the report examines both current and potential new financing instruments that could support and expedite the transition of the EU's vehicle fleet to EVs.

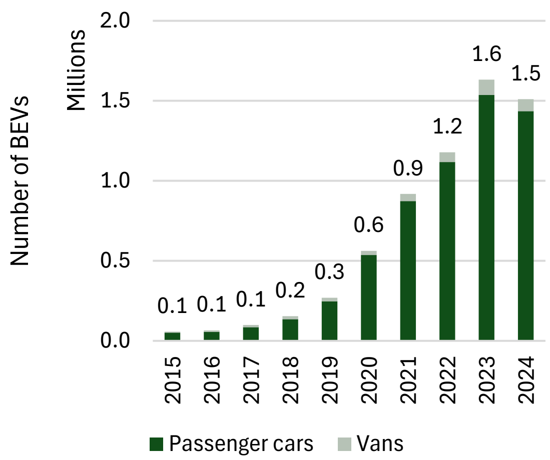
# 1. THE FUTURE OF EU VEHICLE MANUFACTURING

The transition occurring in the automotive industry raises important questions about the future viability of European car manufacturing, especially at the current scale. Existing revenue streams are under pressure, and new ones, along with new business models are just beginning to emerge. As global competition continues to rise, both the market share and production of cars manufactured in the EU are at risk of declining, which could also impact industry margins.

## 1.1. TRANSITION CHALLENGES

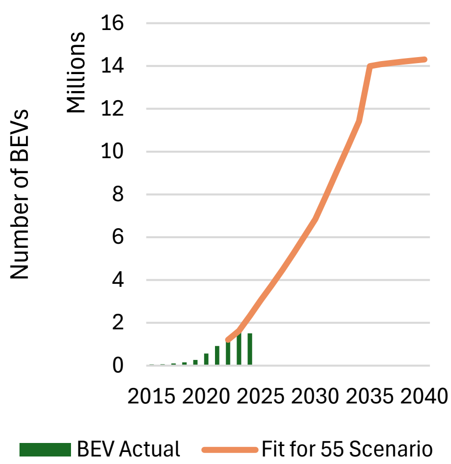
The share of BEVs in the total vehicle fleet in the EU has grown steadily in recent years, with consumer adoption accelerating significantly since 2020/2021 (Figure 1). The decline in new BEV registrations in 2024, compared to 2023, has raised concerns about the future uptake of EVs. Notably, developments at the Member State level, such as the phase-out of BEV subsidies in Germany, significantly contributed to the lower uptake of BEVs in 2024[26]. Early signs of a recovery in BEV uptake are emerging – evidenced by strong growth in BEV registrations in Q1 2025, particularly in Germany, Belgium, and the Netherlands[27]. Maintaining and accelerating this momentum remains crucial for both the EU's decarbonisation efforts and the future of the automotive industry (Figure 2). This also raises the question of how the transition will be financed — broadly understood to include private purchases, business investment, and public support.

Figure 1 New registrations of BEV passenger cars and vans in the EU (2015-24)




*Source:* Own elaboration based on EAFO (2025).

Figure 2 New registrations of BEV passenger cars and vans vs Fit for 55-aligned projections in the EU (2015-40)




*Source:* Own elaboration based on EAFO (2025) and Energy Policy Simulator (2025).

A study by T&E[28] estimates that the cumulative financing needed to increase the European BEV fleet for LDVs in order to reach a net zero mobility system by 2050 will be approximately EUR 5.5 trillion by 2040. According to the study, this translates into around EUR 1.3 trillion between 2025 and 2030, rising to approximately EUR 3.4 trillion by 2035. Of the total financing needs by 2030, some EUR 76 billion, or around 6 % of the total needs are projected to come from public sources. Hence, approximately 94 % would have to come from private consumers buying BEVs.

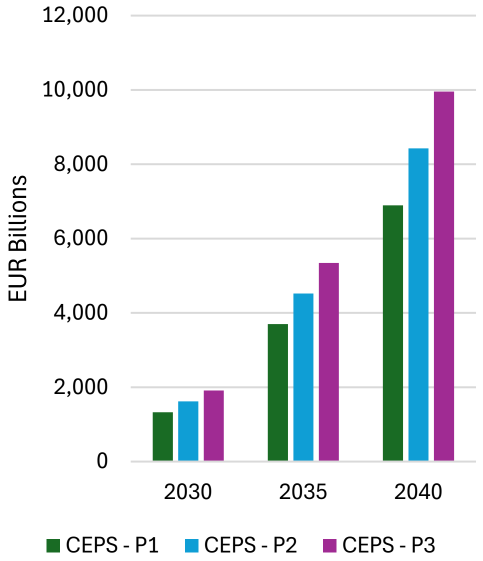
Translating T&E's[29] estimates into yearly financing needs equals a yearly average of around EUR 217 billion for 2025-30. Projections foresee a strong increase in required financing to around EUR 410 billion for 2031-35, and approximately EUR 420 billion for 2036-40.

Our own estimates on cumulative financing needs using three pricing scenarios (P1-P3)[iii] for the deployment of battery electric passenger cars and vans in line with Fit for 55 policies are somewhat higher, ranging between around EUR 7 trillion (P1) and EUR 10 trillion (P3) by 2040 (Figures 3 and 4). This translates into yearly estimates of between EUR 138 billion (P1) and almost EUR 200 billion (P3) in 2025, increasing to a range of almost EUR 310 billion (P1) and EUR 445 billion (P3) in 2030 before showing signs of plateauing between 2035 and 2040 on approximately EUR 630 billion (P1 – 2035) to almost EUR 645 billion (P1 – 2040) in the low pricing scenarios and EUR 910 billion (P3 – 2035) to EUR 930 billion (P3 – 2040) in the high pricing scenarios. Model results depend highly on assumption of how many BEVs can be sold and at what price.

A back-of-the-envelope calculation can help put the estimated annual financing needs into perspective. In 2024, around 10.8 million passenger cars and 1.6 million vans were newly registered in the EU[30]. Of those respectively 14 % and 6 % were BEVs. Taking an average price of 45 000 to 65 000, as used in the CEPS pricing scenarios, this corresponds to current annual spending by consumers of roughly EUR 72 to EUR 105 billion on BEV passenger cars and vans. Based on this, scaling up to the 2025 scenario would require an additional EUR 66 billion to EUR 95 billion.

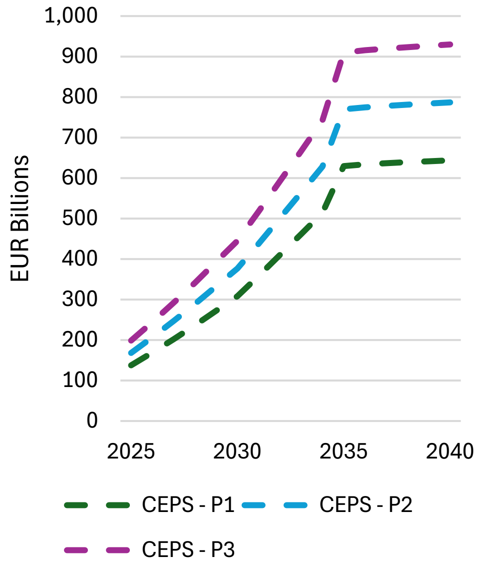
[iii] The scenarios estimate financing needs based for three pricing levels per vehicle ranging from EUR 45 000 (P1) over EUR 55 000 to EUR 65 000 (P3) per vehicle (See Annex II for methodology).

Figure 3 Sales scenarios for BEV passenger cars and vans – Cumulative financing needs in the EU (2030-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 4 Sales scenarios for BEV passenger cars and vans – Annual financing needs in the EU (2025-40)

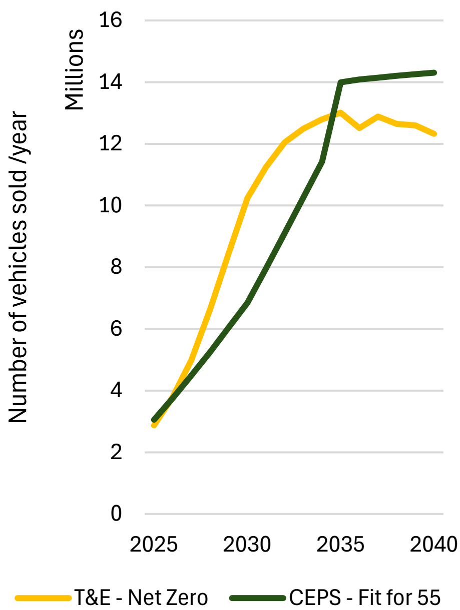



*Source*: Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

The differences between the T&E and CEPS estimates are primarily driven by variations in price assumptions and annual vehicle sales projections (Figures 5 and 6)[iv]. The price projections used in the T&E scenario are sourced from BloombergNEF. T&E projects in their net zero scenario data a stronger uptake of EVs until 2035 compared to the fleet scenario underlying CEPS' estimates before this relationship reverses moving further towards 2040.

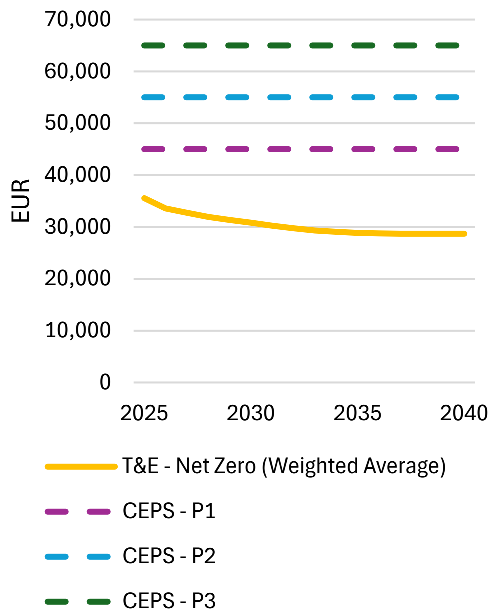
[iv] See also Annex I for more information on European vehicle fleet scenarios used for CEPS scenario modeling.

Figure 5 Number of BEVs sold for scenario modelling




*Source:* Own elaboration based on T&E (2024) and CEPS' own estimates based on Energy Policy Simulator (2025).

Figure 6 Prices per BEV for scenario modelling




*Source:* Own elaboration based on T&E (2024) using Bloomberg NEF price projections and CEPS' own estimates based on Energy Policy Simulator (2025).

## 1.2. ESTIMATES OF FUTURE REVENUE STREAMS, COSTS AND MARGINS

The financing needs of the illustrated scenarios can also be interpreted, in a broad sense[v], as possible revenue streams from BEV sales. Combining these projections with similar estimates on revenues from ICEV sales, shows how revenue streams for vehicle manufacturers could evolve over time on the European market, in line with current Fit for 55 policies.

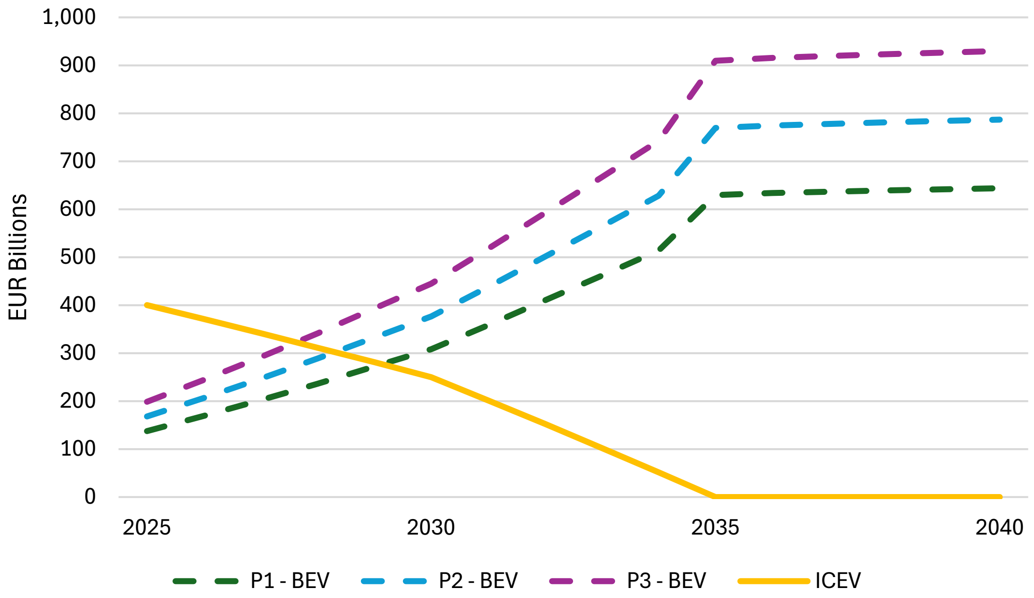
### *Revenues*

In a scenario consistent with the Fit for 55 policies, ICEV sales would generate around EUR 400 billion in manufacturer revenues in 2025 but are expected to decline steadily until their phase-out from the European market by 2035. At the same time, BEV sales are estimated at EUR 139 to 199 billion in 2025 and would need to grow significantly to offset this decline and support the transition (Figure 7). For some time, car industry revenues from the sales of combustion engine passenger cars and vans are projected to be higher

[v] Revenues from vehicle sales are defined here broadly as the total value of vehicles sold, calculated by multiplying the vehicle price (including taxes) by the number of units sold.

than BEV revenues. However, these revenues are expected to reach parity with BEV revenues by 2027/2028 under the P1 scenario and by 2029/2030 under the P3 scenario. According to this analysis, revenues from BEV sales would surpass ICEV revenues from 2025 in the late 2020s/early 2030s, depending on the pricing scenario.

Figure 7 Sales scenarios for BEV vs ICEV passenger cars and vans – Annual revenues in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

While BEV automotive industry revenues are expected to increase as estimated in the scenarios, there are also cost implications to consider due to the shift in production processes from ICEVs to BEVs.

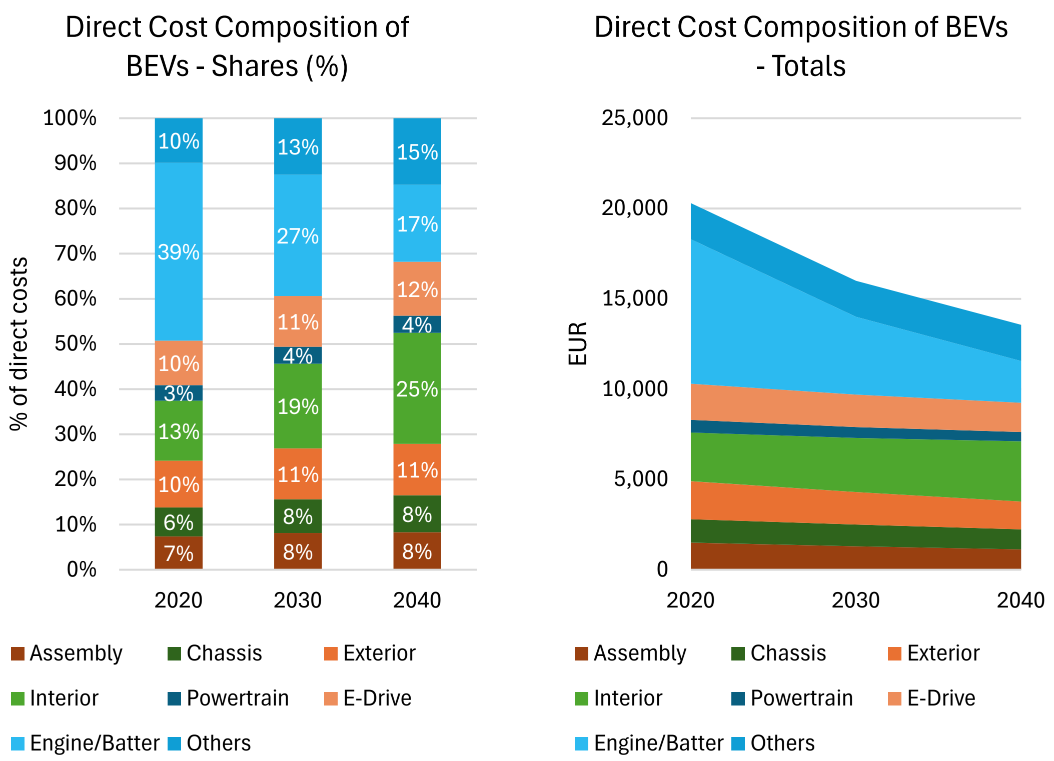
### *Costs*

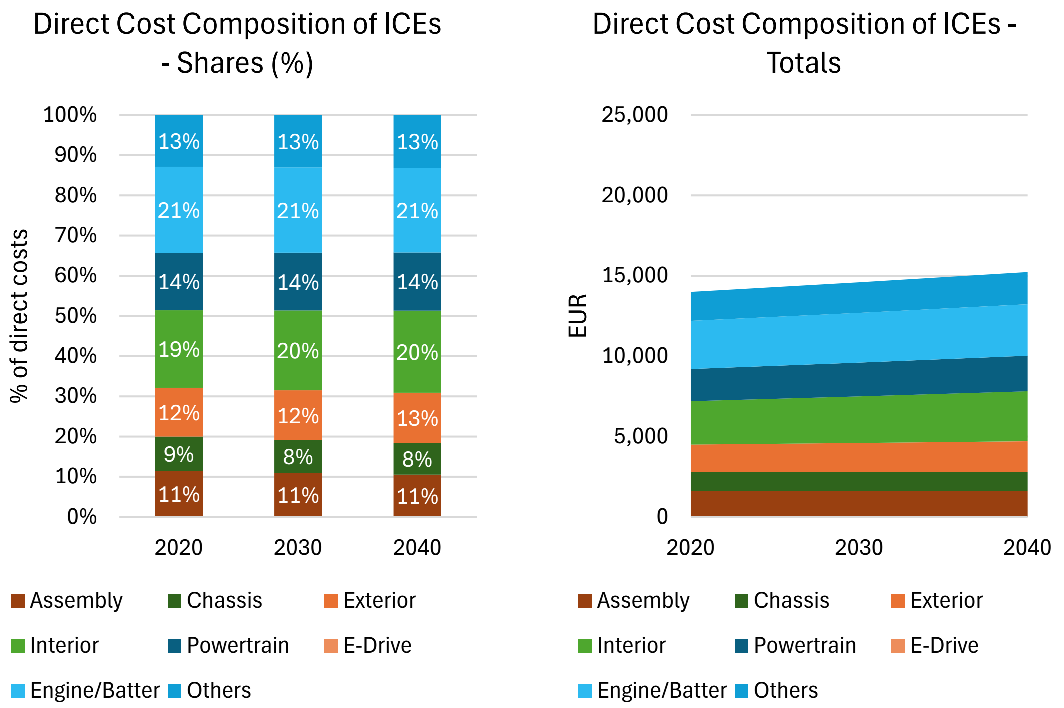
While BEV automotive industry revenues are expected to increase as indicated in the previous scenario (Figure 7), there are also cost implications to consider due to the shift in production processes from ICEVs to BEVs.

According to an analysis by Oliver Wyman[31], direct costs for BEVs in 2020 were around 45 % higher than those of ICEVs. By 2030, this cost differential is projected to narrow to approximately 10 %, driven by two trends: increasing ICEV costs due to higher consumer demand for sustainably sourced materials and more expensive interior features, and decreasing BEV costs resulting primarily from advancements in battery technology and production processes. Assuming a linear trajectory in the growth rates of individual cost components between 2020 and 2030 to extrapolate costs until 2040, for Europe, the cost relationship of BEVs and ICEVs could reverse around 2035, with BEVs projected to have 11 % lower direct costs than ICEVs in 2040 (Figure 8).

Unfortunately, there are only a limited number of studies, such as the one by Oliver Wyman from 2020[32]. Inflation, supply chain disruptions and cost reductions due to learning curves are likely to change the numerical results which in turn may alter the year of cost reversal. In particular, future increases in ICEV costs remain uncertain, as they depend on variables such as consumer preferences, and material pricing that may evolve differently than anticipated. Notably, in China, there are already signs that BEVs have reached price parity with ICEVs[33].

Figure 8 Direct cost comparison – ICEV vs BEV compact-class vehicle in the EU





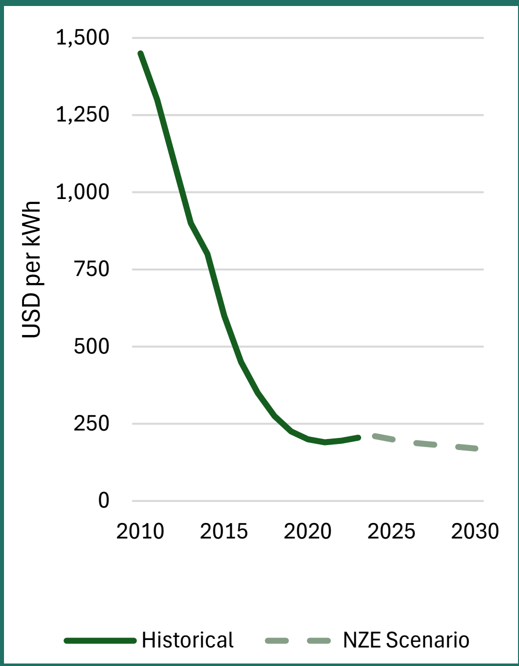

*Source:* Own elaboration based on CEPS' own estimates and Oliver Wyman (as cited in Miller, 2020; König et al. 2021).

## Box 1 Development of battery costs and regional differences

According to the IEA[34], there has been a strong decline in EV battery prices since 2010. The historical trend shows a steep decline from roughly under USD 1 500/kWh in 2010 to below USD 200/kWh by 2023 (Figure 9). In line with net zero emission scenarios, the IEA projects this trend to continue, albeit at a slowing pace beyond 2030[35].

