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Charging ahead: accelerating the roll-out of EU electric vehicle charging infrastructure



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EXECUTIVE SUMMARY

To meet ambitious CO2 targets for cars and vans, sales of electrically chargeable vehicles (ECVs) will need to pick up massively in all EU countries. However, ECV sales only represent part of the story. Appropriate charging infrastructure is required for both types of ECVs: battery electric vehicles (BEVs) and plug-in hybrids (PHEVs).

The OECD says access to charging for ECVs is "a significant concern," ¹ and the IEA underlines the critical importance of public charging infrastructure for widespread adoption, noting that growth in EV sales relies on accessible and affordable private and public charging infrastructure.²

The EU's 2016 low-emission mobility strategy called for EV charging to be as easy as filling a conventional vehicle tank, so that EV drivers can travel seamlessly across the EU.³ This means that the public charging network needs to be able to support all electric car drivers in the way that the traditional refuelling network supports combustion engine car drivers, ie it should be distributed evenly along motorways and major roads, in towns and villages, right across the EU.

This ACEA Automotive Insights report examines the status of public charging infrastructure for lightduty ECVs across Europe⁴, taking a snapshot of the situation at the end of 2023.

^{1.} https://www.oecd-ilibrary.org/environment/how-green-is-household-behaviour_2bbbb663-en

^{2.} https://www.iea.org/reports/global-ev-outlook-2023/trends-in-charging-infrastructure#

^{3.} https://op.europa.eu/webpub/eca/special-reports/electrical-recharging-5-2021/en/

^{4.} This report is about public charging points for electrically chargeable cars and vans, located in public places for public use. It does not discuss private charging points such as home and off-street charging, workplace charging, or hotels and private car parks. It also does not cover hydrogen refuelling stations across the EU, required for fuel-cell electric vehicles – which are also zero-emissions. Finally, it also not consider charging infrastructure for heavy-duty vehicles.

10 key takeaways

- There were 632,423 public charging points available across the EU at the end of 2023, and around 3 million BEVs on the road.
- 2 In 2023, a total of around 153,000 new public charging points was installed.
- The European Commission is calling for 3.5 million charging points by 2030 to support the level of vehicle electrification necessary to reach the proposed 55% CO2 reduction for passenger cars.⁵ Reaching this target would require the installation of nearly 2.9 million public charging points in the next seven years. That's almost 410,000 per year, or 7,900 per week.
- 4 ACEA's projections suggest a significantly higher demand, estimating the necessity of 8.8 million charging points by 2030. Reaching this would require 1.2 million chargers to be installed per year, or 22,438 per week.
- 5 Over the past seven years, sales of BEVs have outpaced the growth of the charging point network by more than threefold. Between 2017 and 2023, electric car sales increased over 18 times, while the number of public chargers in the EU grew merely sixfold during the same period.
- ⁶While some countries are powering ahead when it comes to infrastructure rollout, the majority are lagging behind. Indeed, just three EU countries covering over 20% of the EU's surface area the Netherlands, France, and Germany are home to almost two-thirds (61%) of all EU charging points. The other third (39%) of all chargers is distributed throughout 24 member states, covering almost 80% of the region's surface area.
- There is a strong correlation between public charging point availability and BEVs sales. The list of top five countries with the highest BEV sales is broadly similar to that of the countries with the most chargers: Germany, France, the Netherlands and Italy feature on both top 5 lists.
- Charging speed is also a major issue across the continent, as fast chargers (with a capacity of more than 22kW) make up a fraction of the EU total. Only around one in seven of all chargers (13.5%) is capable of fast charging. The majority are 'normal' chargers, with a capacity of 22kW or less (including many common-or-garden, low-capacity power sockets).
 - At the end of 2023, there were 29 BEVs per fast charger in the EU, and 53 BEV+PHEVs per fast charger.
 - Governments across the EU need to ramp up investments in charging infrastructure, and should swiftly implement the Alternative Fuels Infrastructure Regulation (AFIR) – bearing in mind that it sets minimum requirements only. At the same time, the European Alternative Fuels Observatory (EAFO) must ensure a robust monitoring system that incentivises member states to deploy infrastructure faster.

^{5.} https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_7785

THE EUROPEAN PLUG-IN LANDSCAPE

A comprehensive public charging network will be essential to support the anticipated surge in EV demand as the European Union phases out the sale of vehicles with internal combustion engines.

