An on-ramp to sustainable mobility

Accelerating the shift to electric vehicles

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Key takeaways

The automotive industry is advancing sustainable mobility by accelerating its transition to electric vehicles.

- **50% of consumers expect to own an EV within the next three years.**

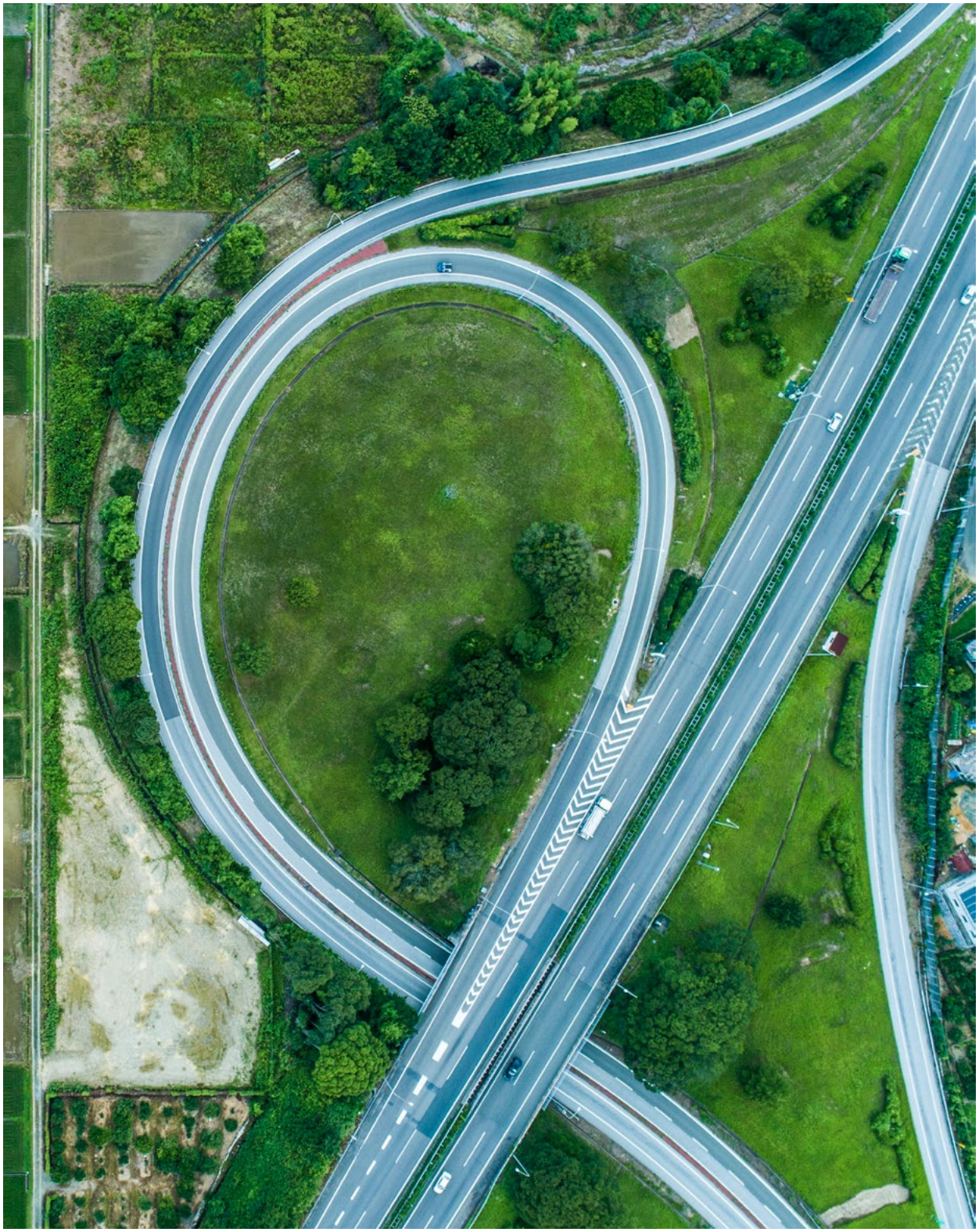
  But they continue to be concerned about the cost and lack of an adequate charging infrastructure.

- **By 2030, auto industry executives estimate corporate spending on EVs will increase 61% and the EV sales share will be 40%.**

  They project that their organizations will no longer sell traditional internal combustion engine (ICE) cars after 2041, cutting spending on those cars in half by 2030.

- **Less than 30% of traditional OEM executives consider vehicle IT systems, including EV platforms, to be core EV capabilities.**

  Only around 40% consider batteries as their core business, but redefined operational models across the automotive value chain appear to be a work-in-progress.



In the headlights: The electric vehicle imperative

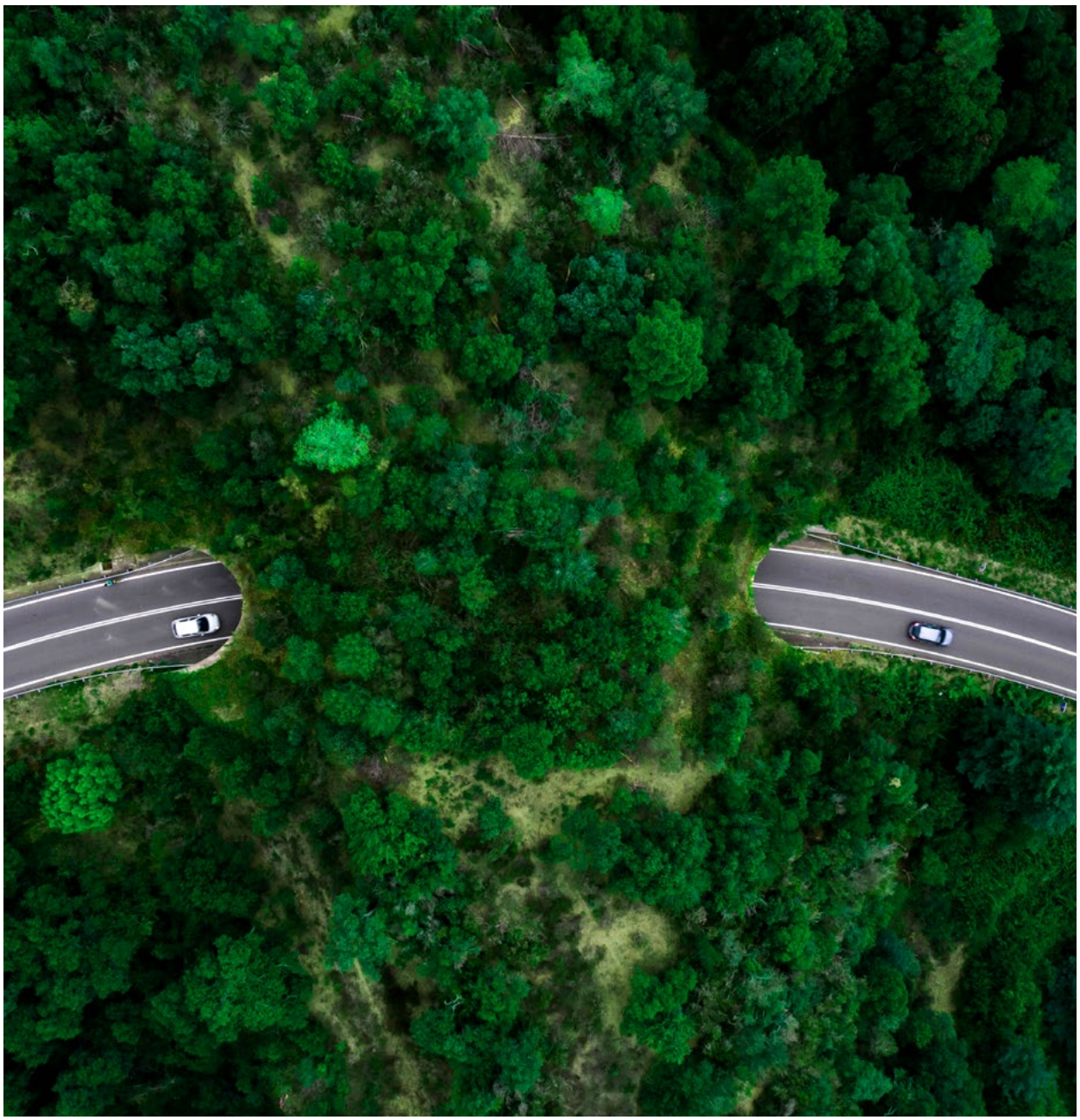
Electric vehicle (EV) sales have been surging in major markets since 2020. While still a small percentage of overall passenger vehicle sales, EV sales doubled from 2020 to 2021 to a 9% share, with that share growing another 4% from 2021 to 2022.[1] Advances in battery technologies—which help reduce vehicle costs and improve travel ranges—combined with more model choices and purchase incentives are making EVs much more enticing to consumers.

