Why BEVs outperform PHEVs and Range-Extended EVs for light transport decarbonization by 2035 in Europe

Executive summary

September 2025

ChargeFrance thanks the BCG team for their analytical support on the total cost of ownership and lifecycle emissions. Their expertise in market analysis was key to writing this study.

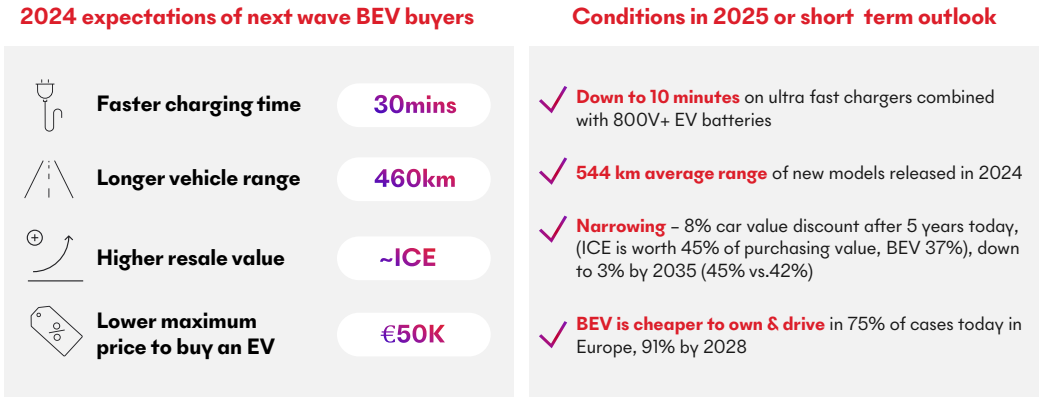
THE EV TRANSITION IS IN MOTION ACROSS EUROPE AND SEES A STRONG H1 2025

The EV transition is accelerating across Europe. Since 2019, battery-electric vehicle (BEV) sales have risen from just 2% to 14% sales share in 2024, with Norway far ahead of the rest of the region, posting 82% BEV penetration in Q1 2025 and forecasting to surpass 85% within the year. H1 2025 sees a strong start for BEV new car sales, with BEV sales increasing by 24% vs. H1 2024, mostly thanks to new affordable electric models (below 25,000€), increasingly available charging infrastructure, and BEVs achieving superior costs advantage across almost all EU countries. Latest forecasts put BEVs at 40-45% of Europe's new car market sales by 2030 and 90-100% by 2035, as BEVs are compliant with the EU's zero-emissions mandate.

BARRIERS TO BEV ADOPTION ARE QUICKLY FADING IN MOST USECASES & SHOULD UNLOCK MASS ADOPTION (59% OF EU CUSTOMERS OWN OR INTEND TO BUY A BEV AS THEIR NEXT VEHICLE[1])

According to a study[2] conducted across Europe, China and the USA, 46% of European respondents intend to purchase a BEV as their next vehicle[1]. It is the highest figure among all regions surveyed and on top of 13% of current EV owners surveyed. The four main barriers to switching to a BEV are quickly fading in the vast majority of use cases:

- **Charging Time:** Public charging stations target 5-20 minutes recharge [3] for next generation cars coupled with infrastructure capable of delivering ultra-high power;
- **Driving range:** new models launched in 2024 average over 544 km of nameplate autonomy[4] vs. 640 km for ICE;
- **Resale value:** in 2025, MSRP[5] reaches 45% of purchasing value for an ICE while only 37% for a BEV after 5 years of usage. This resale value discount should narrow from 8 pp today to 3pp by 2035;
- **Costs:** costs are also lower for a BEV than mature & scalable alternatives as of 2025. BEVs are cheaper to own and drive for 75% of cars sold in Europe[6], and BEVs retain a cost advantage even if fuel prices were to fall to €1.0/L.[7] Purchasing costs are now also lower for small/city cars (B-segments) than ICE cars, and cheaper than Plug-in Hybrid Electric Vehicles (PHEVs) for larger cars.



