TCIP
TECHNOLOGY COMPETITIVENESS & INDUSTRIAL POLICY CENTER

Global Shift?

The Chinese EV/Battery Challenge

Martin Kenney

November 9, 2025

A TCIP Study:
Technology, Competitiveness, and Industrial Policy (TCIP.org)

Corresponding Author: Martin Kenney
(mfkenney@ucdavis.edu)

Posted also as BRIE Working Paper 2025-11 and submitted to SSRN.

Global Shift?

The Chinese EV/Battery Challenge

Martin Kenney

November 9, 2025

A TCIP Study
Technology, Competitiveness, and Industrial Policy (TCIP)

Martin Kenney
Distinguished Professor Emeritus
University of California, Davis
Davis, CA 95616
&
Co-Director
Berkeley Roundtable on the International Economy

Posted also as BRIE Working Paper 11

Global Shift?

The Chinese EV/Battery Challenge

Martin Kenney[1]

Abstract

In less than two decades, China has become the global leader in electric vehicles (EVs) and batteries. This was achieved through a combination of strategic state planning, local government experimentation, and entrepreneurial innovation.

Motivated by serious urban pollution, dependence on imported oil, and vulnerability to global price shocks, China built a complete EV ecosystem—from lithium mining to auto assembly, battery production, charging infrastructure, and end-of-life recycling. China now produces over 60% of the world's EVs and dominates low-cost lithium-iron-phosphate (LFP) battery technology and is on the verge of introducing even lower-cost sodium batteries.

While the future is still uncertain, China's EV policies have positioned it to for leadership in the "Electric Age". This paper explores lessons and implications from the development, government policies, and current state of the Chinese BEV industry.

Executive Summary

In less than two decades, China evolved from an automotive follower dependent on foreign joint ventures to the global leader in the transition to electric vehicles (EVs), both battery powered (BEVs) and plug-in hybrid (PHEV). This transition will be a bridge to what some have termed an "Electric Age."

China's rise was the result of long-term central government planning, aggressive local experimentation, and entrepreneurial dynamism. China's powerful domestic market, its emerging leadership in BEVs, battery technology, and lithium-ion supply chain sets it up for dominance in

---

[1] **Martin Kenney** is Distinguished Professor Emeritus of Community and Regional Development at the University of California, Davis, and a Senior Project Director at the Berkeley Roundtable on the International Economy (BRIE).

the larger clean-energy transition. Given the current trajectory, the rapid growth and improvement in the Chinese EV industry poses a fundamental threat to incumbent automakers whose business models are dependent upon the internal-combustion engine.

The Evolution of the EV Industry in China

Facing severe urban air pollution, dependence on imported oil, vulnerability to global price shocks, and a recognition that it was likely to remain backward in internal combustion engine technology, China began experimentation with new energy vehicles, but by the 2010s began to emphasize the development and commercialization of BEVs. Within a decade, China emerged as the global center for BEV innovation and production, and by 2024 China was building over 60% of all EVs globally.
The Chinese government was critical in the development of the EV industry – not only at the national but also at the local level. We divide their efforts into four stages and describe some of the most important policies in each stage:

1. **Technology Development (2001–2009):** Government-funded R&D partnerships between automakers and universities established core NEV (New Energy Vehicle) capabilities.

2. **Pilot Production (2009–2013):** "Ten Cities, Thousand Vehicles" programs tested adoption in municipal fleets, with limited private take-up.

3. **Large-Scale Adoption (2013–2018):** Expanding subsidies, tax exemptions, and licensing advantages spurred mass consumer adoption; by 2015, China became the world's largest EV market.

4. **Market Competition (2018–Present):** Gradual subsidy withdrawal and rising technical standards fostered competition. One signal of confidence in Chinese competitiveness was giving permission to Tesla to build a wholly owned Shanghai factory – the first wholly foreign-owned automobile factory in China.

Local governments reinforced central policy by offering land, loans, infrastructure, and preferential licensing. This multi-level governance model produced a vast industrial base, though one with overcapacity and fierce price wars.

The Chinese EV Industry

In China, 59% of all sales are now new energy vehicles (NEVs and predominantly BEVs). In 2024, the Chinese NEV market was 12.87 million (and increasing rapidly), compared to US NEV sales that are expected to be about 1.6 million in 2025, while sales in the EU were marginally larger, but some of these were imported from China. There are substantially no foreign EVs imported, though foreign automakers and Tesla do produce and sell BEVs in China. More important, today China is the largest automobile and EV exporter in the world.

Interestingly, the leading BEV and battery manufacturers are not the state-owned enterprises (SOEs), but rather are founder-led entrepreneurial firms and, more recently, entrepreneurial firms from the electronics industry such as Huawei and Xiaomi have entered the industry.

