

POLICY BRIEF

Policy options for sustainable mobility: the road to decarbonization

Authors

Andrei Marcu, John Cooper, Chiara Cavallera



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1. Objectives

This paper focuses on regulatory aspects in the area of climate change. It does not attempt to determine the contribution of climate change regulation to the current situation, but rather to put forward new ideas on how climate change objectives can be better achieved, so the focus is on policy options to meet climate change objectives.

2. Introduction

- **The EU automotive industry is currently adapting to a new business environment**

The automotive industry is a cornerstone of the EU economy, contributing over 7% to its GDP (equivalent to ~€1 trillion) and supporting approximately 13.8 million jobs directly and indirectly¹. Direct manufacturing alone provides jobs for 2.6 million people, representing 8.5% of all EU manufacturing employment, while downstream activities, including vehicle sales, maintenance, logistics, and transport services, support an additional 9.2 million jobs. Additionally, the automotive sector is the EU's largest private investor in research and development, allocating around €73 billion annually, which accounts for approximately 33% of total EU R&D spending, driving innovation and sustaining extensive supply chains spanning steel, chemicals, ICT, and mobility services². The automotive sector is also one of the European Union's largest exporting industries and a major contributor to the EU's manufacturing trade surplus, with vehicles and automotive components accounting for a significant share of extra-EU exports. In 2024, the EU exported around 5.4 million cars valued at €165.2 billion, and imported 4.0 million cars worth €75.9 billion, resulting in a net trade surplus of €89.3 billion in the automotive trade³. European OEMs are deeply integrated into global value chains, relying on complex cross-border flows of components, materials and technologies. While this international integration has historically underpinned the sector's competitiveness and scale, it also increases exposure to external shocks, trade distortions and geopolitical developments, making the resilience and autonomy of automotive supply chains an increasingly important factor.

Large European car manufacturers such as Volkswagen, Stellantis, BMW, Mercedes-Benz, and Renault remain the backbone of the EU automotive sector, driving innovation, scale, and international competitiveness. However, the broader ecosystem also relies heavily on a dense network of small and medium-sized enterprises (SMEs) that supply components, software, and specialized services, often operating as Tier 2 and Tier 3 suppliers. Many of these SMEs are embedded in regional industrial clusters, for example in Germany's Baden-Württemberg and

¹ European Commission. https://single-market-economy.ec.europa.eu/sectors/automotive-industry_en

² <https://www.acea.auto/figure/rd-shares-of-industrial-sectors-in-european-union/>

³ Eurostat. (2025, April 1). <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20250401-1>

Bavaria, northern Italy, and Spain's Catalonia, where automotive production, engineering expertise, and supplier networks have developed over decades⁴.

Currently as it will be discussed in the next section, the EU automotive industry is adapting to a new business environment.

3. Challenges the EU automotive industry is facing

- **There are several types of challenges that it is facing**
 - **Changes in public preferences for transportation solutions**
 - **Increase in urbanization translates into cars not always being the preferred solution with demand for cars decreasing significantly.** While in rural and sparsely populated areas private cars remain a necessity, as limited public transport and longer travel distances leave few viable alternatives, increasing levels of urbanization are fundamentally reshaping mobility patterns in European cities, making private cars a less preferred solution. Today around 70 % of the EU population lives in urban areas, and this share is expected to continue rising in the coming decades as urbanization progresses⁵. As more people move into densely populated cities, the limitations of car ownership become increasingly evident: congestion worsens, parking becomes scarce and expensive, and urban policies increasingly restrict car use through low-emission zones, congestion charges, and pedestrian-focused planning. At the same time, public transport networks, shared-mobility services, and micro-mobility options continue to expand.
 - **Slow uptake of new technologies.** The uptake of new technologies such as electric vehicles (EVs) and hydrogen-powered vehicles⁶ remains slower than anticipated. Despite clear policy ambitions and growing awareness of the need to decarbonize mobility, several structural barriers continue to hinder widespread adoption. High upfront costs, limited charging and refueling infrastructure, concerns about range and reliability, and uneven regional deployment all contribute to consumer hesitation. For electric vehicles, which have seen stronger growth, the pace of adoption is increasingly challenged by grid constraints in countries with congested or underdeveloped distribution networks, supply chain bottlenecks, and evolving incentive schemes. Together, these factors mean that, especially in certain areas, electric vehicle technologies are not scaling as rapidly as required to meet long-term climate and energy objectives.

⁴ European Parliament resolution of 12 December 2023 on reshaping the future framework of EU structural funds to support regions particularly affected by challenges related to the automotive, green and digital transitions (2023/2061(INI)). <https://eur-lex.europa.eu/eli/C/2024/4166/oj/eng>

⁵ European Commission. https://environment.ec.europa.eu/topics/urban-environment_en

⁶ Mohapatra P. (2025, October 31). Hydrogen-powered vehicles face a rough road. S&P Global. <https://www.spglobal.com/automotive-insights/en/blogs/2025/10/hydrogen-powered-vehicles-face-rough-road>

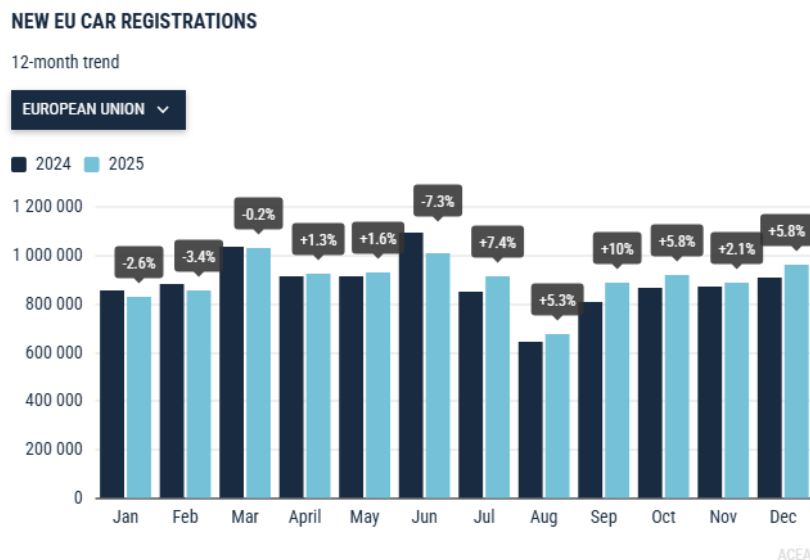
Outline of current EU statistics on cars and vans.

In 2025, new EU car registrations increased by 1.8% compared to the previous year, although total volumes remained below pre-pandemic levels.

By powertrain, electrified vehicles gained market share. Hybrid-electric cars accounted for 34.5% of new registrations, remaining the most registered power type in the EU. Battery-electric vehicles reached a market share of 17.4%, up from 13.6% in 2024, with 1.88 million units registered. Growth was recorded across the largest EU markets, including Germany, the Netherlands, Belgium and France. Plug-in hybrid registrations also increased, reaching just over 1 million units and a market share of 9.4%, compared to 7.2% the previous year, supported by strong growth in Spain, Italy and Germany.

