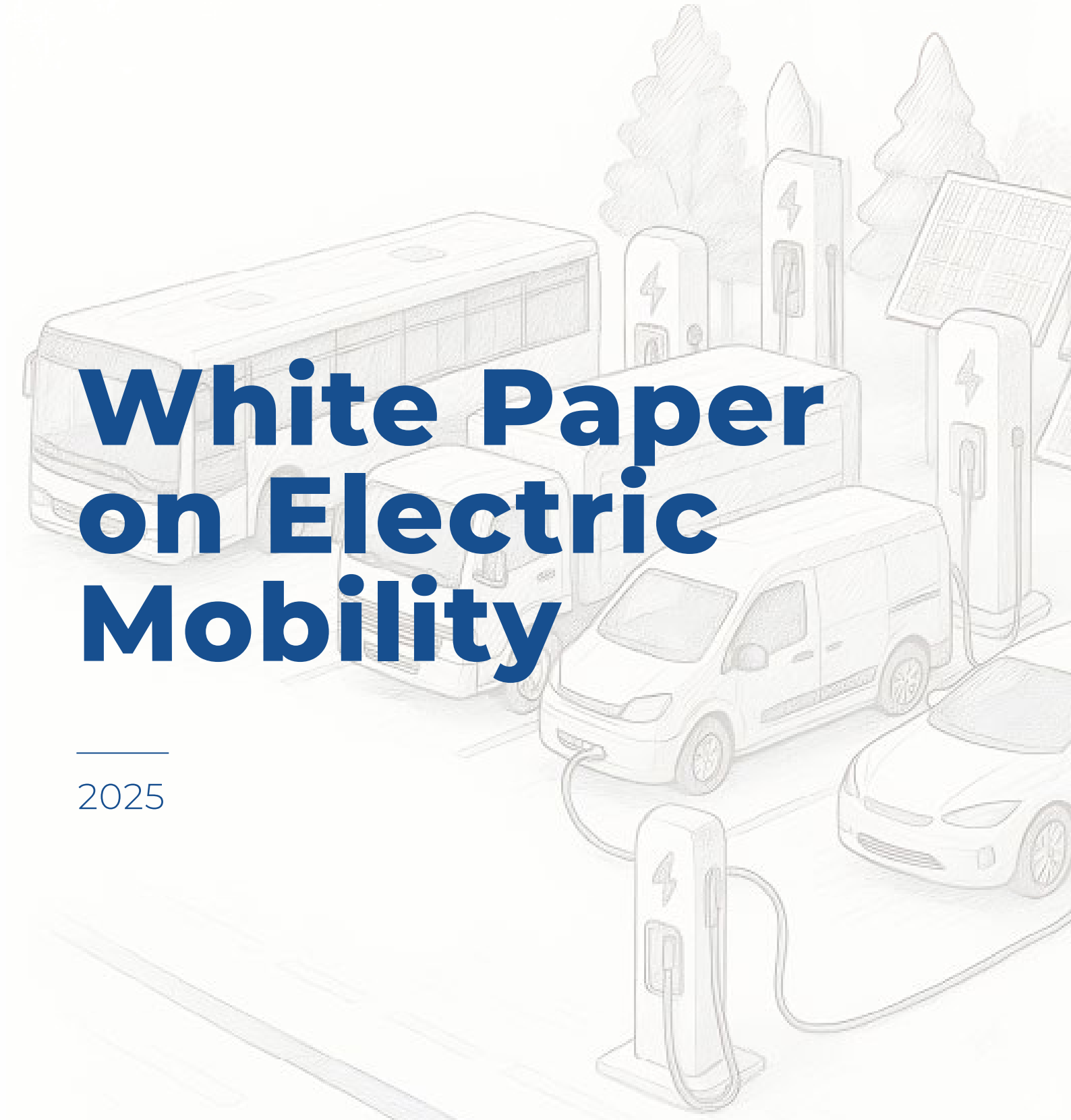

White Paper on Electric Mobility

2025

MOTUS E

WHITE PAPER ON ELECTRIC MOBILITY 2025

By Motus-E

We would like to thank the members of Motus-E and the stakeholders who wanted to give their contribution such as **GSE, RSE**, for their support and assistance in drafting the report.
DataForce, Cassa Depositi e Prestiti, Teraton and Utilitalia

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Who we are

Motus-E is the Italian association established by industrial operators and the academic world to promote the technological transition in the transport sector, promoting electric mobility and disseminating its economic and environmental benefits. Founded in **2018, Motus-E now brings together over 100 members and partners along the entire e-mobility value chain, representing the most authoritative interlocutor in the sector for institutions at all levels**. The association plays a key role in accompanying Italy in the process of decarbonising transport, ensuring a continuous flow of data and information to support professionals, policy makers and citizens.
This is achieved thanks to **analyses and studies with universities and research centers of excellence, as well as with the creation of guides and handbooks aimed at specific targets**. All accompanied by a constant mapping of the charging infrastructures in the territory and by a timely analysis of the market for electric cars, vans, buses and trucks. A 360-degree information framework aimed at **understanding all the implications of the transition underway and functional to seize the opportunities, which is accompanied by activities aimed at developing ad hoc skills**, through the preparation of specific educational paths for students and the organization of training courses aimed at professionals and trade organizations.

MOTUS-E | the members:

Fabio Pressi

Motus-E
President

> ***"The electrification of transport is an essential viaticum for national competitiveness and the country is beginning to become aware of this"***

Condensing all the data on electric mobility – in Italy, Europe and the world – together with analyses and regulatory proposals, thematic focuses and technological insights, in a single publication is not an exercise in style.
It is adecisive step forward to develop a truly informed debate on the technological transition of transport, a crucial topic for the prospects of our country.
A debate that intertwines the themes of energy and mobility, to be addressed by going beyond the environmental issues, now acquired, to focus on industrial, technological and system aspects.
Unfortunately, **the last few years have been marked by a discussion steeped in misleading ideologies**, with profound changes taking place interpreted only in light of the impositions of the European Green Deal. Too often, without grasping the true scope of a colossal technological revolution.

Years of disputes over Europe's mistakes - real and presumed - have wasted precious energy, which could be used to govern a change already underway throughout the world. There is time to recover ground, but we must act quickly.

Presenting a White Paper on electric mobility means offering a tool for deep reflection, which goes beyond the statistics of an evolving market. Because **the very concept of "mobility market" is in transformation**: today it involves sectors that once walked on parallel lines.
We are now in the presence of alarge, extended industrial supply chain, which must know and consolidate itself.
In this sense, **Motus-E is clear about the decisive role it is called to play, thanks to a unique and transversal vision of this sector**, which takes shape in the extraordinary amount of activities carried out thanks to the precious collaboration of over one hundred associates and partners.
The electric vehicle is a strategic node that connects batteries, electrical networks and software, with a natural opening to artificial intelligence.
We need a systemic vision that brings together manufacturing, energy, regulation and territories.
From the point of view of motorists, despite the growth of the charging network, Italy is going through a period of uncertainty that has slowed down the process of adopting electric mobility, distancing us from other large European countries. **An unnecessarily conflictual climate has contributed to citizens losing sight of the more practical values of the transition**: from the possible economic savings to the pleasure of driving, through comfort and safety.
It will be essential to bring these tangible benefits back into view, which speak to the daily lives of people, but also of companies that, through their fleets, play a leading role in electrification.
Returning to industrial reading, last year, at the beginning of my mandate, I chose a strong parallel – the one with Kodak and BlackBerry – to shake consciences and remind us how much it can cost to underestimate change.
Now I can say that the alarm has begun to have an effect: the **electrification of transport is an essential viaticum for national competitiveness** and the country is starting to become aware of it.
We must insist on the diffusion of this approach, at all levels.
Motus-E will continue to do its part, with the utmost pragmatism and energy, as aplatform for discussion, proposals and vision, at the service of industry and institutions.
The future of mobility is a challenge, but also an extraordinary industrial opportunity for Italy.

Interview with:

Maciej Mazur

E-Mobility Europe
President

> ***"The outlook remains positive, with BEV market share expected to reach 21.5% by the end of 2025 and up to 26% in 2026."***

1. What were the main forces shaping the European automotive market in the first half of 2025 and what prospects can we expect for the second half and 2026?

The first half of 2025 saw the European automotive market driven by regulatory changes, a surge in affordable BEV models and strengthening OEM compliance efforts. According to Schmidt Automotive Research, BEV penetration in Western Europe has risen to 18.4%, with plug-in vehicles reaching 26.4% of new registrations.
The outlook for the second half of 2025 and for 2026 remains positive, with a share

BEV market share expected to reach 21.5% by the end of 2025 and up to 26% in 2026 supported by a new generation of affordable electric vehicles and localized production by European and Chinese manufacturers.electric

2. How could the growing range of affordable electric vehicle models reshape the EU car market in the coming years?

The expansion of the range of affordable electric vehicles, starting at around €25,000 and falling below €20,000 from 2026, will democratize access to electric mobility. Efforts by Renault, Volkswagen and Stellantis using LFP battery technology are making BEVs accessible to a broader consumer base. As they approach cost parity with internal combustion engines, the European market will shift decisively toward mass electric adoption.

3. How far along is Europe in developing the charging infrastructure needed to support widespread electric mobility?

Europe is making progress, but infrastructure deployment is still lagging behind vehicle growth. Regulations such as the AFIR, which requires fast chargers every 60 km on TEN-T corridors by 2025, are important steps. However, significant disparities between Member States remain, making an accelerated and harmonised rollout of charging infrastructure essential to support mass electrification.

4. How could the changing tariff landscape influence the technological transition in the European transport sector?

The imposition of EU anti-dumping duties on Chinese-made BEVs from late 2024 has altered competitive dynamics.
It slowed the influx of Chinese BEVs and encouraged local manufacturing investment. This room for maneuver allows OEMs Europeans to strengthen their BEV offerings, but sustainable competitiveness will ultimately depend on continued innovation rather than long-term protectionism.

5. Why does innovation play such a crucial role in ensuring the global competitiveness of the European automotive industry?

Innovation is key to Europe's global standing. Advances in battery technology, vehicle connectivity and energy integration (such as vehicle-to-grid capabilities) are essential to remain competitive.
European manufacturers must innovate faster to match the agility seen from emerging global players, particularly China and the US, who are aggressively pushing new models and technologies to global markets.

6. What policy actions should the European Commission prioritise to drive this essential technological transition, both in terms of demand and supply?

The European Commission should prioritise robust and harmonised incentives for BEV adoption, accelerate the deployment of charging infrastructure, develop strong industrial policies to support European battery and e-mobility value chains, and promote flexibility solutions such as vehicle-grid integration. Ensuring full implementation of the 2035 zero-emission transport targets is key to providing the necessary certainty for industry investments and maintaining Europe's leadership in clean mobility.

The key numbers of electric mobility in Italy

all data in this study refer to march 2025

LIGHT PASSENGER VEHICLES

299.659

electric vehicles **circulating** in italy

5,2%

(+77% vs 2024)
percentage of electric vehicles registered up to march 2025

153

(+31% vs 2023)
electric models offered on the market

2,1%

(+165% vs 2024)
market **share** of **other electric freight vehicles** registered up to March 2025

3,2%

(+69% vs 2024)
market share of **electric light commercial vehicles** registered until March 2025

COMMERCIAL VEHICLES

24.664

electric vehicles **circulating** in italy

LOCAL PUBLIC TRANSPORT VEHICLES

2.522

electric vehicles in **circulation**

11%

(+136% vs 2024)
market share of electric buses registered up to march 2025

6%

of the **buses circulating** in italy are electric

93,7%

of the **Italian territory** that has at least 1 charging point within a 10 km radius

5,4

ratio of circulating BEVs to active public charging points

RECHARGE

65.992

(+17% vs 2024)
charging points for public use in march 2025

BATTERIES

4,4 GWh

installed in vehicles sold in italy

80%

NMC batteries

+800%

the growth of the **LFP in 3 years**

62%

of the **investments** planned for the three-year period 2024-2027 are concentrated on products/services that are invariant with respect to the powertrain

2.142

companies who work in the automotive supply chain

AUTOMOTIVE ECOSYSTEM (OTEA)

167.000

working people

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MOTUS

Automotive

Light passenger vehicles

+142% vehicles

segment B sold
in Italy
in Q1 2025 vs Q1 2024

Key point
The price of electric vehicles is falling further and further

23.060

(+75% VS 2024)

Key point
Fleets must be the driving force for the growth of the Italian market share

>500 km

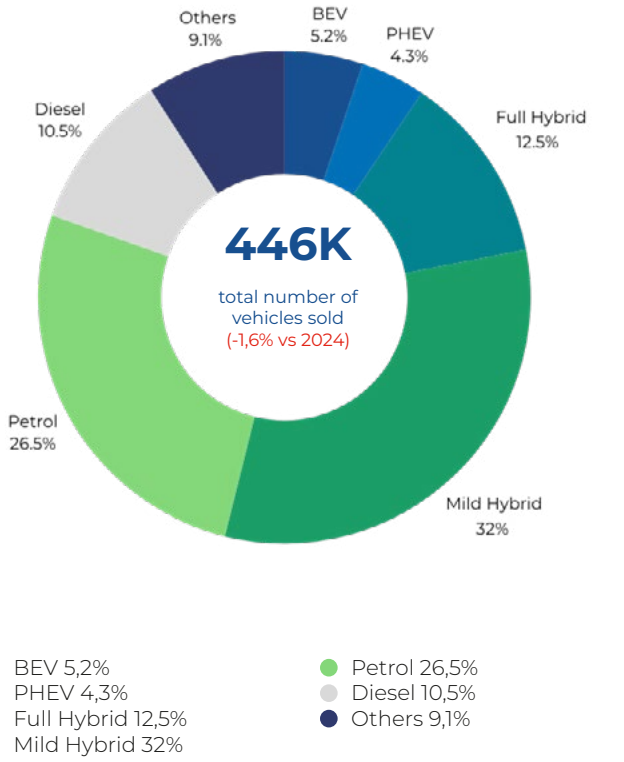
of **average autonomy approved** for vehicles available on the market European

Towards the new car generation

The car is today experiencing the greatest transformation inits 150-year history.
The transition from internal combustion engines to electric engines is a key player in the ongoing technological evolution; moreover, the automotive industry has since its birth constantly introduced revolutionary advances, which have made it a pillar of the world economy and society.

Today's transition is, however, unprecedented and epochal, called, as rarely happens, to take place in arelatively short period of time.
A new identity is taking shape for the car. Its electrification is one of the **technological innovation** drivers that is engaging manufacturers in investments and projects to optimize efficiency, autonomy, charging times, and costs.
But it is not the only one. Software, and with it Artificial Intelligence, is becoming increasingly central on board and off board, even more so in electric vehicles (ADAS, virtual assistants, user interfaces, connected services), paving the way for vehicles entirely designed around software (SDV). **New consumer needs are emerging in terms of mobility, new experiences are being designed to integrate the car with the electrical network and with connectivity networks.**
Technological challenges are accompanied by global environmental, energy, economic and geopolitical challenges, challenges of competitiveness and strategic autonomy, which also put the automotive industry and traditional business models to the test, creating new ones.
The rise of new players, especially from China, is redefining the balance, showing a surprising speed of execution and aholistic approach to the electric car value chain (critical materials, technological innovation, charging infrastructure, market,...), which Europe is struggling to match.
The market for zero-emission electric vehicles is thus developing in the Old Continent at a slower pace than expected, reaching **15.2% in the EU and 5.2% in Italy in the first quarter of 2025.**

Market Share Passenger Car by Power in Italy YTD 25[1]

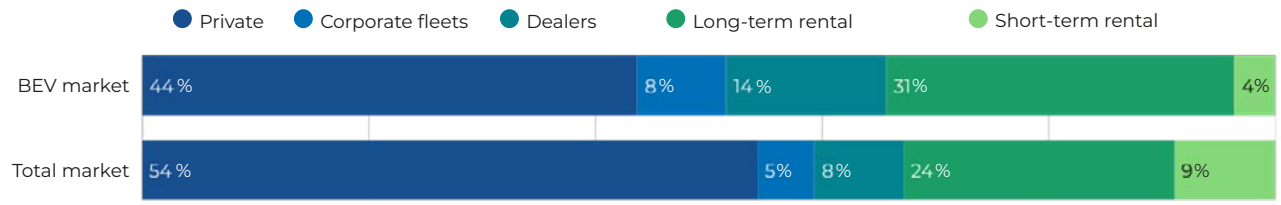


In **Italy** the entire market in the first quarter of 2025 recorded a **drop of 1.6%** compared to the same period in 2024, however **electric vehicles** showed a counter-trend marking a **clear improvement of 75% in terms of units sold** compared to the aggregate of March 2024, even surpassing the numbers recorded in 2023 (+40%), the best year of sales of BEVs in Italy. Thanks to these results at the end of first quarter of 2025, Italy has reached a total **BEV circulation of about 300 thousand vehicles, marking a growth of 830%in the last 5 years**
Looking at the **market channels for BEV vehicles**, in the first quarter of 2025 the channel **that has recorded the most interesting growth** compared to the same period in 2024 is the **car registration and 0km channel (+146.3%)** driven by aconsiderable increase in the supply of 0-emission vehicles in dealerships.

Also worth noting is the **significant growth**

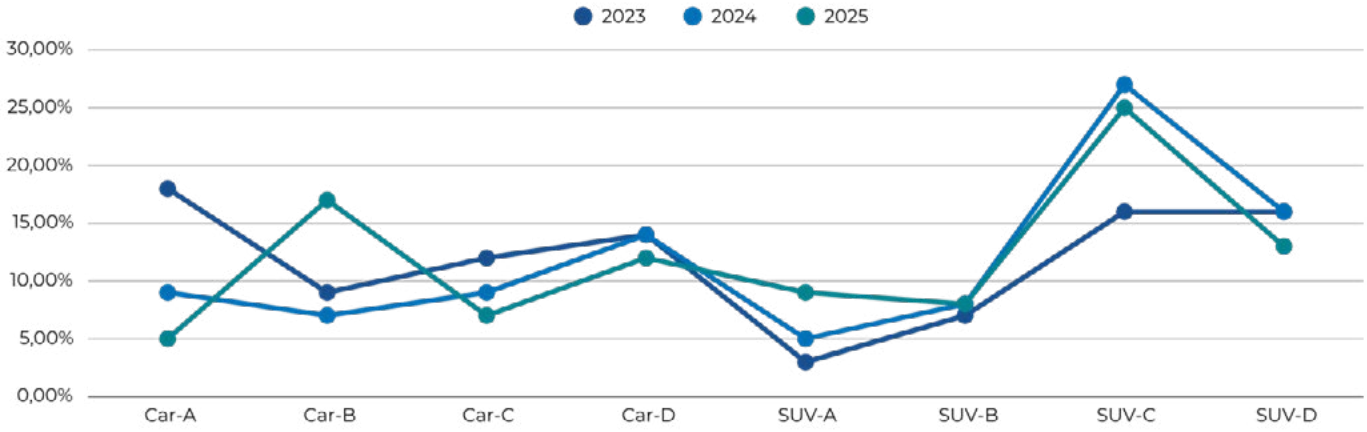
Data source: [1]Dataforce

Distribution by market channel in Italy [1]



of long-term rental, which recorded a **+89.6%** and positioned itself as **the second market channel** for BEV vehicles **in the first quarter of 2025 (30%) after the private channel (43%)**, also by virtue of the effects deriving from the change in the regulation on fringe benefits for company cars, present in the latest budget law. This figure, achieved despite the absence of incentives for demand, is certainly a consequence of the exit of new models **with a list price of around €25,000** which are mostly mass market products. If we analyze in which market segments the greatest growth has been found, **we note an increase of 142%** compared to the same period of the previous year in the market share of **B-segment vehicles (MS 17%)** on total BEV vehicles sold and a c**onsolidation of the C-SUV segment.**

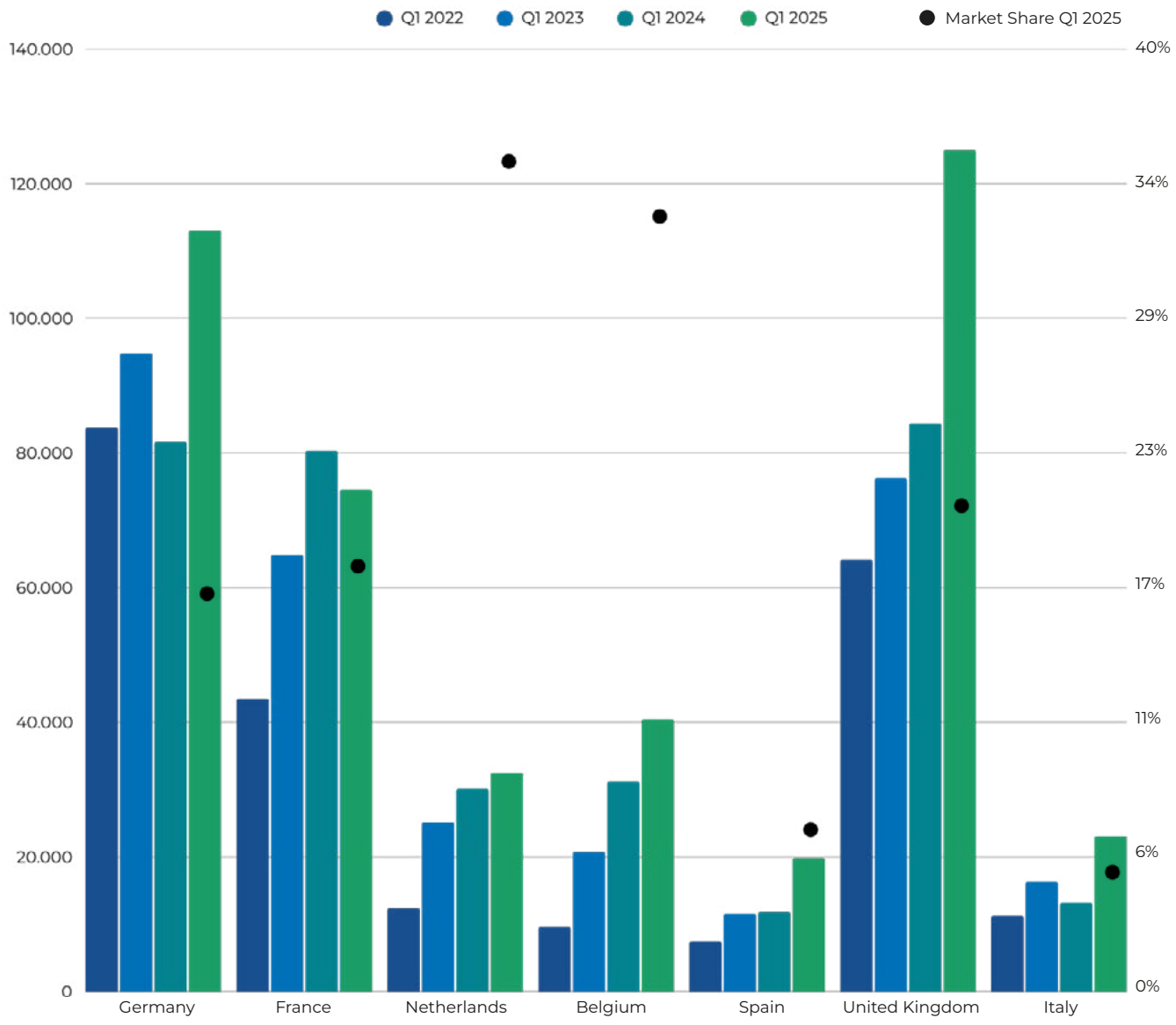
Italian BEV market breakdown by segment [2]



Even in Europe, where **8.8 million vehicles in circulation have been reached (marking a growth of 480% in the last 5 years)**, a similar phenomenon can be noted where the entire market has fallen by about 2 percentage points, while the share of electric vehicles has **grown from 12.3% to 15.2%,** thanks in particular to some countries that are returning to the volumes prior to the drops seen in 2024. It is noted that **Germany**, the main European market, has registered about 113,000 vehicles, **reaching a 17% market share,** exceeding not only the numbers for 2024 but also those for 2023 and 2022 where there were direct purchase incentives. **France is maintaining the path already traced last year (MS 18%)** while the countries of the Benelux area are growing sharply, thanks in particular to policies supporting company fleets. Special mention should be made of the **United Kingdom,** which, thanks to the clear policies of the new administration, is among the large economies of Europe that has shown the greatest increase in terms of volumes **(+36,000 units) reaching 20% of market share.**

Data Source: [1] Dataforce, [2] EV Volumes

Passenger Car BEV Registrations &Growth Rates in Major European Markets [1]



"Other Europe" includes: Türkiye, Russia, Albania, North Macedonia, Bosnia and Herzegovina, Kosovo, Serbia,Ukraine, San Marino. Values expressed in units of BEV vehicles sold

Data source: [1] EV Volumes; Values expressed in units of BEV vehicles sold

INSIGHT

Electrification is a global phenomenon

Electric mobility is a **global mega trend** which, like it or not, cannot be ignored. Whereas until a few years ago the electric car was a niche choice, sales of zero-emission cars have now become extremely significant. **The global trend of the electric vehicle market** inthe first quarters of recent years shows constantgrowth both in **absolute** terms and in terms of **market** share.
In **Q1 2022**, BEV registrations stood at around **1.44 million units**, with a market share of 8.4%. This share progressivelygrew to **10% in Q1 2023, 10.2% in Q1 2024,** and reached asignificant leap in **Q1 2025,** with over **2.74 million units** andamarket share of **13.8%.** This trend confirms that BEVs are gaining ground on the global market, both thanks to the increase in the offer of electric models and to the incentive policies and the growing restrictions on traditional engines in many areas of the world.
The strong increase between Q1 2024 and Q1 2025 signals a significant acceleration of the transition to electric.
It should also be noted that the **first quarter (Q1)** is typically the one that records the worst performance of the year in terms of sales volumes for electric vehicles, due to seasonal and market factors.
Despite this, **Q1 2025** has already recorded a **market share of 13.8%,** a figure higher than that of the entire previous year.
This suggests that, if the trend continues, 2025 could close with a share of **over 20%,** or with **1 in 5 cars sold in the world being fully electric.**

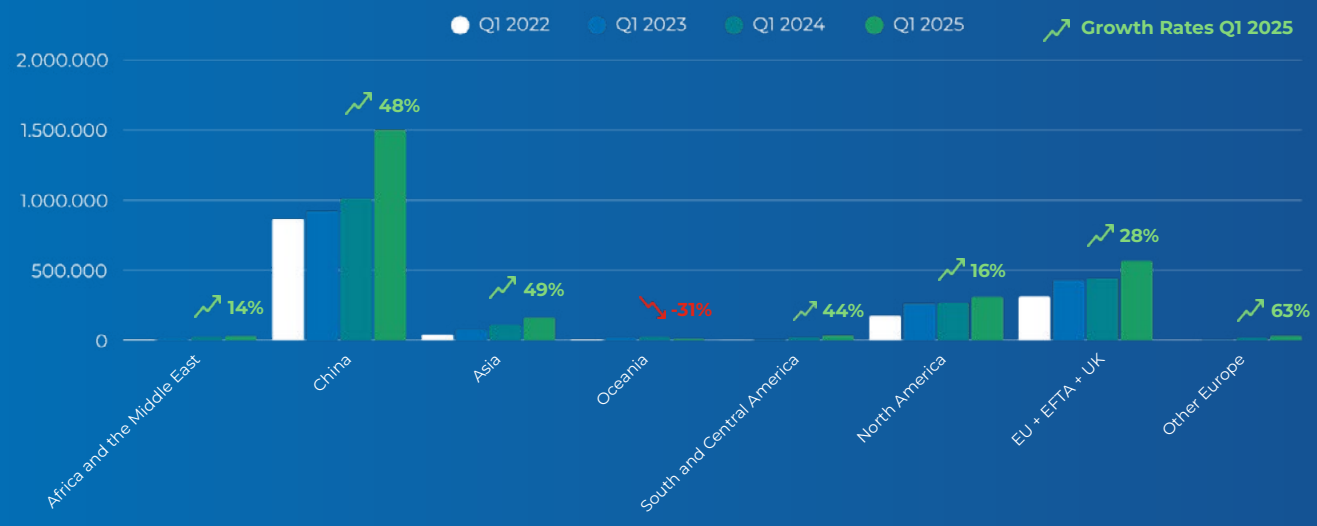
Passenger Car BEV Registrations &Market Share Worldwide

Values expressed in units of BEV vehicles sold

Data source: [1] EV Volumes

This confirms the **growing penetration of electric vehicles** in the global market and the acceleration towards zero-emission mobility, driven by innovation, regulation and greater consumer awareness. **The electrification of the car fleet is no longer confined to the most mature markets:** today, electric cars are a global phenomenon, rapidly expanding on every continent. From the sales boom in China, world leader with over 50% of BEVs registered in 2024, to the rapid adoption in Northern European countries, up to the significant increase in regions traditionally less inclined to change, such as South America and Africa.
The graph shows **the trend of electric car sales in different regions of the world** in the first quarter of the years considered (2022-2025) and the respective growth compared to the previous year. The data shows significant sales growth in nearly all **global regions between Q1 2022 and Q1 2025,** with particularly strong increases marked in emerging countries that are starting their journey of transport electrification. China and the EU continue to lead in absolute volumes, while only Oceania will see a decline in 2025. Overall, expansion is sustained, with different dynamics between mature and developing markets.
This **exponential growth is fueled by a convergence of factors:** falling battery costs, expanding charging infrastructure, increasingly stringent emissions regulations, and the entry of new global manufacturers into the market.
Electric mobility is redefining automotive value chains, transforming the industry and paving the way for a zero-emissions future. Demand is limited by an unfavorable consumption scenario, with a reduction in purchasing power and a lack of incentive systems that support the poorest segments of the population.
Added to this is a negative narrative about electric, fueled by numerous fake news that negatively influence consumer choices.

Passenger Car BEV Registrations & Growth Rates in Different Regions of the World [1]



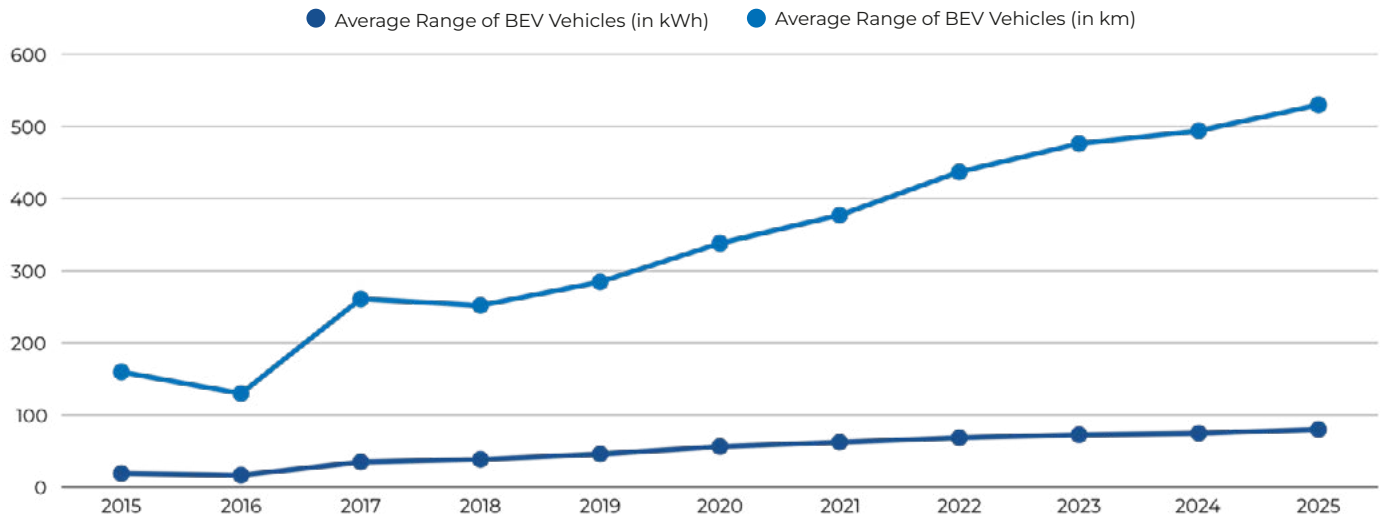
"Other Europe" includes: Türkiye, Russia, Albania, North Macedonia, Bosnia and Herzegovina, Kosovo, Serbia, Ukraine, San Marino.

Data source: [1] EV Volumes; values expressed in units of BEV vehicles sold

Market Trends

The electric vehicle market i**s not only growing in sales, but also redefining the entire technological paradigm of the sector.** The electric car today represents a true laboratory of innovation, pushing the boundaries of technology on multiple fronts: from battery autonomy to on-board artificial intelligence, through intelligent charging management and integration with electricity networks. Over the last ten years in Italy, **the average approved autonomy of the models in the price list has more than tripled, reaching an average of over 500 km.**
Over the same period, **the average traction battery capacity almost doubled.**
As the graph shows, the growth in autonomy has been more marked and dynamic than that of capacity, which has followed a more constant and linear trend, a sign of a process of improvement in the energy density of the batteries and the management of the power electronics, which has made **the electric car even more efficient.**

Evolution of autonomy and capacity of BEV vehicles [1]



Furthermore, if we also consider the vehicles announced for release in the next few years, we can see how the average battery capacity will reach **higher values of up to 94 kWh in 2028.**
The technological progress of electric vehicles also concerns other components such as **cables, power electronics, tires and engine.** In recent years, the electric engine **has undergone a radical transformation,** driven by technological innovation and the need to increase efficiency, power and sustainability.

If the first models of electric vehicles were based on classical **direct current (DC)** motors , **today technology has made a leap forward towards asynchronous current motors and innovative solutions such as variable reluctance motors and permanent magnet synchronous motors (PMSM).**
Another aspect that has undergone a **strong evolution over the years is the charging power supported by electric vehicles which have experienced asignificant evolution,**

Data source:[1] Quattroruote Professional, Motus-E "An electric choice today. A value choice tomorrow"

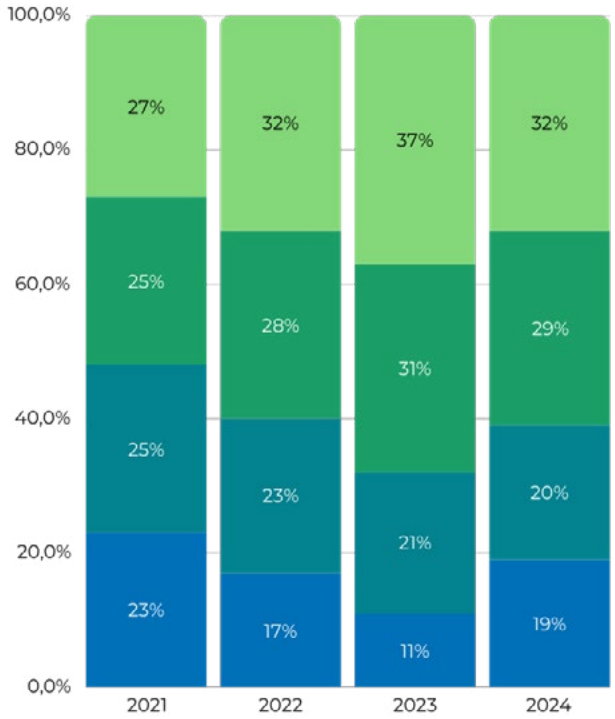
transforming the user experience and drastically reducing waiting times. If the first BEV (Battery Electric Vehicle) models supported slow and limited charges, **today modern electrical architectures allow for the absorption of power up to 350 kW** and more, paving the way for a future of ultra-fast charging up to **1 MW of power. Already today on the world market there are 14 vehicles with 800-volt** architecture that improves efficiency and reduces heat loss, allowing for faster charging times.

Kilometers traveled with a charge of between 5 minutes and 1 hour [1]

Minutes	5	10	15	20	25	30	35	40	45	50	55	60
AC charging* (11 kW)	5	10	15	20	25	30	35	40	44	49	54	59
DC charging (50 kW)	22	45	67	90	112	135	157	180	202	225	247	269
DC charging (150 kW)	67	135	202	269	337	404	472	539	606	674	741	808
DC charging (350 kW)	157	314	472	629	786	943	1.100	1.257	1.415	1.572	1.729	1.886

Considering a vehicle with efficiency 16.7 kWh/100 km and a charging efficiency of 90% at optimal temperature conditions with a State of Charge from 10%-80%

Evolution of charging times for models sold on the European market [2]



"The maximum charging power of the traction battery of the new models placed on the market is stabilizing between 100 and 150 kW, effectively becoming the most widely used standard for direct current charging."

- % of vehicles charging in DC up to 50 kW
- % of vehicles charging in DC between 50 and 100 kW
- % of vehicles charging in DC between 100 and 200 kW
- % of vehicles charging in DC over 200 kW

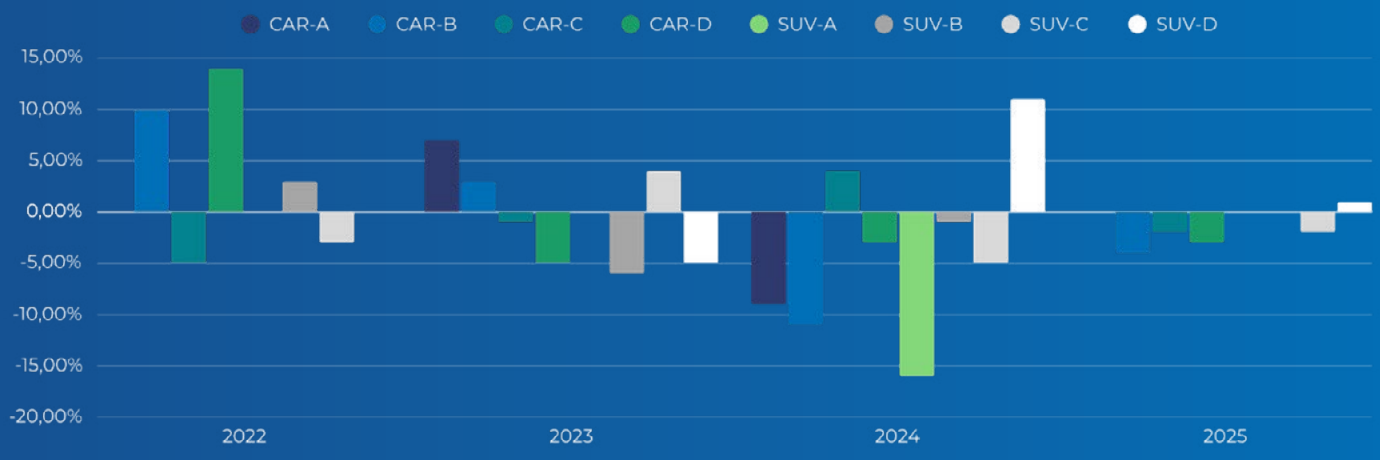
Data source: [1] [2] Quattroruote Professional, Motus-E "An electric choice today. A value choice tomorrow".