- **Supply Chains:** China now controls roughly 75–85% of the global lithium-ion battery supply chain, from raw-material mining (lithium, graphite) to cell manufacturing and recycling
- **Batteries**: China's early bet on lithium-iron-phosphate (LFP) chemistry meant that it would have a cost significant advantage over Japan and Korea's more costly nickelcobalt based technologies.
- **Electric Motors:** China is also a leader in automobile electric motor production. Though it is not yet clear whether the electric motor industry will be integrated by the automobile assemblers, the battery producers, or independent motor producers (BYD currently produces not only its own batteries but also electric motors).
- **Semiconductors**: China has recently implemented policies to replace foreign semiconductors with Chinese products – an area that has recently been politicized by the Netherlands seizure of Nexperia.
- **Charging Infrastructure:** By 2022, China had installed nearly 50% of global EV charging stations, and 90% of fast chargers.

Globalization

Facing domestic oversupply and margin compression, Chinese firms began exporting EVS. Since 2022, exports have surged making China the world's largest auto exporter by 2023.

Leading Chinese EV and battery producers are rapidly building overseas factories across Southeast Asia, Europe, and Latin America. This will continue to raise trade tensions, especially with the US and EU, whose domestic producers are laggard in terms of competitiveness and technology.

While the impact of labor abuses and government subsidies should not be ignored, China has been able to take advantage of the disruption caused by the transition to BEVs to reclaim the domestic market from the SOE-foreign ICE-based joint ventures and rapidly and decisively enter the global market.

Conclusions

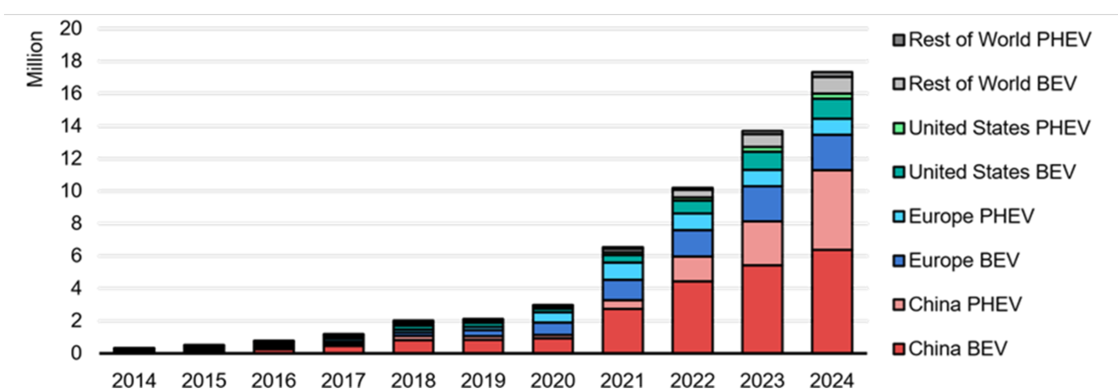
While the future is uncertain, today Chinese firms dominate the global EV market and, increasingly technology. This dominance includes battery production and, it will be the first large economy to transition to an electricity-centric economy and society.

For other nations, if the current trajectory of Chinese EV and battery development continues, their domestic industrial and environmental policies will have to be made, while recognizing that China will, almost certainly, be the central actor in the dawning electric-centric energy era.

The revolution in transportation created by the transition to battery-powered vehicles (BEVs) is being led by China, as the adoption of battery-powered electric vehicles and plug-in hybrid electric vehicles (PHEV) or, collectively, electric vehicles (EV) has grown from a curiosity to a transition from internal combustion engine–powered vehicles (ICEV). This transition will be centered on EVs, batteries, and renewable energy increasingly generated by wind and solar energy. China is already the world's leading producer and consumer of automobiles because of the size of its domestic market. Based on its emerging leadership in BEVs and batteries, Chinese firms are becoming the dominant global manufacturers and innovators (Victor and Davidson 2024). The EV industry is also vitally important because it is an enormous consumer of batteries and thus will drive the battery production and the rise of what some call an "electric age," in much the same way as the ICEV drove the development of what might be termed the "petrochemical age". For this reason, BEVs are critical for the transition to a more sustainable electric age that will reinforce Chinese dominance in photovoltaics and clean energy. The entrance of Chinese EV makers to the global auto industry, combined with the transition to BEVs, is a profound threat to the success of incumbent automakers in the rest of the world as well as their survival as global firms, as they might end up being confined to protected domestic markets.

Of course, the BEV industry has a long history. At the beginning of the automobile era in the early twentieth century, BEVs might have been the direction taken but, at that time, batteries were quite rudimentary, hence, that became the road *not* taken. In the 1990s, incumbent ICEV producers created some experimental vehicles, but only in the 2000s were new entrants introduced, in particular by Tesla, and US government investment, incentives, and policies employed to initiate mass production and sales of BEVs. Unnoticed by the rest of the world, the Chinese government and entrepreneurs also were experimenting, and, in the 2010s, BEVs began to be commercialized in China. By the end of the decade, China had emerged as the global center of BEV and vehicle battery technologies and production, and by 2024 China had become the global center for BEV consumption, as over 60 percent of all EVs were bought there, as shown in **Figure 1.**

Figure 1. Global EV sales by country, 2014-2024



Source: International Energy Agency (2025).

