New Direction

A TWO SPEED EUROPEAN UNION

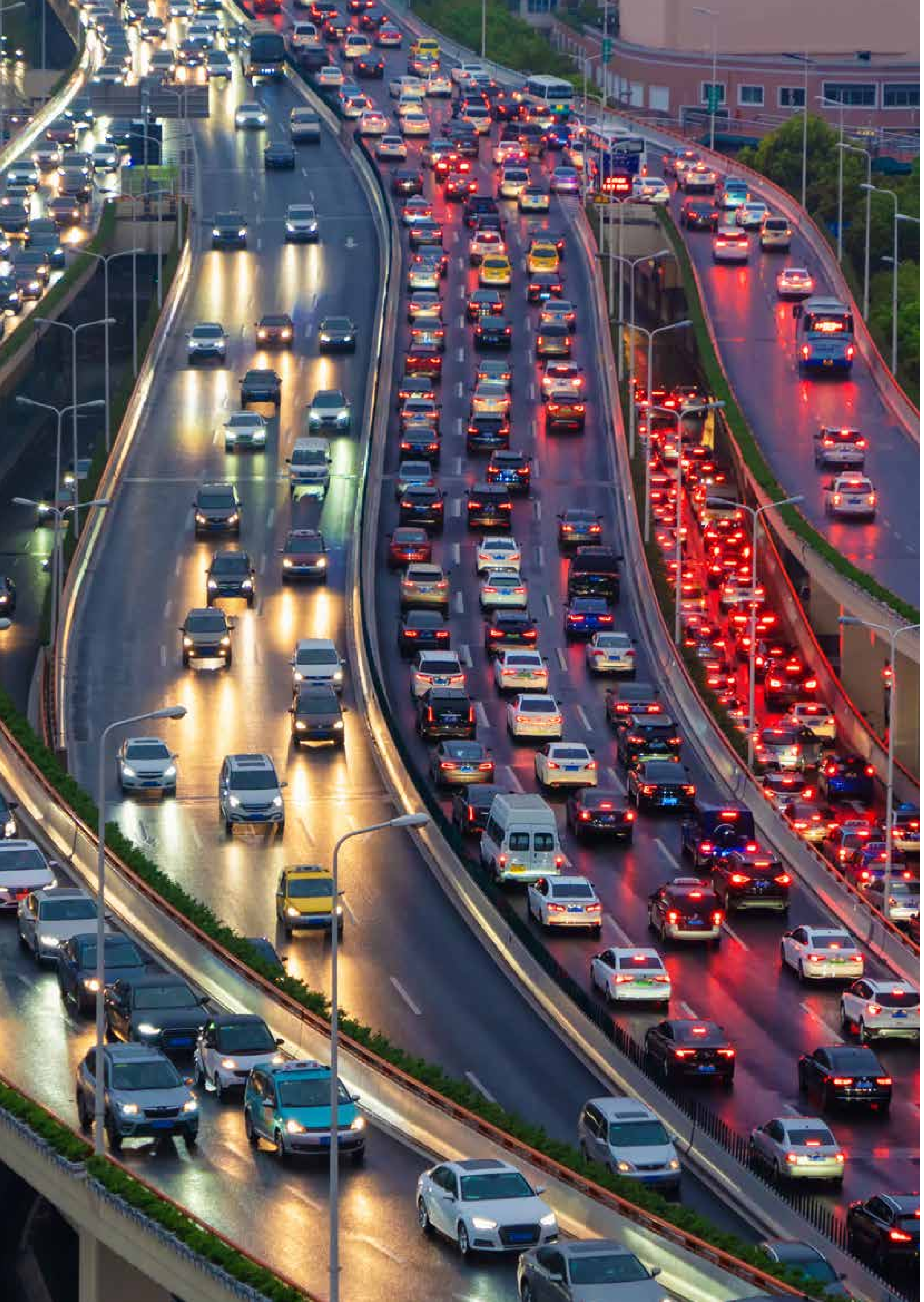
Electric Charging Network in Europe

Founded by Margaret Thatcher in 2009 as the intellectual hub of European Conservativism, New Direction has established academic networks across Europe and research partnerships throughout the world.

newdirection.online @europeanreform

New Direction is registered in Belgium as a not-for-profit organisation and is partly funded by the European Parliament.
REGISTERED OFFICE: Rue du Trône, 4, 1000 Brussels, Belgium. EXECUTIVE DIRECTOR: Witold de Chevilly.

CONTENTS



1

THE ELECTRIC MOBILITY SECTOR

1.1. Introduction

Although it may seem to be a modern sector that has emerged in the last decade linked to the energy transition, the reality is that electric mobility was born at the same time as the transition from the horse-drawn carriage to the motorized car. The electrification of transport systems began at the end of the 19th century, mainly in urban transport such as streetcars, subways, trolleybuses and then trains over medium distances. In fact, the use of electrified public transport has been retained today, and some European cities are even investing in new public transportation systems using traditional electrified solutions such as the trolleybus.

Today, the vast majority of brands already offer fully electric or hybrid vehicles. Throughout this transition, it has been the development of power electronics, sensor systems and control that have made it possible to evolve towards a new concept of electric, connected and autonomous mobility. In the transition to the electric car of the future there are several accelerating factors, the most important of which is the growth of the population in urban areas and the improvement of air quality in those areas, as stated in the United Nations SUM4ALL initiative. The local initiative will give way to a more sustainable mobility, based on clean and shared transport, where the electric vehicle will be the fundamental axis, both public and private. These needs will drive technological developments in more efficient, economical and recyclable batteries, as well as the creation of an adequate recharging infrastructure. The reduction in the cost of batteries must make the electric car more competitive with the combustion car in order to achieve mass acceptance. There are numerous technological developments external to the car that will also integrate and boost it, such as the use of batteries for other applications, services associated with new sensor systems in Smart-cities, blockchain in car sharing, etc. According to various sources, it is estimated that by 2030 the majority of vehicle sales will be electric.

As an initial definition, the electric mobility sector, as we currently understand it, is a sector of the transportation industry that focuses on the design, development, manufacture and use of vehicles powered by electric motors, as well as the associated infrastructure necessary for their operation. This field encompasses a wide range of vehicles, from passenger cars to cargo trucks and public transportation systems, all of which use electricity as a primary energy source instead of conventional fossil fuels.

This sector is characterized by its commitment to environmental sustainability and the reduction of greenhouse gas emissions, in line with global climate change mitigation goals. Electric vehicles (EVs) offer significant advantages in terms of zero local emissions during operation, helping to improve air quality in urban environments and reduce dependence on fossil fuels.

The drive toward electric mobility is supported by a combination of factors, including technological advances in batteries and electric propulsion systems, government regulations that promote the adoption of clean vehicles, consumers' growing environmental awareness, and the search for more sustainable and efficient energy alternatives.

In addition, the electric mobility sector encompasses a complete ecosystem that includes charging infrastructure, electric distribution networks, fleet management services, and intelligent transportation system integration. These components work together to drive the transition to cleaner, more efficient and resilient mobility in the modern transportation landscape.

1.2. The importance of a key sector

This sector represents a key element for the future of the European Union, as it is fully aligned with the objectives of emissions reduction and decarbonization of the transport system. The development of this sector represents a great opportunity to address critical challenges related to climate change, air quality and long-term sustainability.

The transition to electric vehicles and cleaner and more efficient transportation systems is closely aligned with the global goals set by the United Nations, particularly within the framework of the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change, mainly:

- Reduction of greenhouse gas emissions: the transportation sector is one of the largest emitters of greenhouse gases worldwide, contributing significantly to global warming and climate change. The mass adoption of electric vehicles, which operate with zero emissions at the point of use, offers a crucial opportunity to drastically reduce these emissions and limit global warming below critical levels.

- Improving urban air quality: Internal combustion vehicles emit a variety of air pollutants, such as fine particulate matter, nitrogen oxides and volatile organic compounds, which have adverse effects on human health and the environment. Electric mobility significantly reduces these local emissions, which improves air quality in urban areas and reduces the health risks associated with air pollution.

- Diversification and decentralization of the energy matrix: Electrification of transportation allows for greater diversification and decentralization of the energy matrix by integrating renewable energy sources, such as solar and wind, into the generation of electricity used to charge vehicles. This reduces dependence on imported fossil fuels and strengthens the energy resilience of transportation systems.

- Stimulating innovation and technology development: The transition to electric mobility drives innovation and technology development in key areas, such as high-capacity batteries, smart energy management and fast charging infrastructure. This not only improves the efficiency and performance of electric vehicles, but also fosters job creation and economic growth in related sectors.

This last issue is fundamental, as the emergence of the electric mobility sector represents a strategic opportunity for the European Union (EU) to consolidate its position as a leader in the technological, regulatory and industrial development of a new economic sector with global repercussions. In a constantly evolving economic and geopolitical context, pioneering the creation, definition, management and development of this industry not only positions the EU at the forefront of innovation and sustainability, but also gives it a significant competitive advantage on the global stage.

The breadth of the value chain associated with the electric mobility sector spans key industries that have traditionally been dominated by European manufacturers, such as the automotive industry. From the manufacture of electric vehicles and battery components to the installation of charging infrastructure and the provision of shared mobility services, each stage of the value chain presents opportunities for innovation, investment and economic expansion within the EU.

By leading the development of this sector, the EU is in a privileged position to extend its economic and regulatory influence to the rest of the world. By setting standards of quality, safety and sustainability in the manufacture and operation of electric vehicles, the EU can export its experience and expertise to international markets, thus promoting the global adoption of cleaner and more efficient mobility solutions.

In addition to the economic benefits derived from the expansion of the electric mobility industry, its development contributes substantially to the goals of emission reduction and decarbonization of the EU's transport system. By boosting the adoption of electric vehicles and sustainable transport systems, the EU not only meets its international climate change commitments, but also creates an environment conducive to innovation and competitiveness in the global marketplace.

In short, the EU's leadership in the development of the electric mobility sector not only boosts GDP and wealth generation within the EU, but also strengthens its position as a key player in the world economy and as an advocate for environmental sustainability at the global level. This initiative reflects the EU's commitment to a transition to a low-carbon and climate change resilient economy, while taking advantage of the economic and geopolitical opportunities offered by the electric mobility revolution.

1.3. Challenges

In the medium and long term, mobility trends will continue to evolve, even faster than they have done so far. In particular, the future distribution of the population will determine the mobility requirements of people and goods, which will be shaped by the social perception of the different means of transport and their technical evolution.

The depopulation of rural areas towards urban areas will further focus the problem of mobility, air quality and noise in large cities on: private transport, the need for more efficient public transport, and the urban distribution of goods. In most countries, a stable population growth is expected, which will make the development of cities progressive and contained, giving time to establish traffic management policies.

There are still many technological challenges in the development of electric vehicles, both in terms of vehicle components and charging infrastructure. The technological evolution of batteries will be a critical aspect, both in terms of their maximum charging/discharging power, the energy they can store (the different technologies will have to adapt to these requirements) and finally their acquisition cost. The charging power will allow faster and safer recharging than the current one, which will require a power of more than 350kWh. On the other hand, the battery power will be increasing to satisfy a range of up to 1,000 km, and for this it will be necessary to have a charge capacity of more than 150kWh. This will completely determine the characteristics required for the recharging infrastructure, which will be characterized by the power and energy demand of the batteries and by the connection system.

According to recent studies, the expected power generation capacity will make it possible to integrate the growth in consumption associated with the charging of electric vehicles, safely and with very low generation emissions. However, its impact on electricity distribution networks requires intelligent management of recharging, since otherwise it could lead to congestion in the supply network, forcing the network to be reinforced.

1.4. Key players in the sector

The electric mobility sector is composed of a variety of key players that play fundamental roles in its development and success. These actors can be broadly classified into three major groups, each one of them with their respective roles and responsibilities:

- **Electric vehicle manufacturers and their supply chain/suppliers:** this group includes electric car manufacturers, as well as suppliers and manufacturers of components and systems required for the production of electric vehicles, such as batteries, electric motors and energy management systems. Close collaboration between vehicle manufacturers and their suppliers is essential to ensure the availability and quality of components required for large-scale electric vehicle manufacturing.

- **Energy suppliers:** This group comprises utilities, renewable energy providers and other actors involved in the provision and distribution of electricity needed to charge electric vehicles. These suppliers play a crucial role in the creation of a robust and reliable charging infrastructure, as well as in the promotion of renewable energy sources to power electric vehicles (trying to encompass the full decarbonization cycle), thus contributing to the reduction of emissions and the decarbonization of transportation.