Under the European Green Deal and the European Commission's Fit for 55 legislative package, the EU is targeting carbon neutrality by 2050, and a 55% reduction in emissions by 2030. The CO2 regulation for cars and vans sets a 100% CO2 reduction target for 2035.

To meet these ambitious targets, sales of electrically-chargeable vehicles (ECVs) – including battery electric (BEVs) and plug-in hybrid electric vehicles (PHEVs) – will need to pick up massively. The availability of public charging infrastructure is essential for this to happen.

AFIR

The Alternative Fuels Infrastructure Regulation (AFIR) is a new law governing public charging point deployment across Europe. This provides for specific targets that will have to be met in 2025 and 2030.

In terms of passenger cars and light commercial vehicles, AFIR aims to:

- increase the level of power needed for public charging;
- align the implementation timeline of the Trans-European Transport (TEN-T) core network with that of the TEN-T comprehensive network, while increasing the overall power installed per charging point;
- introduce a density parameter for charging points; and
- stimulate the deployment of fast charging stations.

AFIR requires that from 2025, fast recharging stations of at least 150kW must be installed every 60 km along the EU's main transport corridors, the so-called Trans-European Transport Network (TEN-T). It is important to note that AFIR sets "minimum requirements" only, and that its targets remain well below what would is necessary to meet CO2 targets.

Public charging points: a long way to go

At the end of 2023, there were 632,423 public charging points across Europe. This falls far short of the number needed.

The European Commission is calling for 3.5 million charging points by 2030 to support the level of vehicle electrification necessary to reach the proposed 55% CO2 reduction for passenger cars.

ACEA's estimates indicate a much higher demand: 8.8 million charging points will be needed by 2030, increasing to 18.8 million by 2035.

There is a significant difference between the Commission and ACEA estimations of the number of charging points needed by 2030 due to several factors:

 the Commission underestimates the number of vehicles on EU roads that will need a charger by 2030: their estimate is 30 million, versus 65 million as estimated by Strategy& and Fraunhofer ISI and used in ACEA calculations.⁶ ACEA figures include battery-electric vans, which are primarily charged using the same infrastructure as cars, as well as plug-in hybrid electric vehicles, whereas the Commission only counts battery-electric cars;

^{6.} https://www.isi.fraunhofer.de/content/dam/isi/dokumente/cce/2023/2023-12-20_Strategy_Fraunhofer%20ISI%20-%20Fleet%20Electrification%20Study.pdf

- the Commission assumes significantly lower vehicle energy consumption compared to recent realworld monitoring figures (14.8 kWh/100 km for battery-electric vehicles (BEV) and 19.2kWh/100 km for plug-in hybrid electric vehicles (PHEV), versus 20 kWh/100 km for BEV and PHEV by ACEA); and
- the European Commission acknowledges that the Alternative Fuels Infrastructure Regulation (AFIR) requirements represent the minimum coverage needed, and will be insufficient to enable the CO2 targets for cars and vans to be met.

CHARGING POINTS PER COUNTRY, PLUS PERCENTAGE OF EU TOTAL 2023						
Country	Chargers	% of EU total	Country	Chargers	% of EU total	
Austria	18,637	2.9 %	Italy	41,114	6.5%	
Belgium	44,363	7.0 %	Latvia	535	0.1 %	
Bulgaria	1,624	0.3 %	Lithuania	1,313	0.2 %	
Croatia	1,074	0.2%	Luxembourg	2,323	0.4%	
Cyprus	329	0.1 %	Malta	101	0.0 %	
Czechia	4,664	0.7 %	Netherlands	144,453	22.8 %	
Denmark	23,072	3.6 %	Poland	6,102	1.0 %	
Estonia	683	0.1 %	Portugal	7,306	1.2 %	
Finland	11,247	1.8 %	Romania	2,754	0.4%	
France	119,255	18.9%	Slovakia	2,380	0.4%	
Germany	120,625	19.1%	Slovenia	1,608	0.3 %	
Greece	3,166	0.5%	Spain	30,385	4.8 %	
Hungary	3,319	0.5%	Sweden	37,166	5.9 %	
Ireland	2,825	0.4 %	EU	632,423	100 %	

SOURCE: EAFO

To reach 3.5 million by 2030, nearly 2.9 million public charging points will need to be installed in the next seven years, equivalent to almost 410,000 per year, or 7,900 per week. For context, just 153,027 new public EV charging points were installed in 2023. This should increase to 1.2 million per year, or 22,438 per week, if we consider ACEA's 2030 target of 8.8 million charging points.