INSIGHT

Evolution of the average price of vehicles for the different segments

To date, the purchase price of an electric car is **still generally higher**, but this difference is increasingly narrowing even in **the lower segments with the release of many models priced below 25,000 euros.**
The table below shows the evolution of the average price of BEV vehicles for the main segments in Europe, highlighting how the values tend to gradually decrease and get closer to the prices of endothermic vehicles.
In **4 years, a reduction in the price of all the main European segments** is noted , thanks above all to the general decline found in 2024, a sign of aconstant approach to the prices of the respective ICE counterparts. In reality, in some segments there are already very competitive products, such as in the higher and premium channels. Segment B, the main market channel for countries like Italy and France, began its phase of sustained decline in 2024, which continues at the beginning of this year. Another interesting sector to analyze is that of SUVs, in particular the C segment, more widespread in central and northern European countries, which shows a constant downward trend in prices.
Broadening the reflection, it is then important to remember that the selling price represents only one of the cost items related to the car. Considering the lower **management costs for refueling and maintenance of electric vehicles, in addition to national and local bonuses, tax breaks and various possible forms of soft incentives (such as access to restricted traffic zones or free parking),** the situation changes radically, with electric already being the most convenient fuel option for various types of drivers.

Percentage change in the average price of electric vehicles for the main segments



Data source: [1] EV Volumes

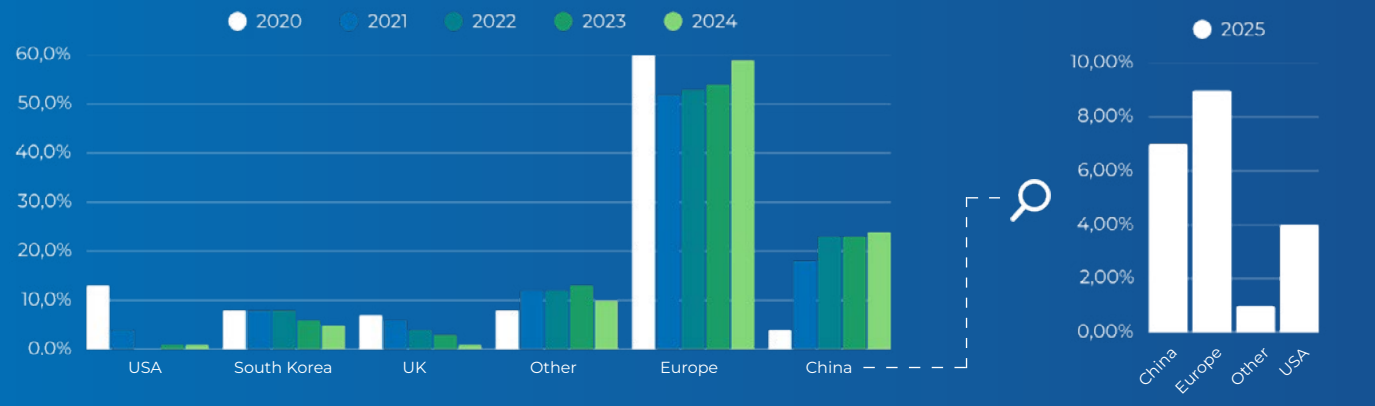
BEV Market: Is It Really a Chinese Leadership?

In recent years, **the Chinese automotive industry has made a strong entry into the European market**, redefining the dynamics of competition and accelerating the transition to electric mobility. In particular, it initially entered the **European market by acquiring significant capital** within already well-known European brands and subsequently integrated its presence on the market with brands of 100% Chinese origin. If we look at the trend of market penetration of vehicles produced in China for the European market, **we notice that 2021 was the year of the total change of direction,** where vehicles produced in China conquered 17% of the market. In the following years there was a complete **consolidation around 20%,** and a consequent loss of products imported from the United States.

In Europe, the two main producing countries are Germany and France, while **the worst performance is that of the United Kingdom.** But if we analyze in detail the brands of the models that are within the 20% **produced in China we realize that they are mainly brands with headquarters in the West.**
In reality, the current BEV market share of Chinese brands in Europe is around 7%-8%.
If we analyze the data of the last year, **published by Schmidt Automotive Research, the change of strategy of Chinese OEMs is clear,** which have reacted quickly to the protectionist policies of European duties present only on zero emission vehicles by concentrating their offer more on endothermic vehicles with and without electric hybridization.

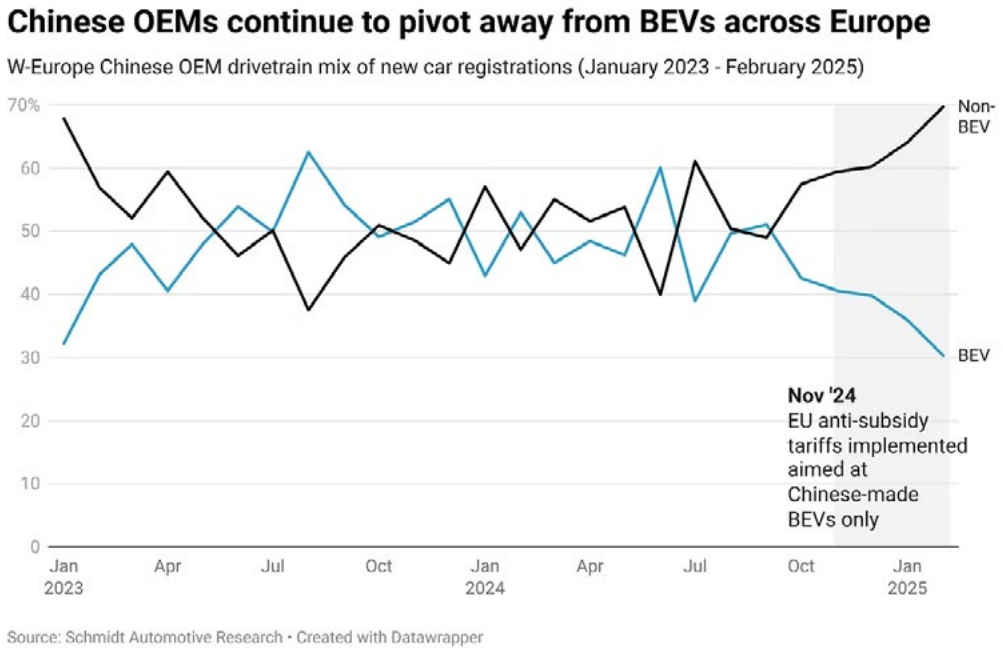
Distribution by country of production of electric vehicles [1]

Distribution by Headquarters of Electric Vehicles Produced in China [2]



Data Source: [1] [2] EV Volumes – 2025 to March

INSIGHT

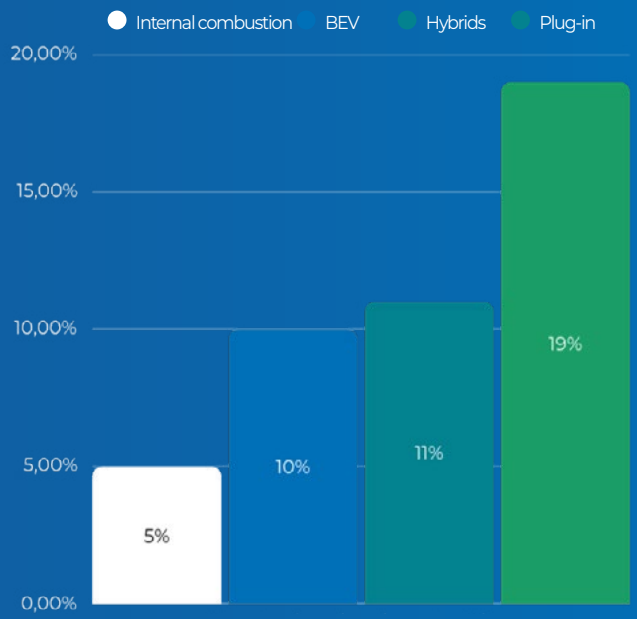


The same phenomenon can also be seen by analyzing the numbers of the Italian market. Among the European Union countries, Italy **shows a penetration value of electric vehicles from Chinese brands above the average of European countries (10%).**
However, if we extend the analysis to all fuels, we realise that this phenomenon is affecting all the main emerging fuels, **in particular plug-in hybrids which see the highest penetration rate at 19%.**

Penetration of brands with head quarter in China in the Italian market 5%

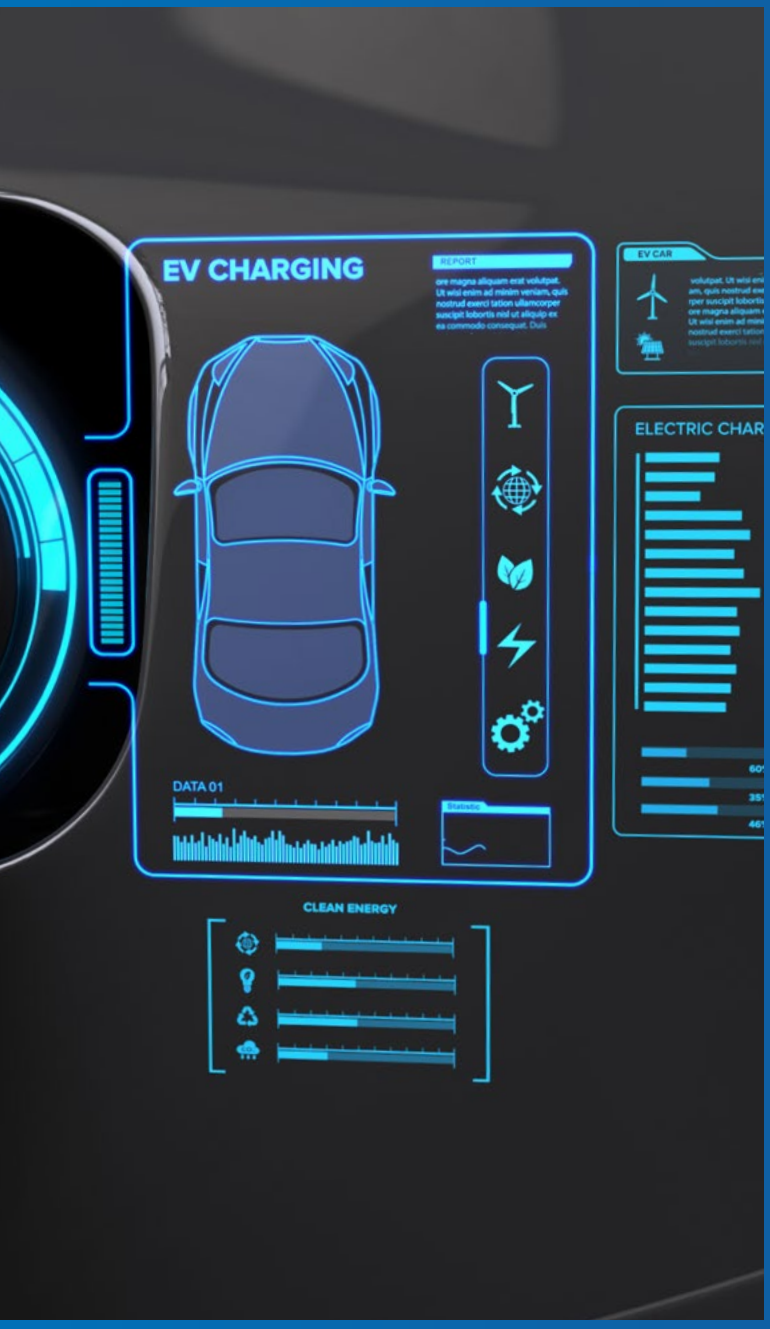
(VS 7% European shar)

Brands with headquarters in China that have penetrated the market in various car power supply sectors [1]



Data source: [1] Dataforce "Volvo and DR automobiles group considered with European headquarters"

Surprise: Batteries last a lifetime



Automakers are revising u**pwards the useful life expectancy of batteries installed** in electric vehicles: although specific policies on traction batteries vary from manufacturer to manufacturer, some aspects – **in terms of warranty and State of Health (SoH) certification – are common among the various manufacturers.** In addition, electric car maintenance services include regular diagnosis of the state of health (SoH) of the traction battery. **This monitoring allows manufacturers to evaluate their degradation over time and, in the future, could determine an extension of the warranty coverage period**.
This allows us to offer certified used programs from manufacturers that provide for the release of a specific certification of the **residual battery capacity that in some cases can allow for a** further extension of the warranty period. These data do not currently affect the residual value of the vehicle and therefore tend not to be emphasized, **but the maintenance of the value of the electric car over time is precisely given by the SoH** of the battery which is the beating heart of the vehicle itself.

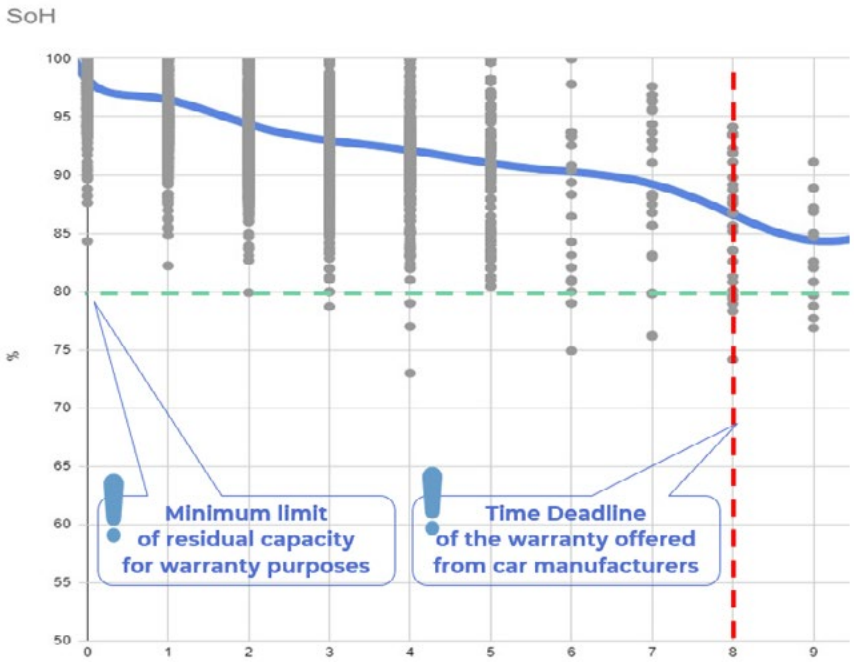
When approaching a second-hand vehicle, it is always important to check this data, because it provides us with an unequivocal guarantee of the product's quality, something that on endothermic vehicles is more complex to establish

INSIGHT

As shown in the image, the blue line represents the trend over time of the residual capacity of the traction batteries of a sample of 5 thousand cars of multiple brands registered over a ten-year time horizon (the grey points in the graph). Starting from the fifth year of seniority, a reduction in the number of samples is highlighted (the grey points) consistent with the lower registrations recorded before 2020. In summary, compared to the sample analyzed, the graph shows a battery degradation of 1.5%

, più accentuato an average annual battery degradation of 1.5%, more accentuated in the first two years.
Overall, the decay is faster in the first 5years (-7%) and then slows down over the long term. Over a period of nine years, the loss of capacity – and therefore autonomy –is still less than 15%. The battery performance remains high even after the manufacturer's warranty expires.

Empirical Analysis of the Health Status of Batteries [1]



Discover
the full report

Data source: [1] Quattroruote Professional, Motus-E: "An electric choice today. A value choice tomorrow"

THE VOICE OF THE EXPERTS

Stefano Sordelli
Director Future Mobility & Government Relations
Volkswagen Group Italy

The new platforms for electric vehicles

Mechatronic platforms have always been one of the pillars of the Volkswagen Group's strategy. Already today, the MEB and PPE, specifically designed for electric mobility and used respectively for volume models and the premium market, are platforms that allow for great flexibility and cutting-edge performance also in terms of charging speed: for vehicles based on the MEB, a maximum power of 200 kW is reached, while for those developed on the PPE the peak is 270 kW. With a view to simplification and efficiency, the next important step for the Volkswagen Group will be the introduction of the SSP (Scalable Systems Platform), a new-generation platform with 100% electric drive, fully digital and highly scalable, based on a standardized software architecture, which will be the technical basis for vehicles in all segments: in concrete terms, this means that a single platform will be used for all models. **The SSP will be a true technological collector, capable of accommodating future advances in safety and connectivity and managing vehicle updates quickly and effectively.**

> ***"The next important step for the Group Volkswagen will be the introduction of the SSP, a new generation platform with 100% electric drive, digital and scalable drivetrain"***

It will integrate an advanced 800V architecture, which will allow to further reduce charging times even in volume segments; as regards energy storage, the SSP has been designed to accommodate unified cell batteries and is also ready to receive the next technological evolution: solid-state batteries.

THE VOICE OF THE EXPERTS

> ***"The technology 800 Volts is a real game changer in the experience of use of a car electric"***

Francesco Calcara
President & CEO
Hyundai Motor Company Italy

Charging speed: potential of new architectures

The electric car is revolutionizing mobility and charging time has always been a point of discussion, especially when talking about long journeys. To solve this problem, 800 Volt technology was introduced, which allows for much faster charging compared to traditional 400V systems. Hyundai was the first generalist car manufacturer to implement it on its IONIQ range, confirming its role as a pioneer in innovation that improves people's lives.

The 800 Volt technology is based on an electrical principle that optimizes energy transmission and reduces losses, resulting in a more efficient and stable charging process. The system allows for the transfer of more power while maintaining the same current intensity (measured in Amperes), **avoiding an increase that would require thicker and heavier cables and would cause an increase in temperatures with consequent energy dispersion.** In terms of electric vehicles, this allows for a significant increase in the charging speed without increasing the weight and thickness of the cables, also increasing transmission efficiency.
The tangible benefits for customers include extremely short charging times – **thanks to the ability to maintain high and constant power peaks –and greater efficiency both during charging and driving.** For example, our electric sedan has a range of 614 km and charges from 10 to 80% in just 18 minutes.
In short, this technology is a real game changer in the experience of use of an electric car used on long distances, because it aligns the charging time with that necessary and recommended in any case for a break during along-distance journey.

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Raffaele Fusilli
CEO
Renault Italy

> ***"In a car market where the push for renewal has been reduced, corporate fleets could be a flywheel for the transition"***

The role of corporate fleets

In the technological and energy transition of the car, company fleets emerge as a **key player** to drive change, accelerating the adoption of electric vehicles and their impact on reducing transport emissions. It is no coincidence that the European Commission, recognizing their potential, proposes to dedicate specific action plans to the decarbonization of fleets. **In Italy, one in two cars is intended for company use.** It is not only the size of the reference market that makes company vehicles acrucial lever for the transition. Fleet purchasing decisions are reflected well beyond the individual company, which finds in electric cars a **reduction in operating costs, an advantage in environmental performance** and a growth in its image. In fact, company vehicles generally cover higher mileages and this increases their **effect on air quality** in the case of adopting clean technologies. Furthermore, they are placed on the used market after a relatively short period, making them accessible to a wider audience of consumers who can thus access greener, more modern and safe second-hand vehicles.

Its role is therefore also understood in the broader theme of the modernization of an obsolete fleet of vehicles, which in Italy counts more than 40 million vehicles with an average age of over 13 years.
In a car market where the push for renewal has been reduced, the corporate fleets could be a flywheel for the transition. However, valorizing them requires **identifying the answers to what currently holds back a wider adoption of electric vehicles:** initial cost, concerns about residual value, uncertainties about the variables of management costs and especially those related to charging, availability of charging infrastructures suitable for professional use that cannot ignore the efficiency of vehicle usage times. Incentives, taxation, energy prices, charging network... the electrification of corporate fleets requires a **holistic approach** that rewards the most efficient technologies and accompanies companies, creating a stable context for valuable investments.

THE VOICE OF THE EXPERTS

Roberto Colicchio
Head of Business Development and Sales
Plenitude On the Road

> ***"Electrifying the fleet and equipping it with a dedicated charging network is not just an ecological and "facade" choice, but a strategic investment."***

Equipping your company fleet with a smart charging network: a virtuous path

The electrification of corporate fleets is a **strategic choice** that **combines sustainability, efficiency and savings.** Electric vehicles (EVs) guarantee lower operating costs, thanks to reduced maintenance.One of the key steps to make this transition effective is **the installation of charging points at the company headquarters**. Having internal infrastructure allows for greater autonomy in energy management, optimizing charging times based on shifts and operational needs. **Intelligent charging management** is another crucial element. Dedicated software systems allow you to monitor consumption, schedule charging at times of lower energy costs and assign priority to vehicles based on use. Furthermore, advanced platforms integrate access control, reporting and the ability to share charging points with employees, encouraging sustainable mobility. In some cases (for example, business centers, hotels, restaurants) it is possible to make charging points accessible and subject to charges also to the public or to a predefined category of users (e.g. guests, suppliers, other companies) In order to fully exploit all the potential that acharging network can offer, it is important to rely on specialized companies that make electric mobility their core business and that can also offer a consultancy approach in the choice, avoiding analyzing the issue in a fragmented way and focused solely on the installation part. In short, **electrifying the fleet and equipping it with a dedicated charging network** is not just an ecological and "facade" choice, but a **strategic investment** that **optimises** resources, **improves operational efficiency and strengthen corporate reputation .**

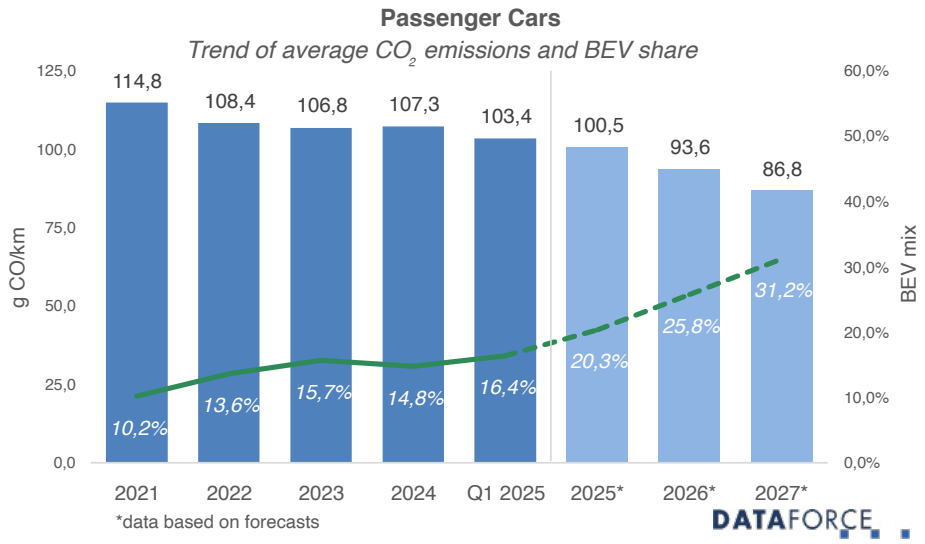
CAFE Regulation: new limits, new challenges

From 2025, the CAFE targets **have been reduced to 93.6 g CO_2/km** for passenger cars and 153.9 g CO_2/km for light commercial vehicles, thus requiring a CO_2/km cut of more than 10% for PCs and almost 20% for LCVs compared to 2024. Each manufacturer **has its own specific target, defined based on factors such as the average weight of registered cars, the share of low-emission vehicles, i.e. up to 50 g CO_2/km, compared to the market trend;** the EU also defines derogations for OEMs with low registration volumes. All these factors are taken into account in the Road To Zero tool.
The European Union, in the early months of 2025, **established that any sanctions will be calculated on the three-year average of CO_2 emitted between 2025 and 2027,** offering car manufacturers a broader horizon to offset emissions.
However, with a view to eliminating fines in a more or less constant volume market, a linear decrease in CO_2 would mean a drop of almost -7 and -17 grams of CO_2 per year for PC and LCV respectively, and for the latter only quintupling the BEV share in three years. With ICE engine emissions with little room for improvement and the introduction of the Utility Factor that will increase the detected CO_2 values for PHEV engines, the only lever left to hit the targets is the strengthening of the BEV mix. There are two possible paths: incentivizing electric models or discouraging traditional ones with pricing policies.

by:

DATAFORCE

INSIGHT


Passenger Cars
Trend of average CO2 emissions and BEV share
g CO/km
BEV mix
125,0
100,0
75,0
50,0
25,0
0,0
60,0%
50,0%
40,0%
30,0%
20,0%
10,0%
0,0%
114,8
108,4
106,8
107,3
103,4
100,5
93,6
86,8
10,2%
13,6%
15,7%
14,8%
16,4%
20,3%
25,8%
31,2%
2021
2022
2023
2024
Q1 2025
2025*
2026*
2027*
*data based on forecasts
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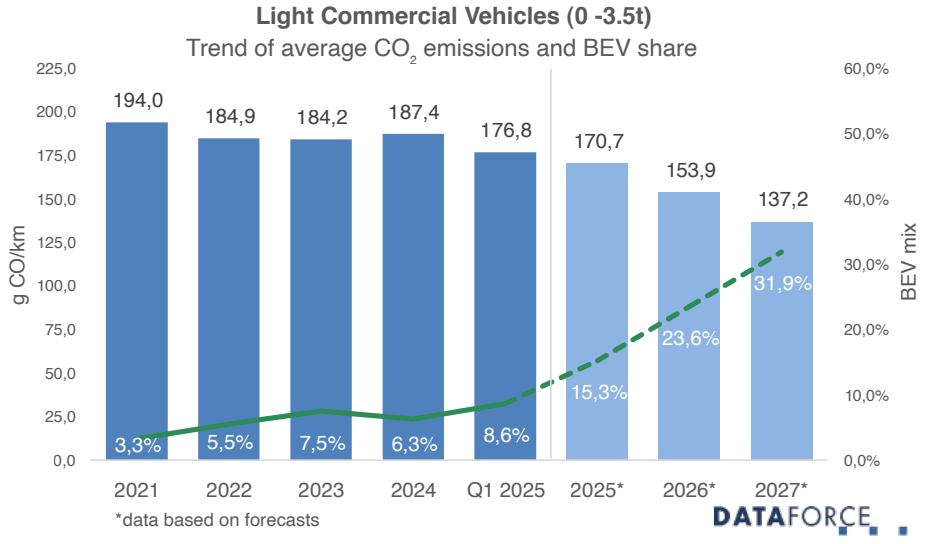
Light Commercial Vehicles (0 -3.5t)
Trend of average CO2 emissions and BEV share
g CO/km
BEV mix
225,0
200,0
175,0
150,0
125,0
100,0
75,0
50,0
25,0
0,0
60,0%
50,0%
40,0%
30,0%
20,0%
10,0%
0,0%
194,0
184,9
184,2
187,4
176,8
170,7
153,9
137,2
3,3%
5,5%
7,5%
6,3%
8,6%
15,3%
23,6%
31,9%
2021
2022
2023
2024
Q1 2025
2025*
2026*
2027*
*data based on forecasts
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Commercial Vehicles

1.429

(+41,2% VS 2024)
Registrations YTD March 2025 for light commercial vehicles

Key point

Eurovignettes to promote decarbonisation

370 Km

Average autonomy approved for other vehicles for the transport of goods

295 Km

Approved average range for **light commercial** vehicles

Key point

Planning of public and private charging infrastructure

145

(+137,7% VS 2024)

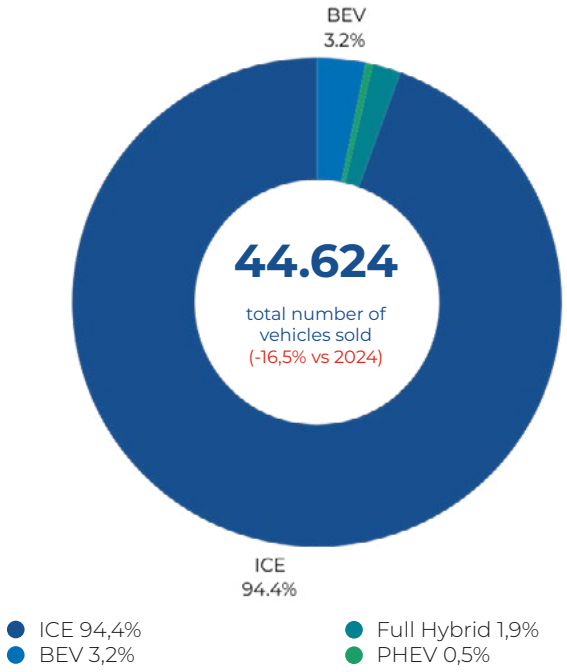
YTD registrations March 2025 for other vehicles for the transport of goods

The electric transition in freight transport: towards zero-emission logistics

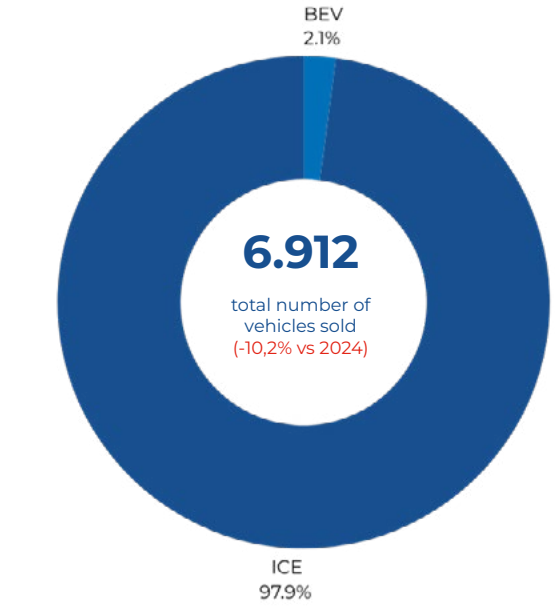
Similarly to what is happening in the automotive sector, the road freight transport industry and market –proximity logistics and medium and long range road transport – are also called upon to face a technological transition path that will lead them to reduce their polluting and climate-altering emissions by the end of the next decade. **In fact, both the light commercial vehicle segment (up to 3.5t) and that of other goods transport vehicles are subject to binding regulations in the European context** that prescribe, among other things, progressive and increasing reductions in CO_2 emissions to be achieved exclusively through the adoption of vehicles with zero-emission engines.
Among these technologies, **battery-electric power currently demonstrates the greatest degree of maturity,** margins for technological development and market penetration.

However, despite the fact that electric models are now available across the continent for almost all transport missions, the level of commercial penetration of BEVs (battery electric vehicles) in the European Union remains significantly lower than in the passenger car segment.
In 2025, electrified light commercial vehicles (BEVs) accounted for 3.2% of registrations in Italy; a figure that drops to 2.1% for other goods transport vehicles.
This performance is also worrying in view of the achievement of the targets on CO_2 emissions of the average registrations in the EU for each OEM for both light commercial vehicles and trucks and articulated vehicles. In Italy, despite the lack of incentives to demand, for the N1 market the growth trend of 2022 and 2023 seems to be resuming, which had seen an abrupt stop in 2024, despite the general market being growing.
At the beginning of 2025, the BEV share reached 1,429 units, marking a +41% compared to the same period last year, despite a general market in sharp decline -16.6%. **There are also good news for the market of the others**

Market Share Light Commercial Vehicles N1 by fuel type in Italy YTD 25 [1]



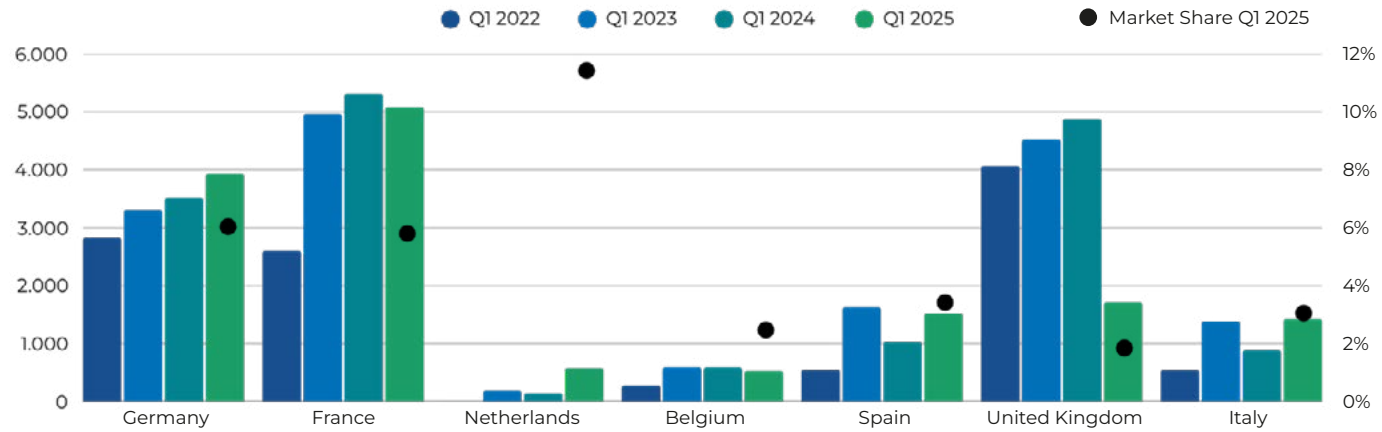
Market Share N2N3 vehicles for fuel type supply in Italy YTD 25 [2]



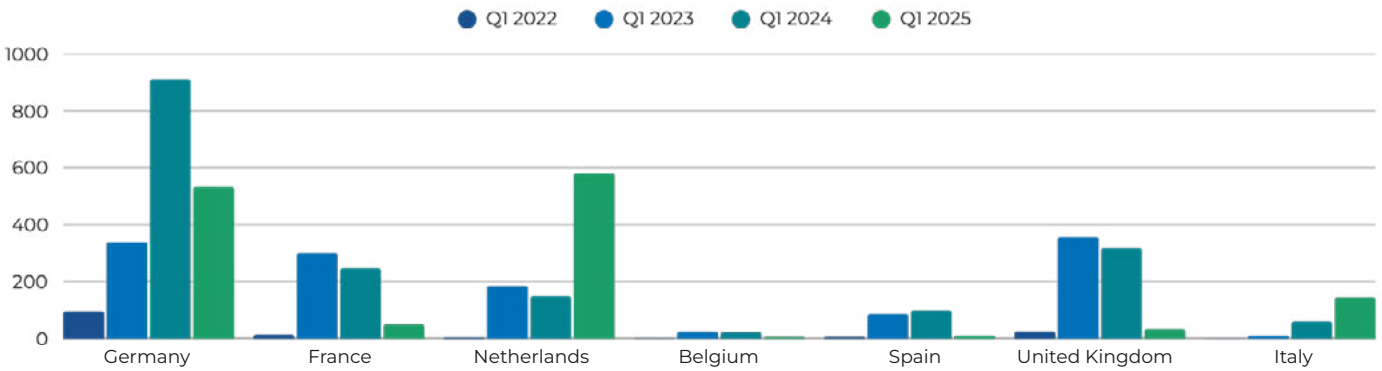
Data source: [1] [2] Dataforce

goods transport vehicles, which instead see a great acceleration compared to previous years, despite 2024 having already recorded growth, **the first three months of 2025 show a sales level of 145 units (+137% compared to last year in the same period), only about 60 units lower than the entire market in 2024 which had stopped at 208 vehicles delivered.** If we broaden our view to the entire European market, we note that in the first quarter of 2025, **sales of electric light commercial vehicles** show growth at different rates in the main European countries. **Germany** and **France** lead in volumes, with market shares of 6.2% and 6.0% respectively.
The **Netherlands** stands out for the most significant increase in share rising **from 1.6% in 2022 to 11.6% in 2025. Italy** and **Spain** are showing signs of recovery, while the **United Kingdom,** in contrast, is recording a marked decline to **2%**, after years of stability. As for the market for other heavy-duty vehicles, in general, **the trend of BEV sales shows strong growth in 2023 in almost all countries, but followed by a significant reversal in 2024 and, even more so, in 2025, with declines in many areas. Germany and France, despite the initial boom, show strong contractions, as do the United Kingdom, Spain and Belgium. Italy, on the other hand, stands out for its stable and positive growth, with sales constantly increasing.**

Registrations of light commercial vehicles N1 BEV & Market Share in Europe [1]



Registrations of other vehicles for the transport of goods BEV in Europe [2]



Data source: [1] [2] EV Volumes; values expressed in units of BEV vehicles sold

A worldwide comparison

The data shows a steady and significant growth in global registrations of electric commercial vehicles, in the first three months of 2022 to 2025. Specifically, **electric light commercial vehicles** increased from approximately **67,000 units in March 2022 to over 115,000 in March 2025,** an increase of approximately 73% in three years. This highlights an acceleration in the electric transition for urban logistics and last-mile deliveries, also driven by tighter emissions regulations in urban centers and a total cost of ownership (TCO) now at parity in the majority of missions in urban contexts.

Other **electric** vehicles for transporting goods also show impressive growth: from around **7,500 in 2022 to over 17,400 in 2025,** representing growth of **over 130%.** Although absolute volumes are still lower than for light vehicles, the speed of the increase suggests strong expansion in the long-haul segment as well, thanks to investments in more efficient battery technologies and the expansion of high-power charging infrastructure.

BEV commercial vehicle registrations worldwide [1]

	Light commercial vehicles	Other goods transport vehicles
MAR 22	66.984	7.458
MAR 23	86.263	8.864
MAR 24	106.174	13.166
MAR 25	115.812	17.409

In summary, the trend confirms that **commercial electric mobility is no longer limited to light fleets,** but is progressively extending to other vehicles for transporting goods, marking an important step towards the decarbonisation of the entire transport sector.