- **Charging stations network:** This group is responsible for the deployment and operation of the charging infrastructure needed to power electric vehicles. This includes the installation and maintenance of charging stations in urban areas, roads and workplaces, as well as the development of fast and ultra-fast charging solutions to reduce charging times and encourage the adoption of electric vehicles. A well-developed and strategically located network of charging stations is crucial to remove the barriers of "range anxiety" and promote the mass adoption of electric vehicles.

It is clear that collaboration and coordination between these three groups of actors is essential for the comprehensive development of the electric mobility sector. The lack of coordination and common incentive policies can hinder the growth and expansion of the industry, as has been observed in some southern European countries, where the speed of penetration of the electric mobility sector has been slower due to the lack of adequate charging infrastructure and limited power supply capacity.

Therefore, it is essential to establish adequate regulation that promotes collaboration and cooperation between the different actors in the sector, as well as the development of shared incentives that drive growth and innovation. In addition, challenges related to energy supply capacity and the processing of connection requests need to be addressed to ensure that charging infrastructure adequately accompanies the introduction of electric vehicles into the market. Only through coordinated and collaborative action can the full potential of the electric mobility sector be unlocked and effectively contribute to the goals of emission reduction and decarbonization of the transport system.

The key characteristics of each of the sector's stakeholder groups, and how they affect the evolution of its implementation and development, are outlined below:

Electric vehicle manufacturers and their supply chain/suppliers

- These group is composed by global companies, with delocalized production sites and supply chains.

- Asian manufacturers have rapidly developed their capabilities in this sector, and control a large part of the raw material supply chains. They represent a major threat to European manufacturers, who may see their historical leadership position in the automotive sector threatened.

Energy suppliers

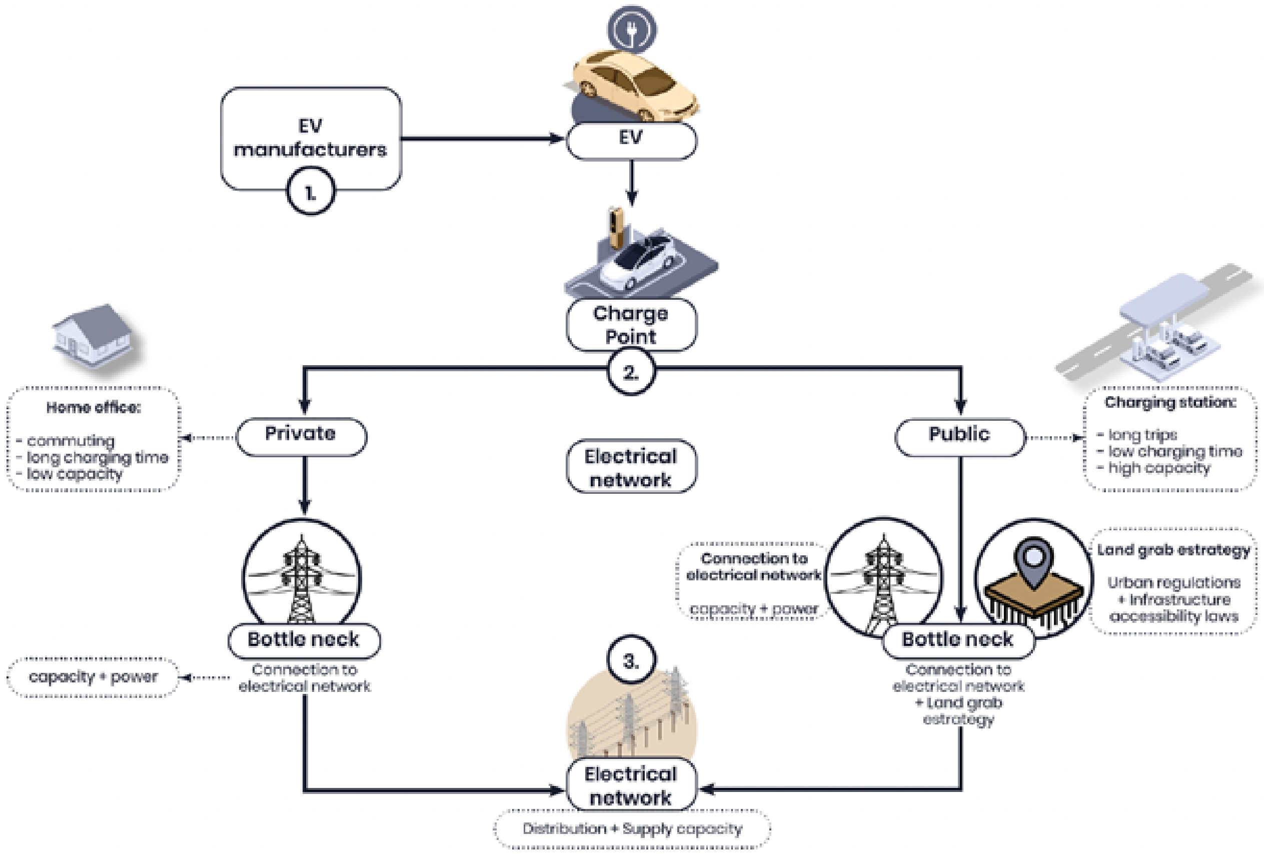
- These are players with a clear multidomestic conditioning, completely dependent on the national jurisdiction in which they operate.

- They work in a highly regulated sector, whose generation and distribution capacities are conditioned by multiple factors and laws.

- They are strongly influenced by various external actors and conditions, such as different interest groups and the existing generation and distribution infrastructure. The modification of these conditions may imply important costs in time and money, especially in the planning and execution of large CAPEX investments.

Charging stations network

- Multinational companies can coexist with local players.
- It is a fundamental element to enable the deployment of the electric mobility sector, but completely conditioned by the supply capacity of energy providers (both for the capacity of generation/transmission networks, as well as for the bureaucracy required to be able to carry out the procedures to request a connection point).
- The electric charge infrastructure to be deployed can be obtained from various global suppliers; however, obtaining the requested energy and power depends to a large extent on the existing regulations in each national jurisdiction.
- It is completely affected by local, regional and national urban planning regulations, which can significantly affect its implementation and scope.



Therefore, and as main conclusion, the development of the electric mobility sector can be influenced by two main limitations:

1. **Market penetration of electric vehicles:** Currently, this aspect does not represent a significant barrier due to the continuous growth in the production of electric vehicles by global automotive manufacturers. The existence of a global production chain has allowed for increased availability of these vehicles year after year.
2. **Development of a distributed charging network across the territory:** The main limitation for the sector's deployment lies in the capacity of the energy distribution network and the legal and urban planning restrictions that hinder the establishment of an adequate charging infrastructure.

The deployment and installation of an effective charging network across the geography is fundamental for the sector's development. This deployment is directly influenced by two main factors: the current capacity of the energy distribution and charging network, and the availability of land to locate the charging stations.

Throughout the report, the second limitation will be analyzed in detail, examining how different EU countries are addressing it in various ways. This disparity in the strategies for implementing the charging network is resulting in the development of the electric mobility sector progressing at different rates within the European Union. The differences in national approaches highlight the varying levels of commitment and investment in electric mobility infrastructure, which directly impact the pace of sector growth in each country.

The key constraint facing the development of the electric mobility sector lies in the complex interrelationship between several critical factors: the electrical grid, charging infrastructure, regulations, and the complexity of the permit processes for connections and hookups. The efficiency and capacity of the electrical grid play a vital role in supporting widespread electric vehicle (EV) adoption, as an inadequate grid can lead to insufficient charging capabilities. Additionally, the establishment and expansion of a robust charging infrastructure are essential for ensuring that EV users have convenient access to charging points, which is crucial for alleviating range anxiety and promoting confidence in EV usage.

Regulatory frameworks and the procedural complexities associated with obtaining permits for the installation of charging stations are also significant barriers. These processes can be time-consuming and bureaucratic, leading to delays and increased costs for developers and operators. This combination of factors can result in the lack of establishment or significant delays in the implementation of charging stations, which in turn discourages the adoption and purchase of electric vehicles by consumers. Potential EV buyers may be hesitant to switch from traditional internal combustion engine vehicles if they perceive a lack of reliable and accessible charging options.

However, this situation also presents a unique opportunity to act proactively and address these challenges while simultaneously boosting the production of electric vehicles by European companies. In this regard, it is crucial to implement measures that simplify and expedite the processes of obtaining permits and connections for charging stations. Streamlining these procedures can significantly reduce the time and cost associated with developing charging infrastructure, thereby encouraging more rapid deployment across the continent.

Additionally, this opportunity can be leveraged to more effectively regulate the entry of vehicles manufactured by non-EU companies into the market, ensuring that all vehicles meet adequate standards of quality, safety, and sustainability. Establishing stringent regulations and standards can protect the market from substandard products and ensure that consumers receive reliable and safe vehicles. This regulatory oversight can also promote fair competition and support the growth of the European electric vehicle industry by creating a level playing field.

By addressing these challenges comprehensively, a more favorable environment for the adoption of electric vehicles can be created, thus fostering the transition towards cleaner and more sustainable mobility. Furthermore, promoting local manufacturing and production of electric vehicles strengthens the European industry and generates economic and employment opportunities in the region. In summary, this situation not only represents a challenge but also an opportunity to advance towards a more efficient and sustainable future of electric mobility.

In conclusion, addressing these interconnected challenges requires a coordinated effort at both national and EU levels. By fostering collaboration between governments, industry stakeholders, and regulatory bodies, it is possible to create a conducive environment for the rapid and sustainable growth of the electric mobility sector. Through proactive measures and strategic investments, the European Union can position itself as a global leader in electric mobility, driving innovation and promoting environmental sustainability.

2

MOBILITY, A STRATEGIC SECTOR FOR THE EU. POLICIES TO PROMOTE MOBILITY

2.1. Electric mobility as a strategic sector for the EU

As mentioned in the previous section, the electric mobility sector is a fundamental element in the development of the European Union's long-term economic and environmental objectives. This is primarily due to its ability to address environmental challenges, foster innovation and competitiveness, create jobs and economic growth, reduce energy dependency, and promote the transition to a cleaner and more sustainable energy system. Building on the points mentioned earlier, the following key aspects can be summarized:

1. Reduction of emissions and achievement of environmental goals: Electric mobility plays a crucial role in reducing greenhouse gas emissions and improving air quality in cities. As the EU is committed to achieve ambitious targets in terms of emission reductions and fighting climate change, promoting electric mobility is essential to meet these commitments and ensure a cleaner and healthier environment for European citizens.

2. Innovation and competitiveness: The transition to electric mobility involves a significant amount of innovation in terms of vehicle technology, charging infrastructure and energy management systems. By leading the development and adoption of these technologies, the EU can maintain its position as a world leader in innovation and technology, which in turn boosts the competitiveness of its automotive industry and other related sectors.

3. Job creation and economic growth: electric mobility not only creates jobs in the manufacture of electric vehicles and components, but also in the installation and maintenance of charging infrastructures, the development of software and management systems, and in a variety of associated services. This contributes to the EU's economic growth and the strengthening of its industrial base.

4. Reducing energy dependence: By promoting the use of electric vehicles, the EU significantly reduces its dependence on imported fossil fuels, which is a critical step towards enhancing its energy security and strategic autonomy. The reliance on external sources of fossil fuels, particularly from geopolitically unstable regions, poses a substantial risk to the EU's energy supply and economic stability. By shifting to domestically generated electricity, especially from renewable sources such as wind, solar, and hydroelectric power, the EU can mitigate these risks and ensure a more stable and predictable energy supply.

   Furthermore, decreasing the dependence on fossil fuel imports not only enhances energy security but also has positive economic implications. It reduces the outflow of capital to foreign oil and gas producers, allowing those funds to be invested within the EU. This can stimulate local economies, support job creation in the renewable energy sector, and foster technological advancements in energy generation and storage.

   In an uncertain geopolitical context, where energy resources can be used as leverage or be subject to supply disruptions, having a robust and self-sufficient energy system becomes increasingly important. Electric vehicles, powered by a diversified and resilient energy grid, contribute to this strategic autonomy. They reduce the vulnerability of the EU to external shocks and geopolitical tensions, ensuring that the region remains economically and politically stable.

   Overall, the promotion of electric vehicles and the corresponding reduction in fossil fuel dependency represent a strategic move towards a more secure, autonomous, and economically resilient European Union.

5. Fostering innovation in renewable energies: Electric mobility can act as a key driver for the integration of renewable energies into the European electricity grid. By using electricity generated from renewable sources to charge electric vehicles, the EU can move towards a more sustainable and resilient energy system.