Based on the number of installations in 2023, the public charging network will stand at just 1.6 million units by 2030. These numbers assume that those public charging points already in place are maintained and remain in place.

Number of charging points (end-2023)	632,423
New installations in 2023	153,027
Charging points required to reach 3.5 million by 2030, as of end-2023 (European Commission requirements)	2,867,577
Charging points required to reach 8.8 million by 2030, as of end-2023 (ACEA real estimates)	8,167,577
Number of charging points installed by 2030 based on new installations in 2023	1,550,585 (With a target of 3.5 million charging points, this leaves a shortfall of 1.9 million. 7.2 million with a target of 8.8 million charging points)
Annual installations required	To reach 3.5 million: 409,654 (or 7,878 per week) To reach 8.8 million: 1.2 million (or 22,438 per week)

SOURCE: ACEA, EAFO, EUROPEAN COMMISSION

Get connected: Type 2 and CCS connectors dominate in Europe

Public charging points ⁷ in Europe are typically equipped with one of two charging connector types: Type 2 is the predominant connector, with the Combined Charging System (CCS) occupying most of the remaining market share.

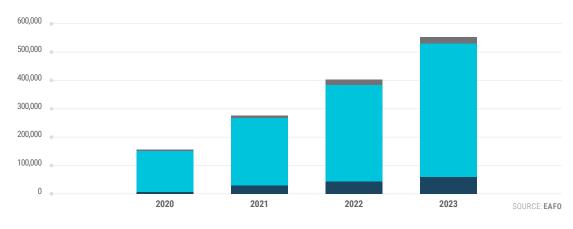
The Type 2 connector has a universal socket capable of delivering up to 22 kW for slow and fast charging. CCS connectors have a combined AC and DC port used for fast or ultra-fast charging, with a maximum power output of up to 350 kW and the capability to fully charge a BEV in 15 minutes.

Total number of publicly accessible AC and DC recharging points across the EU, according to the AFIR classification at end-2023

AC CHARGING POINTS

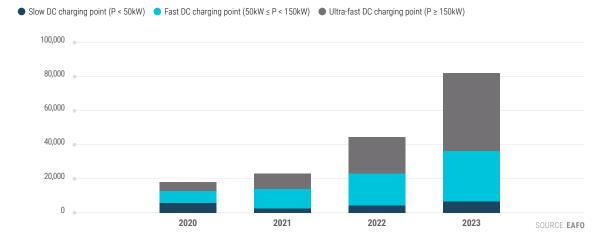
Total number of publicly accessible AC charging points, according to the AFIR classification

● Slow AC charging point (P < 7.4kW) ● Medium-speed AC charging point (7.4kW ≤ P ≤ 22kW) ● Fast AC charging point (P > 22kW)



DC CHARGING POINTS

Total number of publicly accessible DC charging points, according to the AFIR classification



7. Recharging points can contain several connectors; recharging stations can house several recharging points; and recharging pools are usually home to several recharging stations. However, only one connector per recharging point can be active for recharging at a time. For more detail: https://alternative-fuels-observatory.ec.europa.eu/general-information/recharging-systems

Fast or slow? It's a two-speed race

Typically, AC chargers are used for slow charging and are best suited to home and workplace charging, as well as public spaces such as supermarkets and leisure facilities. DC chargers are most commonly used for fast charging, usually on motorways and main highways, allowing drivers on long journeys to charge quickly en route rather than overnight.

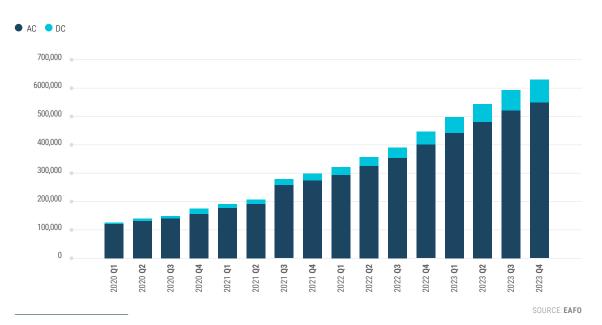
But public fast chargers are not exclusive to long distance and motorway driving; their presence can help to alleviate range anxiety, and act as an enabler for those without private charging options to consider to buy an ECV.