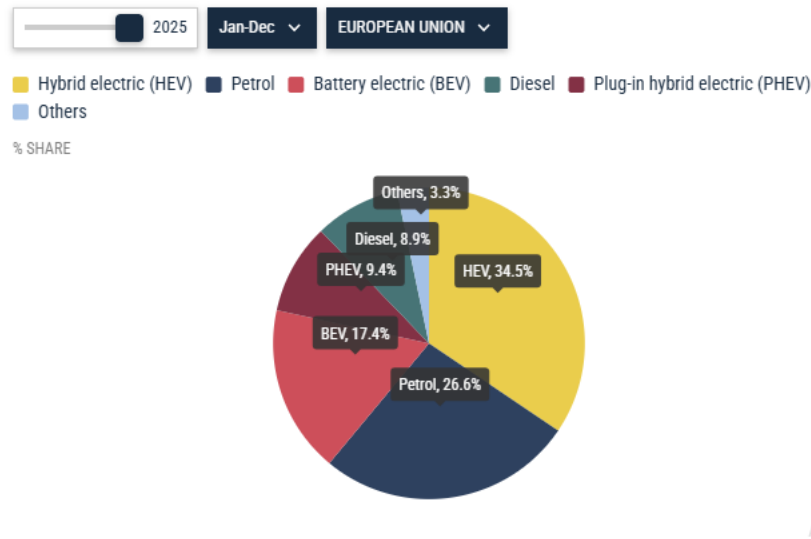
Combined, petrol and diesel cars represented 35.5% of new registrations in 2025, down from 45.2% in 2024. Petrol car registrations declined by 18.7% year on year, reducing their market share to 26.6%. Diesel registrations fell by 24.2%, accounting for 8.9% of the EU market.

End-of-year data showed continued growth in electric powertrains. In December 2025, year-on-year registrations increased by 51% for battery-electric vehicles and by 36.7% for plug-in hybrids, while hybrid-electric vehicles grew by 5.8%. Over the same period, petrol and diesel registrations declined by 19.2% and 22.4% respectively⁷.



⁷ ACEA. (2026, January 27). New car registrations. <https://www.acea.auto/pc-registrations/new-car-registrations-1-8-in-2025-battery-electric-17-4-market-share/>

NEW EU CAR REGISTRATIONS BY POWER SOURCE



ACEA, Latest passenger car registrations, 13-month trend⁸

○ **Public policy**

- **Climate change policies to meet Paris Agreement objectives:** The Paris Agreement commits signatories to limiting the increase in global average temperature to well below 2°C above pre-industrial levels, while pursuing efforts to cap warming at 1.5°C.
 - **CO₂ standards for cars and vans.** Within the European Union, the CO₂ emission standards for cars and vans regulation constitute the main regulatory tool to drive emissions reductions in the transport sector. These standards set progressively more stringent fleet-wide emission limits for manufacturers, in order to steer the market towards electrification and low-emission vehicles. While they aim to accelerate the uptake of electric vehicles, they also impose substantial compliance costs on manufacturers, particularly in a context of high capital expenditure requirements and technological transition.
 - At the same time, broader **climate and environmental policies have contributed to rising input costs across the automotive value chain.** Measures such as carbon pricing, environmental regulations, and sustainability requirements combined with geopolitical developments affecting energy markets have increased the cost of key raw materials and basic commodities, including steel, aluminum, and critical minerals. These cost pressures affect energy-intensive industries and add to the competitiveness challenges faced by EU-based manufacturers.

⁸ ACEA. (2026, January 27). New car registrations. <https://www.acea.auto/pc-registrations/new-car-registrations-1-8-in-2025-battery-electric-17-4-market-share/>

- **Less friendly public policies measures especially in cities: discourage automobiles, encourage public transportation.** Beyond regulatory and cost-related factors, public policy in many European cities and Member States has increasingly shifted towards reducing car use altogether. Policy measures aimed at discouraging private automobile use include low-emission zones, congestion charges, stricter parking regulations and pricing, reduced road space for cars, car-free or low-traffic neighborhoods, urban speed limits, and restrictions on access for certain vehicle categories. It is unclear whether public policy is leading or following public opinion and preferences but there is, especially in urban centers, a lifestyle that leads to support for public transport, shared mobility, bicycles and active travel.
- **Commercial challenges**
 - **Increase in international competition for domestic markets.** Chinese manufacturers, underpinned by long-term industrial policy, large-scale domestic demand and sustained public support for electric vehicles, are rapidly gaining market share in Europe, particularly in the EV segment⁹. China has built global leadership in new energy vehicles through decades of coordinated state intervention, including joint ventures designed to absorb foreign know-how, followed by massive subsidies and scale-driven cost reductions¹⁰. EU Original Equipment Manufacturer (OEMs) risk dependence on imported technologies notably in batteries, software and EV platforms and are transferring production to China through joint ventures¹¹. Overall, 80% of the growth in the automotive sector is expected to occur outside the EU¹². For example, in the first half of 2025, global vehicle production increased by 3.5%, reaching 37.7 million units. Asia accounted for the majority of output, with a 60.1% share, while the EU represented 15.9%. ¹³ The European automotive industry faces a growing risk of losing market share globally due to limited competitiveness in zero-emission vehicle technologies and production capabilities. A key bottleneck lies in critical components, particularly batteries, which represent 30-40% of the value-added in a typical electric passenger car. Europe's current production of battery cells remains small compared with Asia, leading to heavy reliance on imports and exposure to supply chain risks. This cost and capacity gap not only affects the pricing and profitability of European electric vehicles but also constrains the ability of EU Original

⁹ MIT Technology Review. (2024, September 23). Some countries are ending support for EVs. Is it too soon? MIT Technology Review. <https://www.technologyreview.com/2024/09/23/1104247/ending-ev-subsidies/>

¹⁰ Greeven, M., & Liu, S. (2024, January 26). China's automotive odyssey: From joint ventures to global EV dominance. I by IMD. <https://www.imd.org/ibyimd/innovation/chinas-automotive-odyssey-from-joint-ventures-to-global-ev-dominance/>

¹¹ Ibidem

¹² European Commission. https://single-market-economy.ec.europa.eu/sectors/automotive-industry_en

¹³ ACEA. (2025, September 24). Economic and Market Report Global and EU auto industry: First half 2025. <https://www.acea.auto/publication/economic-and-market-report-global-and-eu-auto-industry-first-half-of-2025/>

Equipment Manufacturers (OEMs) to scale production rapidly and compete effectively in global markets¹⁴.

- **Significant decrease in exports.** In 2024, export volumes fell across nearly all major destinations for EU vehicles. Sales to China saw the steepest drop, decreasing by 24.2%, while exports to Switzerland were down 11.9%. Deliveries to the United States declined by 6.2% and those to Türkiye by 5%. The United Kingdom registered a smaller reduction, with exports slipping by 2.2%. Similarly, in terms of export value, EU car exports also weakened in several key markets. Shipments to the United States fell by 4.6%, while China recorded the sharpest decline at 25.5%, reflecting intensifying competition from domestic manufacturers. Export values to Switzerland and Türkiye dropped by 9.9% and 7.6%, respectively. By contrast, the United Kingdom saw a modest increase of 2%, signaling steady demand for EU-produced vehicles¹⁵.
- **High energy prices resulting in increase in cost for steel, aluminum, and other metals.** Energy-intensive sectors that supply the automotive industry, particularly steel, aluminum, and other metals, continue to face disproportionately high gas and electricity prices in Europe, driving up production costs and eroding the competitiveness of EU-based supply chains. These persistent cost pressures are already translating into concrete industrial impacts, including production cuts, plant closures¹⁶ and a sharp decline in capacity utilization across the European steel sector.¹⁷ Additionally, increasingly stringent regulatory requirements as well as high and volatile energy prices have made new investments in primary, low-carbon production routes economically unattractive, delaying or cancelling decarbonization projects. Instead, parts of the industry are being pushed towards a growing reliance on secondary production through recycling, which, despite its importance, cannot on its own sustain Europe's manufacturing base or meet future demand from downstream sectors such as automotive¹⁸.
- **Availability of low-carbon energy.** The 2040 Climate Target Impact Assessment, projects that final electricity demand in the transport sector will grow eightfold between 2021 and 2040. In absolute terms, demand is expected to triple by 2030, rising from 60 TWh in 2021