2.2. European regulations. Objectives

From different European Union bodies various pieces of legislation are been promoted to foster the deployment of the electric mobility sector, some of which have already been approved and others are in the pipeline. Among them, some of the most important ones to highlight would be:

- **Air Quality Directive Revision:** Aims to reduce major pollutants such as heavy particles, NO2, SO2, etc., and sets stricter limit values for 2035
- **CO_2 emission performance standards for cars and vans.** It stablishes that vehicles that generate emissions will not be allowed to be sold from 2035.
- **CO2 Standards Regulation for Heavy-Duty Vehicles – (currently under consideration in the European Council).** It updates the CO2 emission limits for the new heavy-duty vehicles, both passenger and freight. It defines zero-emission heavy-duty vehicles (ZEV) as those emitting <3 gCO2/tkm – (only electric vehicles meet this criterion). It establishes the following European emission reduction targets for new vehicles compared to 2019:
    - 45% reduction in emissions starting from 2030,
    - 65% reduction starting from 2035, and
    - 90% reduction starting from 2040.

  It stipulates that by 2035, 100% of the new urban bus fleet must be zero-emission.
- **EURO 7: Deal on new EU rules to reduce road transport emissions.** This regulation updates the pollutant limits (NOx, SOx, particulates...) for new light and heavy duty vehicles. Car manufacturers have 2 and a half years to implement the regulation, while truck manufacturers have 4 years.
- **European alternative fuels infrastructure regulation (AFIR).** It establishes national infrastructure targets and obligations for roads, ports, and airports. The Regulation is mandatory and does not require transposition. The main key points of the new Regulation are as follows (to be complied with by 2024):
    - Establishes minimum national targets for alternative fuel infrastructure in roads, ports, and airports.
    - Charging infrastructure for small vehicles:
        - Annual target for each country. Ensure that there is charging infrastructure with an accumulated power equivalent to ≥ 1.3 kW/electric vehicle.
        - Charging stations every ≤ 60 km in each direction of the Trans-European Transport Network.
    - Charging infrastructure for heavy-duty vehicles:
        - Charging stations every ≤ 60 km in each direction on the first-level Trans-European Transport Network, and every ≤ 100 km on the second-level Trans-European Transport Network by 2031.
    - Electrical infrastructure in ports: Ports in the Trans-European Transport Network must cover 90% of the demand with OPS.
    - LNG: Road and port infrastructure is limited until 2025.

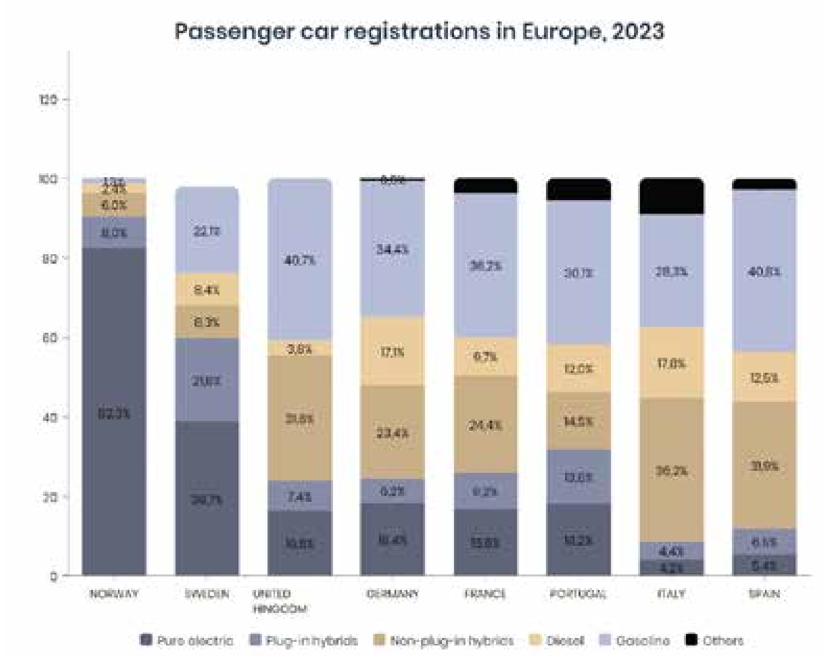
3

ELECTRIC VEHICLE'S PENETRATION IN THE EU

Electric mobility is growing rapidly in Europe, with electric models from different manufacturers reaching all-time high sales. This is a sign of the acceptance and demand for electric vehicles by consumers.

European climate targets and, consequently their regulation, have contributed to the adoption of electric vehicles. This technology contributes to efforts to combat climate change, reduce greenhouse gas emissions and improve air quality in cities.

The last few years have seen significant growth in the sale of electric vehicles in Europe. A comparison of the evolution of registrations between 2022 and today in eight European markets: Norway, Sweden, Germany, United Kingdom, France, Italy, Spain and Portugal, shows how this evolution has been. This type of car, including all-electric, plug-in hybrids and non-plug-in hybrids, has a market share of 52 % in Europe.



The arrival on the market in 2024 of new electric cars with more competitive prices and a wider range of options may signal a strong year in terms of sales and registrations. However, it is important to consider that these new electric vehicles will predominantly come from Asian countries, posing a significant challenge to European manufacturers and their traditional dominance in the automobile production market. A deep reflection at the European level will be essential to assess how this development might impact the interests of the Union. There is a risk that the benefits generated by this important sector could be diverted to third countries, potentially undermining the competitive position and economic interests of European manufacturers. It is fundamental to establish strategic measures and policy considerations to ensure that the advantages of the electric vehicle market are harnessed to benefit all stakeholders within the European Union.

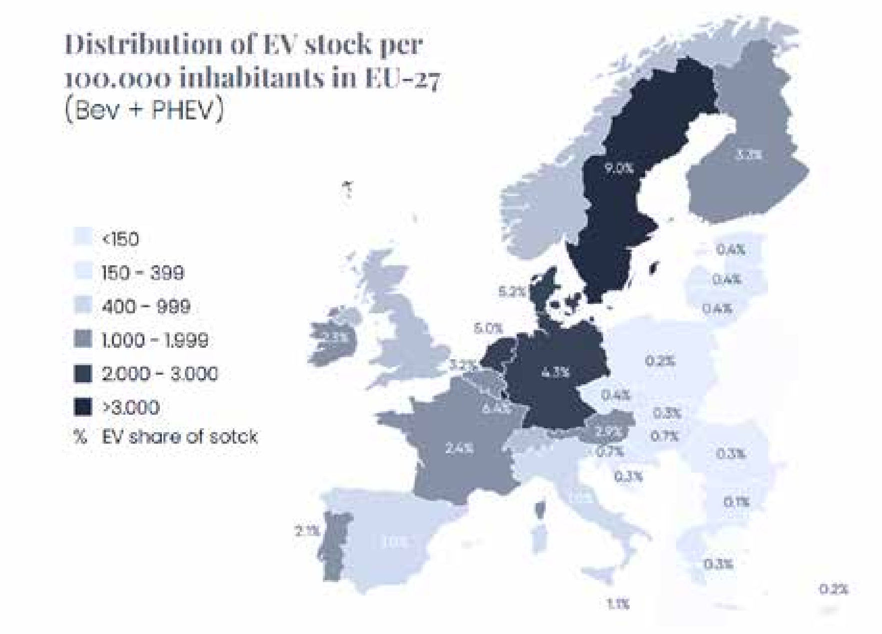
If we analyze the data corresponding to the different countries (both for the year 2023 and previous years), we can see that there is a clear difference in the penetration of the sector between the countries of northern and southern Europe. While in the Nordic countries a high number of registrations of electric, plug-in hybrid and non-plug-in hybrid vehicles can be observed, with percentages of pure electric vehicles above 30%; in Southern countries such as Italy and Spain much lower percentages can be observed, where the total of pure electric and plug-in hybrid vehicles is only around 10%. It is necessary to question the reasons for these differences, where the causes may be diverse:

- Per capita income (electric vehicles still have a higher price than their fossil fuel counterparts).
- Cultural characteristics.
- Fiscal and incentive policies for electric vehicles. There are common EU regulations; however, each country has its own policies to promote this sector.
- State and availability of the charging network

It will be necessary to act on these four components to boost the penetration of electric vehicles in southern European countries; however, the last two are the aspects on which public institutions will be able to act. Fiscal and incentive policies must be established for the adoption of electric vehicles, both through the imposition of taxes on combustion vehicles and through savings policies for the purchase of electric vehicles (including pure electric vehicles and plug-in hybrids).

In any case, these policies would be of no use if action is not taken on the existing bottleneck in the countries of Southern Europe for the development of the sector: the lack of a charging network correctly distributed throughout the territory, and with an adequate charging capacity and speed for the new electric vehicles. As will be seen in the following sections, the development of this charging network faces important difficulties, mainly those derived from the complex national regulations for the provision of infrastructures (sector and urban planning legislation), the availability and complexity of the processing of energy requests at the sites (where there is dependence on generating and distributing companies), and the capital requirements necessary for the deployment of this network. The existing combination in countries such as Spain, where a strong investment is needed for the development of the charging network, and where there are significant legal and regulatory obstacles for its development (therefore, high investment required, long terms and substantial risk), completely discourage the presence of private actors to make the necessary investments that allow the deployment of a proper charging network, which in turn results in the lack of market penetration of new electric vehicles and plug-in hybrids. It could be said that the European Union, mainly the countries of the South, is missing the opportunity to take advantage of this new sector and make it profitable.

The following map shows how there is a two-speed Europe in the development of the electric mobility sector:



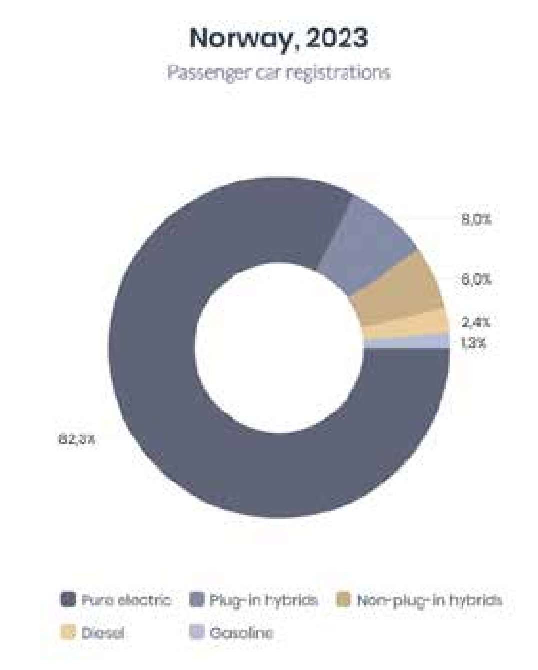
The following analysis covers the main indicators of electric vehicle penetration in different European countries, highlighting the varying speeds of implementation in each country.

Norway

The end of 2022 marked a significant milestone for Norway, with an impressive 79.3% pure electric car market share. However, over the course of 2023, pure electric passenger car registrations surpassed this figure, reaching 82.4% of total sales. The Scandinavian country even achieved a record of 87% of electric vehicles in September.

As 2024 began, tax changes were implemented in the automotive sector. Although these changes affected all energy sources, electric vehicles proved to be less affected compared to plug-in hybrids, which experienced an increase of up to 10% in the average vehicle price.

Possibly as a result of these tax adjustments, a noticeable shift in sales is observed: in December, sales of plug-in hybrids rebounded significantly, reaching 16% of the market, while sales of electric vehicles dropped to 73.5%. Overall, plug-in vehicles (both pure electric and hybrid) accounted for a total of 90.4% of new registrations in 2023 in Norway, up from 87.8% in the previous year.

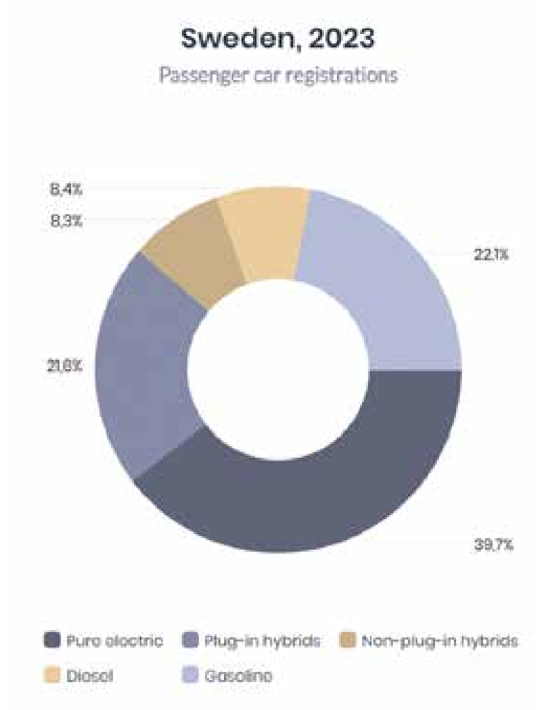


Sweden

During 2023, the Swedish new car market saw only a slight increase of 0.4% in the total number of passenger cars, remaining similar to the previous year. However, the highlight was the impressive 18% increase in the purchase of electric vehicles, which rose to 38.8% of the market, up from a previous 33%.

