

Automotive & Assembly Practice

Could extended-range EVs nudge more car buyers toward full electric?

Slowing battery-electric-vehicle sales growth reflects consumer price consciousness and range anxiety. Could extended-range EVs persuade more buyers of traditional cars to make the switch?

This article is a collaborative effort by Kevin Laczkowski and Patrick Hertzke, with Anna-Sophie Smith, Deston Barger, Madhumitha Aravanan, and Paul Hackert, representing views from McKinsey's Automotive & Assembly Practice and the McKinsey Center for Future Mobility.



As battery-electric-vehicle (BEV) sales growth in most markets has slowed, the automotive industry is weighing new methods to accelerate electrification momentum. In addition to plug-in hybrid electric vehicles (PHEV), extended-range electric vehicles (EREVs) have reemerged as one potential solution to assuage range anxiety and cost concerns among current owners of internal combustion engine (ICE), hybrid, and electric vehicles.

Many potential buyers of electric vehicles (EVs) are reluctant to pay a premium to purchase a BEV instead of an ICE vehicle. Alongside price, driving range is a top source of unease among car buyers. For car owners who live in apartments or in other types of homes that lack regular access to overnight charging, as well as for drivers planning long-distance trips, scant public charging can be a concern. And though most drivers have a daily commute of less than 50 miles, others have much longer commutes.¹

Given their inherent capacity to quell range anxiety and their strong sales momentum in China, EREVs have caught the attention of OEMs in Europe and the United States as one potential way to boost EV sales growth. EREVs were part of the first wave of electrification a decade ago, but they didn't take off, because innovation-driven early EV adopters were mostly only interested in pure BEVs.² EV buying has moved from early tech-savvy adopters to mainstream car buyers who are looking for a broader range of options.³ While EREVs are similar to PHEVs, they combine a small ICE-powered generator with an electric powertrain and can offer an electric-only driving range of 100 to 200 miles (versus a comparable PHEV's range of 20 to 40 miles) and a total range of 400 to 500 miles (see sidebar, "EREVs and PHEVs: How are they different?").⁴

Informed by McKinsey analysis and data from an October–November 2024 survey of car buyers in the United States and Europe, this article explores whether EREVs could attract more customers to electric driving than BEVs or PHEVs. It also examines

whether it could be worthwhile for OEMs to invest in a different powertrain technology in an environment where budgets are often tight and challenging regulatory deadlines are rapidly approaching.

EREVs appeal to car buyers in the United States and Europe, but consumer education is vital

McKinsey's late-2024 survey of more than 2,800 new-car buyers in the United States and 2,300 in Germany and the United Kingdom found that a sizable segment would consider an EREV for their next vehicle purchase if the option were available.⁵ What's more, two-thirds of these potential buyers noted an intent to purchase an ICE or hybrid vehicle in the absence of an EREV option. This indicates that EREVs could motivate more ICE vehicle owners to transition to electric driving (Exhibit 1).

Alongside price, the top reason cited by surveyed consumers for preferring ICE vehicles to EVs is what's commonly known as "range anxiety." This describes a general sense of unease related to the following: being unable to drive for as long or as far in an EV as in an ICE vehicle; lacking fast-charging stations with the frequency or convenience of traditional gas stations; needing to recharge too frequently; or running out of electric power before reaching a charging station.

Interest in EREVs was higher among owners of premium-brand vehicles than among mass-market-brand cars. There was also slightly higher interest in EREVs among current owners of larger cars and SUVs than among owners of smaller cars.

A key market segment that might embrace EREVs is EV owners who are considering switching back to an ICE because of frustration with inadequate charging availability and driving range in their current vehicles. In the 2024 McKinsey Mobility Consumer Pulse Survey, for example, 46 percent of US EV owners and 19 percent of European EV owners reported they were considering switching back to an ICE vehicle.⁶

¹ Alex Fitzpatrick and Alice Feng, "Americans' average daily travel distance, mapped," Axios, March 24, 2024.