Analyzing the sales trend of LCV BEV in different areas of the world, we observe how the global market for light electric commercial vehicles is **rapidly expanding,** but **maturity and stability vary greatly between regions.**
Emerging economies are showing explosive potential, while advanced economies are entering a phase of **more stable growth and consolidation.**
The BEV commercial vehicle market **is highly polarized, with China and Europe leading the way**, while the rest of the world is struggling to take off, highlighting a **still significant technological and infrastructural gap.**

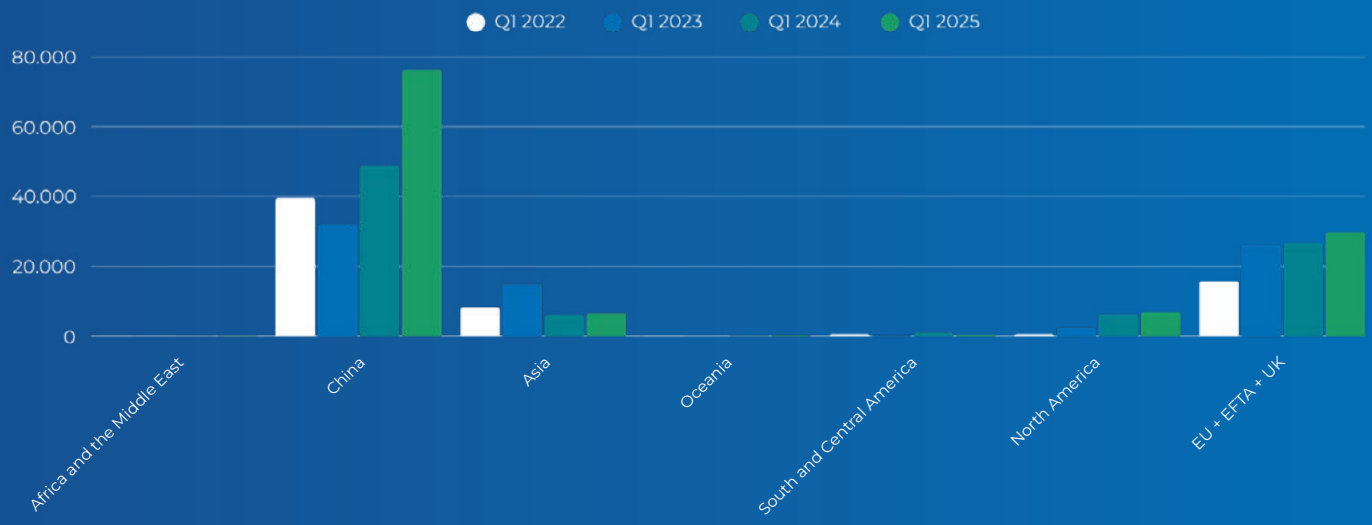
In particular, the distribution of electric commercial vehicle sales shows a clear predominance of China, which confirms itself as the leading market with numbers far superior to all other regions.
In Europe (EU + EFTA + UK), sales are significant, establishing itself as the second most relevant market, while the rest of Europe records a smaller but not negligible share.

North America is positioned as the third pole, with volumes well distanced from China and Western Europe, but still significant. South and Central America still show limited diffusion, although growing compared to almost absent markets such as the Middle East and Africa.

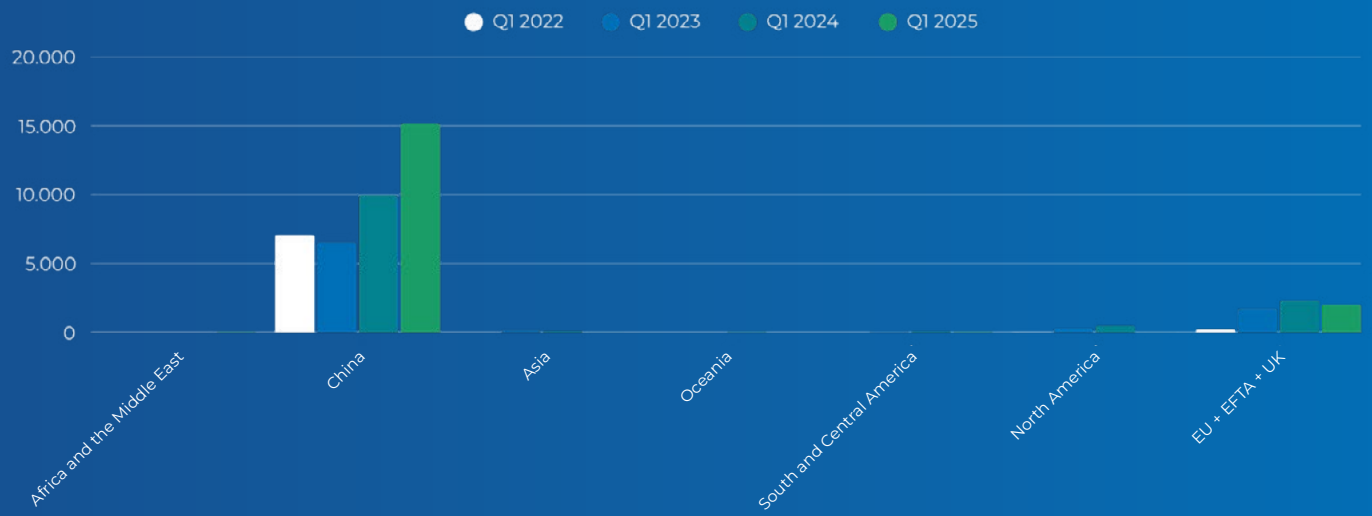
Data source: [1] EV Volumes; values expressed in units of BEV vehicles sold

INSIGHT

Registrations of light commercial vehicles BEV in different regions of the world [1]



Registrations of N2 N3 BEV vehicles in different regions of the world [2]



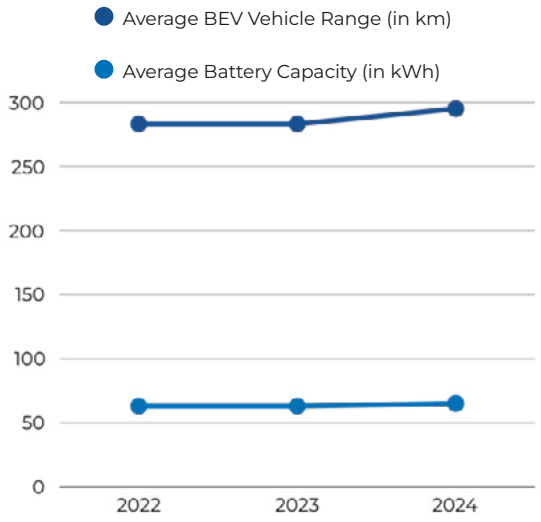
Data source: [1] [2] EV Volumes; values expressed in units of BEV vehicles sold

Market Trends

Freight transport is undergoing a profound technological transformation, driven by the increasing electrification of light commercial vehicles for freight transport.

The need to reduce CO_2 emissions and comply with European zero-emission regulations by 2035 is accelerating the development of innovative solutions capable of improving efficiency, autonomy and load capacity.
In particular, light commercial vehicles represent the most dynamic segment in the electric panorama. Vans for urban logistics and last-mile delivery are progressively adopting electric powertrains to exploit the advantages of urban ZTL and limited traffic areas, also thanks to a TCO (total cost of ownership) that has already reached, in many types of missions, parity with traditional fuel vehicles.

Evolution of LCV autonomy and capacity [1]



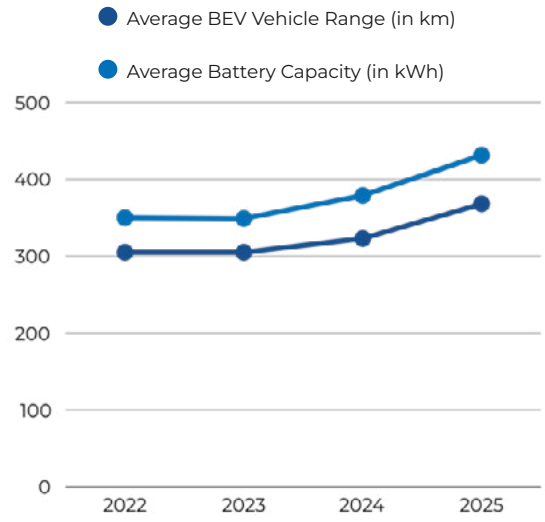
The data shows acertain **stability of the products offered on the market in the last 3years,** a sign that the offer can **already be considered in a mature technological phase.** The main issues that need to be addressed are **the load capacity of the vehicle, weight reduction and route optimization.**

The biggest challenge concerns other vehicles for transporting goods, with a mass above 16 tonnes, used in long-distance freight transport. The introduction of solutions such as megawatt charging (MCS), 800-volt architectures and high-density LFP batteries are progressively overcoming the limits of autonomy and charging times, opening up new opportunities in sustainable transport.

From 2022 to 2025, **the average range of BEV vehicles for freight transport has progressively increased by 20%** over the last 5 years, **at the same time the battery capacity has also increased by the percentage,** a sign that much work has been done **in particular on battery density.**

From the data it is clear that **the efficiency kWh/km** of the vehicles is a territory that needs to be explored but it is essential to allow for lighter vehicles and greater loading spaces.

Evolution of autonomy and capacity of other vehicles for the transport of goods [2]



The slow pace of transition in the sector can be partly attributed to technological reasons such as the current lack of economies of scale capable of cushioning the innovation investments made by manufacturers and, consequently, reducing the cost.

Data source: [1] [2] EV Volumes

final of new vehicles for end users. Added to this, however, are the delay in the development of an efficient ecosystem of charging infrastructures –especially for long- range missions –and, above all, the lack of European and national policies capable of accompanying all the actors in this supply chain in atransformative challenge of epochal proportions.

In the Italian case, for example, the measures currently in favor of the renewal of the road haulage fleet are able –when available –to compensate for **approximately 6-7% of the price differential that a haulier would have to sustain if he chose to invest in azero-emission vehicle rather than atraditional one.**

The road to the ambitious decarbonization goals adopted in Brussels necessarily involves acomprehensive and organic rethinking of policies for ecological and technological transition, **which also looks to a structural revision of regulations traditionally considered stable, such as those relating to the weight and dimensions of commercial vehicles.** The increase in unladen weight caused by the integration of batteries or alternative traction systems compromises the payload capacity, with a direct impact on the logistical efficiency and economic balance of electrified fleets, especially in the medium-heavy and heavy segments.

The current legislation is still strongly anchored to a thermal paradigm. For this reason, it is necessary to start an update process that recognizes the functional and technical needs of new vehicles, harmonizing the discipline on weight and shape limits with the new requirements of size and load distribution.

Areas suitable for freight transport

The adoption of **electric light commercial vehicles is already advantageous from the first years of use, thanks to a competitive TCO (Total Cost of Ownership), especially in urban contexts:** in fact, the lower operating costs (charging vs. fuel, less maintenance) and tax incentives compensate for the higher initial purchase price.

Added to this is the privileged access to the ZTLs, often free only for zero-emission vehicles, ensuring greater operability in cities where bans on traditional vehicles are multiplying.

The situation is different for other goods transport vehicles, however, for which **the TCO reaches parity with diesel vehicles after approximately 6 years of use,** considering **factors such as concessional credit lines, ESG bonuses (which improve the client's rating) and potential toll discounts.**
By December 2025, the new European **AFIR regulation requires that 15% of the Italian road network be equipped with high-power charging stations dedicated to heavy vehicles,** with groups of columns of at least 1,400 kW in total, of which at least one charging point of 350 kW. To date, 3 charging areas dedicated to electric trucks are active (Mantua, Savona and Bolzano) along the busiest motorway arteries: one of these also hosts the first Megawatt Charging System (MCS) installed in Italy that allows you to charge a heavy vehicle with 500 kWh batteries in half an hour, providing it with a range of 500 kilometers.

To meet this deadline effectively, **it is essential to develop a strategic project that does not limit itself to meeting the minimum requirements,** but that optimizes the distribution of **infrastructure based on the real mobility needs of freight transport.**
Through a detailed analysis of freight traffic flows on a national scale, it was possible to identify the priority corridors (motorways, logistics hubs and trade routes) **where charging hubs should be installed,** maximizing utilization and reducing downtime for haulers

The proposed approach combines:
- Regulatory compliance: achieving minimum 15% coverage with high-performance stations.
- Operational efficiency: intelligent positioning of the columns, aligned with truck travel and parking data.
- Future scalability: Prepare the network for upgrades in anticipation of the increase in electric vehicles.

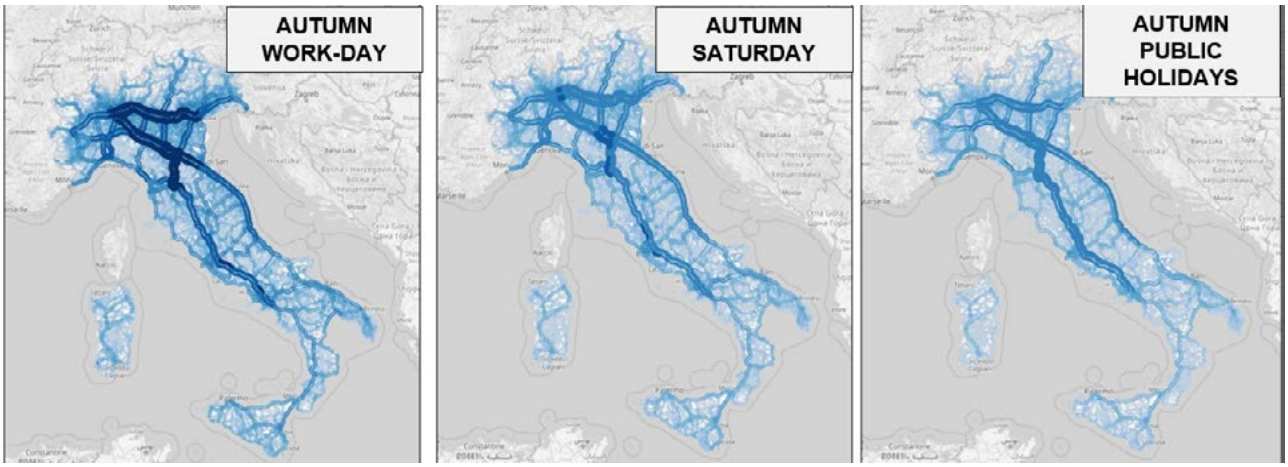
A plan of this kind, supported by partnerships with energy and logistics operators, will ensure not only compliance with EU deadlines, **but also the creation of asustainable charging ecosystem that is truly functional to the needs of freight transport.**
In particular, the study was based on the analysis of GPS data from over 100,000 vehicles, out of a total of approximately 750,000 in circulation, generating over a billion daily consumption points (FCD) and analyzing 12 different scenarios (3 typical days for 4 seasons).

All the activities of this study, including the reconstruction of the average daily annual flows of freight vehicles, are based on an OpenStreetMap cartographic database. As can be seen from the flowgram, the flows of vehicles are mainly concentrated on motorways, with most of the transits occurring in the centre- north, in particular along the Milan-Venice and Milan-Bologna-Florence routes.

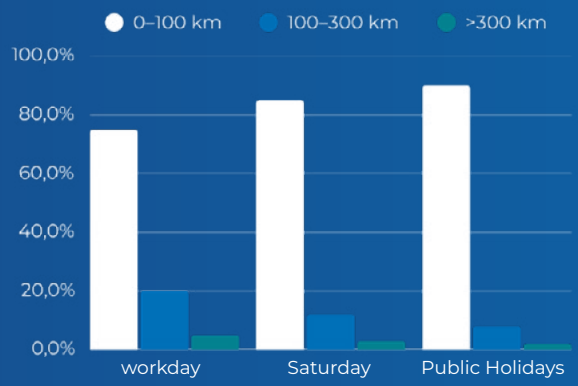
Check out the "Studies and Research" section of the motus-e.org website in the coming months to read the entire report

INSIGHT

Flowcharts Italy



Average daily mileage by type of day



"From the analysis of the missions carried out in 2024 by vehicles above 3.5 tons, it is noted that over 90% of these are well below the average autonomy guaranteed today by electric vehicles."


MOTUS

Local Public Transport

119

(+85,9% VS 2024)
YTD
Registrations
March 2025

Key point

Training for public transport operators

27

models with capacity over 400 kWh

>300 Km

Approved average autonomy

Key point

Improvement of tendering procedures

6%

of the Italian vehicles in circulation are powered by electricity

The electric revolution in Local Public Transport: Towards zero-emission cities

The Local Public Transport (TPL) sector in Italy is going through a phase of profound transformation, with a growing focus on environmental sustainability and decarbonisation.
Historically, **Italian public transport has been characterised mainly by the use of buses with internal combustion engines,** mainly diesel, which in 2022 represented 87.1% of the road fleet.
However, in recent years, thanks in part to the targets set **by the EU, there has been a progressive interest in electrification, seen as the main solution** - in urban areas -to reduce polluting and climate-altering emissions.

The current state of the art sees an acceleration in the electrification process, with an increasing number of electric buses registered.

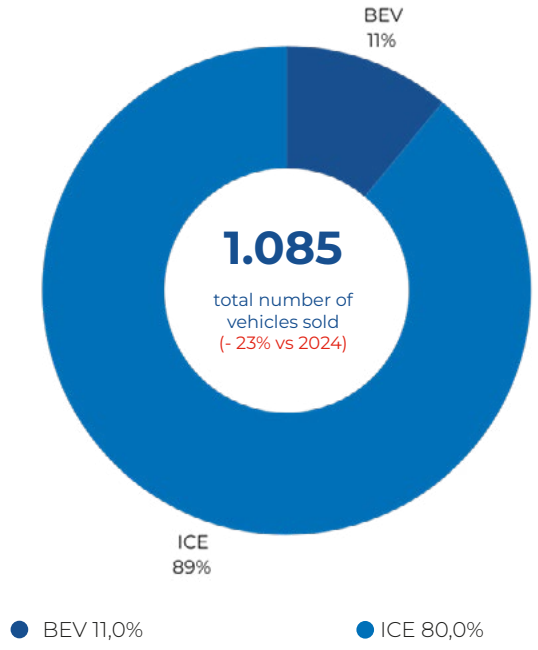
In 2023, approximately 27.5% of new registrations of urban buses in Italy were electric, a value still lower than the European average of 40%. However, this trend is growing, with 2024 seeing a further increase, **so much so that out of ten urban buses registered, four were electric, with a growth of 162% compared to 2023.**

At the beginning of 2025, 6% of the buses in circulation, approximately 2,522, are powered by electricity. This growth trend is expected to continue in 2025.

In 2024, the European electric bus market saw a significant growth, with almost half (49%) of new city buses registered being zero-emission, of which 46% were battery electric vehicles (BEVs).

Countries such as Luxembourg, Finland and Denmark have surpassed 66% market share for zero-emission buses in 2024, highlighting a strong adoption of sustainable technologies in public transport. In Italy, although the bus fleet has a high average age of 10.3 years, 33% higher

Market share of BEV buses by fuel type in Italy YTD 25 [1]



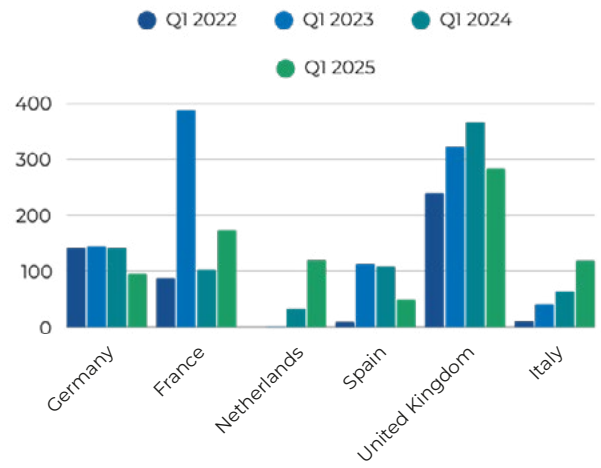
compared to other major European markets, There is a growing adoption of electric buses, especially in urban contexts, with a significant concentration in the north of the country.
The European market for electric vehicles for public transport showed mixed trends across countries in the period from Q1 2022 to Q1 2025. While some countries showed sustained and continuous growth, others experienced declines linked to market dynamics and infrastructure factors.

Germany shows a decline compared to previous years, while **Italy has recorded strong growth. France and the Netherlands have improved their performance** compared to the past, while the United Kingdom maintains a solid position.

Due to the specific nature of the sector, **which depends heavily on public tenders and delivery times,** the analysis on a quarterly basis has less value and may not be indicative of actual trends.

Data source: [1] Dataforce

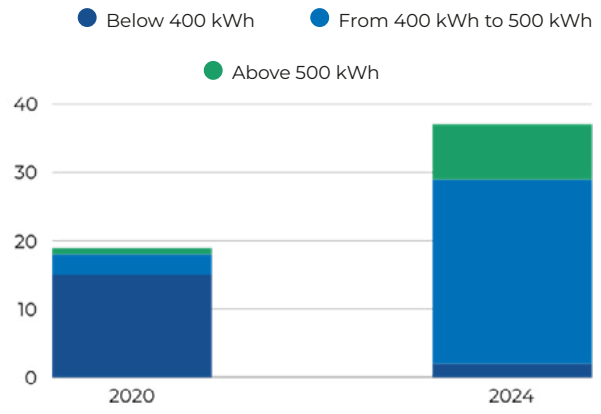
BEV Bus Registrations in Europe [1]



Technology Trends

The e-bus sector has seen significant technical progress over the past four years, with particularly notable improvements in range and battery technology.

Bus Distribution 12 meters vs. battery capacity [2]



On the autonomy front, **the maximum available capacity for 12- metre buses available on the European market has grown by 34% between 2020 and 2024.** This increase is accompanied by an unprecedented expansion in the offer of models **with batteries greater than 400 kWh, from just 3 units in 2020 to 27 in 2024, with a percentage increase of 800%.** At the same time, there has been a significant change in **battery chemistry. LFP (Lithium Iron Phosphate) solutions** are gaining more and more ground thanks to their greater cost-effectiveness and safety compared to traditional NMC, not to mention the recent advances in energy density that make them increasingly competitive.

Energy density itself has seen significant improvements, **reaching benchmark values of +170 Wh/kg in 2024.** Added to this is the growing **availability of cell-to-pack solutions,** which allow for more efficient integration of batteries directly into the vehicle chassis.

These advances are leading to a new generation of electric buses characterized by greater autonomy, efficiency and structural integration, thus marking an important step forward towards increasingly sustainable and high-performance public mobility. Local public transport will offer further opportunities for the penetration of electric power both in urban areas and, thanks to the improvement of vehicle performance, in services for urban and extra-urban citizens.

By 2035, every new urban bus registered will have to be zero-emission. It is estimated that in 2050,
the Italian urban bus fleet will be composed of 88% electric vehicles and 9% hydrogen vehicles. This ambitious goal is supported by the significant funding allocated at European and national levels.

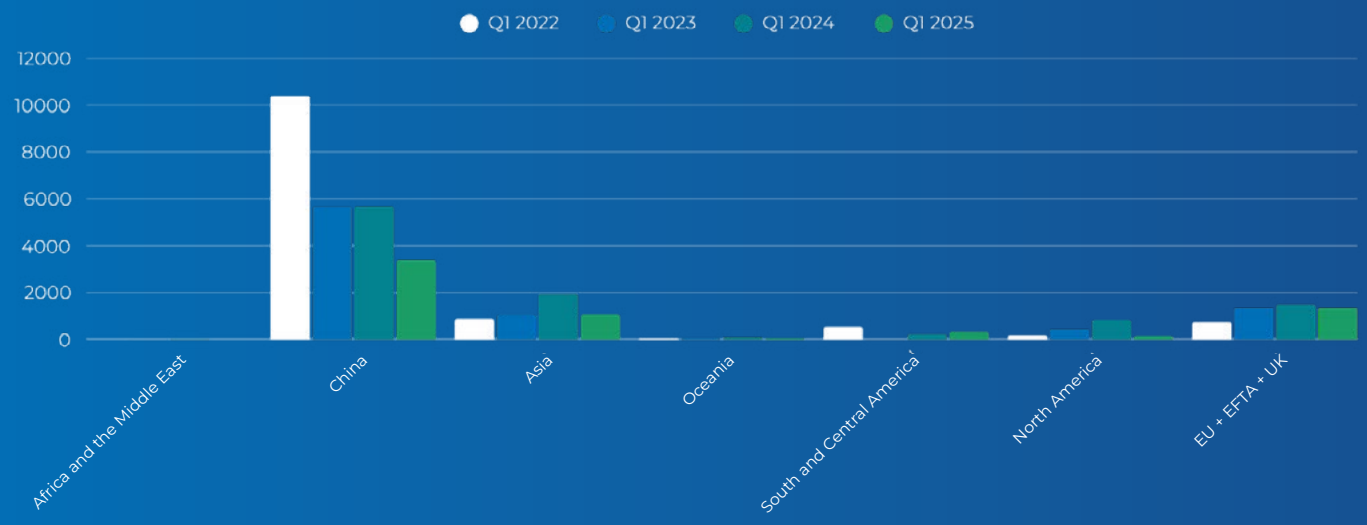
The expected injection of new European funds for public transport also represents a further opportunity to accelerate this process, leading to significant benefits in terms of air quality and reduction of climate-altering emissions. However, it is worth reflecting on the fact that this transformation also entails new operational challenges, in the medium and long term, related to the management of electric fleets, charging systems and overall energy management for public transport companies. The transition in public transport towards electric cannot therefore ignore an integrated vision and a continuous and coordinated commitment at all levels, both in terms of executive and regulatory-financial tools, addressing the operational, infrastructural and territorial challenges that still exist.

Data source: [1] Evolution of the electrification of local public transport; values expressed in BEV BUS units available on the on the European market [2] EV Volumes; values expressed in units of BEV vehicles sold

A world comparison

The spread of electric buses in the world presents very different dynamics worldwide. **China, despite a progressive decline compared to 2022 levels, remains by far the most relevant market. Western Europe,** on the other hand, shows **constant growth,** consolidating itself as one of the main hubs for the adoption of this technology.
In North America, a significant expansion is observed until the first quarter of last year, followed by a sharp slowdown in the last quarter analyzed. On the contrary, **South America, after an initial collapse, seems to have regained momentum, while Central America, starting from zero, is beginning to register a timid but growing adoption.** In Asia, the trends vary considerably: some areas, such as South Asia, have seen a surge followed by a partial decline, while others, such as East and Southeast Asia, show fluctuations without a clear trend. Regions such as **Africa, the Middle East and Oceania are still marginal,** with very low numbers and irregular trends. Even in Central and Eastern Europe, as well as in the countries of the former Soviet bloc, the diffusion of e-buses is proceeding slowly, without particular peaks.
The global electric bus market is therefore mainly driven by China and Western Europe, while other areas alternate growth phases with setbacks, often linked to local factors such as public policies and infrastructure investments.

BEV Bus Registrations in Different Regions of the World [1]



Data source: [1] EV Volumes; values expressed in units of BEV vehicles sold

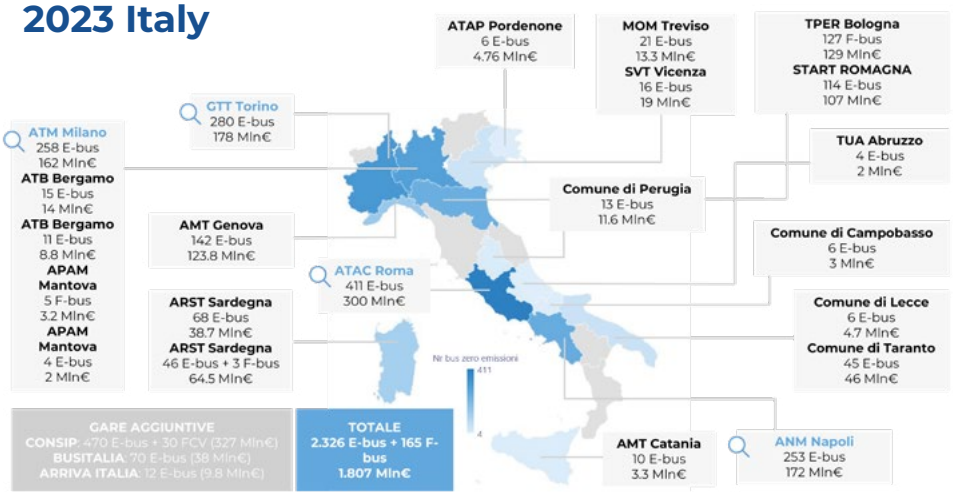
INSIGHT

The electrification of local public transport

The analysis highlights market trends and technological development in local public transport with a 73% growth in new registrations in 2023 of alternative tractions in European urban buses and over 40% zero-emissions. In Italy, again in 2023, 27.5% of new urban registrations were zero-emissions, mainly in the north, **although the average age of buses circulating in the peninsula is over 10.3 years, 33% higher than in other** European countries. Since 2019, over 7.5 billion euros have been allocated to renew the fleet with low and zero emission vehicles: the European objective is to reach 90% of new urban buses registered with zero emissions by 2030. In 2023 alone, tenders were issued for a total of 2,326 E- buses and 165 F-bus, with atotal investment of 1.8 billion euros: one fifth of these vehicles are derived from CONSIP agreements.

The analysis also estimated that by 2050, 97% of buses will be zero-emission, requiring around 2,000 new registrations per year to maintain the average age of the fleet. This will lead to areduction in CO_2 emissions of 2,393 kt and a saving of 957 million liters of fossil fuels. However, the impact on the network should not be frightening: the **charging capacity of new buses will be around 2.55 GW, less than the renewable energy capacity installed in 2023 alone, and the energy demand for buses in circulation in 2050 will be 3,412 GWh,** compatible with the new renewable production of last year, although it will require local adaptations of power for charging.

Distribution of tenders 2023 Italy



Data source: Motus-E: "Evolution of the electrification of local public transport"

Discover the full report

Electric mobility and charging infrastructure

Green Bond Report 2025
CDP_Green_Bond_Report_2024_EN_01.indd

Since 2017, CDP has successfully launched 10 **ESG issues for a estimated to generate an overall reduction in emissions of total of 6.75 billion euros. Among these, the first Green Bond - issued in 2023 for 500 million euros -has financed 28 initiatives in strategic areas,** generating concrete environmental impacts such as an annual reduction of over 56,000 tons of CO_2 eq/ anno. The sustainable mobility sector plays a central role in the funded initiatives, representing the most significant share in terms of resources allocated, with approximately 153 million euros. These interventions are **approximately 8,700 tonnes of CO_2 eq/anno.** The analysis of avoided emissions is therefore essential to measure the effectiveness of the funded projects and to direct resources towards those with the greatest impact. The evaluation of new electric mobility projects requires, first of all, the identification of the "green" kilometres enabled by the charging infrastructure and an estimate of the evolution of emissions from the vehicle fleet, in order to precisely quantify the expected reduction in CO_2.

1. Enabled "green" kilometers

The annual "electric" mileage can be estimated on the basis of different assumptions and indicators, including:
•**The forecast of energy supplied by the** new charging stations, identified on the basis of the analysis of a portfolio of benchmark projects with similar characteristics (e.g. positioning and type of infrastructure) which - considering the average consumption of vehicles available in the reference market (kWh/km) -allows the calculation of "green" kilometres.

- **The number of electric vehicles enabled per new charging station,** determined by considering the historical ratio between the number of charging stations installed and electric vehicles in circulation and estimating the projection of this ratio over the years. Starting from the number of new charging stations planned, the associated new electric vehicles are obtained and, consequently, having an estimate of the average annual mileage, the enabled "green" kilometres.

Although the two methods are based on different assumptions, the results obtained tend to converge when the input data are solid and consistent. This convergence represents an important cross-validation of the obtained estimates, increasing the reliability of the results. However, it is important to underline the need for timely and shared input data in order to obtain consistent results.

2. Avoided emissions: the circulating fleet

To estimate the impact of electric mobility, a comparison is made with a counterfactual scenario, analyzing the emissions that would be generated by an internal combustion vehicle traveling the same kilometers enabled by the project. This comparison is made with a vehicle representative of the Italian fleet, whose future projection represents the third major assumption of the model, which requires the most precise information possible.

This reference vehicle represents a weighted average of CO_2 emissions (in addition to NOx, PM2.5, PM10) per kilometer associated with all cars actually in circulation in agiven year.
The comparison is integrated with emissions related to the national energy mix for a complete assessment of the contribution of electric mobility.

INSIGHT

3. Conclusion

The transition towards more sustainable mobility is not only a desirable direction, but a necessary one, and it already brings concrete benefits in environmental, economic and social terms.
For this path to be effective and lasting, it is important to equip ourselves with an adequate infrastructure, a clear regulatory framework and coherent policies, accompanied by structured investments.

It would be desirable for all operators in the sector to be able to rely on certified, updated and transparent data. In particular: (i) clarity on the implementation of European regulations in terms of the progressive phase out of less efficient vehicles, (ii) definition of uniform guidelines for the adoption of Low Emission Zones and policies on local public transport by local administrations, (iii) strengthening of the personal data shared by Charge Point Operators (CPO), such as registration, energy supplied, usage rate, failure rate (iv) clear planning of the charging infrastructure, supported by analyses on potential use and impact, (v) real sharing of data on emissions from internal combustion vehicles and on the efficiency of electric vehicles.
In this context, replicable and transparent calculation tools can represent a valid support.

Conclusions

The automotive sector is in the midst of an unprecedented transformation, driven by the transition to electrification and the growing focus on environmental sustainability. **The evolution of propulsion technologies, the spread of charging infrastructures and the adoption of more stringent regulations are reshaping the mobility landscape, with significant impacts on production, the industrial supply chain and consumer habits.**

At the heart of the strategic dialogue between stakeholders is the **need for a technological and industrial innovation strategy that includes a vision of the entire value chain** (supply, production footprints, energy sources, circular economy,...) and a more integrated planning of the entire ecosystem: development of demand, acceleration of infrastructure, reduction of energy prices, development of new skills, creation of new supply chains.

According to market analyses, electric vehicles in Europe are currently between the "Early Adopters" and the beginning of the "Early Majority" phase in the adoption curve of new technologies.

This curve derives from a theoretical model that describes how apopulation adopts an innovation over time. This model, developed by Everett Rogers in 1962 through the "Diffusion of Innovations Theory," divides the adoption process into five categories of users and in the automotive world it is a function of market share. Italy is currently at the rear of Europe in terms of adoption of 100% electric vehicles, with only 5.16% in the first quarter of 2025, therefore it is in the initial phase of this curve. This is why a greater effort is needed by all stakeholders, through a debate no longer based on the clash between the various technologies but that looks at a **pragmatic and scientific approach privileging certain technologies in certain areas, underlining how all the technologies available today will have a leading role in this transition.** In aworld of finite resources it is essential to have a strategy and a long-term vision that clearly indicates the path to follow.
To succeed in climbing the adoption curve in this phase it is important to act on some fundamental guidelines:

- access to new forms of mobility even for populations with below-average income;
- support long-term incentive policies to provide greater stability to OEMs in terms of investments;
- review the current legislation on company fleets and fringe benefits in order to achieve a clear, streamlined, dynamic regulatory framework in line with the new needs that have emerged in the market;
- provide more territorial planning tools to develop zero-emission logistics projects.

The electric transition represents a unique opportunity to relaunch the Italian automotive industry, making it the protagonist of a new production and sustainable paradigm. To achieve this goal, a joint commitment between industry, institutions and citizens will be necessary, supported by a clear and predictable regulatory framework and targeted investments. For this reason, it is important to bring to the attention of the institutions proposals that can accelerate this transition.

Equal access to electric mobility

The establishment of the Social Climate Fund by the EU is an essential tool to accompany the ecological transition process in a fair, sustainable and inclusive way.

A targeted intervention to promote access to electric mobility for the less well-off can play a crucial role in promoting access to electric mobility for the weakest social groups.

For this reason, the Motus-E proposal intends to outline a regulatory framework for the introduction of a social long-term rental system, with the following objectives: ·promote access to electric mobility for low-income population groups

- contribute to decarbonisation
- reduce social inequalities

As for the implementation methods, the possibility of long-term rental of electric vehicles, new or used, is foreseen for aperiod of 3 years, at a symbolic monthly fee (for example 200 euros). For used vehicles, the battery state of health (SoH) must be at least 90%, guaranteeing a battery life of at least 80% during the rental period.
The aforementioned monthly fee will include all additional costs, such as insurance, ordinary maintenance and taxes, avoiding territorial heterogeneity.
The program will have to be aimed at people with an annual income of less than €25,000 (ISEE) or vulnerable individuals, giving priority to those who live or work in areas at risk of air quality infringements, and to those who have to travel at least 8,000 km per year.

Depending on the challenging objectives that are set, the maneuver could have a direct impact on increasing the market share of vehicles, estimated at around 10% - 15% in the first 3 years, if the social climate funds are used appropriately to sustain the measure in a lasting way.

Tax policy to support companies in the process of decarbonising their fleets

The Italian car fleet is among the largest in Europe, but unfortunately it is also the most polluting and the least safe. The average age of cars is in fact around 13 years, afactor that makes it essential to renew the fleet in circulation from at least two points of view: environmental, because 23% of the total is represented by pre-Euro 4 cars, with polluting and climate-altering emissions enormously higher than Euro 6 cars;

- road safety, because only in recent years have active and passive safety equipment become widespread, thanks to the introduction of new technologies that are partly mandatory.

This renewal is particularly important and urgent for Italian companies that, in facing the transition process towards zero-emission vehicles, must deal with a tax regime that is less favorable than other European countries.
It should be noted that the annual amounts on which the percentage of deductibility is measured (currently 20% for pooled cars; 70% mixed use; 80% commercial agents) are still at the values determined at the end of 1997, i.e.: · €18,075 for the purchase and €3,615 for the rental of company cars in a pool and for mixed use.

- €25,822 for the purchase and €5,164 for the rental for sales agents.

From this perspective, the Motus-E proposal therefore **envisages increasing the percentage of tax deductibility of zero-emission company cars to 80% for all uses, aligning it with that currently envisaged for commercial agents, and at the same time increasing the maximum fiscally recognised cost:**

- From €18,075 to €25,822 for the purchase and financial leasing.
- From €3,615 to €5,164 for rental.

The expected effect would be an increase in car registrations company electrics of 100,000 units (+30%) for a total cost of the measure in the three-year period 2026 -2028 of 470 million euros.

Extension of the energy-intensive regime to companies of Local Public Transport (TPL) and logistics

In the decarbonization process, the main costs that Local Public Transport (TPL) and logistics companies sustain, in terms of operations, are attributable to the purchase of fuel. Today, the Italian legal system already provides for incentives for the purchase of traditional fuels in terms of reducing the cost of excise duties, therefore Motus-E believes it is essential to provide, also in consideration of the European directives, the extension of the aid provided for energy-intensive companies, currently regulated by the Ministerial Decree of 21 December 2017, also to these entities as provided for by the Energy Taxation Directive.

As mentioned, the proposal to extend the incentives to public transport and logistics companies is in line with the European targets for the decarbonisation of transport. Indeed, incentivizing the electrification of fleets will help reduce CO_2 emissions and promote the use of renewable energy, with a rather limited economic impact on the incentive scheme.

