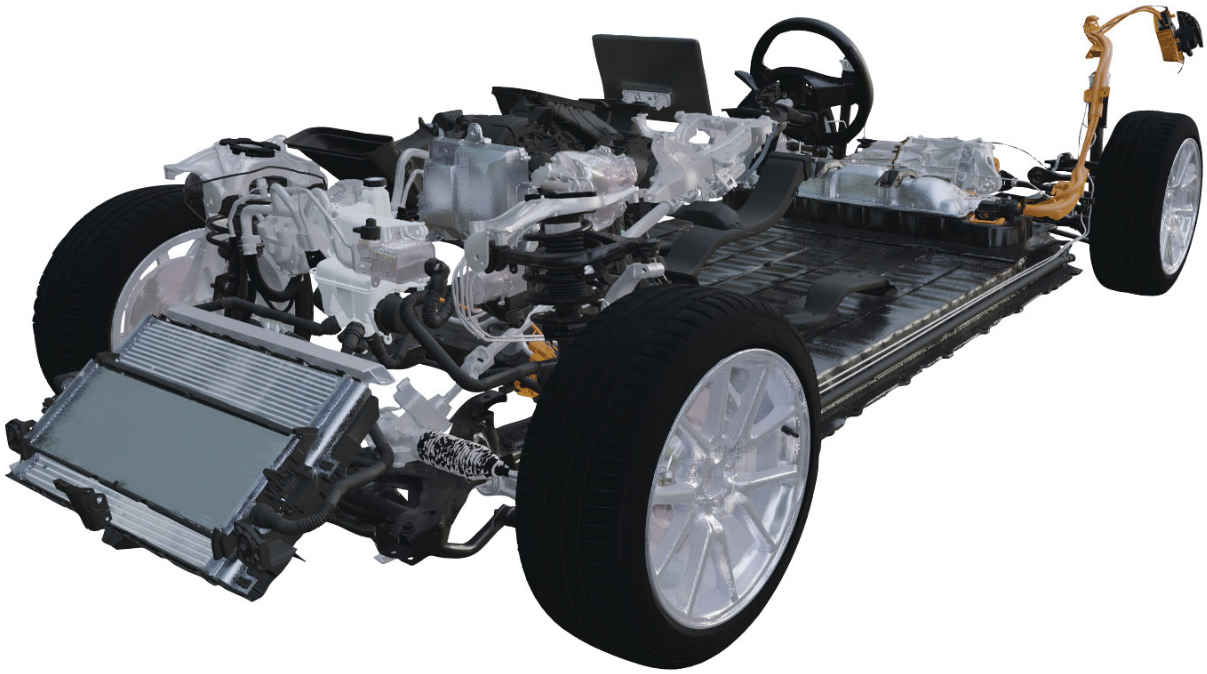
McKinsey & Company

McKinsey Center for Future Mobility

Winning the Chinese BEV market: How leading international OEMs compete

Keeping up with the ever-changing battery-electric-vehicle industry is a high-stakes challenge. Our benchmark of two international and ten local models reveals how OEMs can win over Chinese consumers.

This article was a collaborative effort by Clemens Dabelstein, Philip Schäfer, Dennis Schwedhelm, Jingbo Wu, and Ting Wu, representing views from the McKinsey Center for Future Mobility.



May 2021

In China, the top market in the world for battery-electric vehicles (BEVs), local OEMs have long been dominant and had an 85 percent share of sales volume in 2019. That may soon change, however. International OEMs began moving into the Chinese market in 2020, attracted by its potential, and they are aggressively trying to gain an edge against the locals.

How will these "newcomers" succeed? While international OEMs have many advantages and a long record of producing quality cars, they may find obstacles ahead because Chinese automakers are part of a well-established local BEV ecosystem, characterized by battery and electronics expertise and a strong focus on a fast time-to-market. Chinese OEMs also have a head start because they understand local customer preferences and have designed their vehicles to suit them. International OEMs, which are accustomed to serving other markets, may find that some of their most popular features carry less weight in China.

In a previous article, we benchmarked ten popular Chinese BEVs in a detailed technical analysis that also provided cost estimates for individual components. To gain additional insights that reflect the growing competition, we expanded our original benchmark analysis to include two additional BEV models that were specifically developed by international OEMs for the Chinese market (see sidebar, "About our benchmark").

In summary, our work revealed the following major areas of insight:

— OEMs still have the opportunity to increase efficiency significantly across vehicle systems, especially in the e-powertrain. With combustion engine vehicles, such improvements have always been important, but they tend to occur incrementally over long periods. By contrast, our benchmark shows that OEMs have the potential to reduce costs in e-powertrains by double digits relatively quickly. As they strive for improvement, OEMs will gain more by focusing on vehicle- and system-level collaboration, rather than the traditional, siloed approach in which they try to optimize individual components.