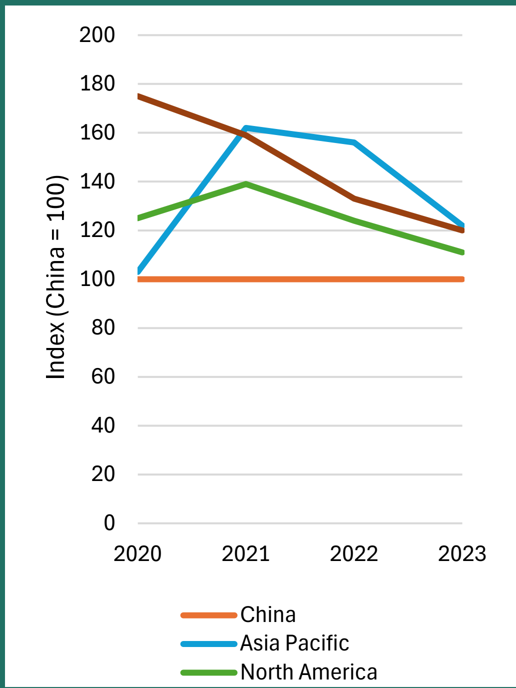
The trend of decreasing battery costs has been one of the key drivers in reducing BEV costs but notable cost differences across regions persist, as illustrated by the IEA[36] (Figure 10). The cost differential between the Europe and China fell to 20 % in 2023. Such differences are significant for EV production costs, as studies indicate that batteries accounted for around 40 % of the direct manufacturing costs of European BEVs in 2020 and are expected to remain at approximately 27 % by 2030 . A linear trend would imply a cost share of about 34 % in 2025 (Figure 8).

Figure 9 Average EV battery price (2010-30)




*Note:* NZE – Net zero emission scenario.
*Source*: Own elaboration based on IEA (2024).

Figure 10 Battery price index by region (2020-23)




*Source*: Own elaboration based on IEA (2024).

Given the higher estimated direct costs of BEVs compared to ICEVs, the transition from ICEV to BEV sales will most likely have an impact on the profit marginsvi of European car manufacturers. This effect could persist until the cost gap narrows, eventually resulting in a cost advantage for BEVs. At the same time, rising ICEV costs, driven by producer-specific direct and indirect costs, as well as other factors such as final vehicle pricing, dealership markups, and taxes, could place additional pressure on margins.

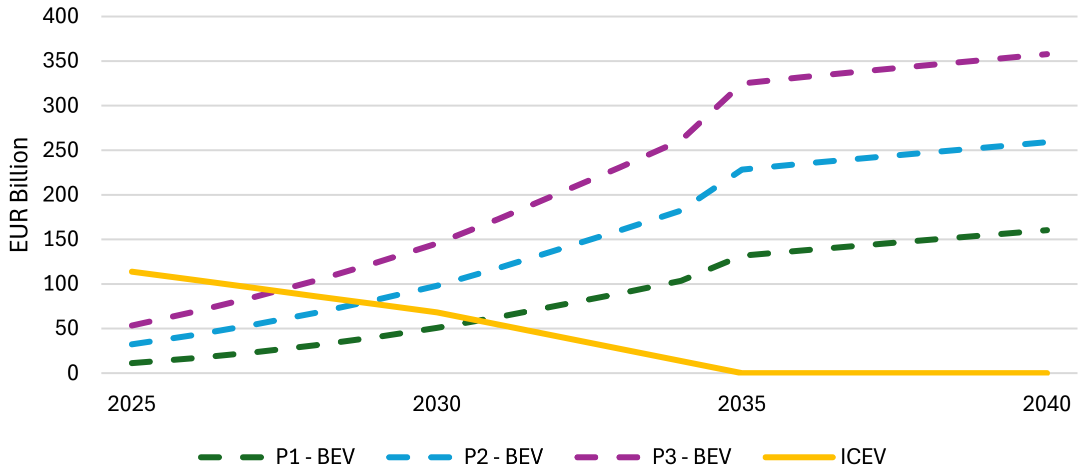
Following the projected development of direct / indirect costs as well as estimates for dealership-related costs and taxes for BEVs and ICEVs, the revenue-to-cost dynamics of BEVs and ICEVs over time could evolve as illustrated in Figure 11 for passenger cars and vans between 2025 and 2040.

Under the first BEV pricing scenario (P1), margins generated through sales start at around EUR 11 billion (P1) to some EUR 54 billion (P3). The margin for ICEVs due to higher sales volumes and lower costs per vehicle starts at EUR 114 billion in 2025. Based on the assumed cost dynamics and expected growth in sales of BEVs, BEV margins would surpass

[vi] (Profit) margins are defined as the vehicle price minus direct, indirect, and other costs, including dealership markups and taxes (see Annex II for methodology). The terms 'profit margins' and 'margins' are used interchangeably.

those of ICEVs between 2027/2028 (P3) and 2030/2031 (P1). All three pricing scenarios would largely outperform ICEV margins from 2025 by 2035 before reaching their peaks in 2040 at around EUR 160 billion (P1) to EUR 358 billion (P3). In line with Fit for 55 policies, ICEV sales on the European market would phase out after 2035 and margins (like revenues) would decrease to zero in this segment.

Figure 11 Sales scenarios for BEV vs ICEV passenger cars and vans – Margins after costs and taxes in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

The illustrated scenarios assess both revenues and margins on the basis of the projected European market for BEV and ICEV for passenger cars and vans. However, EU manufacturers have been losing market share to both new entrants and more established international manufacturers[37]. IEA[38] analysis suggests that the position of EU producers in the European EV market has steadily declined since 2015, dropping from over 80 % to 60 % in 2023. Chinese manufacturers have significantly expanded their presence from 5 % to 15 % over the same period. For European manufacturers, a shrinking market share could imply cost disadvantages because of missing out on economies of scale. Crucially, the share of total revenues and margins for EU producers in these scenarios will depend on their ability to maintain or expand their market position.

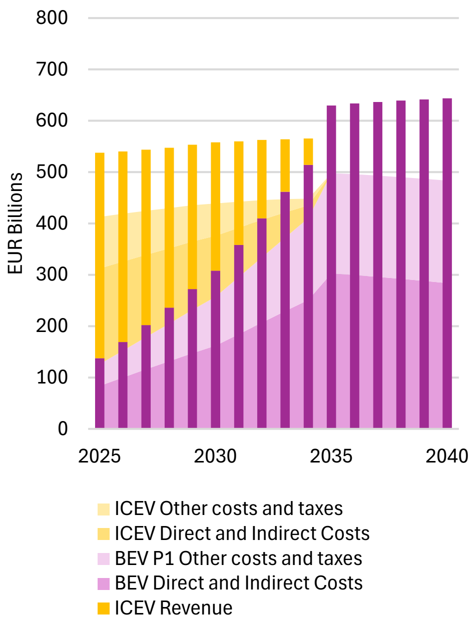
In 2019, McKinsey & Company[39] estimated additional costs of EUR 2 233 (USD 2 500) per vehicle due to lower production volumes compared to ICEVs. Combining revenue, cost, and margin estimates for both BEVs and ICEVs can provide insights into how much rising BEV sales might compensate for declining ICEV profitability (Figures 12-17). The calculations show that in all pricing scenarios (P1-P3), total margins (BEV+ICEV) for vehicle manufacturers could increase by 2040 compared to 2025 levels. This suggests that, *in the long term,* profits from decreasing ICEV sales could be compensated by the growth of BEV sales for passenger cars and vans.

However, this balancing effect does not materialise immediately across all scenarios. Only the medium and high pricing scenarios (P2 and P3) for BEVs offset the losses from decreasing ICEV sales from 2025 onwards. In the low pricing scenario (P1), combined annual margins from ICEV and BEV sales remain below 2025 levels by around EUR 4 to 9 billion until 2035. Over this period, the cumulative shortfall relative to 2025 reaches around EUR 62 billion. According to the model, this shortfall would be fully recovered by 2039, with BEV margins surpassing 2025 combined levels by about EUR 35 billion annually in 2040.

In contrast, scenarios P2 and P3 project consistently growing margin surpluses (in comparison to 2025 level) over time. In the medium to high pricing scenarios (P2 and P3), combined margins of BEV and ICEV sales would be around EUR 1 billion (P2) to EUR 6 billion (P3) above 2025 levels. By 2030, this surplus would increase to between around EUR 20 billion (P2) and EUR 46 billion (P3) in 2030. In 2035, it could reach almost EUR 89 billion (P2) and EUR 165 billion (P3) and further increase to EUR 113 billion (P2) and slightly above EUR 190 billion (P3) by 2040.

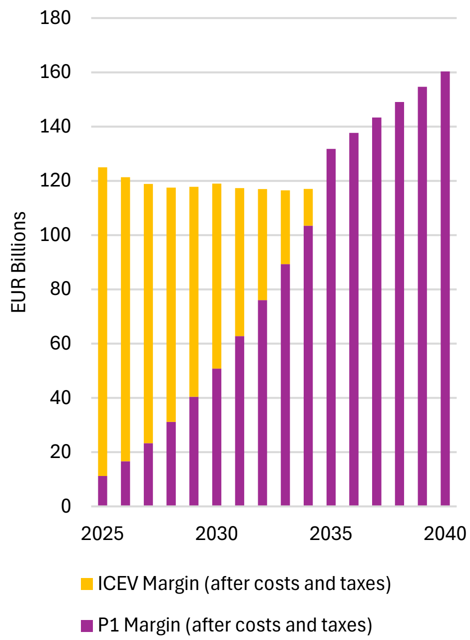
These developments depend on several variables. Lower dealership markups and taxes could bring forward the break-even point, while sharper reductions in the direct and indirect costs of BEVs would have a similar effect. For instance, a 50 % lower dealership margin in the P1 scenario, compared to the baseline model, would anticipate the combined margins from BEV and ICEV sales exceeding 2025 levels to the early 2030s. Conversely, lower than projected BEV uptake or a faster decline in ICEV sales could delay the timeline for shifting profitability.

Figure 12 Scenario P1 – Revenues, costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)



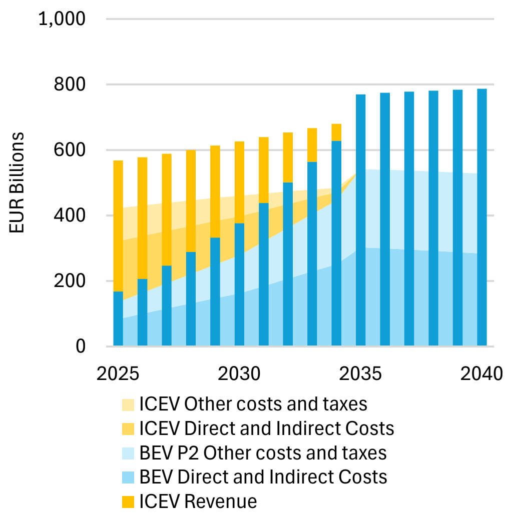

*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 13 Scenario P1 – Margins after costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)



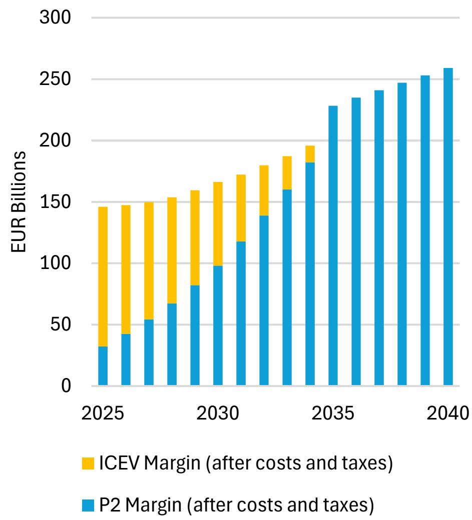

*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 14 Scenario P2 – Revenues, costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)



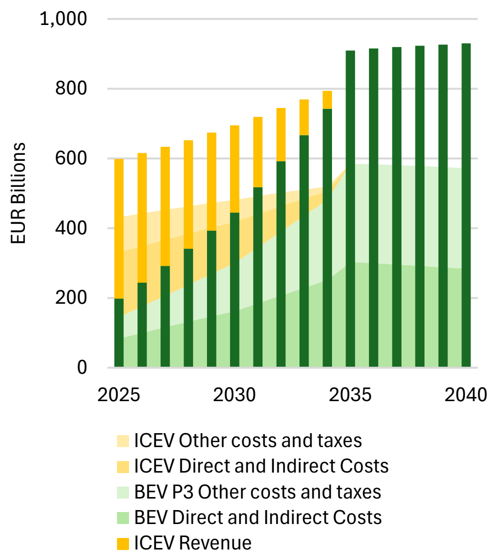

*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 15 Scenario P2 – Margins after costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)



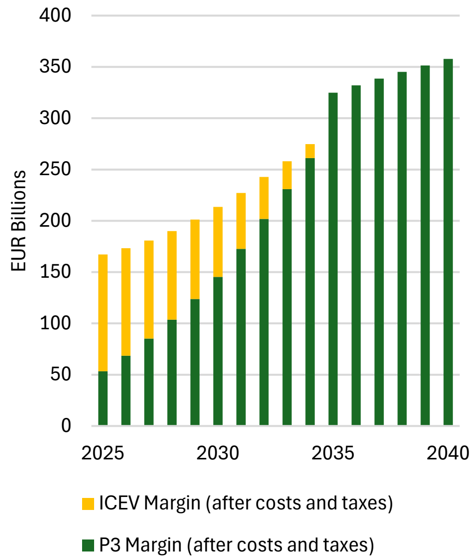

*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 16 Scenario P3 – Revenues, costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 17 Scenario P3 – Margins after costs and taxes for BEV and ICEV passenger cars and vans in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

## 1.3. CONSUMER WILLINGNESS TO PAY

Transitional revenue streams from ICEVs could potentially balance out initially lower or negative margins from the shift to BEVs to some extent. However, BEV consumer uptake will not only need to accelerate to create revenues to finance further investment but also to improve the economies of scale that contribute to bringing down indirect costs per BEV.

Yet, consumer surveys indicate that the purchase price of BEVs remains a barrier. This raises doubts about the feasibility of faster adoption without additional support[40]. According to the Consumer Monitor[41], the median price that consumers are willing to pay for a new or used BEV is around EUR 20 000. This roughly equals the median disposable income of inhabitants (19 955 PPS) in the EU in 2023[42]. Notably, Chinese manufacturers have announced plans to introduce BEVs to the European market for under EUR 20 000, but this pricing will only be available during the initial launch. After that prices are expected to increase to around EUR 23 000[43].

CEPS' analysis suggests that prices below EUR 45 000 for BEV passenger cars and vans will result in combined margins (BEV+ICEV) being below 2025 levels until the late 2030s. To maintain vehicle manufacturers' profit margins at least somewhat in the short term, setting a minimum price of EUR 45 000 would create a gap of around EUR 25 000 per vehicle compared to consumers' willingness to pay and the average disposable income in the EU. The uncertainty surrounding the EUR 45 000 figure is quite significant. However, it can be confidently assumed that there is a substantial gap between the minimum price that EU manufactures would require for BEVs to sustain current pricing structures and the amount that private car owners are willing to pay. To achieve the goal of providing BEVs at EUR 20 000 per vehicle while keeping manufacturers' margins close to 2025 levels, this gap would have to be covered through a combination of demand-side measures, such as targeted incentives, and supply-side support, to accelerate cost reductions along the value chain. However, adjustments of pricing structures along the value chain may also be necessary (Box 2).

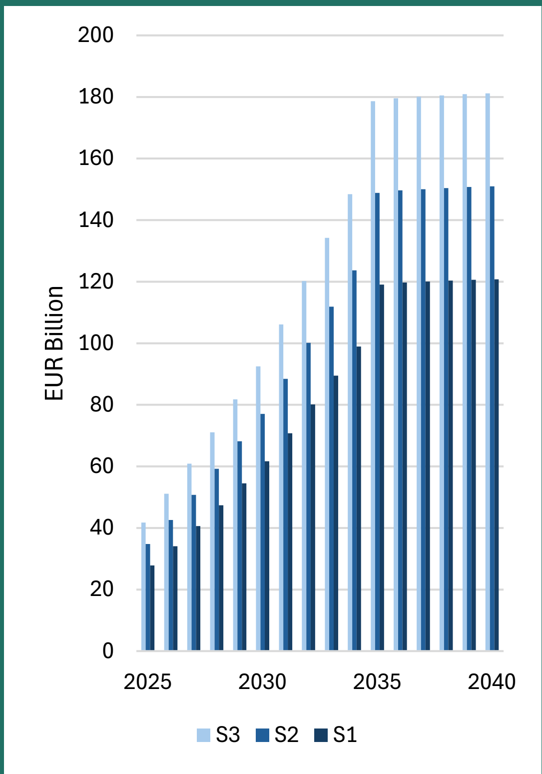
**Box 2 Estimating the gap to sustain margins**

Considering EU sales data by vehicle segments, statistics indicate that 58 % of new cars in the EU were from the upper segments (D-F) and SUVs in 2022. SUVs alone accounted for 49 % of new cars[44]. This is likely driven by corporate car sales which tend to be larger in size and make up approximately two thirds of sales in the EU[45]. Small to lower medium car segments (A-C) accounted for 37 % of new vehicles in 2022[46].

Using market share scenarios in small to lower medium car segments as proxy for the demand of BEVs below EUR 45 000, can be used to estimate the gap between the P1 price at which manufacturer margins can be sustained to some extent and the level of consumers' willingness to pay and disposable income in the EU. Figures 18 and 19 show that this gap would range between approximately EUR 28 billion (S1) and EUR 42 billion (S3) in 2025. Yearly needs would increase to EUR 119 billion (S1) and EUR 179 billion (S3) in 2035 before reaching a relatively constant level by 2040. Cumulatively, these estimates would amount to a range of EUR 266 billion (S1) to EUR 399 billion (S3) by 2030, EUR 725 billion (S1) to EUR 1.1 trillion (S3) by 2035 and EUR 1.3 trillion (S1) to around EUR 2 trillion (S3) by 2040.

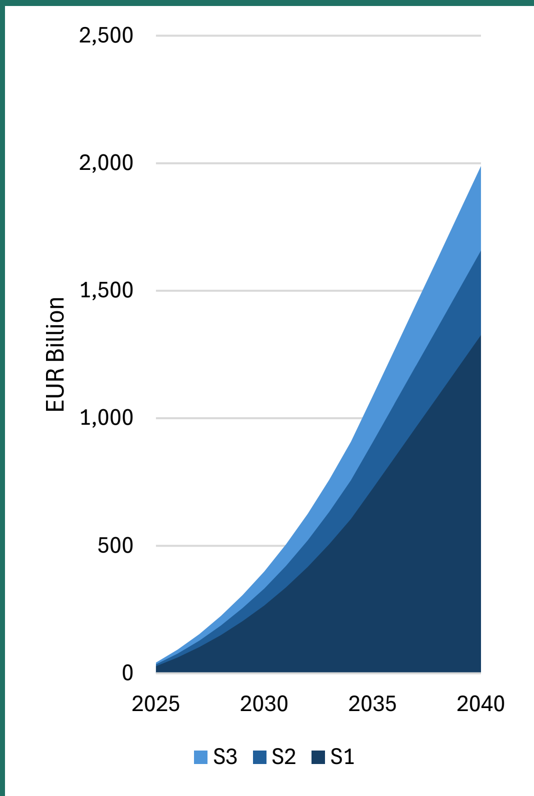
Notably, a margin surplus compared to 2025 levels (BEVs+ICEVs) could also incrementally contribute to filling this gap as soon as rising profitability from BEV sales have compensated for corresponding losses from ICEV sales. However, this will depend strongly on the EV uptake in relation to the development of producer-specific costs, dealership markups and taxes over time.

Figure 18 Scenarios for the yearly gap between median equivalised disposable income and P1 pricing level for different market shares in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

Figure 19 Scenarios for the cumulative gap between median equivalised disposable income and P1 pricing level for different market shares in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

## 1.4. OTHER REVENUE STREAMS

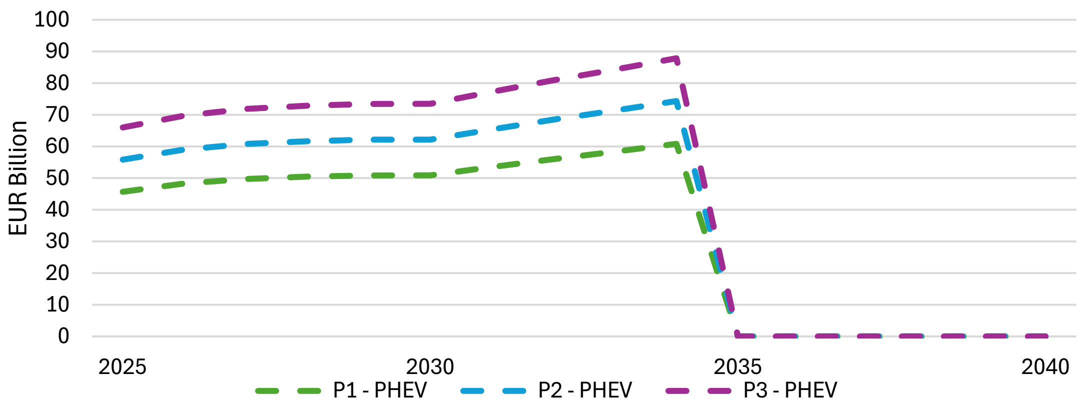
Similar to its projections for BEVs, CEPS estimated a scenario for yearly revenues generated by plug-in hybrid (PHEV) sales in the passenger car and van segments from 2025 to 2040 under three pricing scenarios (P1-P3) (Figure 20)[vii]. Depending on the price level, these revenues could range between some EUR 46 billion (P1) and EUR 66 billion (P3) in 2025. Increasing demand could lead to an increase of expected revenues until peaking in 2034 at around EUR 61 billion (P1) to EUR 88 billion (P3). In line with current

[vii] The scenarios estimate financing needs based for three pricing levels per vehicle ranging from EUR 45 000 (P1) over EUR 55 000 (P2) to EUR 65 000 (P3) per vehicle. As reference, the volume weighted average price of a PHEV in Europe according to the Statista (2024) is projected to be around EUR 63 600 in 2025.

EU regulations, sales of PHEVs with a fossil fuel-powered combustion engine, are projected to be phased out in the EU after 2035.

A notable trend in some markets, such as China, has been the growing uptake of extended-range EVs (EREVs)[47]. These vehicles are equipped with both an electric powertrain and an ICE which is used to extend driving range by recharging the battery. With a larger battery compared to regular PHEVs, this allows for longer fully electric driving ranges. In China, sales of EREVs accounted for around 25 % of PHEV sales in 2023, representing a 10 % increase compared to the previous year. In Europe, EREVs have played a limited role in EV sales so far; however, they could potentially contribute more to PHEV revenues if demand increases as observed in other markets.