The current Chinese dominance is due to a confluence of government policy and entrepreneurial activity as well as, in part, the result of early decisions by Chinese entrepreneurs to focus on the chemistry of lithium iron phosphate (LFP) batteries, which they were already producing for consumer electronics. This success was built on prior experience in other modes of transportation, such as e-bikes and e-scooters, which helped accumulate volume and LFP experience. LFP proved to be cheaper than existing EV battery chemistry based on nickel and cobalt that was used in non–plug-in hybrid vehicles (e.g., Toyota Prius). Chinese success was achieved through trial and error subsidized by the government but undertaken by entrepreneurial firms that were intent on competing with the nickel/cobalt-based solutions used by Japanese and Korean manufacturers in their hybrid vehicles. The LFP development trajectory has been steep, in part, driven by the massive, across-the-board research investment made at the national and local levels at universities and research institutes and subsidized similarly large corporate investment.

Chinese EV and battery producers are now the global leaders, the most potent demonstration of their success. In the following discussion, we show that China not only built the entire supply chain for LFP batteries but also dominates it, capturing market shares in excess of 75 percent at most nodes in the supply chain. If the current Chinese lead continues, then other countries and their automotive industries will have to develop strategies for competing in an environment formed by Chinese firms and technologies. This paper explores the development, government policies, and current state of the Chinese BEV industry.

Why EVs in China?

In the 1990s, as the Chinese economy boomed, purchases of passenger vehicles expanded, creating increasingly serious air pollution in large Chinese cities. Moreover, China is a petroleum-poor country and thus was forced to import ever-larger amounts of oil as it grew, leading to outflows of foreign exchange, a matter of great concern at the time (Chow 1992;

Leung 2011).[2] In other words, China was on an inescapable treadmill and constantly at risk of an oil price shock from the US-controlled global oil economy. Chinese leaders faced pressure due to worsening air pollution at home and global climate change turbocharged by Chinese growth, the latter of which was acknowledged in discussions related to the Kyoto Protocol (He 2010). They realized that the pressure would only grow, as China's growth would lead to ever higher bills for oil imports.

Roughly contemporaneously, China initiated a concerted effort to develop a photovoltaic industry (Mathews 2014; Shubbak 2019)—the other part of a clean energy revolution. In the 1990s, the Chinese auto industry began to grow rapidly, as Chinese state-owned vehicle enterprises formed joint ventures (JVs) with foreign firms, which were immensely profitable for the foreign firms (Helveston et al. 2019). For example, for many years, Volkswagen's largest and most profitable market was China, which accounted for 37 percent of the company's total profits in 2020 (Volkswagen Group 2021; Waldersee et al. 2024). For China, these JVs were intended to transfer technology and liberate it from dependence on foreign technology; but, understandably, the foreign firms resisted technology transfer. However, a transition to EVs was seen not only as a solution to pollution and foreign exchange problems but also as a new industry that would not have many incumbents. Finally, China already had a consumer-electronics battery industry that used lithium-ion batteries, which was the battery chemistry used by Chinese firms to scale up and rapidly dominate, whereas Korean and Japanese firms dominated nickel batteries. From a larger perspective, EVs are only a part of the sustainability transition that includes solar/wind/nuclear energy production, battery storage, and battery-powered EVs (not only

---

[2] Also, most of this oil came from the Middle East and thus was vulnerable to being cut off during periods of global tension. In many respects, China found itself in the same position as Japan had before the onset of World War II. After World War II, Japan became almost totally reliant on the US oil majors.

automobiles, but also buses, trucks, motorcycles, lawn mowers, leaf blowers, e-bikes, ships, and perhaps even aircraft—basically anything with an internal combustion engine [ICE]).

The foregoing suggests that China is driving a "sustainability" transition to electrification. The current success of the Chinese EV industry is the result of a strategy that China developed in its catch-up phase but, more recently, has been adapted for cutting-edge industries (Jun and Kenney 2025). Moreover, pursuing further growth and development of a global-class auto industry would allow China to deepen its manufacturing infrastructure using a path similar to that taken by Korea and Japan earlier, as they became exporters.

Until recently, Chinese production of ICE was in JVs with foreign partners that had little interest in exporting from China to markets that they already controlled. China came to understand that the ICE industry would be very difficult to master, at home and, even more so, abroad

Evolving Policies to Create a BEV Industry[3]

As in every other country developing a new infrastructural technology, China has relied on the critical role of government in creating its EV industry, but the way in which this role was played was nuanced and evolved with technological progress and maturation of the market (e.g., regarding plug-in hybrid EVs [PEV] in China, see Helveston et al. [2019]).[4] The early Chinese government activities are best seen as aspirational and exploratory. Chinese government officials

[3] This section draws heavily on and is abridged from Kenney et al. (2025).

[4] For a more general discussion of how the Chinese government policies evolve as the industry grows, see Breznitz and Murphree (2011).

closely followed developments in developed countries and were highly motivated to find solutions to the multiple problems as the industry developed. Moreover, focusing simply on central government policies overlooks the role of local governments—many of which were critical in supporting startups, such as BYD, Nio, and Xpeng. Following and drawing on Kenney et al. (2025), we divide the Chinese central government efforts to nurture new energy vehicles (NEV), of which BEVs predominate, development into four stages. Further, because of the importance of local governments, we add a final section briefly highlighting a few of their many policies to encourage NEVs, in particular, BEVs.