² For example, see "BMW confirms i3 Range Extender (REx) model is to be discontinued," WhichEV, November 26, 2019.

³ "How European consumers perceive electric vehicles," McKinsey, August 5, 2024.

⁴ Driving ranges based on McKinsey analysis of vehicle specifications from OEM websites.

⁵ Based on data from McKinsey Center for Future Mobility (MCFM) Mobility Consumer Insights. German and UK data based on German and UK EREV Perception Survey, November 2024, n = 2,312; US data based on US EREV Perception Survey, October 2024, n = 2,843.

⁶ Based on data from the McKinsey Mobility Consumer Pulse Survey, February 2024, an online survey of 36,954 current mobility users in Australia, Brazil, China, France, Germany, Italy, Japan, Norway, and the United States.

EREVs and PHEVs: How are they different?

An extended-range electric vehicle (EREV) is a mix of battery-electric-vehicle (BEV) and internal combustion engine (ICE) technology. While the typical plug-in hybrid electric vehicle (PHEV) uses a parallel electric-motor and ICE powertrain configuration, an EREV uses a series configuration that includes a small ICE-powered generator that recharges the battery pack.

Typical PHEVs have smaller battery packs than either BEVs or EREVs. In a typical PHEV, an ICE functions as a mechanical drive after the battery pack's state of charge becomes low or if the driver needs extra power in electric mode. The average electric driving range for a PHEV is 20 to 40 miles, and once the PHEV's battery is drained, it functions as an ICE vehicle.

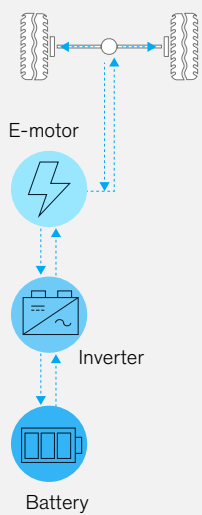
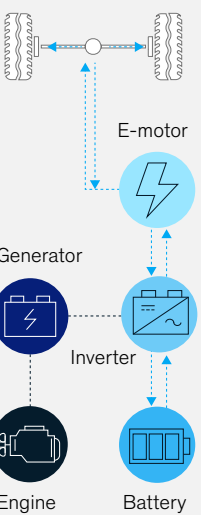
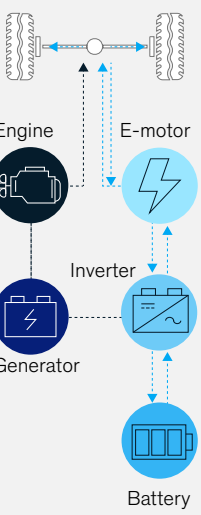
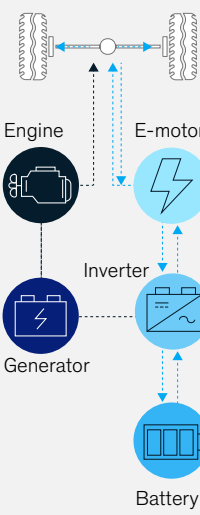
EREVs and PHEVs can both be charged at regular EV charging stations, home chargers, and fast-charging outlets, and their ICE engines can be refueled at traditional gas stations. But as their name suggests, EREVs can offer a longer electric driving range of 100–200 miles (exhibit).¹

¹ Driving ranges based on McKinsey analysis of vehicle specifications from OEM websites.

Exhibit

In an extended-range electric vehicle, a gas engine and generator extend driving range but are not connected directly to the drivetrain.