Figure 20 Sales scenarios for PHEV passenger cars and vans – Annual revenue in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

According to IEA[48] projections, European vehicle production could decline by approximately 20 % by 2035 under the Announced Pledges Scenario[viii], compared to 2023. The decline in the scenarios is driven by a faster reduction in domestic ICEV production than EV sales by EU manufacturers because of intensifying competition from non-European producers and structural barriers such as high energy costs and 'fragmented' local battery production.

[viii] The IEA's (2024) Announced Pledges Scenario (APS) assumes full and timely implementation of all climate-related commitments declared by governments, including net-zero targets, Nationally Determined Contributions, and related commitments such as energy access. It also considers pledges from international fora, businesses, and non-governmental organisations, as well as announced manufacturing projects, including preliminary plans, regardless of the existence of supporting policies.

While revenues from PHEVs and ICEVs are expected to phase out for passenger cars and vans in the European market after 2035, vehicles with a combustion engine produced in the EU will continue to play a role for export markets, at least for some time.

The long-term contribution of ICEV exports to future revenue streams will depend on the pace of global EV adoption, particularly in advanced economies where climate policies are accelerating the transition. The development of alternative low-carbon mobility solutions may offer additional opportunities for the sale of EU-produced vehicles in foreign markets. However, in emerging markets and developing economies, competition from non-European manufacturers, particularly from China, is expected to intensify. In this context, it is worth noting that not all European manufacturers rely on / can build on exports as a significant source of revenue for EU production. Exports as revenue streams are more typical for brands operating in premium market segments, where higher margins help absorb the logistics costs of shipping vehicles abroad[49]. For brands which focus on lower price segments and typically have lower margins per vehicle, localised production in the country of sale is more common.

The trade dynamics will have a major impact on market developments and individual vehicle manufacturers (Box 3). Market shares will depend on the specific measures adopted and the responses of the EU's trading partners. For example, the countervailing tariffs apply only to BEVs, not for PHEVs made in China. As a result Chinese PHEV sales are on the rise[50]. The European Commission's Automotive Action Plan is trying to address and has emphasised its commitment to 'levelling the playing field' for the European automotive sector[51].

**Box 3 The potential impact of escalating global trade tensions**

The European automotive industry is facing mounting trade tensions. In 2024, the EU launched an anti-subsidy probe into Chinese EV imports, leading to countervailing duties and sparking controversy across observers and the industry itself[52,53].

Tensions escalated further in early 2025, when the US introduced its *'fair and reciprocal trade plan'*, followed by the announcement of 25 % tariffs on imported vehicles and parts[54,55]. The EU has pledged a strong response and reaffirmed its willingness to adjust trade policy in defence of its vehicle industry and its *Automotive Action Plan*[56,57].

These developments pose significant risks for European manufacturers for several reasons, including:

**Exposure through exports:** The US remains a major market for European automotive producers, accounting for around 22 % of export value and 15 % of EU exported vehicles in 2024[58]. New tariffs will directly affect these trade volumes.

Although the Kiel Institute for the World Economy[59] estimates modest short-term effects for the EU-27 economies, with a 0.3 % decline in automotive exports and a 0.08 % drop in production, impacts are uneven across Member States and may intensify if tensions continue. Germany, with its local manufacturers focusing more on the export-oriented, premium segment, is expected to be more affected than other Member States (such as France), facing projected export losses of 0.4 % and production declines of 0.18 %.

Notably, these losses are estimated on a national level but will be particularly incurred by a small number of European manufacturers – hence, the firm-level effects may be much more severe and could strongly affect the ability of export revenues to contribute to financing the EV transition for European manufacturers.

**Impact on US-based operations:** With around 830 000 vehicles produced annually in the US facilities of European automotive brands[60], these brands also face impacts from an (US) importer perspective.

Tariffs on key inputs such as steel and aluminium, as well as potential retaliatory measures, could significantly raise costs and affect the entire value chain (at least for US-based production of European manufacturers). China's suspension of rare earth and magnet exports is a case in point[61].

According to IfW Kiel[62], the new tariffs could reduce US exports by 2.8%, increase the local price index by around 1 %, while production remains largely stable (-0.04 %). Again, these estimates are only on the national level though. For the individual manufacturers, the anticipated tariffs of 25 % on automotive parts – and potential retaliatory measures by other countries, such as China – could significantly affect costs and disrupt supply chains.

**Potential trade diversion of US targeted exports to the EU:** Vehicles originally destined for the US, e.g. from China, could be redirected to the EU market, intensifying domestic competition at a time when European brands are already seeing decreasing sales in foreign markets, such as China, and the European market is gaining more relevance as future revenue source[63,64].

Additional revenue streams related to batteries offer potential opportunities that go beyond car production (e.g. McKinsey & Company[65]). One business model involves the establishment of battery leasing programmes, enabling consumers to lease batteries separately from vehicles. This approach addresses concerns about battery performance and degradation while generating over EUR 950 (USD 1 000) in additional revenue per vehicle over a 5-year lease term through monthly fees and margins on the battery's depreciated value. However, some questions regarding the economic viability of this business model both for consumers and manufacturers still remain[66].

Some European producers such as Renault have already offered battery leasing for one of their models (i.e. ZOE), but this service was phased out in 2024[67]. In 2021, the Chinese manufacturer NIO launched an own battery leasing programme, which provided customers with the option to rent longer range batteries to upgrade their EVs. In 2023, they extended the service from monthly / yearly leasing periods to daily options, admitting however the logistical challenge to operating a network of stations for swapping the batteries[68].

Another idea is to repurpose older batteries for secondary use in the stationary storage market, creating an additional profit opportunity. McKinsey & Company[69] estimates that these batteries could be resold to remanufacturers at approximately EUR 62/kWh (USD 65). While vehicle manufacturers are assumed to make no profit on the resale, remanufacturers could generate profits by repurposing the battery packs for stationary energy storage applications. As the energy transition advances, energy storage needs are expected to exponentially increase. This market will depend on continuous reforms to electricity market regulations and the development of the grid , notably at distribution level.

The transition to EVs is accompanied by the growing importance of software in vehicles. Digital innovations are expected to transform mobility through connected vehicles, enhanced driver assistance systems, and advancements in autonomous driving technologies. Artificial intelligence in particular is anticipated to play an important role, with applications in improving efficiency across vehicle and component development, production, and testing[70]. CEDEFOP[71] estimates that by 2030, electronics and software could account for around 50 % of a vehicles value. BCG[72] projects that software-defined vehicles to become a major revenue source for vehicle manufacturers.

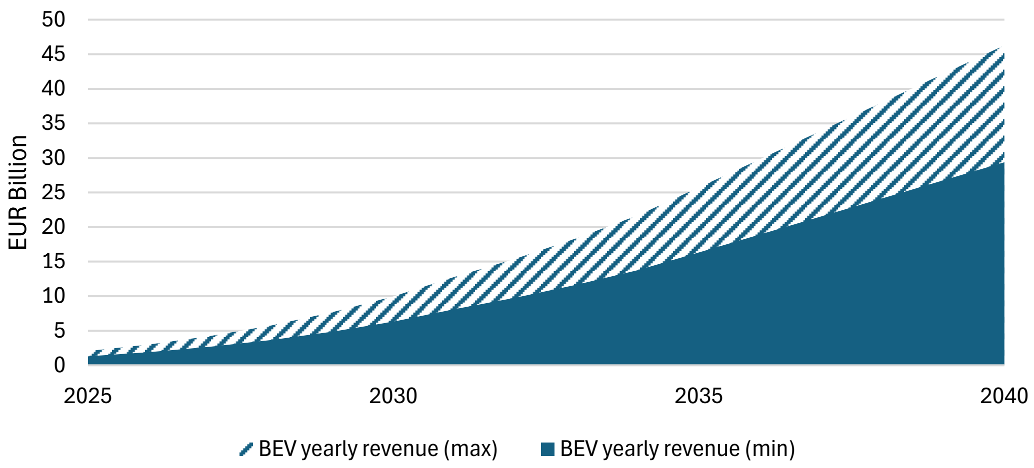
The McKinsey & Company[73] Connected Car Customer Experience (C3X) framework defines five levels of user experience in connected vehicles, ranging from basic to advanced connectivity. Basic connectivity, focused on drivers, includes functions such as tracking vehicle usage, monitoring technical status, and integrating personalised profiles with external digital platforms. Advanced connectivity introduces predictive systems, enabling real-time interactions, proactive recommendations, and a virtual assistant powered by artificial intelligence to address passenger needs.

McKinsey & Company[74] has estimated annual revenues per vehicle at EUR 124 to EUR 200 for basic connectivity, EUR 210 to EUR 333 for intermediate connectivity, and

EUR 381 to EUR 581 for advanced connectivity, by 2030. These projections assume a predominance of basic services (67 % of vehicles using connected services), followed by advanced services (19 %) and intermediate services (14 %)[ix]. According to the same study , around 95 % of new vehicles sold will be connected by 2030, increasing from around 50 % in 2021.

Figure 21 illustrates a potential scenario for the yearly revenue generated by connectivity services for BEVs in the passenger car and van segments between 2025 and 2040. Under this scenario, minimum yearly revenues are projected to start at around EUR 1.3 billion in 2025, growing to EUR 6.3 billion by 2030 and almost EUR 30 billion by 2040. Maximum revenues could range from around EUR 2 billion in 2025 to EUR 10 billion by 2030, eventually reaching EUR 46 billion by 2040.

Figure 21 Scenarios for BEV and ICEV Passenger cars and vans – Annual revenues of connected services in the EU (2025-40)




*Source:* Own elaboration based on CEPS' own estimates, McKinsey & Company (2021) and Energy Policy Simulator (2025).

Other business models that are emerging, such as shared mobility services, have seen strong growth over recent years, according to a market analysis by Fluctuo[75,x]. This also includes shared cars which have seen an increase of 25 % in fleet size from 2022 to 2023 and a plus of 39 % in rides taken. In 2023, a total of around 930 000[xi] shared vehicles were in operation in the EU-27 (+UK, Norway and Switzerland). Of those shared vehicles 6 % were cars (55 800), which translates to 0.02 % of passenger cars in the covered region[76]. These shared vehicles provided 7 % (42 million) of the number of trips taken in 2023

[ix] The percentage shares were calculated using estimates McKinsey & Company (2021) on number of vehicles per connectivity service group by 2030.

[x] Including shared bikes, scooters, mopeds and short-term rentals of cars. Excluding ride-hailing, car-pooling and long-term rental services (Fluctuo, 2024).

[xi] Fluctuo (2024) indicates a variation of +/- 10 % for the number of shared vehicles due to seasonality.

(600 million). However, Fluctuo[77] also notes that observed market dynamics characterised by several mergers and actors dropping out of the market (such as Zity in Paris), point towards profitability issues and high competition in this sector.

Meanwhile, autonomous driving, particularly on motorways, could present an opportunity for European manufacturers to tap into new revenue streams that complement revenues from connected services[78,79]. Some vehicle manufacturers, such as Mercedes Benz[80] and Tesla[81], have announced that they will offer autonomous driving systems starting in 2025. These offers could also be linked to other connected services for EV drivers. To date, these systems do not seem to be advanced enough for use in urban driving where significant profits are anticipated.

The European Commission's Industrial Action Plan for the Automotive Sector positions 'innovation and digitalisation' as a core pillar[82]. One focus area is connected and autonomous driving, with planned measures to enhance industrial capacities in software and IT hardware and establish a common architecture for these technologies. Proposed initiatives include an EU software platform, a pilot facility, and a supportive regulatory framework, such as 'regulatory sandboxes'[83].

# 2. BATTERIES

The rising adoption of EVs has historically been a strong driver of battery demand in the EU, a trend expected to accelerate further with the EV transition. To date around 50 % to 70 % of battery cells used in the EU are produced in China[84]. Meeting the anticipated surge in demand due to the EV transition under current trends, will reinforce dependency on external suppliers notably China, unless there is a significant scale-up of European production capacity. However, supply chain dependencies and related risks are not the only challenges. By importing batteries, the European automotive industry in a broad sense misses the opportunity to create significant added value in Europe.

## 2.1. EXPECTED DEMAND AND EUROPEAN VALUE ADDED

T&E[xii] estimates the financing needed to meet European battery demand for BEVs at around EUR 876 billion[xiii] between now and 2040[85]. This also includes batteries for heavy-duty vehicles. This breaks down into around 260 billion for the period 2025-30[xiv] or around 43 billion per year, EUR 372 billion for 2031-35, (74 billion per year) and EUR 247 billion for 2036-40 (EUR 49 billion per year). If battery manufacturing were to pursue a 'Made-in-Europe' strategy to meet 100 % of domestic demand through European production, T&E estimates that this would require additional initial investments of around EUR 120 billion for 2025-30.

The IEA[86] projects significantly lower investment needs. Under its Announced Pledges Scenario[xv], average annual investment for battery manufacturing and its components in the EU amount to roughly EUR 10 billion between 2025 and 2030 or EUR 60 billion in total. In the Stated Policies scenario of the IEA[xvi], yearly investments from 2025 to 2030 reach roughly EUR 8 billion, totalling around EUR 48 billion[87]. The IEA[88] [89] expects installed battery manufacturing capacity to meet domestic demand by 2030, with the potential for a production surplus enabling exports if all announced projects as of 2023

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[xii] T&E's (2024) calculation methodology estimates the investment to reach the battery production capacity aligned with net-zero emission mobility by 2050. This involves combining data from BloombergNEF on battery cost shares and vehicles prices.

[xiii] Excluding T&E's (2024) estimates for 'extra investment for strategic autonomy' which account for additional costs to reach 100 % European production, reflecting the estimated capital and operational expenditure needed to scale up current EU production capacities.

[xiv] Excluding T&E's (2024) estimates for 'extra investment for strategic autonomy'.

[xv] The IEA's (2024) Announced Pledges Scenario (APS) assumes full and timely implementation of all climate-related commitments declared by governments, including net-zero targets, Nationally Determined Contributions, and related commitments such as energy access. It also considers pledges from international fora, businesses, and non-governmental organisations, as well as announced manufacturing projects, including preliminary plans, regardless of the existence of supporting policies.

[xvi] The IEA's (2024) Stated Policies Scenario (STEPS) is based on a review of existing and announced policies. It incorporates only those policies backed by concrete implementation measures. The scenario also includes projects that have reached a certain investment stage. Targets which have not been met yet are not considered.

are realised. Notably, around 50 % of the considered announcements were from non-European companies[90]. The European Commission[91] estimates the EU will need to mobilise EUR 36 billion in manufacturing capacity investments in batteries between 2023 and 2030, merely to maintain its share of battery production in meeting domestic demand in 2022.

The variation across estimates reflects not only underlying uncertainty but also differences in modelling assumptions, data sources, and demand projections. For example, the IEA[92] foresees battery demand for approximately 10 million EVs in 2035, while T&E[93] projects demand for over 13 million EVs in LDVs alone.

### *European value added*

Part of the economic relevance of the automotive sector is derived from the upstream and downstream linkages, generating demand and employment across industries[94]. In the context of the EV transition, this includes batteries. However, manufacturing processes and supply chains differ between BEVs and ICEVs. As the IMF outlines, the most important components of BEVs include batteries, wiring, and electric motors, while ICEVs require combustion engines, fuel systems, and exhaust parts[95]. Further, some studies suggest that less manual labour is required for BEVs, compared to ICEVs[96].

For 2023, McKinsey & Company[97] estimate that European value added accounts for 70-75 % of the manufacturer's suggested retail price for BEVs, compared to 85-90 % for ICEVs. This is attributed particularly to a lower European share in value added for batteries of BEVs. The European value added falls even further to 50-60 % for BEVs manufactured in Europe by foreign firms, and to around 20 % for fully imported BEVs. These findings are somewhat complemented by a study by Frieske et al.[98] which compares the origin of drivetrain components in Volkswagen's combustion engine and electric models, the Golf 8 and ID.3. The analysis shows that the ICE model, Golf 8, is made up of around 76 % components sourced from the EU and 13 % from Asia. Conversely, 36 % of the BEV model, ID.3, are sourced from the EU and around 33 % from Asia.

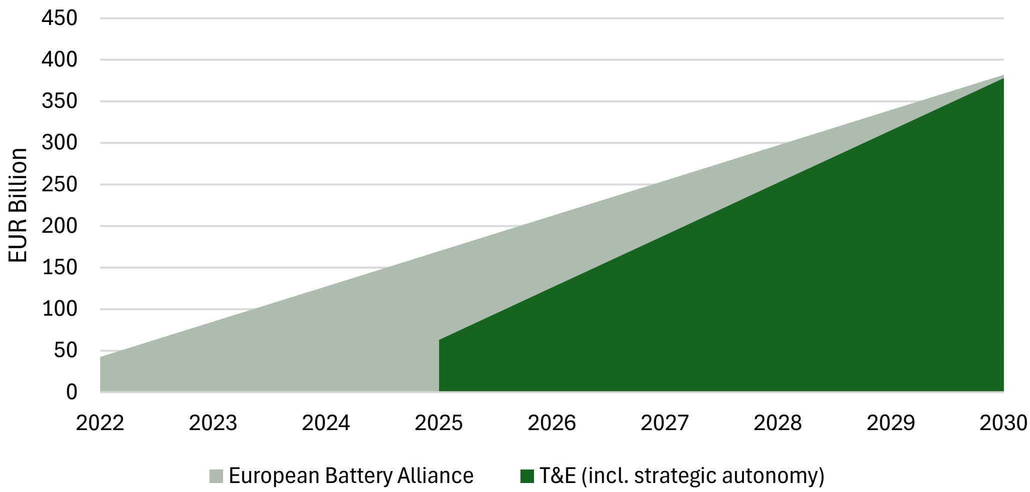
### *What does scale-up of EU battery production mean?*

To enhance European value added, McKinsey & Company[99] suggest scaling up European battery production as well as increasing the regional capacity to source and refine battery raw materials, including recycled material.

T&E[100] explore the case for increasing European battery production to meet 100 % of local demand and estimate additional financing needs following 'a "Made-in-Europe" strategy'. Extra investment would amount to EUR 120 billion by 2030, in addition to the estimated EUR 260 billion for meeting battery demand of EVs in the period 2025-30. This translates to around EUR 20 billion of additional financing needs for 2025-30, and thus total investment requirements amounting to EUR 378 billion by 2030. This would increase overall financing needs for battery production in the EU in line with projected EV demand to EUR 997 billion by 2040.

In comparison, the European Battery Alliance[101] estimates that EUR 382 billion in additional investments will be required by 2030 to establish 'a self-sufficient battery industry' in the EU, with annual investments averaging around EUR 42 billion between 2022 and 2030. Despite covering different time horizons, these estimates correspond to T&E's estimate including the provisions for 'strategic autonomy' (Figure 22). By contrast, estimates from the European Commission[102] appear significantly lower, projecting cumulative investment needs of EUR 77 billion between 2023 and 2030 to achieve full self-sufficiency. Again, differences in estimates are likely driven by several factors, such as data and methodological differences.

Figure 22 Scenarios for scaling up European battery production to meet 100 % of demand – Cumulative financing needs in the EU (2022-30)




*Note*: T&E's[103] estimates for 'extra investment for strategic autonomy' which account for additional costs to reach 100 % European production, reflecting the estimated capital and operational expenditure needed to scale up current production capacities. This is understood to correspond to the estimates by the European Battery Alliance[104] to establish 'a self-sufficient battery industry'.

*Source:* Own elaboration based on EC (2022) and T&E (2024).

The European Commission has announced a strong commitment to expanding domestic battery manufacturing. This includes targeted support to help the industry achieve the 'near-term cost competitiveness of domestically produced cells and components', as outlined in the 'battery booster package' of the new Automotive Action Plan[105].

However, more than half of the announced investments to build or enhance battery production by 2030 are considered to be at risk of being cancelled or delayed[106] and the bankruptcy of Northvolt dampens hopes for the rapid scaling of EU homegrown clean tech manufacturing. In addition, a comparison of capital costs for building battery gigafactories across regions shows that Europe is currently at a significant disadvantage, with costs of around EUR 100 million / GWh (EUR 150 million / GWh if considering also cathode and anode production), compared to EUR 68 million/ GWh in China[107].

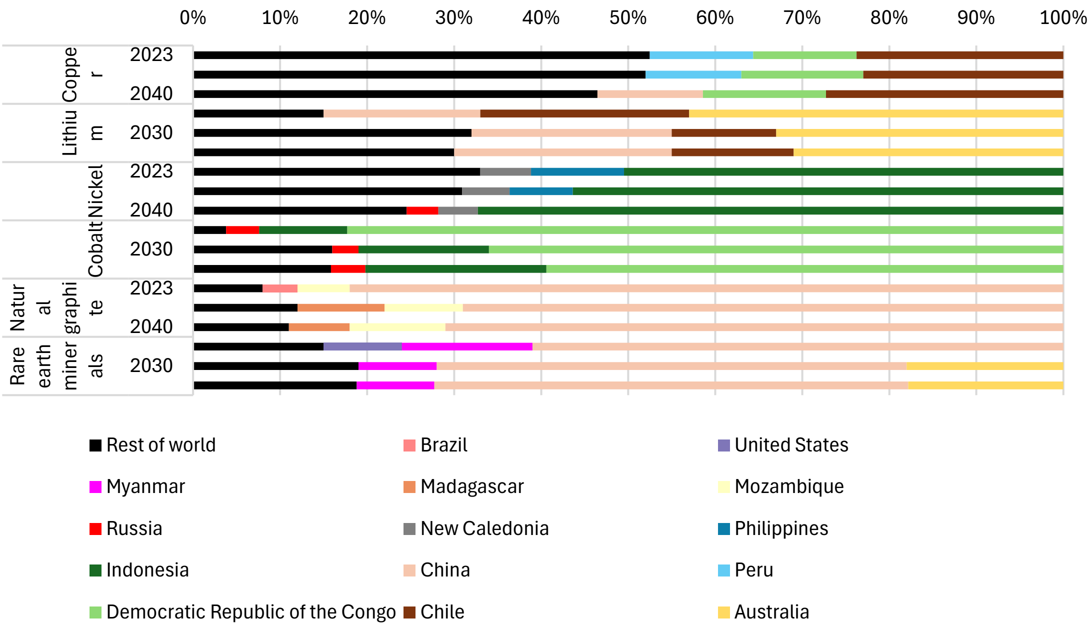
The existing cost differentials and the experiences from the Northvolt case raise the question of whether in the short term, a cost-effective acceleration of the EV transition is possible without a degree of Asian clean tech in European BEV production processes.