Stage 1: Industrial policies for developing the technology, 2001–2009

The Chinese government began to experiment with developing NEVs as early as the 1990s. In 2001, the tenth five-year plan (FYP) called for "the development of economical cars, the improvement of the manufacturing level of automobiles and key components, and the active development of high-efficiency, energy-saving and low-emission automobile engines and hybrid power systems."[5] During this period, the idea of developing an "NEV industry" appeared in various industry-specific initiatives, but the ideas about what that would mean and how to do it remained vague—and were largely confined to some publicly funded research projects.

In 2001, the State Economic and Trade Commission issued the tenth FYP for the automobile industry, calling for the promotion of R&D on alternative-fuel vehicles. The goal was to develop NEVs, including BEVs as well as fuel cells, and hybrids. This policy was intended to nurture not only the development of the basic technologies but also the associated supply chains.

---

[5] www.gov.cn/gongbao/content/2001/content_60699.htm.

The central government's investment during the tenth FYP was mainly to support technology-development partnerships between existing automobile manufacturers and universities.[6] In the period of the eleventh FYP (2006-2011), the government funded 270 science and technology projects, which covered key components, power systems, vehicle integration, test platforms, demonstration, and promotion, as well as standards and policies. The financial investment available through the projects totaled RMB 7.5 billion (US$1 billion).[7] The main emphasis was on technology development across all NEV technologies. (Tesla was formed in Silicon Valley to develop EVs in 2003). Contemporaneously, though largely unsupervised or unsupported by the government, Chinese entrepreneurs began to introduce battery-powered motorcycles, which became popular with consumers (Weinert et al. 2007). As this stage ended, perhaps, inspired in part by Tesla's growing success, the central government began to consider the demonstration stage.

Stage 2: Industrial policy for pilot production, 2009–2013

Beginning in 2009, the government introduced policies to create a market for new every vehicles. First, it designated pilot cities that would be charged with creating. In early 2009, the State Council advocated the large-scale development of NEVs and initiated the "Ten Cities and One Thousand Vehicles Demonstration and Application Project for Energy-Saving and New Energy Vehicles." This policy provided financial subsidies to 10 cities that were each meant to

---

[6] During this period, state-owned enterprises that were internal combustion engine–centric automakers joined these research projects, but they did not lead the commercialization of battery-based electric vehicles.

[7] www.gov.cn/jrzg/2012-09/14/content_2224960.htm.

purchase and use 1,000 NEVs. The ambitious goal was to have NEVs account for 10 percent of all vehicles sold by 2012. However, in 2012, only 27,432 pilot vehicles were in use in the now 25 NEV demonstration cities—of which 23,032 were in the public service sector and 4,400 were purchased by private individuals (Wang et al. 2012). This policy largely failed to spurs NEV purchases.

In 2010, the State Council introduced policies to target the core technologies including batteries, drive motors, and electronic control for PHEV and BEV."[8] In addition to these policies, subsidies for BEV purchases were introduced. In 2012, the State Council issued policies that showed that BEVs were becoming the focus of government policies. Hybrids such as the Prius and energy-efficient ICE vehicles that already had significant market share no longer benefited from government policies.

The Chinese government had identified EV and PHEV as the goal of its NEV policy by 2012, though research on fuel cells continued. Interest in EVs was growing rapidly, as new firms were being formed in the United States, and Tesla, in particular, was growing rapidly. Further, Chinese air pollution problems continued to worsen, due to rapid growth in automobile ownership.

Stage 3: Industrial policy for large-scale adoption, 2013–2018

In the third stage, the government's goal was to encourage the large-scale adoption of EVs. In 2013 and 2014, the Ten Cities and One Thousand Vehicles Policy was extended to most large and medium-size cities. By September 2015, 180,945 EVs were operating in 39 cities. Moreover, in 2015, 379,000 NEVs were sold, outpacing US EV sales After 2015, China became

[8] www.gov.cn/gongbao/content/2010/content_1730695.htm.

the world's largest EV market (Liu 2024: 37). Industrial policies now focused on incentives to encourage large-scale adoption. For example, in 2014 purchases of EVs became tax exempt. Also, EV manufacturers reduced prices by deducting the subsidies for them, as the central government reimbursed manufacturers directly.[9] This policy set the subsidy standard in 2016 for various types of EVs, but it was gradually reduced over time (Liu 2024: 109).

As a result, consumer sales increased from a few thousand in the public transportation sector at the end of 2013 to more than 60,000 at the end of 2017, of which more than 60 percent were privately owned (Jin et al. 2021). This growth slowed in 2016 because of a scandal involving subsidies in which some EV manufacturers sold cars to car rental firms that they owned yet received over RMB 1 billion (approximately $150 million) in public subsidies (Yan & Dou 2016). In response, the government not only decreased fiscal incentives but also mandated that, to qualify for subsidies, EVs would have to be graded by government inspectors, and EVs with advanced technologies would receive preference for subsidies. This enabled government officials to test and certify EVs (Qiong 2017) as well as to set quality standards, which were tightened every year. By the end of this period, China had a small but growing consumer market for EVs, whose technological sophistication was rising.