Electric vehicle (EV) and hybrid vehicle configurations and characteristics

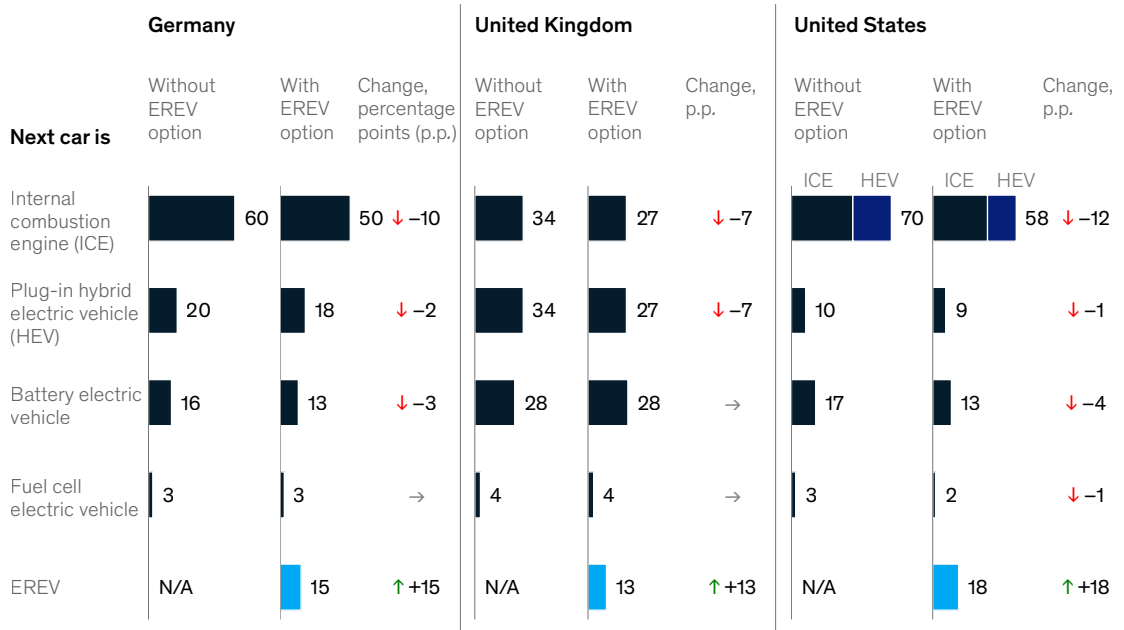
	Battery EV (BEV)	Extended-range EV (EREV)	Plug-in hybrid EV (PHEV)	Hybrid vehicle
Powertrain	Electric motor (e-motor)	E-motor	E-motor (primary) and internal combustion engine (ICE)	ICE and e-motor
Refueling or recharging source	Electricity only 	Electricity and gasoline 	Electricity and gasoline 	Gasoline only 
Emissions	Zero emissions	Zero emissions in electric mode	Zero to low emissions in electric mode; moderate emissions in hybrid mode	Reduced emissions
System structure				

Source: McKinsey analysis of vehicle specifications from OEM websites

Exhibit 1

An extended-range electric vehicle option appealed to a significant segment of surveyed car buyers, even those disinclined to purchase electric vehicles.

Consideration of potential extended-range electric vehicle (EREV) option,¹
share of respondents who own a car today, %



Note: Figures may not sum to 100%, because of rounding.

¹Stated intent based on consumer survey responses.

Source: McKinsey Center for Future Mobility, Mobility Consumer Insights—German and UK data based on German and UK EREV Perception Survey, November 2024, n = 2,312, and US data based on US EREV Perception Survey, October 2024, n = 2,843

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Despite EREVs' apparent appeal to a variety of car buyers, consumer education that clearly conveys the benefits of EREVs and generally demystifies the distinctions between all EV and hybrid-vehicle options is vital. Consumers have difficulty understanding how EREVs differ from PHEVs, BEVs, or other hybrid vehicles.

Consumers in the United States appear to find the distinctions between different EV and hybrid powertrains especially perplexing. Among US car buyers included in McKinsey's survey sample, nearly half (48 percent) agreed with the statement "I'm overwhelmed by the number of powertrains (currently available) to choose from."⁷

⁷ Based on data from MCFM Mobility Consumer Insights, US EREV Perception Survey, October 2024, n = 2,843.