## 2.2. SUPPLY CHAIN RISKS AND MITIGATION MEASURES

Even if European battery production scales up successfully, supply chain risks related to CRM dependencies will persist due to the dominance of a few countries, notably China, in key stages such as mining and refining. A dominance which is projected to remain for various CRMs according to the IEA[108] (Figures 23 and 24).

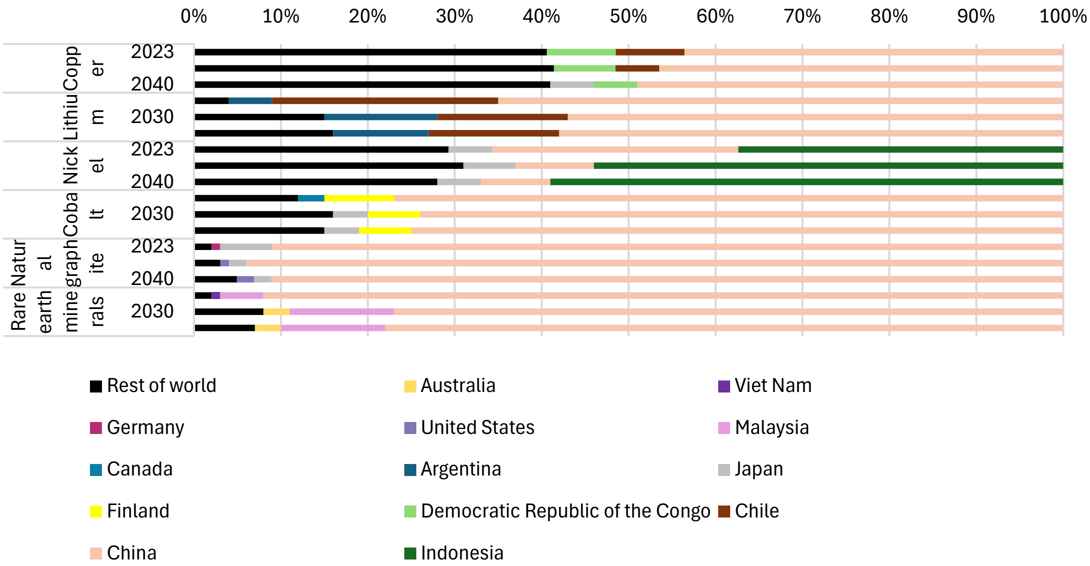
Addressing supply chain risks, particularly with the objective to meet European demand in the future, will require a combination of different strategies to both reduce / shift demand in CRMs while diversifying supply chains.

Figure 23 Scenarios for geographical distribution of mined or raw material production for key energy transition minerals (2023-40)




*Source:* Own elaboration based on IEA (2024).

Figure 24 Scenarios for geographical distribution of refined material production for key energy transition minerals (2023-40)




*Source:* Own elaboration based on IEA (2024).

## *Re-use and recycling*

Enhancing recycling of CRMs can contribute to mitigating supply chain dependencies and related risks by lowering demand for primary materials. While re-use can reduce total material demand, recycling shifts material demand to secondary materials[109].

Analysis suggests that in an optimistic scenario, recycling of lithium, nickel, cobalt, aluminium and copper in the EU could supply materials of up to one quarter of the demand for EV lithium-ion batteries by 2030. By 2040, the shares could increase to almost 60 %, again in the best case (e.g. Rizos and Righetti[110]). To date, however, CRM supply for recycling chains is 'currently either very low or virtually non-existent'[111]. The main barriers to the development of recycling markets, are economic viability, fragmented supply chains, regulatory challenges, technological limitations and a lack of transparency on material flows.

The EU has made significant strides in recycling batteries and permanent magnets made from rare earth materials. To make recycling an effective solution for addressing supply chain dependencies, the supply and demand for recycled materials must be better aligned. Given the expected lifetime of CRM-dependent technologies, such as EVs, wind turbines and solar panels ranging between 10-12 years for EVs to up to 40 years for solar panels, a mismatch between recycled CRM supply and demand is likely to persist until the 2030s[112,113].

### *New battery technology*

Another strategy to address dependencies is to develop new battery technologies which require fewer and/or different materials. According to scenarios by the IEA[114], where lithium iron phosphate chemistries and sodium-ion batteries are adopted more rapidly on a global scale, the demand for minerals used in EV batteries could decrease by approximately 13 % by 2030 and 18 % by 2050, compared to the baseline projections.

When it comes to financing, the European Commission estimates that meeting around a quarter of EU demand for battery raw materials, such as lithium and cobalt, through domestic sourcing would require investments of approximately EUR 7 billion by 2030 and some EUR 13 billion by 2040. Of this, public funding is expected to require almost EUR 3 billion and almost EUR 5 billion, respectively[115]. To meet 100 % of domestic demand, around EUR 28 billion would be needed by 2030 and EUR 52 billion by 2040[116].

## 2.3. BATTERY INNOVATION

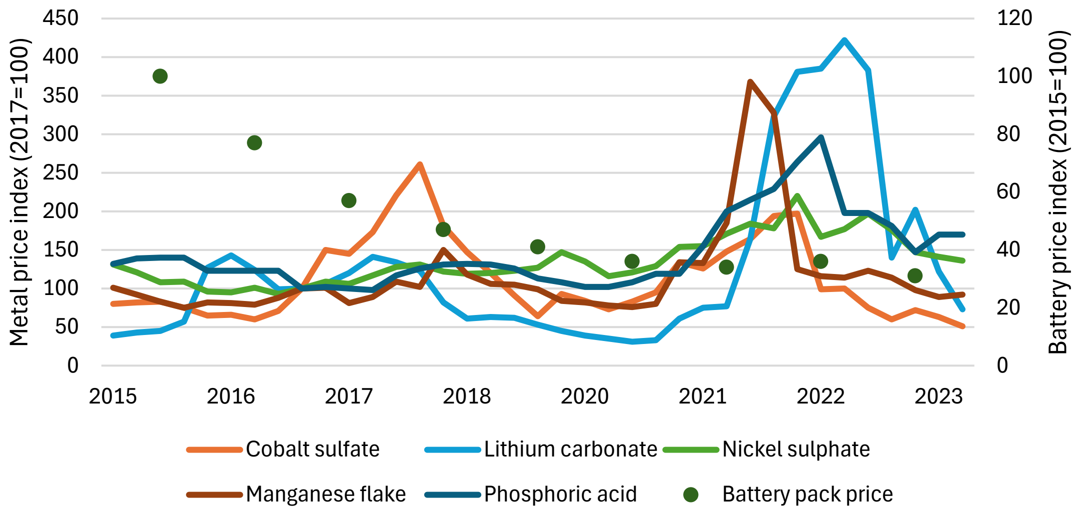
Materials account for the largest share in battery production costs (55 %), with energy contributing an additional 15 %[117]. These costs are driven by the reliance on CRMs and energy-intensive manufacturing processes. Prices for CRMs have been volatile in the past – with impacts on battery prices (Figure 25). Innovation in these fields could reduce costs and help to address supply chain risks.

### *Battery chemistries*

Potential for adjusting chemistries for EV batteries exists. Lithium iron phosphate (LFP) batteries, for example, could offer a more affordable alternative, costing up to 30 % less than high-nickel lithium nickel manganese cobalt oxide (NMC) batteries. However, according to the IEA[118], European producers currently lack extensive experience with LFP chemistries. The lower profit margins associated with these batteries may deter rapid adoption. To date, the EU is lagging behind in new battery chemistries[119].

Another strategy brought forward by the IEA[120] involves optimising NMC batteries by increasing their manganese content, thereby reducing nickel dependency and increasing energy density. Estimates suggest that this adjustment could lower costs by up to 10 %, with industrial production planned in the near future[121,122].

Figure 25 Price of selected battery materials and lithium-ion batteries (2015-23)




*Source:* Own elaboration based on IEA (2024).

### *Manufacturing processes*

Manufacturing innovation presents an opportunity to lower energy costs in battery production. Energy expenses for cell manufacturing can account for up to 40 % of total energy costs in battery production[123]; Energy-intensive steps include drying electrode materials (28 % of energy demand), maintaining dry room conditions (25 %), and formation processes to ensure battery performance (23 %). Advancements such as dry coating, near-infrared drying, optimised dry room designs, accelerated formation cycles, and improved temperature regulation could contribute to bringing down energy demand and related costs.

The European Commission's Automotive Industry Action Plan[124] identifies 'competitiveness and supply chain resilience' as a central priority. To this end, the EU aims to scale up battery manufacturing through demand and supply-side measures. These measures include direct support for battery producers, State aid, non-price criteria in procurement, and European content requirements. It also proposes steps to secure CRM supply chains and boost domestic recycling capacity.

However, the key question is whether the proposed measures will be enough to balance the potential trade-offs between costs, supply chain resilience, and the value added to Europe, especially in the short term.

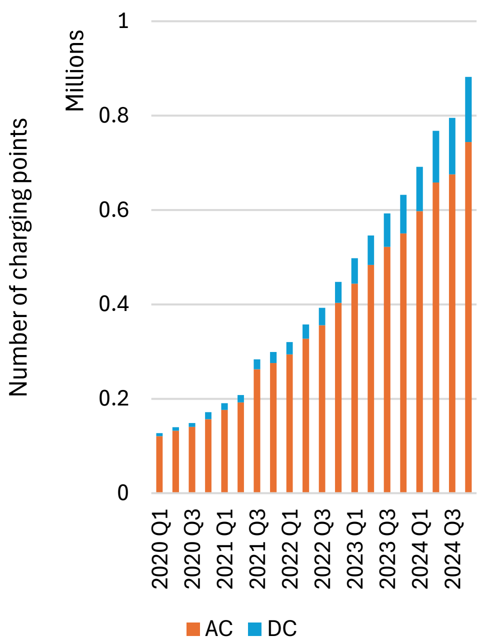
# 3. CHARGING INFRASTRUCTURE

The pace of charging infrastructure roll-out has largely kept up with the growth of EVs in the EU, but questions remain as to whether existing targets are ambitious enough to match future needs. Beyond national-level statistics, disparities between rural and urban areas, and between fast and slow chargers, risk reinforcing uneven access and slowing adoption in certain regions. At the same time, the expansion of charging infrastructure increasingly depends on the readiness of electricity grids, with varying investment needs across Member States due to differences in grid capacity, urbanisation, and projected EV uptake.

## 3.1. DEPLOYMENT OF CHARGING INFRASTRUCTURE AND EV ADOPTION

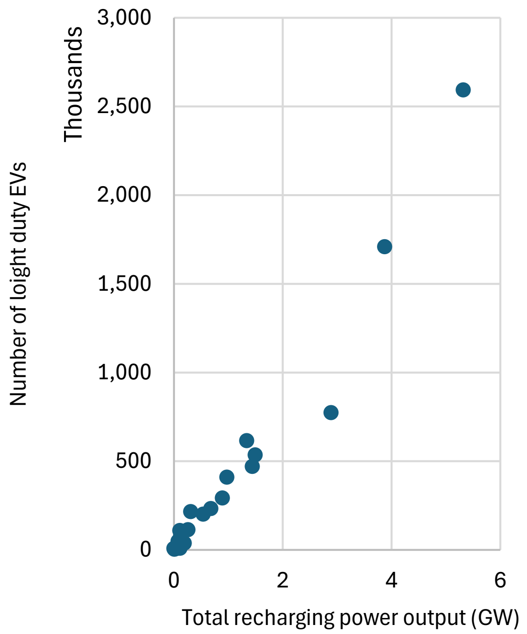
The EU has witnessed continuous growth in publicly available charging infrastructure to around almost 900 000 chargers by the end of 2024 of which 84 % were 'slow' chargers (i.e. alternating current (AC)), and 16 % the comparably faster direct current (DC) chargers (Figure 26). The growth accompanied the uptake of EVs across the EU, evidenced by a positive correlation between recharging capacity and the number of electric cars (Figure 27).

Figure 26 Total number of recharging points in the EU, according to the AFIR classification (2020-24)




*Source:* Own elaboration based on EAFO (2024).

Figure 27 Light duty EV fleet and total recharging power output in EU Member States (Q1 2024)




*Source:* Own elaboration based on EAFO (2024).

One benchmark to evaluate the adequacy of the existing charging infrastructure in relation to EV uptake is the fleet-based target set in the Alternative Fuel Infrastructure Regulation (AFIR) (Box 4). As T&E[125] analysed, the fleet-based targets have already largely been met by EU Member States ahead of schedule. By 2023, nearly all Member States had pre-emptively fulfilled the charging infrastructure targets set by the regulation. According to the European Alternative Fuels Observatory (EAFO)[126]data tracker, only Malta and Ireland had not reached the AFIR targets as of February 2025. The indicator target achievement however may be misleading. It could signal effective policy as well as a weak target.

Questions remain as to whether AFIR's minimum targets are sufficient to support the expected pace of EV deployment. Transport & Mobility Leuven[127] highlights significant discrepancies between the European Commission's demand projections and other studies. For instance, a McKinsey & Company[128] study for ACEA estimates a need for 6.8 million public charging points by 2030. A new report by ACEA[129] adjusts the projected needs to 8.8 million chargers. Both estimates are substantially higher than the European Commission's 3.5 million [130]. Further concerns include the fact that AFIR targets are set at the national level, potentially overlooking important sub-regional disparities (e.g. rural vs urban) and differences in charger types (e.g. slow vs fast charging). This may be particularly relevant as notable (sub-)regional differences in the deployment of EV charging infrastructure exist (Box 5).

#### Box 4 Alternative Fuel Infrastructure Regulation

The AFIR, which came into force in April 2024, sets binding targets for the deployment of recharging and refuelling infrastructure for alternative fuels in the EU for the time period 2025 to 2030.

AFIR[131] establishes, among others, two key requirements that affect the charging infrastructure for LDVs:

First, mandating the deployment of fast-charging points for cars and vans at least every 60 kilometres along highways and roads by 2030. With intermediate targets i) to cover the major transport routes, which constitute the core network of the Trans-European Transport Network (TEN-T), by 2025, and ii) and at least 50 % of the comprehensive TEN-T road network by 2027.

Second, AFIR[132] introduces a dynamic fleet-based target, requiring each Member State to scale its public charging infrastructure in proportion to the number of registered EVs. According to EAFO[133], these requirements translate into a minimum of 1.3 kW available power output of publicly available charging points per registered BEV in the Member State. For PHEVs, the corresponding benchmark is 0.8 kW per registered vehicle. The total required available charging output is calculated as the sum of these figures.

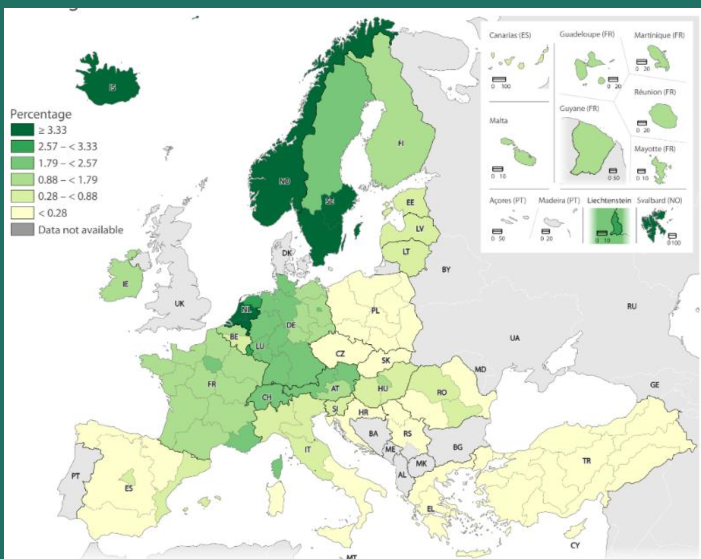
Notably, these requirements can be adjusted once (BEVs) make up 15 % of the total number of LDVs in the respective Member State.

The criticism that the AFIR fleet-based targets are too low or inadequate is partly supported by surveys indicating that the current state of charging infrastructure remains a significant barrier for potential buyers considering the purchase of EVs. Although other surveys indicate that this view is changing, the perception of insufficient charging infrastructure seems to continue playing a role in purchase decisions[134,135].

**Box 5 (Sub-)regional disparities in EV adoption**

In Europe, Norway, Sweden, Iceland, and the Netherlands lead with the highest shares of EVs, each exceeding 3 % of the passenger car fleet (Figure 28). Other parts of Western and Central Europe, including regions in Germany, France, Belgium, Switzerland, and Austria, show moderate adoption, ranging between 0.88 % and 3.33 %. In Southern and Eastern Europe, EV shares are lower, with most regions in Spain, Italy, Poland, and the Balkans below 0.88 %. Several areas, particularly in Eastern Europe and parts of the Balkans, have a low share of EVs in their total fleet.

Figure 28 Share of EVs in passenger car fleet by category and regions (2022)

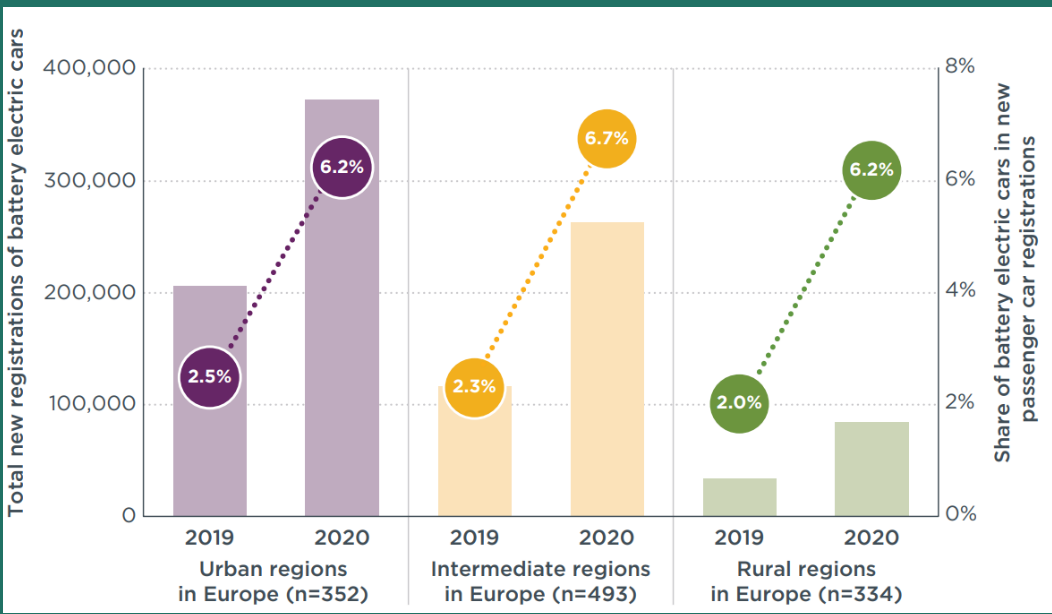



*Source:* EAFO (2024).

On a more granular level, the International Council on Clean Transportation (ICCT) finds that the electric passenger car market expanded consistently across a sample of urban, intermediate, and rural regions in the EU, with BEV registrations doubling in urban areas compared to 2019[136]. While total new registrations were highest in urban and intermediate regions, rural areas saw lower numbers which is attributed to lower population sizes (Figure 29).

According to the study, market shares were relatively balanced across regional types, with BEVs representing 6.2 % of new registrations in urban and rural regions and 6.7 % in intermediate areas. However, differences within the regional typologies exist, with intermediate regions having the highest proportion of areas with BEV adoption levels above the European average (45 %), followed by rural (42 %) and urban (38 %) regions.

Figure 29 Number of registrations and average market share of BEV passenger cars in Europe (2019-20)




Source: ICCT (2022).

Charging infrastructure needs vary significantly by regional type due to differences in user profiles[137]. In rural areas, EV drivers usually have to cover longer distances, and tend to rely on personal passenger cars due to lower levels of public transport. In addition, there is a higher prevalence of one-or two-family homes in rural areas, thus access to private charging stations is more common than in urban areas[138].

However, rural areas are not homogenous. According to ICCT[139], the share of inhabitants with potential access to home charging in examined rural EU regions ranged from 49 %

to 90 % in 2020. As the study uses the share of the population living in one- or two-family homes as proxy for access to home charging, the figures are driven by variations in housing across the regions. ACEA[140] finds similar figures with 83 % of EV owners in rural areas estimated to be able to charge at home in 2021.

Thus, despite a larger availability of private charging, the ICCT[141] argues that complementary public fast-charging infrastructure remains essential to support EV adoption. To support this finding, the ICCT points to several rural regions in the EU that lead in EV adoption, noting their well-developed public fast-charging networks as a key factor.

In (sub-)urban areas, the use cases and therefore charging needs differ due to shorter distances, more public transport and limited possibilities of EV drivers to install private charging stations, increasing the need for public charging stations. According to ACEA[142], 58 % of EV drivers in cities, and 76 % in towns could potentially install home chargers in 2021.

In theory, the economics of publicly available charging infrastructure should play in favour of accompanying the roll-out of charging points in urban areas due to a clear demand for it with rising EV adoption. However, the business case is less attractive in rural areas due to the potentially higher access to home chargers[143]. This could lead to a lack of publicly available charging infrastructure in rural areas in the future – although here the needs are more for fast chargers than slow chargers as the latter are more likely to be covered by private chargers in homes. Theoretically, home chargers could be made available publicly, if the enabling conditions are in place.

## 3.2. FINANCING NEEDS

### *Charging infrastructure*

Available estimates for financing needs to expand EV charging infrastructure vary depending on the methodology and timeframes considered.

For private and public charging infrastructure of passenger cars and commercial vehicles, ACEA[144] projects cumulative investment needs of EUR 73 billion by 2025 and EUR 172 billion by 2030, corresponding to average annual requirements of almost EUR 20 billion for 2025-30.