Stage 4: Industrial policy to encourage market competition, 2018–

In the fourth stage, which began in 2018, the central government gradually decreased the subsidies (Kennedy 2024) and promoted marketization. In February 2018, new policies were

---

[9] www.miit.gov.cn/jgsj/zbes/gzdt/art/2020/art_dc795b036a644bdf8e3e38a75107c401.html.

introduced to increase the technical threshold requirements to qualify for subsidies.[10] Subsidy policies would now be updated annually and gradually applied to fewer vehicles; according to one estimate, total EV subsidies declined from $13,860 in 2018 to $4,500 in 2023 (Kennedy 2024). Perhaps most surprising is that the government was so confident that it allowed the then–global leader, Tesla, to build a wholly owned factory in Shanghai that was intended to produce 500,000 EVs a year.

The central government increased support for building charging infrastructure and deploying batteries, and so forth, while encouraging further technological innovation, such as developing intelligent, connected vehicles. The Circular of the General Office of the State Council on the Issuance of the New Energy Vehicle Industry Development Plan (2021–2035) issued by the State Council focuses the development agenda on R&D. With respect to the "three vertical" trajectories, it stresses pure EVs, plug-in hybrid (including programmable) vehicles, and fuel cell vehicles. In addition, the industrial policy emphasizes improving EV infrastructure by subsidizing the construction of charging networks, coordinating and promoting the construction of intelligent road networks and facilities, and orderly creation of a hydrogen fuel supply system.[11]

As the foregoing lays out, China's industrial policy evolved in four stages. The initial technology-development strategy was intended to develop the technology for building a domestic EV industry. The targets of these industrial policies evolved from the supply side to the demand side. Initially, the demand-side industrial policies were aimed at vehicles for public

---

[10] www.gov.cn/xinwen/2016-12/30/content_5154971.htm#1/.
[11] www.mee.gov.cn/zcwj/gwywj/202011/t20201103_806156.shtml.

transportation, such as buses and taxis, in designated cities. This was followed by attempts at large-scale marketization of EVs in the nationwide consumer market for passenger cars. This stage was driven by production and sales subsidies. Supply-side industrial policies continued with large subsidies for R&D. The synergies between the supply-side and demand-side industrial policies accelerated the evolution of EVs by increasing market size and encouraging rapid improvement in batteries and other components. When technological capabilities (e.g., battery technological innovations by CATL and BYD), production levels, and the scale (e.g., large sales) of BYD, CATL, and others expanded, the competitive advantages of China's EV industry became more obvious.

All aspects of EV adoption were considered, and applicable industrial policies were introduced. Throughout this period, safety was a policy and regulatory goal, as the government established safety standards for EV batteries. In 2025, it introduced the world's most stringent EV battery standard, aimed at preventing fires and explosions (Miao 2025). Because of the growth and increasing dominance of the Chinese industry and markets, increasing exportation of automobiles, and building of factories globally, these and other Chinese-developed standards will probably become the de facto and de jure global standards adopted by regulators in other countries. In many respects, the size of the Chinese EV market and its increasing dominance in much of the world suggest that it will increasingly dominate in all but the most protected markets.

Local government initiatives

China has developed a national innovation system in which the central government is responsible for setting the goals for developing industries and technology, but, in many industries, local entrepreneurs and local government officials manage the implementation of these goals. For example, the central government's desire to establish industry-university partnerships was almost invariably realized by building relationships between regionally proximate actors. For example, when the central government mandated that pioneering local governments should purchase EVs—some cities, such as Shenzhen, mandated that its municipal bus and taxi firms, which are state-owned enterprises (SOEs), purchase BYD EVs, thereby creating a market for EVs (Li et al. 2016). As local government officials were judged by their adoption of EVs, they became responsible for building charging networks. Local governments also innovated local industrial policies, such as preferential license quotas, traffic control exemptions, and infrastructure support for EVs. In addition, some cities reduced costs for vehicle owners by reducing annual inspection and parking fees, among other initiatives. For example, in 2014 the Beijing government greatly reduced the quotas for new ICE vehicles, while increasing those for EVs. These quotas are important because larger Chinese cities are crowded with cars already, so it is difficult to obtain permission to buy them. These nonpecuniary (dis)incentives can be as powerful as prices.

In addition to offering demand-side incentives, local governments also extended supplyside incentives to local entrepreneurs launching EV startups. For example, local governments gave factories building permits and low-cost land, helped arrange and fund cooperation with local research institutions, and even went so far as to offer key employees residence permits to live in particular cities. Local governments also offer loans to entrepreneurs. This support was critical in the early success of many entrepreneurial EV firms and had a positive effect on their growth. However, it has a downside, as the support can lead to excess capacity, ruinous subsidized competition, regionalism, and duplication, which can result in ferocious price wars— as the industry experienced in 2025. This situation has also contributed to a massive export boom, as manufacturers seek to circumvent domestic market competition by entering foreign markets and offering very aggressive pricing.[12]

The Chinese EV Industry

In China, more than 50 percent of all sales are now for NEVs, predominantly BEVs. As discussed earlier, government policy was critical for the development of the BEV industry. However, contrary to what one might believe about a country in which government policy is so important, the leading BEV and battery manufacturers are not SOEs but, rather, are founder-led startups and, more recently, those in the electronics industry, such as Huawei, the Chinese electronics giant, and Xiaomi, the mobile phone giant. Only after 2020 did the SOEs with their JVs with foreign firms begin a large-scale pivot to BEVs as well.