¹⁴ European Commission (2025, March 3). Automotive Package. https://transport.ec.europa.eu/transport-themes/action-plan-future-automotive-sector/automotive-package_en

¹⁵ ACEA. (2025, March). Economic and Market Report Global and EU auto industry: Full year 2024 https://www.acea.auto/files/Economic_and_Market_Report-Full_year_2024-rev.pdf

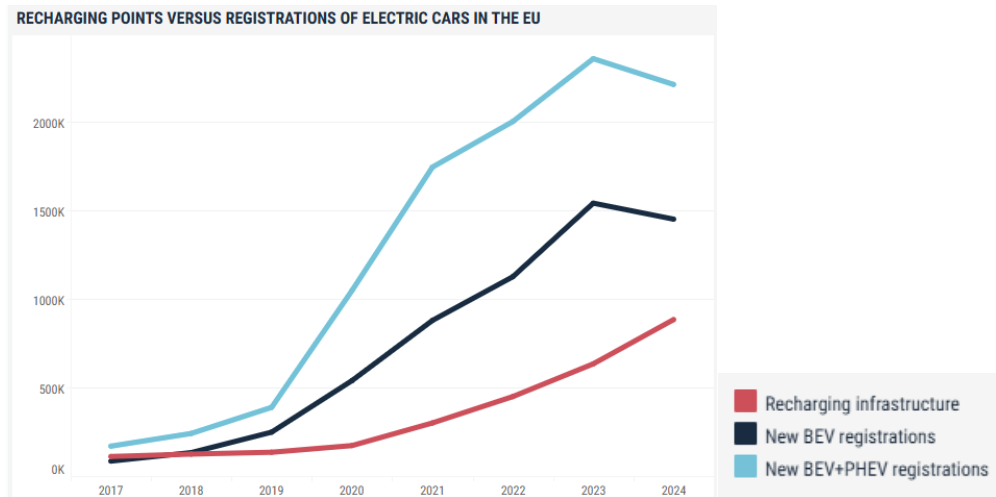
¹⁶ GMK Center. (2025, January 31). Norsk Hydro is closing a plant in Slovakia due to high electricity prices. <https://gmk.center/en/news/norsk-hydro-is-closing-a-plant-in-slovakia-due-to-high-electricity-prices/>

¹⁷ EUROFER. European steel industry on the brink: The EU must act now or risk losing manufacturing, warns. <https://www.eurofer.eu/press-releases/european-steel-industry-on-the-brink-the-eu-must-act-now-or-risk-losing-manufacturing-warns-eurofer>

¹⁸ Blenkinsop, P. (2023, December 18). EU sets critical mineral goals, but faces struggle to hit them. Reuters. <https://www.reuters.com/markets/commodities/eu-sets-critical-mineral-goals-faces-struggle-hit-them-2023-12-18/>

to 180 TWh, and then nearly triple again to around 505–510 TWh by 2040.¹⁹ It should be noted that the rapid rise of large data centers and AI installations is likely to cause big increases in electricity demand in areas where data center capacity is highly concentrated. There is a risk that in such contexts the supply of electricity for a growing fleet of electric cars will be from gas power generation, for some years beyond that originally expected unless accompanied by timely grid expansion, accelerated deployment of low-carbon energy generation, and demand-side flexibility measures.

- **Infrastructure development not at levels needed.** The infrastructure required for electrification and use of hydrogen is not in place and may be more challenging than generally accepted. It is not technologically difficult or new, but the sheer need is to a level that the resources and effort required as well as practical operationalization makes a great challenge if it is to be implemented at the scale of 100% non-liquid fuel in a short timeframe.



Source: ACEA²⁰

- Determining the contribution of each of these factors to where the industry is today, but the current situation is becoming untenable and is not sustainable. It must be recalled that the objective of the paper is to look into how to decarbonize industry. A few questions that should be asked:
 - Would removing the ban on ICE in 2035 change the situation and make it sustainable?
 - Is electrification the result of climate change needs, or has it become detached from that?
 - Are other issues, such as energy security in some countries making certain options more attractive for policy makers and consumers?

¹⁹ Eurelectric (2024, February). Europe's 2040 climate target & path to climate neutrality by 2050 Analysis of Commission communication and accompanying impact assessment. <https://www.eurelectric.org/wp-content/uploads/2024/06/2040-communication-impact-assessment-eurelectric-analysis.pdf>

²⁰ ACEA, <https://www.acea.auto/zero-emission-tracker/>

4. Policy options to meet Climate Change objectives

To achieve the objectives of the paper, that is to analyze how best to decarbonize transportation, this paper puts forward a few principles. Principles are routinely dismissed in today's polarized discussions as being sometimes "inconvenient, not aligned with current realities, impeding rapid progress towards a decarbonized world" – but they are essential if we are to make objective decisions that can be justified and, and at a future time.

Some of the principles we propose would include:

- **Objectives of the regulation and the role of the regulator.** The objective of climate change regulation is to ensure that environmental objectives are met, which can only be defined as deriving from Art 2 of the UNFCCC which clearly states "*stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.*" In a market economy it is not the role of the regulator to make economic choices for either the producer or the consumer. The regulator needs to focus on "what is to be achieved" and not "how", unless there is an acknowledged move to a centrally planned economy. How the regulator defines the objective of the regulation has direct implications on what can be defined as viable solutions to that regulation. In the case of vehicle standards, defining the objective of zero at tailpipe or LCA will automatically eliminate certain solutions which may or may not be viable economically.
- **Technology neutrality, market forces, consumer choice.** Climate regulation should be designed in a way that does not prescribe or privilege specific technologies but instead defines clear emissions objectives and allows different technological solutions to contribute to their achievement. A technology-neutral framework enables market forces to identify the most efficient and scalable decarbonization pathways across different sectors, use cases, and time horizons. By preserving consumer choice, such an approach recognizes that mobility needs, cost considerations, and infrastructure availability vary across regions and users. This principle supports innovation, competition, and investment by reducing regulatory lock-in and allowing solutions to evolve in response to technological progress, market maturity, and changing economic conditions. Some instruments such as the EU ETS should be technologically neutral. However, by not (for now) including CDRs in the EU ETS (or limiting their use) that neutrality is affected. By making the objective of vehicle standard zero at tailpipe, it effectively eliminates any solution that results in tailpipe emissions, even if that solution, coupled with other parts of their LCA, will result in same global net zero. If the issue is the feasibility of an LCA, that is a fair question, but then the debate is technical feasibility and not policy, and the regulator should not insert into it.