This support measure would significantly contribute to reducing emissions in transport and achieving national and European decarbonisation targets.

Support for road transport companies in the process of decarbonising their fleets

The road haulage sector in Italy is characterised by afleet of vehicles with an average age among the highest in Europe (19.5 years compared to the European average of 14.1), which is growing year after year.

Over 50% of medium and heavy trucks (N2 – N3) currently in use fall into the Euro IV emission class or lower, with significant repercussions both in terms of the environment and road safety.

It is therefore evident that the main instruments that should promote the modernization of fleets of vehicles used for the transport of goods -the so-called 'Investment Fund' and 'High Sustainability Fund' - are ineffective for this purpose, as they are discontinuous and not sufficiently financed.

In order to stimulate the sustainable transition of the sector, it is necessary to promote a reform of current public policies by establishing a dedicated multi-year fund, as was originally envisaged for cars and light commercial vehicles with the so-called 'Automotive Fund' of Legislative Decree no. 17 of 1 March 2022.
This instrument must be characterised by al ong-term perspective and sufficient resources to guarantee the economic competitiveness of zero-emission power plants in the face of a higher cost of initial investment. In line with what has been established for light commercial vehicles, it is also important that public support measures for the transition of the road haulage fleet are not limited to purchase support. Long-term rental is, in fact, a fundamental guideline for the promotion and penetration of new technologies on mature markets, reducing the impact of the initial investment.

A reform of the measures for the road transport transition therefore appears essential to truly promote the decarbonisation of the sector, in accordance with the climate targets set by the European Union.

Vision to 2035

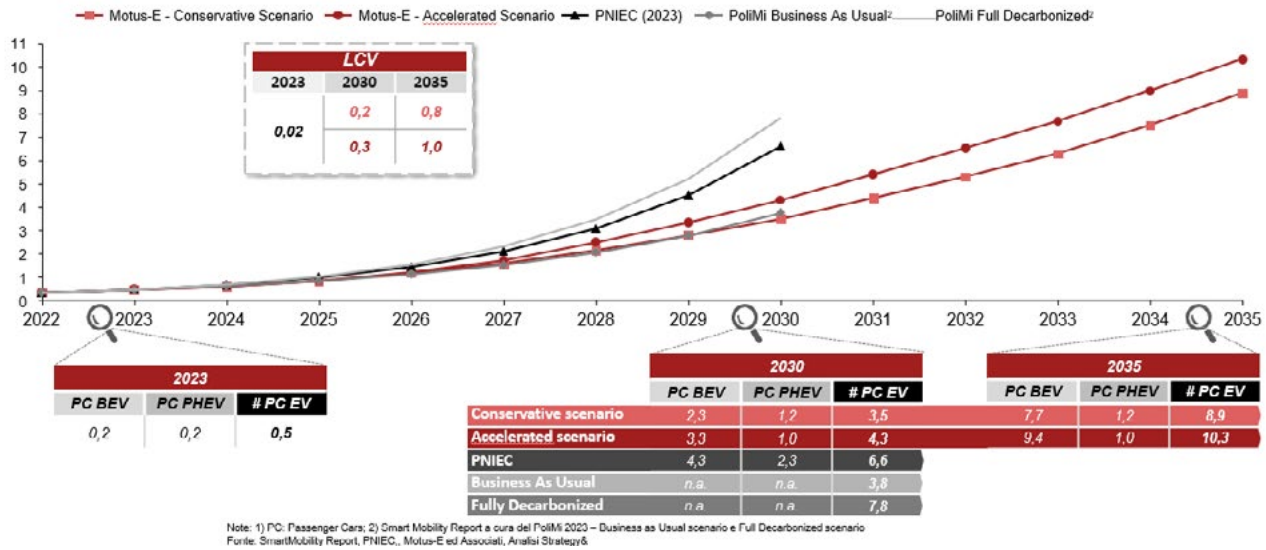
Discover the full report

The transition towards a zero-emission mobility system represents one of the biggest challenges relevant and ambitious of the next decade. In order to achieve European carbon neutrality objectives climate by 2050, **the vehicle sector electric will have to grow exponentially, with clear and measurable intermediate goals that outline a concrete path towards the total decarbonisation of transport on rubber.** The transition is a process that has we need a clear road map, which sets out short, medium and long-term targets. Even considering these challenges it is important to underline that the effort made certainly **will not allow the numbers to be reached designated by the PNIEC** (National Integrated Energy and Climate Plan) programmatic document, which set a vehicle penetration target for 2030 electric equal to approximately 6 million.

The path traced requires milestones clear and measurable that mark the stages towards the 2035 milestone:

- **2025 –Consolidation Phase: Reach at least 0.4 million electric vehicles on the road** by expanding rapid charging infrastructure and improving the accessibility of electric vehicles for corporate fleets and public transport.
- **2030 –Turning Point: reach 3.5 million electric vehicles in Italy**, integrating Vehicle-to-Grid (V2G) technologies and strengthening the fleet of light commercial vehicles (LCV).
- **2035 –Urban Decarbonization: complete the electrification of urban transport with over 10 million electric vehicles in circulation**, meeting European zero-emission regulations in urban centres.

Motus-E estimates for 2030 are below the PNIEC forecasts (3.5-4.3 Mln vs. 6.6 Mln EV) –8.9-10.3 Mln for 2035



Data source: Strategy &Motus-E "The future of electric mobility in Italy-2035"

Batteries

The battery supply chain

157 GWh

installed in electric vehicles in Europe in 2024

Key point

Promoting the creation of a European value chain for recycling

52%

of the world's batteries is NMC

99%

the European market is supplied by Asian producers

Key point

Reduction of CO_2 emissions from the production phase

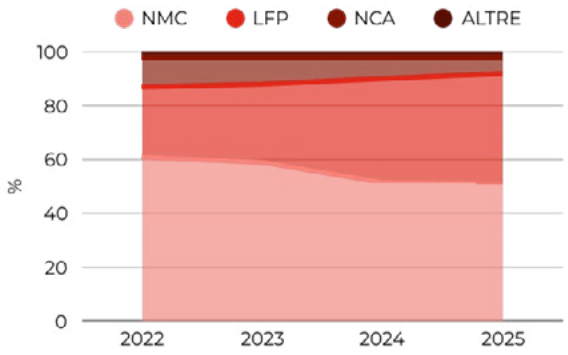
300 Wh/g

the maximum energy density of NMC cells

Lithium-ion batteries: the enabler for electric cars

Lithium-ion battery technology is behind the recent boom in electric mobility: while the **first electric vehicle** was presented at the Universal Exhibition in Paris in 1867, recent improvements in lithium-ion batteries have made it possible to reduce the impact of heavy lead-acid storage batteries, increase vehicle autonomy and **unleash the potential of zero-emission mobility**. The turning point is the result of our **portable devices:** the need for powerful and long-lasting batteries for laptops and gadgets has driven the development of lithium-ion cells. This technology has finally offered the energy density necessary for electric cars with interesting autonomy, as intuited by pioneers such as Tesla. Furthermore, a battery can be **used thousands of times** to store and release energy, thus making the life cycle of a battery more sustainable than that of fossil fuels.

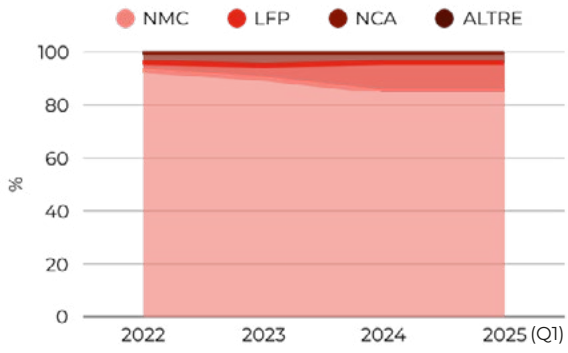
The evolution of battery chemistry worldwide [1]



The global battery market has seen **a significant technological change in just a few years.** Traditional **NMC batteries,** while maintaining a leading position, have seen their **dominance reduced by 20% in favor of LFP batteries,** which have recorded constant and marked growth, from 26 to 41% in just 3 years. This shift reflects the growing demand for more economical, stable and sustainable solutions, particularly suitable for both mass-market electric vehicles and storage systems.

stationary. At the same time, **NCA batteries, once considered a valid premium alternative, have progressively lost share, relegated to specific market niches.** Other minor technologies have remained substantially marginal, without significant changes. This evolution marks a clear orientation of the sector **towards chemistries that balance performance, costs and sustainability, with a progressive abandonment of the most expensive solutions and those dependent on critical materials.** The transition, already evident in 2024, has further consolidated in the first months of 2025, outlining a technological landscape increasingly polarized between the two main alternatives.

The Evolution of Battery Chemistry in Europe [2]

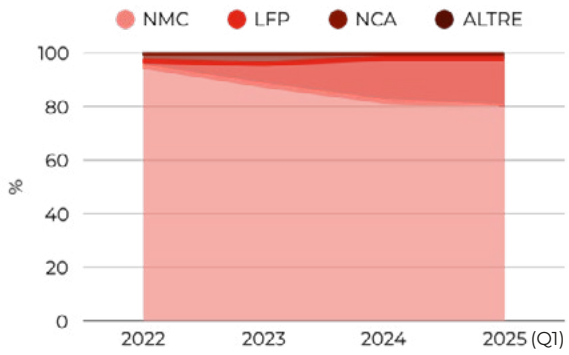


The European landscape shows **a gradual but significant transition. Traditional** NMCs, while maintaining their leadership, have seen their predominance constantly decrease, going from an almost total diffusion to a still majority but less overwhelming share.At the same time, LFPs have seen exponential growth, evolving from a marginal presence of 3% to conquering over 10% of the market. The transition, although late compared to the global one, nevertheless indicates a clear orientation towards more economical and sustainable solutions, without completely abandoning traditional performance technologies. **Italy is experiencing a double transformation in the electric vehicle battery sector. On the one hand, traditional NMCs remain the dominant technology,** albeit with a slow decline of over 18%.

Data source:: [1] [2] elaborations on EV-Volumes data

On the other hand, LFPs are experiencing rapid diffusion, conquering from 2 to 18% of the market in just 3 years, favored by the entry of new economic models and the growing attention to sustainability. Finally, unlike other European markets, where premium batteries find space, in Italy NCAs remain negligible.

The evolution of battery chemistries in Italy [1]

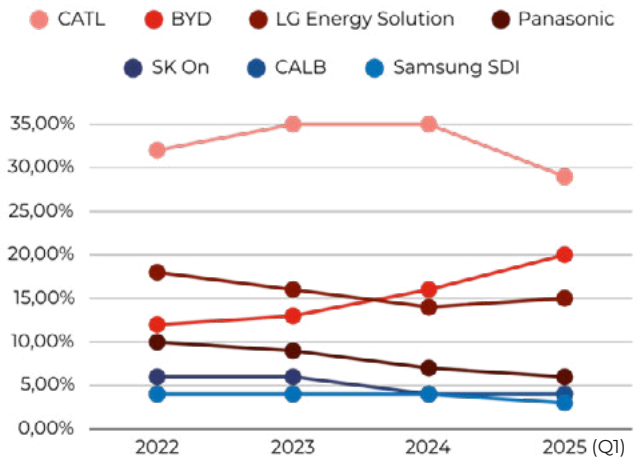


The global **battery cell manufacturers** market has undergone a significant reorganization in the four-year period considered: CATL, the undisputed leader in the sector, has maintained a dominant position albeit with aslight percentage decline in the last period. **At the same time, BYD has shown the most marked growth,** increasing steadily increased its market share to **20%**, positioning itself as the main competitor in the sector. Traditional Asian players recorded differentiated performances: **LG Energy Solution saw a progressive downsizing, while Panasonic confirmed a more pronounced negative trend.** Other smaller manufacturers, including SK On, CALB and Samsung SDI, maintained relatively stable but marginal market shares, without being able to significantly impact the overall balance of the sector.

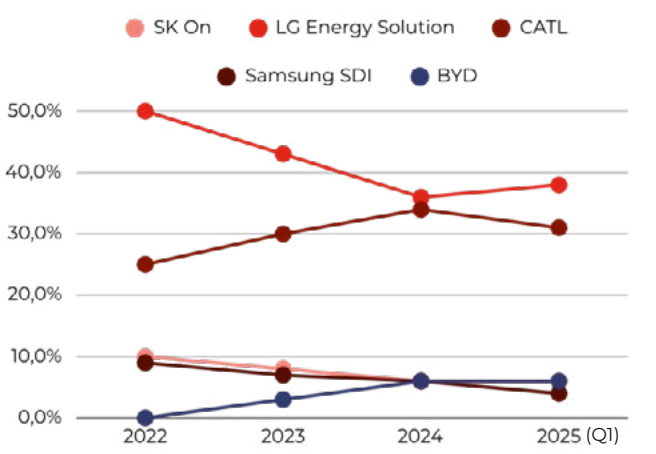
This evolution reflects the **growing polarization of the market between the two main Chinese producers and the downsizing of other competitors, with a progressive reduction in the overall fragmentation of the sector;** the dynamics also shows the consolidation of Chinese dominance in the global production of battery cells, capable of combining production capacity, technological competitiveness and economies of scale. **The European market shows a gradual but clear transition in the battery supply chain: LG Energy Solution,** while remaining a leader, has seen its share progressively reduced, while **CATL has consolidated its presence approaching 30-35% of the market.**

BYD, absent in 2022, entered the market with a 6% share. Finally , South Korean players (SK On and Samsung SDI) recorded a slight decline, but still maintained a significant presence.

Evolution of battery cell suppliers in the world [2]



Evolution of battery cell suppliers in Europe [3]



Data source:: [1] [2] [3] elaborations on EV-Volumes data

Future trends for automotive batteries

Dry electrode manufacturing

Leading lithium-ion battery companies have also announced **their plans for dry battery electrode (DBE) manufacturing** in 2024. LG Energy, Samsung SDI, and Tesla have joined the ranks of startups in the field, including Dragonfly, Anaphite, and AM Batteries. DBE technology was first showcased by Tesla at Battery Day in 2020, but it took years of research and development **to make it compatible with the large-scale processes of their Gigafactory. The main advantage behind DBE lies in the reduction of costs and production times,** thanks to the removal of some typically used solvents, which **require evaporation and collection in controlled conditions.**

Sodium ion batteries

More and more companies, particularly in China, are **introducing sodium-ion technology – aclose relative of lithium-ion chemistry – to the market.** BYD has launched SIBs (sodium ion batteries) for stationary storage, using its "Blade Battery" platform, and Hithium has followed with asimilar announcement. Stellantis has finalized an investment in the French startup Tiamat to bring this technology to the automotive sector. In China, the first electric vehicles powered by SIB are already being commercialized by JAC and JMEV.

The new formats of "cell-to-body" batteries

Automotive companies are increasingly integrating their battery packs **into their vehicles following the cell-to-pack (CTP) architecture**

The evolution of the energy density of BEV batteries [1]

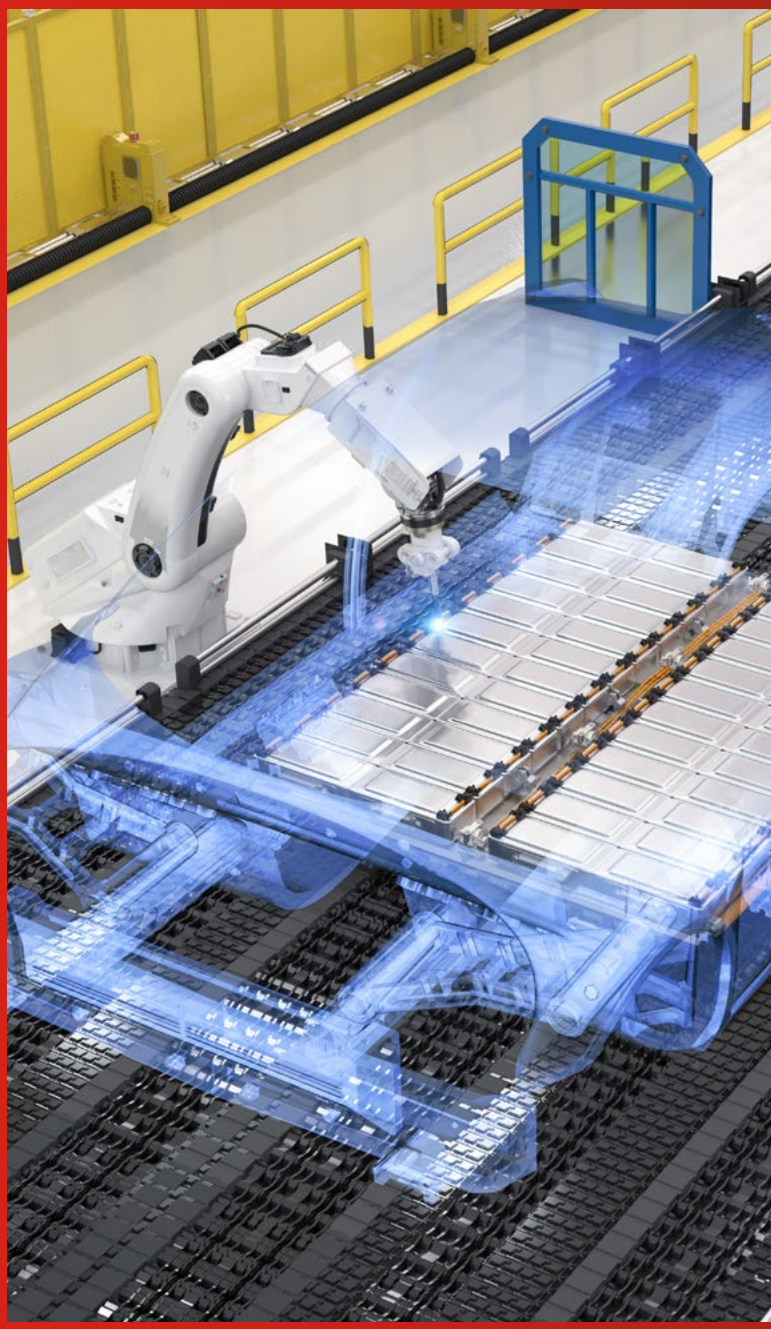
Technology	2000	2010	2024	Future (2030+)
Lead Acid Batteries	30–50 Wh/kg	–	–	–
LFP	–	–	150–180 Wh/kg	Incremental improvements (200+ Wh/kg)
NMC (111/811)	–	150 Wh/kg	300 Wh/kg	Optimizations (350+ Wh/kg)
NCA/NCA+	–	200 Wh/kg	300 Wh/kg	New anode alloys (350+ Wh/kg)
State Batteries Solid	–	–	–	400–600 Wh/kg (expected)

Data source: [1] elaborations on EV-Volumes data

INSIGHT

but some of them are already moving towards a further evolution called **cell-to-body (CTB).** Both architectures allow the **reduction of inactive components** and therefore a higher energy density, as well as ensuring that the batteries also act as structural components of the vehicle.

The **energy density of batteries is afundamental parameter** for evaluating **the efficiency and performance of storage systems.** It is measured in watt-hours per kilogram (Wh/kg) and **indicates how much energy can be stored per unit of weight.** The evolution of the energy density of electric car batteries tells a story of constant and decisive technological progress for sustainable mobility: in the early 2000s, heavy lead-acid batteries with their 30-50 Wh/kg were the only available option, but they were clearly unsuitable for efficient electric vehicles. The turning point came in the 2010s with the advent of lithium-ion batteries: the NMC 111 chemistries at 150 Wh/kg and especially the NCA at 200 Wh/kg.
Finally allowed the birth of high-performance electric cars, opening a new era for electric mobility. Today, **technology has made great strides: the modern NMC 811 and NCA+ have reached 300 Wh/kg,** allowing real autonomy over 500 km; at the same time, the more economical and reliable **LFP batteries, despite their more modest 150-180 Wh/kg, are democratizing electric thanks to low costs and greater safety.** But the future promises even better: **on the horizon there are solid state batteries with energy densities expected between 400-600 Wh/kg,** which could bring autonomy over 1,000 km and revolutionize charging times.

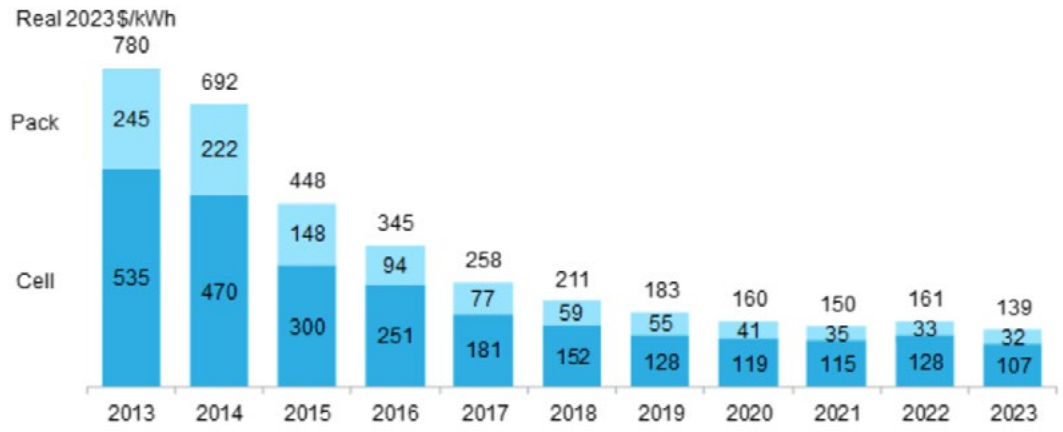


The drastic reduction of the costs

In recent years, lithium-ion batteries have experienced – and are still experiencing – an extraordinary evolution, **with a drastic reduction in costs. They have gone from $806 per kWh in 2013 to $115/kWh in 2024,** despite a slight increase in 2022 due to generalized global inflation and an increase in demand for critical raw materials.

Factors driving the decline in battery prices include **overcapacity of cell production, economies of scale, low metal and component prices, and the adoption of low-cost lithium iron phosphate (LFP) batteries.** Below is aglobal average, with prices varying widely across countries and application areas.

Volume-weighted average prices of lithium-ion battery packs and cells



Data source: BoolmerbegNEF

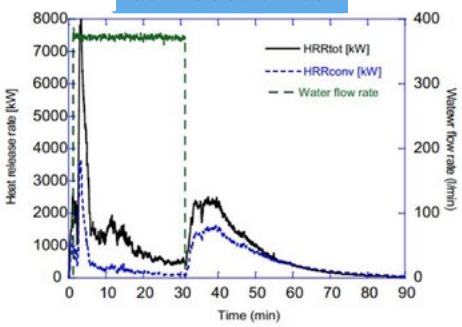
INSIGHT

Emerging technologies for security of the batteries

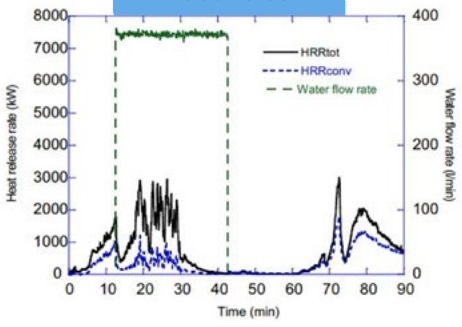
For every 100,000 cars sold, thermal cars record 1,530 fires compared to 25 for electric cars (BEV), thanks to the Battery Management System (BMS), which guarantees control and stability. As can be seen from the graphs, fires in thermal cars develop very high heat immediately, while in BEVs **the temperature rises more slowly and with less intensity, allowing for alonger time to secure people.**

The risk of re- ignition exists, but without peaks comparable to thermals.
To manage emergencies, technologies **such as the EV Drill Lance (drilling the battery to inject water), special fire extinguishers (water + encapsulating agents) and thermal blankets (resistant to 1,500°C) are becoming widespread today.**

Combustion car



Electric car



Discover the full report

Data source: Springer

THE VOICE OF THE EXPERTS

Alessandro Danesi
Commercial Director
S.E.VAL Group

> ***"The main lever for the development of the sector is the availability of material to process, i.e. exhausted batteries"***

Critical materials for electric mobility

The most relevant **critical raw materials for electric mobility** and where recycling is focusing are **neodymium (**present in the magnets of the most performing engines), **lithium,** cobalt and **nickel** (present in lithium ion batteries). While in the case of neodymium , recycling is still in its early technological stages (we are still trying to understand how to isolate material with a high concentration of neodymium), in the case of lithium, cobalt and nickel, technologies and plants already exist. The first step in battery **recycling** today is a mechanical **separation of the active material of the batteries** (so-called black mass), where lithium, cobalt and nickel are highly concentrated. This technology, although not yet fully mature, is now commercial and is winning over traditional pyrometallurgical processes (melting and roasting).
The **black mass** obtained must in turn be **refined** to produce lithium, cobalt and nickel in the chemical form and purity required by manufacturing industries. This step is carried out by hydrometallurgical processes, which are starting to become widespread, even if mainly in China, Korea, the Philippines, Japan and the USA, where there is a large availability of material to recycle and where the cost structure is favourable.
The main lever for the development of the sector is in fact the availability of material to process, namely exhausted batteries.
With the current state of technology, battery recycling plants need to process thousands of tons per year to have an economically sustainable size, while for hydrometallurgical processes quantities even ten times higher are needed. A developed electric mobility market allows the emergence of battery treatment plants, just as the presence of many battery treatment plants makes large quantities of black mass available, favoring the emergence of hydrometallurgical industries for their management.
We are certainly only at the beginning of the development of a frontier sector, destined to create – if we are able to support this development and not slow it down – a new industrial supply chain of the circular economy for hundreds of thousands of tons.

THE VOICE OF THE EXPERTS

Luca Gentilini
R&D Engineering
Haiki Cobat

> ***"This market still has strong growth potential, as an industrial standard has not yet been established"***

Recycling and Reuse: the potential

The battery, the largest component in terms of weight of an electric car, is also the element that poses the greatest challenges in terms of **end-of-life management.**
Recycling is complicated by the risks associated with its handling, such as electrical shock and uncontrolled thermal drift. In addition, **lithium-ion cells** have a **very complex** and layered structure. To recover the noble metals present as oxides in the cathode material, the battery must be discharged, made safe and disassembled to segregate the cells from all ancillary components such as the structural case and the electronics. Subsequently, it must go through a chain of mechanical and sometimes thermal processes for the liberation and detachment of the black mass (mixture of cathode and anodic material). The recovery and refining of target materials such as lithium, cobalt, nickel, finally occurs chemically.
This market still has strong growth potential, as an industrial standard has not yet been established. Enabling technologies including disassembly and commissioning automated safety, efficient mechanical chemical pretreatment and innovative low environmental impact chemical refining processes would have a strong industrial reception. Finally, this supply chain is also rapidly being renewed due to the entry into force of the new European regulation on batteries (EU2023/1542), which on the one hand sets very challenging targets for efficiency and recovery of recycling processes, on the other hand provides those who manage the end of life of batteries with tools for traceability and sharing of information such as the digital passport of the battery.

Francesco Mastrandrea
Managing Director
E-GAP Engineering

> ***"The evaluation of second life must transcend economic considerations and include the value of the resources safeguarded"***

Il second LIFE

BESS represent a true paradigm of the energy transition, especially for e-mobility: on the one hand, **they store energy from renewable sources, which** are random and unmanageable by nature, and on the other, **they allow the delivery of high power peaks** for charging, bringing the user experience closer to that of ICE vehicles. The reuse of electric vehicle batteries in stationary storage systems offers aconcrete opportunity for the circular economy. However, beyond the hype, we must face some **technical challenges:** accelerated degradation after 80% of the capacity, increased internal resistance that reduces efficiency, and the complexity of integrating management systems. Furthermore, the significant drop in the cost of new BESS has made second-life ones less attractive from a purely economic point of view.

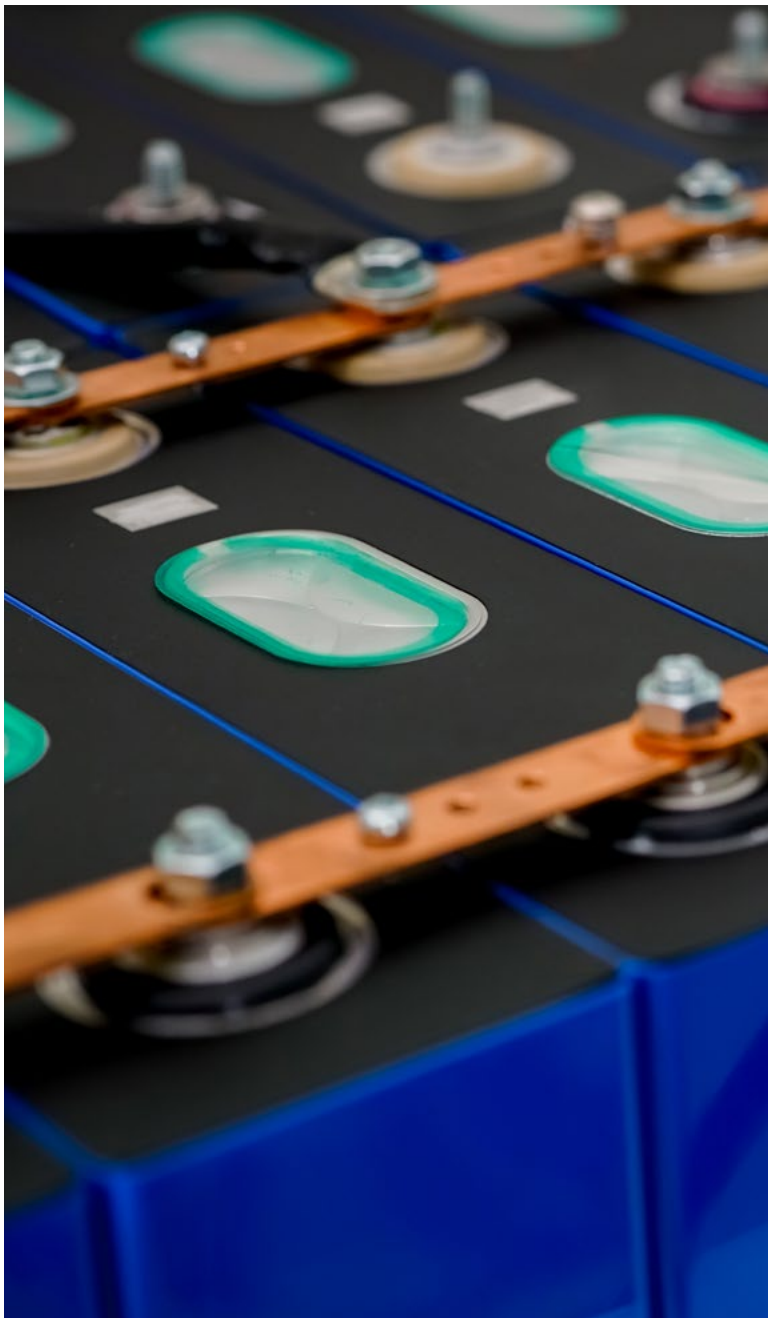
The evaluation of second life must transcend economic considerations **and include the value of the resources safeguarded.** We need a system that incentivizes and facilitates this virtuous practice.

The future looks bright, however, with the transition to LFP batteries with greater safety and longevity, the introduction of the European Battery Passport to improve traceability and interoperability, and innovations in advanced management systems.

It is precisely from the awareness of current challenges that opportunities arise to **make second life a sustainable pillar of the energy transition.**

Conclusions

Why does the electric revolution seem unstoppable this time? In addition to the unprecedented market penetration, the huge investments made by many economic players and the rapid development of new storage technologies, it is the connection with the energy transition that makes the difference. The electric car is no longer isolated, but part of an ecosystem integrated with the electricity grid. Technologies such as Smart Charging, Vehicle-to-Grid (V2G) and Vehicle-to-Load (V2L) make it an active element of the future smart grid, capable of stabilizing the network, providing emergency energy (as demonstrated by the Nissan Leaf in Japan) and facilitating the spread of renewables. Decarbonization is an economic and environmental necessity and batteries are crucial to managing the intermittency of renewable sources, becoming a strategic national asset to streamline the grid, reduce costs and increase resilience. The batteries of the future will be increasingly high-performance: they are expected to surpass hydrogen by 2035 and double their energy density every 8 years (a 100 kWh battery could weigh less than 200 kg in 2050). Furthermore, this transformation goes beyond the car, involving agriculture, sailing and transport. **Italy,** despite not having a gigafactory, boasts **high levels of expertise** along the entire supply chain (research, components, recycling): **the challenge is to overcome fragmentation** and coordinate these excellences to enhance the national potential and lead a more sustainable future. The Italian lithium-ion battery **recycling chain** represents a **strategic opportunity for the country,** thanks to investments in cutting-edge plants, consolidated industrial skills and cutting- edge research centers. With a **growing market** (18.5 kton of BESS and 28.4 kton of electric vehicles in 2023) and a potential of 40 kton of end-of-life batteries by 2030, **Italy can position itself as an European recycling hub,** attracting foreign flows and closing the loop.



Incentivising the recycling of lithium ion batteries in Italy: an industrial and geopolitical opportunity

Italy is currently in an initial phase with regard to the **lithium-ion battery recycling chain.** However, this situation must be read as **astrategic opportunity for the country system.** First of all, in fact, it should be noted that **in 2023 in Italy 18.5 kton of batteries were installed for renewables and 28.4 kton in electric and hybrid vehicles;** although their duration is increasing, the end of life will have to be managed, and rapidly developing a recycling chain would allow the valorization of materials, reduce dependence on imports and promote the production of new batteries. Secondly, creating an innovative recycling hub would make Italy a **European hub,** attracting volumes of **exhausted batteries from other European countries** that already have a electric circulation. Currently, **the Italian supply chain focuses on the mechanical phase of recycling** (disassembly and crushing), **but lacks anadvanced capacity for the chemical and metallurgical recovery of the most precious materials.** In fact, to date the so-called "black mass" (residue containing lithium, cobalt, manganese, nickel and graphite) is exported to Asia for the extraction of materials, which are then reused for new batteries resold in Europe. This phase, which **requires significant investments** and synergies of large industrial groups with chemical expertise, **would allow the European supply chain to be completed,** with the production of new batteries, **and to respect the material recovery objectives set in the new Battery Regulation (2023/1542).** According to estimates, the complete recycling of batteries could generate **revenues in Italy of over €600 million by 2050,** without considering the related induced effects created. Motus-E's proposals are therefore the following:

1. Large-scale recycling plants: develop medium-large hydro-metallurgical plants (10,000 - 50,000 kton/year) in Italy to ensure profitability and meet the needs of gigafactories.

2. European positioning of Italy: promote Italy as a European hub for the treatment and recovery of metals from lithium batteries, incentivizing the sending of exhausted batteries and black mass from other EU countries.

3. Strategic agreements with gigafactories: foster agreements between Italian recycling companies and European gigafactories.

4. Rules for the recycling market: introduce incentives that cover market risk, in addition to those for innovation, to make all phases of the process economically sustainable up to the production of black mass.

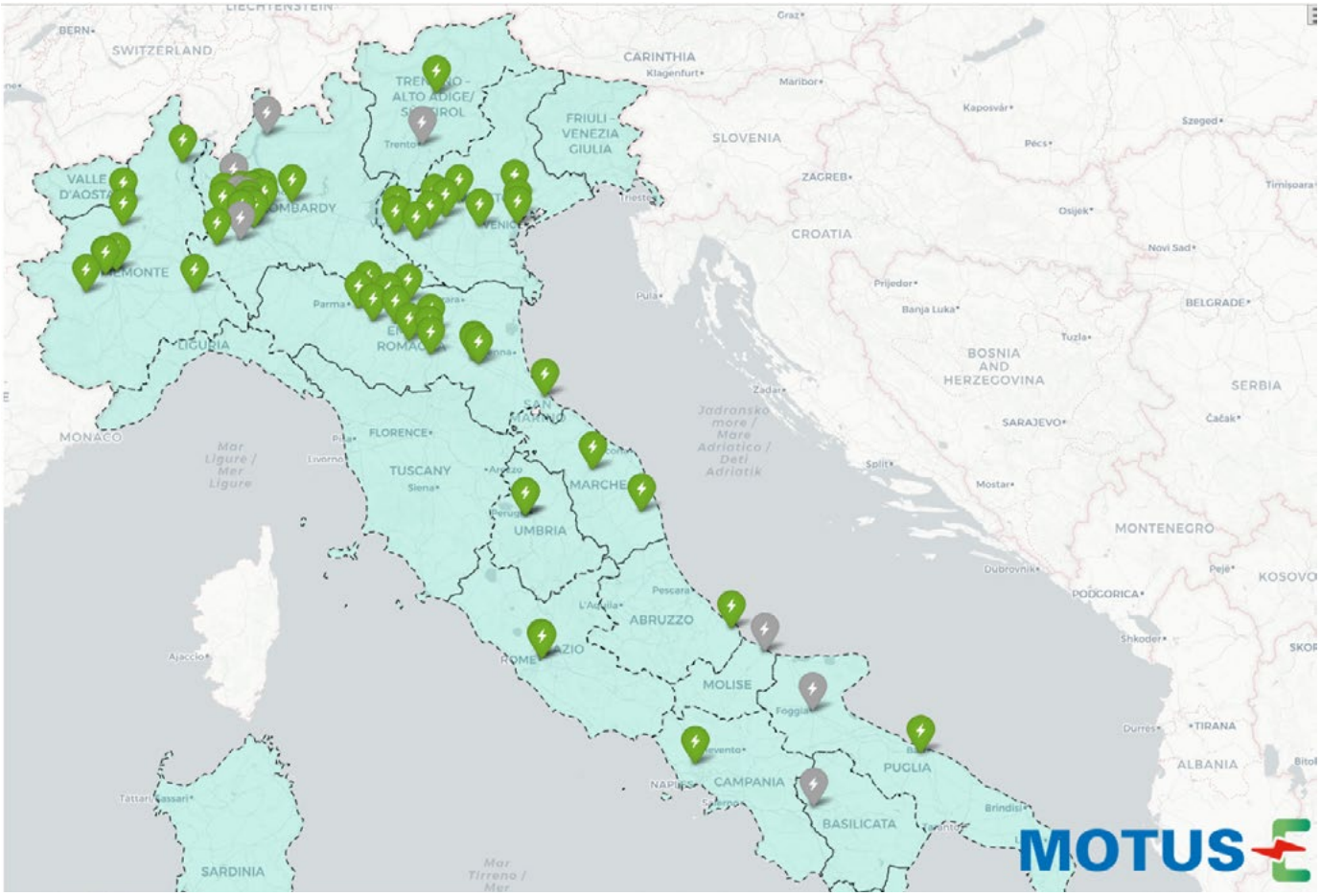
5. Simplification of intra-EU shipments: harmonize Italian regulations with European ones, recognizing black mass as a product and not as waste.