The Chinese automobile market is by far the largest in the world, with sales of 31.4 million vehicles in 2024, compared with the entire market in the European Union (EU) of nearly 11 million and the North American market of 11.5 million (the Indian and Japanese markets each total approximately 4.5 million). In particular, in 2024 the Chinese EV market totaled 12.87 million vehicles; the NEV share of total sales increased monthly, and 2025 will certainly set a new record. In contrast, EV sales in the US were expected to be about 1.6 million and sales in the EU marginally higher. This is the competitive environment in which the more than 50 Chinese and foreign EV firms, including Tesla China, are operating. When it was first introduced in large

---

[12] One example of this use of exports as an outlet is that Chinese auto manufacturers began to export new vehicles as "used cars" in order to offload excess vehicles.

volume in China in 2019, Tesla was very successful: In 2022, it was the third-largest NEV producer in China, but by February 2025 it had ceased to be among the top five brands and continued to decline because it lagged in technology and design. At the same time, Wuling, the SAIC–General Motors joint venture, rose to become one of the top five brands (see **Figures 2 and 3**). China imports essentially no foreign EVs, whereas, as mentioned earlier, it exports a large number of Chinese EVs.[13]

Figure 2: Top 18 Companies in EV sales, 2022 and 2023

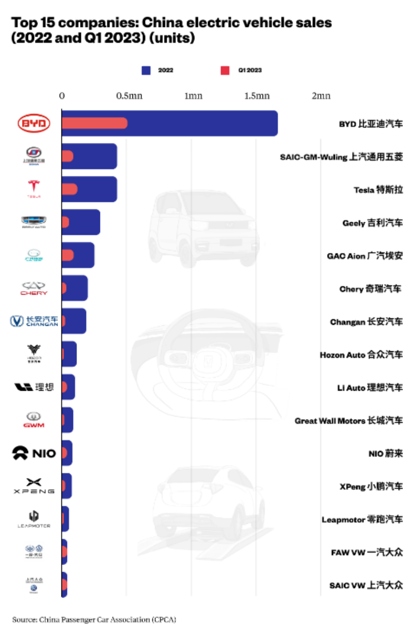


Figure 3: Automakers Share of China NEV Market (February 205 Retail)

[13] China also is exporting large numbers of ICE vehicles, especially to Russia but also other countries.

The number of EV producers in China has been counted in various ways. As of 2025 the broadly accepted total seems to be 50 discrete firms, which represents a decline from the high of approximately 90 firms in 2024. Some firms have exited the market, but many new ones have entered it, including SOE-foreign JVs and, most recently, Huawei and Xiaomi. These new entrants have engaged in ferocious price cutting, dubbed "involution." Even the strongest firms, such as BYD and Xpeng, have experienced shrinking profit margins, and the central government has cautioned firms to temper their price reductions (Wong 2025). Their fierce "race-to-thebottom" price wars are destructive of capital and can destabilize entire sectors, but ultimately the survivors become extremely competitive, though with enormous and destructive pressure on their suppliers and workers.

At this early stage, it is still difficult to determine how EV supply chains will be organized. For example, at present CATL is purely a battery producer that supplies batteries to Chinese and global manufacturers, including Toyota, VW, Nissan, and GM. Other Chinese battery makers also supply various EV producers. In contrast, BYD, the world's largest EV manufacturer, has integrated battery, electric motor, and vehicle production, and it also sells batteries to other EV manufacturers. Almost all incumbent ICE vehicle producers that had built engines and transmissions in-house now purchase batteries and electrical motors from suppliers. Given the scale and sophisticated knowledge required for battery production, backward integration into battery production might be difficult, though the two early entrants, BYD and, to a smaller degree, Tesla, continue to be battery producers (though Tesla participates in a JV factory with a dedicated battery manufacturer). Thus, no dominant design has emerged yet, and it is possible that BYD, like Apple, will become more integrated, and other EV producers will purchase batteries. However, BYD's integration strategy might be threatened by CATL's announcement in October 2025 of a sodium-ion battery that could make LFP largely obsolete, which would weaken BYD's strong position in it.

China has become the center of the global market by dint of the sheer volume of its EVs produced and sold, the number of its competing firms, and its technological advancements, and firms such as BYD, Xpeng, and CATL have developed world-class technology. Chinese firms benefit not just from lower labor costs than in many other countries but from proximity to worldclass suppliers and multidimensional economies of scale, scope, and know-how. These advantages are amplified by the ability of Chinese EV makers to develop and introduce new models every 18 months—far outpacing their European and Asian competitors (Ezell 2024).