In comparison, T&E[145] estimates financing needs for charging infrastructure of LDVs and HDVs to be roughly EUR 98 billion for 2025-30, EUR 172 billion for 2031-35, and EUR 230 billion for 2036-40. Total investment requirements amount to some EUR 500 billion by 2040. Annual financing needs rise from around EUR 16 billion (2025-

30) to roughly EUR 35 billion (2031-35) and peak at EUR 46 billion (2036-40). Of the approximately EUR 500 billion required by 2040, around EUR 300 billion are estimated for light vehicle charging infrastructure in Europe. According to T&E, public charging networks for LDVs will require at least some EUR 16 billion by 2030, with an estimated EUR 69 billion allocated to private chargers, bringing the overall investment to EUR 85 billion within the next decade. The estimated investment split between public and private charging infrastructure by 2030 is thus approximately 19 % for public charging and 81 % for private charging.

The European Commission[146] estimates average annual investment needs of EUR 15 billion for 2031-50, peaking at EUR 20 billion annually between 2036 and 2040.

#### *Electricity grid*

The roll-out of charging infrastructure requires updates to some electricity grids, varying by region due to differences in grid readiness, EV uptake, and residential charging needs. ACEA[147] estimates average investments in distribution grids at around EUR 900 per EV across Europe, totalling EUR 41 billion for 2021-30. The need for distribution and transmission grids cannot be clearly separated. As noted by T&E[148], the European Commission's[149] 2023 Grids Action Plan estimates a total investment need of EUR 584 billion for electricity grids by 2030, which translates to an average annual investment of approximately EUR 83.4 billion for 2024-2030. According to Ember[150] annual investment in transmission grids amounted to EUR 28 billion and for distribution grids EUR 35 billion, totalling around EUR 63 billion.

Notably, there are country-level differences for estimated investments in distribution grids from 2021 to 2030 by ACEA[151] due to differences in grid readiness, urbanisation, and projected EV adoption rates. Ireland leads with the highest investment per EV due to its dispersed rural charging needs, followed by Italy, where an estimated 30 % share of households will require additional grid capacity. For countries like Germany and Sweden, ACEA[152] projects lower investments, as their urban and existing grid capacity can integrate most charging points.

## 3.3. CHARGING PRICES AND MODES

#### *Charging prices*

According to EAFO[153], the pricing structure for recharging EVs differs significantly from refuelling ICEVs. Unlike ICEV drivers, who usually only have the single option to pay the indicated price at fuel stations, EV users can choose, albeit depending on individual circumstances, between private charging (at home or work) and public charging infrastructure, leading to greater price variability and competition – but also more complexity for consumers. Costs depend on factors such as the type of charging connector and power level. Generally, home charging remains the most cost-effective option, while high-power fast charging is the most expensive. Usually, EV users rely on a combination of home and public charging solutions.

As described by EAFO[154], the price of charging at home or work is influenced by factors such as electricity prices, taxes, levies, and network charges, which vary by country or region. In many EU Member States, variable electricity and network pricing has become increasingly common as a strategy to manage demand peaks and prevent grid congestion, making off-peak charging, such as overnight, more cost-effective. Workplace charging costs also vary, as some companies provide free charging for employees, while others impose a fee.

### *Private charging prices*

According to EAFO (2024), at-home and workplace charging prices[xvii] for EVs within the EU-27 at the beginning of 2023 varied significantly, ranging from EUR 0.11 to EUR 0.48 per kWh. Western and northern European countries generally exhibit higher charging costs compared to Southern and Eastern Europe. For instance, countries such as the Netherlands and Germany report higher average prices, while eastern European countries, including Bulgaria and Hungary, display lower rates (Figure 30).

Charging prices play an important role in EV adoption as they strongly influence the total cost of ownership (TCO)[xviii] of an EV, adding a barrier to consumer adoption, alongside upfront costs and value depreciation[155]. Although some BEVs already outperform ICEVs in TCO, particularly with higher usage ICEVs remain more cost-effective in lower price segments and for less frequent drivers.

### *Smart and bidirectional charging*

The European Commission views smart and bidirectional charging as an opportunity to lower fuel costs for EV drivers while easing grid pressure and improving EV integration into the electricity system. Due to this, the Automotive Action Plan[156], proposes a 'conducive framework' at the Member State level and aims to facilitate the exchange of best practices and the establishment of 'regulatory sandboxes'. Another potential measure that could directly impact charging prices for consumers is the European Commission's suggestion for Member States to 'create a business case for bidirectional charging' through 'appropriate taxation of electricity'[157]. In addition, measures are

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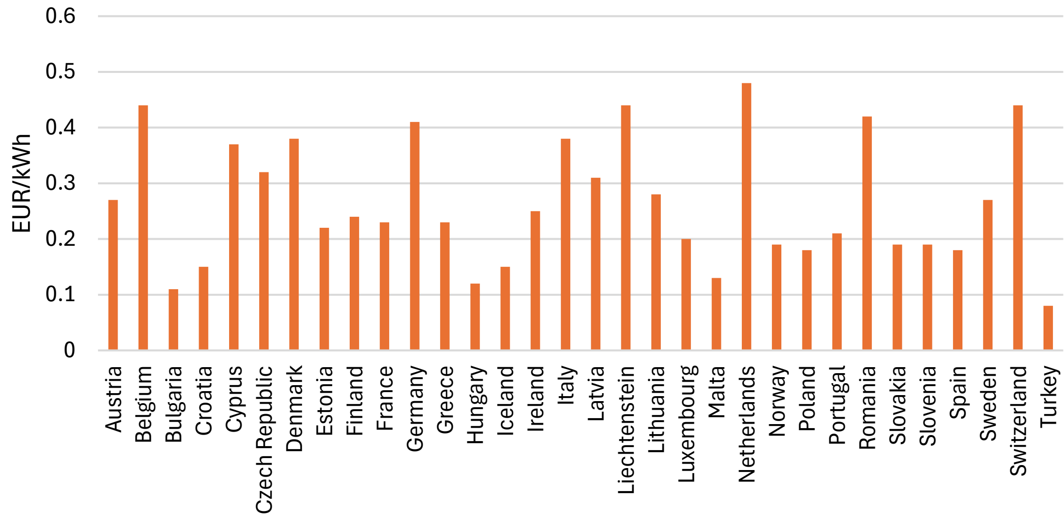
[xvii] Reflecting the average electricity prices for household consumption, including taxes, levies and network charges (EAFO, 2024).

[xviii] According to Agora Verkehrswende (2022), the TCO can be defined as 'all costs that accrue from initial purchase to resale, including depreciation, fuel costs, taxes, insurance, and repair and maintenance'.

foreseen to build on existing regulations to enhance transparency on public charging prices for consumers as part of the AFIR review in 2026[158].

Figure 30 Charging prices at home and at work across countries (2023)




*Source:* Own elaboration based on EAFO (2025).

## 3.4. REGULATORY FRAMEWORK

The deployment of EV charging infrastructure in the EU faces challenges related to permitting and grid connection procedures, as highlighted by a survey conducted in 2021 by the Sustainable Transport Forum's Public Authorities subgroup[159]. The survey revealed that fragmented and cumbersome permitting processes, inconsistent local regulations, and a lack of administrative resources and technical expertise create delays and increase costs for recharging infrastructure projects. When it comes to distribution, grids, main challenges included insufficient grid capacity, a lack of prioritisation and transparency from distribution system operators (DSOs), and unclear procedures, further complicating infrastructure roll-out.

The principal bottlenecks identified by survey participants[160] highlighted the absence of standardised procedures and timelines, unpredictable costs due to varied local authority fees and grid connection charges, and insufficient collaboration between public authorities and DSOs. These issues, compounded by a lack of integrated planning between authorities, charging point operators, and grid operators, risk undermining the EU's ability to meet AFIR targets for EV infrastructure deployment.

Private charging, presents regulatory barriers particularly for apartment tenants primarily due to the need for approval by property owners. Additionally they face other barriers such as high installation costs and structural limitations of residential buildings[161]. The initial provisions mandate that charging infrastructure be installed in newly constructed homes and those undergoing substantial upgrades as outlined in the Energy Performance of Buildings Directive which came into force in May 2024. The Energy Performance of Buildings Directive excludes most existing buildings. Given renovation rates of around 1 %, obligations under the Directive will take time to materialise[162].

# 4. EMPLOYMENT AND SKILLS

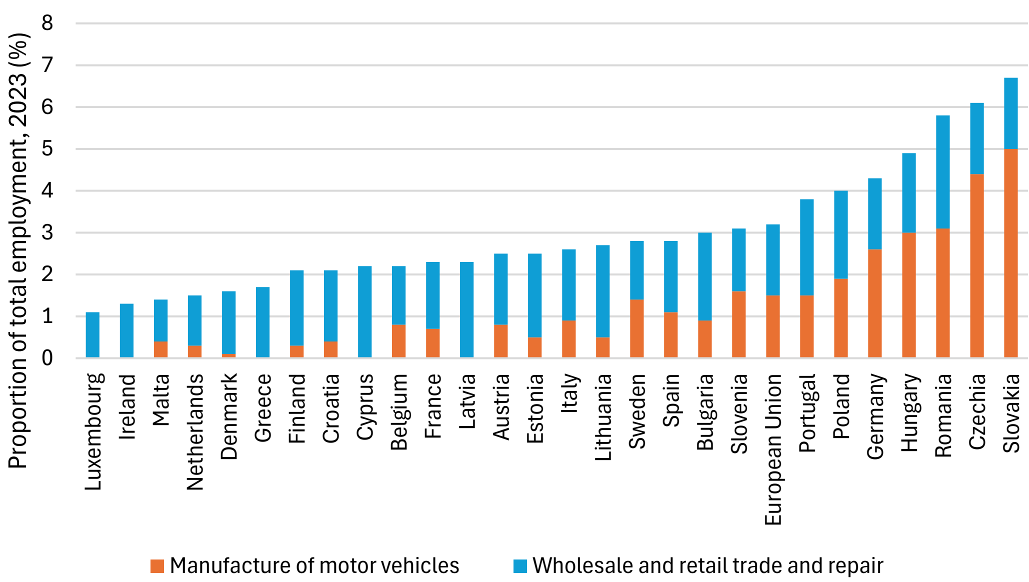
The automotive industry is a major employer across the EU, though its importance to regional labour markets varies. Employment patterns have gradually shifted from Western to Eastern Europe, shaped by trends such as digitalisation and automation. As the transition to electric vehicles accelerates, job profiles and skill requirements are evolving. While new opportunities are emerging, particularly in areas like battery and software development, regions dependent on traditional supply chains face growing adjustment pressures.

## 4.1. REGIONAL EMPLOYMENT DISTRIBUTION AND TRENDS

The broad automotive industry provides employment to approximately 14 million people in the EU, according to the Draghi report[163]. Employment in the core automotive industry is estimated at around 6.7 million, of which 3.1 million jobs are in motor vehicle manufacturing, and 3.6 million in sales and repairs[164].

However, the regional relevance of these jobs for total employment varies across the EU. Focusing on motor vehicle manufacturing and sales and repairs, shares in total employment range between 6.7 % in Slovakia to 1.1 % in Luxembourg (Figure 31). The share of motor vehicle manufacturing in total employment ranges from 5.0 % in Slovakia to just 0.1 % in Denmark, while employment in wholesale, retail trade, and repair varies from 2.7 % in Romania to 1.0 % in Malta.

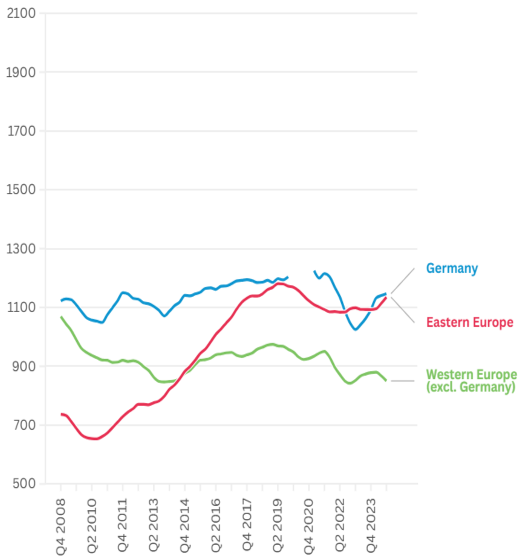
Figure 31 Employment in automative sector by country (2023)




*Source*: Own elaboration based on Eurofound (2025).

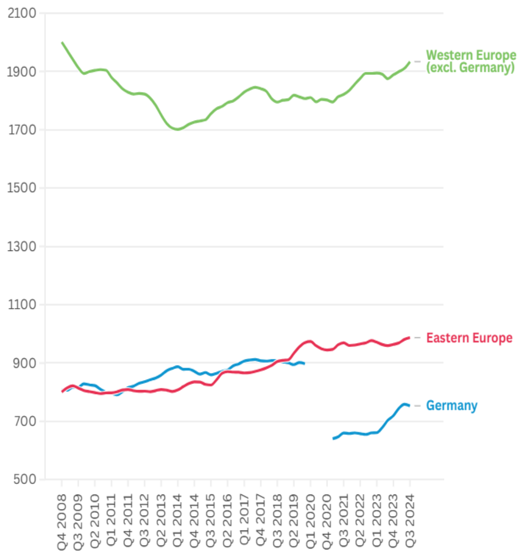
Existing regional disparities have been shaped by diverging employment trends in the automotive sector over time. Eurofound[165] data show that while employment in car manufacturing has gradually grown in Eastern Europe, it has decreased in Western Europe since 2008, albeit with country-level differences. For instance, Germany's employment figures in automotive manufacturing have remained relatively stable compared to the rest of Western Europe, where there has been a more significant decline during the same period (Figure 32 and 33).

Figure 32 Employment trends in automotive manufacturing in thousands (2008-23)




*Source:* Eurofound (2025).

Figure 33 Employment trends in automotive sales and repairs in thousands (2008-23)




*Source:* Eurofound (2025).

## 4.2. EMPLOYMENT IMPACTS OF THE EV TRANSITION

Vehicle manufacturing is characterised by a high degree of automation. While automation and digitalisation have been a growing trend over the past decade, requiring more digital skills and reducing demand for manual labour, the key question is how the EV transition will further shape the jobs and skills required in the sector.

It is difficult to isolate employment effects of the EV transition from broader trends in the automotive sector. Studies project both positive and negative employment impacts[xix]. Early in the transition, concerns arose that EVs, being less complex than ICEVs, would reduce labour requirements. More recent studies, although confirming a negative effect on employment in powertrain production and vehicle manufacturing, have since

[xix] Such as, Bauer et al. (2018), Boston Consulting Group (2020) and European Climate Foundation (2017).

suggested that the aggregate employment effect across the entire automotive ecosystem is likely to be neutral [166]. However, market shares of local manufacturers have come under pressure as foreign competitors, for example from China, have increased their market shares in recent years significantly[167]. Although driven by competitive factors and strategic decisions by European manufacturers, these developments could lead to negative effects on employment in the EU during the EV transition.

A study by IMF[168] finds that workers in ICE supply chains and production lines have already been affected by the shift to EVs. While the expansion of EV production may generate new local employment opportunities, it may not be sufficient to fully compensate for job losses in ICE supply chains and production lines, particularly in regions heavily dependent on the automotive sector. In response to the profound transformation faced by the automotive sector, a study by the ETUI[169]finds that car manufacturers in Germany have invested strongly to adapt to the transition to EVs and the increasing relevance of digitalisation by for example stronger vertical integration in the areas of 'electric powertrain and battery (cell) production as well as in software development'. Similarly, suppliers have made significant investments to adjust to the 'dual transformation'[170]. Active labour market policies, particularly worker training programmes, can have a positive effect. Automotive workers in ICEV supply chains and production lines sectors possess transferable skills relevant for other jobs, such as manufacturing of industrial gases, electric motors, electrical equipment for vehicle[171].

# 5. FINANCING INSTRUMENTS

The financial viability and overall feasibility of scaling EV production in the EU relies on several conditions, including i) sufficient certainty regarding the future uptake of demand for EVs, needed to justify long-term investments; ii) improvements in the profitability of EVs manufacturing, including via product and process innovation and reduced input costs (energy, materials), to accelerate cost parity with ICE models; and iii) the security and availability of critical inputs, such as CRM and skilled labour, as well as the readiness and reliability of infrastructure, including electricity grids and charging networks. Provided that most of the financing required to address the investment gaps identified in previous chapters will need to come from the private sector, targeted public financing support – alongside regulatory measures – can play a role in accelerating the achievement of these conditions.

## 5.1. SUPPORTING EV UPTAKE

Levers to incentivise EV market uptake include financial incentives for EV consumers, mandating EV quotas in corporate and/or public fleets, or a combination thereof. The suitability and effectiveness of these instruments may ultimately vary depending on the market segment or vehicle type. For example, while quotas and mandates might prove highly effective for publicly procured HDVs, measures involving direct financial support (e.g. purchase or lease subsidies) may be more beneficial in market segments where uptake is hindered by relatively high upfront costs or by low profitability for manufacturers, such as compact LDVs.

In the EU, EV buyers have long benefited from financial incentives at national level. As of April 2025, ACEA reports that most EU Member States still offer forms of fiscal incentives for the acquisition or ownership of EVs. Recent years have also seen some notable cases of incentives being reduced or withdrawn, owning to budget constraints or a perceived EV market maturity. Where they remain in place, incentives tends to vary significantly, possibly limiting their overall effectiveness and preventing the emergence of a consistent price signal across the EU. As national subsidies will, in most Member States, remain important drivers for EV uptake in the years leading up to cost parity with ICE models, greater coordination and a more gradual phase-out could ensure a smoother transition.

To complement national efforts and ensure a more coherent approach, EU-level financing tools could be used to target regions with weaker incentives and less profitable market segments (i.e. compact vehicles). The Social Climate Fund (SCF), ETS2 revenues-based fund set up to address the possible social and economic impact of the introduction of ETS2 on vulnerable groups, is ideally poised to support a scheme for low-income households and micro-enterprises. The Fund is expected to mobilise at least

EUR 86.7 billion of public fundings between 2026 and 2032, 25 % of which is a mandatory national contribution (which can come from nationally allocated ETS2 revenues). It will be implemented via schemes proposed by Member States within their national Social Climate Plans, which should be submitted to the European Commission by June 2025.

Along with support for public transport modes and EV charging infrastructure, the European Commission's note on good practices for the implementation of the Social Climate Fund[172], suggests alternative schemes to incentivise the uptake of EVs. These include purchase subsidies for individuals and companies, scrappage schemes or social leasing schemes (Box 6), particularly if targeted at low-income households and small-micro-enterprises. Beyond the SCF, the remaining share of Member States' ETS2 auction revenues (about EUR 195 billion)) could also be used for the same purpose.

In the Automotive Action Plan, the European Commission[173] identified social leasing schemes as particularly promising tools to improve EV affordability in lower price EV segments. Beyond this, the Plan also emphasises the need for stronger coordination among Member States on incentive schemes, and announces future work on a toolbox of options to provide guidance to Member States. It also announces the intention to explore possible avenues for an EU-level incentive scheme, and identify suitable EU funding sources to support it.

Box 6 Social leasing schemes

Social leasing schemes consist of targeted support measures aimed at providing access to electric mobility to lower-income individuals, who would / may otherwise not have access to traditional car financing. Social leasing for EVs was pioneered in France in January 2024, though soon frozen due to oversubscription[174]. The scheme took the form of a traditional lease contract (i.e. with an option to purchase the vehicle at the end of the lease) whereby the government provided an up to EUR 13 000 subsidy to cover the initial deposit, and monthly payments ranging from EUR 70 to 150. Support was targeted at lower-income households depending on a vehicle for day-to-day activities, and eligible vehicles had to meet certain environmental criteria – de facto excluding vehicles produced in China. The scheme is set to be reintroduced in 2025, with a reduced budget of EUR 300 million (down from the EUR 650 million in 2024)[175].

T&E[176][177] recommends the adoption of social leasing schemes in the Social Climate Plans to be submitted in 2025. The schemes would largely be backed by ETS2 revenues through the SCF, as well as additional (mandatory) Member States co-financing, also from ETS2 revenues. More specifically, T&E recommends earmarking EUR 26 billion from the SCF for this initiative (about 30 % of its entire budget) which spread out until 2032 would correspond to roughly EUR 3.7 billion per year. Assuming an upfront subsidy of EUR 6 500 per vehicle - i.e. half of what was granted by the French scheme, which was likely too high considering the resulting oversubscription – this would allow support to be provided to ~570 000 ZEV leases per year, i.e. about 30 % of the current total yearly sales of the mini and small vehicles segments.

Beyond direct financial support, additional measures to accelerate the electrification of the private and public fleets will also be important levers. With around 60% of vehicles in the European car market purchased by businesses, corporate fleets represent a significant opportunity to drive EV demand. In 2022, only 10.8 % of new corporate vehicles were BEVs (compared to 14 % of private market), highlighting significant untapped potential. Incentivising larger adoption of BEVs among corporate fleets, particularly in the car leasing and short rental sectors – can help address the issue of higher upfront cost of BEVs. Additionally, since corporate vehicles typically have a shorter ownership period, electrifying this segment could accelerate the second-hand EV market, hence also improving affordability for private owners.

In a Communication on decarbonising corporate fleets published alongside the Automotive Plan, the European Commission has reported that fiscal incentives emerged as the preferred option among stakeholders to drive faster EV adoption in corporate fleets[xx]. While the contours of the upcoming legislative initiative on corporate fleets have not yet been defined, previously proposed actions also include the introduction of mandatory EV targets for corporate fleets. These targets would gradually increase over time and could be adjusted based on regional disparities in vehicles electrification rates (i.e. lower in regions with slower EV adoption)[178,179].

Public fleets can also be a driver of EV purchases – particularly for heavy-duty and special and commercial vehicles. Based on the Clean Vehicles Directive, which entered into force in 2021, Member States's public authorities have minimum procurement targets of clean vehicles[xxi] in their purchase, lease, rent and services contracts. With revision of the Directive foreseen for 2027, a revision and increase of the targets, particularly for the post-2030 period, may provide a further stronger market incentive for EV adoption.