— Chinese OEMs lead in providing a superior customer experience to local consumers. Strong human–machine interfaces (HMIs) and connectivity differentiate them from the competition. These technologies require a solid foundation in software, electronics, and local ecosystems for applications and services. OEMs that do not offer similar capabilities may lose ground—first in China and eventually globally.

— With China representing about 50 percent of the global BEV market, OEMs with a presence there must increase their value to customers and find cost-saving opportunities by designing vehicles to meet local requirements. International players must consider trade-offs between global platform scale and local optimization to compete in China (and other major markets).

— A local battery ecosystem is critical to securing the right specification for the market at the right price point. Chinese OEMs still have a natural advantage here. While international players are strengthening their technology position, they also need local ties to realize additional opportunities.

About our benchmark

Our analysis of Chinese battery-electric-vehicle models includes a large portion of the market. We reviewed popular vehicles from both incumbent OEMs and new players. These included models by automakers Buick, BYD, GAC, Geely, JAC, NIO, Roewe, SAIC Motor, and Weltmeister. For the international models, we focused on recent competitive market entries made by Volkswagen and Tesla. Our Design-to-Insights database contains an index of 1,000 battery-electric-vehicle components, including cost estimates and 3-D representations.

— The rapid pace of innovation and frequent technology leaps, especially in software, are shortening of the development cycle for BEVs. Advanced electrical and electronic (E/E) capabilities, such as advanced driver-assistance systems (ADAS) and over-the-air (OTA) software updates, and the ability to make design upgrades during the vehicle life cycle are becoming crucial to remain competitive, both in China and globally.

This article sets out to further translate these insights into technical and design applications and point the way for key levers to drive efficiency and customer excitement in future BEVs (Exhibit 1).

The dynamic Chinese BEV market

Total BEV sales reached nearly two million in 2020. China and Europe are the two leading markets worldwide, accounting for 80 percent of sales, and

Exhibit 1

Several levers are key to increasing vehicle efficiency and customer excitement about battery-electric vehicles.

Impact per key lever (nonexhaustive)

Lever	Description	Product cost	System efficiency	Vehicle performance	Customer value
System optimization in e-powertrain	• Silicon-carbide MOSFET[1] technology (increased efficiency) • Integrated thermal management • Submerged oil cooling for higher peak power • Integrated DC–DC[2] converter and onboard charger	High	High	High	Low
Next-level manufacturing	• New levels of modulization and preassembly • Optimized integration of components, harmonization of joining methods	High	Medium	Low	Low
HMI[3] features and integrated app ecosystem	• Stronger integration in local digital ecosystems • Improved set of connectivity features, such as navigation, shopping, entertainment, service/ maintenance, or insurance	High	Low	Low	High
Local-market-focused design	• Drive comfort (eg, suspension systems and subframe) tailored to local reduced speeds	High	Medium	Low	Low
Battery ecosystem	• Segment-specific use of cell technology (NMC811-based vs NMC532 or NMC622[4]) • Transversal battery layout with flexible module allocation	High	Medium	Low	Low
Best-in-class electrical/ electronic architecture	• Advanced electronics architecture, eg, by integration of control units, to enable enhanced functionality, including advanced driver-assistance systems (ADAS) and over-the-air (OTA) updates	High	High	High	Medium

[1]Metal-oxide-semiconductor field-effect transistors.
[2]Converter of direct current to direct current.
[3]Human–machine interface.
[4]Lithium nickel manganese cobalt oxide.

they will likely hold these positions for the duration of the COVID-19 pandemic and beyond (Exhibit 2). While China's 57 percent share of the global BEV market in 2019 was still well ahead of Europe's share, it has since dropped to slightly below 50 percent because of a strong uptake of BEV sales in Europe.

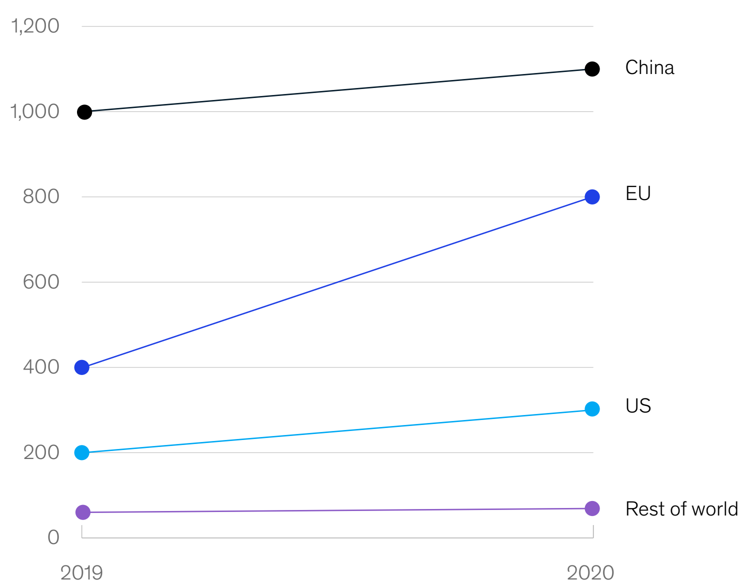
In absolute numbers, however, China is and will continue to be the biggest global BEV market for the foreseeable future. Our analysis projects that BEV sales will reach about nine million in China by 2030, representing an annual growth rate of 24 percent (Exhibit 3). Key drivers of this growth include the extension of BEV state subsidies until 2022 and the continued push for BEV adoption, both in corporate and leasing fleets and among Chinese private car buyers. For example, an increasing number of cities in China have mandated that ride-hailing cars must be BEVs, and the government specifies that a certain number of new license plates must go to BEVs.