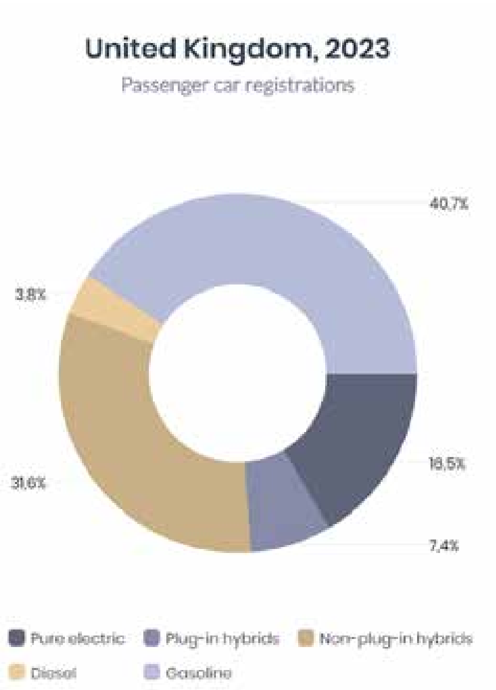
Plug-in vehicles, whether pure electric or plug-in hybrid, made up a significant share of new registrations in Sweden, reaching 59.9% of the market. Despite this, a decline of 8.3% was observed for plug-in hybrids, resulting in a two percentage point drop in their market share.

The year 2022 witnessed a notable increase in the popularity of pure electric vehicles in Sweden, especially during the last quarter, when they achieved a market share of 44.4% (and 51.3% in December). The reduction of incentives at the beginning of 2023 seems to have significantly influenced this growth. On the other hand, non-plug-in hybrids and combustion vehicles continue to experience a gradual decline in registrations.



United Kingdom

In the United Kingdom, new regulatory conditions have been established to promote the penetration of electric vehicles. The ZEV mandate, a regulation aimed at reducing greenhouse gases, has been established. Among other measures, it establishes a minimum percentage of zero-emission vehicles to be registered. These minimum required percentages increase from 22% in the current year 2024, to 38% in 2027, 80% in 2030, and 100% of registered vehicles in 2035. In this way, the United Kingdom establishes a clear regulatory measure that boosts the sector, since it establishes the obligation to introduce an increasing percentage of zero-emission vehicles in the market in the coming years. Obviously, this measure must be supported by an adequate deployment of the charging network, so that this incorporation into the market of the electric demand for new vehicles can be assumed.



With regard to the 2023 data, it can be seen that there was a 17.8% increase in pure electric passenger car registrations compared to the previous year, reaching a total of 314,684 registrations in 2023. However, this increase is practically identical to that experienced by the market as a whole, with a difference of just one tenth of a percentage point less. On the other hand, plug-in hybrids have gained market share, rising from 6.3% in 2022 to 7.4% in 2023, representing an increase in the overall plug-in market share from 22.8% in the previous year to 24% in the last year. However, it is possible that this effect is derived from the application of the ZEV mandate, as manufacturers may have reduced the supply of electric vehicles available for sale in the last few months of the year, with the aim of generating greater demand in 2024 and thus meeting government requirements.

Germany, France and Portugal

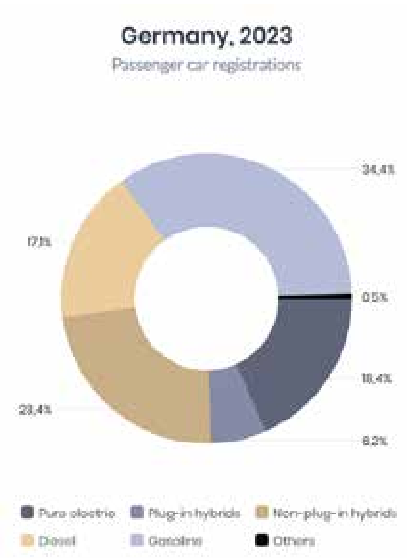
These three countries may represent an intermediate situation between the Nordic countries (pioneers in the incorporation of electric vehicles) and the two southern European countries with a lower incorporation in the sector (Spain and Italy).

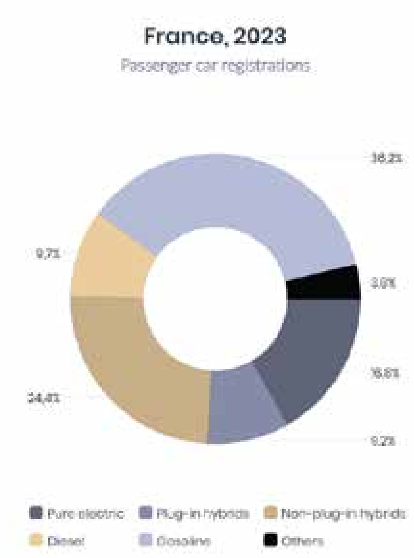
On the other hand, the traditional privileged position of the German industry in the production of cars with combustion engines should be taken into account, which may represent a cultural barrier to the incorporation of electric vehicles.

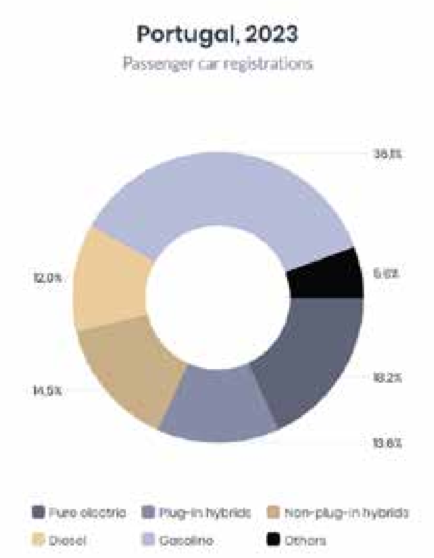
In any case, it can be seen that in these countries, registrations of plug-in vehicles in 2023 (both pure electric and plug-in hybrids) will be around 25-33%; i.e., in these markets, between one in three and one in four vehicles registered in 2023 were a plug-in vehicle. But in addition to this figure, the percentage increase in registrations of this type of vehicle compared to data from previous years is substantial, mainly:

- In Germany, the number of pure electric vehicles registered grew by 11.4% compared to the data for 2022.
- In France, zero-emission vehicles grew by 40% in market share compared to the previous year's data.
- In Portugal, zero-emission vehicles grew by 100% in 2023.

As indicated above, this growth must be accompanied by the correct deployment of the charging network to absorb the new electricity demand that will be generated.

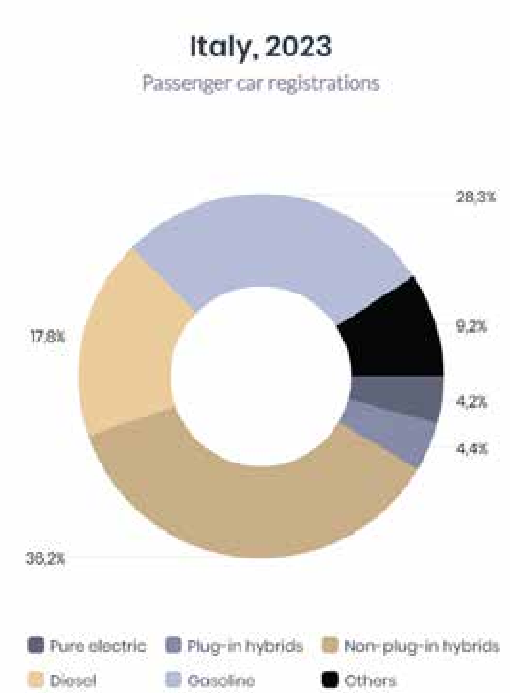






Italy

In Italy, the situation of the sector is very different from the one analyzed for the Nordic countries. The year 2023 did not turn out to be favorable for electric mobility in Italy, as indicated by passenger car registrations data. Plug-in cars dropped to 8.6% market share, which represents a decrease of two tenths compared to the previous year.



Although pure electric vehicles recorded a slight increase from 3.7% to 4.2%, a growth of 34.5% in the last year, their absolute values are so small that the percentage growth does not provide really substantial data. It should be borne in mind that in 2023 less than 1 in 20 new cars registered was a pure electric vehicle, so the market penetration of this technology is still minimal.

In addition, plug-in hybrids lost seven tenths of a percentage point of their market share, closing the year at 4.4%. In contrast, and contrary to what is happening in northern European countries, gasoline and diesel continue to be the most popular options for the purchase of new cars, accounting for 46.1% of the market.

Obviously, this situation, which is the complete opposite of what is happening in the countries of Northern Europe, deserves a more detailed reflection. In this scenario, causes derived from the main factors indicated above will converge (more so considering the cultural and GDP per capita differences between the Nordic countries and Italy); however, it seems logical to think that it is urgent to act on two key points to enhance the development of the sector: national regulation and policies that enhance the incorporation of the electric vehicle into the market (with actions similar to those incorporated in the UK with the ZEV mandate), and the correct deployment of the charging network that allows absorbing the new potential demand (so as to overcome the current lack of knowledge and confidence of Italians in the country's charging infrastructure).

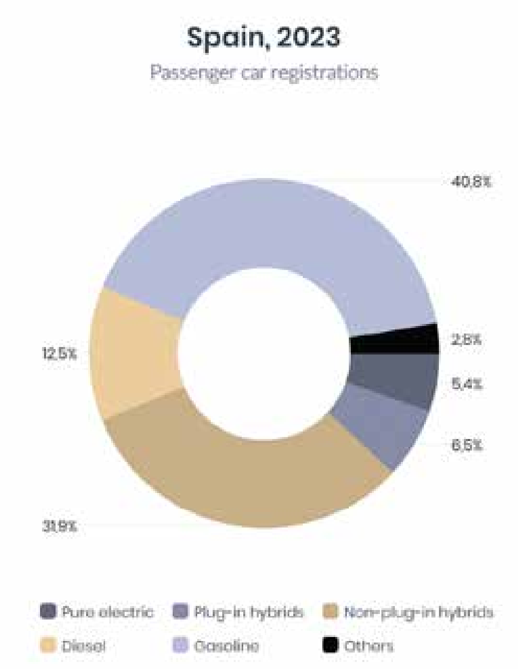
Spain

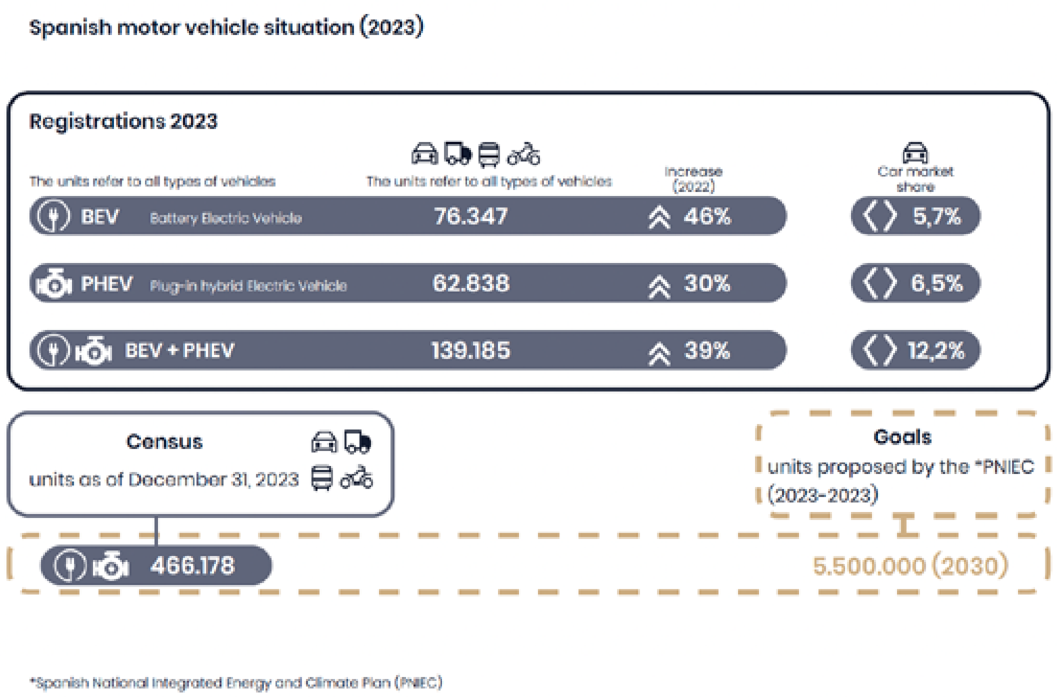
In this instance, although slightly improved, the situation mirrors the conditions observed in Italy. The penetration of plug-in vehicles (both pure electric and plug-in hybrids) remains minimal within the mobility sector. In 2023, the total registrations of plug-in vehicles did not reach a 12.50% market share, indicating that scarcely one in ten newly registered vehicles possessed these characteristics.