6. Single database for traceability: create a centralized system of data on batteries placed on the market to improve end-of-life management and optimize the flow of materials to recycling plants.

7. Stabilization of battery collection: organize an efficient collection by chemistry and battery type, training waste holders and facilitating correct management and delivery to treatment centers.

8. National regulatory adaptation: within the framework of the European Delegation Law 2024, integrate the practices already developed by Italian operators and consortia to ensure effective implementation of the EU legislation on extended producer responsibility.

The map of the battery supply chain in Italy



The Italian **battery supply chain landscape includes over 80 companies, with a clear predominance in Northern Italy.** The Motus-E mapping reveals a complex structure, where **24 companies dedicated to the production of battery packs** stand out , along with another 11 specialized in production machinery, demonstrating a solid manufacturing base. In the components sector, we find 7 companies focused on electronic components and 3 operating in the chemical materials sector, numbers that indicate growth potential in these strategic areas.**The recycling and sustainability sector shows**

9 operators active in battery recycling, while only one company deals specifically with black mass, a fact that suggests development opportunities in this crucial sector for the circular economy. It is interesting to note that only 2 companies work on the topic of the second life of batteries, an area that could offer interesting growth prospects. **Among the complementary services, 5 companies offer testing services and 3 participate in EPR (Extended Producer Responsibility) consortia, thus completing the picture of the skills present on the national territory.**

Recharge

The charging infrastructure

80%

achievement of the AFIR target by 2025

Key point

Review of regulated components to enhance flexibility

4.230

(+40,0% vs mar-24) charging points with power >150 kW in March 2025

45%

of service stations a long the motorway network have at least one charging point

Key point

Developing technologies that improve user experience

4th

Italy's place in the ratio of BEV circulating on public charging points among the major world economies

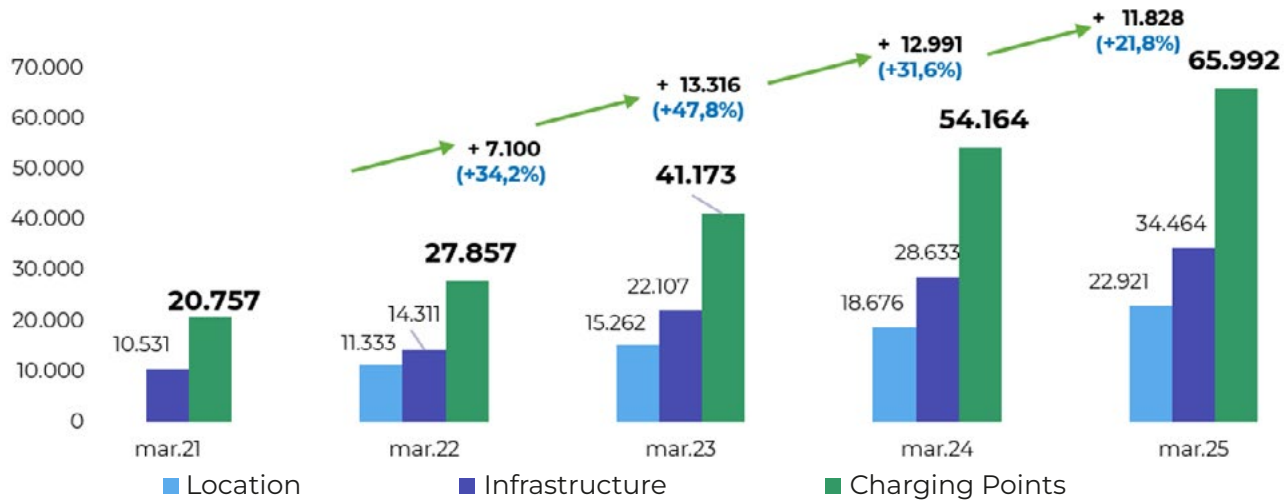
The Electric Charging Revolution: Past, Present and Future

A central role in the transition of mobility to electric is played by charging operators, protagonists of a rapidly evolving sector that has seen the birth of new operators and business models.
Today, the charging supply chain is divided into three main roles: the **Charging Station Owner (CSO),** owner of the infrastructure; the **Charging Point Operator (CPO),** responsible for the technical management of the charging points; and the **Mobility Service Provider (MSP),** which offers the service to end users via apps and digital platforms. The integration between these last two actors occurs through standardized protocols (typically OCPI or OICP) and roaming platforms that promote interoperability. From the initial experimental phase, in which the charging infrastructures were managed by energy distributors, we have moved on to an open and competitive market, with the installation of over sixty **thousand public charging points in Italy.**

The **growth of the charging infrastructure** is an **essential element** for the spread of electric mobility and on this front Italy is moving very quickly. As of **March 31, 2025** 65,992 charging points for public use have been installed in the Peninsula , **of which 55,549 are active: the remaining 16% are waiting** for connection to the network (over 10,000 charging points) with activation times that are often prolonged, afact that demonstrates the importance of speeding up authorization procedures and to increase the participation of the various subjects involved in the process. This result leads to a **ratio between BEVs circulating in Italy and active public charging points of 5.38.** If we also consider private charging, which is the main charging method for Italian EV drivers, we can come to the conclusion that the **availability of charging points does not** actually represent **an obstacle to the electrification of mobility.**

The map shows the distribution of charging infrastructures on the Italian territory. **57% of the total is located in the North of the Peninsula, compared to 20% in the Center and 23% in the South and the Islands.** It is worth highlighting the significant progress of installations in the South and the Islands in the last period (+25% compared to March 2024).

The evolution of charging infrastructure [1]



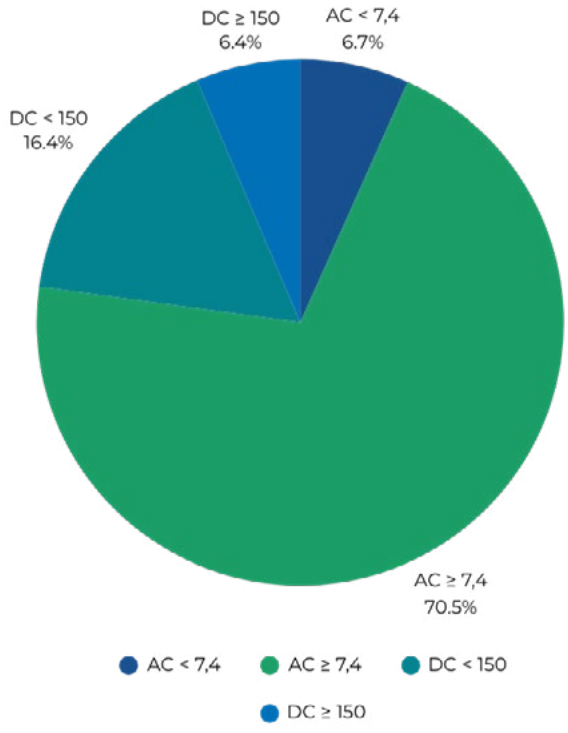
Data source: [1] Motus-E elaborations

Looking back, the graph shows a steady and significant growth of the charging infrastructure for electric vehicles in Italy from 2021 to 2025, **with a 217% increase in charging points in four years, going from around 21,000 to almost 66,000.** The most significant growth occurred **in 2023, when new installations grew at an average rate of around 50%.** Of the total 65,992 points in March 2025, **50,931** are **AC** with power less than 50 kW, **10,831** are fast **DC** with power between 50 and 149 kW and **4,230** are **ultra-fast** with power greater than or equal to 150 kW. High-power charging points are those that are recording the highest growth rate. In terms of charging power, **77%** of the installed charging points are **in alternating current (AC),** while **23% are in direct current (DC):** it is interesting to underline that **the weight of the installed fast charging** (in DC) has increased by **50%** compared to March of last year. In particular, it is important to underline the growth of the **fast charging DC points** (10,831 on March 25 vs 6,124 on March 24) which marks a **+77%** compared to last year and of the **ultrafast** charging points (>150 kW) which have reached **4,230,** marking a growth of **+40%** compared to March 2024 (3,021 points on March 24). This increase in the power of charging points indicates **an evolution towards long-distance needs,** after an initial phase focused on lower power for longer stops. Of all the types of points installed, compared to last year, there has been areduction only in the charging points **< 7.4 kW** (4,406 Mar 25 vs 4,437 Mar 24; **-0.7%**).

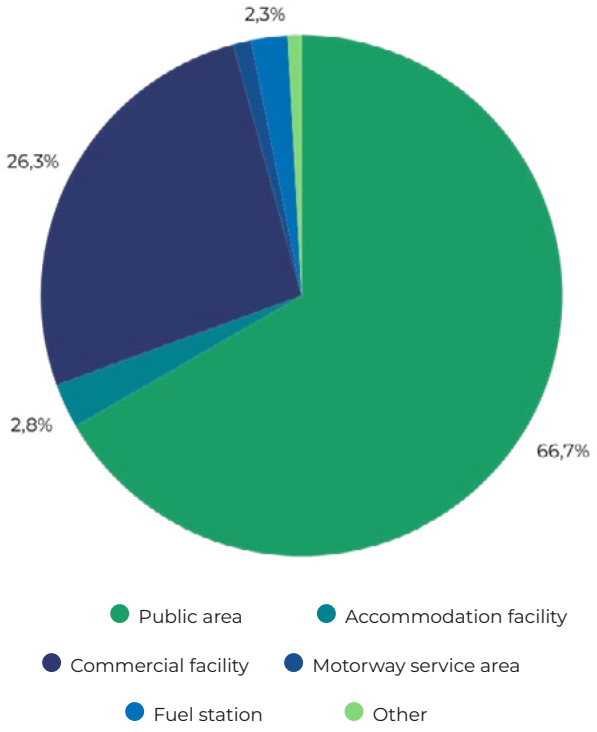
Type of locations installed

Public land is the predominant location with **66.6%,** followed by installations in commercial facilities with **26%;** charging stations installed in hotels, B&Bs or other accommodation facilities account for 2.7% of the total.
Installations at existing **filling stations** are increasing, reaching **2.2%** of the total, followed by those installed at **motorway service areas** and **interchange areas, such as ports, airports, etc., respectively equal to 1.1% and 0.8% of the total.**

The evolution of charging infrastructure [1]



Percentage distribution of locations [2]



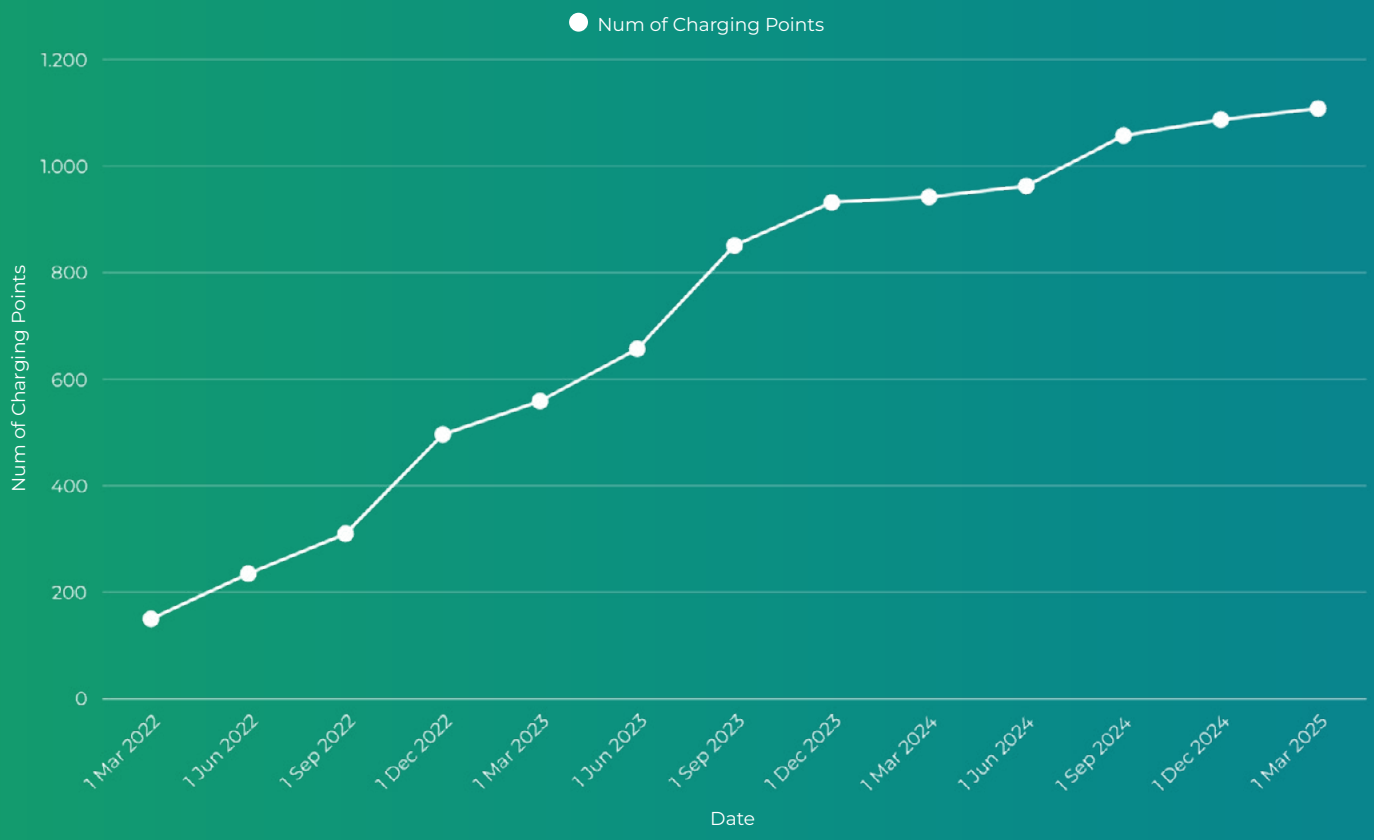
Data source: [1] [2] Motus-E elaborations

Highways

The Italian reality with respect to the infrastructure of the motorway network counts **1,108** charging points for public use **in service** areas as of March 2025. The points cover 45.5% of the approximately 407 service areas along the Italian motorway network. It is worth noting that **more than half (64%)** of the active points have a power **equal to or greater than 150 kW**, and 86% are of the fast direct current type.

Furthermore, if we consider the new regulatory definitions, there are 3,609 charging points (66% high power) installed within 3 km of motorway exits, guaranteeing almost total national coverage to potentially support along-distance electric journey.

Evolution of charging points in motorway service areas [1]



Data source: [1] Motus-E processing

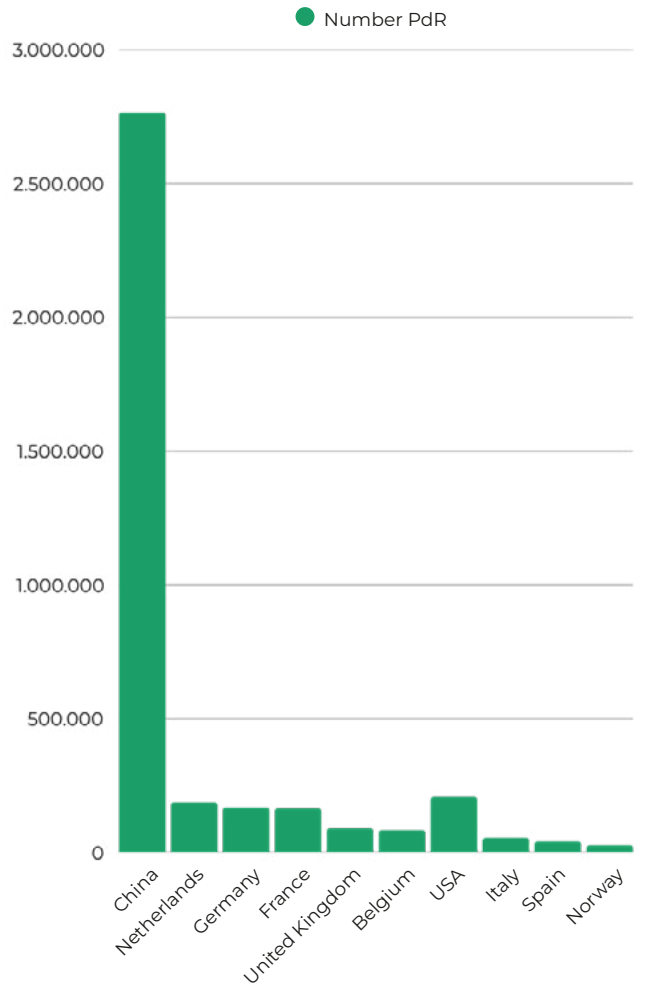
Charging: A comparison on a global level

The electrification of vehicles cannot ignore the development of the charging network, an infrastructure necessary to guarantee an efficient and safe service across the globe. For this reason, it is important to analyze the main global trends with a particular focus on the countries that currently have agreater share of electric vehicle penetration.

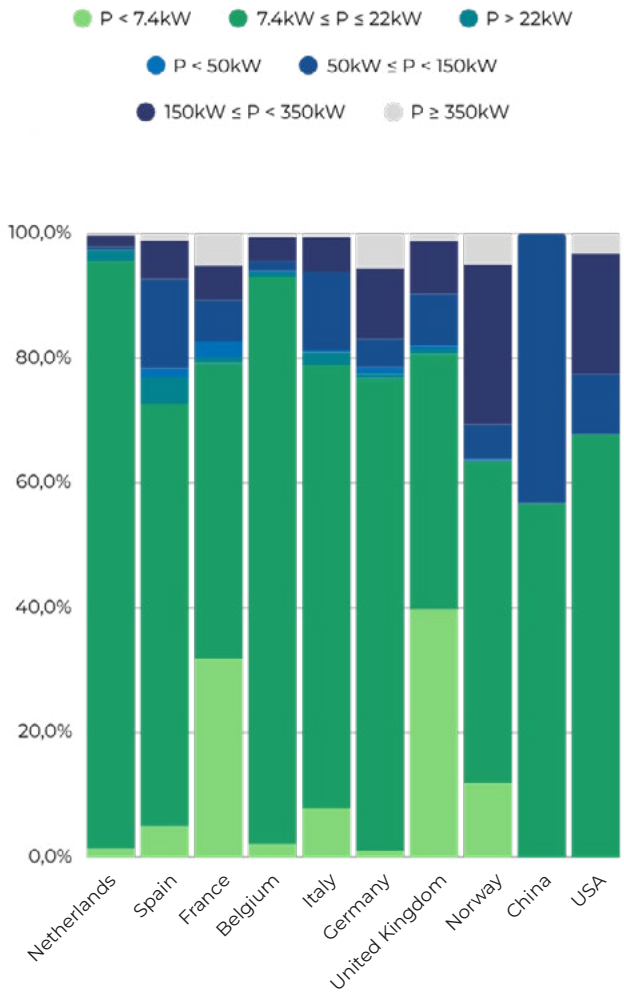
China clearly stands out, with **over 2.7 million public charging points,** confirming its global leadership in transport electrification. Europe comes in second with **1,059,923 public charging points (+411% compared to 2020).**

Within it, countries such as **the Netherlands (188,242), Germany (168,848) and France (164,886)** are establishing themselves as European hubs for electric mobility. Among non-European countries, **the United States** appears to have a surprisingly lower number compared to its economic and territorial potential, with over two hundred thousand **infrastructures. Italy,** with **55,549 active public charging points,** is in the medium- low range, slightly ahead of **Spain** (41,942) and **Norway** (27,321). This ranking highlights the strong commitment of Asia and some Northern European countries in the transition to electric mobility, while others, despite having good foundations, still need to strengthen their infrastructure to adequately support the growing diffusion of electric vehicles.

Charging points in the main European countries, China and USA [1]



Distribution by installed power [2]

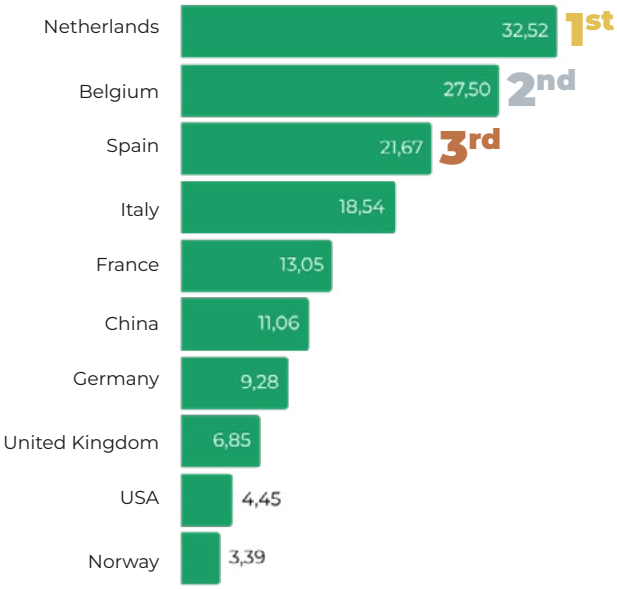


Data source: [1] European Alternative Fuels Observatory; EV Volumes, US Alternative Fuels Data Center, Motus-E Elaborations European Alternative Fuels Observatory; [2] EV Volumes; Motus-E Elaborations, US Alternative Fuels Data Center The data for the USA and China do not include some power classes.

Are there sufficient charging points to cover the charging needs of the fleet?

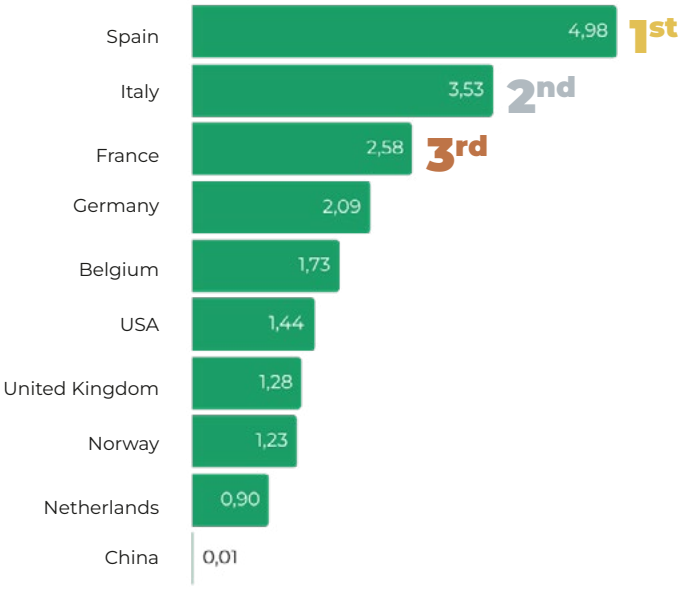
The analysis highlights the relationship between available charging points and the number of pure-electric vehicles in circulation in the various countries. Leading the ranking are the Netherlands and Belgium, with over **32 and 27 charging points per 100 BEVs respectively.** Italy ranks **fourth,** demonstrating good coverage of the charging network in relation to its fleet, surpassing countries such as **France, China, Germany, the United Kingdom, Norway and the USA.** It is worth noting that, if we only consider direct current (DC) installations, Italy makes a further leap forward, reaching **second place in the ranking with over 3DC charging points for every 100 BEVs.** As for the distribution of charging points per inhabitant, expressed as the number of charging stations **available per 10,000 inhabitants,** the ranking sees the Netherlands at the top, with over one hundred **points per 10,000 inhabitants,** followed by **Belgium** and **Norway.** Italy closes **the ranking third to last,** preceding only **Spain and the USA.** This highlights the need to increase the number of charging stations in various countries, in order to ensure a more widespread network and support the increase in the circulation of electric vehicles in the future. Considering the capillarity of charging points in relation to the territory, Italy is in fifth place, allowing EV drivers to find a charging point approximately every 4 km. **In this sense, the country is in line with the other main European countries. At the top is China, which has developed one of the most extensive charging networks for electric vehicles in the world, and the Netherlands with acapillarity of less than one km.** Closing the ranking of the main countries in the world is **the United States with the enormous value of over 300 km** on average for each charging point: in particular, the concentration in certain urban centers/states with favorable regulation (such as California) penalizes many territories that remain completely uncovered.

Charging points per 100 BEVs in circulation [1]



Data expressed in number of available charging points compared to compared to the population in different countries

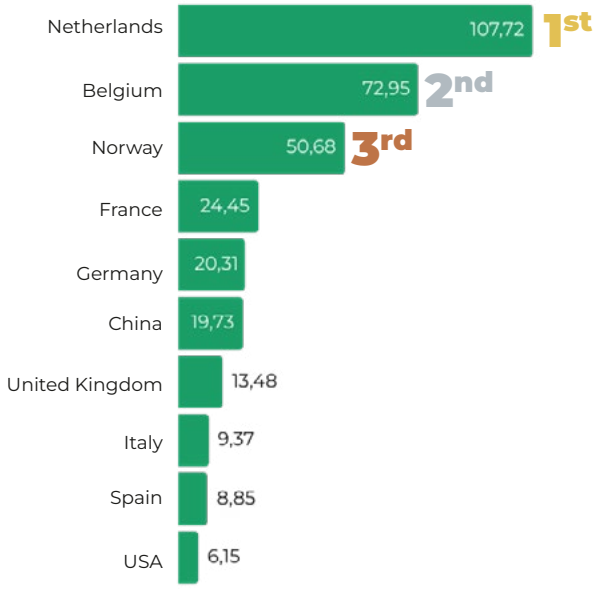
Ranking of countries with respect to the circulating amount for DC only [2]



Data expressed in number of available charging points compared to the fleet in circulation in the different countries

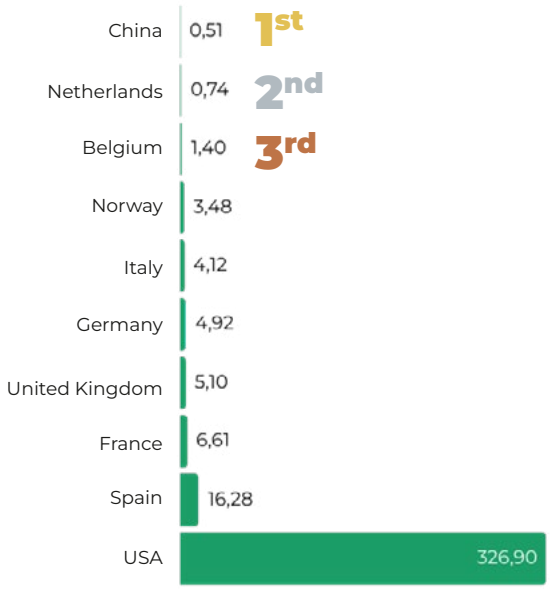
Data source: [1] [2] European Alternative Fuels Observatory; EV Volumes; Motus-E processing, US Alternative Fuels Data Center

Charging points per 10,000 inhabitants [1]



Data expressed in number of available charging points compared to the fleet in circulation in the different countries

Charging points relative to the roads [2]



Data expressed in number of available charging points in relation to the territorial surfaces in the different countries

Data source: [1] [2] European Alternative Fuels Observatory; EV Volumes; Motus-E processing, US Alternative Fuels Data Center

New modes of recharge

Charging without dedicated stalls

To overcome the concept of parking limited to the charging period, innovative projects have been launched in Italy: a solution has been developed **with low-power charging stations,** which power multiple points with asingle meter, reducing energy demand and increasing charging availability. **These stations do not exclusively occupy** spaces for charging, maintaining the parking disciplines (blue, yellow, white) in order not to take away excessive parking spaces from citizens. This model is particularly suitable for high-density urban contexts, such as city centres, where vehicles tend to park for extended periods.

Off grid charging

To develop atechnological mix to support the development of sustainable mobility, **mobile or semi-mobile charging** stations reach the user, or are positioned temporarily (less than 6months), offering complementary advantages to on-grid ones, such as the management of peak demand and “home” services for users who prefer them.

Charging with storage systems

To address high power demands, charging solutions are being adopted with storage systems that offer the following advantages:

- photovoltaic energy storage;
- support during peak demand energy, useful in the absence of power from the distributor.
- enhancement of existing stations: increase the capacity of existing charging stations operational, in areas with limited grid power, reducing the load on the national electricity grid.

Charging with satellite station

Power unit and satellite solutions can be i**nstalled with or without battery storage (BESS),** offering charging flexibility and high power levels thanks to multiple Power Unit cabinets.

The system supports up to 8 charging points connected to a Power Unit and distributes high-power energy in direct current (DC) via dispensers. The power cabinet, which can be positioned up to 80 meters from the dispensers, reduces infrastructure costs, thanks to less AC wiring.

Additionally, the power sharing function increases efficiency by distributing **power between dispensers based on vehicle charging needs, through advanced algorithms and control systems implemented in the power cabinet.**

Thanks to its cost-effective and scalable design, the centralized solution is a reliable choice for both public and private charging infrastructures.

INSIGHT

The Italian distribution network: development and opportunities Utilitalia

Electricity distribution networks are now recognized as having a strategic role in the long and complex path of decarbonization of the transport sector.The Italian DSOs are committed to promoting the development of their network infrastructures with a view to facilitating the creation of new connections, including those functional to the activation of charging infrastructures. In this context, with the 2025-2029 recently approved by the main DSOs, interventions and network enhancements have been planned to anticipate future connection requests. Specifically, the Plans include a specific section dedicated to local energy scenarios, with a focus on the expected development of electric mobility, both private and public. **Consequently, continuous dialogue between all the interested Operators -DSO, CPO and Electric Mobility Operators in general (e.g. TPL Companies or Logistics Companies)** -is essential to intercept in a preventive manner future power request needs on the electricity grid and at the same time help promote efficient use of the network itself, taking into account the high connection powers required for fast and ultra-fast charging stations.
At the same time, DSOs are experimenting with the use of local flexibility solutions, with a view to responding to the growing electrification of consumption and the spread of distributed generation thanks to the creation of a flexibility market through which they can better manage the use of network systems. **With specific reference to electric mobility, examples of possible technical solutions are represented by the use of formulas contractual arrangements that allow flexible exercise of the power made available to the end user -similar to the ongoing experimentation promoted by ARERA for domestic charging pursuant to resolution 541/2020 - and the structuring of so-called vehicle to grid - V2G structures;** these are, in essence, solutions that allow effective system synergy, ensuring efficient management of electricity networks through the use of market instruments available to interested parties. Utilitalia's hope is that, in any case and **also through the progressive development of flexibility services for electricity networks,** further and necessary forms of greater collaboration can be activated between the Operators involved in the development of sustainable mobility.

By:

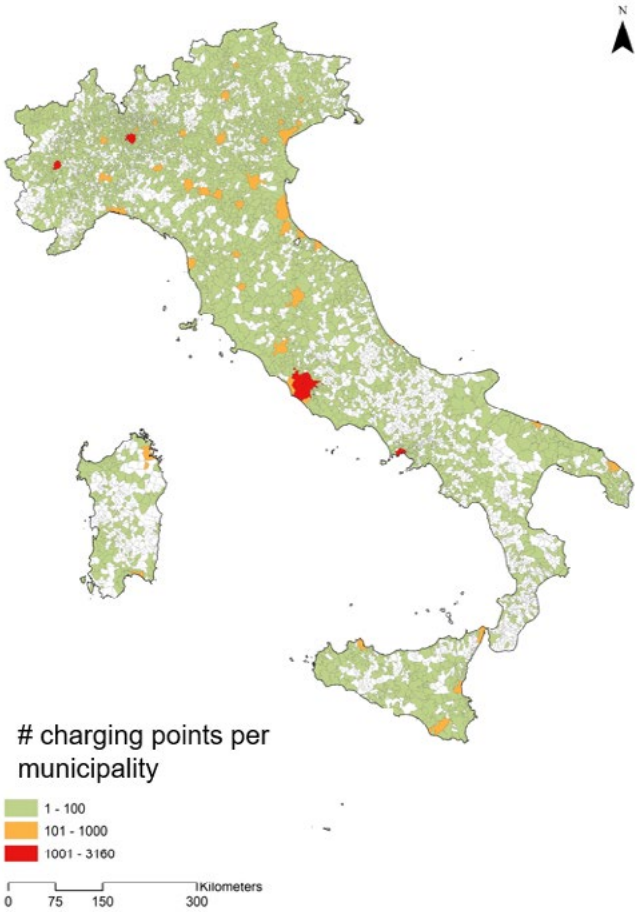
UTILITALIA
FEDERAZIONE UTILITIES
acqua | ambiente | energia

Spatial analysis of geolocalized charging points

The maps shown in this section were created by RSE using **GIS applications,** with the aim of providing a spatial analysis of the geolocalized data of the National Single Platform (PUN), managed by GSE.
The dataset used, harmonized with the data of the associated CPOs and partners of Motus-E, is **updated to December 2024.**

The distribution of electric charging points in Italian municipalities highlights a strong concentration in some areas, but also deficiencies in others. In fact, **most municipalities** (about 58%) have a number of charging points ranging from **1 to 100,** but over **40% of municipalities** still do not have any charging infrastructure. In total, only **44 municipalities** have more than **100 charging points,** demonstrating a disparity in coverage across the territory.

On the contrary, **the four most populous cities** in the country - **Rome, Milan, Naples and Turin** -stand out for a significantly higher number of charging points, with each one well exceeding the threshold of **1,000 charging points,** a figure that reflects their centrality and greater commitment in the most densely populated urban areas.



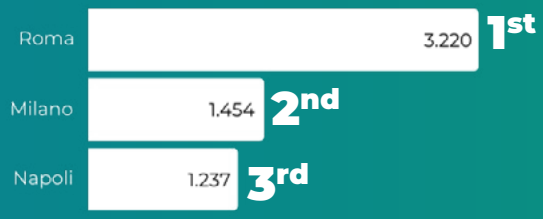
Discover
the full report

Data source: Motus-E: "Public charging infrastructures in Italy – Sixth edition"

INSIGHT

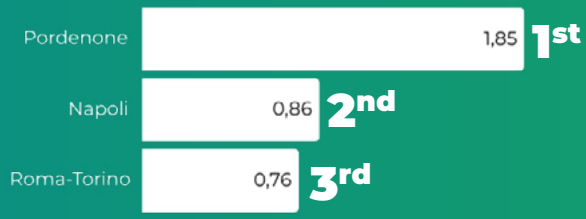
The most virtuous municipalities

Most virtuous municipalities in absolute terms of number of points



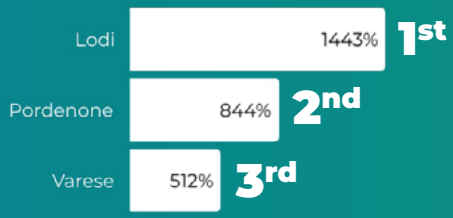
Rome confirms its first place with 3,220 active charging points, followed by Milan (1,454) and Naples (1,237): this data highlights the driving role of large metropolitan cities in the development of electric mobility in Italy.

Ranking by number of PdRs on the total population



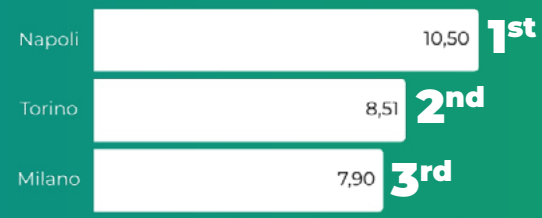
Pordenone ranks at the top with 1.85 charging stations per 1,000 inhabitants, demonstrating an extraordinary commitment to electric mobility; Genova and Rome follow, which despite having higher absolute numbers, show aless advantageous inhabitants/ stations ratio.

Ranking by growth over the last 12 months



Over the last 12 months (Mar-24->Mar.25), Lodi has stood out as the municipality with the most impressive growth in the number of charging points for electric vehicles, followed by Pordenone and Varese. These results demonstrate how, alongside large metropolitan cities, medium-sized urban areas are also making giant strides in the transition towards sustainable mobility, with performances that in some cases even surpass those of large urban centres.

Most virtuous municipalities in terms of comparison with respect to surface area



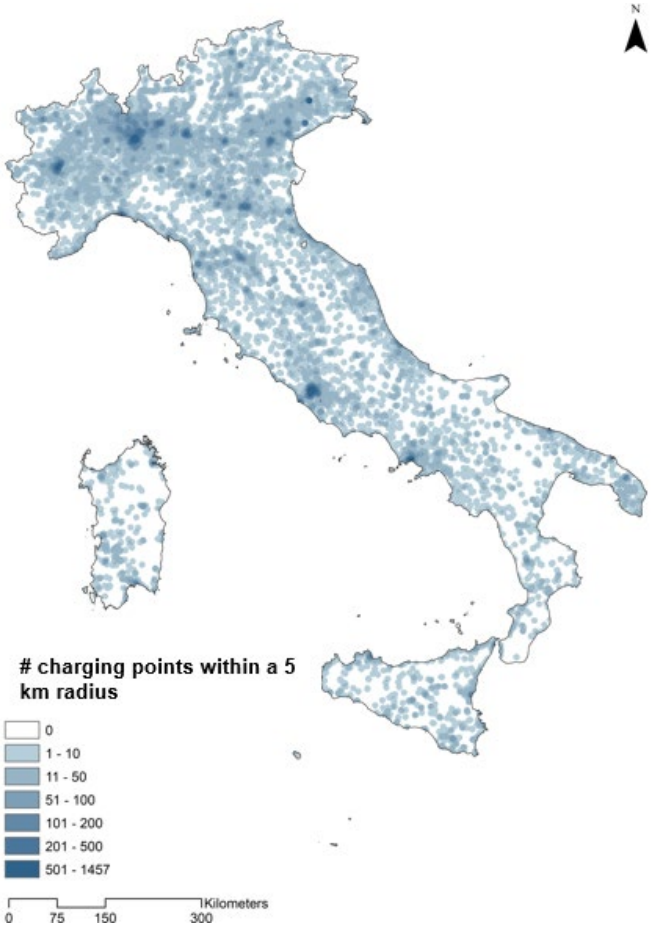
Naples takes first place with 10.5 active charging points per km², demonstrating the highest density of infrastructure for electric vehicles among large Italian cities. Turin follows with 8.5 points/ km², while Milan completes the podium with 7.9 points/ km². The analysis highlights how these three metropolises have developed particularly extensive charging networks in relation to their surface area, with Naples emerging for the most widespread territorial distribution.