- **Contribution to EU climate change objectives and commitments.** Regulatory measures should be aligned with the European Union's climate targets and international commitments, such as the Paris Agreement. Each policy should be evaluated based on its ability to produce verifiable emissions reductions.
- **Ensure EU prosperity, reaching Climate Change objectives through decarbonization not deindustrialization.** Climate policies should aim to achieve reductions in emissions while safeguarding industrial competitiveness, economic growth, and employment within the EU. Effective regulations should support the modernization and decarbonization of strategic industries rather than imposing measures that risk plant closures, job losses, or relocation of production outside the EU. By combining environmental ambition with economic sustainability, policies can secure both climate and prosperity objectives.
- **Carbon accounting that shows a correct picture of the different options.** Accurate and comprehensive carbon accounting is essential to evaluate the effectiveness of different decarbonization strategies. Policies should embrace comprehensive lifecycle methodologies that account for emissions across the entire value chain, therefore including raw material extraction, manufacturing, use phase, and end-of-life processing. This provides a true picture of the climate impact of the options adopted and ensures that decisions are informed by reliable data, and that low-carbon solutions receive appropriate recognition, supporting environmental and economic efficiency.

4.1 Options for decarbonization of transport

- **What are the options for decarbonization of transport?**
 - **Electrification**
 - **Sustainable fuels**
- **Policies for decarbonization must consider not only the contribution of all options but also consider the measures that are needed to optimize the contribution of each option.** This includes providing clear and credible investment signals to guide private sector deployment, ensuring that adequate infrastructure is in place to support new technologies, and applying robust sustainability criteria to avoid unintended environmental trade-offs. Additionally, coordination across interconnected industrial sectors such as metals, battery materials, fuels, and energy systems is also essential, as the success of one sector often depends on the readiness and availability of inputs from another.
- **Current policies and new options need to be evaluated as per the principles enumerated above.**

4.1.1 Electrification

○ Policies

- The CO₂ Emissions Standards for Cars and Vans Regulation sets binding EU-fleet CO₂ targets for new passenger cars and vans (percentage reductions vs 2021), including the 2030 intermediate targets and the 2035 net-zero fleet target. This is the principal demand-pull instrument: by forcing manufacturers' fleet averages down, it effectively mandates rapid EV uptake.
- The Alternative Fuels Infrastructure Regulation (AFIR) provides binding deployment targets for public charging and refueling infrastructure across the TEN-T network (distance-based and power/aggregation requirements), plus national targets for publicly accessible charging. For example, AFIR requires progressively denser fast-charging coverage on the TEN-T core/comprehensive networks. AFIR is the EU's main supply-side policy for EV rollout.
- The Renewable Energy Directive (RED) requires that basic battery and EV data such as state of charge, state of health, and capacity are being made available in real time. Manufacturers are obligated to provide these information to battery owners, users, and third parties on a non-discriminatory basis and at no cost (Article 20a²¹).
- The EU Battery Regulation introduces EU-wide rules on battery sustainability, traceability and waste: e.g. the Battery Passport / digital product passport, carbon footprint rules, information obligations, mandatory recycling & recovery efficiency targets, and (phased) minimum recycled-content thresholds for metals used in batteries. These rules affect EV producers, battery makers and recyclers and aim to secure clean, circular battery supply chains.
- The Energy Performance of Buildings Directive (EPBD) requires that new and renovated buildings include pre-cabling and recharging points for EVs to support smart and, where appropriate, bidirectional charging. For non-residential buildings, the Directive sets minimum ratios of recharging points and pre-cabling based on the number of parking spaces. For residential buildings, pre-cabling must cover at least 50 % of parking spaces, with at least one recharging point in new buildings. Member States must ensure that recharging points follow interoperable, non-proprietary standards and remove administrative and regulatory barriers to installation, including tenant or co-owner approvals. Implementation timelines differ depending on building type, ownership, and renovation status, and support schemes may be introduced to facilitate installation. (Article 14)²².

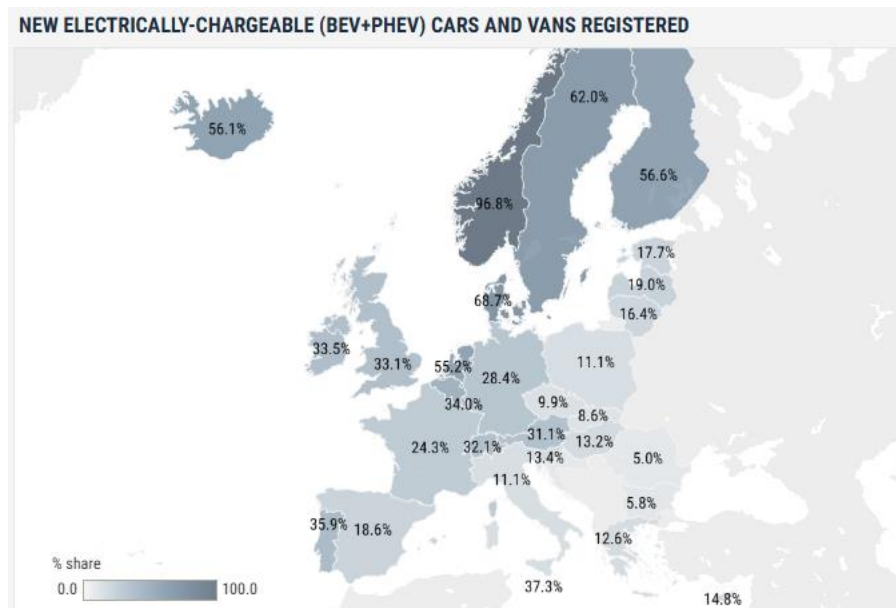
²¹ EUR-Lex. Directive (Eu) 2023/2413 Of The European Parliament And Of The Council of 18 October 2023. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023L2413&qid=1699364355105>

²² EUR-Lex. Directive (Eu) 2024/1275 of the European Parliament and of the Council of 24 April 2024. <https://eur-lex.europa.eu/eli/dir/2024/1275/oj/eng>

○ Challenges

- Large-scale BEV deployment creates acute demand for lithium, nickel, cobalt, and graphite, exposing the EU to supply and geopolitical risks despite mitigation efforts under the Critical Raw Materials Act and the Battery Regulation.
- Rapid EV penetration increases peak loads and local congestion, requiring major grid upgrades and smart-charging systems not fully addressed by AFIR.
- Battery production is energy-intensive; life-cycle assessments show substantial upstream CO₂ emissions, especially if cell fabrication uses non-renewable power.
- Upfront costs and uneven charger access disadvantage lower-income and urban-apartment users, challenging equitable compliance with fleet targets.
- The reality of what needs to be put in place for feeding chargers is enormous and simply not an accepted barrier. It can be done, there is little from a technological point of view that needs to be put in place and is unknown, the practicality of it is simply way beyond what can be achieved.

Currently, the share of battery electric vehicles and plug-in hybrid electric vehicles in the total vehicle fleet varies across EU countries, with Denmark, Sweden, Finland, and the Netherlands recording the highest adoption rates.



Source: ACEA²³

○ Pros & Options

- Direct electrification is undoubtedly the dominant and most cost-effective decarbonization strategy for light-duty vehicles (LDVs) which maximizes energy efficiency and delivers the largest emissions reductions per unit of clean energy used. However, rather than imposing

²³ ACEA. <https://www.acea.auto/zero-emission-tracker/>

bans on alternative technologies, efforts should be concentrated on enhancing grid capacity and flexibility through digitalization and intelligent network management to reduce overall system costs and support a higher share of electrified transport, facilitating cost-effective scaling of EVs. This digital integration supports smart charging, demand-response, and vehicle-to-grid (V2G) technologies, which can balance grid load dynamically and reduce peak demand costs enabling energy use optimization and integrating higher shares of low-carbon electricity.