Local OEMs may have gained the dominant position they enjoy today by launching their initial BEV models so quickly.[1] Our benchmark analysis showed that these first-generation Chinese BEVs showed substantial variety in design and technology, and many still have the opportunity to optimize their electric-vehicle (EV) platforms and reduce costs.

Exhibit 2

As of 2020, China and the European Union are the world's largest battery-electric-vehicle markets.

Global BEV passenger car sales 2019–20,[1] thousand



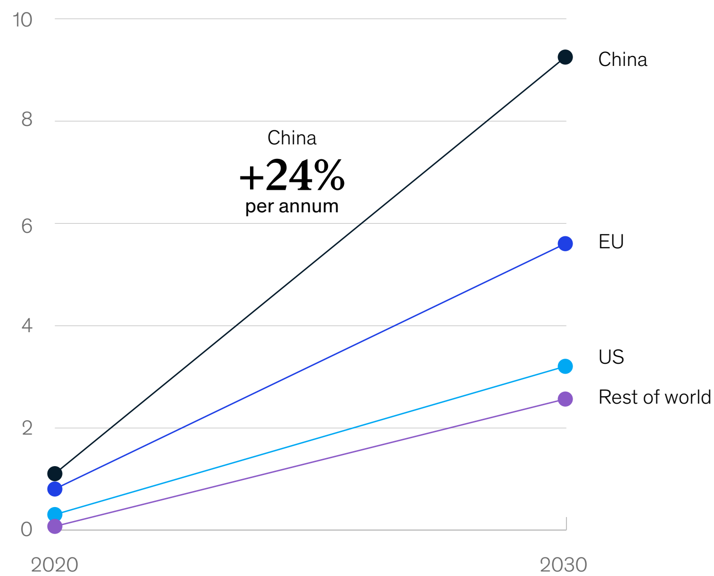
[1]Battery-electric vehicles; based on wholesale volume (typically 10–20% higher than insurance registrations).
Source: EV-Volumes.com; International Council on Clean Transportation; literature search

[1] For more details, see Mauro Erriquez, Philip Schäfer, Dennis Schwedhelm, and Ting Wu, "How to drive winning battery-electric-vehicle design: Lessons from benchmarking ten Chinese models," July 10, 2020, McKinsey.com.

Exhibit 3

By 2030, battery-electric-vehicle sales in China may exceed nine million cars, an average increase of 24 percent each year over the next decade.

Global BEV passenger car sales forecast,[1] million



[1]Battery-electric vehicles; based on wholesale volume (typically 10–20% higher than insurance registrations).
Source: McKinsey Electrification Model

Despite the dominant position of local OEMs, international OEMs have made some recent inroads to gain a larger share of the Chinese BEV market. Some are also taking models originally produced for China to other countries. For example:

— Renault's City K-ZE, introduced to the Chinese market in 2019, will be produced for the global market.

— In mid-2020, Tesla's sales in China accounted for nearly one-quarter of global sales, with year-over-year revenue in the country more than doubling to $1.4 billion. The company's Model 3 became the single best-selling premium BEV model in China in 2020.

— In an expansion of Daimler's Smart brand, the German automaker has formed a joint venture with Geely to develop new EVs. Production is based in China, with sales planned for 2022.

— BMW's majority-owned Chinese company, BMW Brilliance, started construction of a new production facility in China, where it plans to produce 150,000 EVs annually. By 2022, production of the BMW iX3 will also be transferred to the new plant.

— In April 2020, Toyota launched three all-electric models for the Chinese market.

Taken together, these developments will result in an increasingly dynamic and competitive BEV market in which domestic and international OEMs alike will have to fight hard for market share. The following sections provide more insights about the strengths of international models and key learnings from Chinese OEMs. Some of these insights might help companies not just in China but in their quest to become global leaders.

International model strengths: E-powertrain technology and next-level manufacturing

The two international models in our benchmark analysis are designed for superior performance, with e-powertrain system optimization and next-level manufacturing. Accordingly, they offer ranges surpassing that of 80 percent of the Chinese models.