EREV offerings in the global market are scant but growing

Currently, there are few EREVs in the global market. In the United States, EREVs in the SUV and truck segment have been announced, including the 2025 Ram 1500 Ramcharger, which reports a 145-mile pure electric and a 690-mile total driving range.⁸ In China, Li Auto has introduced several EREVs, including its L9, which reports a 134-mile electric range and an 817-mile total range.⁹ And AITO's M9 reports a 140- to 170-mile electric and 840- to 871-mile total range.¹⁰ VW-backed Scout Motors has also announced several EREV models that, according to the company, have received considerably more deposits than their Terra and Traveler BEVs.¹¹

An electric range of 100–200 miles would meet most drivers' daily commuting needs, while a total range of 350–600 miles could eliminate range anxiety. This may indicate a sweet spot for the EREV market (Exhibit 2).

The United States' regulatory environment may make it the most favorable market for EREVs

Going forward, there may be significant opportunities for EREV sales in the United States—and in the European Union, despite quickly approaching deadlines for zero-emission vehicles to account for all new-vehicle sales there by 2035.

The zero-emissions vehicle deadline under current EU regulations means EREVs could be sold in the region through 2034. OEMs will need to consider their narrow window of opportunity in the EU and potential development timelines to determine whether consumer demand will generate enough profit to warrant investment in EREV powertrains. Notably,

EREV powertrains may be a more future-proof option for OEMs than PHEV powertrains because they combine a BEV platform with a small ICE-powered generator that is not connected to the drivetrain.

Unlike the European Union, the United States has no zero-emissions requirement in place for new-car sales. At the federal level, Environmental Protection Agency standards tie compliance bonuses to electric driving ranges, which indicates a potential advantage for EREVs over PHEVs.¹² For example, an EREV with a range of at least 70 miles could receive a 65 percent bonus in compliance standards, while a PHEV with a 25-mile range could receive a 30 percent bonus.¹³ The California Air Resources Board's Advanced Clean Cars II rule does mandate 100 percent electrification in new cars sold by 2035, but one-fifth of those vehicles could be PHEVs or EREVs, and manufacturers could receive full credit for each vehicle with an electric range of at least 70 miles.¹⁴

Thus, in terms of regulatory requirements, new opportunities for EREVs may be greatest in the United States market.

EREVs might provide a cost-competitive alternative to BEVs and ICE vehicles

If focused on providing an electric range of 150 miles, EREV combined powertrain costs could be as much as \$6,000 lower than BEV powertrain costs.¹⁵ However, the gap between BEV and EREV production costs will likely narrow as battery costs decrease. The production costs for EREVs are expected to fall between those for similar-sized BEVs and ICE vehicles. In a McKinsey modeled scenario, an EREV pickup truck with a 150-mile electric range and a total range of 500 miles or more could be

⁸ "Ram 1500 Ramcharger," Ram, accessed November 26, 2024; Austin Irwin, "2025 Ram 1500 Ramcharger hybrid," *Car and Driver*, 2025.

⁹ Jill Shen, "Li Auto announces new SUV L9 with competitive pricing," Technode, June 22, 2022; "Li Auto Inc. unveils Li L9, its flagship smart SUV," Li Auto, June 21, 2022.

¹⁰ Phate Zhang, "Huawei-backed Aito launches 5-seat variant of M9 to further tap luxury SUV market," CnEVPost, September 10, 2024; "Products: AITO M9," TopEV, accessed January 27, 2025.

¹¹ Michael Wayland, "VW's Scout has more than 50,000 reservations for upcoming EVs as automaker aims to grow U.S. share," CNBC, updated January 8, 2025.

¹² *Multi-pollutant emissions standards for model years 2027 and later light-duty and medium-duty vehicles*, US Environmental Protection Agency, March 2024.

¹³ *Multi-pollutant emissions standards for model years 2027 and later light-duty and medium-duty vehicles*, US Environmental Protection Agency, March 2024.