Note: Mean figures; Next wave's sample: n = 2038; BEV owners' sample: n = 587
Source: BCG BEV Adoption Survey Europe (n = 5,121), May 2024

[1] Conditional to four pre-requisites that are eroding

[2] BCG BEV adoption surveys: EU=~5000 respondents, CH = ~2500 respondents; 2024; intend to buy does not necessarily lead to purchase

[3] To go from 20% to 80% of battery, 5 minutes recharge only possible where power system capable of supporting 500+ kW

[4] Theoretical range announced by car manufacturers for their BEVs based on mass market US/EU/Korean OEMs' BEV new model launch schedule. Source: Nomura report 04/2025

[5] Manufacturer's Suggested Retail prices

[6] Based on 5 years Total Cost of Ownership analysis, 49% when accounting for current discount in resale value, assuming average driving distance of European drivers

[7] Example for family cars (D-Segment) in France, assuming blended public & private charging costs in 2025

BEVS OFFER A SUPERIOR VALUE PROPOSITION FOR CAR DRIVERS & OWNERS, PHEVS & REEVS APPEAR AS BRIDGE SOLUTIONS IN EUROPE

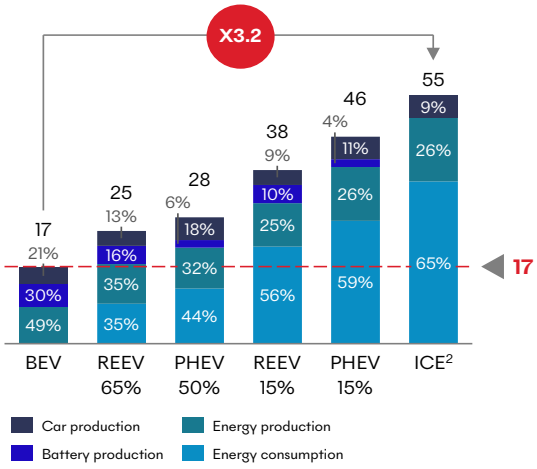
Though variation exists by usage profile & market, BEVs **show cost and emissions advantages vs. Plug-in hybrids (PHEVs),** which have double motor systems, **and Range-Extender EVs (REEVs),** which run on an electric motor but also have a fuel tank and a generator that can recharge the battery. Real-world data shows that **PHEVs run in electric mode** only 45-50% of the time for private users and **only 10-15% for company cars**[8]. That is far from the 80% initially forecasted by European regulators. **A BEV costs 640 – 1,600 €/year less than a PHEV to own and drive for an average driver**[9]**.** REEVs, strongly picking up in China, share the same structural weakness. Early real-world data in China shows they run on average 35%[10] of the time using the fuel tank & generator. REEVs, primarily large cars, rely on smaller batteries and use a simple, low-cost generator that would not anchor powertrain jobs in Europe.

Driving electric also plays a role by **reducing dependence on imported fossil fuels**, particularly oil, a resource for which the EU remains heavily reliant on external suppliers. If the electrification path reaches current forecasts, Europe could **reduce oil imports by 15% by 2035 vs. 2025**, only when accounting for light-vehicle transport electrification. This would represent €40-45 bn per year[11]. In addition, this electric transition in road transport should have a positive socio-economic impact: current European announcements of battery manufacturing factories should **generate about c.100,000 direct jobs**[12]**, and the EV charging industry c.70,000 by 2030.**[13]

BEVs enable to meet net zero emissions targets, even for large family cars, and the spread is growing as Europe's energy mix is decarbonizing. BEVs consistently emit less CO_2 than PHEVs, regardless of the energy mix and most often before hitting 20,000 km driven. Over their lifecycle, **BEVs generate half the CO_2 emissions of a comparable PHEV for a private user**[14] (17 t CO_2 -eq vs. 28t CO_2 -eq) and **2.7 times less than a comparable PHEV with a company car usage** (46 t CO_2 -eq)[15].These technologies can play a role in a shorter-term reduction of emissions in certain rural or high-mileage geographies, but will not be able to meet net zero ambitions, especially as the European energy mix will continue to decarbonize by 2030[16], widening the BEV emission advantage.