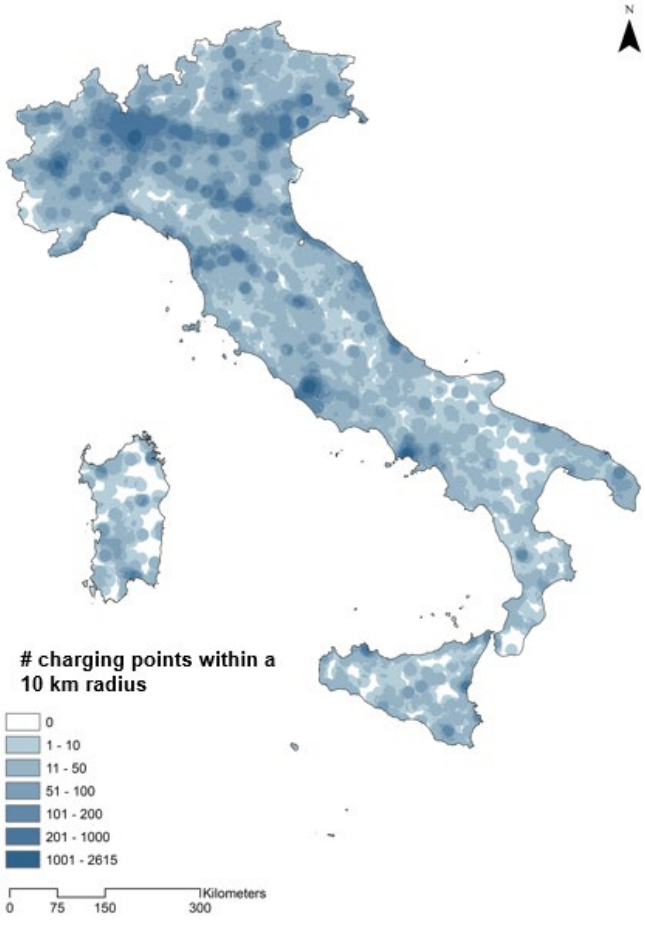
Data source: Elaborazioni Motus-E

How widespread is the charging infrastructure in the area?

For this analysis, the territory was divided into 1 km square cells. For each cell, the number of charging stations within a radius of 5 or 10 km was counted. The results show a **promising density** of charging stations within **both radii.**
A third of the national territory **has no stations** charging points **within 5 km,** while **6%** within **10 km. 30%** of the territory has **more than 10 points charging points within a 5km radius** and more than **26% of** the territory has **more than 50 points within a 10km radius.**
In both cases, the highest densities of charging points are found **near large cities and main roads, also considering the particular topography of the Italian territory which includes mountainous areas for approximately 35% of the territory.** The analysis shows a significant disparity in the availability of stations between the South and the rest of Italy; in particular, many areas of southern Italy have an insufficient number of charging stations.

Availability of charging infrastructure within 10 km and 5 km [1]





Data source: [1] Motus-E "Public charging infrastructures in Italy – Sixth edition" Data updated to December 2024.

Evaluation of the achievement of objectives

By the end of 2025, the European core road network (TEN-T) will have to ensure public charging hubs with a minimum power of 400 kW, each equipped with at least one 150 kW charging point. The hubs will have to be distributed in all main directions, with intervals of no more than 60 km to ensure homogeneous coverage of the territory.
Currently, **the Italian network already meets 75-80% of AFIR requirements, with 9 months still available** to achieve full compliance with regulatory provisions.
However, completing the course is not a given: to fill the remaining gap, the support of the institutions and a close collaboration with DSOs, especially to overcome the critical issues related to high-power charging stations (HPC), a key element of the regulation. It is important to underline that the current 80% target has been achieved over several years, and therefore completion within a few months cannot be taken for granted without a concrete acceleration of the actions underway.
The Italian circulating fleet includes approximately three hundred thousand pure-electric vehicles (mar-25), supported by a charging infrastructure with over 2.2 GW of total power. **This translates into an average power of over 7 kW per vehicle, significantly higher than the minimum standard of 1.3 kW required by the AFIR regulation,** demonstrating the system's ability to adequately support the growth of electric mobility in Italy.

By the end of:
2025

Light Vehicle Goals:
TEN-T Core Network

Output power from each charging hub::

≥ 400 kW

Including at least 1 charging point with power:

≥ 150 kW

Public charging hub:
In every direction

Public charging hub:
Ranges up to 60 km

Data source: Motus-E "Public charging infrastructures in Italy –Sixth edition"

Private Charging – The Turning Point Towards Everyday Electric Mobility

The easiest way to tackle the transition to an electric car without upsetting your habits is to charge it in the places where you spend the most time: **at home or at work.** Having a wallbox **in your garage or condominium garage will soon become as common as having an internet connection at home.** As often happens with innovations, it is just a matter of time and infrastructure. In independent homes, installation is almost always immediate: just contact a professional to have a safe, certified and compliant system. The advantages of home charging:

- Possibility to recharge the car during the night, taking advantage of lower rates
- Greater satisfaction with an infrastructure personal, reliable and comfortable;
- Schedule refills based on personal or market needs.

In acondominium, however, the management of common spaces and compliance with more complex regulations - such as fire prevention regulations - similar to those in corporate contexts come into play. Here it is essential to adopt a long-term vision:

- **Dedicated electrical infrastructure:** a private system that may or may not share the POD (electricity delivery points) with the condominium system, which allows energy to be managed independently;

- **Condominium infrastructure:** the condominium offers this service to its condominium owners and ensures greater efficiency and use of the common infrastructure;

- **System sizing:** to avoid overloads and optimize distribution. Furthermore, the software also allows for optimal accounting of expenses.

For companies that want to monitor and manage consumption, a systemic approach is recommended that considers both workplace and home charging in order to:

- Remotely control the columns installed in agency;

- Manage employee consumption that recharge at home through predefined agreements;

- Reduce management costs thanks to to optimize load peaks.

The evolution of infrastructure will allow us to overcome current logistical and regulatory barriers, ensuring simple, autonomous and accessible charging for all.
Innovations in the sector are transforming **private charging** into **an infrastructure capable of communicating with the national energy system**, contributing to the stabilization of the network and the optimization of consumption.
In particular, bidirectional charging represents a turning point.
With V2G, the electric car is no longer a simple means of transport, but **a mobile energy accumulator** that can return energy to the electricity grid, which allows to stabilize the network, be **an earning opportunity for vehicle owners** (both private and companies) and optimize self-consumption or in energy community contexts.
In this context, the transposition o**f the EPBD (Energy Performance of Buildings Directive) becomes crucial.** The European Directive requires the installation of charging infrastructures in all new buildings and significant renovations.
The goal is clear: to ensure a widespread and easily accessible charging infrastructure, supporting the transition to electric mobility and reducing CO_2 emissions in the residential and commercial sectors.

THE VOICE OF THE EXPERTS

> *"Smart charging [...] allows for the modulation of charging times and power"*

Massimo Minighini
Responsabile Business & Product Development
Neogy

Smart Charging

The evolution of electric mobility introduces new challenges and opportunities for energy management, based on the ever- increasing penetration of renewable sources which, as is known, present the problem of storage and require innovative management and integration systems with the grid. In this context, since the batteries of electric vehicles represent an enormous potential source of stored energy and are ready to support the electricity grid for any needs, **"smart charging" and "Vehicle-to Grid (V2G)" are proposed as advanced technical solutions, candidates for the management of this new opportunity.** Smart charging is, in general, an operating mode that allows for the modulation of charging times and power based on dynamic parameters: grid availability, production from renewable sources, energy tariffs and vehicle needs.
This allows for greater efficiency of the electrical system, reducing demand peaks and promoting the integration of non-programmable renewable energy. One example is automatic night-time charging when electricity demand is low and the cost is more convenient. Another is the adaptation of charging to domestic photovoltaic production forecasts **to maximize self consumption. V2G extends and contextualizes this paradigm, enabling EVs to return energy to the grid.** When not in use, vehicle batteries can act as a distributed energy resource, helping to stabilize the grid and supporting ancillary services such as frequency balancing and load regulation. For example, a company fleet idled during the evening hours can feed energy into the grid during times of high demand. In the residential setting, a parked vehicle can contribute to powering the home or the local microgrid in the event of ablackout.
Of course, V2G does not correspond to the paradox of charging the battery of an electric vehicle, to discharge it instead of using it to move the vehicle, but it is inserted into a logic of additional service that, in certain situations, a customer can provide to the grid under certain remuneration conditions. Let's imagine in the extreme case a vehicle that can charge with energy entirely produced by a photovoltaic system (therefore at zero cost) and, in the event of a prolonged stay in the parking phase, can afford to give the surplus energy, compared to the mere need for movement, to the grid. These technologies ultimately offer new opportunities for energy integration, the development of digital infrastructures and distributed energy management. In acontext of ecological transition, smart charging in its V2G declination takes on a strategic role in transforming the electric vehicle into an active node of the grid, making mobility an integral part of the energy ecosystem.

THE VOICE OF THE EXPERTS

Antonio De Bellis
E-mobility Key Account Lead
ABB E-mobility

> ***"The reference to aim for is critical infrastructure such as telecommunications networks . [...] Ensure a charging success rate of > 80%"***

Uptime and User Experience

E-mobility is an immature industry; the analysis of data accumulated from the installed base and the interaction with customer and user experiences, allow us to identify the **key challenges that the sector must overcome,** to ensure greater availability of charging systems and a high success rate in completing acharge. Among the various challenges we can mention, for example, the **management of the flow of digital payments, the recovery times of acharging point outage,** the difficulty for the user/user **in interacting with the charging infrastructure,** elements that affect factors such as the availability and success rate in charging. **The usage rates in Italy** for DC infrastructures are on average **below 5%,** with exceptions that aim at 10% and some sites that have averages from Northern Europe, around 20%, at peak times, due to seasonality effects. With an increasing penetration rate of electric vehicles, what will happen to the charging infrastructure when the average rates stabilize around 20%? And when will we reach 40%?, 60%?, 90%?

The reference to aim for are **critical infrastructures,** such as telecommunication networks, where availability and success rates are higher than those currently provided by charging infrastructure. The ecosystem as a whole must work to **ensure an availability rate >95% and a charging success rate >80%.** Furthermore, it must be **inclusive,** that is, able to be used by any user profile; therefore, the heterogeneity of the users will measure the degree of achievement of this objective.
This involves creating a new generation of solutions that offer a **superior charging experience** and whose design and construction is focused on the experience to be provided to the user. To significantly improve the charging experience, the final result depends on the provision of an integrated charging solution, i.e. acomplete integration between the charging system, the service packages and the network services that accompany it. The integrated set helps to ensure availability and success in charging, through ease of use. Industrially, to achieve these goals, additional skills and capabilities are required that evolve the charging infrastructure, as is currently happening on the side of EV transport. Europe and Italy, in particular, have what it takes to overcome the challenges on charging systems.

THE VOICE OF THE EXPERTS

Manuel Cuomo
Head of Beyond Insurance Strategy
Unipol Assicurazioni

> ***"The possibility of unifying the mobility services [...] and in the future [...] electric charging in a single digital solution"***

New payment methods

The mobility sector is witnessing a rapid evolution of payment systems, with the aim of making the experience increasingly simple, interoperable and integrated. In the electric charging sector, alongside traditional RFID cardsand proprietary apps, contactless methods and direct payment solutionsusing bank cards, smartphones and, in the future,connected devices such as electronic toll collection devices are becoming increasingly popular.**At the infrastructure level, the standardization of protocols and the integration with roaming platforms now allow access to different charging networks with asingle payment method.** This approach promotes tariff transparency, continuity of service and centralized management of transaction data. **The developments underway also open up interesting scenarios related to integrated mobility, as is happening with Unipol Move, with the possibility of unifying the payment of mobility services such as electronic toll collection, parking, public transport and in the future other services such as electric charging in a single digital solution,** facilitating the transition towards more sustainable and efficient mobility models.

Luigi Antonio Poggi
Head of Marketing & Sales, Strategy, Communications
Ewiva

> ***“Is becoming available on a large scale the system Plug&Charge [...] Charging stars in a few seconds.”***

New payment methods

Innovative payment methods have been introduced to simplify the public charging experience. **Contactless payment** functions are active directly at the charging station across the entire network – **from north to south, including the islands:** credit, debit, prepaid cards from the Mastercard, Visa, Vpay and Maestro circuits and digital wallets (Apple Pay, Google Pay) allow you to start charging without apps or registrations.
A simple and immediate method, designed to make charging accessible even to those who do not have asubscription or prefer pay-per use solutions, such as tourists, occasional users or in case of need. Alongside this solution, the **Plug&Charge system,** based on the ISO 15118 protocol, is also becoming available on a large scale. Once the subscription is activated with a compatible MSP, the user connects the vehicle and the column automatically recognizes the profile: charging starts in a few seconds, without further steps. Ewiva was the first CPO to introduce this feature on a large scale in Italy. These solutions, now operational on the high-power charging network, simplify access to electric mobility and break down technological barriers.

The direction is clear: **an increasingly accessible and e-driver- friendly infrastructure,** designed to respond to different mobility needs and accelerate the adoption of electric vehicles in Italy.

THE VOICE OF THE EXPERTS

Federico Caleno
Chief Operating Officer
IPlanet

Service stations and electric charging: synergies and opportunities

The service station is a key element of sustainable mobility, an integrated environment in which the e-driver customer can **recharge the vehicle without changing current habits.**
The HPC infrastructure allows charging times compatible with ancillary activities such as cafés, restaurants and relaxation, promoting a continuous and fluid experience. The technical solutions aim to always ensure ultrafast charging and vary according to the characteristics of the location: in urban contexts, typically characterized by limited spaces, solutions with a maximum of 2 charging points can be used, which require a LV connection, which allow ultrafast charging to be offered thanks to the help of storage systems; **in extra-urban areas, solutions with multiple charging points can be installed that allow power of up to 400 kW thanks to MV connections to the electricity grid.**
The creation of electric charging stations within fuel service areas is a complex operation that requires careful technical planning, compliance with current regulations and effective management of existing infrastructure

> ***“A great efficiency [...] would be achieved if the authorization processes could be unified, providing for automatic authorization for the DSO”***

This process is divided into several phases, ranging from preliminary assessment to commissioning, with the aim of ensuring operational efficiency, safety and economic sustainability.
The entire process, from the study phase to commissioning, has an average duration that varies from six to nine months. **The variability of these timescales depends largely on the times to obtain the authorisations that impact both the initial phase** to get to the executive project, but above all in the connection energisation phase when the DSO must obtain authorisations for its works. **A great efficiency of the service area electrification process would be achieved if the authorisation processes could be unified, providing for automatic authorisation for the DSO to carry out its connection works,** once authorisation for the construction of an HPC site within a service area has been obtained.

Ezio Maria Palilla
Sales Manager eMobility
Siemens

> ***"Service areas are a strategic asset for the development of sustainable mobility in Italy."***

Service stations and electric charging: synergies and opportunities

Service areas are a strategic asset for the development of sustainable mobility in Italy. Installing a high-power electric charging infrastructure in the oil sector **requires specific planning** that takes the context into account: assessing station interference, complying with safety distances from sensitive installations, carrying out activities in ATEX zones, limiting space to ensure the manoeuvrability of electric and internal combustion vehicles sharing the same area, assessing the subsoil with careful waste management and, above all, involving strategic stakeholders such as the fire brigade and DSOs in advance. It is therefore necessary to **provide infrastructure that is suitable for the context,** for example charging stations with low electromagnetic emissions, cabins without the need for invasive foundations, cable lines at appropriate depths to ensure the passage of heavy vehicles, and the use of charging station user interface systems that can provide an experience that benefits related services, such as food, entertainment and marketing in the same area. Italy is the country with the **highest density of oil sales outlets in Europe, with 21,000 sites,** so the **potential** of this ecosystem **is fundamental to ensuring coverage in all areas of the country.**

Conclusions

The transition to electric mobility requires **an efficient and widespread charging ecosystem that integrates both private and public solutions.** While private charging **represents the convenience of charging the vehicle in the places where you spend most of your time,** such as home or work, **public charging is the essential element for ensuring long-distance mobility and widespread access to energy in every corner of the country.**
The integration of private and public charging allows to overcome infrastructural barriers, ensuring continuous and widespread access to electricity. The public charging network, with rapid and ultra-rapid columns located in strategic points such as highways, shopping centers and service stations, completes the electric mobility model, encouraging large-scale adoption.
In Italy, the situation regarding the availability of charging points, compared to the current circulation and road mileage, **is in line with the main European countries** and in some cases even occupies aplace among the best (2nd place PdR in DC on BEV circulation).
As regards the distribution of **private charging points,** it is not easy to estimate the distribution today, but we can certainly say that the possibility of charging in private contexts is **the main driver that leads to the purchase of a zero-emission vehicle,** as it significantly reduces operating costs, especially if combined with a photovoltaic system.
Even if the numbers are positive, we must continue to work to make electric mobility accessible to all Italian citizens, **working on some fundamental guidelines:**

- reduction of energy costs for the end user;
- improve the legislative framework for installations in condominium contexts;
- greater collaboration in planning network investments;
- incentives for areas currently experiencing market failure, identifiable through the single national platform (PUN) to make the distribution of PdRs more uniform, especially in the south of the country;
- simplification and harmonization of permitting procedures, which today are affected by the different sensitivities and competences of individual municipalities.
- coordinated DSO-CPO action in order to speed up the connection times of charging stations to the electricity grid, with particular reference to medium voltage.

To overcome these obstacles, it is first necessary to work on the digitalization and simplification of the permitting phase, which today is one of the main obstacles to the growth of charging points, especially those in high power. This phase in Italy lasts on average a year and a half, having a strong impact on the business plans of CPOs. Furthermore, to give greater competitiveness to the sector, it is important to enhance the potential for flexibility that charging can give to the network and through price signals and dynamic tariffs throughout the day. It is a challenge that requires a profound change from a rigid system to a more flexible one but which can bring a benefit to the entire electrical ecosystem.

To accelerate this transition, MOTUS-E is actively engaged in dialogue with main players in the sector: manufacturers, network operators, trade associations and public administrations, through the drafting of technical guides, memoranda of understanding and collaboration agreements. Among the main ones

	Description	Partner	Qr Code
Public Charging Guide	Guide to building a network of public charging stations and best practices. The guide aims to help the Municipalities in coordination activity of urban infrastructure with site identification tips, business models and methods of operator engagement.	ANCI	
Private Charging Guide	Installation Guide for infrastructures for private individuals and condominiums in collaboration with ANACI. The Vademecum provides a comprehensive overview of reality andpotential of the electric vehicle, answering some of the typical questions on private charging.	ANACI	
The infrastructures of charging for Electric vehicles transporting goods	The study analyses the different charging strategies and methods to optimize charging for electric freight transport. The analysis covers both depot charging needs and public charging needs from the point of view of infrastructure and tariffs, in relation to the different vehicle mileages; including a focus on AFIR targets for heavy vehicles.	ZET Project Kyoto Club	

subjects with which Motus-E has started collaborations and synergies include: Utilitalia and E- Distribuzione to promote the dialogue between CPO and DSO; GSE and RSE for collaboration in the analysis of charging stations for public use in Italy; UNEM to support and accompany the transition of service stations towards amulti-energy model; FIAP and Union Trasporti for to facilitate the transition of the entire logistics value chain.

The effective collaboration with the various stakeholders involved, in various capacities, in this transition is constantly growing and evolving.

The sharing skills and matching mutual needs is a fundamental approach to achieving common institutional, regulatory and commercial goals.
Collaboration between the various stakeholders is essential to create a solid and integrated ecosystem, capable of responding to the challenges of the energy transition, but it is also necessary that the institutions are close to this transition process and that they play a key role in ensuring transparency and certainty in investments. For this reason, we believe it is essential that some of our proposals are taken into consideration.

Tax treatment for home charging

Within the taxation of company fleets, we are currently witnessing a **disparity in tax treatment for employees who use endothermic cars** and those who use electric cars, with reference to refueling/powering in home charging.

This gap does not facilitate the transition and renewal of circulating fleets since **domestic recharges are configured as reimbursement to the worker and therefore are included in the calculation of the fringe benefit.** On the contrary, fuel supplies are paid directly by the employer, thus not configuring themselves as additional taxable matter.

For the **Revenue Agency**, the sums paid to workers who receive electric or hybrid (plug-in) vehicles as reimbursement for **domestic charging expenses are to be considered income from employment,** with the obvious exception of expenses reimbursed and incurred in the exclusive interest of the employer.

Furthermore, the sums paid as reimbursement for expenses incurred for the installation of charging infrastructures in the employees' homes are taxable.
The final **effect** of the position expressed by the Agency **is therefore adouble taxation on the employee,** who in addition to paying the flat-rate tax determined by calculating the cost of the fringe benefit indicated annually by the ACI, would be required to pay an additional tax on the purchase of electricity, the cost of which is already included in the flat-rate tax.
To avoid the tax disadvantage of electric vehicles compared to endothermic ones, **Motus-E proposes:**

1. Introduction into the regulatory framework of the non-taxability of top-up refunds electric ones received by the employee, equating them to the treatment of fuel supplies in the case of endothermic vehicles assigned for mixed use.

2. **Reimbursement calculation method based on data that the company is able to control, specifically by subtracting** the annual kWh recharged at publicly accessible charging points from the annual value of consumption recorded in terms ofannual kWh, in order to simultaneously quantify the expenses incurred by the employee through home charging. The remaining kWh will then be **multiplied by the average price of energy indicated every six months by Eurostat data.**

Credit mechanism for release for consumption

Italy is called to implement the RED III Directive, defining National Objectives aligned with what is reported in the PNIEC.

In this context, **Motus-E's proposal** to incentivize the use of renewable electricity in transportation **is to act on the system of Input Credits,** integrating the current mechanism provided for the input for consumption of biofuels, **with the introduction of a new source to generate CICs.** With this solution, a **CIC-E** would be created generated for the input for consumption of fuel electricity produced from renewable sources that would be certified through the possession of Guarantees of Origin.

The beneficiaries of the credit would be the CPOs (Charging Point Operators), responsible for the management of public charging points and main beneficiaries of CIC-E for electricity supplied by RES and **owners of electric vehicles (private individuals and companies).** To ensure an effective implementation of the Electricity Input Credits (CIC-E) mechanism in Italy, it will be essential to adopt a strategic approach that considers several key aspects.

First, **it is essential to set ambitious targets** that ensure compliance with the targets set by the RED III Directive, while avoiding an excessive supply of credits that could depreciate their market value.

In addition, **the implementation of automated systems** for collecting data on the energy supplied by charging points will help make the system more efficient and transparent.

Finally, it is appropriate to promote synergies with other sectors, allowing transport companies to use CIC-E to certify the reduction of CO_2 emissions, in line with decarbonisation objectives of logistics required by current regulations.

Tariff review for electric mobility

The current tariff structure for public charging of electric vehicles presents significant differences compared to other European countries, **especially with regard to the cost of the energy quota and the application of general system charges.** The study conducted by Motus-E and AFRY reveals that **network costs for high-power public charging** are disproportionately **higher (up to 7 times) than those of commercial customers** in Member States such as Italy, where dynamic network tariffs are not applied. In many states, in fact, such charges are not foreseen for public charging, encouraging a greater diffusion of electric mobility. Furthermore, in many states the tariff relief is currently **concentrated on medium voltage (MT)** and high-power charging points, contributing to the growth of the sector. For these reasons, **Motus-E proposes the introduction, starting from 2025 and for an experimental period of three years, of a monomial or binomial tariff that reduces the incidence of charges on the cost of energy for charging operators.** This measure would improve the competitiveness of public encourage the growth of the electric vehicle market. The adoption of a tariff dedicated to charging electric vehicles would have a **positive impact on final prices for the consumer,** making the service more accessible and incentivizing electric mobility. Furthermore, it would allow us to collect useful data for a future overall review of tariffs by 2028, based on market evolution and actual use of infrastructure. **Proposal for improvement of the connection phase** In parallel, Motus-E considers it appropriate develop standardized interaction methods between CPOs and DSOs **that can make the process of formulating and managing connection requests more functional.** Furthermore, **the Association suggests the possible creation of a digital platform by DSOs,** with detailed information on the network's capacity to accommodate new loads. A reference model could be the "PNRR Interactive Map for connections at fuel stations", with possible evolutions based on international best practices. The introduction of these measures would optimize the expansion of the charging infrastructure, promote a greater diffusion of electric vehicles in the market and support the achievement of the economic sustainability of the sector in the medium-long term. Furthermore, this platform could be used **to identify in advance areas where the installation of charging infrastructures could bring benefits to the system and perhaps guarantee lower costs and shorter implementation times.**

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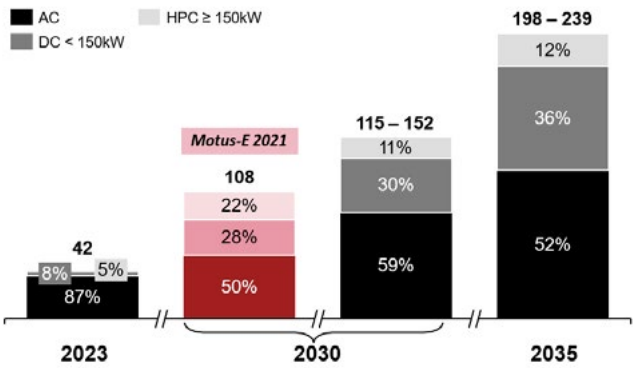
Vision to 2035

Looking to the future, the sector is preparing for new transformations: from immediate payment systems **to "plug and charge" technologies, to the integration with other digital services (such as the efficiency in managing payments between CPO and MPS) and the impact of autonomous driving on the distribution of the charging network**. The electric charging market will not only continue to expand, but will evolve into an increasingly efficient, connected and oriented ecosystem to the needs of ev-drivers.

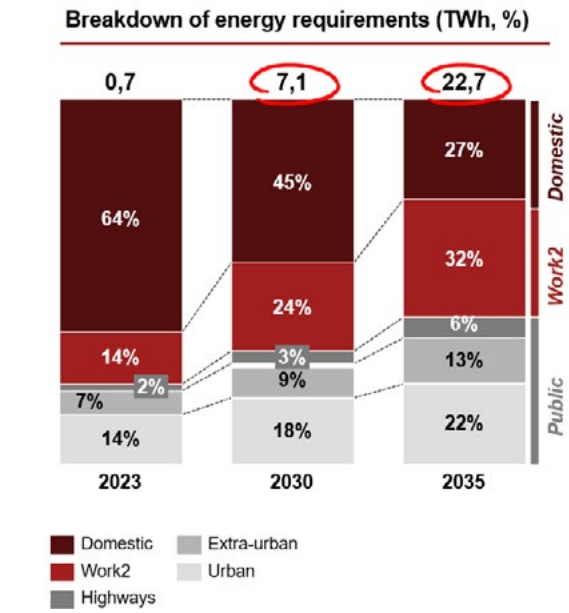
The evolution of public charging infrastructures by 2035 [1]

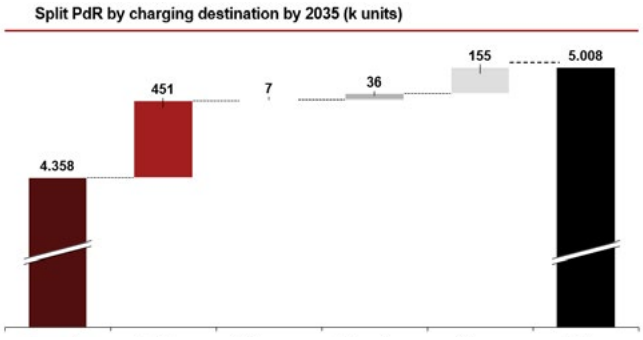


A central aspect of this transition is the growing energy demand that the electrification of the vehicle fleet will bring. However, it is necessary to dispel some false myths: Myth 1: 'The electricity grid will not cope with the increase in demand' – Data shows that **a 10-15% increase in consumption by 2035 is perfectly manageable** with targeted enhancement interventions and the adoption of smart charging models. Myth 2: 'Charging all vehicles simultaneously will cause blackouts' – Modern infrastructure, equipped with load balancing systems.

They are designed to distribute energy intelligently, avoiding critical consumption peaks. If we analyze the growth scenarios of the circulating fleet we can calculate easily that in reality in 2030 it would be equal to about 7TWh, while in 20235 it would be around 23 TWh. Considering that in 2024, the total energy consumption **was equal to about 312 TWh and that such consumption in the early 2000s was equal to 330 TWh (decreased thanks to the improvement of energy efficiency in industry),** it can be easily calculated that the effect of the growth of mobility in terms of energy will be largely absorbed by the national electricity grid.

Evolution of energy demand to 2035 [2]





Data source: [1] [2] Strategy &Motus-E "The future of electric mobility in Italy - 2035"

Incentives and Funds

Main European regulations and incentives

The European Union has introduced in recent years a broad package of regulations to accelerate and accompany the decarbonisation of transport, in line with the objectives of the Green Deal and the Fit for 55 plan. These measures, in force or being defined between 2023 and 2025, cover several key aspects: limits on vehicle emissions, development of the **charging infrastructure network,** integration of electric mobility into **energy and transport networks** (TEN-T), **sustainable regulation of batteries** and strengthening of the **European industrial supply chain** (critical raw materials, production of vehicles and batteries). Below, we outline the main EU regulations that have an impact on the topic of electric mobility and the transition to zero emission transport.

1. Vehicles and emission standards

Directive 1996/53 | Weights and dimensions of trucks: This directive sets the maximum permitted weights and dimensions (length, width, height) for heavy-duty vehicles, such as lorries and buses, travelling on EU roads. As heavy-duty vehicles are responsible for 28% of greenhouse gas emissions from road transport, a revision of this directive has been proposed It had already been amended in 2015 by **Directive 2015/719,** which aimed to make heavy-duty vehicles and buses greener and safer by authorising weights and dimensions exceeding the limits set in Directive 96/53. With the most recent revision proposal, the Commission has proposed to reduce emissions by 45% by 2030 and by 90% by 2040 and to stimulate the spread of zero-emission trucks.

Directive 2008/50 | Air quality: establishes a common regulatory framework for the

assessment and management of air quality in the European Union,setting limit values for various air pollutants (such as PM10, PM2.5, NO2, ozone, benzene, carbon monoxide, etc.) and requiring Member States to adopt short-term action plans in cases where they are exceeded. This Directive was updated in October 2024, encouraging Member States to include measures to promote electric or hybrid vehicles in their plans.

COM(2021) 550 final |Fit for 55 package: introduces, among other things, the ETS for the road transport sector from 2027, which provides for the purchase of CO_2 emission permits by fossil fuel suppliers, thus indirectly favouring electric vehicles.

COM(2021) 556 | CO_2 emissions from passenger cars and light commercial vehicles: This is alegislative resolution adopted by the European Parliament, amending **Regulation (EU) 2019/631** as regards the strengthening of CO_2 emission performance standards for new passenger cars and new light commercial vehicles, in line with the Union's increased climate ambition.

Directive (EU) 2022/362 |Eurovignettes: together with Regulation 2019/1242/EC partially rewrites the way in which tolls should be calculated in Europe. The EU has set a target of reducing CO_2 emissions from road traffic by 30% by 2030.

To achieve this goal, a new assessment method will be applied to vehicles weighing more than 3.5 tonnes to classify them into one of the 5 CO_2 tax rates.

Regulation 2024/1257 |Euro 7: sets standards for tailpipe emissions from road vehicles, but also for other types of emissions, such as tyre abrasion and particle emissions from brakes. It also introduces requirements for battery durability. In particular, batteries will have to retain at least 80% of their initial capacity for up to five years or 100,000 km for cars and 75% for up to eight years for light commercial vehicles.

Regulation (EU) 2024/1610 |Truck and Bus Emissions: This regulation aims to strengthen CO_2 emission limits for new heavy-duty vehicles (lorries, buses and trailers). CO_2 emissions from large trucks and buses will have to be reduced by 45% for the period 2030-2034, by 65% for 2035-2039 and by 90% from 2040. By 2030, new city buses will have to reduce their emissions by 90% and become zero-emission vehicles by 2035. Emission reduction targets are also set for trailers (7.5%) and semi-trailers (10%), starting in 2030.

COM(2025) 95 final |Automotive Action Plan: aims to support the European automotive industry in the transition towards sustainable and competitive mobility. In particular, the Commission stated the need to adopt an amendment to **Regulation (EU) 2019/631,** aimed at introducing a one-off flexibility, limited to the period 2025-2027, in the method of calculating compliance with CO_2 emission standards, while ensuring the maintenance of the overall emission reduction targets.

2. Battery sustainability

Directive 2000/53 |End of life vehicles: sets clear targets for end-of-life vehicles and their components, and bans the use of hazardous substances in the production of new vehicles (in particular lead, mercury, cadmium and hexavalent chromium), subject to defined exceptions when there are no suitable alternatives which are listed in Annex II of the directive. Since this directive entered into force, several amendments have been made and several related rules introduced. Areview of the End-of-Life Vehicles Directive was also launched in 2021, which led to aproposal for new regulation in 2023.

Directive 2008/68 |AdR: establishes common rules for the safe transport of dangerous goods within or between EU countries by road, rail or inland waterway. This Directive also covers aspects such as loading and unloading, transfer to and from another means of transport, as well as stops during the transport process, and extends the application of international rules to the national transport of dangerous goods.

Regulation (EU) 2023/1542 | Battery Regulation: introduces stringent requirements for the sustainability of electric vehicle batteries, including mandatory declaration of carbon footprint, minimum percentages of recycled materials and a digital passport to facilitate recycling and reuse.

Regulation (EU) 2024/1252 | Critical Raw Materials Act (CRMA, 2023): aims to ensure the sustainable and secure supply of critical raw materials for batteries and electric motors, with indicative targets for 2030 on domestic production (10%), refining (40%) and recycling (25%).

3. Charging infrastructure

Directive (EU) 2014/32 | MID (Measuring Instruments Directive): is the legislation that governs the approval and verification of measuring instruments used in commercial transactions, including electricity meters, fuel dispensers and charging systems for electric vehicles. The aim of the MID is to ensure accuracy, transparency and uniformity in measurements within the European single market. Recent developments in relation to the MID include **Commission Implementing Decision (EU) 2021/1402** on harmonised standards for gas meters and other measuring instruments drafted in support of Directive (EU) 2014/32 and, more recently, **the Amendment of 26 February 2025** to Implementing Decision (EU) 2021/1402.

Regulation (EU) 2023/1804 | AFIR: establishes binding requirements for Member States on the availability of rapid charging points along the European core road network (TEN-T core) every 60 km by 2025. It also imposes interoperability standards and immediate payment without subscription. In addition, the European Commission is empowered to adopt delegated acts to: 1) include additional types of data that each operator of publicly accessible charging and refuelling points for alternative fuels must make available; 2) establish common technical requirements for an application programming interface, in order to allow for automated exchange and uniform data between the operators of charging points and refueling points for alternative fuels accessible to users.

Directive (EU) 2023/2413 | RED III art. 25: The Renewable Energy Directive, in Article 25, requires Member States to carry out a coordinated mapping for the deployment of renewable energy and for the related infrastructure, in coordination with local and regional authorities. Furthermore, still in the context of the transition towards more sustainable mobility, RED III introduces significant provisions on renewable energy in transport, offering Member States two main options to be achieved by 2030: 1) a14.5% reduction in the intensity of greenhouse gas emissions in the transport sector resulting from the use of renewable energy 2) a share of at least 29% of renewable energy in final energy consumption in the transport sector. Finally, the directive deals with promoting the use of energy from certified renewable sources through the system of guarantees of origin.

Directive (EU) 2024/1275 | EPBD (Energy Performance of Buildings Directive): provides for obligations for new and renovated buildings. In particular, for non-residential buildings with more than 20 parking spaces, at least one charging point for every 10 spaces and electrical provision for 50% of the spaces by 2027.

Regulation (EU) 2024/1679 | TEN-T: The 2024 revision formally integrates electric charging infrastructure into the planning of the European Core Corridors, making a uniform and continuous network for electric mobility mandatory.

4. Further regulations

Regulation (EU) 2020/852 | EU Taxonomy: is a classification system that establishes a list of environmentally sustainable economic activities, providing a common language and a clear definition of what is “sustainable”.
This system helps businesses, investors and policy makers identify and develop environmentally sustainable economic activities, thus contributing to the transition towards alow-carbon, resilient and resource-efficient economy.

Directive (EU) 2022/2555 |NIS II (Network and Information Security Directive II): significantly expands the scope of cybersecurity in the European Union. In the context of electric mobility, the following facilities are now considered critical: charging infrastructures connected to smart grid systems, energy management platforms (e.g. Smart charging and Vehicle-to-Grid) and digital applications for monitoring/billing of charging services.

Regulation (EU) 2023/955 |Social Climate Fund: This is a fund established to support an equal transition towards climate neutrality by mitigating the social and economic impacts of the extension of the Emissions Trading System (ETS II) to the buildings and road transport sectors.

To access funding, Member States must draw up National Social Climate Plans listing and explaining all measures and investments planned to support vulnerable households, transport users and micro-enterprises. The plans should be based on a national consultation of local and regional authorities, representatives of economic and social partners, civil society and youth organisations, as well as other stakeholders.

Directive (EU) 2023/2413 |RED III art. 20: Renewable Energy Directive III, in Article 20, focuses on interoperability and transparent exchange of information. In particular, the article requires Member States to facilitate data exchange between charging infrastructure operators and energy service providers, ensuring that users have access to real-time information on the availability, prices and compatibility of charging points. This information must be made available in a digital, harmonised and interoperable format, readable by devices such as electric vehicle charging stations, smart metering systems and energy management platforms, in order to enable smart charging and demand balancing functions.

Directive (EU) 2023/959 |ETS II: The EU Emissions Trading System –EU ETS –is a cap-and-trade carbon market for emissions allowances for energy-intensive industries and the power generation sector. It is the EU's main instrument for reducing emissions, covering around 40% of the EU's total CO_2 emissions.

As part of the revisions to the ETS Directive, a broader emissions trading system has been defined under the name of ETS II.
This is a system separate from the EU ETS and is responsible for managing CO_2 emissions from buildings, road transport and additional sectors largely represented by small and medium-sized enterprises not covered by the current EU ETS.
It will be active from 2027, however monitoring and reporting of emissions to the European Commission are required from 2025.

Regulation (EU) 2024/2847 | Cyber Resilience Act: aims to improve the cybersecurity standards of products that contain adigital component, requiring manufacturers and retailers to ensure cybersecurity throughout the lifecycle of their products.