But is the upward trajectory enough to answer the urgent calls to slash greenhouse gas (GHG) emissions? Global climate scientists are sounding the alarm: current national plans are falling short of 2050 net-zero emissions targets established in the Paris Climate Accords.[2] With the transportation sector contributing almost one-quarter (23%) of global CO2 emissions—road transport making up 75% of those—the automotive industry is under pressure to get more EVs on the road.[3] Not surprisingly, sustainability weighs heavily on the minds of automotive original equipment manufacturer (OEM) CEOs, ranking as their greatest challenge over the next two to three years.[4]

Over the lifetime of an electric car, total GHG emissions are typically lower than those of a gasoline car, with the amount depending on the source of the electricity powering the vehicle.[5] Consequently, as governments pin their hopes on vehicle electrification to reduce a significant portion of GHG emissions, they have set aggressive goals for automakers to grow EV sales.[6] The US aspires for EVs to comprise 50% of sales by 2030, and China, Japan, the EU, and the UK are aiming for 100% by 2035.[7]

But society has contemplated embracing EVs intermittently for decades, sparked by the high gas prices of the 1970s and then again by heightened environmental awareness in the 1990s.[8] Following the introduction of more successful brands such as Tesla in the early 2000s, consumer interest piqued once more. Still, as the IBV explored in a 2011 report about the shift to EVs, high purchase prices, little to no charging infrastructure, and simple lack of consumer education were preventing the movement from taking off.[9] Have pressing climate concerns and encouraging technological innovations created the moment when EVs will be universally adopted?

To see if the auto industry and consumers are truly intent on making the full pivot to EVs, the IBM Institute for Business Value (IBV) interviewed 1,501 executives from nine countries. We also surveyed 12,663 consumers from seven countries to understand their readiness to accept EVs. Our results found consumers are indeed willing but wary about the persistent cost and charging issues that have plagued the EV market since its inception. And executives also appear committed—but not entirely confident.



The shift to EVs is real this time, but challenges remain

Based on our survey responses, it appears the transition to EVs has gathered enough speed to carry it forward as part of a future of sustainable mobility. 50% of consumers who drive expect to own an EV within the next three years, with ownership plans varying widely by country—the US and Japan lagging China and India significantly. And auto industry executives say that EVs are taking a more prominent position within corporate strategies, with only 4 out of 1,501 respondents stating that EV is not a strategic focus today.

But more significantly, executives project their spending on EVs will surpass their allocations to ICE vehicles within the next few years (see Figure 1). By 2030, they expect to be spending 61% more on EVs than they do now, and ICE allocations will be cut in half. Perhaps even more striking, none of the executives expect to sell ICE vehicles after 2041, with 62% expecting ICE sales to phase out around 2035 (see Figure 2).

Yet, despite their strategic and spending priorities, only 44% of automotive executives expect to achieve the industry's ambitious 2030 EV sales goals, which range mostly from 50% to 80% of total sales in Europe, the US, and China.[10] Why might they be uncertain? EVs mark a significant transition for automakers, requiring entirely new designs, components, skills, partnerships, and processes as well as a renewed focus on what is most important to consumers. And herein lie the challenges.

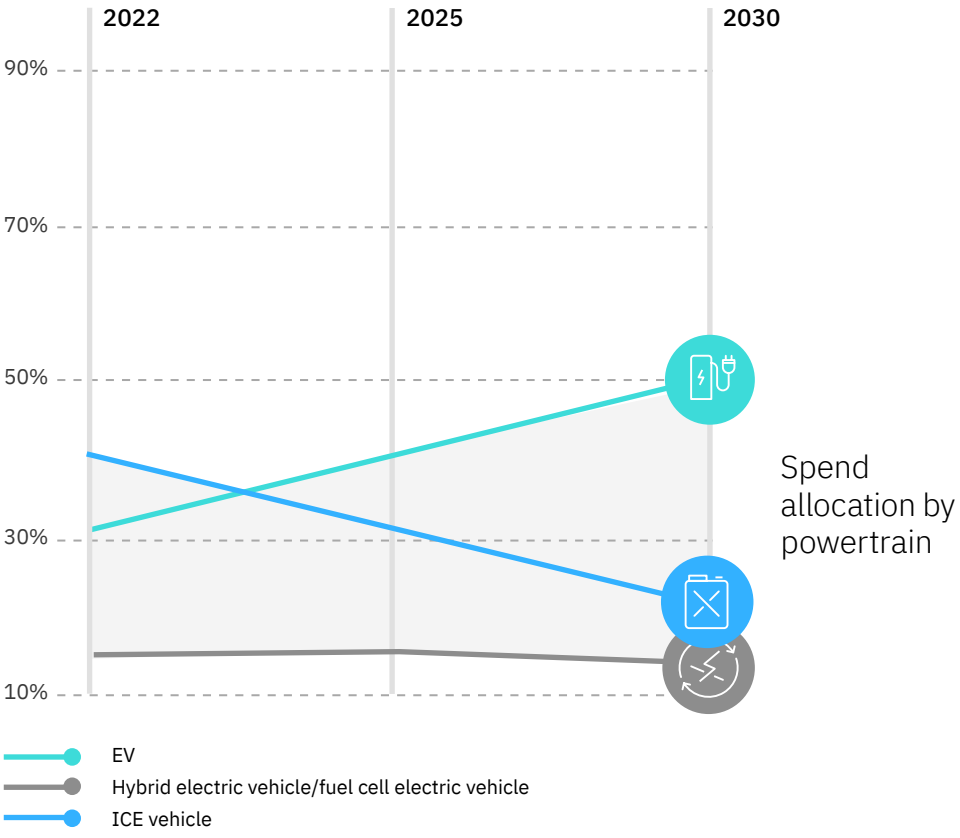
Our survey surfaced several speed bumps that need attention to maintain the momentum of the industry's EV transformation:

- A disconnect between consumer expectations and executive perceptions as OEMs define how to price and sell EVs
- The need for stronger ecosystem collaboration to support the charging infrastructure and battery lifecycle needed for widespread—and eventually universal—adoption of EVs
- Continued evaluation as to which new operational competencies OEMs should strengthen and keep in house versus those they should outsource or develop in partnership with external parties.

Leaders must take decisive action for operational alignment to smooth the road for the full transition to EVs. Those who leverage advanced technologies and build robust ecosystems will be better positioned to meet the speed of change needed to deliver on global net-zero emissions goals and seize a competitive market edge.

FIGURE 1

Automakers are committed to the EV transition, shifting spending allocations from ICE vehicles to EVs.