- By leveraging EV batteries as flexible grid assets, grid operators can improve overall system efficiency, while also creating opportunities for vehicle owners to participate in energy markets, monetize stored energy, and enhance the resilience of local grids.
- Geography and settlement density also matter for charging deployment and grid impacts. In less densely populated and rural areas, EV charging can often be deployed more easily, with greater space availability and lower local grid congestion, allowing for managed home and depot charging. In contrast, densely populated urban areas face sharper constraints related to limited space, higher peak demand, and stressed distribution networks, making smart charging, load management, and coordinated infrastructure planning essential to avoid costly grid reinforcements.

4.1.2 Sustainable fuels (biofuels and e-fuels)

a) E-fuels/ synthetic fuels

- **Policies:** The EU's regulatory framework for synthetic fuels (referred to as Renewable Fuels of Non-Biological Origin (RFNBOs), including e-fuels and PtX derivatives) is defined by the Renewable Energy Directive (RED) and the two Delegated Regulations adopted in 2023, which set out detailed rules on production, accounting, and certification. Key policy elements include:
 - RED III raises the 2030 ambition for renewables in transport and introduces a combined 5.5% sub-target for advanced biofuels and RFNBOs. Member States may choose either to reach 29% renewables in transport by 2030 or to achieve a 14.5% reduction in GHG intensity of transport fuels²⁴.
Article 25 specifies that by 2030, hydrogen and e-fuels must account for at least 1% of all fuels used in the transport sector. To stimulate uptake, RED III also introduces multipliers: every 1 MJ of RFNBOs counts as 2 MJ toward compliance. In aviation and maritime, RFNBOs receive an additional 1.5× multiplier²⁵.
 - 2023 Delegated Regulations:
 - (i) Delegated Act setting the conditions under which RFNBOs can be counted as renewable.

²⁴ EUR-Lex. Directive (EU) 2023/2413 of 18 October 2023. <https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng>

²⁵ *ibidem*

It requires that the electricity used for RFNBO production is “additional” (i.e., new renewable capacity built for this purpose) and that producers meet temporal correlation (matching production with periods of renewable generation) and geographical correlation (production located within the same bidding zone or interconnected area) requirements²⁶.

- (ii) Delegated Act providing the GHG-emissions accounting methodology for RFNBOs. It establishes how emissions are calculated across the entire value chain and how GHG savings are determined²⁷.

- **Pros:** E-fuels offer significant potential for reducing greenhouse gas emissions. Although CO₂ is released when they are combusted, CO₂ is also captured and reused during their production, which allows their use to be considered largely carbon neutral. When assessed across their full lifecycle, e-fuels can achieve GHG savings of up to around 90% compared with conventional fossil fuels, though the exact level depends on the origin of the feedstock, the energy sources involved, and whether carbon capture and storage is used. Another key advantage of e-fuels is their strong compatibility with existing fuel systems and infrastructure. Many of them function as “drop-in” fuels, meaning they are chemically very close to traditional fossil fuels.

- **Challenges**

- Synthetic fuels remain several times more expensive than direct supply of electricity and their production cost is 4-5x higher than fossil fuels, requiring heavy and sustained subsidies. This is mainly driven by the high cost of green hydrogen production, as well as the CAPEX of e-fuels technologies and equipment.
- Power-to-liquid (PtL) and power-to-gas (PtG) pathways that are considered by RED part of RFNBOs, convert renewable electricity into liquid or gas fuels through multiple energy conversion steps, resulting in relatively low well-to-wheel efficiency of about 10–15%. In contrast, BEVs have much higher well-to-wheel efficiency, typically around 70–80%, because electricity is used more directly to power the vehicle. This substantial difference makes the large-scale use of PtL/g fuels in LDVs -inefficient compared to BEVs, which is why BEVs are often favored for decarbonizing road transport where direct electrification is feasible.
- Overall, e-fuels represent a more efficient decarbonization pathway for aviation, where other decarbonization pathways are limited and direct electrification is not viable for medium- and long-haul flights due to fundamental constraints related to battery energy density, aircraft weight, and range requirements.

- **Options:** the E-Fuels Alliance suggests introducing a Carbon Correction Factor (CCF) to reflect the CO₂ savings delivered by renewable fuels. A strict Tank-to-Wheel approach does not

²⁶ EUR-Lex. Commission Delegated Regulation (EU) 2023/1185 of 10 February 2023. https://eur-lex.europa.eu/eli/reg_del/2023/1185/oj/eng

²⁷ EUR-Lex. Commission Delegated Regulation (EU) 2023/1184

of 10 February 2023.

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1184&qid=1704969010792>

differentiate between fossil and renewable or low-carbon fuel origins and therefore fails to acknowledge the growing share of low-carbon fuels in the EU fuel mix. A CCF would adjust manufacturers' CO₂ targets by accounting for the proportion of low-carbon fuels and their associated GHG savings, reducing the calculated tailpipe emissions used for compliance. This approach recognizes that real CO₂ performance depends not only on vehicle technology and efficiency, but also on the decarbonization of the fuel mix, something current legislation overlooks despite requirements under the Renewable Energy Directive²⁸.

b) Biofuels

- **Policies:** The EU's policy framework for biofuels is primarily defined by the Renewable Energy Directive (RED II, RED III and their Delegated Acts). Together, these Directives set sustainability rules, feedstock limits, and renewable energy targets that determine how biofuels can contribute to decarbonization.
 - As mentioned for e-fuels, by 2030, Member States must either achieve 29% renewable energy in transport or a 14.5% reduction in GHG intensity. RED III also establishes a 5.5% combined sub-target for advanced biofuels and RFNBOs. A Methodology to determine the share of biofuel and biogas for transport, produced from biomass being processed with fossil fuels in a common process has been established by the Delegated Regulation (EU/2023/1640) adopted in June 2023²⁹.
 - Article 29 RED II sets out the sustainability and greenhouse gas (GHG) emission saving criteria for biofuels and bioliquids and includes limitations on feedstocks associated with high indirect land-use change (ILUC) risks, particularly where crops can displace food or feed production³⁰. To manage these risks, RED II introduced a cap on high ILUC-risk biofuels and requires their gradual phase-out by 2030 (Article 26)³¹.
 - Annex IX of the RED III identifies advanced biofuels as fuels made from non-food feedstocks such as waste, agricultural residues, or algae that deliver substantially lower lifecycle GHG emissions (typically at least 50% less than fossil fuels). Advanced biofuels made from feedstocks listed in Part A of the RED Annex IX are eligible for double-counting towards transport targets. Additionally, Article 25 requires EU Member States to ensure that these advanced biofuels and biogas (from Annex IX Part A feedstocks) reach minimum shares in transport energy consumption³².