Similar to the previous case, there has been a 46.4% increase in electric car registrations compared to the previous year. However, due to the initially small number of such vehicles, this growth remains unremarkable. Even with this increase, the total number of pure electric vehicles registered this year accounts for only 5.7% (one in twenty). The plug-in hybrid segment reflects a comparable trend, showing a 30.1% rise from 5.9% to 6.5%.

In summary, despite notable percentage growth in both pure electric and plug-in hybrid vehicle registrations, the overall market penetration remains limited. The absolute numbers are still too small to mark a significant shift within the sector, indicating a need for more substantial measures to foster broader adoption of plug-in vehicles. These figures are still far from the targets set by the government of 5.5 million plug-in vehicles in 2030, when the current fleet of plug-in vehicles is 466,178, according to AEDIVE (data as of December 31, 2023). In other words, the number of existing electric vehicles should increase ten times in less than seven years.

Obviously, as in the previous case, this situation of contrast with the countries of northern Europe deserves a detailed analysis. The factors that may generate the differences are the same as in the previous case. However, in the case of Spain, the following sections will analyze the need to accelerate the deployment of the necessary charging network, since in this case this deployment is clearly behind the rest of Europe, and is a brake on the potential user when opting for an electric vehicle. Spain has significant obstacles in terms of urban planning, regulations and access to the electricity market for obtaining grid connection points with adequate capacity and power, which are generating a significant brake on the deployment of the charging network and investment by the private sector.





4

STATE OF THE CHARGING NETWORK IN THE DIFFERENT EU COUNTRIES. CHALLENGES

4.1. Importance of the charging network

As previously identified, the charging network is a critical component in the development and expansion of the electric mobility sector. The sector's growth is intrinsically linked to the effective distribution of an efficient charging infrastructure that possesses the necessary capacity and power to meet the energy demands generated by the increasing fleet of electric vehicles.

A rapid and widespread adoption of electric vehicles cannot be realistically expected in the absence of a robust charging infrastructure. The fear among potential users of not having reliable access to charging stations, leading to the possibility of their vehicles being unavailable when needed, is a significant deterrent to the purchase of electric vehicles. This anxiety may drive consumers to continue relying on traditional combustion vehicles or opt for the intermediate solution of plug-in hybrids, which still offer the fallback of conventional fuel. Therefore, it is imperative that stakeholders in the electric mobility sector prioritize the development of a comprehensive and reliable charging network. This network should be strategically distributed to ensure accessibility, with adequate capacity to handle peak usage times and sufficient power to charge vehicles quickly and efficiently. Without these measures, the transition to a predominantly electric vehicle market will be hindered, as consumer confidence will remain low due to concerns over charging availability and convenience. The establishment of an extensive and efficient charging infrastructure is essential for fostering consumer trust and accelerating the penetration of electric vehicles. It is a foundational requirement that must be addressed to support the sector's growth and to encourage a significant shift away from combustion vehicles towards a more sustainable electric mobility future.

The availability of an adequate charging network should be a precondition for the deployment of the electric mobility sector, so that the potential user of electric vehicles is guaranteed an adequate supply of electricity on any journey, both short- and long-range. However, it can be seen that this is not the case in all European Union countries, and that the differences between the density and quality of the charging network in the northern and southern countries of the continent are substantial. Likewise, and as was observed in the previous section, the penetration of electric vehicles in these countries is completely different.

There could be a debate about which of the two conditions affects the other, whether a low penetration of electric vehicles in Southern European countries has led to the failure to deploy an adequate charging network (mainly because the lack of potential users has not generated sufficient incentives for both public and private investment to deploy this network), or whether it has been the other way around, and the lack of an adequate charging network distributed throughout the territory has generated a significant brake on the adoption of electric vehicles by potential users. It seems clear that, even though these factors are interrelated in both directions, the deficient deployment of the charging network has generated a significant brake on the development of the electric mobility sector, as potential users identify it as a major barrier to the purchase of an electric vehicle, given the restrictions on use that the charging operation could generate.

The transition to electric vehicles requires a major paradigm shift in the operation of vehicle recharging/refueling. There must be a transition from a localized system, where recharging/refueling operations are carried out in a network of authorized providers that handle fossil fuels, to a distributed system where the options for obtaining electric charge are diverse, since electricity can be obtained from different providers (whether in the home, the office, a shopping mall or a third party recharging station), and in different public/private locations. In other words, a priori it should be easy to make this transition, since we are moving from dependence on an authorized manager for the handling and distribution of fossil fuel, to the optionality that allows the vehicle to need an electric charge that can be obtained from different sources. If this is the case, why does this charging requirement pose a barrier to electric vehicle penetration? the following key factors can be identified:

- First of all, it should be taken into account that the fossil fuel supply and distribution sector is a well-established, traditional industry that efficiently meets demand. This sector is characterized by its deep-rooted history and high efficiency, the result of decades of development and optimization. Fuel demand is efficiently met due to a well-established and widely distributed supply chain. Over the years, this industry has perfected its infrastructure and processes, ensuring a reliable supply and efficient operation to meet society's energy needs.

In contrast, the electric vehicle charging sector faces significant challenges due to its relative newness and lack of maturity. As an emerging industry, it has not yet achieved the same level of entrenchment and efficiency as the fossil fuel sector. The charging infrastructure for electric vehicles is still under development, which means that the network of charging stations is not as well-established or widely distributed as that of traditional fuels. Additionally, many users may feel unfamiliar or uncertain about how to effectively use this emerging technology, potentially limiting its widespread adoption and utilization.

In summary, the electric vehicle charging sector faces unique challenges due to its novel and developing nature, in contrast to the fossil fuel sector, which has been refined and optimized over many years.

- The electric vehicle charging sector, as it is relatively new, faces an additional barrier: fear of the unknown on the part of users. The transition from internal combustion vehicles to electric vehicles implies a significant change in the way mobility is approached, which can generate uncertainty and resistance to change among traditional users. This fear is based on unfamiliarity with electric technology, including concerns about battery range, availability of charging points and vehicle durability.

- On the other hand, the switch from combustion vehicles to electric vehicles implies a significant change in the charging/refueling experience. While fuel charging requires short charging times, electric charging requires longer charging times. Depending on the charging infrastructure used, and the charging capacity of the vehicle's battery, these charging times can vary from minutes to hours. This causes an important change in the user experience, because while with combustion vehicles the availability of charging points and stop times are not a problem (any user has a gas station within a reduced range of km, and needs refueling times of a few minutes), in electric vehicles the user must properly plan the trip, analyzing where there are charging points within its range of autonomy in the planned trip, and the time needed in them to get the necessary charge (depending on the number of existing chargers and the maximum charging speed that could be obtained). Thus, until a well-distributed charging network with ample capacity is established, effective trip planning, including the analysis of stopping points and durations, remains crucial for electric vehicle users. Unlike combustion vehicles, where refueling logistics are less critical and users can undertake trips without significant consideration of refueling logistics, electric vehicle journeys necessitate thoughtful planning to ensure seamless travel experiences. This situation generates important uncertainties associated with charging availability.

- Currently, due to limitations in battery efficiency and capacity advancements, electric vehicles typically offer a shorter driving range compared to combustion vehicles. Coupled with the challenge of locating suitable charging stations along major road networks that provide adequate charging capacity and power, long-distance travel with electric vehicles remains challenging. As a result, despite increasing adoption of electric vehicles for urban commuting, characterized by short and repetitive trips conducive to slow charging at home or work, their uptake for longer journeys has been significantly lower.

  The disparity in range and charging infrastructure highlights a critical barrier to the widespread adoption of electric vehicles beyond urban environments. Addressing these challenges through advancements in battery technology and expansion of robust charging networks will be pivotal in enhancing the feasibility and attractiveness of electric vehicles for longer-distance travel scenarios.

- The inadequate deployment of the charging network stands out as a significant impediment to the widespread adoption of electric vehicles in the market. This challenge is multifaceted, encompassing various constraints, including regulatory and legal hurdles, as well as economic and public-private partnership considerations.

  Regulatory and legal restrictions pose substantial barriers to the installation of charging points in both public and private locations. Local and regional regulations often impose stringent requirements regarding the placement, type, and permitting of electric chargers. These regulatory frameworks can lead to bureaucratic processes that are lengthy, complex, and costly. For instance, zoning laws may dictate specific areas where chargers can be installed, while building codes might prescribe technical specifications that must be met. Moreover, obtaining the necessary permits and approvals from local authorities can involve navigating through a maze of administrative procedures, further deterring potential investors and stakeholders from committing to charging infrastructure projects.

  In addition to regulatory challenges, economic factors play a crucial role in the deployment of charging networks. The upfront costs associated with installing charging stations, coupled with uncertainties about usage patterns and return on investment, can dissuade private businesses and investors from taking the initiative. The profitability of charging infrastructure often depends on factors such as electricity pricing, demand forecasting, and the availability of subsidies or incentives. The installation of charging points can incur significant costs, particularly in areas where substantial upgrades to the electrical grid or additional infrastructure are necessary. Owners of charging stations must also factor in ongoing operational expenses, such as electricity consumption and equipment maintenance, alongside considerations of the payback period, which influences their decision-making regarding network expansion.

  To alleviate these financial burdens, governments can implement tax incentives and subsidies aimed at promoting the installation of charging infrastructure. These incentives can reduce upfront costs for businesses and individuals investing in electric vehicle infrastructure projects. Additionally, governments can establish financing programs specifically tailored to support the development and expansion of charging networks, thereby incentivizing private sector involvement and accelerating deployment.

  Furthermore, the development of a robust charging network necessitates effective collaboration between public entities, private businesses, and other stakeholders. Establishing successful public-private partnerships requires navigating differing priorities, financial constraints, and operational complexities. Aligning interests and responsibilities among these diverse stakeholders is essential for scaling up the charging infrastructure to meet the growing demand for electric vehicles. These collaboration between government entities, private businesses, and other stakeholders can pool resources, share costs, and coordinate efforts to maximize the efficiency and reach of charging infrastructure. By leveraging combined expertise and resources, stakeholders can address logistical challenges more effectively and accelerate the deployment of charging stations across various locations.

  In conclusion, the barriers to widespread deployment of EV charging networks stem from a combination of regulatory complexities, economic considerations, and the imperative for collaborative partnerships among diverse stakeholders. Overcoming these obstacles demands a holistic approach that addresses regulatory hurdles, provides financial incentives, and promotes effective collaboration between public and private sectors. By doing so, governments and industry leaders can pave the way for a more accessible and robust charging infrastructure, facilitating broader adoption of electric vehicles and advancing sustainable transportation solutions.

As discussed above, the charging network plays a crucial role in the successful development of the electric mobility sector. Its presence, with adequate capacity and efficient distribution throughout the territory, is essential to encourage the mass adoption of electric vehicles by users. However, the deployment of this network faces significant challenges on multiple fronts.

First, at the regulatory level, there are various regulations and legislations that may affect the installation and operation of charging points. These regulations can vary between countries or even within a single country, which complicates the standardization and efficient implementation of charging infrastructure. In addition, the supply capacity of the power grid is a critical factor to consider. Expansion of the charging network requires a robust electrical infrastructure capable of supporting the additional demand posed by electric vehicles. This may involve significant investments in upgrading and modernizing the existing electrical grid.

On the other hand, the investments required to deploy the charging infrastructure are also an important consideration. From the installation of the charging points themselves to the associated operational costs, such as power supply and maintenance, a substantial financial commitment is required to effectively expand the charging network.

Addressing these challenges through effective coordination between the public and private sectors is critical. Working together to develop policies and strategies that encourage the expansion of the charging network, as well as to identify and overcome regulatory and economic barriers, will be key to driving the electric mobility sector forward.

It is important to note that differences between northern and southern European countries in regulatory, cultural, economic and business terms have led to divergent approaches to charging network expansion. These differences have significantly influenced the development and penetration of electric vehicles in each country, highlighting the importance of addressing these challenges in a collaborative and coordinated manner at the European level.