Optimization of e-powertrain systems

Our analysis revealed that four technology trends enable the superior e-powertrain performance, and incumbent OEMs can gain advantages from these at the system and concept level:

— *Use of silicon carbide transistors in inverters.* Use of insulated-gate bipolar transistors, or IGBTs, in inverters is now standard in advanced e-powertrain design because of their cost efficiency at high volumes, wide availability, and operational efficiency. Out of the 12 models in our benchmark, 11 still rely on this technology. Customized inverters with silicon-carbide metal-oxide-semiconductor field-effect transistors (SiC MOSFET) are even more efficient, however, and provide significant opportunities to optimize the e-powertrain system—for example, by downsizing the thermal management system and battery. One of the international models in our benchmark already uses this technology, and other OEMs are likely to begin to adapt.

— *Smart thermal management.* Integrated thermal management systems, which connect the battery, electric motor (e-motor), inverter, and cabin, have become the standard architecture for state-of-the-art BEVs. These systems enable vehicle components to maintain optimal temperatures, regulate heat flows, and maintain energy efficiency. Although both international models in our benchmark feature this design, only three of the ten Chinese models do. The other seven Chinese models use simpler approaches. Overall system costs can be further reduced if vehicles can use heat from their e-motors or inverters, eliminating the need for a separate heater. Only one of the international models in our sample uses this technology, however. The other OEMs could potentially optimize their models by following suit.

— *Submerged oil cooling of the e-motor.* Many vehicles cool their e-motors via liquid-cooling jackets because it's a low-cost solution. Ten out of 12 BEV models in our benchmark analysis have this feature. But another solution, oil cooling, enables a higher peak power at lower cost. Oil cooling also provides the packaging advantages of a slimmer motor, since an outer shell is not required. The one international model in our benchmark that uses oil cooling can reach a peak power of 211 kilowatts (kW); the other models, which were cooled by a liquid jacket, only reach up to 160 kW (Exhibit 4).

— *Integrated onboard charger and converter of direct current to direct current (DC–DC).* An integrated direct current-to-direct current DC–DC converter and onboard charger (OBC) unit can significantly reduce costs through the integration of physical and functional components (Exhibit 5). Indeed, our analysis reveals that the cost of a single DC–DC and

Exhibit 4

Ten out of 12 benchmarked battery-electric-vehicle models use liquid-cooling jackets on the motor; only two rely on oil-soaked cooling.

Cooling technology comparison

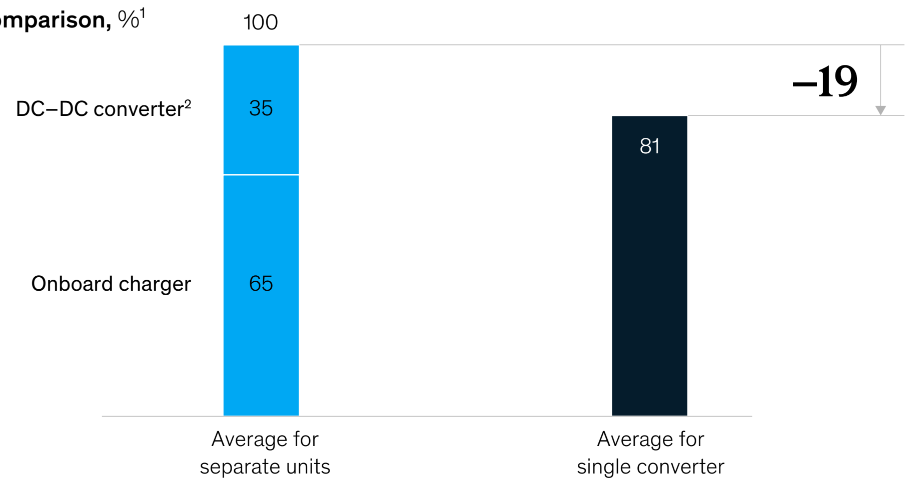
● Very advantageous ● Disadvantageous

	Heat-extraction capabilities	Integration complexity	Overall motor cost
Liquid-cooling jacket Liquid cooling on outer shell of motor with an in/out hose connector	Inertia in heat extraction	Use of a simple cooling jacket	More active mass is needed for the same power output
Oil-soaked cooling Oil-soaked cooling on detachable heat exchanger	Direct extraction at heat source	Dynamic seals and high electric insulation are needed	High heat extraction supports downsizing

Exhibit 5

Integration of the DC–DC converter and the onboard charger in battery-electric vehicles can reduce costs by 19 percent.

Cost comparison, %[1]



[1]Assumptions based on standardized parameters (eg, volume, overheads, manufacturing location) excluding cost/amortization of R&D and tooling in part price.
[2]Converter of direct current to direct current.

OBC unit is 19 percent lower than the cost of having two separate units. While one of the international models in our benchmark utilizes this technology, only half of the Chinese models currently do.