Both AC and DC chargers are suitable for public charging. AC chargers dominate, but of the 632,423 charging points available across the EU at the end of 2023, only around one in seven (13.5%) is capable of fast charging (with a capacity of more than 22kW). The majority are 'normal' chargers with a capacity of 22kW or less.

PUBLIC CHARGING POINTS IN THE EU BY COUNTRY AND TYPE (AC/DC)2023						
Country	AC	DC	Country	AC	DC	
Austria	15,229	3,408	Italy	35,195	5,919	
Belgium	41,903	2,460	Latvia	296	239	
Bulgaria	1,165	459	Lithuania	1,039	274	
Croatia	675	399	Luxembourg	2,143	180	
Cyprus	306	23	Malta	101	0	
Czechia	3,389	1,275	Netherlands	140,561	3,892	
Denmark	20,896	2,176	Poland	4,477	1,625	
Estonia	339	344	Portugal	5,582	1,724	
Finland	8,508	2,739	Romania	1,817	937	
France	100,767	18,488	Slovakia	1,690	690	
Germany	97,704	22,921	Slovenia	1,346	262	
Greece	2,950	216	Spain	24,931	5,454	
Hungary	2,742	577	Sweden	32,413	4,753	
Ireland	2,355	470	EU	550,519	81,904	

SOURCE: EAFO

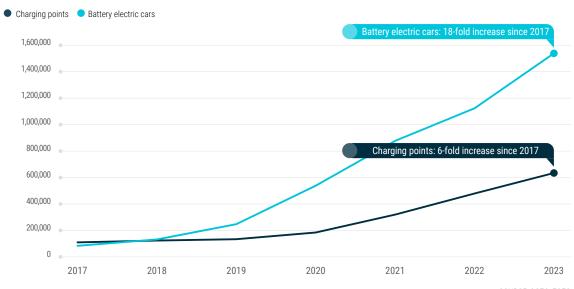
PUBLIC CHARGING POINTS IN THE EU BY TYPE (AC/DC)



Out of sync: Charging point deployment and BEV uptake

The rate of installation of charging points is clearly slower than the sales of battery electric cars. In 2023, BEVs represented 14.6% of EU new car sales, with plug-in hybrids accounting for 7.7%, according to ACEA data. The share of battery electric cars is expected to reach almost 30% of the European market by 2025 and to exceed 70% by 2030.⁸

Over the past seven years, sales of BEVs have outpaced the growth of the charging point network by more than threefold. Between 2017 and 2023, electric car sales increased over 18 times, while the number of public chargers in the EU grew merely sixfold during the same period.



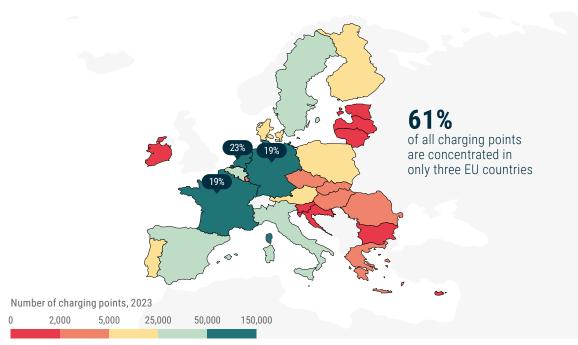
CHARGING POINTS DEPLOYMENT VERSUS SALES OF BATTERY ELECTRIC CARS

^{8.} https://www.acea.auto/news/electrification-trends-worldwide/

Distribution of charging points

The strategic placement of charging infrastructure is essential to ensure all customers across Europe feel sufficiently supported in choosing an EV as their next vehicle.

However, just three EU countries – Netherlands (144,453 charging points), France (119,255) and Germany (120,625) are home to almost two-thirds (61%) of all EU charging points. These countries make up 22% of the entire EU surface area. The Netherlands – the country with the highest share of infrastructure – has over 52 times more charging points than Romania (2,754), which is roughly seven times bigger. The other 39% (over one third) of all chargers are scattered throughout the remaining 78% of the region's surface area.