4.2. Typologies of charging network

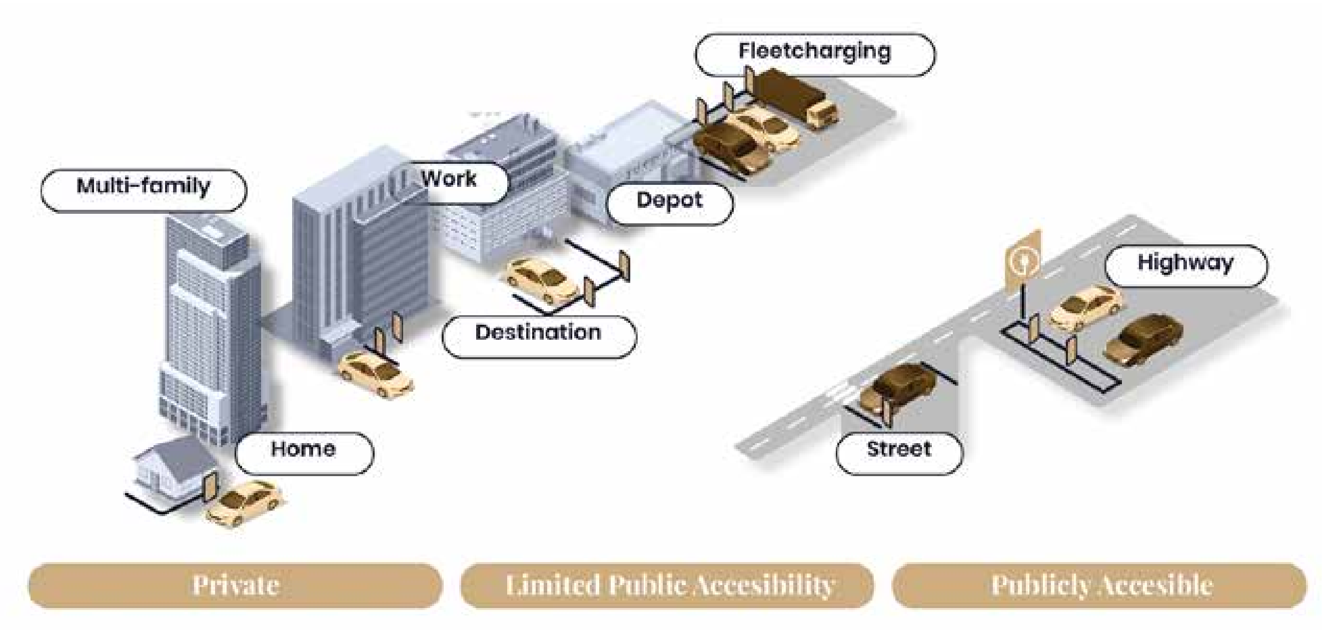
There are different types of locations for charging operations, each with its own characteristics, needs and potential users. We can classify these options into three main groups:

- Private. Private charging points inside private properties (mainly homes or residential buildings)

- Public with limited access. Charging points in public areas where access may be restricted to certain users, for example: offices, hotels, shopping malls,...

- Public with free access. This is the network of charging points located on public roads and with open access to any user. Within this group we can include charging points distributed on urban roads, and charging points in service stations located on interurban roads and highways.

Each type of charging has its distinctive characteristics, both in terms of charging type, usage and infrastructure:



Charging in private areas

These are charges that users typically perform at their homes, involving slow charging with chargers typically around 22 kWh. The charging infrastructure consists solely of a charger connected through a relatively simple installation to the existing electrical grid. The power and charging capacity of these installations are low, as the electrical demand of such installations is minimal.

These charges are conducted daily at home during night time hours. They allow vehicles to be partially recharged overnight, providing sufficient autonomy for urban commuting trips. This type of charging meets the needs of users who rely on electric vehicles for daily short-distance journeys, requiring charging only during night hours at home using these slow charging systems.

In general, these installations are processed relatively straightforwardly and do not require significant modifications to the supply grid. However, in the event of widespread adoption of electric vehicles, and the concentration of a significant number of connection and charging points within densely populated areas, the new electricity demand entering the system could necessitate modifications and expansions to the electrical supply grid. This potential scenario could pose a major barrier to electric vehicle adoption, as any alteration to urban energy supply networks will entail lengthy and complex administrative procedures, in addition to requiring substantial capital investments for their expansion.

This is one of the reasons why it is essential for the development of the electric mobility sector to be accompanied by substantial public support in preparing both regulation and the distribution and supply of electrical infrastructure. This proactive approach is crucial to effectively managing the new demand that may be introduced into the system.

Charging in limited public accessibility areas

In this case, charging occurs in non-exclusive areas but with restricted access in some way, such as offices, shopping centers, industrial estates, logistics zones, and parking lots. These are charging points accessible only to specific users. The charging infrastructure in these locations typically features higher capacities compared to private homes, as the charging sessions are shorter and therefore require higher-power chargers. Additionally, multiple charging stations are often installed within these zones, potentially necessitating upgrades to the existing electrical infrastructure due to the collective electrical demand they could generate. In these locations, the new electricity demand entering the system may require actions such as installing a new transformer substation or, in areas with a high concentration of charging points, modifying the distribution network to meet the increased supply requirements.

In these locations, multiple groups of chargers with power levels ranging between 50 kWh and 100 kWh are typically installed. These are considered medium charging installations, where the average charging time could vary from several minutes to hours. This is because these sites accommodate two types of charging operations: slower ones at facilities associated with offices and parking lots (where users stay for several hours and vehicles can charge at lower power levels), and shorter sessions at locations linked to shopping malls, public buildings, etc., where the average stop time is shorter and users demand higher-capacity charging points.

Regular users of these charging points often use them as supplements to those already available at their homes. By utilizing low-power overnight charges at home and low to medium-power charges at workplaces, shopping areas, parking lots, etc., users can fully meet their energy needs for urban or semi-urban electric vehicle use, covering daily trips of up to 100 km.

Charging in public areas

The charging points included in the two previous groups meet the needs of a specific set of users: those who regularly use electric vehicles for urban or semi-urban journeys with daily distances typically below 100 km. These users primarily rely on electric mobility systems for daily commuting, but such systems would not cover the demand of individuals intending to use their vehicles for intercity or long-distance travel. Meeting these needs requires a geographically well-distributed public charging network with sufficient capacity and power to accommodate the potential demand it would generate.

These charging points require high power levels, to support fast and ultra-fast charging operations. In this context, we are talking about fast chargers ranging from 150 kWh to 250 kWh.

These are locations that must meet the needs of users undertaking long-distance journeys, or making unplanned trips, thus requiring charging operations that do not disrupt their travel plans and times (similar to current refueling operations for combustion vehicles, where users can reliably find a gas station within a short range, refuel in minutes, and continue their journey). This generate the need of strategically placing charging points across the territory, often far from urban areas where securing the necessary electrical connections may be more complicated. Additionally, each charging site will necessitate substantial investments, not only in road infrastructure (for connecting the station with the existing infrastructure) and the charging station itself, but also in electrical infrastructure to support fast and ultra-fast charging points.

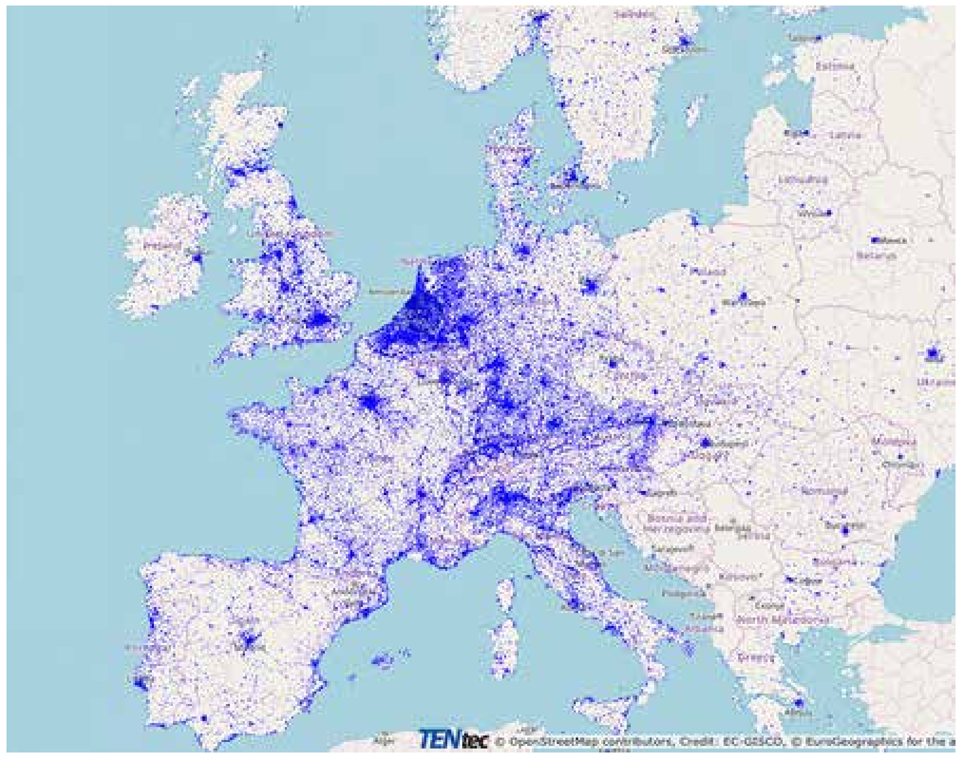
On the one hand, we are talking about locations that will integrate multiple fast and ultra-fast chargers, resulting in high demands for power and electrical supply. On the other hand, a significant portion of these sites will be situated outside urban areas where access to the electrical grid and its capacity may be severely limited. Therefore, alongside the deployment of this charging network, there must be an effective coordination (both public and private) with electricity distribution and supply networks. This would ensure that adequate capacity would be available to support the rollout of this charging network distributed across the territory.

This public charging network is significantly underdeveloped compared to what is needed in Southern European countries like Italy and Spain. These countries face significant geographical, social, and regulatory constraints that have hindered private investment and the development of such infrastructure. This situation represents a major obstacle to the sector's growth, as it prevents the widespread use of electric vehicles beyond daily short-distance trips covered by private or publicly accessible charging installations.

4.3. Charging network in Europe

As previously mentioned, the charging network in the European Union is unevenly distributed, with a noticeable concentration of charging points in Northern and Central European countries.

Below is an attached map illustrating the distribution of charging points across the different European countries, highlighting those with higher densities of charging infrastructure:

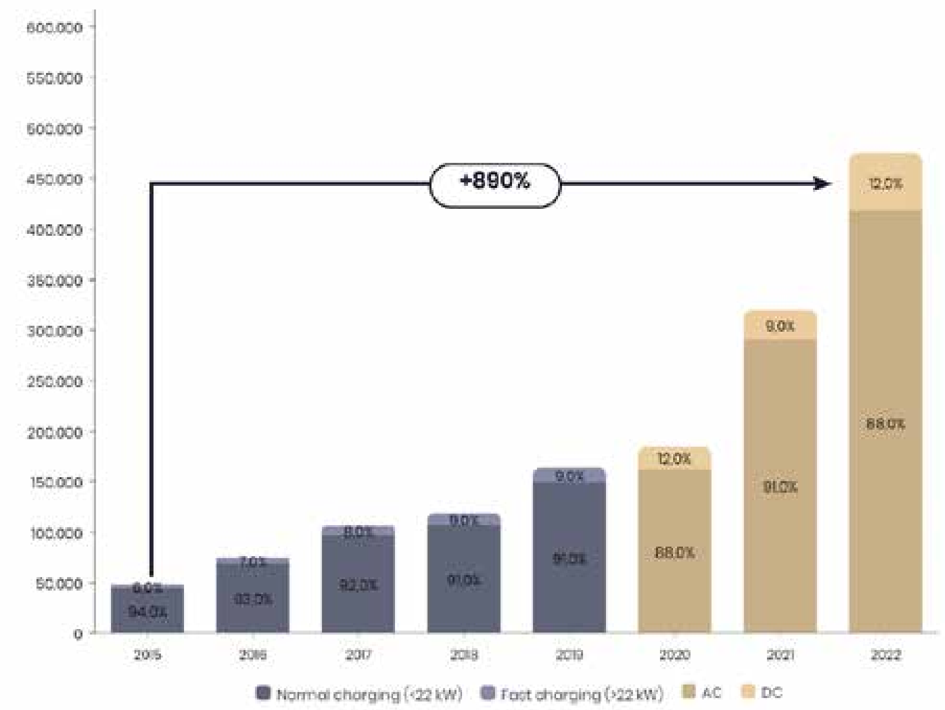


The European Commission has developed an interactive map compiling all the charging points across the continent:

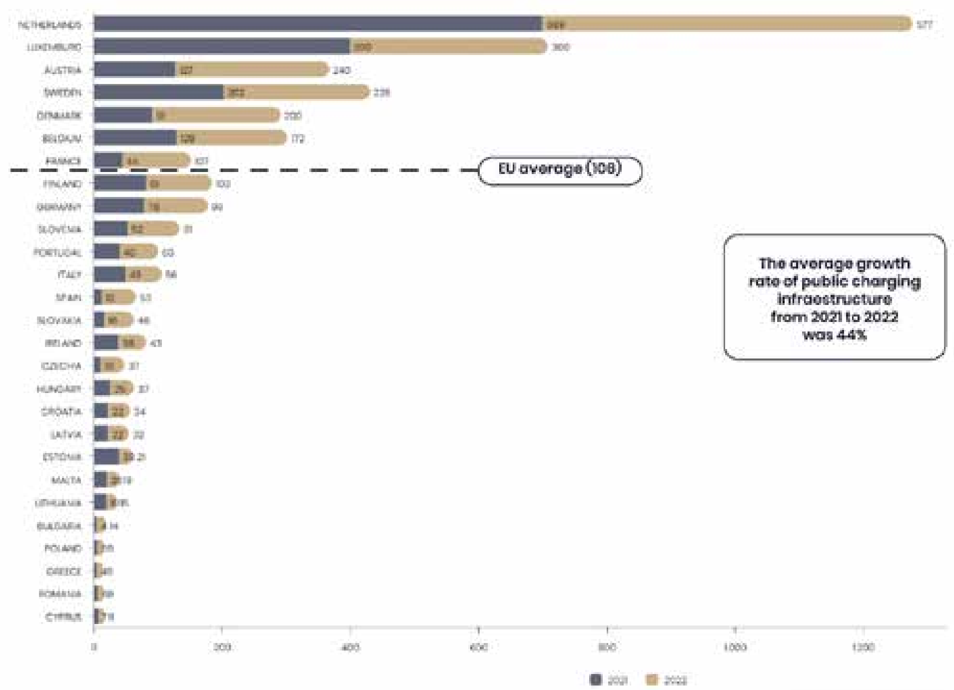
https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html

The deployment of charging networks has been evolving rapidly over the past few years; however, this evolution varies significantly depending on the country. Across the continent, in the past seven years, the number of charging points has increased tenfold. This growth has been even more pronounced in recent years, with the number of charging point multiplying by 2.5 between 2020 and 2022, increasing from 185,000 points in 2020 to 475,000 points in 2022.

Additionally, within these charging points, there has been faster growth in points with capacities greater than 22 kWh (i.e., mainly installed in public areas or restricted public areas)



If we separate these data by country and analyze them according to the number of potential users (based on the population of each country), we can observe the great differences that exist within the European Union, which allows us to conclude that there are indeed two clearly differentiated speeds of development. The information included in the chart below shows the number of charging points in each country per 100,000 inhabitants:



It is evident that the European Union average for charging points remains relatively low, with only 100 charging points per 100,000 inhabitants, equating to one charging point for every thousand people. In contrast, the most advanced countries boast ratios exceeding 200 points per 100,000 inhabitants. Southern European countries, however, display lower averages in this regard. Specifically, Portugal, Spain, and Italy each have around 50 charging points per 100,000 inhabitants.

Despite this modest figure, it is important to highlight that Spain has made significant strides in the past year, increasing its number of charging points from 12 to 53 per 100,000 inhabitants. This rapid growth underscores a positive trend in the development of the sector within Spain, indicating substantial progress and a promising outlook for future expansion.

As indicated above, these charging points can be located in private areas, in limited public accessibility areas, or in public areas.

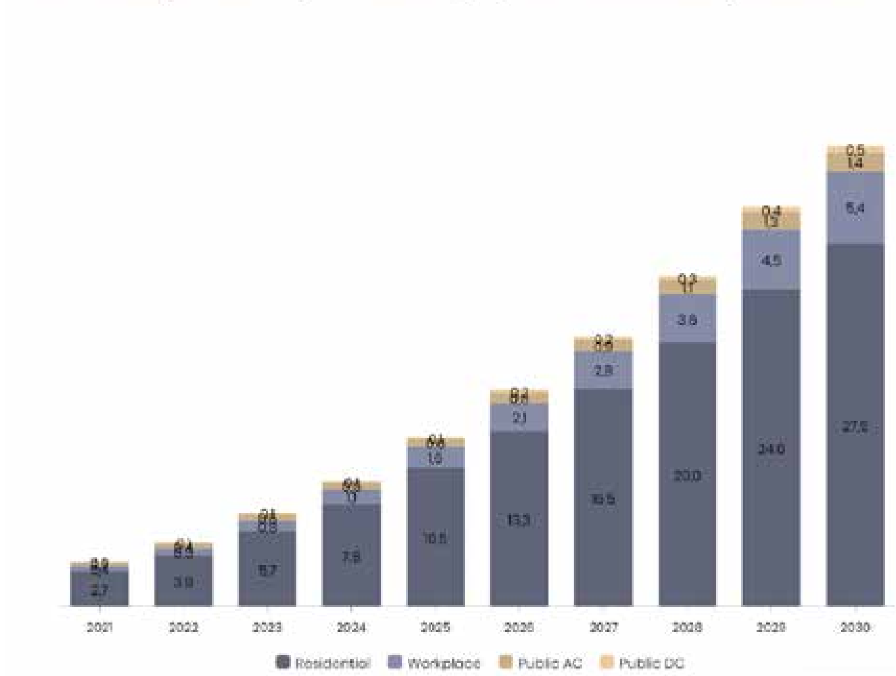
Available data for the year 2023 show that, for the time being, most of the installed charging points are located in private areas. The medium-term forecast is that private charging points will continue to account for the largest share of the available charging structure (around 80%), followed by charging points in work areas (around 15%). Although the number of fast charging points in public places is expected to grow significantly (from less than 100,000 today to the 500,000 expected in 2030), they will still represent only 1.4%, which is clearly insufficient to enable the electric mobility sector to develop properly.

Therefore, the deployment of a well-distributed public charging network, covering the entire territory and equipped with sufficient power and charging capacities, is crucial for the effective replacement of internal combustion vehicles by electric vehicles. Specifically, the inclusion of fast charging stations with infrastructure capable of delivering power above 200 kWh is essential.

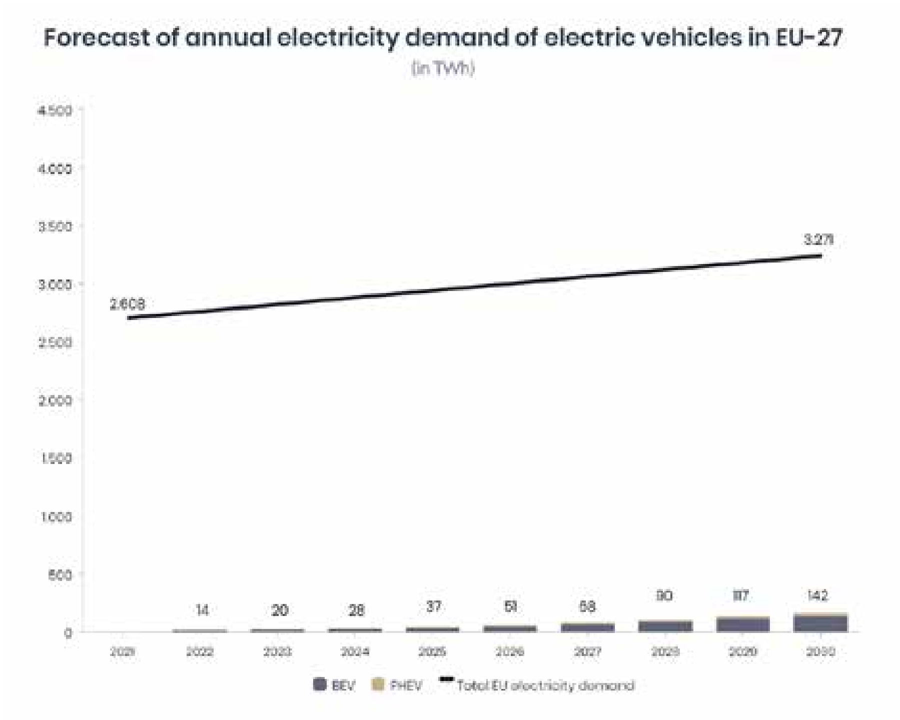
Without such a comprehensive public charging infrastructure, the use of electric vehicles will be mainly confined to short-range trips and daily commuting predominantly within urban areas. In these scenarios, users will primarily rely on private and restricted-access public networks for their charging needs, which significantly limits the practicality and appeal of electric vehicles for longer journeys and widespread adoption.

The following chart projects the forecast increase in the number of chargers according to their typology until the year 2030. This projection shows the insufficient expected growth rate of fast charging points.

Forecast of public and private charging infrastructure by use in EU-27



As indicated above, the deployment of this charging network entails a potential increase in electricity demand, and it is necessary that both electricity generation and distribution have sufficient capacity to meet this increase in demand. Based on the forecasts indicated above, and taking into account a very small increase in fast charging points (representing only 1.4% of the total), electricity demand for this sector would increase tenfold between 2022 and 2030, rising from 14 Twh in 2022 to 140 Twh forecast for 2030. Even so, in absolute value this demand would account for 4% of total demand within the European Union.



5

KEY ELEMENTS FOR THE DEPLOYMENT OF THE CHARGING NETWORK

There are several key elements that determine the possibility of deploying an adequate high-speed charging network on public roads, in order to allow the correct penetration of the electric mobility sector. The main elements are:

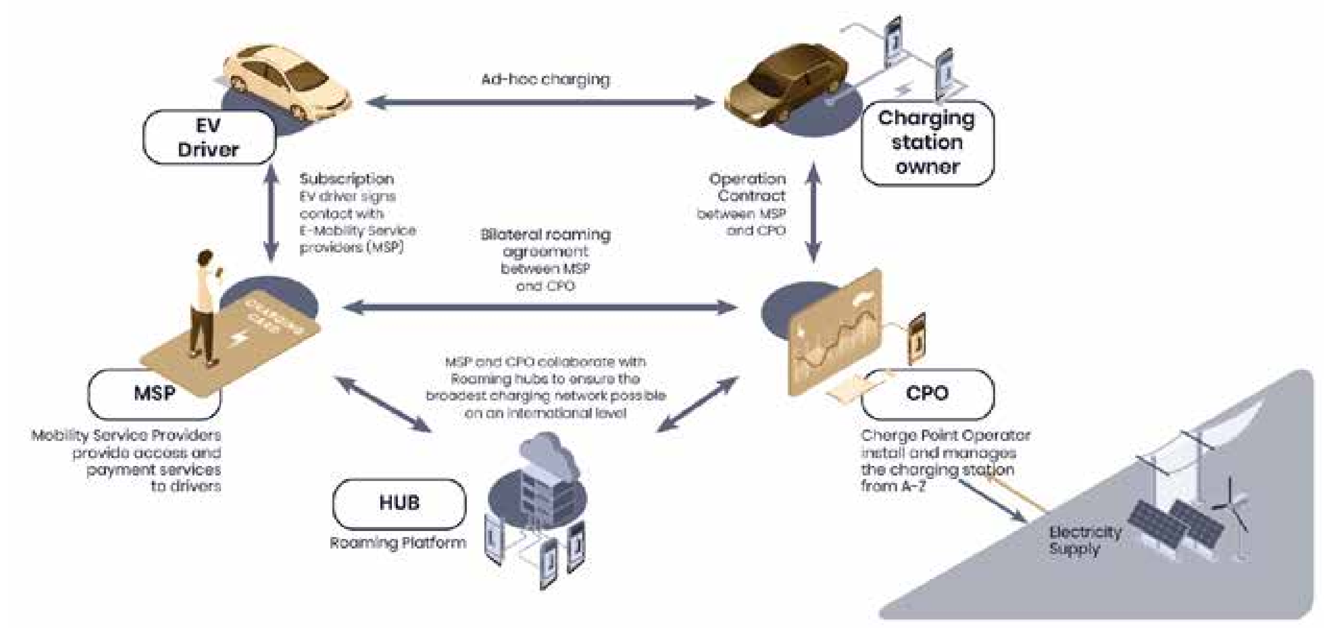
- Regulation and Legislation. Mainly concerning the procedures for requesting and obtaining the necessary permits (for connection to the electrical grid) with adequate supply capacities. However, regulation and legislation are also key in identifying, obtaining, and developing the necessary land (and its infrastructure) to set up charging points. Finally, legislation related to access to the public road network, and their requirements for access and connection to new infrastructure sites, can also have a significant impact.

- Capacity of the existing energy transmission and supply network. The new demand for energy may exceed the existing capacity of some parts of the current transmission infrastructure. Therefore, adding new connection points or increasing the power at existing ones may require the upgrading of the line or even the construction of new infrastructure. In these cases, the necessary investment costs and timelines are significant. If a proactive analysis and reinforcement of this infrastructure are not carried out, it could potentially hinder the deployment of the charging network, thereby slowing down the development of the electric mobility sector.