When we considered all of these technologies together, we found that one of the international models in our benchmark has optimized its e-powertrain system, partly through some proprietary technologies. The vehicle therefore has an electric-drive system, or e-drive, that achieves a 50 percent higher peak performance when compared with an average competitor at a similar e-drive weight and cost (Exhibit 6).

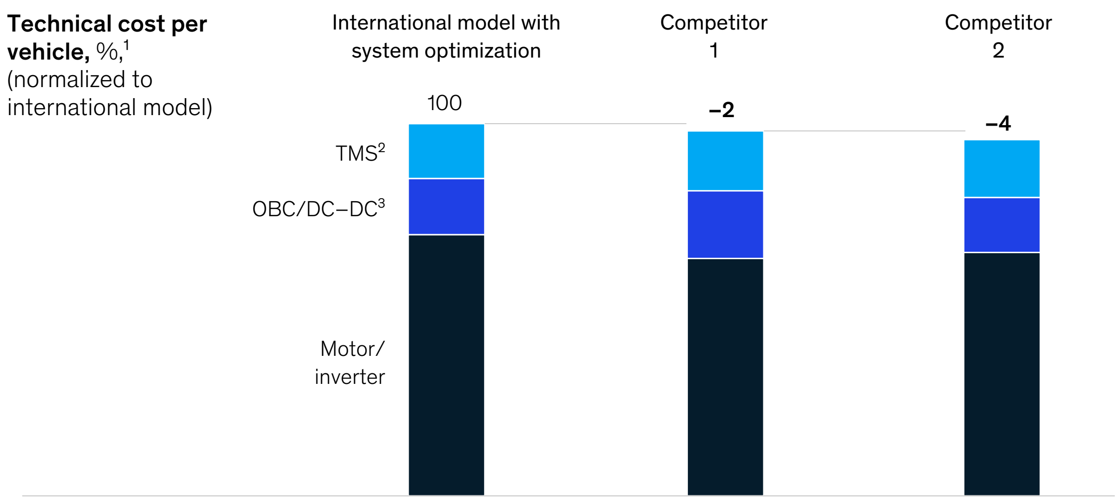
Next-level manufacturing

The two international models in our benchmark leverage best-in-class design techniques, although they take different approaches. For example, the manufacturing process for one model appears to involve a new level of integration and greater preassembly. The OBC and DC–DC converter are integrated into the battery housing, which makes final assembly of the vehicle easier because more components are shifted into the preassembly phase (Exhibit 7).

The other international model employs best-in-class design for manufacturing, which reduces the overall cost of producing parts, as well as expenses for

Exhibit 6

A smart e-drive design can unlock significant performance advantages at comparable cost.



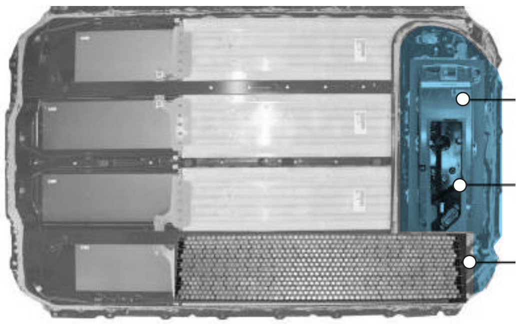
	International model with system optimization	Competitor 1	Competitor 2
Inverter	Silicon-carbide metal-oxide-semiconductor field-effect transistors (SiC MOSFET)	Insulated-gate bipolar transistors (IGBT)	IGBT
Ø peak power, kilowatts	211	150	135
Energy efficiency, kilowatt-hours/100 km	14.3	16.2	14.1
Motor cooling	Submerged oil	Water jacket	Water jacket

[1]Assumptions based on standardized parameters (eg, volume, overheads, manufacturing location) excluding cost/amortization of R&D and tooling in part price.
[2]Thermal management system.
[3]Onboard charger/converter of direct current to direct current.

Exhibit 7

A potential best-in-class battery design for manufacturing displays a new level of modularization, allowing for an easier vehicle assembly.

In-battery housing of an integrated DC–DC[1] converter and onboard charger (OBC) enables a simplification in assembly by shifting content into preassembly



ADVANTAGES

Reduced high-voltage (HV) cabling in final assembly
- From the OBC to the battery
- From the battery to the DC–DC converter

Reduced effort in final assembly
- Placement and mechanical integration of the DC–DC converter

Reduced effort in rear axle preassembly
- Cabling of the OBC
- Placement and mechanical integration of the OBC

DISADVANTAGES

Increased effort in battery preassembly
- Internal cabling
- Integration of HV components

Increased complexity in end-of-life and leakage testing

[1]Converter of direct current to direct current.

materials, overhead, and labor. These methods, which are based on long experience, optimize the battery integration process, reduce the amount of work in the body shop (for example, lowering the required amount of spot welding), and harmonize joining methods, among other benefits.