DISTRIBUTION OF ELECTRIC CAR CHARGING POINTS ACROSS THE EU

SOURCE: EAFO

In 2023, the top five countries with the most EV charging points in the EU were the Netherlands, Germany, France, Belgium, and Italy.

The five countries with the fewest public charging points in 2023 were Croatia, Estonia, Latvia, Cyprus, and Malta (among Europe's smallest countries).

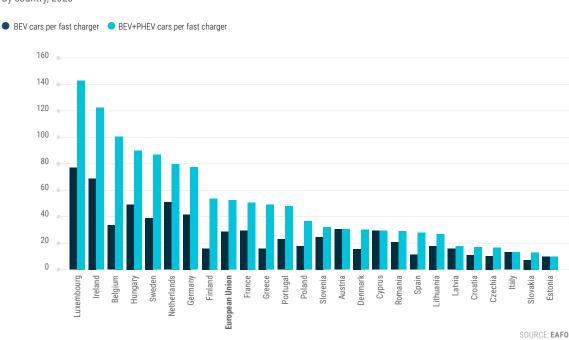
TOP 5: countries wit	h MOST charging points	TOP 5: countries with LEA	ST charging points
 Netherlands 	144,453	1 Croatia	1,074
2 Germany	120,625	2 Estonia	683
France	119,255	3 Latvia	535
4 Belgium	44,363	4 Cyprus	329
5 Italy	41,114	5 Malta	101

SOURCE: EAFO

Electric cars per charger

There are approximately 3 million BEVs on the road in the EU for 632,423 public charging points. That equates to approximately 5 BEVs per public charging point. Of course, as the number of BEVs increases, the ratio of BEVs per charging points will increase, bearing in mind that BEVs are forecast to account for 30% of the market by 2025, and 70% by 2030. It is important to note that PHEVs also use public charging points, increasing the number of vehicles per charger. The EU recommends one public charge point for 10 BEVs.

Public fast chargers, especially those located along motorways, enable longer journeys, and can address range anxiety, a barrier to EV adoption. At the end of 2023, there were 29 BEV cars on road per fast charger in the EU, and 53 BEV+PHEV cars per fast charger.



NUMBER OF ELECTRICALLY CHARGEABLE CAR PER FAST CHARGER (P > 22KW) By country, 2023

Other indicators

Looking at other indicators, it is evident that the BEV share is heavily correlated with the availability of charging points.

Several countries boasting the highest share of BEV cars on the road also rank among the top five in other indicators, such as the number of charging points per 1,000 inhabitants or per 10 km of road. For instance, Denmark, leading the EU countries in BEV adoption, also ranks second in the number of charging points per inhabitant, with almost four per 1,000 inhabitants, and fourth in the number of charging points per 10 km of road, with over three.

BEV cars on the road (% share, 2022)		New BEV cars sold (% share, 2023)		Charging points per 1,000 inhabitants	s (2023)	Charging points per 10 km of road (20	23)
EU	1.2%	EU	14.6%	EU	1.4	EU average	1.3
		т	OP FIVE	COUNTRIES			
1 Denmark	4.0%	 Sweden 	38.7%	 Netherlands 	8.2	1 Luxembourg	8.0
2 Sweden	4.0%	2 Denmark	36.3%	2 Denmark	3.9	2 Netherlands	7.7
3 Netherlands	3.7%	3 Finland	33.8%	3 Belgium	3.8	Ortugal	5.1
4 Luxembourg	3.1%	4 Netherlands	30.8%	4 Luxembourg	3.6	4 Denmark	3.1
5 Austria	2.1%	5 Luxembourg	22.5%	5 Sweden	3.6	5 Belgium	2.9
BOTTOM FIVE COUNTRIES							
 Czechia 	0.2%	1 Italy	4.2%	 Croatia 	0.3	1 Latvia	0.1
2 Slovakia	0.2%	2 Poland	3.6%	2 Bulgaria	0.2	2 Estonia	0.1
Oland	0.2%	3 Czechia	3.0%	3 Malta	0.2	3 Poland	0.1
Oprus	0.1%	4 Croatia	2.8%	4 Poland	0.2	4 Hungary	0.2
5 Greece	0.1%	5 Slovakia	2.7%	5 Romania	0.1	5 Lithuania	0.2

SOURCE: ACEA, EAFO, EUROSTAT

In terms of public charging points per 1,000 inhabitants, against an EU average of 1.4, Netherlands is first with 8.2, followed by Denmark (3.9), Belgium (3.8), and Luxembourg and Sweden each with 3.6.