²⁸ Renewable fuels for cars. <https://www.renewable-fuels-for-cars.eu/>

²⁹ EUR-Lex. Directive (Eu) 2023/2413 Of The European Parliament And Of The Council of 18 October 2023. <https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng>

³⁰ EUR-Lex. Delegated Regulation (EU) 2019/807 of 13 March 2019. https://eur-lex.europa.eu/eli/reg_del/2019/807/oj/eng

³¹ RED II also includes “no-go” areas for which public support to biofuels is not allowed, mainly to preserve primary forests, highly biodiverse areas, wetlands and protected areas

³² Publications Office of the EU (2024) Clean Energy Technology Observatory, Advanced biofuels in the European Union

- The Directive foresaw a Union Database for biofuel to ensure full traceability and prevent double counting. It records every consignment of renewable and recycled carbon fuels placed on the EU market, from raw material origin to final consumption.
- Finally, under Implementing Regulation 2018/2066 on the monitoring and reporting of greenhouse gas emissions, biofuels and biomethane that comply with EU sustainability criteria are counted as zero-rated within the EU Emissions Trading System³³. Therefore, when compliant, their use is treated as having a zero-emission factor.

○ **Pros:**

- Biofuels can be produced from a wide range of sustainable feedstocks (wastes, residues, sewage sludge, forestry/agricultural residues), improving resource efficiency and enabling circular economy approaches.
- Advanced biofuels mitigate risks of indirect land-use change (ILUC) by utilizing waste streams or biomass from marginal lands, avoiding competition with food production and ecosystem degradation. Empirical studies confirm that waste-based biodiesel can reduce lifecycle emissions by 74–86%, while biofuels coupled with CCU can approach near-zero carbon intensity³⁴.
- Biofuels, such as biomethane, are fully compatible with existing fuel infrastructure, distribution networks and internal combustion engines. As a result, they can be deployed at scale without requiring additional investments or retrofitting of vehicles, refueling infrastructure or transport modes.

○ **Challenges**

- Biofuel expansion is capped by land-use and ILUC limits in RED II/III, restricting available supply. By contrast, advanced biofuels, including biomethane, produced from feedstocks listed in Annex IX Part A and Part B are not subject to these land-use caps and directly contribute to renewable energy targets in transport. However, according to IEA's Net Zero Scenario, biofuels from advanced feedstocks (waste, residues, non-food crops) would meet around 40 % of total biofuel demand by 2030³⁵.
- High production costs and limited commercial maturity persist for many advanced conversion pathways such as cellulosic ethanol, advanced biodiesel, biomass-to-liquids fuels. Capital expenditure, technology risk and financing challenges slow deployment compared to fossil

<https://op.europa.eu/en/publication-detail/-/publication/f70a757a-a7bd-11ef-acb1-01aa75ed71a1/language-en>

³³ EUR-Lex. Commission Implementing Regulation (EU) 2018/2066

of 19 December 2018. https://eur-lex.europa.eu/eli/reg_impl/2018/2066/oj/eng

³⁴ JRC (2024, November 20) [Clean Energy Technology Observatory: Advanced Biofuels in the European Union - 2024 Status Report on Technology Development, Trends, Value Chains and Markets](https://publications.jrc.ec.europa.eu/repository/handle/JRC139335)
<https://publications.jrc.ec.europa.eu/repository/handle/JRC139335>

³⁵ IEA Bioenergy (2024, December). Development and Deployment of advanced biofuel demonstration

facilities. <https://www.ieabioenergy.com/wp-content/uploads/2025/02/IEA-Report-T39-T4-Development-and-Deployment-of-advanced-biofuel-demonstration-facilities-2024.pdf>

fuels and other low-carbon alternatives. Additionally, collection, pre-treatment and logistics add significant complexity. Gathering dispersed low-density biomass entails higher transport costs, energy use, and emissions, which can erode lifecycle GHG benefits and hinder scalability.

- **Options:** FuelsEurope³⁶, European Biogas Association (EBA) and other stakeholders³⁷ advocate for the introduction of a Carbon Correction Factor (CCF) in the CO₂ emissions standards. A CCF could remain in place while CO₂-neutral fuel production expands and a dedicated vehicle class is established. This mechanism would adjust the emissions attributed according to the share of low-carbon fuels present in the overall energy mix.³⁸ Overall, a CCF would reflect real emissions, drive investment in low-carbon fuel production, and incentivize operators and off-takers to use biomethane, bioLPG, Hydrotreated Vegetable Oil (HVO) and other biofuels without undermining the overall climate targets.

The EU Commission recently published two new proposals that introduce provisions relevant for the automotive industry. Section 5 and 6 will provide an overview and an assessment of those proposals.

5. EU Commission proposal – CO₂ emissions standards for cars and vans³⁹

³⁶ FuelsEurope (2025, November 20) <https://www.fuelseurope.eu/publications/publications/anchoring-renewable-fuels-in-the-co2-regulation-for-passenger-cars-and-light-commercial-vehicles>

³⁷ Eurogas, German association of the Automotive Industry (VDA), Confindustria

³⁸ European Biogas Association (2025, October 7) EBA response to the Call for Evidence for the Revision of the CO₂ emission standards for cars and vans regulation [https://www.europeanbiogas.eu/wp-content/uploads/2025/10/EBA-Call-for-evidence-for-a-revision-of-the-CO₂-emission-standards-for-cars-and-vans-regulation.pdf](https://www.europeanbiogas.eu/wp-content/uploads/2025/10/EBA-Call-for-evidence-for-a-revision-of-the-CO2-emission-standards-for-cars-and-vans-regulation.pdf)

³⁹ European Commission (2025, March 3). Automotive Package. https://transport.ec.europa.eu/transport-themes/action-plan-future-automotive-sector/automotive-package_en

Road transport currently accounts for around one quarter of the EU's total greenhouse gas emissions. On December 16, 2025, the European Commission released the Automotive Package aimed at supporting the automotive sector in its transition towards decarbonization⁴⁰. This Package foresees a revision of the existing CO₂ emission standards for cars and vans.

From 2035 onwards, carmakers will need to comply with a 90% tailpipe emissions reduction target compared to 2021, while the remaining 10% emissions will need to be compensated through two compensation mechanisms counting the use of low-carbon steel made in the Union and the actual emissions savings from e-fuels and biofuels put on the market during a specific year. This is not a ban of the ICE per se but rather a mandate based on a specific accounting methodology from 2035 onwards⁴¹.

- **Sustainable fuels (article 5a):** will contribute to the decarbonization of road transport. Eligible fuels are renewable fuels of non-biological origin (RFNBOs), biofuels, and biogas, as defined in Directive (EU) 2018/2001 (RED II). RFNBOs must meet the sustainability and GHG savings criteria set out in Article 29a of RED II. Biofuels and biogas must be produced from feedstocks listed in RED II Annex IX and must meet the sustainability criteria set out in Article 29⁴². Reductions achieved through their use are recognized as fuel credits for vehicle manufacturers, which can be used to offset the tailpipe emissions of their fleets. These fuel credits can contribute up to 3% of the 2021 reference target.
 - **Fuel credits:** for each fuel compliant with article 5a, the energy amount brought into market for the road transport sector and registered in the Union Database (Q_{fuel}) shall be multiplied with GHG savings in comparison to the RED fossil fuel comparator, number of new vehicles registered and mileage. Date shall be taken from two calendar years prior. The mileage is 240,000 km for cars and 300,000 km for vans.

$$Q_{fuel} * GHGsavings * \frac{fuelsharevans}{newvans * mileage}$$

- **Low-carbon steel (article 5b):** Vehicle manufacturers may offset part of their vehicles' CO₂ emissions by claiming credits for the use of low-carbon steel produced within the EU in their manufacturing processes. These low-carbon steel credits can contribute up to 7% of the 2021 reference targets. This mechanism has been designed to encourage the uptake of low-carbon steel in automotive production and to support the development of a lead market for low-carbon steel within the Union⁴³.