Chinese model strengths: Customer experience and battery technology

The Chinese-made models in our benchmarking study outflank international OEMs on two fronts: customer experience (through advanced connectivity solutions) and battery technology.

According to our global survey, Chinese consumers are much more willing than their American and European counterparts to switch car brands to access better-connected features, and Chinese auto manufacturers have responded in kind, developing advanced HMI features and a suite of apps that enable in-car shopping, entertainment, and other conveniences. These features enhance the customer experience, as does the fact that Chinese OEMs tailor their vehicles to suit the needs of the local market. Local OEMs also offer leading battery technology and are rapidly gaining ground in the development of the underlying E/E capabilities.

The local models' strengths and advantages can essentially be traced back to the following four practices that are common to Chinese OEMs.

Through advanced HMI features and integrated apps, Chinese OEMs provide an outstanding connected experience

Chinese OEMs are exemplary in understanding and meeting the needs and preferences of their local consumers, who are excited about smart BEV offerings, such as advanced HMI features. Local consumers also appreciate robust and innovative vehicle connectivity that enables various online services, such as navigation, shopping, entertainment, as well as the exchange of data to vehicle service and maintenance providers, charging stations, and insurance companies. On both counts, the Chinese models are exceling.

Most Chinese models offer HMIs with technologically sophisticated, integrated, and interactive designs. For example, all of the Chinese models in our benchmark use the combination of a center-stack screen with an additional instrument cluster display, which offers an enjoyable customer experience in terms of ease, comfort, and convenience. While the interface is achieved in a cost-efficient manner for the mid-to-low-end models, the top-tier models feature large screens and additional features not seen in the international models (for example, a voice assistant offering over 20 local dialects).

The Chinese models also improve the customer experience by offering a wide range of digital services. These are enabled either by proprietary solutions or extensive partnerships between Chinese OEMs and leading local tech players (such as Alibaba, Tencent, or Huawei). Services such as in-vehicle payments, local navigation, and voice-controlled digital assistants offer consumers a more connected, convenient ride.

Chinese OEMs emphasize design to value for the local market

Our benchmark revealed that Chinese models are tailored to local requirements. Their subframe, for example, does not need to be optimized for dynamic performance at high speeds, since the vehicles are primarily used for daily commuting, and the suspension is also designed for this use. Our study of one Chinese model shows that the twist-beam rear axle can be used in a vehicle with a total weight of about 1,800 kilograms with front drive, thereby saving about 80 euros when compared with the use of multilink rear axles, which are more common in such a weight class.

Chinese consumers are much more willing to switch car brands to access better features, and manufacturers have responded by developing advanced human–machine interfaces that enable in-car shopping and other conveniences.

Our analysis also revealed that a vehicle's body-in-white (the frame joined together from sheet-metal parts) can be optimized in many ways, such as by using thinner sheets of metal and optimizing sheet-metal design for a high degree of stiffness. Through this simpler design, the Chinese models in our sample weighed less across all segments. For example, the body-in-white of a local SUV model has a greater than 100 kilogram net weight advantage than one international model, after accounting for different vehicle segments and design choices/requirements. It still achieved a C-NCAP five-star safety rating[2] (Exhibit 8).

Chinese OEMs leverage the local battery ecosystem

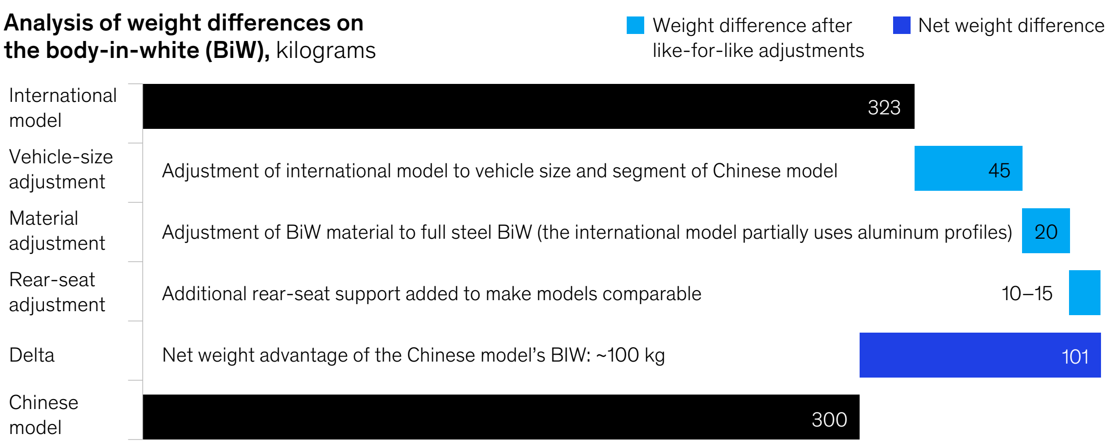
Chinese models feature leading battery technology because of the strong local supply system, as well as the preexisting in-house expertise frequently found at local OEMs. Looking at battery chemistry, two Chinese models were already using NMC811-based cells in 2019, years ahead of international OEMs. By increasing the volume of nickel in a cathode composition of nickel, manganese, and cobalt, NMC811-based cells have a higher power density compared with the more common NMC532 or NMC622 cells, at even lower raw-material costs. The cells' higher power density enables an increased driving range. Similarly, one Chinese OEM in our benchmark had already implemented the use of lithium iron phosphate (LFP) batteries for their most economical model in 2016, a development that international OEMs have begun implementing in recent models as well.[3]