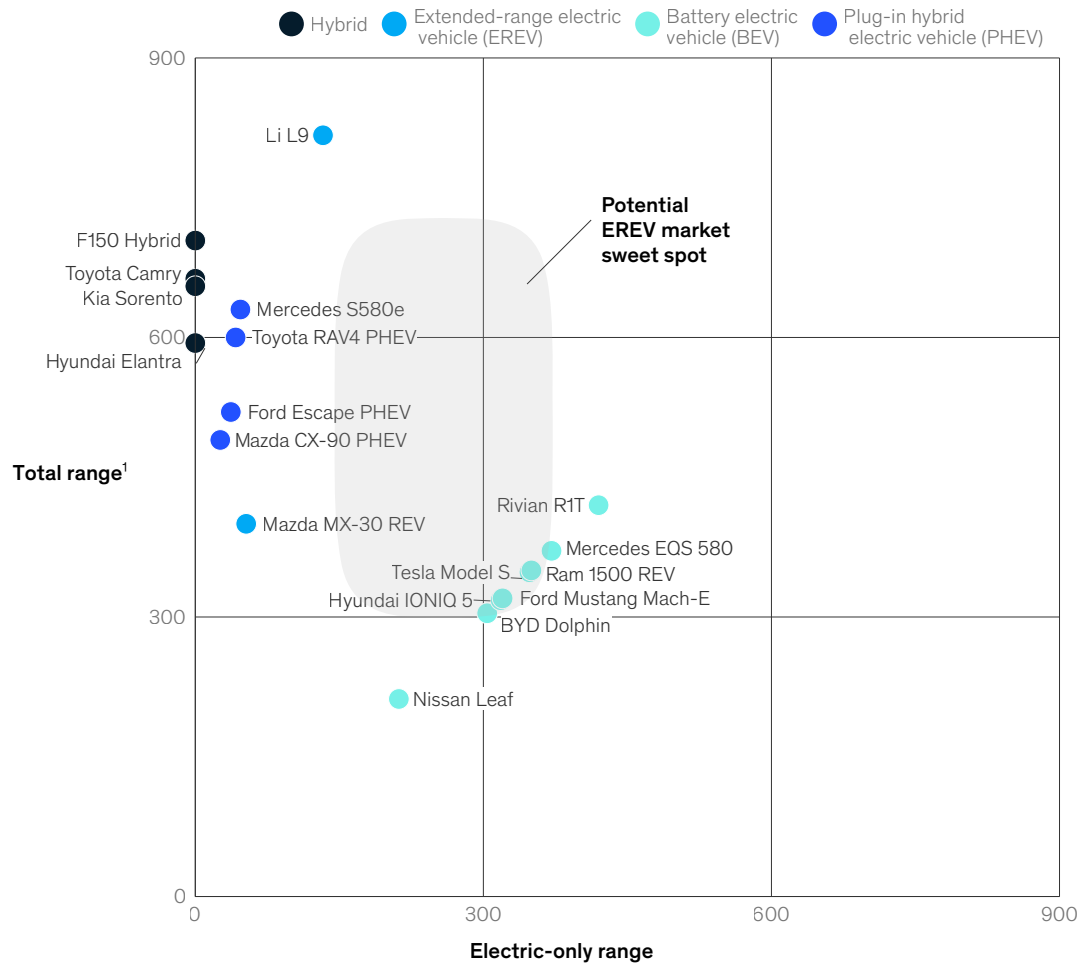
¹⁴ Anh Bui, Dale Hall, and Stephanie Searle, *Advanced Clean Cars II: The next phase of California's zero-emission vehicle and low-emission vehicle regulations*, International Council on Clean Transportation, November 2022.

¹⁵ Based on a modeled comparison between a 68 kWh EREV variant and a 18 kWh variant with NMC battery pack. Does not include Inflation Reduction Act subsidies.

Exhibit 2

A 100- to 200-mile electric range could meet most commuters' needs—a potential sweet spot in the extended-range electric vehicle market.

Total driving range versus electric-only range, miles



¹Scout Motors announced an EREV with an up to 500-mile total range in 2024, but it did not specify the electric range.