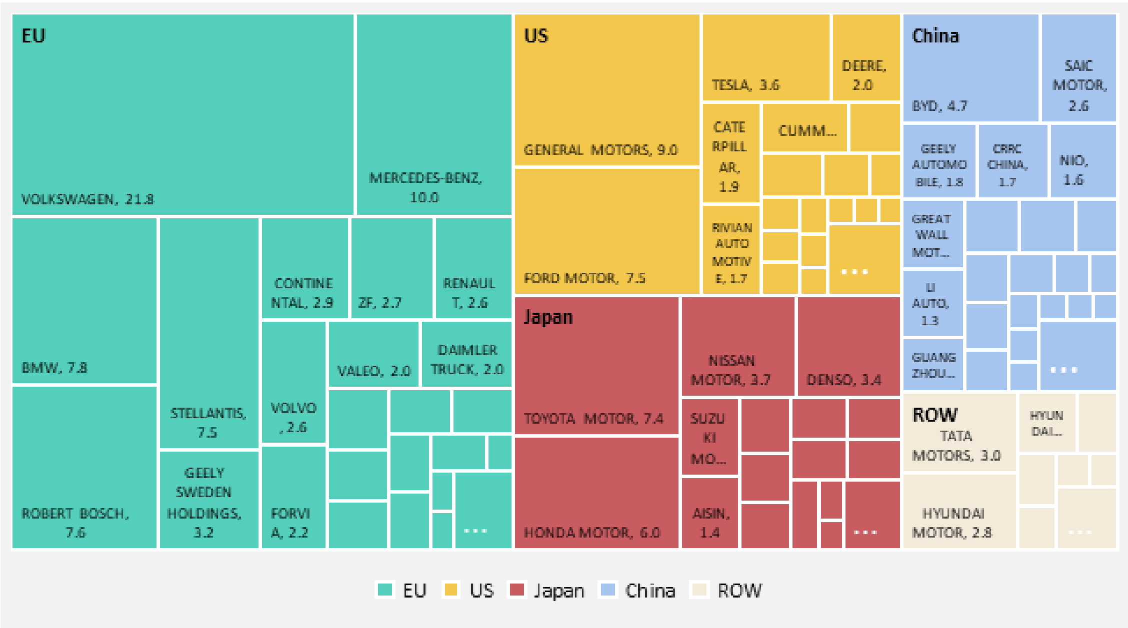
[xx] These finding were based on public consultation held from February to July 2024. On the basis of such consultation, a legislative initiative is expected to be presented by the end of 2025.

[xxi] For the definition of 'clean vehicle', please refer to Clean Vehicles Directive- European Commission.

## 5.2. RESEARCH AND INNOVATION

Global competitiveness in the automotive industry will increasingly hinge on the capacity to innovate. Investing in process or product innovation, particularly in areas linked to emerging revenue areas such as next generation batteries, software-defined vehicles, autonomous driving technologies or battery circularity is crucial if EU manufacturers are to reduce production costs and regain competitive margins globally. Most of these investments will need to come from the private sector. In the EU, automakers and automotive suppliers are already leading in R&I spending, accounting for 34 % of total EU business R&I investments. European automakers also stand out compared to non-EU peers, carrying out 61 % of global automotive R&I investments[180] (Figure 34).

Figure 34 World top 2000 R&I investors, automobiles and parts in EUR billion (2023)




*Source*: EU Industrial R&I Investment Scoreboard (World 2000) (2024).

Despite this leadership, the EU share of global R&I spending in the automotive sector has been decreasing in recent years, partly due to the rapid growth of R&I investments by non-EU producers – most notably China[181]. Moreover, EU automakers have largely focused their R&I efforts on incremental, 'mid-tech' innovations of incumbent (mainly ICE-related) technologies, rather than on breakthrough innovations linked, for example, to electrification, where other global regions have instead made significant strides[182]. This trend has contributed to a loss of competitiveness for EU manufacturers, particularly in fast-growing segments like EV.

In this context, the EU's R&I&I Framework Programme can play an important role in complementing and catalysing private investments in innovation, particularly in high-potential areas where high-risk might deter market-led efforts. With an overall budget of EUR 95.5 billion the current Framework Programme, Horizon Europe (2021-27) supports R&I activities in virtually all areas relevant to the automotive value chain, from innovative electric powertrains through to new-generation batteries and automated mobility, in most cases with direct involvement of European automakers[xxii]. According to the Automotive Action Plan[183], the Horizon Europe Programme is set mobilise EUR 1 billion of joint private and private investments for automotive-related R&I between 2025 and 2027.

Horizon Europe supports R&I projects through competitive calls for proposals evaluated based on excellence, impact, and implementation quality, across three 'Pillars'[xxiii]. Within Pillar II, which accounts for the largest share (64%) of its budget, an important emerging instrument is that of European Partnerships. These platforms are meant to share governance with, and pool resources from, the private sector to better align funded projects towards industrial needs, thereby providing a significant degree of financial leverage.

Several ongoing partnerships are directly or indirectly relevant to innovations in the automotive sector, most of them under Cluster 5: Climate, Energy and Mobility, which has an overall budget of EUR 15 billion (half of which is allocated to partnerships). These include:

- BATT4EU is a partnership between the European Commission and the Batteries for Europe Association (BEPA), where the latter gathers stakeholders from European battery-related industries industry, as well as academia and others. It has an overall budget of EUR 1.85 billion, equally shared between EU (Horizon Europe budget) and private partners' commitments.
- The partnership between the European Partnership on Connected, Cooperative, and Automated Mobility (CCAM) Association and the European Commission – CCAM Partnership, which focuses on accelerating CCAM technology development, including Automated Driving Systems (ADAs). It has an overall budget of EUR 1 billion, half of which is contributed by the European Commission.
- The Zero Emission Road Transport (2Zero) Partnership, which aims to 'accelerate the development of zero tailpipe-emission road transport', including by

[xxii] EUCAR, the European Council for Automotive R&I, reports its members are currently involved in 18 collaborative projects co-funded by the EU's Horizon Europe Framework Programme, with an overall cumulative budget of EUR 413.4 million (EUR 257.3 million of which of actual EU funding) (EUCAR, 2024).

[xxiii] Pillar I (Excellent Science), supports frontier research and researcher mobility; Pillar II (Global Challenges and European Industrial Competitiveness), funds collaborative research addressing societal challenges and industrial innovation; Pillar III (Innovative Europe), focuses on scaling up breakthrough innovations and supporting SMEs.

developing innovative EV and charging technologies. It has an overall budget of EUR 1.23 billion, with EUR 615 million mobilised by the European Commission.

Beyond these, several other European Partnerships, while not directly focused on the automotive sector, are relevant due to their cross-cutting technological contributions. These include partnerships under Cluster 4 – Digital, Industry and Space, such as the Chips Joint Undertaking[xxiv], which supports the development of advanced, EU-made semiconductor technologies and systems that are critical for future mobility applications. Additionally, this includes partnerships in the areas of raw materials and process industries – such as the European Partnership for Clean Steel – Low Carbon Steelmaking, the upcoming European Partnership on Innovative Materials for the EU, and the European Partnership on Raw Materials for the Green and Digital Transition (Figure 35).

Figure 35 The European Partnership portfolio and automotive-relevant partnerships


*Source*: European Commission (2025).

The instrument of Partnerships has shown promising results on catalysing R&I investments in high priority areas, strengthening collaboration within the broader European R&I system and coordinating research agendas across the EU[184]. At the same time, a certain degree of inflexibility, lack of focus on future technologies and strong administrative burden have been highlighted as possible elements discouraging stronger industry participation[185]. Furthermore, in some cases these tools offered limited opportunities to reduce innovation divide across the EU. Within BATT4EU, for example, activities has been almost entirely concentrated within western (EU-15) countries[186] – a

[xxiv] Together with co-programmed and co-financed Partnerships, Joint Undertakings are one of the three typologies of European Partnerships.

notable shortcoming considering Central and Easter Europe has been emerging as key hotspot for battery manufacturing and innovation in the EU[187]. Assessments also highlighted limited synergies of partnerships with other EU collaborative ecosystems, notably the *Knowledge and Innovation Communities* (KICs) of the European Institute of Innovation and Technology (EIT) and industrial alliances (Box 7)[188]. Ultimately, strengthening such synergies might go a long way in identifying industry-relevant research priorities, while also supporting regional / peripheral integration (particularly given the EIT's highly decentralised structure – see below).

In the Automotive Action Plan, the European Commission opens the possibility of setting up an additional, automotive-dedicated Joint Undertaking. While a similar initiative (whose scope is yet to be defined) is worth exploring, new partnerships should ideally narrowly focus on complementing existing ones, preventing overlaps or diversion of resources from them. Ultimately, a more focused and less fragmented budget allocation could be more effective in enabling the pooling of more public and private resources toward larger scale and high priority projects.

Based on the analysis in previous chapters, priority should be given to areas linked to emerging (or potential future) revenue streams, such as next generation battery technologies, connected services, and autonomous driving, where EU manufacturers still have an opportunity to secure a competitive edge globally. Similarly, areas that address excessive import dependencies – such as circularity and advanced materials – should also be prioritised for future R&I activities. Beyond setting up new partnerships, increasing the relative budget dedicated to partnerships within Pillar II Framework Programme should also be considered.

**Box 7 Automotive-relevant industrial alliances**

Although not involving direct financing, the instrument of industrial alliances is also meant to foster collaboration between industry and the research community, therefore helping to identify R&I priorities within a specific value chain and drive (private) investments into relevant R&I projects (which may eventually benefit from funding under EU funding programmes). The European Battery Alliance, the Industrial Alliance on Processors and Semiconductor Technologies and the European Raw Materials Alliance are all notable examples of alliances highly relevant for the automotive sector. In the Automotive Action Plan[189], the European Commission announced the launch of a new European Connected and Autonomous Vehicle Alliance, which is to foster cooperation of EU automotive stakeholders on the development of connected and autonomous driving technologies.

In addition to strengthening industry involvement through partnerships, an identified area of improvement within the EU R&I Framework Programme lies in its limited orientation towards breakthrough innovation[190,191,]. Within Horizon Europe, Pillar III – 'Innovative Europe' (with a budget of EUR 13.6 billion) is meant to address this, particularly via the European Innovation Council (EIC). The EIC supports high-risk, high-reward innovations with an overall budget of EUR 10.1 billion, providing funding to consortia, individual start-ups and SMEs in the form of grants and equity investments through its funding arm, the EIC Fund.

The EIC operates through three main programmes, targeting distinct stages of the innovation cycle: EIC Pathfinder (TRL 1-4), EIC Transition (TRL 3 – 6) and EIC Accelerator (TRL 6-8). Since the EIC Accelerator Programme focuses on projects closer to commercialisation, however, only the EIC Pathfinder and Transition are suited to support real disruptive innovation at low readiness level. Together these two schemes account for about half of the total EIC budget – around EUR 5 billion – meaning that only about 5 % of the overall Horizon Europe budget is currently allocated to early stage breakthrough innovation, which is substantially lower than what other world regions like the US provide (Draghi, 2024; Fuest et al., 2024). Moreover, although mobility-related innovation features quite prominently in the Accelerator programme (as further described below), it does not appear as a priority area in either the Pathfinder or the Transition programme.

## 5.3. FIRST INDUSTRIAL DEPLOYMENT AND SCALE-UP

While the EU's funding ecosystem for basic R&I is comprehensive, a critical funding gap often exists at the stage of early commercialisation (the 'valley of death', i.e. TRL 7-10) and scale-up of innovative technologies[192]. In part, this is related to limited access to venture capital for EU innovators. In the EU, Corporate Venture Capital (CVC) – i.e. investments made by stablished, large companies in innovative start-ups or scale-ups, – has actually been growing in importance among EU carmakers, which are on a par with global competitors in terms of mobilised resources; however a significant share of these investments has benefited US-based start-ups, reflecting a less-developed and attractive EU venture capital market for start-up and scale-up financing[193].

The gap in start-up and scale-up funding is particularly severe for clean technologies like batteries, where the valley is 'longer and deeper' due to high capital intensity, and greater technological and regulatory risks and longer times to market[194,195,xxv]. Indeed, producing batteries at competitive costs requires large economies of scale ('gigafactories'), therefore high upfront factory costs in equipment and production facilities; In addition,

[xxv] This also emerges as a gap within the broader EU innovation finance framework, as highlighted during the consultations for the upcoming EU Startup and Scaleup Strategy.

the rapidly evolving technological landscape of batteries introduces significant uncertainty, increasing the risk for investors..

Mobilising the level of investments needed to achieve this scale in the EU therefore hinges on significant public support – especially in light of generous incentives being deployed in other world regions, notably in the US and China[xxvi]. In light of significantly higher operating (energy, labour) costs of running battery manufacturing facilities in Europe compared to these countries (up to 70% more than China, according to T&E[196]) support should be designed in such a way that it accounts for operating expenses (OPEX).

### *EU budget instruments*

Under Pillar III of Horizon Europe, the EIT and the EIC also aim to address these financing needs. The former is an independent EU body that supports late-stage innovation and market entry (TRL 5 to 8) with a budget of EUR 3 billion. It operates through nine *KICs*, or 'ecosystems' of challenges (Figure 35), four of which are particularly relevant for innovation activities in the battery and the automotive sector at large: EIT Urban Mobility, EIT manufacturing, EIT RawMaterials (which also leads the European Raw Materials Alliance) and EIT InnoEenergy (which manages the European Battery Alliance – EBA).

EIT provides annual grants through competitive calls to each KIC, which depending on the degree of maturity of the specific innovation, might need to co-fund innovation projects. Similar to European Partnerships, these clusters aim at connecting regional, national, and EU-level actors to foster innovation but in a more dynamic, bottom-up and regionally focused approach, which also integrate a strong education and training component. The EIT *Regional Innovation Scheme* – implemented within each KIC in its respective area of focus – is meant to bridge the innovation divide between leading innovation hubs and regions that are only moderate innovators, (thus possibly covering the gaps of European Partnerships highlighted above).

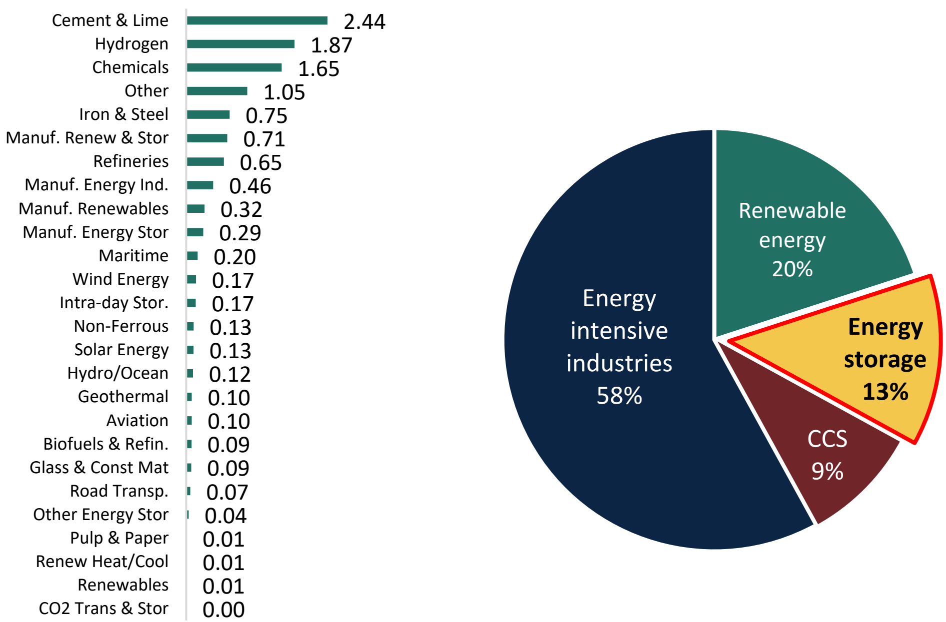
The EIC Accelerator, which accounts for about half the EIC's budget, provides grants and equity investments to start-ups and SMEs scaling innovations to market (TRL 6-8). The Programme features different thematic areas, or 'challenges', which align with EU policy objectives. In the 2025 EIC Work Programme, one of the five EIC Accelerator challenges (each supported with ~EUR 250 million) is focused on 'Breakthrough innovations for future mobility'. Key focus areas for this challenge include 'advancements in the design, manufacture, assembly and operation of road vehicles', 'development and integration of digital tools to enhance autonomous transport solutions', or 'smart and bidirectional

[xxvi] The European Commission (2023) estimated that about 20% of the overall EU investment required to scale net-zero technologies manufacturing – including battery technologies – were to be public investments. Others, like T&E (2024), assume public share of investment in battery production to be as high as 40%.

charging functionalities'. In addition, the programme features a workstream on advanced materials, focusing on developing applications for the energy, mobility, electronics and construction areas.

The ETS-proceeds-based Innovation Fund (IF) is the EU's main financing instrument supporting first-of-a-kind demonstration projects (TRL 6-9) of low-carbon technologies. The Fund currently accounts for 10 % of total ETS revenues, and has a projected budget of EUR 40 billion for the period 2020 to 2030[xxvii]F. While the decarbonisation of energy-intensive industries remains its primary objective, the Innovation Fund is emerging as an important EU funding tool for energy storage projects, which now account for 13 % of the whole IF projects portfolio (Figure 36).

Figure 36 EU contribution per sector (grant agreements in force) in EUR billion (left) and Innovation Fund project share by category (right)




*Source*: European Commission (2025).

For most of its projects, the IF provides support in the form of 'regular' grants via calls for proposals, typically covering up to 60 % of the additional cost associated with the low-carbon innovation, awarded based on strict predefined criteria. Beyond providing direct grants, the IF can combine funding with other funding instruments (e.g. InvestEU blending instruments – see Box 8) and, as of 2023, it provides fixed premiums via auctions. This is exemplified by the European Hydrogen Bank, which awarded a fixed premium to green hydrogen producers per kg produced via regular auctions of the Innovation Fund. In principle, this type of production-based (i.e., OPEX-oriented) support

[xxvii] This figure is estimated based on a carbon price of 75/t$CO_2$.

mechanism is effective as it allows the most cost-efficient and 'geo-agnostic' provision of public funding, prioritising support for the most cost-competitive projects. However, having evaluated its replication for battery manufacturing support, DG CLIMA concluded that battery projects are not yet suitable for support via fixed premium auctions due to the lack of homogeneous and/or standardised product, the lack of a mature projects pipeline, and the limited available budget compared to single projects funding needs.

**Box 8 The Battery Booster package**

As part of what was later branded as the 'Battery Booster package'[197], in December 2024 the Innovation Fund launched a dedicated EUR 1 billion call (IF24 Battery) to support via regular grants projects producing innovative EV battery cells and/or developing innovative battery manufacturing processes (but excluding raw materials extraction and refining activities). Furthermore, as part of a partnership between the European Commission and the EIB (also announced in December 2024), the Innovation Fund also provided a EUR 200 million loan guarantee top-up to the InvestEU programme, which would allow the EIB to mobilise an additional EUR 1.8 billion in venture debt to support the EU's battery value chain. The battery dedicated call (IF24 Battery) received a total of 14 proposals, requesting EUR 1.6 billion in EU funding. The proposals are currently under evaluation.

Regardless of how the Innovation Fund will provide support, if it is to become – as it appears – the single most important EU funding instrument for battery manufacturing (as well as clean tech manufacturing at large), mechanisms to expand its leverage by channelling resources from either other EU budget instruments or Member States should be considered and/or strengthened in the short term. Indeed, ESI funds, (unspent) Recovery and Resilience Facility (RRF) funds or ETS revenues-based instruments like the Modernisation Fund, could all be mobilised to support cleantech manufacturing, provided supported projects align with each instrument policy objectives[198]. However, this fragmented funding landscape (combined with an often complex application processes) has been noted to prevent for project promoters from fully leveraging these instruments, including in the battery sector[199,200].

A recent initiative to streamline, coordinate and/or facilitate access to EU funding is the Strategic Technology for Europe Platform (STEP). Established in early 2024 as part of the Multiannual Financial Framework (MFF) mid-term review, the platform steers resources from 11 EU funding programmes[xxviii] to support the development and manufacturing of

[xxviii] STEP mobilises funding across 11 EU funding programmes – 6 directly managed by the European Commission (the Digital Europe programme, the European Defence Fund, the EU4Health programme, Horizon Europe and the Innovation Fund) and 5 managed by Member States (the Cohesion Fund, the European Regional Development Fund, the European Social Fund+, the Just Transition Fund and the Recovery and Resilience Facility).

innovative technologies (as well as related skills) in three strategic sectors: digital technologies and deep innovation (e.g. semiconductors, autonomous mobility solutions), clean and resource-efficient technologies (e.g. next generation batteries), and biotechnologies. This is done by providing an EU label ('STEP Seal') to high-quality projects that align with its objectives. These may include projects eligible for the Innovation Fund that have not been selected for funding as well as Strategic Projects recognised under the Net Zero Industry Act and the Critical Raw Materials Act. The label ultimately enhances their visibility, facilitating access to additional funding sources.

Within its first year of operation, STEP has mobilised EUR 15 billion towards 142 projects, including EUR 6 billion that was reallocated from Cohesion Policy funding by some Member States. In the Clean Industrial Deal, the European Commission[201] has committed to a) strengthen synergies under the STEP framework to channel additional resources from other funding instruments to Innovation Fund projects that are also 'STEP seal' certified, and b) align funding criteria between the Innovation Fund and national financing, allowing faster approval for State aid for STEP seal' projects.

In the case of auction-based funding, the 'auction-as-a-service' model enables the coordination of EU (Innovation Fund) and national funding (or nationally allocated EU funding) under a single European auction platform, increasing opportunities for participating project promoters and allowing for a larger pool of supported projects. Pioneered within the European Hydrogen Bank, the mechanism allowed for the mobilisation of over EUR 1 billion from instruments such as, the Modernisation Fund, RRF, or national budgets to support eligible renewable hydrogen production projects. This effort complements the EUR 3 billion of IF support mobilised in two Hydrogen Bank auctions[xxix]. While effective in mobilising additional resources, the mechanism might limit the 'geo-agnostic' and cost-efficient nature of EU-wide auctions, particularly if funding from national budgets are used. The model, which is set to be tested for industrial decarbonisation projects in the context of the upcoming Industrial Decarbonisation Bank[202], could be considered for battery projects, once market maturity and standardisation improve sufficiently to support auction-based support mechanisms for battery manufacturing.