In addition to the advantage of superior battery chemistry, our analysis of battery packs revealed that one Chinese model is able to attain an approximately 15 percent higher energy density, while also reducing costs by about 10 percent, than competitor models that use a similar cell chemistry. The OEM achieved this advantage by

Exhibit 8

The body-in-white of a Chinese battery-electric vehicle weighed 100 kg less than an international model's, while still achieving a 5-star C-NCAP safety rating.

Analysis of weight differences on the body-in-white (BiW), kilograms



Note: C-NCAP is a Chinese car-safety assessment program by the China Automotive Technology and Research Center.

[2] C-NCAP is a Chinese car-safety assessment program by the China Automotive Technology and Research Center. Assessment requirements will change in 2021–22.
[3] For more details, see Nicolò Campagnol, Mauro Erriquez, Dennis Schwedhelm, Jingbo Wu, and Ting Wu, "Building better batteries: Insights on chemistry and design from China," April 2020, McKinsey.com.

packing the cells in rows, using a high number of cells per module, and using simplified parts for battery housing.

Chinese OEMs are catching up for best-in-class E/E architecture

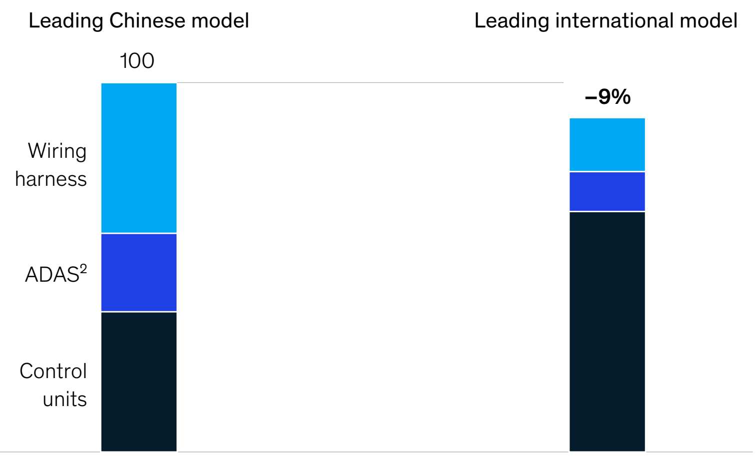
In some areas where Chinese OEMs are not already in the lead, they are clearly catching up. For example, in advanced E/E capabilities, some Chinese models are gaining on the international models and have demonstrated massive technological advances over the past two years, including the inclusion of centralized engine control units (ECUs) or the achievement of OTA or level-3 ADAS readiness.

For ADAS and OTA readiness, one of the top vehicles in our sample was international and the other was local. The international model enjoys a 9 percent cost advantage for technical materials compared with the leading Chinese model in our benchmark. In addition, it shows forward thinking in the design of the E/E architecture. Its ECUs are integrated into central software controllers to enhance functionality (for example, through firmware over-the-air, or FOTA, updates). This integration also reduces costs, such as those for the wiring harness, while enhancing vehicle performance. The leading Chinese OEM is catching up, however, and can provide level-3 ADAS readiness and OTA updates close to the level of the leading international OEM (Exhibit 9).

Exhibit 9

A leading international battery-electric-vehicle's technical costs are 9 percent less than the leading Chinese model's.

Electrical/electronic (E/E) systems of a leading Chinese model vs a leading international model technical costs, euro per vehicle,[1] normalized to leading Chinese model



	Leading Chinese model	Leading international model
ADAS[2] Level	L3 ready	L3 ready
OTA[3] capability	Enhanced firmware/software over the air	Full firmware/software OTA
Engine control unit	Integrated domain controller for ADAS	Integrated main control unit (hardware 3) with proprietary high-performance full-self-driving chip
Sensor fusion	Yes	Yes
Sensors	5 cameras + 5 radars	9 cameras + 1 radar

[1]Assumptions based on standardized parameters (eg, volume, overheads, manufacturing location) excluding cost/amortization of R&D and tooling in part price.
[2]Advanced driver-assistance systems. ADAS level describes the readiness level of the control unit hardware.
[3]Over the air. OTA describes the ability to update software "over-the-air."

Chinese OEMs will likely continue to tailor their designs to the local market. With this customer-centric approach, they will benefit from a highly dynamic market where customers are increasingly excited about BEVs.