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designed using a 68 kilowatt-hour (kWh) lithium nickel manganese cobalt oxide (NMC) battery pack; a comparable BEV would need a 228 kWh battery pack to deliver a 500-mile range. In this scenario, an EREV powertrain could cost 30 to 40 percent less to produce than a BEV powertrain (Exhibit 3).

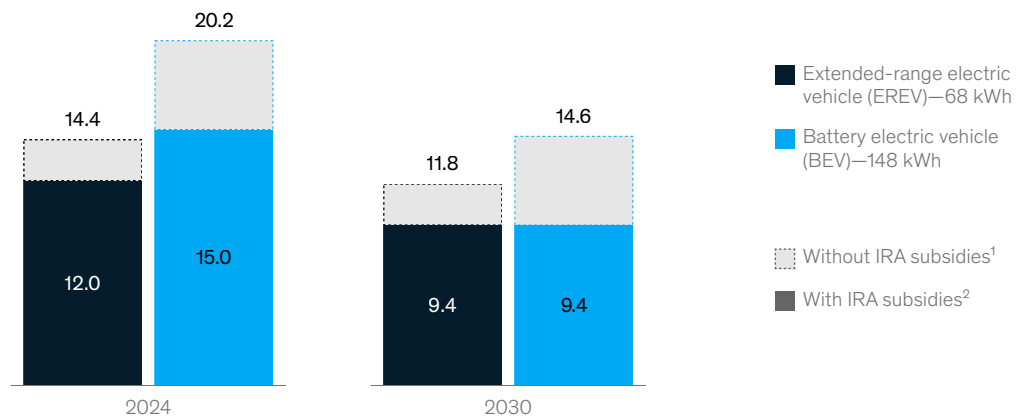
If OEMs are able to achieve lower production costs and provide EREV price points attractive to ICE-inclined and BEV-resistant car buyers, EREVs could

represent a significant opportunity to revitalize EV sales growth. But OEMs should carefully consider the decision to invest in an EREV platform in light of increased portfolio complexity. If an EREV yields an average cost savings of \$3,000 over time, two-thirds of which is passed on to the consumer, then an OEM would need to sell at least one million units, provided an EREV platform would cost around \$1 billion to develop.

Exhibit 3

Average production costs for extended-range electric vehicles are lower than for battery electric vehicles, but that may change as battery costs decrease.

Battery pack, engine, and generator costs for a pickup, \$ thousands



	EREV	BEV
Battery capacity, kWh	68	148
Engine, liters	3.6	N/A
Targeted best-in-class driving range, miles	500 ³	350

Note: Figures are as of September 23, 2024.
¹For battery packs manufactured in North America, American OEMs can receive subsidies of \$35/kWh under Section 45X of the Inflation Reduction Act of 2022 (IRA).
²Without subsidies, the 2024 lithium-ion nickel magnesium cobalt battery cost is \$115/kWh, and the 2030 cost is expected to be ~\$80/kWh as of October 2024.
³Electric-only range of the EREV is expected to be 150 miles.

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EREVs could help smooth the transition from ICE vehicles to BEVs by serving as a bridge technology for consumers while charging infrastructure is improved and expanded and BEVs become more mainstream and cost-competitive in the global marketplace. Car buyers hesitant to purchase EVs could welcome EREVs as an option, provided

manufacturers can make the technology accessible and clearly distinguish EREVs from PHEVs, other hybrid vehicles, and BEVs, particularly in the US market. For OEMs to benefit from adding EREV powertrain technology, achieving an expeditious time to market is critical, alongside careful planning and oversight for additional development costs and more-complex supply chains and production.

Kevin Laczkowski is a senior partner in McKinsey's Chicago office, and **Patrick Hertzke** is a partner in the London office. **Anna-Sophie Smith** is an asset leader in the Munich office, **Deston Barger** is a solution associate in the Boston office, and **Madhumitha Aravanan** is an asset leader in the Detroit office, where **Paul Hackert** is a senior expert.

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