Regulation (EU) 2024/1735 |Net Zero Industry Act (NZIA): aims to improve European production capacity for zero-emission technologies and their key components by addressing barriers to scaling up production in Europe. The regulation will increase the competitiveness of the zero- emission technologies sector, attract investment and improve market access for clean technologies in the EU, as well as contribute to the development of electric mobility. The Net Zero Industry Act supports the clean energy transition and improves the EU's energy resilience. The aim is to meet at least 40% of the EU's domestic demand for these technologies by 2030.

Communication (EU) 2024/3113 |Temporary Crisis and Transition Framework (TCTF): allows Member States, until 2025, to grant extraordinary incentives for green transition industrial projects, including the production of electric vehicles, batteries and charging infrastructure. Specifically, the aim of the TCTF is to promote support measures in sectors that are key to the transition to anet-zero emissions economy, in line with the Green Deal industrial plan.

COM(2025) 80 -81 -87 |Omnibus Package: aims to simplify the rules on sustainability-related obligations for companies and investments. The Package consists of two different sets of measures. The first, on sustainability, focuses mainly on the proposal for adirective amending the **Corporate Sustainability Reporting Directive** (CSRD) and the **Corporate Sustainability Due Diligence Directive** (CSDDD). The second, on investment simplification, includes a legislative proposal to simplify and optimise the use of several investment programmes, including InvestEU, EFSI and traditional financial instruments.

COM(2025) 85 final |Clean Industrial Deal: a plan that aims to provide incentives for companies to decarbonise Europe by mobilising €100 billion. In particular, the plan focuses on strategic sectors such as batteries, hydrogen and green steel, as well as providing for red tape reduction measures, trade protection such as CBAM and investment in skills.

At the same time, the Commission adopted the Action Plan for Affordable Energy, to reduce industrial energy bills.

REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
Directive 1996/53 | Truck weights and dimensions	1996	Emissions reduction	Reduce emissions by 45% by 2030 and by 90% by 2040 and stimulate the deployment of low-emission trucks zero..
Directive 2008/50 | Air quality	2008	Emissions reduction	It establishes acommon regulatory framework for the assessment and management of air quality in the EU.
COM(2021) 550 final | Fit for 55 Package	2021	Emissions reduction	Encourage the adoption of electric vehicles through the ETS from 2027.
COM(2021) 556 | CO2 emissions from passenger cars and light commercial vehicles	2021	Emissions reduction	Stimulates demand and development of the EV market in view of the zero emissions goal by 2035.
Directive (EU) 2022/362 | Eurovignette	2022	Emissions reduction	Penalizes high-emitting vehicles through CO_2 tolls, encouraging the adoption of electric vehicles in heavy transport.
Regulation 2024/1257 |Euro 7	2024	Emissions reduction	It establishes standards for exhaust emissions from road vehicles and other types of emissions.
Regulation (EU) 2024/1610 | Truck Emissions and Bus	2024	Emissions reduction	It aims to tighten CO_2 emission limits for new heavy-duty vehicles.
COM(2025) 95 final | Automotive Action Plan	2025	Emissions reduction	Supports the industrial transition to electric vehicles.
Directive (EU) 2014/32 |MID	2014	Charging infrastructure	Regulates the approval and verification of measuring instruments used for commercial transactions.

REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
Regulation (EU) 2023/1804 | AFIR	2023	Charging infrastructure	Makes a widespread network of fast charging stations every 60 km mandatory by 2025.
Directive (EU) 2023/2413 | RED III Art. 25	2023	Charging infrastructure	It stresses that public charging stations must be accessible, interoperable and transparent, promoting the use of energy from certified renewable sources.
Directive (EU) 2024/1275 | EPBD	2024	Buildings and infrastructure	Promotes the spread of electric charging in buildings.
Regulation (EU) 2024/1679 | TEN-T	2024	Charging infrastructure	Integrate electric charging into European transport network planning.
Directive 2000/53 | End of life vehicles	2000	Battery sustainability	It sets clear targets for end-of-life vehicles and their components, and bans the use of hazardous substances in the production of new vehicles.
Directive 2008/68 | AdR	2008	Battery sustainability	It establishes common rules for the safe transport of dangerous goods within or between Union countries.
Regulation (EU) 2023/1542 | Battery Regulation	2023	Battery sustainability	Improve the sustainability and traceability of electric vehicle batteries.
Regulation (EU) 2024/1252 | Critical Raw Materials Act	2024	Sustainability batteries and Sustainable sourcing	It ensures a stable and sustainable supply of critical raw materials for batteries and electric motors, supporting European production.
Regulation (EU) 2020/852 | EU Taxonomy	2020	Classification system	Classification system that establishes a list of environmentally sustainable economic activities.

REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
Directive (EU) 2022/2555 | NIS II	2022	Cybersecurity	It expands the scope of EU cybersecurity to include charging infrastructure.
Regulation (EU) 2023/955 | Social Climate Fund	2023	Funds	Fund established to support ajust transition towards climate neutrality.
Directive (EU) 2023/2413 | RED III Art. 20	2023	Interoperability and transparent exchange of information	Article 20 requires Member States to facilitate the exchange of data between charging infrastructure operators and energy service providers, ensuring that users can access the information in real time.
Directive (EU) 2023/959 | ETS II	2023	Emissions trading system	It is the EU's main instrument for reducing emissions.
egulation (EU) 2024/2847 | Cyber Resilience Act	2024	Incentives	Increase the safety of electric vehicles.
Regulation (EU) 2024/1735 |Net Zero Industry Act (NZIA)	2024	Incentives	It supports the European production of e-mobility technologies.
Communication (EU) 2024/3113 | Temporary Crisis and Transition Framework (TCTF)	2024	Incentives	Enable incentives for electric vehicles and batteries.
COM(2025) 80 -81 - 87 |Package Omnibus	2025	Incentives	Simplify the rules for green investing and sustainability reporting.
COM(2025) 85 final | Clean Industrial Deal	2025	Incentives	It offers massive incentives to key sectors such as batteries, supporting the entire e-mobility value chain.

Main national regulations and incentives

In recent years, Italy has undertaken a complex and progressive regulatory path to promote the spread of electric mobility, in line with the European objectives of decarbonization of transport and reduction of climate-altering emissions. This process has involved various legislative and regulatory areas, ranging from the implementation of national plans that cover different areas of electric mobility such as the **PNIEC,** which defines the country's objectives for 2030 in terms of decarbonization, energy efficiency, renewable sources, energy security, single energy market and research and innovation, or the **PNIRE** which provides for the creation of charging infrastructure networks for electric vehicles. To arrive at the definition of the different areas of the **PNRR** and the establishment of **Funds to support** supply and demand.

1. Vehicles

1.1 Cars and commercial vehicles

Budget Law 30 December 2021 n. 234 paragraph 392 |Fund for the sustainable mobility strategy: a special fund called "Fund for the sustainable mobility strategy" is established, with an allocation of 50 million euros for each of the years from 2023 to 2026, 150 million euros for each of the years 2027 and 2028, 200 million euros for the year 2029, 300 million euros for the year 2030 and 250 million euros for each of the years from 2031 to 2034. The purpose of the Fund is to increase the fight against climate change and the reduction of emissions.
These resources are intended, among other things, for the renewal of the local public transport bus fleet, the purchase of hydrogen trains on non-electrified railway lines, the creation of urban and tourist cycle paths,to the development of intermodal freight transport by rail, to the adoption of alternative

fuels to the development of intermodal freight transport by rail, to the adoption of alternative fuels for powering ships and aircraft and to the renewal of vehicles used for road transport. However, it is emphasized that the funds originally allocated from 2023 to 2026 and partially for the years 2027 and 2029 have been reallocated to other purposes with subsequent provisions.

Legislative Decree 1March 2022 n. 17 | Automotive Fund: establishes in art. 22 -"Reconversion, research and development of the automotive sector" -the Automotive Fund with the aim of promoting the ecological transition, supporting research and incentivizing investments in the automotive supply chain aimed at the establishment, reconversion and requalification towards innovative and sustainable production, in line with the European objectives of emission reduction and digital development. This fund is also intended to grant incentives for the purchase of low or zero-emission vehicles and for the promotion of the recovery and recycling of materials.
DPCM 6 aprile 2022 | Incentivi per l'acquisto di veicoli non inquinanti (Ecobonus): introduce incentivi per l'acquisto di veicoli a basse emissioni per il triennio 2022-2024, con l'obiettivo di favorire la mobilità sostenibile. I contributi sono destinati all'acquisto di veicoli di categoria M1, L, N1 e N2.
The planned allocation is equal to 700 million euros for the year 2022 and 1,000 million euros for each of the years from 2023 to 2030. However, it should be emphasized that the funds originally allocated were subsequently reduced by 4.6 billion euros starting from the year 2025 by the Budget Law of 30 December 2024

Prime Ministerial Decree 6 April 2022 | Incentives for the purchase of non-polluting vehicles (Ecobonus): introduces incentives for the purchase of low-emission vehicles for the three-year period 2022-2024, with the aim of promoting sustainable mobility. The contributions are intended for the purchase of vehicles in the M1, L, N1 and N2 categories. Prime Ministerial Decree of 4 August 2022 |Restructuring of incentives for the purchase of non-polluting vehicles (Ecobonus): this decree has modified the Prime Ministerial Decree of 6 April 2022, as part of the implementation of the Automotive Fund, with the aim of strengthening incentives for sustainable mobility. Art. 1, paragraph 1, letter b), numbers 1) and 2) provides for two main innovations. The first introduces a 50% increase in contributions for the purchase of low-emission vehicles (M1 categories) for individuals with an ISEE of less than 30,000 euros. The second extends, within the limit of 50%, access to incentives also to legal entities that use vehicles in car rental activities for commercial purposes, excluding car sharing. Furthermore, this decree introduces a contribution for the purchase and installation of charging infrastructure by domestic users.
Prime Ministerial Decree 20 May 2024 |Restructuring of incentives for the purchase of non-polluting vehicles (Ecobonus): this decree has restructured the incentives for the purchase of low-emission vehicles, providing for a 25% increase in all unit contributions (with or without scrapping). Furthermore, it has introduced incentives for the purchase of used M1 category vehicles, as well as the scrapping of Euro 5 vehicles with acontribution of 8,000 euros for 0-20 g/km and 5,000 euros for 21-60 g/km.
Budget Law 30 December 2024 n. 207 paragraph 48 | Concession of motor vehicles for mixed use to employees - Automotive Fund cut maneuver: this paragraph modifies the rules for the taxation of income from employment, establishing that for newly registered motor vehicles, motorcycles and mopeds, granted for mixed use to employees with contracts stipulated as of 1/1/2025, these contribute to the determination of income to the extent of 50% of the amount corresponding to a conventional mileage of 15,000 km. This percentage is reduced to 10% for BEV vehicles and 20% for PHEV vehicles. Vehicles granted for mixed use from 1 July 2020 to 31 December 2024 are exempt, as are vehicles ordered by employers by 31 December 2024 and granted for mixed use from 1 January 2025 to 30 June 2025.
Furthermore, the 2025 Budget Law has provided for acut of approximately 80% (4.6 billion euros) of the Automotive Fund.

1.2 TPL

Prime Ministerial Decree 17 April 2019 |National Strategic Plan for Sustainable Mobility (PNSMS): approved the National Strategic Plan for Sustainable Mobility, aimed at renewing the bus fleet of local and regional public transport services. The Plan promotes the improvement of air quality through the adoption of innovative technologies, in line with international agreements on the reduction of emissions and with European legislation. Furthermore,

provides for an increase in the resources of the Fund intended to finance infrastructure for charging electric vehicles, directing these resources to the implementation of the Plan itself.

Legislative Decree 19 May 2020 n. 34 | Relaunch Decree: it also played a significant role in promoting the transition towards sustainable mobility, introducing economic incentives for the purchase of low-emission vehicles and providing incentives for the construction of electric charging infrastructures. In particular, it has allocated funds for the implementation of sustainable mobility interventions (such as zero or low-emission public transport), in order to enable the structural and permanent reduction of the environmental impact deriving from vehicular traffic in urban and metropolitan areas. **Ministerial Decree 23 December 2021 n. 530 |National Recovery and Resilience Plan (PNRR):** This decree defines the methods of use of a portion of the resources referred to in **Measure 4 Mission 2 Component 2** of the PNRR. The measure supports the ecological transition of local public transport, with investments aimed at renewing fleets with zero or low-emission vehicles. In particular, M4M2C2 - 4.4.1 finances a program for the purchase of electric or hydrogen buses and related charging infrastructure, as well as ecological regional trains. By 2026, approximately 3,360 low- or zero-emission buses are expected to be put into service, equal to over 1/10 of the fleet in circulation, with priority given to metropolitan cities (to which approximately one third of the resources are allocated).

2 Batteries

Legislative Decree 20 November 2008 n. 188 | Batteries and accumulators: this is the main Italian regulatory reference regarding the management of batteries, accumulators and related waste. The Legislative Decree first establishes the rules for placing on the market batteries and accumulators, both portable and industrial and for vehicles. Precise limits and restrictions are set, in particular regarding the presence of dangerous substances such as mercury and cadmium, in order to reduce the environmental impact of these products from their production. One aspect that is central of the law concerns the management of waste batteries and accumulators. Furthermore, the Legislative Decree imposes mandatory separate waste collection, expressly prohibiting the disposal of this waste together with unsorted urban waste.

Legislative Decree 25 June 2024 n. 84 | Urgent provisions on critical raw materials of strategic interest: this is a measure adopted by the Italian Government to transpose and implement at national level the European legislation on critical raw materials, in line with the Critical Raw Materials Act of the European Union. Specifically, the decree aims to guarantee the security of supplies of strategic raw materials for the ecological and digital transition, promote the development of the national raw materials supply chain, including extraction, refining, recycling and reuse activities, and strengthen Italy's role in key sectors such as electric mobility, batteries, renewable energy and microelectronics.

3. Measures for charging infrastructure

Legislative Decree 22 June 2012 n. 83 | National Infrastructure Plan for Electric Vehicle Charging (PNIRE): this is the national strategic reference framework that, established in 2012, is periodically updated to align with the new objectives of electric diffusion. In particular, the PNIRE promotes the development of sustainable mobility, through measures aimed at encouraging the creation of infrastructure networks for charging electric vehicles.

Fire Brigade Circular 5 November 2018 n. 2| Guidelines for the installation of electric vehicle charging infrastructure: provides guidelines for the installation of electric vehicle charging infrastructure, with particular attention to the prevention of fire and explosion risks, especially when such infrastructure is installed in activities subject to the control of the Fire Brigade (such as large garages, shopping centers, etc.). The main operational indications establish that if the installation of charging infrastructure complies with the rules techniques and guidelines indicated, the modification is considered “not relevant” from a fire safety point of view. In this case, the person responsible for the activity must simply keep the technical documentation and

present it at the periodic renewal of fire safety compliance. Otherwise, if the installation does not comply with these requirements or involves an increase in risk, the modification is considered "relevant" and must be subjected to preventive assessment by the Fire Brigade, following the normal fire prevention procedures.

Legislative Decree 10 June 2020 n. 48 |Building regulations –provision of charging points: in implementation of EU directives (EPBD and AFID), Italy has made the provision of charging points mandatory in certain categories of buildings and infrastructures. In force since 2022, this legislative decree requires, for new residential buildings with≥10 parking spaces, the installation of ducts for all parking spaces for the purpose of future installation of columns, and for new non-residential buildings with ≥10 spaces, the provision of at least 1 charging point for every 5 spaces (in addition to providing the ducts).

Legislative Decree 16 July 2020 n. 76 |Simplifications Decree: this decree, in particular in art. 57, introduces a series of specific measures to promote electric mobility and the spread of charging infrastructures in Italy, simplifying the authorization procedures for the installation of charging points on both public and private land. Through this decree, the non-discriminatory accessibility of charging infrastructures is guaranteed and their widespread diffusion is promoted, with the aim of having at least one charging point for every 1,000 inhabitants in the municipalities. The decree also provides tax breaks and incentives for companies that invest in these infrastructures, as well as aregulation of energy tariffs to keep costs affordable.

Legislative Decree 14 August 2020 n. 104 |Urgent measures to support and relaunch the economy: establishes a fund, with an endowment of 90 million euros for the year 2020, aimed at providing contributions for the installation of infrastructure for charging electric vehicles, carried out by natural persons in the exercise of business, arts and professions, as well as by taxable persons subject to corporate income tax (IRES).

Resolution 541/2020 and subsequent resolutions | Private Charging Experimentation Resolution: with this resolution, and subsequent ones, ARERA has provided for a free experiment aimed at facilitating the charging of electric vehicles during the night hours, being able to obtain both the night-time energy (and on holidays) necessary for charging, and the increase in power from 3kW to 6kW, free of charge. The trial is active from 1 July 2021 to 31 December 2025. The aim of the trial is to promote the smart charging of electric vehicles by exploiting the potential offered by electronic meters and charging devices capable of regulating the charging speed based on the indications of local aggregators or distributors, or automatically.

Legislative Decree 8 November 2021 n. 199 |National Recovery and Resilience Plan (PNRR): dedicates substantial investments to the development of the public charging network for electric vehicles. Within the PNRR, Mission 2 Component 2 includes the crucial Investment 4.3 (Installation of electric charging infrastructure) which allocates approximately €713 million for rapid and super-rapid charging infrastructure. This measure represents the main instrument through which Italy intends to implement the reforms and investments envisaged by the European program Next Generation EU, with the aim of relaunching economic growth and making the country more sustainable, digital and resilient. Overall, the PNRR is divided into six strategic missions, among which acentral role is assigned to Mission 2(Green revolution and ecological transition).

Prime Ministerial Decree 4 August 2022 | Charging infrastructure: this decree introduces acontribution for the purchase and installation of charging infrastructure by domestic users.

ARERA Resolution 345/2023/R/eel and follow-ups | TIDE (Integrated Text of Dispatching Electric): TIDE is aimed at implementing amerit-based economic dispatching model in which all the network resources, including the consumption units, can assume adual role: the "main" role of producing or consuming energy and the "ancillary" role of providing services, which consist in the availability to modify or temporally shift production and consumption, with respect to agiven reference, upon request of the TSO or the DSO.

ARERA Resolution 22/2025/R/eel | TIT (BTVE): the measure examines the contractual typologies, introducing one dedicated to exclusive users at low voltage electric vehicle charging points. The purpose of the resolution is to better reflect real network costs and incentivize charging behaviors that reduce power peaks and oversizing connections.

4. Further rules and regulations

Ministerial Decree 4August 2017 n. 397 | Sustainable Urban Mobility Plans (PUMS): formally introduced the PUMS, which aim to satisfy the mobility needs of people and goods in urban and peri-urban areas, with the aim of improving the quality of life and reducing the environmental, social and economic impacts of mobility. Ministerial Decree 397/2017 was subsequently amended and integrated by **Ministerial Decree 28 August 2019 n. 396.**

With particular regard to environmental sustainability, the drafting of the PUMS falls within the priorities defined at European level in the Green Deal (COM 2019/640) which aims to achieve carbon neutrality by 2050 and provides for a 90% reduction in greenhouse gas emissions produced by transport.

Legislative Decree 8November 2021, n. 199 | National Integrated Plan for Energy and Climate (PNIEC): Implements Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. The PNIEC represents the main strategic energy-climate planning tool at national level and is drafted jointly by the MISE, the MIT and the MASE. A first version was published on January 21, 2020 for the decade 2021-2030, and was subsequently **updated by the Ministry of the Environment and Energy Security in July 2024.** The Plan is structured on 5lines of intervention within which, in the transport sector, Decarbonisation and Energy Efficiency interventions are foreseen. The PNIEC has as its main objective the decarbonisation of the transport sector, with a target of 6.6 million (of which 4.3 BEV and 2.3 PHEV) electric vehicles in circulation by 2030 and an adequate charging network to support them.
Law 25 November 2024 n. 177 |Amendment to the Highway Code (CdS): since 2016, the CdS has prohibited the parking of non-electric vehicles (or electric vehicles not charging) in areas reserved for charging stations (Art.158, paragraph 1, letter h-bis). From 2021, this prohibition is more stringent: an electric vehicle that has finished charging for more than 1 hour is considered equivalent to a vehicle not charging and can be fined.

Furthermore, the Highway Code in art. 117 ("Driving limitations") also provides for new drivers limits on BEVs and PHEVs (a weight/ power ratio of 75 kW/t and amaximum power extended to 105 kW).
For electric vehicles, the Highway Code establishes weight and size limits in line with European regulations. In general, Title III of the Highway Code regulates specific categories of vehicles, also referring to electric vehicles.

REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
Budget Law 30 December 2021 n. 234 paragraph 392 | Fund for the sustainable mobility strategy	2021	Funds	It establishes the "Fund for the sustainable mobility strategy".
Legislative Decree 1 March 2022 n. 17 | Automotive Fund	2022	Funds	Establishes the Automotive Fund.
Prime Ministerial Decree 6 April 2022 | Incentives for the purchase of non-polluting vehicles (Ecobonus)	2022	Incentives	Introduces incentives for the purchase of low-emission vehicles for the three-year period 2022-2024
Prime Ministerial Decree 4August 2022 | Restructuring of incentives for the purchase of non-polluting vehicles (Ecobonus)	2022	Incentives	Amends the Prime Ministerial Decree of 6 April 2022, expanding the group of beneficiaries.
Prime Ministerial Decree 20 May 2024 | Restructuring of incentives for the purchase of non-polluting vehicles (Ecobonus)	2024	Incentives	Restructures incentives for the purchase of low- and zero-emission vehicles.
Budget Law 30 December 2024 n. 207 paragraph 48 | Concession of mixed use of motor vehicles to employees -Maneuver to cut the Automotive Fund	2024	Funds and Incentives	It modifies the rules for taxation of income from employment. It also provides for a cut of approximately 4.6 billion to the Automotive Fund.
DPCM 17 April 2019 |PNSMS 2019	2019	Funds	He approved the PNSMS.
DL 19 May 2020 n. 34 |Relaunch Decree	2020	Funds and Incentives	It has allocated funds for eco-bonuses dedicated to electric and plug-in hybrid vehicles, and has facilitated the installation of charging stations.
Ministerial Decree 23 December 2021 n. 530 | PNRR	2021	Funds	Finance aprogram to purchase electric or hydrogen public transport and related charging infrastructure.

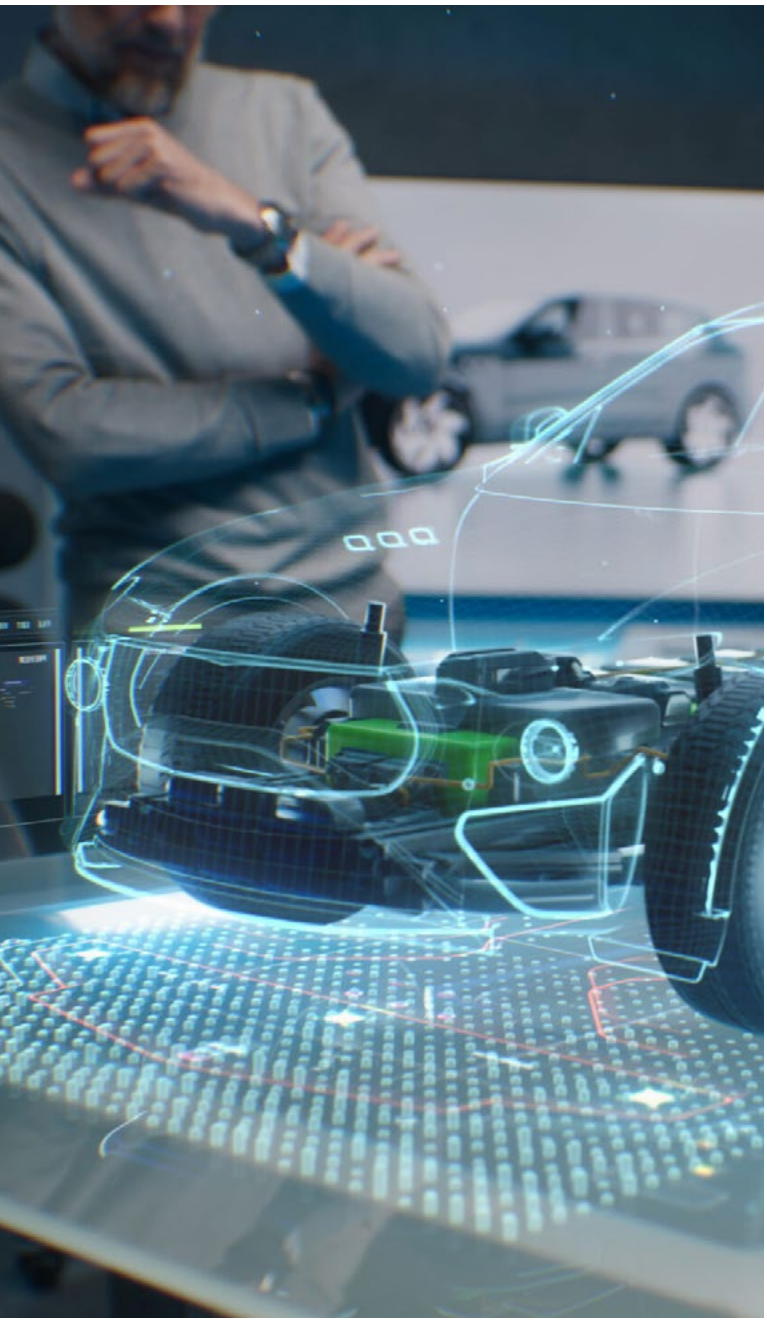
REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
Budget Law 30 December 2021 n. 234 paragraph 392 | Fund for the sustainable mobility strategy	2021	Funds	It establishes the "Fund for the sustainable mobility strategy".
Legislative Decree 22 June 2012 n. 83 | PNIRE	2012	Funds and Incentives	This is the national strategic reference framework.
Fire Brigade Circular 5November 2018 n.2 |Guidelines for the installation of infrastructure for charging electric vehicles	2018	Guidelines	Provides guidelines for the installation of electric vehicle charging infrastructure, with particular attention to the prevention of fire and explosion risks.
Legislative Decree 10 June 2020 n. 48 | Building regulations –provision of charging points	2020	Implementation legislation	It implements Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.
Legislative Decree 16 July 2020 n. 76 | Simplifications DL	2020	Measures for simplifications	Article 57 introduces a series of specific measures to promote electric mobility and the spread of charging infrastructure.
Legislative Decree 14 August 2020 n. 104 | Urgent measures to support and relaunch the economy	2020	Funds	It establishes a fund aimed at providing contributions for the installation of infrastructure for charging electric vehicles.
Resolution 541/2020 and follow-ups | Experimental Resolution Private Charging	2020	Resolution	Free experimentation aimed at facilitating the charging of electric vehicles during night hours.
Legislative Decree 8 November 2021 n. 199 | PNRR	2021	Funds and Incentives	It promotes the decarbonisation of public transport by replacing fossil fuel buses with zero-emission vehicles.
Prime Ministerial Decree 4 August 2022 | Charging infrastructure	2022	Incentives	It introduces a contribution for the purchase and installation of charging infrastructure by domestic users.

REGULATIONS	YEAR	MAIN AREA	IMPACT ON ELECTRIC MOBILITY
ARERA Resolution 345/2023/R/ eel and sequels |TIDE	2023	Resolution	Integrated Text of Electricity Dispatching.
Legislative Decree 20 November 2008 n. 188 | Batteries and batteries	2025	Resolution	It introduces a type of contract dedicated to users exclusively at low voltage electric vehicle charging points.
Legislative Decree 20 November 2008 n. 188 | Batteries and batteries	2008	Reference legislation	The main Italian regulatory reference regarding the management of batteries, accumulators and related waste.
Legislative Decree 25 June 2024 n. 84 | Urgent provisions on critical raw materials of strategic interest	2024	Implementation legislation	It implements and implements at national level the European legislation on critical raw materials.
Ministerial Decree 4August 2017 n. 397 | PUMS	2017	Funds and Incentives	It formally introduced the PUMS.
Legislative Decree 8November 2021, n. 199 |PNIEC	2021	Implementation legislation	In implementation of EU directives (EPBD and AFID), Italy has made the provision of charging points in certain categories of buildings and infrastructures mandatory.
Law 25 November 2024 n. 177 |CdS Amendment	2024	Code of the Street	It regulates various aspects of electric mobility.

Observatory on Transformations in the Italian Automotive Ecosystem

Introduction

TEA osservatorio



2024 has been an extremely complicated year for the European automotive industry where, in contrast to the very positive financial results of the previous year, corporate crises, production collapses and union disputes rarely experienced in the past were encountered.

The reality is that the automotive industry, which for decades has enjoyed arelatively stable market context, is facing sudden changes due to the entry of new competitors (think of those who until two years ago were only involved in consumer electronics and in 2024 produced and sold 130,000 units of acar starting from scratch), the contraction of important markets (China, once among the largest markets for Western manufacturers, is increasingly turning to local producers) and the need to abandon a technology that has been in use for over a century, that of the internal combustion engine, in favor of powertrains based on technologies firmly in the hands of Chinese multinationals.

When we focus on Italy, we must remember that our automotive sector is almost exclusively in the hands of a single manufacturer on the production side, but, on the contrary, the vehicle components supply chain is made up of a huge number of companies, mostly small, which now mainly serve foreign clients. The critical issues on the vehicle production side are therefore strictly dependent on Stellantis' industrial policies, so Italy is now a non-main market and, unfortunately, not very competitive for production compared to other countries; this means that more than the macro effects described above, the responsibility for the decline in production is attributable to corporate choices.

On the contrary, the supply chain, working for almost all producers, is certainly more sensitive to the technological transition and needs tools to remain competitive.

It is therefore crucial to understand as a priority whether and how this transformation, i.e. the need to accelerate the marketing of vehicles with zero-emission engines through the electrification of the powertrain, is contributing to changing the supply chain and whether there are lights or shadows in the transformation.

Likewise, it is necessary to investigate whether and how the supply chain is adapting the production mix to accommodate the need and seize the opportunity to develop components and modules related to software and electronics. With electrification, in the wake of the CASE paradigm (connected, autonomous, shared and electric), the boundaries of the automotive supply chain are, in fact, expanding to companies engaged in the digitalization of the product (and processes) and in technologies related to the connected car. This in a context in which the development of complementary assets necessary for electrification is growing, such as public and private charging infrastructures.

What the overall effect of these negative and positive pressures is on the structure of the Italian supply chain and its economic "health" is difficult to observe. **The Observatory on the Transformations of the Italian Automotive Ecosystem (hereinafter OTEA) works precisely with the objective of producing scientific evidence** and data to answer this question and provide elements to guide industrial policy and business choices.

To achieve this goal, the CAMI - Department of Management of Ca' Foscari University of Venice and Motus-E, with the CNR- IRCRES which led the overall management of the annual Survey, have developed a research protocol to identify the key variables to evaluate whether and to what extent technological development influences the evolution of the automotive industry and, in short, whether it represents an opportunity or a threat.

The 2024 survey

As emerged in the previous study of the **Observatory, technological transformations are taking on a central role, and Italian suppliers have already started to seek a new positioning thanks to the production of invariant or specific components for new engines.** Understanding the situation of the Italian supply chain with respect to these opportunities, and examining the impacts of this second push, is extremely relevant to support policy design and requires an extremely more sophisticated analytical approach.

To this end, a survey was s**ubmitted to over 2,000 Italian automotive companies** that ended around the summer of 2024. The survey provides a snapshot of a supply chain that, compared to the transformation of the automotive ecosystem, has held up better than the car assembly sector both in terms of employment and in terms of adaptability. This is in line with the trend observed over the last 20 years, in which the number of Stellantis employees has decreased by approximately 20% while that of the component supply chain has remained substantially unchanged.

As for the effects of the transformation, which is instead a recent phenomenon, **the results of the survey confirm what was presented in the 2022 and 2023 volume: the positive effects on the employment trend outweigh the negative ones, albeit slightly, and the technological risk of the Italian supply chain is revealed to be contained, despite the supply chain being exposed to other risks, of market volumes and lack of investment in innovation.** This leads to some considerations. First of all, it is crucial to understand which companies suffer the effects, positive or negative, of technological change.

This allows to counteract the decline in the most vulnerable sectors and support the development of the supply chain, considering factors such as size, proximity to the end customer and geographical location. Secondly, the crisis areas and the technologically backward parts of the supply chain require concrete interventions to encourage conversion and competitive repositioning,

rather than deny the need for transformation. The findings highlight critical issues in products, processes, training and financing.
Finally, a significant part of the supply chain is engaged in emerging sectors such as components for electric powertrains, charging infrastructures and digital technologies. These segments, along with some traditional suppliers, are helping to maintain employment.

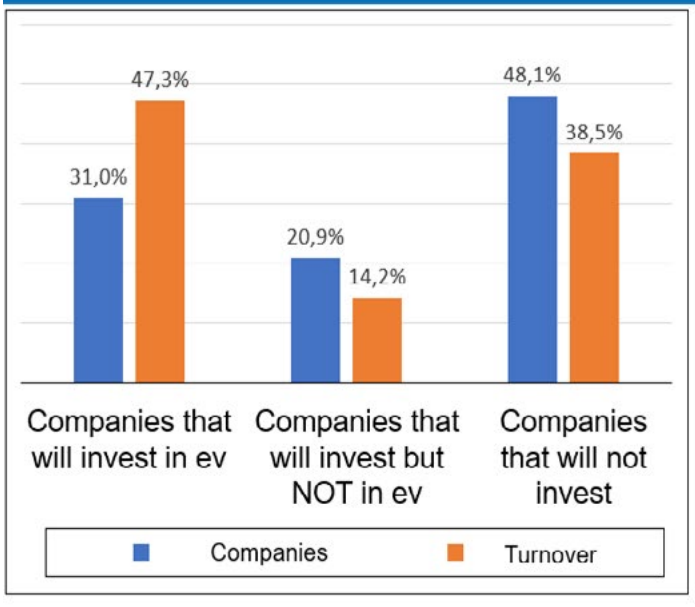
In this framework, some elements seem to be particularly relevant, especially in terms of forecasts for the future:

• **Italian multinationals show a reater propensity for innovation and less dependence on Stellantis,** with a focus on new foreign markets. Instead, the companies most dependent on Stellantis, mostly medium and medium-large sized, Tier 1, and located in Piedmont or other regions of Northern Italy, innovate less, remaining focused on local market.

• **Those who invest in electric vehicles demonstratea more dynamic performance than those focused on products for internal combustion vehicles.** However, many suppliers develop components that can be used for both types of vehicles, reducing the risk associated with the transition to electrification. Companies that report being more exposed to the risk of electrification include micro-enterprises in Tier 3 and the aftermarket, located in the South of the country and with a high dependence on Stellantis.

• **About half of the respondents to the survey stated that they do not plan any investment in Research and Development of new products or processes** and the employment trends and turnover forecasts of these companies are mostly negative. This shows that especially at this time a priority, also highlighted in the Draghi Report, for the competitiveness of the European automotive components industry is precisely investment in innovation.

51.9% OF COMPANIES WILL DEVELOP NEW PRODUCTS IN THE PERIOD 2024-27 FOR THE AUTOMOTIVE SECTOR



Who develops the most products for electric vehicles

Large enterprises (53%)

- Central Italy (46%) and Emilia-Romagna (35%)
- Network infrastructure (84%) and Tier I (36%)
- Italian companies based abroad (55%)
- On average dependent on Stellantis (41%)
- Non-exporters (35%)
- Not very dependent on Germany (33%)

Who develops the least products for electric vehicles

- Nord-Est (23%)
- Tier III (12%)
- Independent companies (24%)
- Heavily dependent on Stellantis (14%)
- Strong exporters (23%)
- Very dependent on Germany (0%)

In this regard, while it is comforting to note that **the majority of investments in new products/services are concentrated in areas of the vehicle that are not likely to change** significantly with the transition from internal combustion engines to electric motors, there are some elements of attention to take into consideration:

• **Investments in vehicle software are marginal,** despite the growing importance of this component (Software Defined Vehicles).

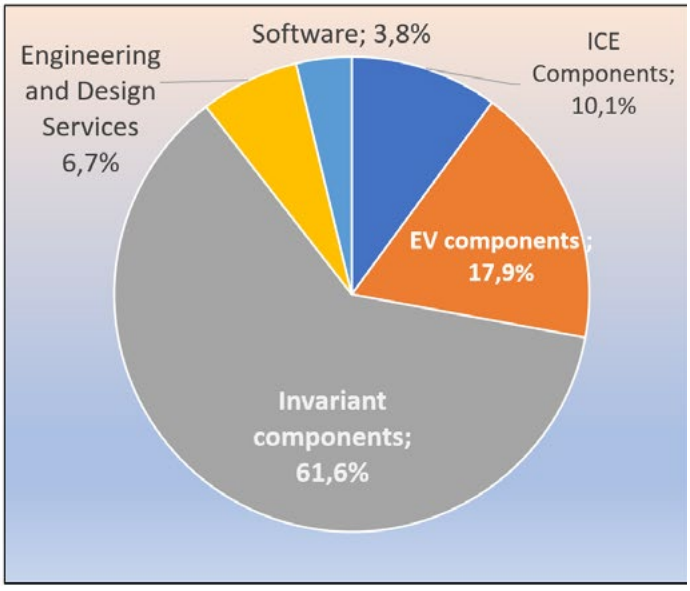
• **Investments in process innovation are declining,** with the risk of a loss of international competitiveness, particularly in a context, that of the new European regulations on monitoring the carbon footprint of companies, of great attention by OEMs to the efficiency and sustainability not only of their own production processes but also of those of their suppliers (who represent a significant share of the total).

Majority of avehicle's emissions and environmental impact).
• **Small to medium-sized suppliers, dependent on Stellantis and located in the South and North-East, struggle to innovate** and may not recover the gap without rapid interventions.

On the innovation front, therefore, **the Italian ecosystem seems to be little exposed to technological risks because it is focused on the development of components that are invariant with respect to motorization** (electric vehicles or ICE), but potentially at market risk due to aproduction specialization that is struggling to move to segments with greater growth and margins and due to poor investments in process innovation in historically strong segments.

HOW INVESTMENTS FOR THE DEVELOPMENT OF NEW PRODUCTS WILL BE DISTRIBUTED IN THE PERIOD 2024-2027

ICE Components	Internal combustion engine
	Auxiliary systems for the ICE engine
EV components	Electric motor
	Power electronics
	Energy management systems
	Electric Vehicle Battery
	Charging infrastructure
Invariant components	Frame Movement Components
	Transmission components
	Interior and body components
	Machining
	Electrical and electronic components
Engineering and Design Services	
Vehicle software	



The 2024 report

As emerged in the previous study, the survey results were presented in January at a public event at MIMIT and then included in the third edition of the Observatory's report on the transformations of the Italian automotive ecosystem that the Observatory publishes annually.