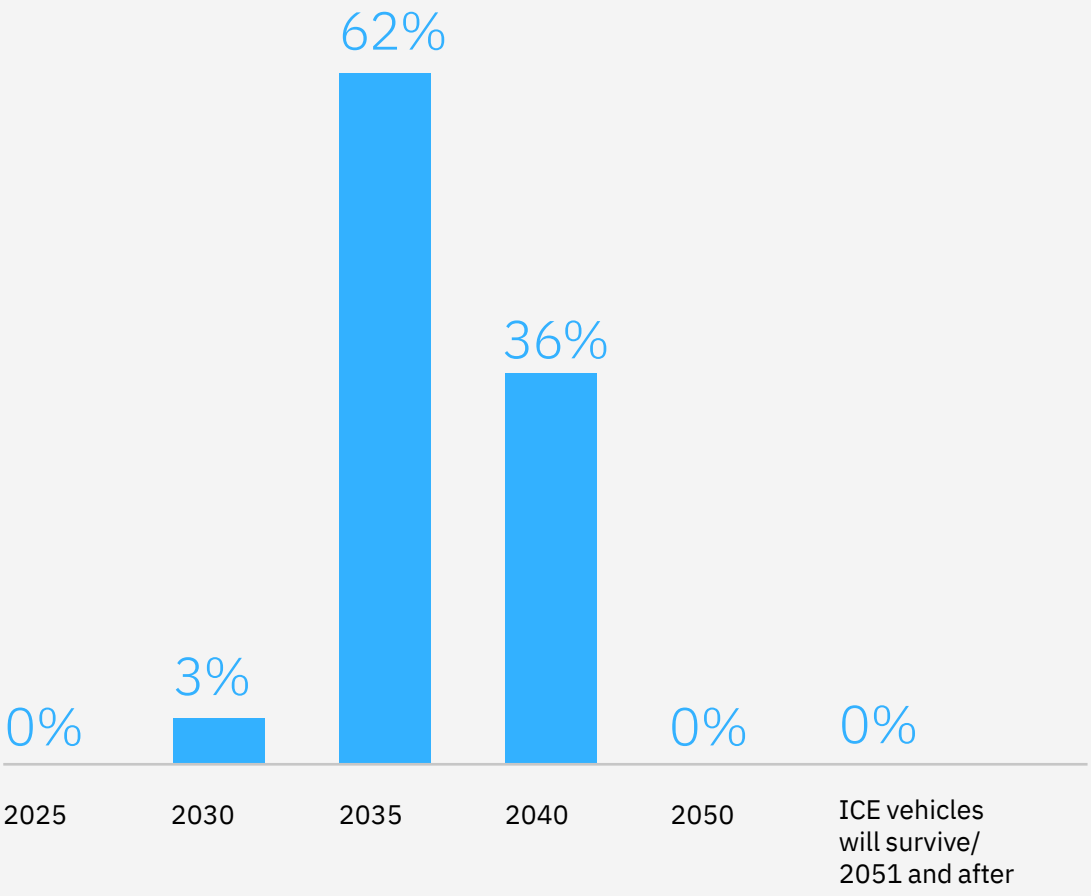


Q. Percent of your global spend aligned to the following powertrain programs in 2022, 2025, and 2030.

FIGURE 2

Executives expect the availability of ICE vehicles to end after 2041.

Projections of when ICE vehicles and related product sales will phase out



Note: Excluding 13% of respondents who do not offer ICE products/services currently.
Q. By when do you expect ICE (cars/components/services) will no longer be available from your global organization?

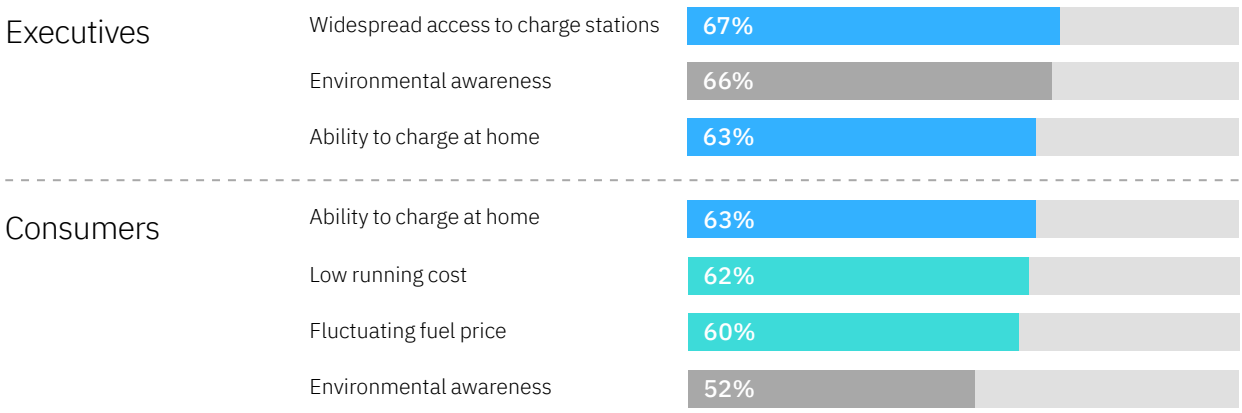
Roadblocks to remove for continued EV growth

The disconnect between consumer wants and executive perceptions

As automotive executives define revenue models for the EV market, it's important that they understand what consumers want in terms of price and features. We asked both groups about the factors that influence the decision to purchase an electric vehicle and found a sharp difference. While consumers chose more cost factors, executives expect charging issues and concern about the environment to be the consumer's primary considerations (see Figure 3).

FIGURE 3

Executive and consumer views differ on factors influencing EV purchases.



Executive Q. Select the factor most important to customers' decision to obtain an EV.
Consumer Q. Choose the extent that each factor influences your decision to obtain a BEV; percentages represent those who selected 5 (to a very large extent) and 4 (to a large extent).

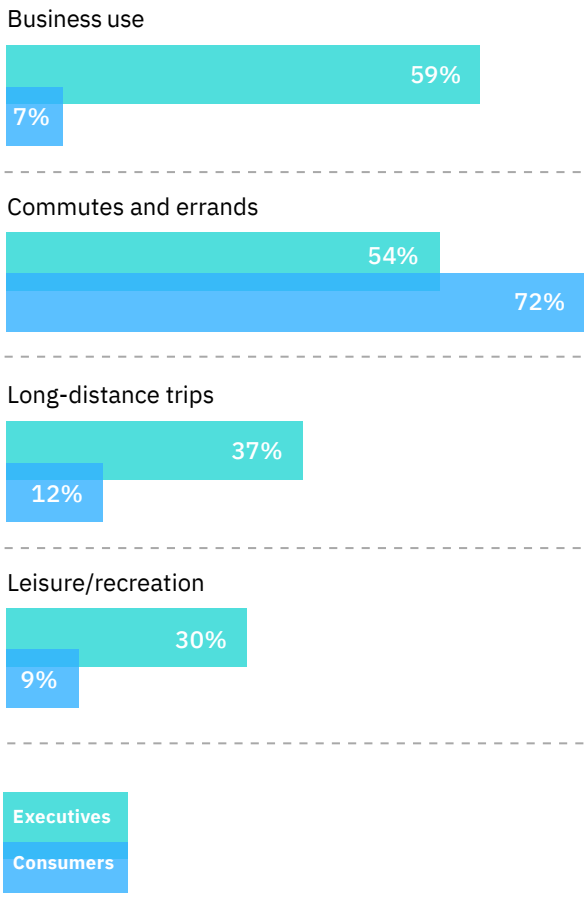
The purchase price of the EV is critical to consumers, named as the top criterion when choosing an EV—and more important than battery range. But again, executive perceptions and consumer expectations don't line up. Executives project consumers are willing to pay a price premium of 5%-8% on the initial purchase of an EV. Survey results indicate consumer interest tapers off around $60,000, which based on IBV analysis, is a current price premium of 16% in the US. Despite the industry's constant efforts to reduce EV prices, a clear gap still exists.

A more interesting dichotomy exists between executives and consumers around EV total cost of ownership (TCO). Assuming a five-year ownership period, executives say they expect consumers will pay an 18% premium over the life of ownership, but more than half of global consumers (52%) expect the TCO to be equal to or lower than for a conventional car. Based on IBV analysis, EVs have a clear advantage with energy costs, but a major contributing factor to EV TCO is depreciation cost, resulting from battery deterioration over time. In addition, the factors that play into TCO may not always be clear to consumers. For example, in the US in 2023, some EVs will be eligible for tax breaks while others will not.[11]

Looking at expected usage of EVs, again, executives and consumers aren't on the same page. Executives expect EV ownership to be almost evenly divided between corporate fleets (53%) and personally owned vehicles (47%). For the personally owned EVs, they envision new usage patterns as EVs go mainstream, but consumers don't yet have this same view of the future (see Figure 4). Executives anticipate business uses, such as ride-sharing services, deliveries, home repair services, sales, and real estate, will be the top ways customers will use personally owned vehicles, but consumers overwhelmingly chose commutes and errands.

FIGURE 4

Executives envision new uses for personally owned EVs as they go mainstream.



Note: Executives chose the top two uses; consumers chose one use.
Executive Q. Choose the primary uses of privately owned EVs in your country.
Consumer Q. What will be the main use of BEV?

The continuing charging infrastructure challenge

An Achilles heel for vehicle electrification has long been the lack of an adequate charging infrastructure. The International Energy Agency (IEA) notes that this issue is even more pronounced in developing and emerging countries.[12] Reducing carbon emissions through EVs requires a systemic view that includes the battery value chain to the charging infrastructure.