⁴⁰ European Commission (2025, March 3). Automotive Package. https://transport.ec.europa.eu/transport-themes/action-plan-future-automotive-sector/automotive-package_en

⁴¹ European Commission (2025, December 16). CO₂ emission performance standards for cars and vans. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025PC0995>

⁴² ibidem

⁴³ ibidem

- **Low carbon steel credits:** To calculate the low-carbon steel credits, low carbon steel GHG savings per tonne⁴⁴ are multiplied by the total quantity of eligible low-carbon steel made in the EU used by the manufacturer in light commercial vehicles in the calendar year. This value is then divided by the total lifetime mileage of the manufacturer's newly registered light commercial vehicles, calculated as the number of new vehicles multiplied by the average lifetime mileage of the vehicle.

$$\text{Low-carbon steel credits} = \text{GHG savings}_{\text{low-carbon steel}} [\text{kg CO}_2/\text{t steel}] * \text{quantity of low carbon steel made in the EU used in light commercial vehicles by the manufacturer in the calendar year [t]} / (\text{new vans} * \text{mileage})$$

For the period leading up to 2035, the proposal revises the 2030 CO₂ emissions reduction target, lowering it from 50% to 40%. It also introduces additional flexibility for car manufacturers in meeting CO₂ standards by adjusting how small, affordable electric vehicles produced in the EU are accounted for. Through the use of “super credits,” (article 5) each such vehicle will be weighted as 1.3 instead of 1 for compliance purposes for the years prior to 2035, thereby encouraging the domestic production of smaller EVs. In addition, a multiannual compliance mechanism, commonly referred to as “banking and borrowing”, is provided for the 2030 -2032 period, allowing manufacturers to offset underperformance in one year with overachievement in another within the same timeframe.

5.1 Assessment

Although the package represents a move in the right direction, acknowledging both the general trajectory and the significance of electrification, it remains only a modest step. While the EU Commission proposal allows 10% of emissions to be offset through compensation mechanisms, the fundamentals of the proposal remains unchanged, as it continues to rely on a tailpipe-emissions approach. Moreover, the rationale for setting the threshold at 10% is unclear and would benefit from a stronger justification, particularly when higher shares could also be considered. What is truly required is a sustained effort that embraces technological neutrality and allows different solutions to coexist, guided by the economic efficiency of achieving environmental goals. This transition must be genuinely sustainable.

The overall target of 10% is negligible, and 3% will not provide a meaningful incentive for investments in sustainable fuels. This is a minimal adjustment that may give the appearance of action but will have limited real impact.

On a positive note, highlighting low-carbon steel will likely boost its adoption in automotive manufacturing. A typical car contains around 900 kg of steel, the production of which generates

⁴⁴ The GHG savings of low-carbon steel are calculated as the difference between the CO₂ emission intensity of the baseline steel and the average CO₂ emission intensity of the low-carbon steel made in the EU and used by a manufacturer in light commercial vehicles, expressed in kg CO₂ per tonne of steel in the calendar year

approximately 1.4 tonnes of CO₂⁴⁵. With EU ETS carbon prices hovering around €90 per tonne, the current signal remains insufficient to bridge the cost gap between conventional and green steel production⁴⁶. In this context, establishing a lead market for its production in Europe, is highly significant⁴⁷. However, there is no reason this focus should be limited to steel, as other materials such as aluminium and plastics⁴⁸ are playing an increasingly important role in automotive components⁴⁹.

Regarding biofuels, it should be noted that only advanced biofuels (produced from feedstocks listed in Annex IX of RED II) are allowed from 2035.

Affordability and consumer impacts must also be carefully considered. Compliance costs associated with new regulatory requirements, whether stemming from vehicle technologies, the use of low-carbon materials, or alternative fuels, are likely to be reflected, at least in part, in vehicle prices. Higher upfront costs could affect purchasing decisions, slow fleet renewal, and influence the pace at which emissions reductions are realized. These effects may be unevenly distributed across consumers, with potential implications for households and small businesses that rely on private transport. Integrating affordability considerations into the regulatory framework, alongside appropriate supporting measures, could help ensure that the transition remains economically balanced while maintaining its environmental objectives.

Equally important is the need to ensure a just transition for workers and communities affected by the shift to low-carbon technologies. This includes the need for upskilling and reskilling initiatives to equip the workforce with the capabilities required for emerging industries, such as sustainable steel production, battery manufacturing, and electric vehicles technologies.

⁴⁵ Negri, M., Bui, A., Ordonez, Y., Bieker, G., & Isenstadt, A. (2024, September 18). Which automakers are shifting to green steel? An analysis of steel supply chains and future commitments to fossil-free steel. International Council on Clean Transportation. Retrieved from <https://theicct.org/major-automakers-in-the-red-when-it-comes-to-using-green-steel/>

⁴⁶ GMK Center. (2023, September 26). “Green steel” premium: to pay or not to pay. GMK Center. Retrieved from <https://gmk.center/en/posts/green-steel-premium-to-pay-or-not-to-pay/>

⁴⁷ ERCST, in its February 2025 Reflection Note entitled, “*Road transport decarbonization: innovative policy approaches for competitiveness and investment*,” proposed just the adoption of such approach, which would give credit towards reaching car standards through the use of EU low carbon products. On average, a passenger car contains around 900 kg of steel, the production of which results in approximately 1.4 tonnes of CO₂ emissions. With carbon prices under the EU ETS hovering around €90 per tonne, widely regarded as insufficient to bridge the cost gap of green steel production, crediting these emission reductions under vehicle CO₂ regulation could prove more cost-effective than compliance penalties, while delivering tangible environmental benefits.

⁴⁸ E.g. Nylon.

⁴⁹ Thanks to relatively transparent supply chains, it should be feasible to ensure robust monitoring, reporting and verification of their actual carbon intensity.

6. EU Commission proposal – Industrial Accelerator Act

On March 4th, 2026 the EU Commission adopted its legislative proposal⁵⁰ for an Industrial Accelerator Act (IAA)⁵¹ which contains provisions relevant for the automotive industry. Notably, the Act is designed to complement the Automotive Action Plan and the Automotive Package adopted in December 2025. Therefore, the IAA contains a set of provisions aimed at strengthening the competitiveness and resilience of the European automotive industry and supporting its transition to low-carbon production.

- A central element of the automotive provisions concerns the use of low-carbon materials in vehicles, particularly steel. Article 10 of the IAA establishes that a product listed in Annex II (such as steel) is considered low-carbon if it complies with requirements defined in delegated acts under relevant EU legislation, notably the Construction Products Regulation and the Ecodesign framework. The Commission is also empowered to adopt Delegated Acts to create voluntary classification systems based on greenhouse gas intensity for certain industrial products placed on the EU market, with verified emissions data and clear methodologies for calculating and classifying products according to their carbon performance⁵².
- The Act prioritizes sectors such as construction and automotive when establishing low-carbon or Union-origin requirements for energy-intensive inputs like steel, cement, and aluminum. Public procurement procedures launched after 1 January 2029 must require minimum shares of low-carbon materials, for example at least 25% low-carbon steel and 25% low-carbon aluminum, when such materials are used in products including motor vehicles and infrastructure⁵³.