In the longer term, expanding the IF's budget share–currently limited to 10 % of ETS revenues (shared with the Modernisation Fund)–may become necessary to meet the scale of investments required for cleantech manufacturing.

[xxix] EUR 350 million in Germany in the first HB auction, EUR 700 million from Spain, Lithuania and Austria in the second.

### *Member States' instruments*

Member States significantly support the manufacturing and deployment of some technologies  via state aid. Through the Temporary Crisis and Transition Framework (TCTF)[xxx], and specifically its 'transition sections'[xxxi], the European Commission has provided high flexibility for Member States to support domestic manufacturing capacity of clean technologies like batteries, as well as related components and CRM. According to the European Commission[203], nearly EUR 47.25 billion of aid was approved under these sections of the TCTF between March 2022 and June 2024, although only EUR 2.38 billion (5 %) has been disbursed. Building on the TCTF – whose transition sections will expire in 2025 its successor, the Clean Industrial Deal State Aid Framework (CISAF) is set to further simplify State aid rules to support renewables deployment, industrial decarbonisation and cleantech manufacturing[204].

Beyond the TCTF framework, aid granted under other policy objectives, including regional development, can support automotive transition-related investments. In April 2024, for instance, the European Commission approved under the Regional aid guidelines a EUR 267 million aid scheme to support the establishment of an EV production plant by Volvo in Slovakia. Under the same objective, a total of EUR 340.85 million worth of State aid measures were approved to support EV production, EV battery production and EV battery recycling in Poland, Hungary and Romania under the same objective over the 2019-2023 period[xxxii]. Under the RDI State aid framework, certain R&D projects can also benefit from State aid support. For example, on the basis of that framework, Croatia received approval from the European Commission for EUR 179.5 million in funding to develop a fully autonomous EV for urban mobility, in line with the framework's objectives. Furthermore, aid can be provided to sustain a specific economic sector, if in line with EU policy objectives. Under the European Chips Act, for instance, a EUR 2 billion Italian scheme and a EUR 5 billion German scheme were approved in 2024 for the construction and operation of microchip plants, including to serve the demand of the automotive industry for EVs and fast-charging stations.

The current EU State aid framework has been criticised on a number of grounds. The primary issue is the unequal capacity of Member States to provide financial support, which results in major imbalances in aid allocation across the EU. State aid spending tends to be unevenly distributed in favour of Member States with greater fiscal capacity[205]. This

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[xxx] In March 2023, the TCTF replaced the Temporary Crisis Framework, which was adopted in March 2022 to enable Member States to assist companies and sectors severely impacted by the energy price crisis.

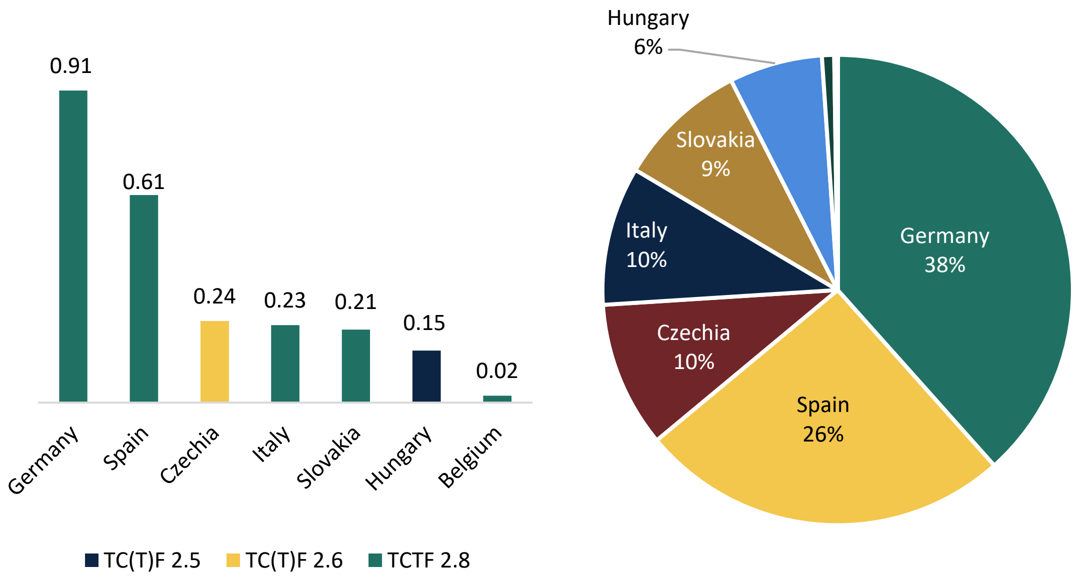
[xxxi] These include sections 2.5 (renewables roll-out and storage), Section 2.6 (Industrial decarbonisation and energy efficiency) and 2.8 (strategic investments in key sectors for the transition to a net-zero economy. These sections are set to expire on 31 December 2025.

[xxxii] See following cases SA.102924; SA.48556; SA.53903; SA.59516; SA.58633 ; SA.54226 ; SA.47662.

risks exacerbating fragmentation and reducing 'collective effectiveness'[206] including by possibly diverting resources from Member States with actual competitive advantages towards those with larger fiscal space[207]. Of the EUR 2.38 billion spent under the TCTF transition sections, for instance, EUR 902 million were approved as part of a single German measure to support Northvolt in constructing a plant for the production of EV batteries. In contrast, only a quarter was spent in Central and Eastern European countries, despite their growing importance as a battery hub (Figure 37). While the NGEU helped partially offset such disparities, its phase-out in 2026 may raise concerns about a renewed divergence in Member States' ability to support industrial policy initiatives – including those related to the transition of the automotive sector.

Additionally, there are concerns about the diversity and complexity of the different existing guidelines indicated above, which can make the State Aid framework difficult to navigate. The State Aid approval process often involves lengthy political negotiations rather than cost-efficiency criteria, which may favour incumbents over innovative newcomers. As such, simplifying and harmonising funding requirements across existing frameworks, while possibly aligning them with other existing EU-level instruments (e.g., the Innovation Fund) could help improve both the accessibility and impact of State Aid spending in the EU [208,209].Finally, a stronger focus on OPEX-oriented (production) support – typically harder to access under current EU state aid frameworks – would benefit cost-sensitive technologies like batteries, where high recurring costs can undermine competitiveness even when CAPEX support is available.

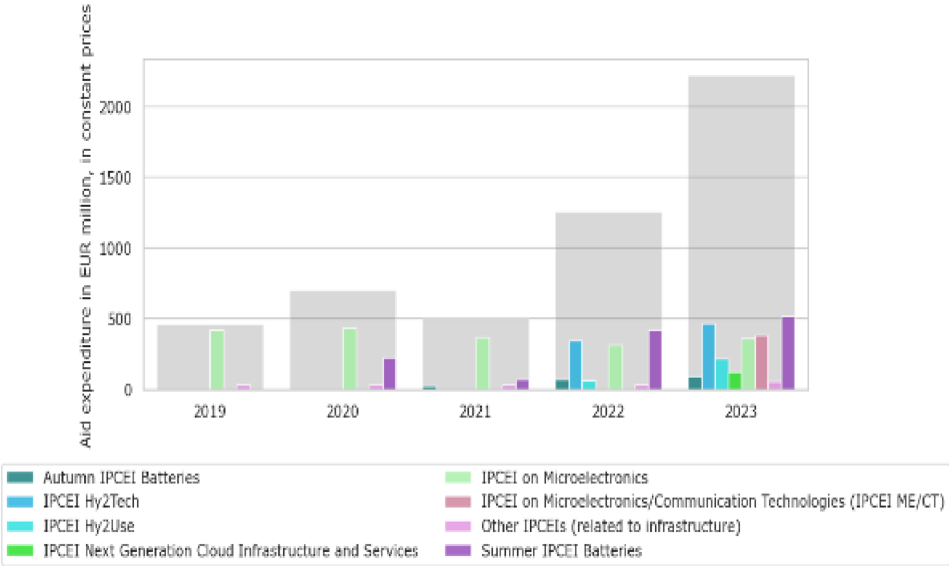
Figure 37 State aid granted under TCTF 'transition sections' between March 2022 and June 2024 in EUR billion (left) and Member States' share (right)




*Source*: European Commission (2025).

Where feasible, the convergence of State aid in Important projects of Common European Interest (IPCEI) may also enable a more cost-effective spending of national resources. IPCEI have become a more used instrument to facilitate cross-border collaborations, enabling Member States to pool national resources towards pan-European R&I and early commercialisation projects. Importantly, Member States are also allowed to use RRF resources in IPCEIs. Among the 10 ongoing IPCEIs, 2 currently focus on the battery ecosystem: the *IPCEI on Batteries*, set up in 2019 (EUR 3.2 billion in national funding) and the *IPCEI European Battery Innovation (EuBatIn),* established in 2021 (2.9 billion of national resources). Together, these two IPCEIs are expected to mobilise about EUR 14 billion in private investments along the battery value chain, from raw and advanced materials to battery recycling, over the duration of the projects. The remaining initiatives focus on microelectronics (2 IPCEIs, EUR 10 billion of State aid) and hydrogen applications – including for mobility (4 IPCEIs, EUR 19 billion of State aid), 1 on cloud computing and 1 on health applications. In 2023, overall reported expenditures under existing IPCEs amounted to EUR 2.22 billion, around EUR 600 million of which as part of the two battery IPCEIs (Figure 38).

Figure 38 Total State aid expenditure on IPCEI measures in EUR billion (2019-23)




*Source:* European Commission (2025).

As recommended in the Draghi report[210], the – currently rather narrow – sectoral focus of existing IPCEIs could be expanded to other innovative areas relevant to the automotive sector, including software-defined vehicles, autonomous driving solutions, battery circularity as well as small, affordable and European made EVs. In the Automotive Action Plan[211], the Commission reported the intention to support Member States in identifying a possible IPCEI candidate for clean, connected and autonomous vehicles. Furthermore, the Clean Industrial Deal announced upcoming action on the design of a new IPCEI on circular advanced materials for clean technologies.

In addition to expanding the sectoral focus in new IPCEIs, there have been repeated calls to make the IPCEI framework more flexible, simplified and accelerated, particularly in areas characterised by rapid technology developments like batteries[212]. To overcome these challenges, the European Commission has committed, under the Clean Industrial Deal[213] , to accelerating and improving the efficiency of the IPCEI process through the creation of a new IPCEI Design Support Hub. To align IPCEIs with EU spending and increase the scale of investment, it may be beneficial to consider including direct EU financial contributions such as for projects that fall within the scope of STEP (or vice-versa).

### *European Investment Bank (EIB) instruments*

EU development finance institutions, notably the EIB, can also play an important a role in supporting the commercialisation of innovative technologies relevant to the automotive transition. The EIB has a long history of financing projects in this space through promotional loans, guarantees, venture debt and venture capital support. This includes its role within the framework (as the main implementing partner) of the InvestEU programme, which provides EU budget guarantees to de-risk investments in strategic areas (see Box 9). The European Investment Fund (EIF), the investment arm of the EIB that specialises in venture capital and risk finance, is a key enabler for venture capital funding. Over the past decade it has contributed to 10 % of the total venture capital raised in Europe[214]. Strengthening and targeting existing EIB instruments – particularly venture capital and venture debt – can play a significant role in attracting private investors to technology start-ups and scale-ups, including within the automotive ecosystem.

A highly relevant instrument in this regard is the European Tech Champions Initiative (ETCI), a EUR 3.85 billion 'fund-of-funds'[xxxiii] launched in 2023 under the pan-European Scale-up Initiative. Managed by the EIF, ETCI provides late-stage growth capital to large EU scale-ups (i.e. those seeking above EUR 50 million) by investing in large venture capital funds. The ETCI has so far mobilised EUR 10 billion in public and private resources – about a third of overall venture capital received by European scale-ups in 2023. While supported funds focus on a wide range of applications (from deep tech and climate, through to cybersecurity, AI, fintech, biotech, and healthcare), given the success of the initiative, its expansion (and possibly more strategic focus) should be considered to retain automotive CVC in the EU[xxxiv].

Looking ahead, the recently announced Strategic Tech-EU investment programme, will also be strategically positioned to support scale-up investments. Through the programme, the EIB is expected to provide EUR 70 billion by 2027 to support disruptive technological innovation and scale-ups throughout the whole value chain of clean and other strategic technologies (e.g. AI, semiconductors, Eurotechnologies), including by supporting EU industrial alliances and in synergy with the EIC[215]. According to the Automotive Plan, the programme will be supporting investments of relevance for the automotive value chain, though details are not yet available.

Financing for CRM operations is becoming a key strategic priority for the EIB, including under the umbrella of the upcoming Tech-EU. This is particularly relevant given the lack of and/or suitable funding mechanisms in the EU budget for the set-up or scale-up of upstream CRM operations. Starting in 2025, the EIB plans to mobilise EUR 2 billion annually in CRM financing, targeting the full CRM value chain with dedicated financing

[xxxiii] EUR 500 million of which coming directly from the EIB Group, and the rest being contributions from six member States (Germany, France, Spain, Italy, Belgium and the Netherlands). 'Funds-of funds' are an investment funds whereby government and private sector co-invest in investment funds, rather than directly in assets.

[xxxiv] Other, more sector-specific – though smaller-scale – instrument of interest include the Cleantech Co-Investment Facility, a EUR 200 million co-investment programme launched in 2024 providing equity investments in innovative green technologies (particularly SMEs and Mid-caps), and the Breakthrough Energy Europe Fund, a EUR 100 million pilot equity fund created in 2019 as a partnership between Breakthrough Energy Ventures, the EIB, and the European Commission to invest in groundbreaking decarbonisation technologies.

tools – project finance for mining and refining, corporate financing for sustainability, circularity and material innovation, venture debt for scaling up innovative technologies – while exploring co-investment opportunities with other CRM-focused investment funds. In light of emerging CRM-dedicated funding initiatives at the national level[xxxv], a CRM task force was also created in early 2024 to provide coordination and advisory services..

**Box 9 Examples of recent automotive transition-relevant EIB investments**

- In January 2025, NXP Semiconductors secured a EUR 1 billion loan from the EIB to support R&D&I activities across its facilities in Austria, France, Germany, the Netherlands, and Romania to advance semiconductor technologies for automotive, industrial, and IoT applications, aligning with the EU Chips Act.
- In December 2024, the IEB announced a EUR 20 million venture debt loan, supported by the InvestEU programme, to Tau Group, an Italian technology company. The loan is intended for the development of high-performance, environmentally friendly magnet wire, which will be used in EV motors, among other applications.
- In July 2024, the EIB supported ZF, a German automotive supplier, with a EUR 425 million promotional loan for the development of advanced braking and steering systems, which are essential for higher levels of vehicle automation. The loan enabled a total investment of EUR 1.3 billion.
- In May 2024, the EIB signed a EUR 36 million loan to CIE Automotive, a Spanish supplier of automotive components, to support its R&D&I activities, process optimisation through digitalisation, and the development of more sustainable manufacturing technology.

## 5.4. EMPLOYMENT AND SKILLS

At EU level, multiple existing financing instruments can be employed to cope with three distinct challenges related to employment and skills: immediate layoffs due to plants closures or relocations, structural mid-to-long-term employment impacts in regions reliant on ICE-related productions, and emerging skills gaps throughout the automotive value chain.

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[xxxv] France has established a EUR 2.2 billion critical materials fund (EUR 500 million of which was financed by the government) in 2023. Germany announced a EUR 1.1 billion worth Critical Materials Fund. Italy set up a 1.1 national strategic fund for ‘Made in Italy’ to support key value chains while boosting the procurement and re-use of critical raw materials.

To mitigate short-term employment impacts, one instrument to consider is the European Globalisation Adjustment Fund (EGF). The EGF is a special EU instrument used to support workers displaced as a result of restructuring with annual budget of EUR 35 million. The tool has already been widely used by the automotive industry with 8 out of 69 applications filed since 2014 were to support displaced workers in the automotive sector[216] – see Table. 1, and its use could be further justified in light of emerging trade disruptions (Box 3).

Given its limited budget the EGF, is unlikely to be sufficient on its own to effectively address possible job losses the EU automotive industry. Therefore, expanding the instrument or establishing a new, dedicated mechanism should be considered. The EU has previously set up temporary mechanisms to aid Member States that are significantly impacted by the socio-economic consequences of economic downturns. SURE (Support to mitigate Unemployment Risks in an Emergency), for example, provided close to EUR 100 billion in financial assistance (loans) between 2020 and 2022 to preserve employment during the Covid-19 pandemic. While the scheme has expired, it has been brought up as a possible model for a permanent solution to safeguard employment in case of economic shocks, including in the automotive sector (Industriall, 2025).

However, such instruments would not replace the need for place-based solutions negotiated at site level. Furthermore, they remain instruments to be activated after the negative impacts occur, meaning that priority should be given to pre-emptive and targeted initiatives aimed at addressing longer-term structural trends.

Table 1 EGF cases in the automotive industry

| Year | Case name | Country | Amount |
|---|---|---|---|
| 2024 | Van Hool | Belgium | € 5 671.445 |
| 2021 | Cataluña automotive | Spain | € 2 795.156 |
| 2021 | Aragón automotive | Spain | € 1 404.863 |
| 2016 | Comunidad Valenciana automotive industry | Spain | € 856 800 |
| 2015 | Volvo Truck | Sweden | € 1 793.710 |
| 2015 | Ford Genk (II) | Belgium | € 6 268.564 |
| 2015 | Adam Opel AG | Germany | € 6 958.624 |
| 2014 | PSA | France | € 12 704.605 |

*Source*: European Commission (2025).

Support for regions highly affected by the transition can in principle come from the Just Transition Mechanism. This policy framework was developed as part of the European Green Deal Investment Plan in 2021 to support workers of the regions most impacted by the green transition via re-training, economic diversification, and SME development. It operates through three funding instruments: the Just Transition Fund (JTF), the InvestEU 'Just Transition' scheme, and the EIB public sector loan facility. The JTF was primarily designed to cope with employment effect of the coal phase-out, particularly in eastern European regions. It provides grant-based funding to projects – in shared management with Member States – with an overall budget of EUR 17 billion (EUR 7.5 billion from the MFF, 10 under the Next Generation EU). The InvestEU scheme provides budgetary guarantees to support investments and includes an advisory hub for guidance, aiming to mobilise EUR 10-15 billion in mostly private sector investments. The Public Sector Loan Facility combines EUR 1.3 billion in EU grants with EUR 6-8 billion in EIB loans to generate EUR 13.3-15.3 billion in public investment.

The European Committee of the Regions (CoR) and its Automotive Regions Alliance have called for the expansion in scope and budget of the JTF (or its successor in the context of the upcoming MFF) to aid regions more affected the automotive sector's transition, and particularly in training and reskilling activities[217] [218]. This option is worth exploring in light of the upcoming MFF negotiation. However, the reach of the JTF remains limited by national planning capacity and prioritisation. Some countries have encountered difficulties in fully leveraging this funding tool due to administrative bottlenecks)[219].

Several other existing tools can complement just transition funding for regionally targeted support in the areas affected by the automotive transition, as well as for the development of (automotive-) relevant skills. These include cohesion policy instruments such as ESI funds – e.g. the European Regional Development Fund (ERDF), the Cohesion Fund and most notably the European Social Fund (ESF) + – as well as the funding from RRF. The effectiveness of these tools in addressing structural / regional impacts might be limited given ICE-based regions are, typically, economically flourishing regions that tend not to be targeted by cohesion funding[220].

However, many of these programmes place a strong emphasis on training and reskilling. According to the European Commission[221], the current MFF allocates approximately EUR 65 billion to tackling skills shortages across different instruments, particularly through the ESF+. Importantly, a substantial part of this financial support has been dedicated to 'green' skills (e.g. EUR 5.8 billion from ESI+, EUR 1.5 billion under RFF). Meanwhile, other initiatives, such as the Digital Europe Programme (EUR 7.6 billion budget overall) have concentrated on fostering digital skills.

While the EU instruments support development skills that are in large part relevant to the automotive industry (digital, green skills) more targeted and/or coordinated support might be required to address the emerging skillset gaps of automotive transition, such as battery production and maintenance or vehicle software development. In this context, the STEP can help direct funding from most of the above-mentioned instruments and programmes to support its objectives, which include the development of autonomous vehicles and net zero technologies. A more explicit mandate could be considered for STEP to channel funding towards the development of skills relevant to the automotive sector transition.

Academies are another tool that can be used to steer EU and Member States' funding towards upskilling and reskilling needs in the automotive sector. Skills academies essentially consist of initiatives to develop learning programmes and materials for training and education, which are then developed by local education and training providers (from local vocational education and training (VET) centres to businesses and universities). After the European Battery Academy was launched in 2022, under the framework of the Net Zero Industry Act (NZIA) other 'Net Zero Skills Academies' have recently been (or are expected to be) established for solar, hydrogen, wind and raw materials.

Building on these examples and on the existing industry-led Automotive Skills Alliance, Draghi (2024) recommends the establishment of an Automotive Skills Academy. Launched under the EU Pact for skills in 2020, the Automotive Skills Alliance is a 'Large-Scale Partnership' which brings together stakeholders from the automotive ecosystem – industry, social partners, regional authorities, and education providers - to coordinate an promote reskilling and upskilling efforts by developing modular training programmes. Given its expertise in managing training and education activities – including as part of academies – a possible automotive academy could be institutionalised in the framework of the EIT – e.g. under the EIT Manufacturing KIC (see Section 5.2.). With regard to funding, the European Commission provides initial 'seed-funding' (through different programmes[xxxvi]) while Member States can mobilise funding instruments such as the JTF or other ESI fund for their implementation. Ultimately, these initiatives are meant become financially self-sustainable.

## 5.5. CHARGING INFRASTRUCTURE

The deployment of charging infrastructure in the EU faces a classic chicken-and-egg dilemma, whereby the absence of a sufficiently EV market may discourage private investment in new charging stations[222]. This is especially true in rural or less populated areas, where economic returns are lower and market-driven roll-out is less viable. In these cases, public support becomes crucial – whether through direct financial incentives to infrastructure providers or co-financing mechanisms.