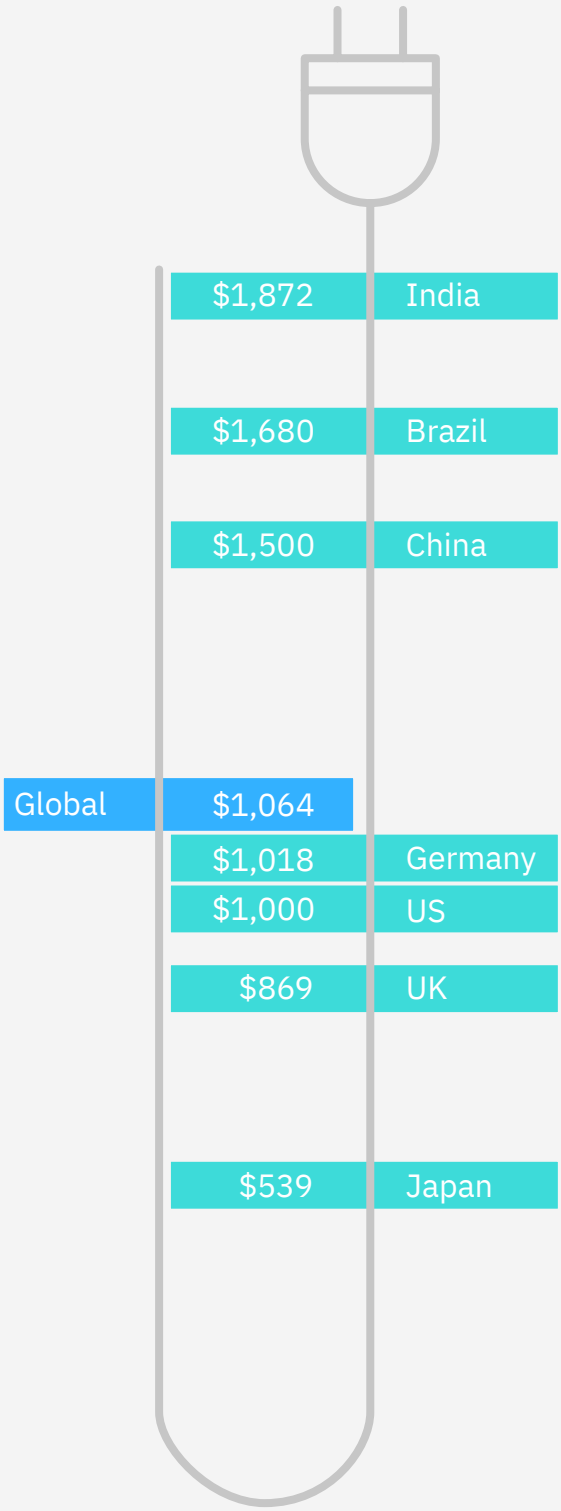
Our survey confirms charging issues are still primary blockers to EV adoption. More than half (57%) of consumers are concerned about the lack of public charging stations, and 51% cite the difficulty of installing an at-home charging station.

Just over half (53%) expect home charging stations to be their main method of charging, so the up-front installation costs may also be a deterrent. US consumers told us they are prepared to spend slightly more than $1,000 (see Figure 5).[13] UK and Japanese consumers have tighter budgets—less than $900—while those in India, China, and Brazil are more willing to open their wallets, saying they would spend over $1,500 for installation.

More than half of consumers are concerned about the difficulty of installing an at-home charging station.

FIGURE 5

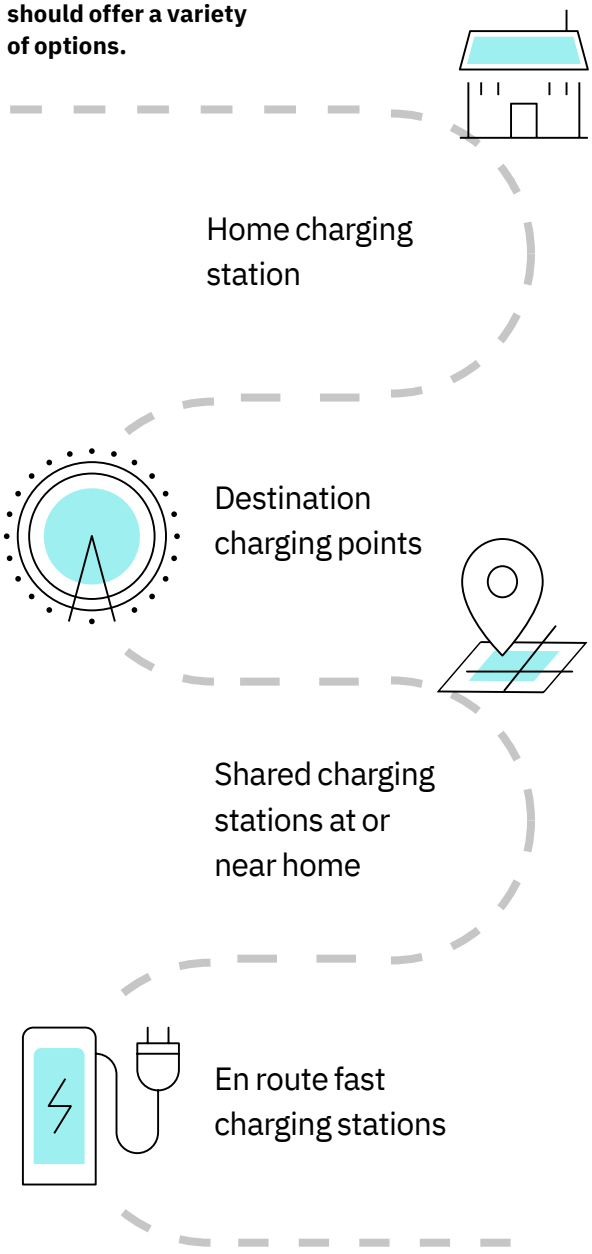
Consumer expectations for the cost of installing at-home charging equipment vary by country.



Source: Based on IBV analysis of consumer responses.

FIGURE 6

With only half of consumers planning to charge at home, the charging infrastructure should offer a variety of options.



Of course, not everyone has the option or capacity to install an at-home charging station, for example, those renting, living in multifamily dwellings, or without a dedicated parking space. Plus, current EV users report driving twice as many miles per day as conventional vehicle owners and taking long-distance trips five times more often, so they need places to charge. Only half of consumer respondents expect home charging stations to be their primary charging method, so destination charging points (such as work, shopping, and travel destinations), shared charging stations near homes, and en route fast charging stations are needed as EV adoption goes mainstream (see Figure 6).

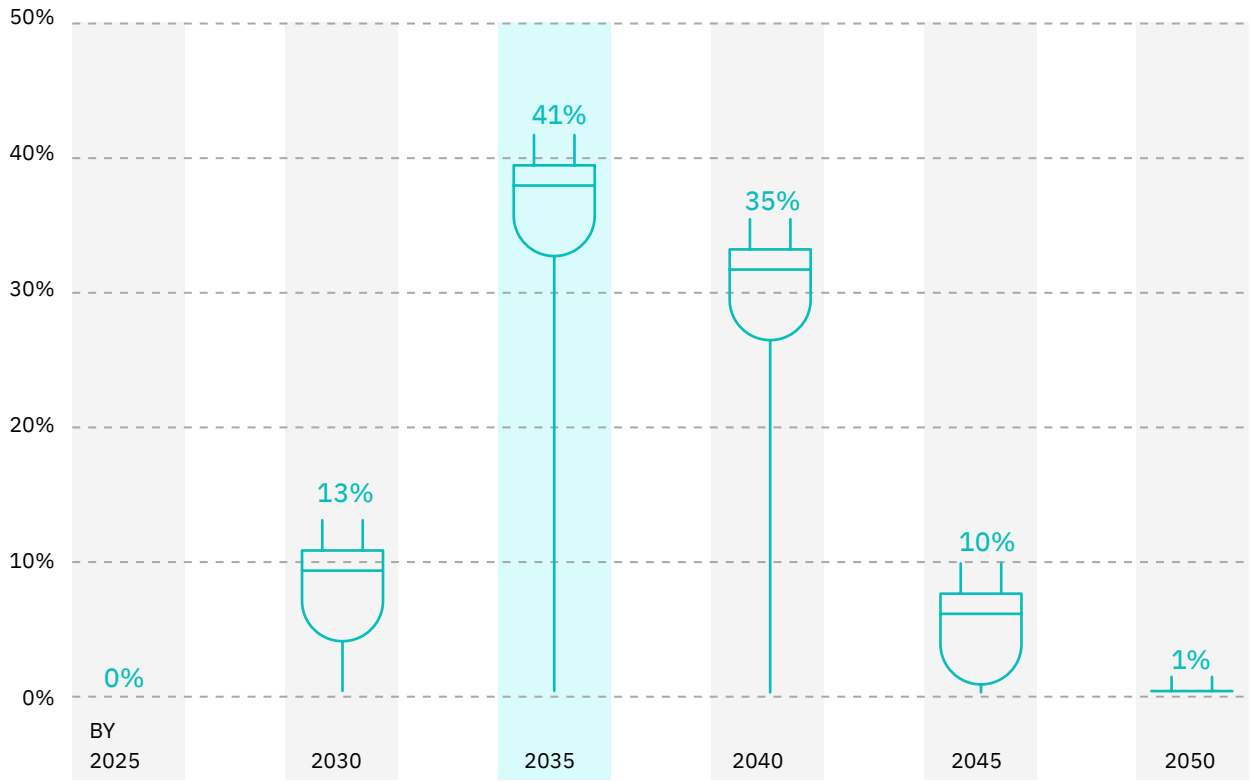
But recognizing the substantial effort needed to build the EV charging infrastructure, executives don't foresee adequate availability of these various charging methods in the immediate future. Not until 2040 do 89% of respondents anticipate their countries will be ready to support the EV fleet. This does not align well with their global EV sales share projections of 40% in 2030; only 13% expect enough charging stations to be available by then (see Figure 7).