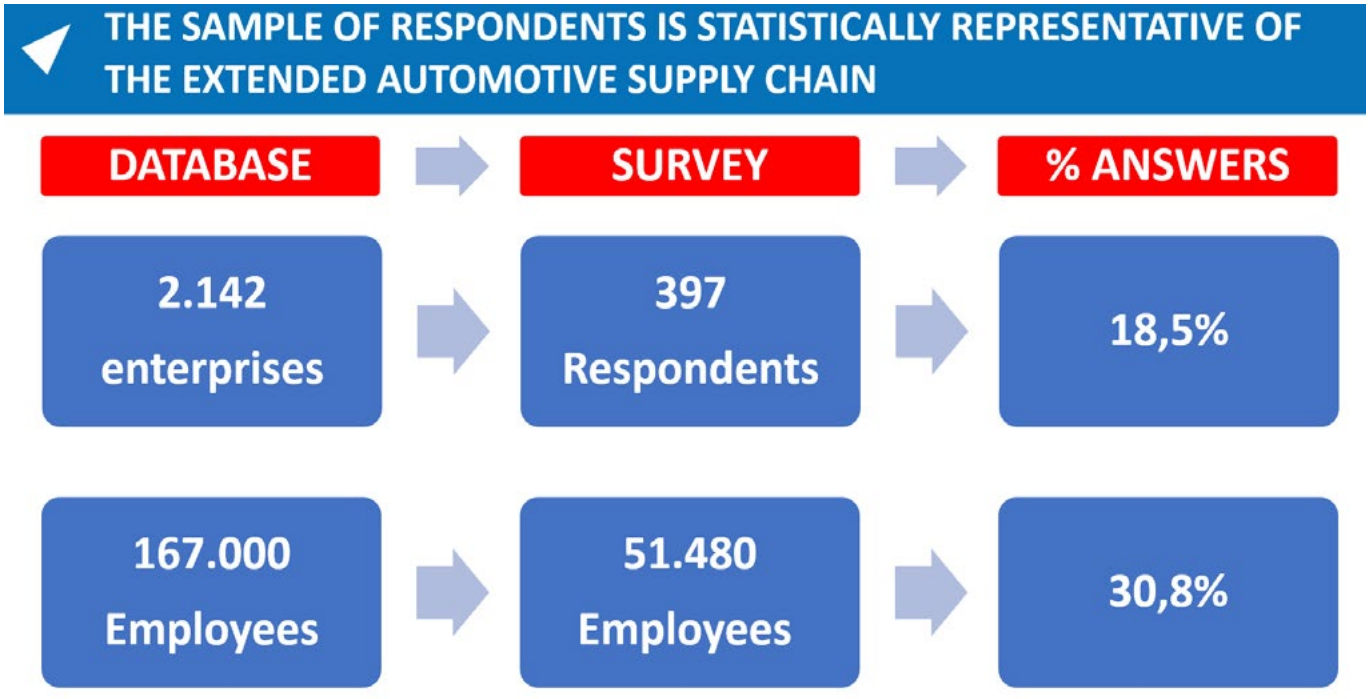
As in previous editions, **the report is essentially divided into two parts: the first reports the results of the survey analysis, and the second some territorial insights** that from different points of view analyze the changes underway in the automotive supply chain which, as anticipated in the previous edition, includes both traditional components and new players specialized in the electric charging infrastructure.:
The first part on the results of the survey analysis is composed of 5 chapters: the first, dedicated to the survey methodology, followed by 4 chapters each dedicated to deepening one of the cognitive objectives identified jointly with the members of the Technical Scientific Committee:

- the skills present within the companies in terms of product and process;
- employment levels and employee skills;
- the financial needs to support the change;
- the most appropriate industrial policies for support and sustain the transformations brought about by technological and regulatory changes.

The full report of the Automotive Ecosystem Transformation Observatory includes, in addition to the results of the analysis of the survey carried out in 2024, five territorial insights on:

- Piedmont
- Lombardy;
- the regions of Tri-Veneto;
- Emilia-Romagna;
- Southern Italy.

For each territory a dedicated event was organized, focused on the peculiarities of the local automotive fabric, also involving institutions and companies.



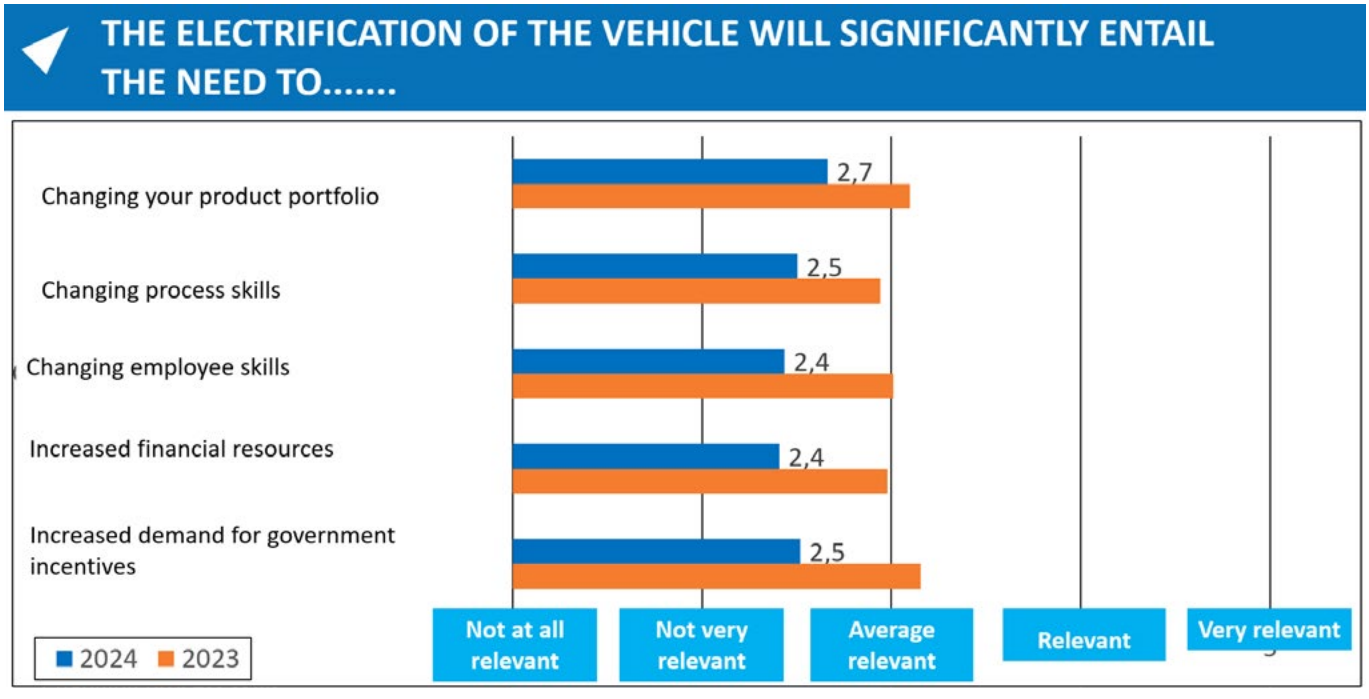
The investigation methodology

Chapter 1 presents the methodological notes that, in addition to highlighting the points of contact between the database analysis, the main object of the 2022 report, and the analysis of the 2024 survey, highlights: the comparison between the size of the sample and the responding companies; the interpretation keys to detect the main peculiarities of the respondents and to be able to cross-reference the results of the questionnaire; a preliminary comparison of the weight attributed by the companies to the particular objectives investigated.

As regards the comparison between the number of the sample and the responding companies, it is important to underline that **the response rate was 18.5%, much higher than last year (10.1%) and that the sampling, although aposteriori, was almost similar to the reference population in terms of size, geography, reference industrial sector, propensity to export and risk profile.** To further validate the results, the T- Student test was calculated to compare the means of asample and therelative population using total turnover and number of employees, both overall and for each classification. All different tests were passed.

Among the interpretation keys, in addition to the variables used to verify the sampling, the production specialization in the automotive sector, the positioning along the supply chain, the corporate control, the investment in research and development, the percentage of graduates, the use of the business plan and the intention to invest in new processes or products for the electrification of the vehicle were taken into consideration.

Finally, as regards the different evaluation that companies have attributed to the specific objectives identified by the Observatory, in line with last year but with slight variations, the most relevant were the changes to the product portfolio and the request for support from public institutions and then: the impact on employee skills, the changes in process technological skills and, lastly, the need for internal and external financial resources.



The skills present within companies

The second chapter analyses the skills present within companies in terms of product and process.

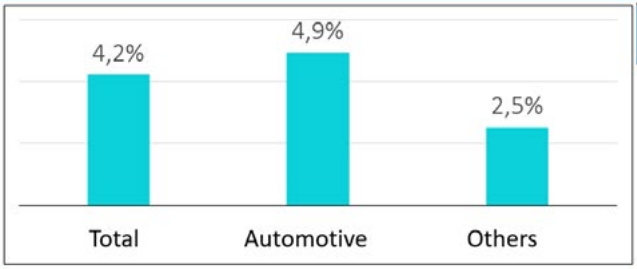
The innovative projects in the automotive supply chain are in continuity with the empirical evidence that emerged in recent years and published in previous reports. First, **a significant percentage of investment in R&D is observed with a small growth in companies performing overall R&D compared to 2022 (+5%).**
In automotive R&D, a higher percentage of companies is also noted, but unchanged with the 2022 results. However, patent activity among these companies is rather low, recording a percentage almost equal to that of 2022. The companies that invest more in these activities and develop a greater number of products and services are mainly the large and medium-large suppliers of Northern and Central Italy, dedicated to the network infrastructure (still in a small number) and closer to the final assemblers. In this context, two subgroups stand out positively:

- some micro-enterprises generally recently and located mainly in Piedmont, Lombardy and Emilia-Romagna, they focus mainly on design and are specialized in engineering, software development or production of specific components;
- Italian-owned multinationals, which show greater export capacity

On the contrary, **it is surprising to see a low rate of product/service innovation among companies that are highly dependent on Stellantis,** which are mostly medium-sized and medium-large Tier 1 companies located in Piedmont or other regions of Northern Italy.
However, there was a more dynamic performance among those investing in electric vehicles than those investing in non- electric vehicle products and processes. This diversity is visible in the rates of investment in R&D and in the forecasts of investment in product and process innovation for the next three years.

Ultimately, on the innovation front, the Italian ecosystem seems to be at astandstill. Little exposed to technological risks because it is focused on the development of components that are

R&D EXPENSES ON TURNOVER



DIMENSION	R&D ESPENSES ON TURNOVER
Micro	14,4%
Small	7,3%
Medium	5,6%
Medium-Big	4,6%
Big	4,7%
Average Italy	4,9%

PRODUCTION AREA	R&D ESPENSES ON TURNOVER
Piemonte	5,3%
Lombardia	3,3%
Nord-est Italia	2,7%
Emilia-Romagna	9,1%
Centro Italia	9,2%
Sud Italia	1,7%
Average Italy	4,9%

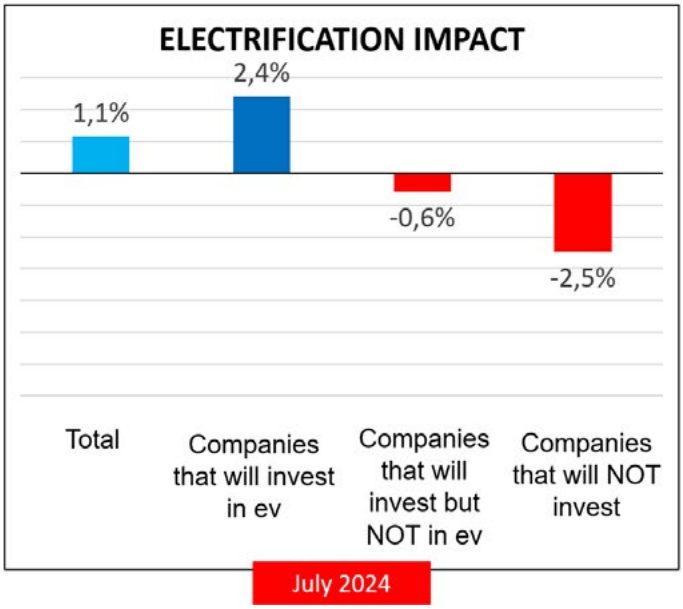
SUPPLY CHAIN POSITIONING	R&D ESPENSES ON TURNOVER
Tier 1	5,3%
Tier 2	3,0%
Tier 3	2,1%
Oltre Tier 3	1,8%
Aftermarket	3,1%
Network infrastructure	16,8%
Average Italy	4,9%

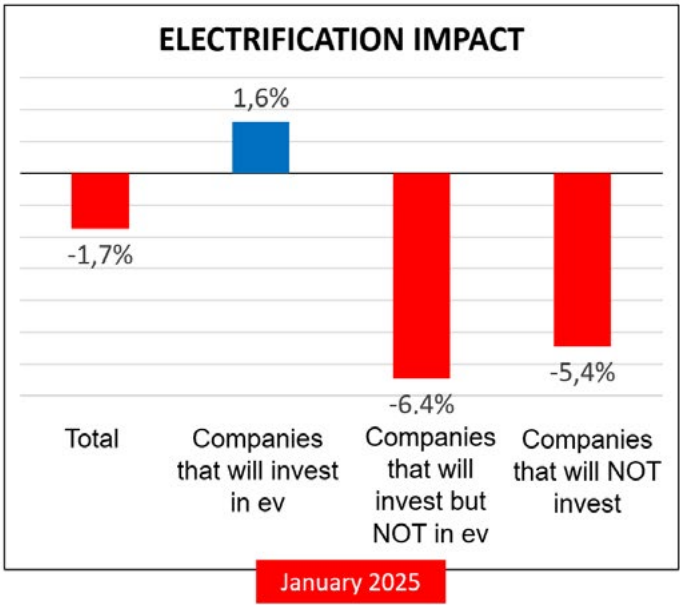
invariant with respect to the engine (EV or ICE), but potentially at market risk due to a production specialization that is struggling to move towards segments with higher growth and margins and due to poor investments in process innovation in historically strong segments.Ultimately, on the innovation front, the Italian ecosystem seems to be at astandstill. Little exposed to technological risks because it is focused on the development of components that are invariant with respect to the engine (EV or ICE), but potentially at market risk due to a production specialization that is struggling to move to segments with greater growth and margins and due to poor investments in process innovation in historically strong segments.

Employment levels

The third chapter focuses on employment aspects and in particular on two aspects: the state and evolution of employment along the extended automotive supply chain in Italy, investigating the role of innovation in the response of companies to the electrification process of the sector. The results of the analyses first of all highlight a **correspondence between companies investing in new products and processes, in particular those whose innovative focus is on solutions applicable to electric motorization, and a greater propensity of the same to hire specialized skills in this sector,** with higher qualifications and for professional roles more related to research and development and/or with specialization in IT.
From the analysis of the answers to the questionnaire, it emerges that overall the companies of the extended supply chain do not declare particularly negative employment impacts following the electrification of the vehicle, and it is above all the most innovative and electric-oriented companies that show better employment prospects for the near future, not only for the most qualified professional and research roles, but also at the level of direct and indirect production workers. Furthermore, the most innovative companies are those that show a more participatory approach to the process of company organization and its skills.
This chapter highlights how **the propensity to innovate is a key variable not only in explaining the cautious optimism for employment**

HOW EMPLOYMENT DEDICATED TO THE EXTENDED AUTOMOTIVE SUPPLY CHAIN WILL VARY IN THE PERIOD 2024-27



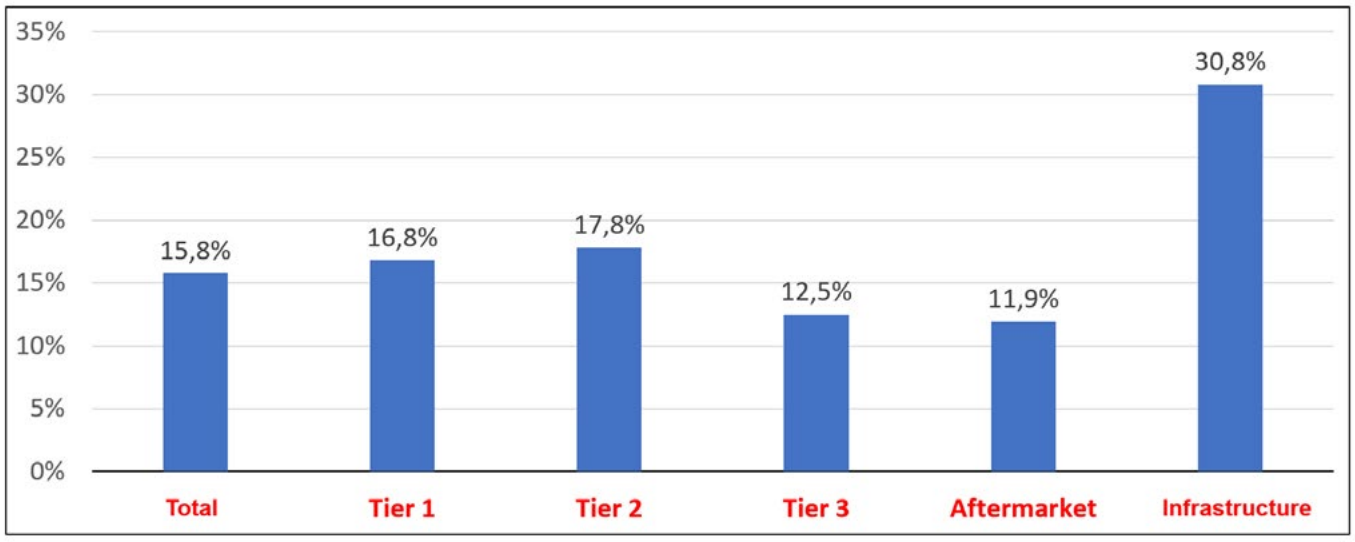


which emerges from this investigation, but also to chart the path to a less bleak future for the sector and its employees. Innovation has always been a valuable tool in the hands of companies to respond to growing technological challenges and remain competitive with respect to market competition on the chessboard of global value chains. Following the news of major upheavals that have occurred in the European automotive sector that have been circulating since August and therefore after the survey was closed, in the last two months of 2024 the set of questions relating to employment dynamics was forwarded again to a significant sample of companies, to verify whether there were substantial divergences with the results obtained by the survey in the first part of the year. The results are in line, with a marginal slowdown in the employment prospects of companies that will invest in EVs, which however maintain a positive outlook, and a more marked worsening among those who do not invest and, above all, among those who do not invest in new electric traction technologies. If for a long time the rents of position and the dependence on a consolidated technological paradigm have discouraged many players in the sector from investing in innovation, especially the most disruptive and expensive type, it is now evident that only the most innovative businesses can keep pace with contemporary challenges, especially by investing in their staff.

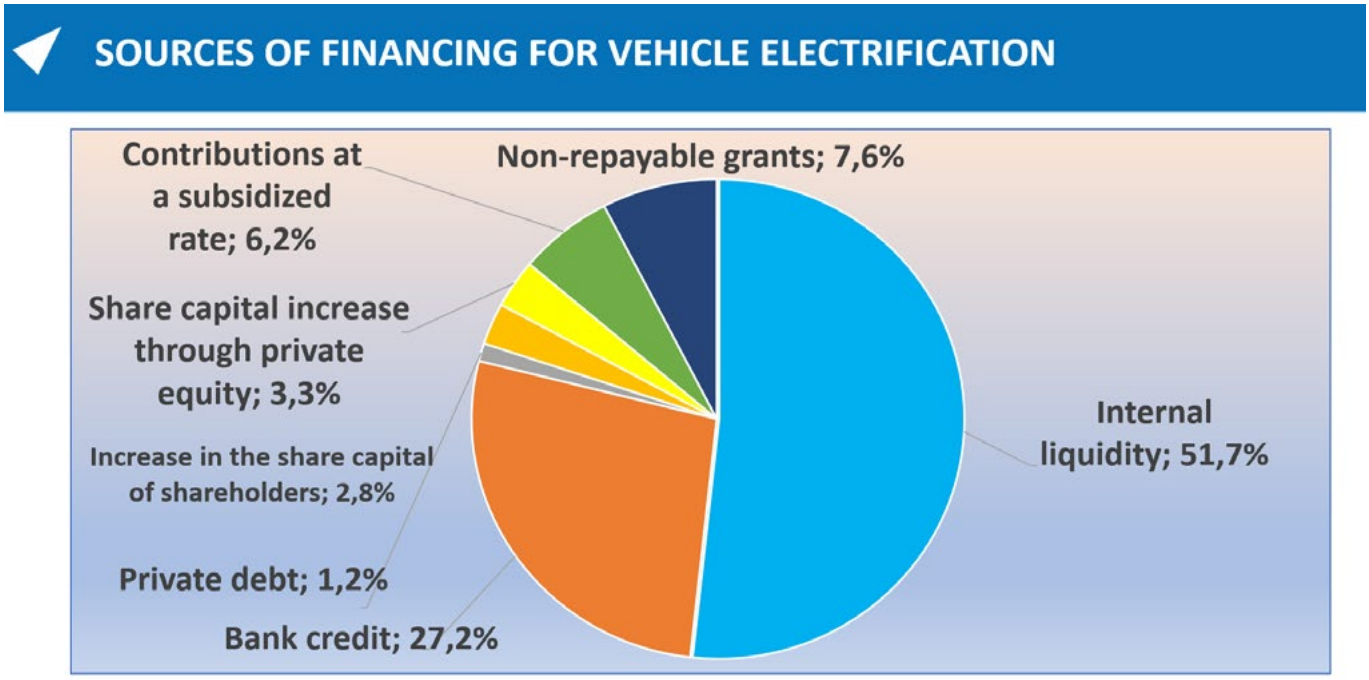
Financial needs

The fourth chapter is dedicated to the financial needs to support vehicle electrification. The chapter focuses on four aspects related to the management of financial resources: the drafting and application of the business plan, the difficulty and obstacles to accessing credit, relationships with financial intermediaries and the sources needed to finance vehicle electrification. The percentage of companies that stated that they had problems accessing credit is relatively low, 15.8%, but increasing compared to the previous survey (11.4%) with significantly higher values only for micro-enterprises, for southern companies and especially for companies specialized in network infrastructure. The main obstacles to credit appear to be the onerous conditions imposed by financiers, the size and the presence of risk factors such as customer management/ suppliers, product shortages or exposure to certain countries.

THE DIFFICULTY IN ACCESSING CREDIT



The fourth assessment focused on the sources of financing. **More than 50% of the financial resources come from internal liquidity within companies** (51.7%), while there is almost no recourse to private credit through the issuance, for example, of bonds. The second source of financing is bank credit (27.2%), followed by non-repayable public contributions (7.6%) and at a subsidized rate. Financing also occurs through capital increases (6.1%), mainly through private equity (3.3%), rather than involving members (2.8%).



Industrial policies

The fifth chapter analyses the most appropriate industrial policies and initiatives to sustain and support the transformations induced by technological and regulatory changes. These policies have been classified in this chapter into six groupings: policies to promote electric mobility, policies to support the automotive supply chain, policies to structure the production system, policies to promote product development, employment policies, energy policies.

Reducing energy costs is considered a priority to support the electrification of the extended automotive supply chain and, to a greater extent, policies to promote electric mobility.

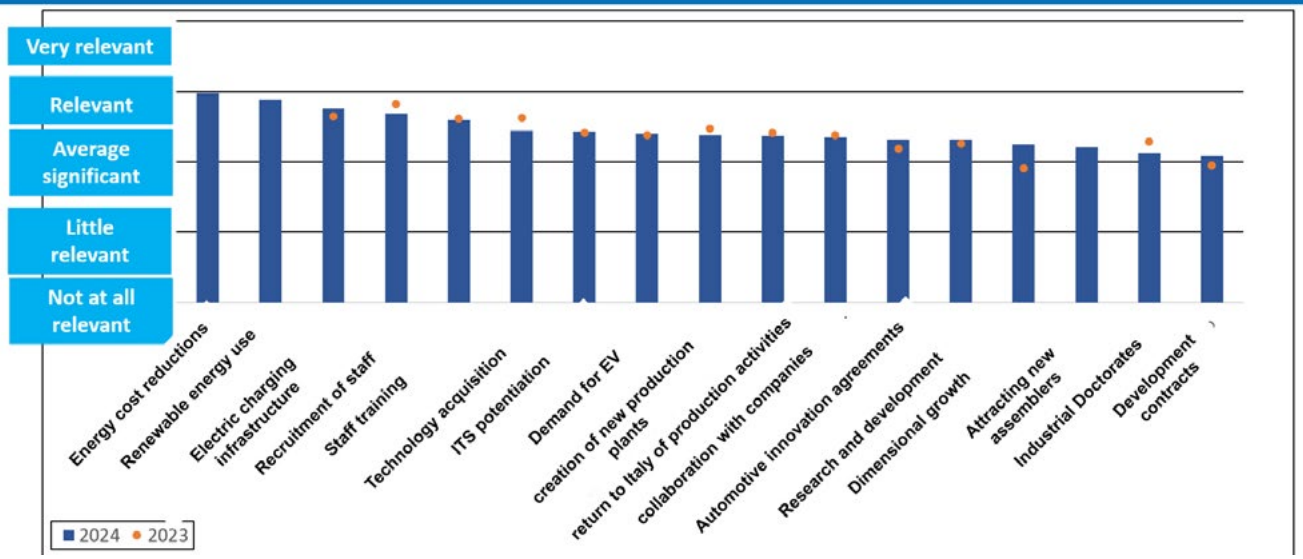
Particular attention is given to incentives and policies that promote employment and personnel management, considered a priority over those intended to support production and product development.

Comparing the assessments of industrial policies supporting the transformations of the automotive ecosystem with the responses of the previous survey, a growing attention towards supporting the electrification of the vehicle is highlighted. The attention of companies appears to be growing in particular towards incentives to improve the electric charging infrastructure (+5.1 percentage points).

Continuing the comparison with the previous survey, employment policies have also been given increasing importance with an average variation of 2 percentage points. The exception is the strengthening of industrial doctorates which has seen areduction in interest of 10.4 percentage points, going from 46.3% last year to 35.9%.

The changes made to industrial policies for the renewal of innovation agreements in the automotive sector and development contracts have seen an increase in the relevance attributed by the respondent companies with +4.2 and 6.6 percentage points respectively. Finally, it is important to point out that **the policy that registered the greatest increase inthe evaluation of the respondent companies was the support for dimensional growth** also through mergers with +14.3 percentage points which contrasts with a lower interest in the acquisition of technologies (-8.0 percentage points) and the construction of new plants (-5.6 percentage points).

THE DEGREE OF RELEVANCE OF POLICIES TO SUPPORT ELECTRIFICATION



Conclusions

Intervention by:

Francesco Naso

Motus-E
Secretary General

The electrification of mobility today represents **the fulcrum of a technological transformation that goes far beyond the simple energy transition.** It is inextricably linked to the **digitalization of vehicles,** with the affirmation of the Software Defined Vehicles (SDV) paradigm, where the software governs the management of energy flows and **the battery, of the individual functional modules** (brakes, steering, suspension, engine/generator), **of driving assistance** and safety, OTA updates and **user interfaces.**

This convergence between energy and digital requires an integrated and transversal vision that **involves the entire supply chain, from automotive to ICT, from vehicle production to the infrastructure network.**

> ***"In the first quarter of 2025 we are already witnessing to a significant growth which on average is leading to almost one in five pure electric cars being registered on the continent, a goal unthinkable up to 10 years ago"***

Global data confirm a consolidated growth dynamic. In 2024, almost 17.7 million electrified vehicles were registered worldwide, with an increase of +25% compared to 2023. **Of these, approximately 11 million are BEVs (100% electric), with a growth of +14%,** while plug-in hybrids have seen an even more marked increase, with +50% on an annual basis, and numerous EREV models, electric with range extender, are coming out on the market, especially in Asia, covering market segments related to large SUVs or sedans.

In Europe, despite an uncertain macroeconomic context and a regulation that pushed car manufacturers to register more in 2025, registrations of vehicles **with the plug grew by +13% in 2024, consolidating a share of over 20% of the car market,** with almost 14% being the prerogative of pure electric cars. In the first four months of 2025, we are already witnessing significant growth that on average is leading to registration on the continent of almost one pure electric car in 5, a goal unthinkable up to 10 years ago. While it is certainly possible to do better, **these results deny the catastrophic versions that describe BEVs as an unsellable product**. A reversal of the trend can also be seen in Italy: in the first quarter of 2025, BEV registrations rose to 25,161 units, with a market share of 5.16%, compared to 3.82% in the same period of the previous year. This is an important signal, but not yet sufficient, because Italy remains at the bottom of the class in Europe.

The lack of structured support for demand and an Automotive Action Plan that has not yet been implemented limit the potential for national and European growth and undermine competitiveness.

of the Community industrial sector par excellence. An important support would result from the modification of the tax treatment of company fleets, an application in which electric can grow faster and which would allow **European OEMs to better plan the market in order to reach the objectives of the CO_2 regulation.**

From the point of view of the technological evolution of electric vehicles, we are progressively witnessing substantial improvements in electrical architectures, with two developments in particular: the introduction of high voltage systems that drastically reduce **charging times and increase efficiency, together with new batteries that accept higher power charging,** reduce vehicle costs and their weight, improving their consumption and autonomy. In fact, the battery market shows encouraging signs: **in 2024 the average cost of battery packs fell by 20%, reaching 115 $/kWh,** with construction solutions that increasingly reduce weight (with the elimination of modules and the integration of cells directly into the chassis, C2P and C2B) and emerging technologies such as sodium-ion and semi-solid state cells are starting to enter the commercial phase, driven by R&D and targeted industrial policies, unfortunately not yet implemented in the European industrial sector but still the prerogative of Asian players.This makes the development of HPC infrastructures a long strategic routes and in logistics hubs even more urgent, in particular to support the electrification of commercial and industrial vehicles. **The whole-life cost (TCO) of vans is now competitive in many applications** compared to the endothermic equivalent, **while for heavy commercial vehicles there is a need for support in replacing vehicles with zero-emission vehicles,** the immediate implementation of the **Eurovignette Directive and attention to**

the application of the AFIR Regulation at national level; on this last point, planning of charging infrastructures is central, which as an association we are supporting with a proposal for strategic location in collaboration with logistics operators and electricity network managers.

The Italian charging network **continues to grow (+27% in 2024),** and its capillarity is increasing (with almost 90% of Italian municipalities served by at least one charging point) but there are portions of the territory that are still not adequately served (especially by high-power charging), limiting their attractiveness also from a tourist point of view and the user experience of charging needs to be improved. A growth in charging stations requires the full involvement of DSOs, in addition to CPOs, to ensure an efficient and rapid connection to the grid, with still 16% of stations installed but not connected. **Grid resilience becomes a fundamental enabling condition for the scalability of the system.**

However, it is essential to point out that before the pandemic, the cost of charging was a strong incentive to choose electric vehicles. Today, with the increase in the number of charging points, especially high-power ones, and low usage rates, the cost of ultra-fast charging is among the highest in Europe and this makes the cost of operating electric vehicles less advantageous for certain types of users. In fact, **Italy has the highest cost of medium voltage electricity applied to charging compared to other large European markets;** this inevitably represents an obstacle to overcome, in particular through targeted tariff interventions, which would weigh imperceptibly on the charges in the bill and which as an association we have repeatedly reported to the Energy Authority.
Inaction already has a high industrial and social cost, as shown by the responses to the questionnaire to companies in the automotive supply chain launched by the TEA Observatory: half of the **responding companies do not invest at all in Research and development of new products or processes, only 3.8% of the investment volume is dedicated to software and digitalisation** and the only **companies that estimate positive trends in revenues** and employment **in the next three years are those that invest in components for electric mobility or in software.**
Faced with this global acceleration, Italy must decide whether to be an active part of the change or aspectator who risks living the next few years with great regrets.
Only through **close collaboration and a shared vision** will it be possible **to accelerate the transition and ensure a charging infrastructure** that effectively supports the growth of electric mobility in Italy.
Motus-E is at the forefront of building a community of intent among all stakeholders involved: public administrations, energy companies, vehicle manufacturers and industry associations.

"Italy has the highest cost of medium voltage electricity applied to charging compared to other large European markets; this inevitably represents an obstacle to overcome, in particular through targeted tariff interventions"

GLOSSARY

- **AC:** Alternating Current.

- **AFIR:** Alternative Fuels Infrastructure Regulation. European Commission proposal for aregulation of the European Parliament and Council on alternative fuel charging infrastructure.

- **BEV:** Battery Electric Vehicle. BEVs are purely electric vehicles (full electric) characterized by electric motors powered exclusively by batteries, in which electricity is stored. The battery, in turn, is recharged via a cable connected to the electrical grid via a charging infrastructure (be it ahome wallbox or apublic or private charging infrastructure).

- **CAFE (Corporate Average Fuel Economy) REGULATION:** Set of regulations that establish the energy efficiency obligations for vehicles sold by each car manufacturer.

- **Vehicle Category**
  - **category M:** vehicles intended for the transport of people and having at least four wheels;
  - **category M1:** vehicles intended for the transport of people, having a maximum of eight seats in addition to the driver's seat;
  - **category M2:** vehicles intended for the transport of persons, having more than eight seats in addition to the driver's seat and a maximum mass not exceeding 5t;
  - **category M3:** vehicles intended for the transport of persons, having more than eight seats in addition to the driver's seat and a maximum mass exceeding 5t;
  - **category N:** vehicles intended for the transport of goods, having at least four wheels;
  - **category N1:** vehicles intended for the transport of goods, having a maximum massnot exceeding 3.5 t;
  - **category N2:** vehicles intended for the transport of goods, having a maximum mass not exceeding 12 t;
  - **category N3: v**ehicles intended for the transport of goods, having a maximum mass exceeding 12 t.

- **Emission class:** Environmental category attributed to a vehicle based on the quantity of polluting emissions produced, according to European emissions regulations

- **CPO:** Charging Point Operator. The entity responsible for the management and operation of a charging point that provides a charging service to end users, also in the name and on behalf of amobility service provider.

- **DC:** Direct Current (direct current).

- **DSO:** Distribution System Operator. They distribute energy and manage the primary (HV/MV) and secondary (MV/LV) cabins under concession, as well as the final low voltage (LV) portion of the electricity grid.

- **EREV:** Extended-Range Electric Vehicles. Special types of electric vehicles equipped with an additional internal combustion engine, which acts as agenerator of electricity to recharge the battery while driving. The traction is therefore exclusively electric, using a combustion engine exclusively to extend its autonomy and range.

- **ESG:** Environmental, Social and Governance. Acronym indicating the three sustainability criteria used to evaluate the environmental, social and governance performance of a company or investment.

GLOSSARIO

- **HPC/Ultra-fast:** High Power Charger. Charging points of 150 kW and above that make charging times similar to those for refueling cars with combustion engines. In exchange for a slightly higher charging cost (in terms of €/kWh), they potentially allow you to charge up to 80% of the battery in just 10 minutes.
- **LFP:** Lithium-Iron-Phosphate.
- **MS:** Market Share. Market share or percentage of sales of aproduct within a market.
- **MSP:** Mobility Service Provider. A legal entity that provides services to an end user in exchange for a fee, including the sale of charging or refueling services.
- **NMA:** Lithium-Manganese-Aluminum.
- **NMC:** Nickel-Manganese-Cobalt.
- **PHEV:** Plug-In Hybrid Electric Vehicle. PHEVs combine the internal combustion engine with the electric motor, powered by the battery. The latter can be recharged via acable, connected to the electrical network (in the same way as BEV vehicles).
- **PLUG&CHARGE:** technology that allows the automatic charging of electric vehicles simply by connecting the cable to the column, without the need for cards, apps or manual authentication.
- **PNIEC:** National Integrated Plan for Energy and Climate. The PNIEC is the strategic document with which each member state of the European Union defines its own objectives and measures in this area. of energy and climate to be achieved by 2030 in five dimensions: energy efficiency, renewable sources, reduction of greenhouse gas emissions, energy security, energy market and research and innovation.
- **PNIRE:** National Infrastructure Plan for the charging of electrically powered vehicles. Defined according to Law No. 134 of 7 August 2012, Art. 17 septies.
- **PNRR:** National Recovery and Resilience Plan.
- **POD:** Point of Delivery. Point of delivery of electricity.
- **Charging point power:** the theoretical maximum power, expressed in kW, that a charging point, station or group of charging stations or an installation for the supply of electricity from land can supply to vehicles or vessels connected to that charging point, station or group of charging stations or to that installation.
- **Segment A:** City cars and mini cars (length 2.7 -3.7 metres)
- **Segment B:** Small cars (length 3.7 -4 metres)
- **Segment C:** Compact (length 4-4.5 metres)
- **Segment D:** Medium sedans (length up to 4.9 metres)
- **SUV:** Sport Utility Vehicle, is a two-volume vehicle elevated and voluminous bodywork
- **TCO:** Total cost of ownership, the lifetime cost of a vehicle which or rental of the vehicle and all operating and refueling costs incurred during its useful life.

GLOSSARY

- **TEN-T global:** a comprehensive network within the meaning of Article 9 of Regulation (EU) No 1315/2013.
- **TEN-T core:** a core network within the meaning of Article 38 of Regulation (EU) No 1315/2013..
- **TSO:** Transmission System Operator. They are responsible for the transmission of electrical energy on the main high-voltage power grids. In order to ensure security of supply, they also ensure the safe operation and maintenance of the plant.
- **YTD:** Year To Date. A measure used to record the results of an activity from the beginning of the year to the current day.
- **Vehicle-Grid Integration: Set of** technologies, policies and strategies that regulate the timing, power and location of electric vehicle charging to support the operation of the electricity grid and meet mobility needs. These include:
- **V1G o smart charging:** System for efficient charging of electric vehicles, which optimizes costs, times and impact on the network through real-time communication between vehicle, infrastructure and energy operator.
- **V2G:** Vehicle-to-Grid. Technology that enables electric vehicles to exchange energy with the power grid, returning electricity to the grid when needed. With bidirectional charging technology, an electric vehicle's battery pack stores excess energy and releases it when needed.
- **V2L:** Vehicle-to-Load. Technology that allows an electric vehicle to provide electrical power to external devices or other electrical loads, using the vehicle's battery as the power source.

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