Lifecycle BEVs emissions are 3.2× lower than ICEs with Europe's average carbon intensity

D-segment lifecycle emissions in tCO_2 eq, Europe 2024 (210gCO_2/kWh)



1. Assumes 300km of battery autonomy for BEV
Note : ~225000km driven ; BEV consumption: 17.4kWh/100km; Fuel consumption: 7.1l/100km for ICE & 4.8l/100km for PHEV 50% utility factor (6.3l/100km for 15%). REEV consumption 5.0l/100km & 17.4kWh/100km
Source: IEA EV life cycle assessment calculator ; European Environment Agency (2023) ; BCG analysis

[8] ICCT 2022 Real-world usage of plug-in hybrid vehicle
[9] Considering a D-segment car, with a utility factor ranging from 15% (corporate fleet) to 50% (private user), as per ICCT 2022 real-world usage data, for an average driver in Germany (13,920 km/year), France (13,200 km/year), Spain (13,100 km/year) & Italy (8,100 km/year)
[10] Li Auto, 2024
[11] Assuming c.30% of BEV fleet by 2035, 3% consumption efficiency on ICE & diesel average consumption and 25% for PHEV
[12] Number of direct jobs based on public information and extrapolation on average labor requirement of battery production, considering degree of automation
[13] ChargeUp Europe, 2025 State of the industry
[14] Without battery recycling upside
[15] Considering 210 g CO_2/kWh in Europe in 2025, for a D-segment car
[16] Considering carbon intensity of 110 g CO_2/kWh in Europe in 2030

CHARGEFRANCE & PARTNERS RECOMMENDATIONS – ACTIONS TO TAKE

The objective of this fact-based report is to reduce ambiguity and sharpen focus for all stakeholders in the European EV industry, so that we can act collectively and join forces to reach a resilient, sustainable and competitive European mobility system. This report advocates for three key levers policymakers should pursue:

- **Stand firm on maintaining the 2035 phase out of tailpipe emissions and intermediary milestones.** BEVs are on track to represent 40–55% of new light vehicle sales by 2030, with full alignment towards 100% BEV sales by 2035 still achievable. BEVs generally outperform PHEVs and REEVs on CO_2 emissions (BEVs emit 2-3.5x less than REEVs and 2.5-4.5x less than PHEVs), cost (BEVs cost between €640 and €1,600 less per year than a PHEV), and efficiency (BEVs are 2-4x more efficient than PHEVs)[17]. **Questioning that BEV may not be a sustainable long-term solution adds ambiguity and may hit consumer confidence.**

- **Direct incentives favoring BEVs over PHEVs, REEVs, and ICEs, for both corporate fleets & private users.** Corporate tax incentives have proven effective in accelerating EV adoption among businesses, which account for around 60% of new car sales in Europe and play a key role in supplying the second-hand market. For example, in Belgium, companies can deduct 100% of BEV-related expenses from their taxable income since 2023, while ICE deductions are being phased out by 2028. This has helped push EV sales to 40% in 2024, well above the EU average of 15%. Nevertheless, these incentives schemes often lack cross-border consistency. To foster BEV adoption for private cars, we advocate for incentives that reduce the cost of public charging, if they are lasting in time. **Lowering cost of public charging, such as for households with limited access to private charging infrastructure at home or at work**, could be a key enabler, along with granting reduced public charging costs during the few years following the installation (as done in Spain from 2020 to 2025[18]). Maintaining a **robust level of e-credit incentives** for EV charging is also crucial. Finally, great emphasis is needed on **making the TCO more transparent to end-customers**. One approach could be to add fuel cost estimates into leasing offers, thereby illustrating the economic advantage of BEV vs. alternatives for end users.

- **Foster European supply chain for BEV production.** To stand out, Europe should differentiate its offer by establishing a strong value proposition for **electrified mobility "made in Europe**." Tools like the **battery passport** can reinforce transparency, sustainability, and ethical sourcing, building trust and industrial resilience. At the same time, **greater clarity for consumers** is needed, particularly regarding real life usage data for technologies like PHEVs or REEVs. **Improved labelling, real-world emissions disclosures, and educational efforts** can help debunk misconceptions and highlight benefits of BEVs under typical conditions. To smooth this transition as the auto industry shifts from combustion to electrification, **upskilling & reskilling programs for both white-collar and blue-collar workers** (e.g. the European Battery Academy or the Battery School) is essential to avoid job losses, close skill gaps, and ensure production systems adapt on pace.

[17] Based on 5-year Total Cost of Ownership in France for a Family car (D-segment) in 2025

[18] 3/2020, de 15 de enero, de la Comisión Nacional de los Mercados y la Competencia