- Creation of an appropriate investment framework. The deployment of this charging network requires significant CAPEX investments, which will have a considerable maturation period and, therefore, will not generate immediate cash flows. These are capital-intensive investments that require professional investors with the capacity to support the sector. Hence, it is essential that the regulatory frameworks and legal security of each country are aligned with the needs of the sector, thereby creating the appropriate conditions for the necessary capital to enter the market.

- Existence of suppliers with capacity and experience throughout the value chain of the sector. It is necessary to have specialized companies in each of the chapters involved in the electric charging sector, mainly:
  - CPO (Charge Point Operator), the charging network operators
  - MSP (Mobility Service Providers)
  - Companies specialized in the design and construction of charging infrastructures (EPC).
  - Specialized engineering firms.

The proper deployment of the charging network will require these conditions to be met jointly and with aligned interests, so that secure investment frameworks to be generated where the necessary capital flows and it was available to design and construct charging infrastructures, with the capacities and power levels needed to meet the potential demand that will be generated.



Each country within the European Union exhibits distinct characteristics concerning the aforementioned factors. In Northern European countries, these elements are effectively combined, enabling a successful deployment of the charging network and thereby establishing a conducive framework for users—culturally more inclined to adopt this new technology—to transition from fossil fuel-based mobility to electric vehicle-based mobility.

However, in Southern European countries, these conditions are less developed, resulting in a clearly inadequate current deployment of the charging network, despite recent acceleration over the past two years. This creates a significant barrier to sector growth and hampers market penetration, impacting users' ability to adopt electric vehicles and reduce reliance on fossil fuels in mobility.

If we analyze the specific case of Spain, we can observe that there are important barriers that condition the possibility of developing the installation of charging points at an adequate speed:

- Slow procedures for requesting connection points. Dependence on third parties with opposite incentives to the promoters of the charging stations, in many cases we are talking about companies in the same sector with direct competition, which have their own business unit linked to the creation and management of charging points.

- Complex and lengthy urban planning procedures, often involving the necessity to deal with various levels of authorities: local, regional, and sometimes national...

- In general, these are processes that involve interaction with multiple different entities at various stages, with procedures that are not coordinated. For example, connecting charging stations to public roads requires dealing with different public infrastructure managers: Ministry, regional agencies...

- There could be important issues with the capacity of the electrical grid, which in many areas is not ready to handle the new demand that the sector will generate. Difficulty in obtaining grid connection points, especially in remote areas away from urban centers, where these new high-capacity charging stations, exceeding 200 kWh per unit, need to be installed.

- On the other hand, when it is necessary to expand or upgrade the distribution infrastructure to enable the required connection point, the process can experience significant delays or even come to a halt. These are complex procedures involving other operators and entities, requiring substantial capital investments and long execution periods

- Due to being a relatively immature sector, there is currently a lack of an adequate investment framework where guarantees and regulated processes are established to facilitate the entry of investors into the sector and enable the necessary investments for deploying this charging network

In Spain, we can summarize the technical and administrative process for the start-up of a site in the following five phases:

- Phase 1.- Location and site qualification. The first phase would involve identifying an asset where the conditions are met—based on location and potential demand—to consider installing an electric charging station.

- Phase 2.- Operational Feasibility Study. After selecting the site, the focus shifts to evaluating the project's technical viability. This involves conducting a thorough analysis to ensure that all necessary technical requirements can be met effectively.

  Firstly, there is a need to estimate the potential demand accurately. This estimation is crucial as it informs the design of the charging infrastructure. Factors such as expected usage patterns, peak times, and future growth projections are considered to determine the optimal configuration and capacity of the charging station.

  Once the demand estimation is complete, the next step is to design the charging installation itself. This includes specifying the types and numbers of charging points required, determining the necessary power capacity for each point, and planning the layout to ensure efficient operation.

  Following the design phase, it is essential to assess the feasibility of connecting the installation to the electrical grid. This evaluation includes analyzing the grid's current capacity and infrastructure at the site's location. It may involve discussions and negotiations with local utility companies and grid operators to determine if upgrades or modifications are necessary to support the new charging station.

  Navigating this phase also requires engaging with various stakeholders in the electrical sector. This interaction is critical for obtaining permits, approvals, and coordinating any necessary infrastructure upgrades seamlessly. Effective communication and collaboration with these stakeholders are key to overcoming potential hurdles and ensuring the project progresses smoothly.

  In summary, Phase 2 involves a detailed examination of technical requirements, demand estimation, infrastructure design, and grid connection feasibility. It requires meticulous planning, collaboration with industry experts, and proactive engagement with regulatory bodies to pave the way for a successful implementation of the electric charging station.

- Phase 3.- Economic feasibility study. If the project is deemed technically viable, an economic feasibility study is necessary to analyze its economic viability. This involves assessing all costs associated with designing and installing the charging station based on the defined technical and capacity requirements. This includes initial infrastructure investment costs as well as operating costs during the operational phase.

  Additionally, it is crucial to analyze the existing potential demand in the selected area and project the expected revenues during the station's operation. The business plan must be sufficiently compelling to attract equity providers in this sector and secure the necessary investment. As previously mentioned, within this chapter, alongside potential returns, the analysis of investment risk is fundamental.

  The legal and regulatory framework of each country, and the maturity of the sector, can impact the profitability requirements that potential investors demand from an operation, substantially raising these profitability thresholds and potentially preventing the development of potential sites.

- Phase 4: Administrative authorization, license management, and permits. Once it has been established that the chosen location meets both technical and economic viability criteria, the project moves into the crucial phase of securing administrative approvals, licenses, and permits. This phase is essential for obtaining the necessary permissions to connect the facility to the grid and to obtain licenses for construction, operation, and integration into the existing infrastructure network for the new charging station. This administrative process marks a pivotal point where the project will achieve at the end the "ready to build" status.

  Navigating this phase requires diligent coordination with regulatory authorities at local, regional, and potentially national levels. It entails submitting detailed applications, adhering to regulatory requirements, and addressing any environmental, zoning, or community impact assessments that may be necessary. Successful completion of this administrative phase lays the groundwork for subsequent construction activities, ensuring compliance with legal frameworks and operational readiness for the new charging infrastructure. In summary, Phase 4 represents the transition to execution readiness, where regulatory compliance and administrative approvals pave the way for the tangible realization of the planned charging station, marking a critical milestone in the project lifecycle.

- Phase 5: Installation of the new charging infrastructure. As previously mentioned, this phase represents the most capital-intensive stage, requiring specialized companies with EPC contracts in this sector. It is crucial to maintain strict control over the timelines of each specialized company, suppliers, and the entire production chain to ensure that the timelines of this phase are as tight as possible.

- Phase 6: Operational start of the installation. Beginning of the management and maintenance phase of the facility. From this point onward, the new installation remains operational, and cash flows begin to be generated, allowing for the profitability of the investment made during the previous phases.

During the first three phases of the project, the main actor would be the promoting company (owner) of the charging facility, responsible for all tasks and investments needed to validate the technical and economic viability of the proposed site. In phases 2 and 3, this owner must collaborate closely with both the Charge Point Operator (CPO) and the EPC and engineering firms. These companies will oversee phases 4 and 5 of the process, which culminate in the installation and commissioning of the new infrastructure. Starting from phase 6, the primary actor will be the CPO, who will manage the facility throughout its operational life

In Spain, this process is excessively slow due to challenges encountered at each phase. Administrative and bureaucratic procedures involve multiple entities and administrations that often operate independently, causing significant delays in processing charging installations. Administrative timelines, spanning from phases 1 to 4 as described earlier, can extend from 20 to 30 months. These prolonged timelines pose a substantial hindrance to industry development and serve as a deterrent for attracting the necessary investment into the system. The lack of streamlined coordination among stakeholders contributes to these delays, highlighting a critical need for improved efficiency and regulatory alignment to foster faster deployment of charging infrastructure essential for the advancement of electric vehicle adoption

In the case of Spain, another issue must be added: the poor geographical distribution of the insufficient existing network. While major cities in Spain have a relatively high density of EV charging stations, other geographical areas such as Galicia or Canarias have limited access to charging stations, making it difficult for EV owners to travel long distances. Even though the Spanish government is taking steps to address the challenges with EV charging infrastructure (Plan moves, PNIEC), more efforts are needed to ensure that all areas of the country have access to sufficient charging power and to make electric vehicles a viable option for all citizens.

Therefore, in the case of Spain, as well as in other countries where the electric mobility sector is advancing at a slower pace, it is imperative for both industry stakeholders and public administrations to collaborate closely. It is essential to establish coherent legal and regulatory frameworks aimed at simplifying and expediting administrative processes related to the deployment of electric vehicle charging infrastructure. Additionally, implementing targeted fiscal policies and incentives will be crucial to attract the necessary investments in these systems.

Furthermore, fostering effective public-private partnerships is essential. Such collaborations can leverage the strengths of both sectors to accelerate infrastructure deployment. These partnerships should focus on developing robust charging networks capable of accommodating the growing demand for electric vehicles, thereby facilitating the complete transition away from internal combustion engine vehicles.

The transition to sustainable electric mobility in the transportation sector hinges significantly on the establishment of an extensive and efficient charging infrastructure. This infrastructure not only supports the widespread adoption of electric vehicles but also contributes to reducing greenhouse gas emissions and enhancing air quality in urban areas. Therefore, concerted efforts between industry players and governmental bodies are essential to overcoming existing challenges and ensuring a successful transition towards a cleaner and more sustainable transportation future.

6

CONCLUSION

In the electric mobility sector converge three of the most important themes of contemporary geoeconomics: energy transition (due to its ability to ensure mobility with lower emissions), digital transition (because an electric car is ultimately a computer on wheels with a battery), and economic security (as global powers are increasingly concerned about the backdrop of escalating geopolitical rivalry).

European car manufacturers, who held global leadership for decades, now face a challenging position in the automotive sector due to the rapid industrial and technological advancements in electric vehicles by Asian countries. The industrial policies of these nations have been strategically geared towards bolstering their automotive industries, recognizing the substantial positive externalities and economic spillover effects associated with electric mobility. In contrast, the European Union (EU) has encountered a significant disadvantage. Unlike a fiscal union, the EU lacks the flexibility to implement cohesive fiscal policies and comprehensive public support measures. This includes incentives crucial for fostering innovation and competitiveness in the electric vehicle market. The fragmented approach to fiscal policies across EU member states complicates efforts to provide unified support to European automakers aiming to transition to electric vehicle production. As a result, European manufacturers are navigating a competitive landscape where Asian counterparts are swiftly advancing in electric vehicle technology and production capabilities. The EU's regulatory framework and fiscal constraints pose challenges in effectively supporting its automotive industry's transition to sustainable electric mobility, potentially affecting its global competitiveness and market share in the evolving automotive sector.

One of the pivotal conditions enabling sectoral development is the establishment of a comprehensive charging infrastructure that guarantees the functionality and usability of electric vehicles. This prerequisite is crucial, as without it, widespread adoption of this technology among users will not materialize, and the EU's sectoral development objectives will remain unattainable. The challenges encountered in deploying the charging network mirror those faced in electric vehicle manufacturing. Existing regulatory landscapes across European nations, coupled with the absence of a unified framework encompassing legislation, incentives, and fiscal policies, have hindered the deployment and expansion of investment and specialized enterprises. Consequently, the charging network across Europe exhibits significant disparities in geographic distribution. As previously highlighted, notable discrepancies exist between Northern and Central European countries versus Southern Europe, resulting in marked variations in actual sectoral deployment and electric vehicle uptake by consumers. Addressing these challenges comprehensively within the EU framework is imperative to achieve consistent sectoral advancement. Collective strategies need to be formulated to firmly establish and uphold the EU's leadership position in driving this sector forward.

Therefore, it is still possible to react, as several industry reports indicate. The challenges that the EU must confront to avoid missing the boat in this crucial sector are numerous and include: policies to structurally reduce the cost of electricity, agreements to secure the supply (or internal production) of semiconductors and critical minerals, the introduction of incentives to stimulate demand and foster greater competition, and the design of a more active industrial policy that will necessarily require European-level funding to prevent market fragmentation

In conclusion, there is still much work to be done, both at the European Union level and within national entities, to capitalize on the opportunity that this sector represents for the continent. Europe must lead in the electric mobility sector, and to achieve this, a properly deployed charging network must be ensured, evenly distributed throughout the European territory, equipped with the necessary capacities and power. It is essential, therefore, to eliminate the two-speed European Union scenario (regarding charging infrastructure and electric vehicle penetration) and jointly lead the future of electric mobility.

newdirection.online @europeanreform