In addition to the infrastructure, the battery range factors into the charging equation. IBV analysis determined that most consumers want more than 300 miles of EV range, but the median range in the US in 2021 was 234 miles.[14] The industry has made good progress on improving battery performance and energy density, resulting in increased ranges. However, other battery issues remain.

Battery performance deteriorates over time, so as the number and speed of charges increase, this affects battery ranges as well as the residual value of EVs. Safety problems such as thermal events are concerning. And the environmental impacts of sourcing raw materials, emissions during manufacturing, and recycling used batteries need to be addressed. However, the chemistry behind how batteries work is extremely complex, requiring detailed models of molecular interactions that exceed the limits of classical computing. Some companies are looking to quantum computing to help test these new chemistries, with the hopes of identifying less expensive, more abundant materials that can be used to produce more environmentally friendly, high-performing batteries (see case study "Quantum powers battery materials and energy grid research").

FIGURE 7

Executives anticipate the EV charging infrastructure will be widely available between 2035 and 2040.



Anticipated readiness of EV charging infrastructure

Q. When do you expect your country to have adequate charging infrastructure to overcome consumer concerns?

Case studies

Quantum powers battery materials research

Today's EV batteries primarily use critical earth minerals such as lithium, cobalt, and nickel. But material shortages could become another barrier to meeting the goals for zero-emission vehicles. Following years of incremental progress in battery technology, researchers are turning to quantum computing to supercharge the identification of alternative materials, helping accelerate EV production while keeping them affordable. Quantum computing overcomes the time limitations of classical computing in materials simulation—helping researchers avoid laborious and costly experimental methods.

Quantum simulations can be used to more realistically simulate materials and their interactions with device operation, manufacturing processes, and the operating conditions, enabling productive experimentation on the computer and less lab research and manufacturing development.[15]

Manufacturers have joined the IBM Quantum Network as they look to this powerful technology to fuel their battery research:

- Mitsubishi Chemical is pursuing the promise of lithium-oxygen batteries, which on paper appear to be substantially lighter and to last longer on a single charge. The researchers seek to better understand lithium-oxygen's potential as an energy source by using new algorithms that take advantage of quantum computing.[16]
- Engineers at Mercedes-Benz expect the next great leap in battery technology to come from the lithium-sulfur battery. They plan to use quantum to simulate the multitudes of molecular properties and behaviors that go into the research before building physical prototypes.[17]

Responding to operating model impacts

Automakers are facing the most consequential change in automotive history. They are pivoting to electronics-heavy products controlled by software that supports differentiating features such as over-the-air updates, in-vehicle entertainment, gaming, and even autonomous driving. The mechanics of a vehicle take a back seat to the massive amounts of programming now required. Goldman Sachs estimated that by 2025, each car could require 650 million lines of code—a completely different level of complexity when compared to a smartphone operating system or even a fighter aircraft that has an average of 20-40 million lines of code.[18]

Looking at EVs more specifically, the manufacturing shift is equally dramatic in that they require different parts than ICE vehicles. For example, EVs don't need engines, intake systems, fuel systems, and traditional transmissions. Instead, they use electric motors and bigger batteries.

Industry executives observe that the implications from this EV transformation stretch across the automotive value chain. From design and development, to manufacturing, to sales models and aftersales, they are assessing impacts and evaluating new operational challenges (see Figure 8).

FIGURE 8

The shift to EVs impacts the entire auto manufacturing value chain.

Top 3	
Impacted operations	**Operations challenges**
Component development	Manufacturing
Model development	Aftersales
Production engineering	Component development

Q. Extent that shift to EV will require your organization to make changes in the phase of the value chain; Which value chain phases will EV-related changes present the greatest challenge to your organization? Areas listed reflect the choices of executives who responded 5 (to a significant extent) and 4 (to a great extent).

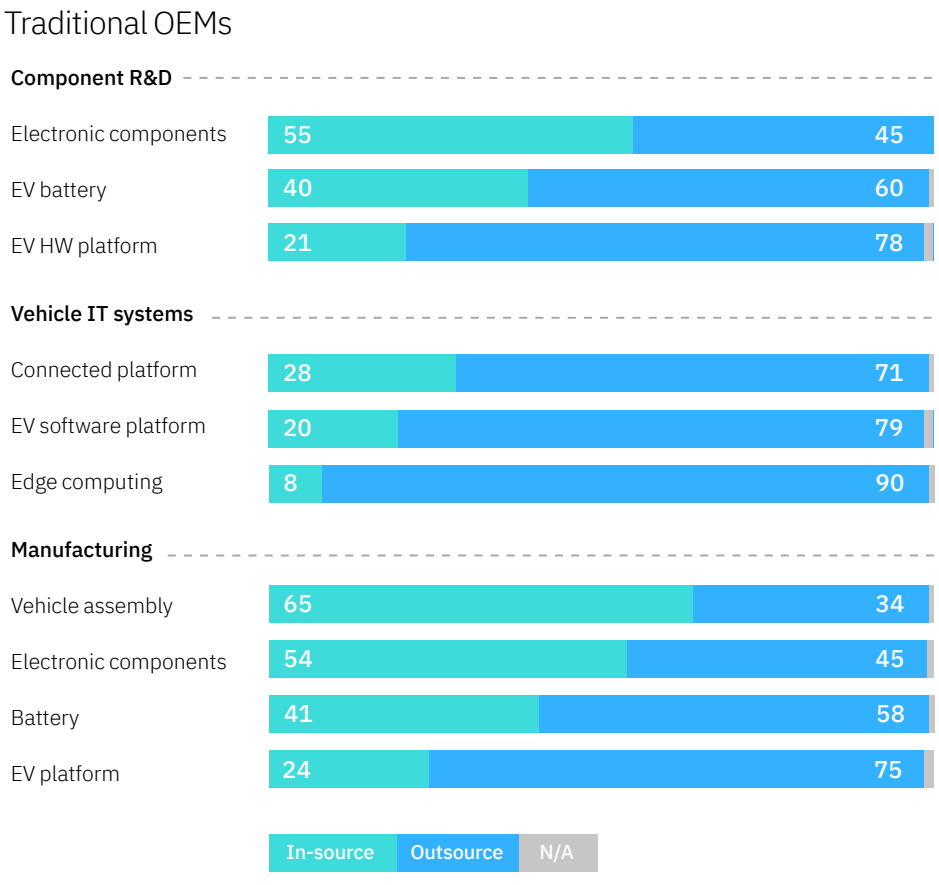
For decades, automakers and their suppliers have known their strengths. They've been clear on their core competencies, and they've built vertical supply chain bases to support their operations. But at this critical juncture in their history, they are facing a future filled with fresh demands for software, hardware, and electric components. To accelerate the transition to EVs, executives require a high-resolution target operating model in each operational area across the value chain, enabling them to adapt to everything new: products, manufacturing processes, and sales and service models. Then they can define a practical roadmap to get there.