Supply Chains

One of the keys to understanding China's dominance is the early decision, driven in part by success in producing lithium-ion batteries for consumer electronics, to emphasize lithium, which has become the dominant battery chemistry, in large measure due to Chinese success.[14] The rapid growth in the Chinese EV industry created enormous demand for components from batteries to suspension systems optimized for BEVs and materials, such as lithium and graphite, that are necessary for producing lithium-ion batteries. Although some components, such as tires and shock absorbers, are largely the same in ICEVs and EVs, the drivetrain-related components are completely different (see **Figure 4)**.

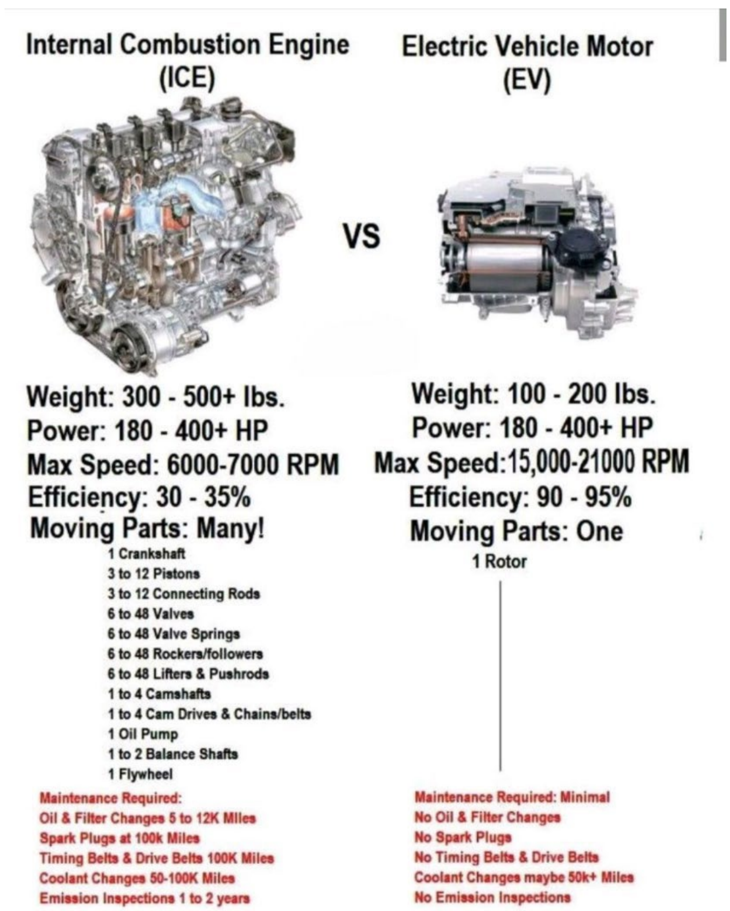


Figure 4. ICE EV Engine Part Count Comparison

[14] The move to lithium iron phosphate batteries meant that the Japanese and Korean early battery leaders no longer had a technological advantage, as their battery chemistries became less attractive particularly on a cost basis.

Precise comparison of the number of components in EVs and ICEVs is difficult, but certainly an EV has far fewer discrete components, considering the large number of subsystems and components in ICEVs. For example, a battery consists of many identical cells. In contrast, an ICEV requires a complex fuel system with a pump, an exhaust and timing system, and a complex cooling system (an EV also requires a cooling system but inherently has less heat that needs to be dispersed).

The lower number of components in an EV drivetrain means that it has less need for parts makers as well, overall. Unsurprisingly, given the domination of the Chinese market and the government's focus on creating an entire supply chain, Chinese suppliers dominate EV and battery production (and, increasingly, R&D). However, they are not alone, as they face global parts suppliers, such as Bosch and Magna (a giant premier Canadian automotive supplier), that have opened global EV R&D centers in China.

Batteries

Chinese firms dominate production at every stage of the EV battery supply chain, beginning with control over 80 percent of the lithium mines. In heavy industry and other infrastructure, SOEs were important investors in building mines, transportation networks, and so on around the world, particularly for lithium, rare earth extraction, and so forth. However, component suppliers are often either existing firms that extended their product lines (e.g., graphite producers) or new entrants. Component production is highly concentrated in a few firms globally, and, just as important, Chinese producers have become even more important. In 2024, China had nearly three-quarters of the production capacity for battery cell, specialized cathode, and anode materials, 70 percent for global cathode, and 85 percent for anode materials, and more than 50 percent of the global raw material processing of lithium, cobalt, and graphite. China dominates the entire graphite anode supply chain end to end, as it has 80 percent of the global graphite mining (International Energy Agency 2022).