To compete in the Chinese BEV market, OEMs should focus on five strategic principles

Because of its sheer size, intense competition, and discerning customers, the Chinese market provides important lessons for what is needed to win in the BEV race. OEMs with global ambitions should strive to understand how to compete in this market not only to gain a foothold in China, but also to transfer the lessons from China to Western markets, where automakers also face increased competition. In our view, five strategies are essential for success.

Taking a systems perspective during the concept phase

Given the high potential to improve BEVs at the vehicle and system level, OEMs must take a holistic perspective to make the right trade-off decisions between cost and performance. For instance, they may choose to include a SiC inverter with higher efficiency to achieve the cost savings that come with downsizing thermal management requirements. Often, this will require them to break down internal organizational barriers and work across R&D departments that have traditionally focused on single modules. OEMs must also adopt a different operating model with suppliers to allow early optimization across systems.

Aligning with the local software ecosystem for superior HMI and connectivity

China is the new trendsetter for software ecosystems. Integration with local providers is already important there and will increasingly become so in other countries. Chinese OEMs are particularly likely to offer a wide range of services in combination with tech giants such as Alibaba and Tencent. To level the playing field, international OEMs will need to focus on developing strong connectivity and HMI features and consider how they compete with benchmark standards. They must also seamlessly integrate their offerings into the local app ecosystem, and this will likely require them to consider pursuing partnerships with Chinese tech players. Again, the strategies that work in China may also confer benefits when applied to other regions.

Tailoring vehicle specifications to suit local customer needs

Western incumbents are still trying to differentiate themselves through extended driving range, higher speed, and more advanced technologies. These aren't the features that are most important to a large share of Chinese customers, however. Local consumers mainly need vehicles for their daily commute and rarely drive above an average speed of about 25 kilometers per hour. Instead of prioritizing greater speed or distance, most Chinese consumers would rather spend their money on exciting HMI and software features.

For best results, OEMs must ensure that their design-to-value approach considers what Chinese customers actually want, rather than what their engineering expertise has traditionally told them to value. After finding out local priorities, they should move resources to customer-centric features.

A strategy that involves focusing on local consumer needs is always likely to provide an edge, so OEMs with global ambitions can take a similar approach in other markets.

Leveraging the local manufacturing ecosystem

International OEMs seeking to make inroads into China should build ties to the local supplier and manufacturing ecosystem and then leverage these connections. After all, the Chinese market has a strong network of battery suppliers—and increasingly e-powertrain suppliers—that could benefit them. OEMs that compete in multiple markets could also look for local battery suppliers or manufacturing partners in those locations who are savvy about regional consumer preferences. In Western markets, OEMs may find local suppliers that optimize the e-powertrain for energy efficiency or performance; in the Chinese market, local suppliers with strong battery-technology expertise might provide larger batteries at lower cost.

Offering over-the-air capable E/E systems

If OEMs want to offer an exciting and flawless customer experience—for example, through the regular delivery of updates that continuously improve features and performance—the E/E architecture must reflect the latest design trends. One well-known Western tech disruptor has taken the lead in this area, with technology years ahead of the competition. That said, our benchmark analysis revealed that Chinese start-ups have also surpassed some of the international and local OEMs with their E/E capabilities. As customers become familiar with the benefits of strong E/E systems, this feature may become more important—and that means international OEMs may no longer gain as much of an advantage from their traditional strengths, such as the ability to create high-performing powertrains or top-quality interiors or exteriors. In fact, many global players may fall behind unless they develop the capabilities needed to produce advanced E/E systems that cater to customer needs at every level and enable intermediate feature updates over the course of the vehicle life cycle.

OEMs must balance their local and global perspectives to develop a winning strategy—not just in China but in any country. Consumer preferences will always vary by location, and it's important to acknowledge these differences and try to suit them. That said, a hyperlocal approach that involves developing different vehicles for each country may not always be feasible, so some compromises may be needed. Similarly, OEMs can't overlook the benefits of global scale during manufacturing, so there may need to be some trade-offs when they think about designing vehicles to suit certain countries. Whatever strategy an OEM selects, one point is certain: in a competitive, ever-changing market, no OEM—whether European, American, or Chinese—can afford to stay still.

Clemens Dabelstein is an associate partner in McKinsey's Hamburg office; **Philip Schäfer** is a partner in the Düsseldorf office; **Dennis Schwedhelm** is a senior expert in the Munich office, where **Jingbo Wu** is a solution leader; and **Ting Wu** is a partner in the Shenzhen office.

The authors wish to thank Björn Bierl, Mauro Erriquez, Stephan Fuchs, Tobias Geisbüsch, Volker Grüntges, Ulf Heim, Rupert Lee, Birte Prinzhorn, Andreas Venus, Alexander Will, and Klaus Ziemann for their contributions to this article.

Designed by McKinsey Global Publishing