Many of the same countries appear near the top of the list of countries with the highest number of public charging points per 10 km of road; with 1.3 being the EU average. Luxembourg has 8.0, followed by the Netherlands (7.7), Portugal (5.1), Denmark (3.1), and Belgium (2.9).

Are we there yet? The long, slow journey to public charge point rollout

There are numerous reasons why public charge point deployment varies locally, nationally, and regionally. Red tape, permits, and planning permission are major hurdles to installation. So too are the capacity and resilience of existing power grids.

In terms of physical deployment, existing service areas on major arterial routes are ideal for fast charger installation. By contrast, crowded urban areas where congestion is an issue and parking is at a premium present challenging conditions for locating slow chargers.

Democratising EV adoption requires equity in charging point placement, ensuring the availability of EV charging in all neighbourhoods – rural and urban, and not just in wealthier areas. Charge point safety is critical, too – charge point users should feel safe stopping to charge, with well-lit and covered charging points installed in secure public locations. And they must be accessible to all, not just to able-bodied EV drivers.

Charge point operators (CPOs)

In its Global EV Outlook 2023, the International Energy Agency (IEA) noted that an agreement between the European Investment Bank and the European Commission would make over ≤ 1.5 billion available by the end of 2023 for alternative fuel infrastructure, including electric fast charging.⁹

Public charging points are managed and maintained by charge point operators (CPOs). The EV charging industry has yet to mature, with the number of CPOs still growing and evolving. The charging market remains fragmented, with a high number of small national players, many of them start-ups. Margins are low, and the return on investment is even lower. The next few years are likely to see considerable growth in charging points and considerable consolidation in CPOs, with charging eventually becoming a commodity.

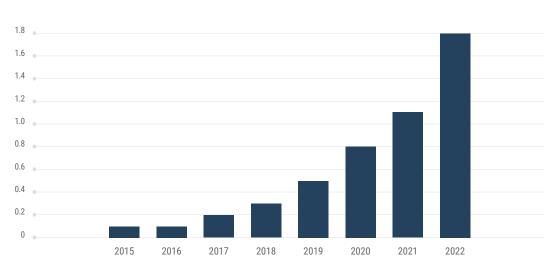
Against this backdrop of uncertainty, automakers are collaborating on infrastructure with other automakers, utility companies, and other stakeholders. Traditionally, fuelling has been outside the realm of the vehicle manufacturer, but with the success of EV sales so heavily dependent on the infrastructure, manufacturers have felt the need to accelerate its deployment.

However, the roles and responsibilities of public and private stakeholders nationally and locally should be clearly defined to avoid hindering infrastructure rollout and delaying maintenance.

A global comparison

China

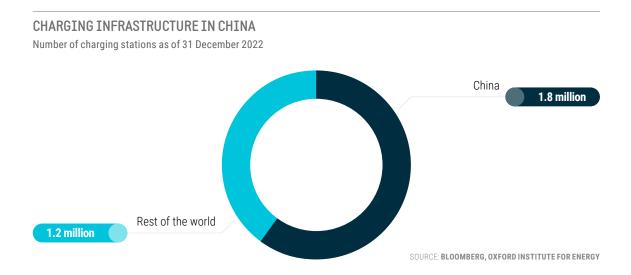
Europe's charging point infrastructure pales into insignificance when compared to China's, where the public charging network accounts for almost two thirds of the global public charging infrastructure and is growing rapidly.



CHARGING INFRASTRUCTURE IN CHINA By country, 2023

9. https://www.iea.org/reports/global-ev-outlook-2023/trends-in-charging-infrastructure

SOURCE: INTERNATIONAL ENERGY AGENCY (IEA)

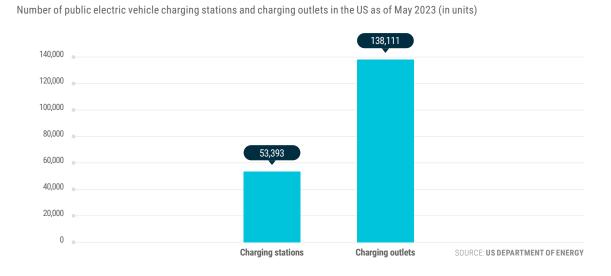


However, comparisons between Europe and China are largely academic. China's considerably greater network of public charging points supports BEVs with smaller batteries than are used in Europe. Chargers also deliver lower power output in China than in Europe; this supports affordable mainstream cars with smaller batteries, but is less suited to higher end vehicles which benefit from fast-charging technology.