As part of this process, they need to define the core competencies that should be kept in-house versus the areas where they require external parties' expertise through either outsourcing or partnering. Based on responses, it appears strategic decisions around operational models are still a work-in-progress.

Perhaps most surprising are executives' current views on vehicle IT systems (see Figure 9). While most EV components are controlled by software versus mechanical parts, less than 30% of automakers position software and other vehicle IT capabilities as core. These are areas where they could differentiate their products, but it is not clear whether they will continue to see them as non-core or if they will begin to build these capabilities in-house.

FIGURE 9

Executives' core competency choices are influenced by financial factors and lack of skills or technology.



Q. Components/functions that you expect to retain in-house versus outsource to business partners/third parties.

Most executives also say EV hardware and software platforms are not core competencies. Although a few companies are announcing EV platforms, many carmakers may envision sourcing those capabilities from external partners and distinguishing themselves through features and applications that run on top of the platforms.[19]

Automakers, for now, seem to be staying mostly in their comfort zone. Survey results show vehicle integration and assembly continue to be core competencies, and electric components are emerging as new core capabilities. Also of interest, despite headlines of new battery factory announcements by OEMs, only 40% of traditional OEM executives position battery R&D and manufacturing as parts of their core business.[20] But this is a fluid situation, and because battery production requires significant investments, strategies may vary widely among companies.

Traditional OEMs indicate the decision to keep a function in-house is guided primarily by financial factors, as some of these new capabilities—such as battery production—require substantial investments, while the decision to outsource is driven by lack of skills or technology.

EV adoption is also expected to drive changes in sales and ownership models. Nearly half of executives (48%) say fully online sales and financing will be the most important sales model and 46% cite traditional dealer sales. But with the EV market leader, Tesla, selling directly to consumers and eliminating the role of dealer franchises, executives are evaluating other sales channels, including third-party car buying services and direct selling. The evolution of sales models may take different paths based on each company's strategy and the regional context in which they operate.

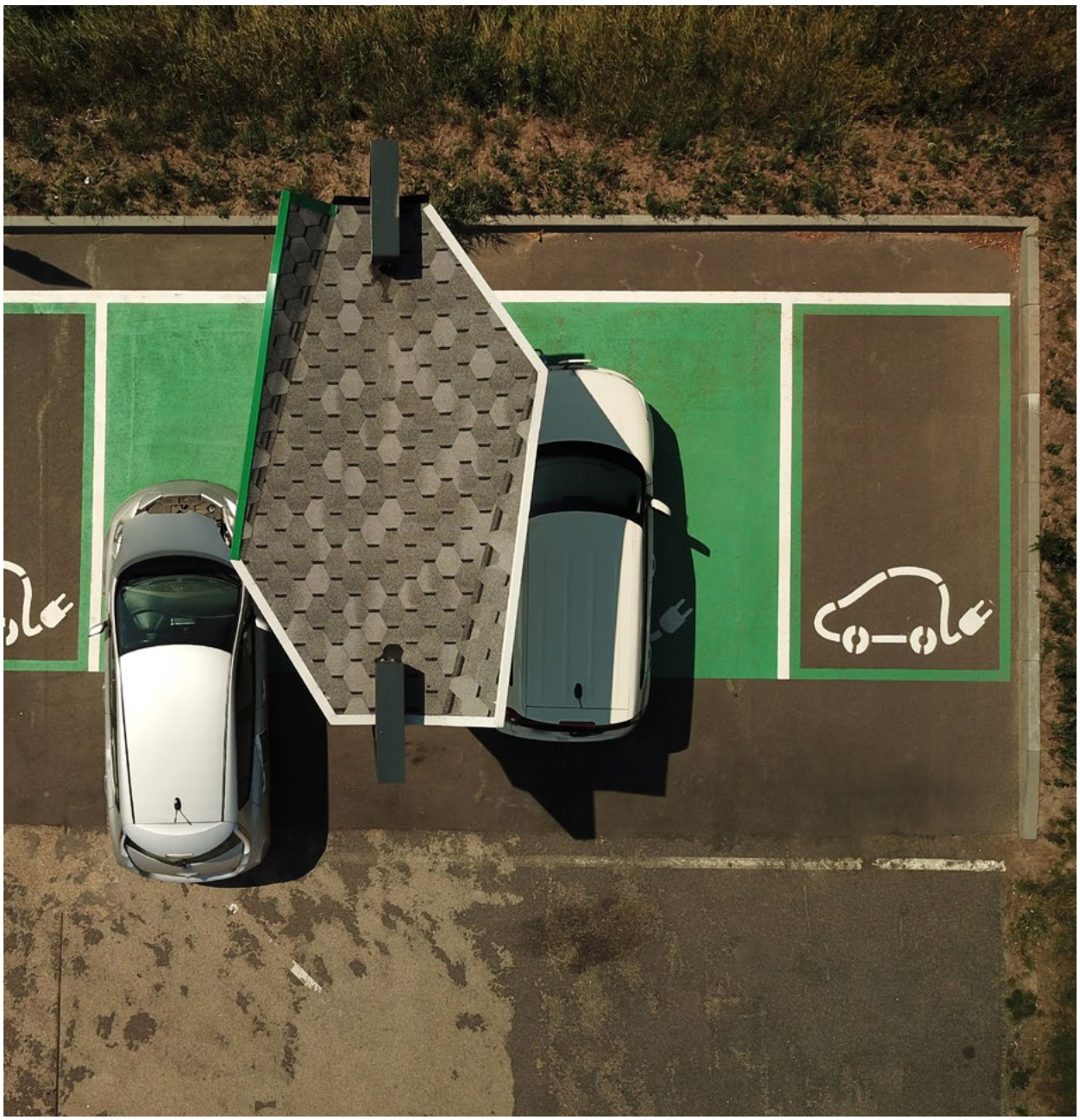
Industry executives project 37% of EVs will be subscribed to rather than financed or leased in 2030.

Executives are also envisioning a significant shift in ownership models for privately owned EVs as compared to the current market. While currently, subscriptions make up only 3% of EV ownership models, by 2030 executives expect ownership to be almost evenly divided between subscriptions, leases, and purchases. A related IBM survey in the German market reveals that subscriptions may in fact be a more viable path to widespread EV adoption by making the cost more manageable.[21]

The switch to subscriptions also works in favor of the automakers. Executives anticipate that EV subscriptions will be a promising revenue source for their businesses by 2030, second only to battery-related services. Although subscription models are still emerging, this executive attention is likely to help propel them to the forefront.

Shifting to the supplier outlook, they appear optimistic in their view of the transition, anticipating 21% global revenue growth by 2030. Nearly half are prioritizing scaling down/exiting from the ICE business, and more than half plan to reskill their workers to meet the changing needs. Fewer than 30% anticipate a corporate restructuring, such as selling or merging with another company, forming a joint venture, or buying another company.

As companies search for the most efficient path to design, development, and manufacturing, those who recognize and address consumer pain points as well as commit confidently and quickly to their new core competencies are more likely to capture the EV market.



Driving EV adoption forward with ecosystems and technology

Partnering for progress

Sustainability and the solutions that support it demand strategic collaboration and innovative approaches across industries (see case studies, “Building a sharing economy for energy”). In the IBV 2022 CEO Study, we found that transformational CEOs engage broadly with their ecosystems to solve environmental problems. They are establishing entirely new business networks or platforms, and they are deepening collaboration to foster open innovation.[22]

Similarly, auto executives report continued use of business ecosystems and partnerships for technology platforms, such as EV software and the in-vehicle customer experience (see Figure 10). As examples, General Motors and Toyota are sharing overall EV platform development costs with other OEMs to enable faster rollouts of a greater variety of models.[23] Likewise, Volkswagen and Ford Motor Company are expanding their e-mobility partnership with Ford planning to produce a new electric model for the European market based on Volkswagen’s MEB electric platform.[24]

The charging infrastructure is also ripe for partnerships. They obviously extend from the auto industry to the energy and utilities industry, which is working to build a clean and balanced grid that further reduces CO2 emissions (see Perspective, “IBM tools support electrification efforts”). The charging infrastructure network also touches the manufacturing industry—those who are building the EVs, the batteries, and the charging equipment and who also need to ensure they are using sustainable, cost-effective, efficient practices. Then consider the retail, real estate, and travel industries, which represent the places people go in their EVs. Consumers need to know they can conveniently recharge while they shop at a store, dine at a restaurant, or sleep at a hotel. Governments have a role to play as well, creating the charging infrastructure along the public roads they maintain and planning the cities where EV owners live, work, and travel.