[xxxvi] In the case of the Battery Academy, the European Commission provided an initial grant of EUR 10 million under the framework of REACT-EU; for the European Solar Academy with EUR9 million from the Single Market Programme. European Raw Materials Academy, supported with EUR 10 million from the Single Market Programme and Horizon Europe.

The most important EU funding instrument supporting infrastructure investments is the Connecting Europe Facility (CEF). One of its three components, CEF for Transport (the others being CEF Energy and CEF Digital) which supports investments in new or upgraded transport infrastructure with an overall budget of almost EUR 26 billion (some EUR 11 billion of which is mobilised from the Cohesion Fund for eligible countries). The programme is managed by CINEA and since 2021 it has a dedicated funding stream for charging and refuelling infrastructure, the Alternative Fuels Infrastructure Facility (AFIF). This supports the roll-out of alternative fuels infrastructure – mainly public charging and hydrogen refuelling stations – by blending CEF grants with additional loans or guarantees from the EIB, the EBRD and national promotional banks, which are implementation partners. Also outside of the framework of AFIF, lending instruments of the EIB and other development banks – including those backed by InvestEU guarantees – are the principal tools for supporting charging infrastructure. These instruments help to mitigate the risks associated with private investments in both public and private (shared buildings and depots) chargers.

Additionally, resources from ESI funds (and particularly the Cohesion Fund), the JTF, the Modernisation Fund[xxxvii] and the RRF could also be used to support charging infrastructure deployment. Indeed, given the emerged regional disparities in the deployment of charging infrastructure across the EU (i.e. differences across Member States and in urban vs rural areas, see Box. 10), the cohesion policy dimension of public investments in charging infrastructures becomes increasingly relevant. As suggested in the Draghi Report[223], public support for recharging infrastructure should be focused on areas with low EV penetration, where the business case for vehicle charging remains less mature. Therefore, unspent budget from some of the above funding mechanisms could be leveraged for charging infrastructure deployment in these areas in the near future. As part of the EU's cohesion policy mid-term review, the European Commission has encouraged Member States to make use of Cohesion funding to 'support investments to promote energy interconnectors and related transmission systems, as well as the deployment of recharging infrastructure.' In the upcoming MFF, AFIF should continue to serve as the funding tool for supporting infrastructure deployment EU-wide, and its expansion – particularly its Cohesion Fund envelope – should be considered. Importantly, were financial incentives to be targeted to low-income households, support schemes could be included as part of the national Social Climate Plan, and hence receive support via the Social Climate Fund[224,225].

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[xxxvii] Financing programme set-up to modernise and decarbonise the energy system of 10 lower-income Member States and financed through ETS revenues. With a budget of EUR 57 billion, it also provides support to infrastructure development for zero emission mobility.

**Box 10 Emerging business and financing models for charging infrastructure**

Practice offers a wide range of public support options for Member States to promote charging infrastructure deployment, including output-based subsidies, lump-sum grants per charger, and loans or guarantees to cover upfront investment costs. Beyond these traditional tools, innovative financing and business models–often involving public-private partnerships (PPPs)–are emerging and could be further leveraged. For instance, to support private chargers in multi-unit dwellings, a service payment model may be used (similarly to the one used by Logivolt in France), whereby the private provider (e.g. a utility company) covers the upfront costs of the electrical installation – potentially supported by public loans or guarantees – and recoups the investment by charging a tariff or connection fee to users in the building, while also operating and maintaining the chargers[226]. Similarly, in operating leases or 'charging-as-a-service' schemes, the operator (e.g. a company) leases the infrastructure from the station manufacturer or owner and pays a regular fee based on the availability of the station[227].

## CONCLUSIONS

The EV transition is crucial for achieving EU climate targets. At the same time, it has many layers and presents a major technological, economic and social challenge. It requires a fundamental restructuring of the European automotive industry – a major pillar of the EU economy – which has now arrived at a critical juncture.

As the transition accelerates, European vehicle manufacturers face shrinking market shares amid intensifying competition and narrowing margins. The latter are driven in part by the higher production costs of BEV manufacturing, which are likely to persist until economies of scale and innovation-driven cost reductions materialise. At the same time, manufacturers must balance declining revenues from ICEVs with growing – but still uncertain – returns from BEVs and emerging business models. From a consumer perspective, there is a notable gap between the willingness to pay and the actual purchase price. This is particularly relevant for small to lower medium car segments where limited annual mileage means that savings from lower charging and maintenance costs take longer to materialise.

Along with regulatory measures, targeted financial support can accelerate the transition of the EU's vehicle fleet, by de-risking investments and increasing short-term economic and technical feasibility of EU-based EV production. Demand-side incentives will still be required in the years leading up to cost parity with ICEVs, particularly for low-price segments where limited profitability and relatively high upfront costs still hinder uptake. Once operational, mechanisms backed by the Social Climate Fund – including social leasing schemes – would be a natural vehicle. Another source could be revenues from EU ETS2 allowances. The faster the uptake of BEVs and the emergence of new revenue streams by the EU car industry, the faster the support can be phased out. Clearly, such a measure has implications for trade, competition within the EU and public finances which will need to be carefully considered in terms of design and necessary funding.

In parallel, the deployment of charging infrastructure, which is crucial to support the EV transition, faces a somewhat fragmented regulatory landscape, and some regional disparities in planning and grid readiness. For the deployment of charging infrastructure, the main bottlenecks appear to be administrative challenges and a lack of planning. To ensure more consistent coverage across the EU, measures for less densely populated areas can be considered. A clear priority, although not achievable in the short term, should be to upgrade the grids, particularly the distribution grid. This should go hand in hand with regulatory changes to allow for bidirectional charging at home. While this could help address the EU's flexibility challenge, it would also, due to lower charging costs, reduce TCO for EV owners.

Battery production is another cornerstone of the transition, but European capacity and competitiveness remain limited. While scaling up battery manufacturing in Europe is justified from a value-added perspective, it presents challenges from a cost standpoint. This is especially true for lower-priced EV segments, where battery costs constitute a significant share of production costs and therefore can have a notable impact on vehicle prices.

The competitiveness of battery production depends strongly on material and energy costs. The EU needs to catch up in battery technology and chemistry innovations, as it is currently lagging behind. Dependence on CRM will also remain for some time to come. Partnerships and the acceleration of low-carbon energy production to reduce energy costs and prices may be a good step to generate a favourable framework for battery production.

The gap in start-up and scale-up funding for clean technologies like batteries is particularly pronounced. This sector faces a 'valley of death' that is both 'longer and deeper' due to their high capital intensity, and high technological and regulatory risks and extended times to reach the market. Indeed, producing batteries at competitive costs requires economies of scale ('gigafactories'), therefore, high upfront factory costs in equipment and production facilities. And given the rapidly evolving technological landscape around batteries, investments face a significant technological risk. Mobilising the level of investments needed to achieve this scale in the EU will therefore hinge on significant public support – especially in light of the generous incentives being deployed in other world regions.

The feasibility and long-term competitiveness of EU-based EV manufacturing will depend to a large extent on the industry's ability to regain technology leadership through innovation. In the context of upcoming negotiations for the next MFF, there is a case for enhancing industrial involvement in the Framework Programme through co-investment mechanisms such as European Partnerships, and increasing the budget dedicated to breakthrough innovation at low technology readiness level – currently a relatively small share of Horizon Europe. The EU instruments supporting late-stage innovation such as the Innovation Fund should be adequately funded or complemented through initiatives like STEP. This will ensure that investment support matches investment needs, particularly in batteries. Along with a more simplified and performance-based State aid framework, new IPCEIs could be considered in new areas deemed critical to automotive transition. EIB de-risking instruments – including those under InvestEU – will be instrumental in scaling up and directly supporting the production support of innovative tech, particularly in areas such as CRM extraction, where EU budget support is limited.

The transition towards electromobility also brings significant implications for employment and skills, occurring alongside ongoing trends of automation and digitalisation in the automotive sector. EV production can create new local job opportunities but this also depends on the market share of European producers. Some EU manufacturers and suppliers have already invested in adapting to the transition, notably in electric powertrains, battery cell production, and software development. There is some early evidence that ICEV workers possess transferable skills suitable for adjacent sectors, including those related to industrial gases, electric motors, and digital vehicle components and possibly, defence. Active labour market policies – particularly reskilling and upskilling programmes – can help to ease the transition. To a large extent this is a task for Member States.

Given the complexity of the transition, not all the identified challenges can be addressed at the same time. And not all measures will have a major impact. The first and foremost challenge therefore seems to be to agree on priority actions, ideally those that can be implemented fast and have a major impact. Which measures then will be chosen is largely a political decision.

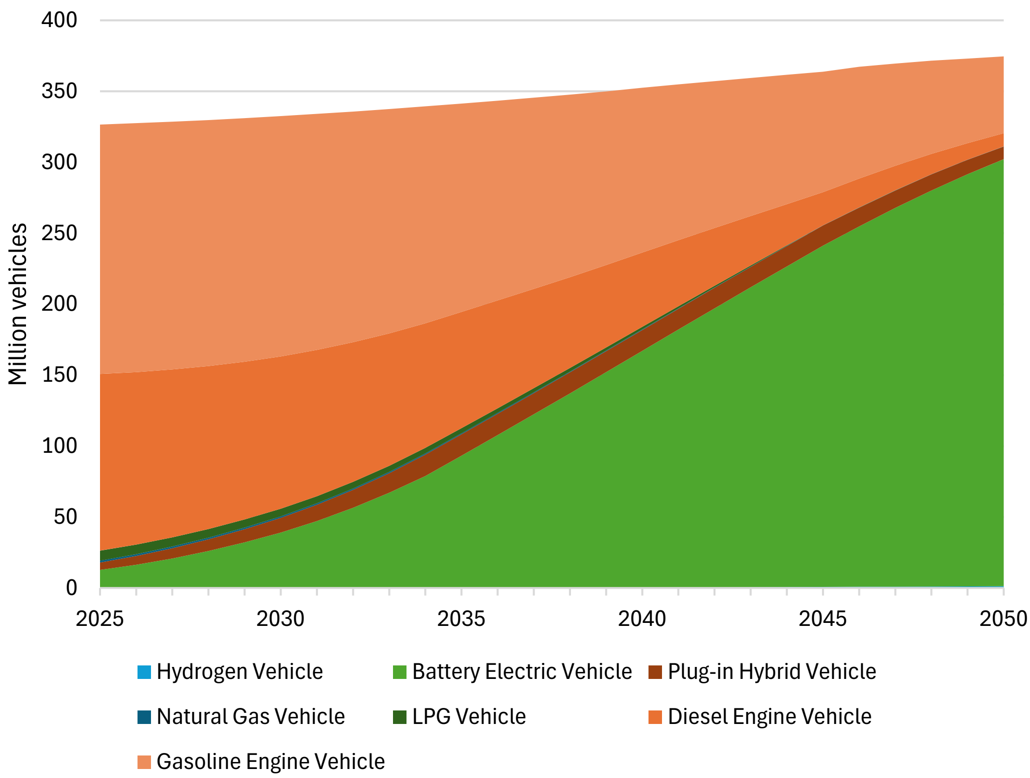
# ANNEX

## ANNEX I: EUROPEAN VEHICLE FLEET SCENARIOS

### *Future projections vehicle fleet composition*

The Energy Policy Simulator[228] developed by the Think Tank Energy Innovation Policy & Technology, models the impact of the Fit for 55 package for different policy areas. For the transport sector, it projects significant changes in European vehicle fleet composition from 2025 to 2050 (Figure 39). The BEV fleet would need to reach around 13 million vehicles by 2025, increasing to roughly 39 million by 2030. BEVs are projected to surpass ICEVs by the end of the 2030s and ultimately reach approximately 300 million vehicles by 2050. In comparison, ICEVs, including diesel, gasoline, natural gas and liquefied petroleum gas, are projected to decline substantially over this period. Decreasing from around 309 million vehicles in 2025 to 283 million in 2030 and 64 million in 2050. Other alternatively fuelled vehicles, such as hydrogen, are expected to play only a minor role, reaching a total of around 1.2 million vehicles by 2050.

Figure 39 EU fleet size scenarios by vehicle type (2025-50)




*Source:* Own elaboration based on CEPS' own estimates and Energy Policy Simulator (2025).

## ANNEX II: METHODOLOGIES FOR SCENARIOS

Estimates are subject to uncertainty, as they depend on developments in vehicle sales volumes and key cost components such as direct and indirect manufacturing costs, dealership markups, and taxation. While not intended as precise forecasts, the results provide indicative insights into how cost and margin dynamics could evolve for projected EV deployment in line fir Fit for 55 policies.

### *Existing revenues streams*

To calculate the financing and revenue scenarios, CEPS used yearly vehicle sales projection of the Fit for 55 scenario computed by the Energy Policy Simulator[229]. The considered vehicle types are passenger cars and freight vans. The number of vehicles sold was multiplied by three different pricing scenarios (P1-P3). Prices are defined as final prices, including taxes. Pricing scenarios for CEPS' estimates range for BEVs from EUR 45 000 (P1) over EUR 55 000 to EUR 65 000 (P3) per vehicle. For ICEVs, an average price of EUR 45 000 was used. As a reference, according to JATO[230], the average retail price of an ICEV in France, Italy, Spain and Germany in 2024, ranged from EUR 42 207 to EUR 53 109. Analogous figures for BEVs are between EUR 55 430 and EUR 64 603.

The pricing scenarios for PHEVs range from EUR 45 000 (P1) over EUR 55 000 to EUR 65 000 (P3) per vehicle. As a reference, the volume weighted average price of PHEVs in Europe in 2025 is projected to be around EUR 63 600[231]. Similar to the BEV figures, these prices were multiplied by the projected yearly sales of PHEV passenger cars and freight vans, according to the Fit for 55 scenario of the Energy Policy Simulator[232].

Revenues from vehicle sales are defined here broadly as the total value of vehicles sold, calculated by multiplying the vehicle price (including taxes) by the number of units sold.

### *Costs*

For cost calculations, direct cost estimates for BEVs and ICEVs for 2020 and 2030, as calculated by Oliver Wyman[233], were used. Assuming a linear development of growth rates for individual cost components from 2020 to 2030, the figures were extrapolated from 2030 to 2040.

Indirect costs were estimated using cost comparisons between BEVs and ICEVs sourced from McKinsey & Company[234]. A surcharge for indirect costs was calculated as a proportion of direct costs, with the total costs comprising the sum of both direct and indirect costs. The differential of indirect costs due to a lack of economies of scale, found by McKinsey & Company[235], is assumed to linearly decrease from 2019 to the beginning of the 2030s when the number of BEV sales in the projections by the Energy Policy Simulator[236] exceed ICEV sales from the early 2020s. In addition, other costs and taxes were assumed based on data from König et al.[237]on dealership markups and ACEA[238] on Value Added Taxes.

### *Margins and margin gaps*

To calculate the margins for BEVs and ICEVs the sales revenues were subtracted from the sum of direct, indirect and other costs (i.e. dealership markups) as well as taxes (i.e. Value Added Tax). The yearly gap between median equivalised disposable income in the EU and the P1 (EUR 45 000) projections was calculated using three market share scenarios S1 (40 %), S2 (50 %) and S3 (60 %) of passenger cars sold in the small to lower medium vehicle segments (A-C). The market shares were used to calculate the number of passenger cars that would need to be provided at the P1 price of EUR 45 000. The number of passenger cars was multiplied by the size of the gap between the equivalised disposable income in the EU and the P1 (EUR 45 000) projections. These estimates are limited to new vehicle sales and do not take into account the role of used BEVs in the secondary market.

### *Future revenue streams*

To calculate the revenue scenarios for connected services for BEVs, CEPS utilised yearly vehicle fleet projections from the Fit for 55 scenario, as computed by the Energy Policy Simulator[239]. The analysis considered passenger cars and freight vans. Estimates from McKinsey & Company[240] regarding the distribution of vehicles across connectivity service packages (i.e. basic, intermediate, advanced) were used to determine usage shares. These usage shares were then multiplied by the vehicle fleet projections from the Energy Policy Simulator[241] and the minimum and maximum revenue projections for connected services per vehicle, as provided by McKinsey & Company[242]for 2030. Usage shares were assumed to grow linearly from 50 % in 2021 to 95 % in 2030, reaching 100 % in 2031. Revenue projections for connected services per vehicle were held constant at 2030 values.

## ANNEX III: OVERVIEW OF EXISTING EU FUNDING INSTRUMENTS

| | Source | Management / implementation | General description - objectives | Financing type | Overall budget (EUR bn) | Period | (Possible) relevance for the automotive transition | Key area(s) | STEP |
|---|---|---|---|---|---|---|---|---|---|
| Horizon Europe | MFF | European Commission | EU's key funding programme for research and innovation. | Grants | 93.5 | 2021 – 2027 | The programme covers virtually all areas relevant to the automotive value chain. Several European Partnerships highly relevant for the automotive sector, including BATT4EU, European Partnership on Connected, Cooperative, and Automated Mobility (CCAM), Zero Emission Road Transport (2Zero) Partnership. | Innovation | Yes |
| European Innovation Council | MFF | European Commission | Supports and scale up breakthrough and disruptive innovations with high market potential. | Grants; Equity | 10.1 | 2021 – 2027 | Supports high-potential innovation across sectors, including automotive -related technologies. | Innovation | Yes |
| European Institute for Innovation and Technology | MFF | European Commission | Supports late-stage innovation & education through Knowledge and Innovation Communities. | Grants | 3 | 2021 – 2027 | Four of its nine KICs are directly relevant for battery & automotive:<br>– EIT Urban Mobility<br>– EIT Manufacturing<br>– EIT RawMaterials<br>– EIT InnoEnergy. | Innovation<br>Employment & skills | Yes |
| Just Transition Fund | MFF / NextGenEU | Shared – Member States and European Commission | Supports EU territories negatively affected by the energy transition. | Grants; equity; loans; guarantees | 17.5 (10 of which from NGEU) | 2021 – 2027 | In can support ICE vehicles-focused regions / workers more affected by the transition of the automotive industry. | Employment & skills | Yes |
| Cohesion Fund | MFF | Shared – Member States and European Commission | Supports EU Member States with lower national income per capita. | Grants; equity; loans; guarantees | 37.3 | 2021 – 2027 | In can support ICE vehicles-focused regions / workers more affected by the transition of the automotive industry.<br>It supports electric mobility infrastructure in lower-income countries. | Employment & skills<br>Charging infrastructure | Yes |
| European Social Fund + | MFF | Shared – Member States and European Commission | Supports social inclusion, employment, education, and skills development, particularly in for green e green and digital transition. | Grants; equity; loans; guarantees. | 142.7 | 2021 – 2027 | It can support up/reskilling of automotive workers, including STEP-relevant technologies. | Employment & skills | Yes |
| European Regional and Development Fund | MFF | Shared – Member States and European Commission | Reduces disparities between regions through investments in economic, social and territorial cohesion. | Grants; equity; loans; guarantees. | 226 | 2021 – 2027 | In can support ICE vehicles-focused regions / workers more affected by the transition of the automotive industry. | Employment & skills | Yes |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Innovation Fund** | ETS revenues | European Commission | Supports first-of a-kind projects of low-carbon technologies. | Grants<br>Fixed premiums<br>CFD<br>CCFD | 40<br>(based on €75/t$CO_2$ carbon price) | | Dedicated EUR 1 billion call for battery projects. Support decarbonisation of basic materials (e.g. steel, chemicals). | Battery manufacturing; CRMs operations (excl. mining) | Yes |
| **Modernisation Fund** | ETS revenues | Shared - Member States, the EIB and the European Commission | Modernise and decarbonising the energy system of 10 lower-income Member States. | Grants; equity; loans; guarantees. | 57<br>(based on €75/t$CO_2$ carbon price) | | Priority investments include infrastructure for zero emission mobility. | Charging infrastructure | |
| **Social Climate Fund** | ETS revenues | Shared – Member States and European Commission | Mitigates the social and economic impact of carbon pricing (ETS2) on vulnerable groups. | Grants | 86.7<br>(including 21.7 of MS financing) | 2026 - 2032 | Supports affordable green mobility via consumer incentives for lower-income households or SMEs, e.g purchase subsidies, social leasing schemes. | Demand incentives, Employment & skills | |
| **CEF for Transport Alternative Fuels Infrastructure Facility (AFIF)** | MFF | European Commission (CINEA) | Dedicated CEF Transport instrument targeting the roll-out of alternative fuel supply infrastructure. | Grants and loans (blending) | 2.57<br>(0.6 of which from Cohesion Fund) | 2021 - 2025 | Supports roll-out of EV charging infrastructure. | Charging infrastructure | |
| **InvestEU Fund** | MFF | European Commission, implementing partners (incl. EIB) Member States ('MS compartment') | Support EU investments in line with EU's policy priorities, incl. green, digital, innovation, skills. | Equity; loans; guarantees | 26.2<br>(EU budget guarantee) | 2021 - 2027 | Provides financing for charging infrastructure, green manufacturing, and SME growth across the automotive value chain. | Innovation and scale-up; Charging infrastructure | Yes |
| **Recovery and Resilience Facility (RRF)** | NextGenEU | European Commission | Post-Covid recovery via green/digital reforms and investments. | Grants; equity; loans; guarantees | 648 bn | 2021 - 2026 | | Charging infrastructure<br>Employment and skills | Yes |
| **EIB European Tech Champions Initiative (ETCI)** | EIB Group & Member States | EIB Group & Member States | It provides growth-stage capital to large EU scale-ups by investing in large venture capital funds. | Equity | 3.85<br>(0.5 from EIF, rest MS contributions) | 2023 - | It supports automotive-related tech scale-ups, including climate and digital technologies. | Innovation and scale-up; | |
| **EIB Cleantech Co-Investment Facility** | EIB Group | EIB | Support co-investment in climate tech companies. | Equity | 0.2 | 2024 - 2028 | Supports cleantech innovations, including auto-relevant tech. | Innovation and scale-up | |
| **EIB Tech-EU programme / platform (forthcoming)** | n/a | EIB, EC, national development banks | Upcoming financing programme aiming at supporting EU start-up funding. | n/a | 70 | 2025 - | EIB CRM strategic initiative, 2 billion. | Innovation and scale-up<br>CRM | |

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