US

In the US, various provisions in the Inflation Reduction Act (IRA) support the deployment of EV charging infrastructure through incentives for consumers, businesses, and manufacturers. These include tax credits of up to \$7,500 per vehicle through 2032; credits up to 30% of the cost of specific alternative fuel vehicle refuelling property, including electric vehicle charging infrastructure; incentives to enable automakers to meet the demand for electrically chargeable vehicles and charging infrastructure; and requirements via the complementary Bipartisan Infrastructure Law which promote the domestic production and installation of charging infrastructure. As of May 2023, the US had over 138,100 charging outlets for battery and plug-in electric vehicles, indicating a substantial foundation for the ongoing expansion of the electric vehicle charging network.

PUBLIC ELECTRIC VEHICLE CHARGING STATIONS AND OUTLETS IN THE US



CLOSING THOUGHTS

Range remains a key consideration for consumers accustomed to the long ranges of vehicles with internal combustion engines, despite average daily commuting distances in Europe of typically no more than 40 km. Coupled with range is an expectation of a charging network as dense as the existing fuel station network. And that includes being able to charge quickly.

How can we charge ahead? The deployment of public charging points in Europe can be accelerated in a number of ways. These include for instance:

- Swift AFIR implementation: Member states should swiftly implement the Alternative Fuels
 Infrastructure Regulation (AFIR) bearing in mind that it sets minimum requirements, which will be
 insufficient by themselves to enable the CO2 targets for cars and vans to be met. At the same time,
 the European Alternative Fuels Observatory (EAFO) must ensure a robust monitoring system that
 incentivises member states to deploy infrastructure faster.
- Incentives and support: Although there are a number of European initiatives to support infrastructure roll-out, 22 EU member states (~80%) do not offer any incentives for infrastructure development or installation.¹⁰
- Grid updates: According to McKinsey, substantial upgrades to utility grids are necessary for the expansion of EV charging stations and increased renewable energy capacity, at an estimated cumulative cost of over €240 billion by 2030.¹¹ Power companies and regulators unprepared for a surge in EV adoption could hinder the deployment of EV charging stations.
- Innovation: Technological innovation could help to accelerate the deployment of EV charging infrastructure, as CPOs and utilities enable functions such as vehicle-to-grid, bi-directional flow, smart grid, and grid balancing solutions, as well as rapidly increased charging speeds.
- Improved customer experience: Beyond the deployment of the charging infrastructure itself, CPOs must significantly improve the customer experience. This includes an end to multiple charging point apps, simplification of payment, and the provision of real-time information about charge point reliability and availability.
- Smoother processes: Red tape, permits, and planning permission are major hurdles to installation
 of charging points. The public charging network should be treated as critical infrastructure, and the
 roles and responsibilities of public and private stakeholders clearly defined.

There may currently be enough public charging points to support today's fleet of ECVs, but the network will quickly become insufficient. It is essential to prepare now for future growth and the continued adoption of ECVs – and that requires increased infrastructure investment.

^{10.}https://www.acea.auto/fact/electric-commercial-vehicles-tax-benefits-and-purchase-incentives-2023/ https://www.acea.auto/fact/electric-cars-tax-benefits-purchase-incentives-2023/

^{11.}https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/europes-ev-opportunity-and-the-charging-infrastructureneeded-to-meet-it

ABOUT THE EU AUTOMOBILE INDUSTRY

- 12.9 million Europeans work in the auto industry (directly and indirectly), accounting for 6.8% of all EU jobs
- 8.3% of EU manufacturing jobs some 2.4 million are in the automotive sector
- Motor vehicles are responsible for €392.9 billion of tax revenue for governments across key European markets
- The automobile industry generates a trade surplus of €101.9 billion for the European Union
- The turnover generated by the auto industry represents over 7% of the EU's GDP
- Investing €59.1 billion in R&D per year, automotive is Europe's largest private contributor to innovation, accounting for 31% of the EU total

ACEA represents europe's 15 major car, van, truck and bus manufacturers

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