Case studies

Building a sharing economy for energy[25]

In anticipation of Sweden making the move to EVs this decade, Eljun—a Stockholm-based green energy company—is concerned whether the country has the charging support infrastructure in place to support this growth. In response, the company is building a network that connects EV owners to charging stations in a mutually beneficial manner. Vehicle owners can locate convenient charging stations, while charging station owners can earn money in the hours when their stations are not otherwise in use.

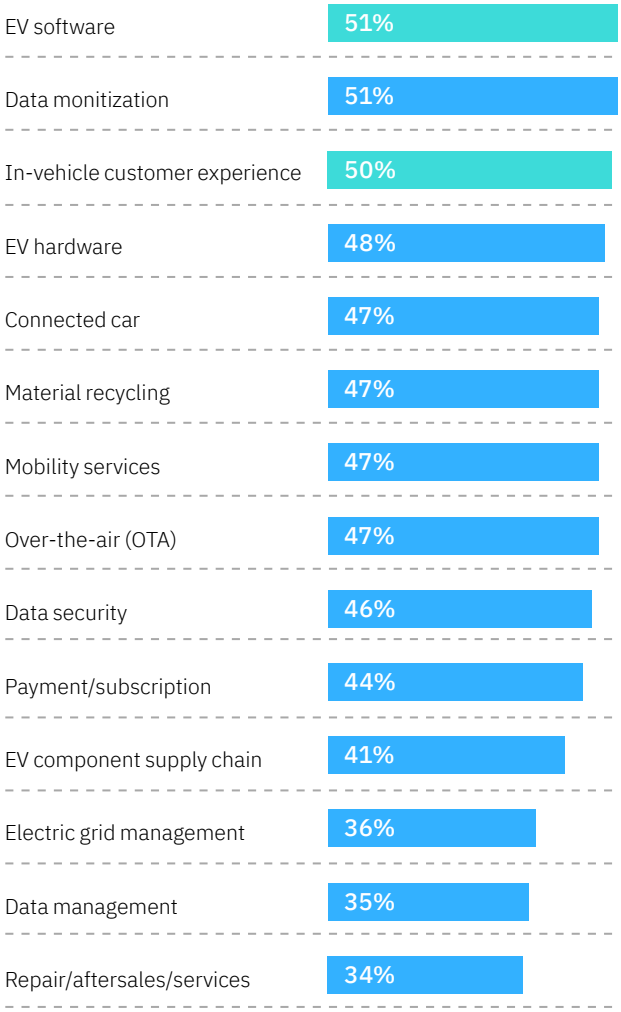
Eljun relies on open source technology, cloud computing, and a managed services platform running in a serverless environment for its solution. These tools have allowed Eljun to design the architecture and then let it manage itself, scaling up and down as needed.

Looking ahead, Eljun hopes to incorporate predictive analytics so they can make suggestions based on weather or if a charging station may need maintenance. And if all the single, privately owned charging stations can connect to this type of sharing economy, Eljun's leaders predict the infrastructure problem could be solved.

E.ON, one of Europe's largest operators of energy networks and infrastructure, is also thinking ahead to solve the distribution of energy across the grid. The company anticipates that energy will no longer flow unilaterally from utility to consumer, but instead smaller companies and even households could feed the grid through their photovoltaic (PV) systems or electric cars. Coordinating and controlling such a system requires enormous computing power that classical computing systems can't accommodate. E.ON is looking to quantum computing with IBM to help manage the processes more efficiently and effectively.

FIGURE 10

Executives plan to continue leveraging business ecosystems and partnerships for technology platforms.



Q. To what extent do you expect to leverage business ecosystems and partnerships for each of the following technology platforms? Percentages represent those who responded 5 (significantly) or 4 (very significantly).

Perspective

IBM tools support electrification efforts[26]

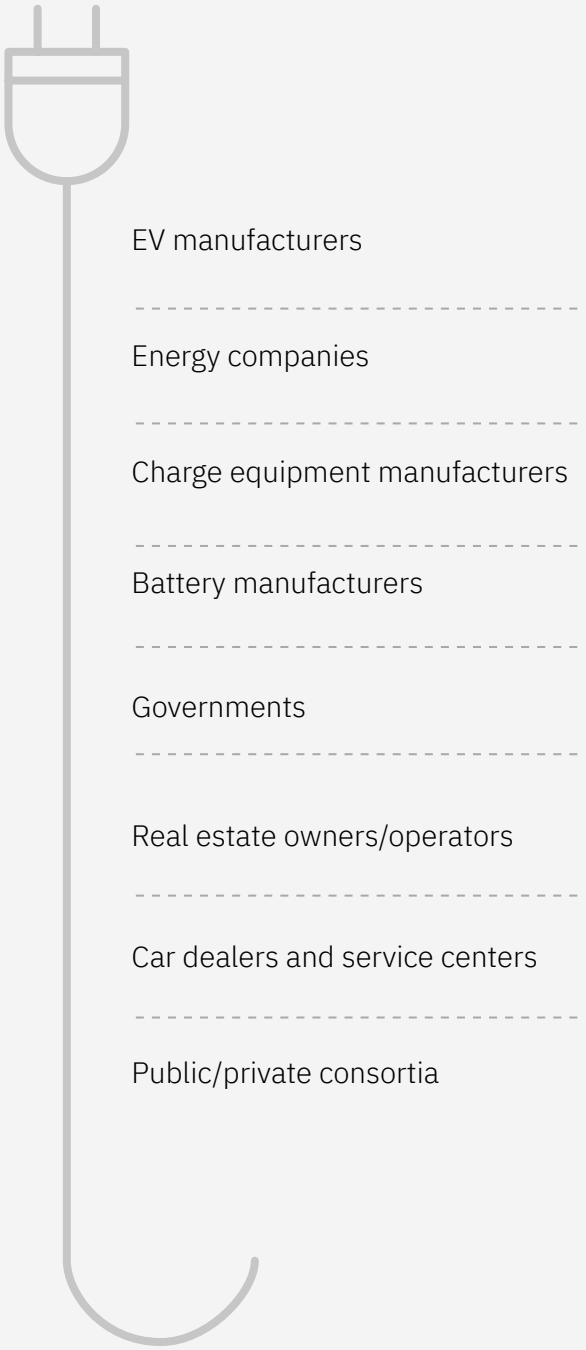
With no common definition of "clean electrification" or agreed-upon standards for achieving it, utilities are struggling to set goals and monitor progress. In response, IBM, in partnership with a global team of energy and sustainability experts, and the American Productivity and Quality Center (APQC), a world leader in open standards benchmarking, have created the Clean Electrification Maturity Model (CEMM).

This open-standards model for clean electrification includes 200 organizational attributes across eight domain competencies: market innovation, strategy and leadership, organization and culture, technology, sustainability, grid operations, work and asset management, and customer experience. Using this tool, electric utilities can assess their organizational maturity against new and emerging clean energy competencies.

In a separate effort to help a UK client create an electrification solution, IBM ultimately developed a reference architecture for EV charging. A product of multiple workshops, studies, and surveys, the reference architecture covers the essential entities for managing the charging of EVs: a digital experience platform, an eMobility service provisioning system, the charging station management system, charging sites, the EVs, enterprise systems, and electrification market integration.

FIGURE 11

The EV charging network requires the contributions of multiple critical players.



Executives recognize the charging network must be broad. They expect EV manufacturers to lead alongside energy companies, charge equipment and battery manufacturers, and others (see Figure 11). Of note, executives from China—where EV sales surpass those of other countries—say that real estate owners should play a large role in the network.[27] And they anticipate dealerships providing charging points and facilitating power grid integration.

Automakers are embracing their role in the EV charging network, with 65% of executives saying EV manufacturers are critical players.

Embracing technology to accelerate the EV transformation

Across the automotive value chain, the transition to EVs introduces many opportunities for progress, and the industry can use technologies to help achieve them (see Figure 12). Building on its productive use of business and operations automation across factory floors and throughout the back-office, the industry can infuse solutions backed by advanced technologies—such as AI and machine learning, advanced analytics, augmented/virtual reality, and hybrid cloud—to reshape areas including product design and development, manufacturing, sales and marketing, service and aftersales, and ecosystem collaboration.