⁵⁰ EU Commission Press corner https://ec.europa.eu/commission/presscorner/detail/en/ip_26_515

⁵¹ The act establishes a Union-wide framework aimed at strengthening the European industrial base in response to the challenges of climate change, increasing geopolitical competition, and concerns over economic security. Its core objective is to ensure that the production of critical industrial goods and net-zero technologies remains within the EU, rather than relocating abroad due to cost pressures or foreign subsidies. At the same time, the Act seeks to accelerate the decarbonization of energy-intensive industries, aligning industrial competitiveness with the EU's climate neutrality goals while reducing risks such as carbon leakage. The IAA also aims to boost economic growth and employment by increasing the contribution of manufacturing to the EU economy, targeting a rise in the sector's share of EU GDP from 14.3% in 2024 to 20% by 2035. Another key objective is to create lead markets for low-carbon products as well as reduce strategic dependencies on third countries in critical industrial value chains, particularly where supply is highly concentrated outside the EU. To reach these goals, the IAA strives to simplify, streamline, and digitalize permitting procedures, create lead markets for low-carbon products, establish "Made in EU" requirements in public procurement and support schemes, set certain conditions for major foreign direct investments, boost sustainable manufacturing by introducing the concept of Industrial Acceleration Areas, cluster strategic industrial projects, foster industrial symbiosis, strengthen EU value chains, and provide aggregated baseline permits to streamline authorizations.

⁵² The methodologies for calculating greenhouse gas intensity shall rely on established emissions-accounting frameworks and data already available under the EU ETS and CBAM.

⁵³ European Commission (2026, March 4). Industrial Accelerator Act. https://single-market-economy.ec.europa.eu/publications/industrial-accelerator-act_en#details

- The IAA introduces “Made in the European Union” / Union-origin requirements. These rules apply particularly to electric vehicles (pure electric, plug-in hybrid, and fuel-cell vehicles) benefiting from public procurement procedures. To qualify, the vehicle must (i) be assembled in the EU, (ii) at least 70% of the value of its components (excluding the battery) must originate in the EU, (iii) and the traction battery must contain at least three key components produced in the EU, including the battery cells. Three years after the publication of the IAA, a 50% threshold for critical components originating in the Union is to be implemented (Annex III IAA). Similar Union-origin requirements apply to vehicles receiving public financial support for corporate fleets, ensuring that public intervention supports EU-based manufacturing. When it comes to the possibility for small zero-emission vehicles to earn “super credits” under EU vehicle CO₂ emission performance standards, Annex III of the IAA defines the criteria to be eligible for such credits. To qualify as “made in the EU,” a vehicle must be assembled in the Union and meet one of two additional conditions: either at least 70% of the value of its non-battery components originates in the EU, or its traction battery contains at least three key components produced in the EU, including the battery cells.

6.1 Assessment

The Industrial Accelerator Act is yet another industrial policy initiative introduced by the EU and overall goes in the right direction. While industrial policy inherently implies a degree of market intervention, it reflects a broader global trend: governments across the world are increasingly supporting strategic sectors. In this sense, the EU is not acting in isolation. However, this raises questions, as it appears to move away from the principles of a free market and an open global economy that the EU has traditionally promoted.

This is not, in principle, what the EU should stand for. Nevertheless, given that other major economies are pursuing similar approaches, failing to act could put European industry at a competitive disadvantage. The IAA can therefore be seen as a necessary measure. While it may deliver results in the short term, its longer-term consequences remain uncertain.

The Act also introduces additional criteria and standards, and measures on the demand side. Given the range of EU policies already in place on the supply side, creating demand for low-carbon products is necessary to ensure that these frameworks translate into real market uptake.

At the same time, the impact of imposing such demand remains unclear. While it is likely to support the deployment of low-carbon products, it may also introduce additional costs. For example, the “Made in the EU” / Union-origin requirements strengthen domestic manufacturing and reduce strategic dependencies on non-EU suppliers. However, the Act’s preference for EU-sourced components in cars could also increase production costs and disrupt global supply chains that the automotive industry has built over decades. Balancing the promotion of EU-based production with the efficiency of integrated international supply chains will be critical to avoid unintended consequences.

7. Takeaways

There are a number of overall takeaways that we can highlight:

- Electrification, especially from low-carbon and renewable sources, has a clear advantage for climate impact, for intrinsic co-benefits such as clean air, noise pollution, the inherent efficiency of electric powertrains, and also falling costs of power generation from wind and photovoltaic solar sources. This is a clear direction of travel and market forces are likely to embrace electrification for a majority of road transport applications. But where a choice is possible for manufacturers and customers/users, other innovative alternatives could emerge where cost-effective.
- Certain sectors are still technologically challenged in moving from molecules to electrons, e.g. aviation and maritime. Competitive solutions may develop differently across markets depending on technological readiness, cost-effectiveness, and customer preferences.
- While electrification is likely to dominate in the road sector, the main challenges need to be recognized: public/customer/user take-up issues linked to charging infrastructure and costs. Also, availability of low-carbon energy in the face of increasing electricity demand from the overall increase in electrification, in some jurisdictions. These challenges are real, and the pace of the transition cannot be separated from the KPIs related to the success in meeting these two challenges. It may lead to promises that we cannot keep to the population in need of transportation.
- To ensure a sustainable transition all options need to be kept on the table in a manner commensurate with the real speed of decarbonization, the different technologies used, appropriate for different applications, and market adoption of these technologies. For illustration purposes, aviation (especially long-haul flights, heavy cargo) and military will continue to utilize molecules, and biofuels and synthetic (e-fuels) are likely to provide the needed solutions. So far, aviation and maritime policies have mostly failed to support e-fuel and advanced biofuels project investment. This is a missed opportunity. The fuels industry has consistently stated that enduring demand from road transport is necessary to support of development of these high-technology-risk projects.
- Enabling flexibility for the sustainable transition, such as crediting for low carbon materials, can also provide a good impulse to help launch markets for low carbon products. As well as steel, other sectors such as aluminum and plastics may benefit from comparable mechanisms, encouraging investment, innovation, and the scaling of low-carbon solutions across a wider range of materials.
- The steps that are being taken need to be decisive and clear, as they will give signals to both consumers and producers. Flexibility needs to be meaningful and enduring, as temporary measures are not investable. Overall direction needs to be clear, with environmental targets, but with the how left to the producer and customer. Technology neutrality is now enshrined in the Climate Law and letting markets and innovators respond to these signals will ensure efficient, scalable, and timely decarbonization.

- The outcome that matters is the concentration of CO₂ in the atmosphere, which as a matter of policy should require that all regulation is based on LCA principles, not one that relies on a narrow methodology pre-determining a single technology. This aligns with the objectives of the Paris Agreement, which focuses on limiting global temperature rise rather than prescribing specific technologies, emphasizing that policy should prioritize effective emissions reductions while allowing flexibility in how different sectors achieve decarbonization. It is also consistent with the “Net-Zero” objective of the green deal as this simple expression describes a LCA methodology.
- The Industrial Accelerator Act introduces new elements in the EU regulatory framework. While creating demand for low carbon products is necessary to complement existing policies, it may also increase costs, and its long-term effects remain uncertain.