Consider component and subsystem design—which is heavily driven by software engineering—as well as product design. Speed is essential to getting new components, products, and functionality to market quickly. AI-powered engineering lifecycle management helps optimize requirements and workflow management as well as enables collaborative modeling, design, and testing environments (see case study, "Lumen Freedom standardizes design management for wireless charging units). Similarly, digital twins—which are digital replicas of a physical object fed by real-time data—allow for simulations, such as crash tests. Or when combined with AI and machine learning, they help engineers identify design issues before building the actual product.[28]

Switching gears, think about the expected growth of subscription models for obtaining EVs. While not unique to EV sales, this approach allows automakers and rental car companies to offer additional fee-based, software-based services, such as autonomous or assisted driving capabilities. Administering these services can quickly become complex, but an intelligent subscription platform can automate the many revenue processes involved, such as quoting, billing, collections, and analytics.

Turning to connectivity, the software-heavy EV is in constant communication with other vehicles, its surroundings, infotainment service providers, and the automakers' back-end systems. For instance, over-the-air software updates can be delivered to the vehicle to meet regulatory requirements or to patch security gaps quickly. And with the expansion of 5G technology, even more data can be exchanged at the edge, which means the back-end systems must be able to respond quickly, and robust edge capabilities need to be built accordingly. To meet these low-latency requirements, automakers are using a variety of technologies, including hybrid cloud platforms, to deploy systems regionally—a tactic that also supports managing local regulatory requirements.[29]

The increase in connected vehicles lights up the radar of cyber criminals by expanding the attack landscape—even extending beyond cars into the charging infrastructure. The effects trickle into the insurance industry as well, as they struggle to assess an unfamiliar set of risks and losses. Automakers are tackling this complex and multilayered situation, starting with protective measures in the vehicle electronics and extending into real-time monitoring of vehicle use through Vehicle Security Operations Centers (V-SOCs).[30]

Regulators are also trying to keep up, expanding standards for automakers to follow.[31] This includes UNECE R155, which outlines specific vehicle cybersecurity guidelines such as the establishment of a cybersecurity management system. This system must take a holistic view of the vehicle and its enabling connected services ecosystem, from development through production, operation, and disposal.[32] Meeting this requirement enables car manufacturers to build trust with consumers and fleet owners.

The auto industry can leverage technology-infused solutions to reshape areas across the automotive value chain, from R&D to ecosystem collaboration.

FIGURE 12

Technology can transform the automotive value chain throughout the EV transition.

	Opportunities	Supporting technology
Research	Battery performance Component light-weighting	Quantum for chemistry/materials research Semiconductor research
Component and subsystem development	Software development Design of new components	Vehicle cybersecurity management systems Engineering lifecycle management software
Product development	Product differentiation Increased connectivity	Digital twins Edge and cloud computing
Supply chain	New supplier base Supply chain visibility	Control towers AI-powered intelligent workflows
Manufacturing	Cost Transition to new production	Smart factory OEE analytics
Sales & marketing	Emerging sales models Emerging revenue sources	Hybrid sales platforms Subscription platforms
Financing	New financing models Evaluation of residual value	Finance platform modernization AI/advanced analytics
Service & aftersales	Technician shortages EV component servicing	Remote diagnostics/connected insights Mobile service enablement/augmented and virtual reality
Recycling	Batteries and precious metals Tracking	Circular economy platform Parts/materials tracking
IT	Increasingly complex environments Speed to deliver	Hybrid cloud DevSecOps/agile models
Ecosystems	Horizontal partner expansion New stakeholders	API management Marketplaces
Admin/HR	Attracting talent Reskilling	Learning platforms/AI-based skills assessment Business process automation
Sustainability	Define KPIs ESG reporting	AI/data analytics Regulatory analysis and reporting platform

Finally, automotive executives don't seem to be connecting their EV programs with their corporations' sustainability strategies. Fewer than half (49%) say the EV program is essential to achieving corporate sustainability targets. And just over half (55%) view CO2 emissions as an explicit measure in evaluating their EV program.

This lack of alignment could be a missed opportunity. Not only can tech tools expedite design and delivery of environmentally friendly vehicles, but digital solutions can offer an end-to-end view of sustainability throughout the production process, including deeper insights into manufacturing emissions and the effectiveness of responsible sourcing and recycling efforts.

The 2022 IBV CEO study on transformational sustainability featured executives who deliberately integrate sustainability and digital transformation and as a result are realizing higher revenue growth than their peers.[33] For automotive executives, this suggests they should define clear operational models that fit with their EV strategy across its value chain—from design to disposal—and align the program's goals to the overall corporate sustainability strategy.

Case studies

Lumen Freedom standardizes design management for wireless charging units[34]

Envisioning that consumers won't want to physically plug in their electric cars every time they need to charge, Australian company Lumen Freedom ventured into developing wireless charging. But as the business progressed and the demand for variations grew, its design and management efforts became more complex and difficult to manage.

Working with IBM Business Partner Olive Grove IT, Lumen Freedom deployed two key software-as-a-service engineering lifecycle management products from IBM that standardized and unified workflow management in their product development processes. The software helps drive efficiencies by centralizing design and workflow efforts—including more than 10,000 requirements—within a single tool and common interface. It also boosts staff efficiency by providing visibility into each team member's workload, so resources can be reallocated as needed.

Action guide

The shift to EVs is accelerating, but work remains for auto executives to verify their EV strategy and its integration with sustainability goals, understand their customers, refine their operational roadmap, and extend their ecosystems horizontally to support electrification. Consider these next steps as part of your near-term planning exercises.

01

Ensure your organization's strategy is aligned with the EV transition

- Revisit and define which market position your organization is targeting with EVs and align financial commitments accordingly.
- Determine your differentiating factors in the chosen market, capitalizing on your organization's unique strengths/expertise. Consider new business models to allow room for emerging revenue sources.
- Define a technical blueprint that allows your organization to be flexible. Make certain it accounts for interoperability, continuous innovation, and scalability.
- Ensure EV program goals and KPIs align with corporate sustainability strategies. Build a data architecture that allows you to measure financial outcomes and progress against sustainability goals.

02

Assess customer needs and wants for EVs and determine how to satisfy current and future needs

- Validate market insights in your target geographies, brand, and customer context. Understand customers by talking to them in the field and holding discovery workshops. Clarify their pain points and reflect those in product planning.
- Use sophisticated data and analytics capabilities to monitor and improve sales KPIs. Include a timely feedback mechanism to reflect the fluid market situation.
- Actively pursue new revenue sources, for example, subscriptions and services around batteries.

Action guide

03

Define a high-resolution target operating model and clear roadmap to guide the transition to EVs

- Conduct benchmarking to assess how your organization's EV-related capabilities compare with competitors.
- For each operational area, define your new target operating model with core competencies and partnership/outsourcing opportunities. Create a clear roadmap to get there. Plan resource allocations accordingly. Find capable partners and pursue creative partnerships to build missing capabilities while managing costs.
- If vehicle IT/software capabilities are missing, leverage external partners' resources and gradually build internal skills.

04

Work with ecosystem players for electrification efforts

- Identify quick-gain investment areas to solve charging concerns for your unique customers, such as installing charging stations where your customers frequent.
- Create innovative value propositions to consumers and industry stakeholders and help each stakeholder understand the role they play in the charging network.
- Consider creative and viable business models that bring financial incentives to all stakeholders.
- Use technology platforms to facilitate collaboration with ecosystem partners.

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Study approach and methodology

The IBM Institute for Business Value (IBV) conducted executive interviews and online consumer surveys on electric vehicles in major automotive markets with a focus on EVs that run purely on electricity. Consumer survey countries represent over 75% of global sales. Respondents included 1,501 executives from nine countries and 12,663 consumers from seven countries. 74% of executives were at the C-suite or senior/executive vice president level, and 26% were directors. Half had global responsibilities and the other half had regional responsibilities. Company types included traditional auto OEMs (22%), EV manufacturers/brands (17%), component suppliers (31%), and ecosystem players such as charging hardware/software and charging point providers (30%). Functional areas included strategy/general management, finance, R&D, manufacturing, procurement, sales and marketing, customer service/aftersales, IT, and regulatory/sustainability.

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