The highest value-added component in EVs is the battery. In less than a decade, China went from being relatively backward and an unimportant actor in the vehicle battery industry to the global leader in production and usage. Although Chinese firms had lagged behind Asian competitors in patenting (Gong and Hansen 2023), in 2025 BYD surpassed Toyota in EV patents (Evans 2025), and its dominance seems likely to accelerate. Similarly, China and, particularly, CATL, the world's largest battery producer, gained leadership in battery patenting, though Japanese and US patents still appear to be the most influential (Greitemeier and Lux 2025). Together, as of 2025, CATL and BYD produced approximately 55 percent of the world's batteries (predominantly LFP batteries) and six of the top ten battery producers were Chinese, three were Korean (only one of which, LG Energy Solution, had a 10% market share, and one was Japanese (Panasonic, essentially for Toyota's Prius, had a 3% market share). Most important, the Korean and Japanese manufacturers are concentrated in the now-declining nickelhydride batteries. The US and the EU have no significant EV battery producers and, most likely, will remain dependent on Chinese battery producers if a new battery chemistry does not emerge.

As with EVs, battery technology development also currently appears to be concentrated in China. Most significantly, in 2026 CATL is expected to mass produce sodium ion–based batteries, whose cost will be significantly lower cost than LFP batteries>, but whose energy density appears to be only slightly less than that of LFP batteries. Sodium-based batteries have some advantages, such as higher safety, the ability to operate in extremely cold temperature, and charging speed (Leung

2025). Some estimates show that the cost of sodium ion–based batteries might drop to $10/kwh—compared to LFP, which cost approximately $80/kwh (Wang 2025). If these estimates are borne out, then battery and vehicle costs will drop dramatically. Chinese producers are even more dominant in the supply chain for raw materials and components for LFP batteries, at least in part because of Chinese government policy. Over the past two decades, Chinese firms consolidated the production of components, such as anodes, cathodes, and cell materials, attaining a market share of 80 percent in most nodes in the LFP supply chain (Greitenmeier et al. 2025). The sources of capital goods for the manufacture of batteries are more difficult to identify, but Chinese capital goods producers are likely to be dominant, at least, with regard to LFP chemistries.

Electric motors

Not surprisingly, electric motors are also a high-technology input. Motor production can be vertically integrated, and motors can be produced by auto assemblers or purchased from component suppliers. For example, BYD produces not only its own batteries but also electric motors. Although not many EV assemblers appear to follow its example, according to a McKinsey (2023) report, those that make more than 100,000 vehicles per year are expected to move powertrain production in-house.[15] EV motor producers are numerous and include Western Tier-One automobile parts suppliers, such as Bosch, Denso, Nidec, Magna, and Valeo, as well as

[15] In addition, specialized producers might be able to produce higher-quality motors, as electric motors made for EVs are also evolving rapidly, and motor efficiency also increases range (Mair 2024).

several startups. Chinese assemblers and various parts suppliers (including battery firms, e.g., CATL) produce EV motors.

Foreign EV drivetrain manufacturers, including major European auto assemblers and Tesla, have invested in both production and R&D operations in China. For example, in 2017, Magna (2017) established a JV with Huayu Automotive Systems to support Magna's first edrivetrain business in China, which is intended to supply a German automaker. Similarly, Punch Powertrain, a Belgian company purchased by the Yinyi Group in China, built significant Chinese production capacity and R&D facilities.

Because of the size and diversity of the Chinese market for electric motors to power not only automobiles but also all kinds of vehicles, from long-haul trucks to buses to bicycles, China has become the center of electric motor R&D. It is not yet clear whether a large independent electric motor industry will exist in the long term or the industry will be absorbed by auto assemblers, such as BYD, or battery producers, such as CATL, as they might be able to exploit synergies between battery packs and electric motors.

Semiconductors

More and more-sophisticated semiconductors are required for all vehicles, especially EVs (Deloitte 2021). Although these semiconductors may not be extremely sophisticated compared to those in computers and smartphones, some are high value added and, until recently, have been designed and produced by US and European manufacturers. Because of increasing trade tensions between the US/Europe and China and the volume of Chinese EV production and its importance to the Chinese economy, it is not surprising that China has implemented policies to replace foreign semiconductors with Chinese products.

Infrastructure: Charging stations

The transition to EVs will require a charging infrastructure. But, unlike the infrastructure necessary for fueling ICE vehicles when they were first introduced, the infrastructure for charging EVs—that is, the electrical grid—largely already exists. Thus, only the final node, the charging station, has to be built.[16] Very early on, the Chinese government recognized the need for this infrastructure and charged local governments with installing it. As a result, by 2022 nearly 50 percent of the EV charging stations in the world had been installed in China. But, more important, 90 percent of the fast chargers were in China, which had an installed base of 760,000, compared with 70,000 across all of Europe (International Energy Agency 2023). As a result, China has so many charging locations that "range anxiety" is far less problematic there than in the US or the EU.

The infrastructure economics are different for EVs than for ICEV, in the sense that fuel for ICEV could be accessed only at gas stations, which were eventually built in large numbers throughout a country to ensure wide availability of fuel. Moreover, ICEV required an entire supply chain, from oil drilling and refining to delivery to the end user. The transition to EVs presented fewer issues than the adoption of ICEV, as the electrical grid had already been built—that is, the problem of energy delivery had already been solved.

The charging infrastructure creates some conundrums. For example, as the range of an EV increases, demand for charging away from home will decline. Mandates that multifamily dwellings have charging points will exacerbate that problem. Further, utility and road maintenance economics will be changed dramatically by residential charging powered using

[16] Of course, as the percentage of vehicles drawing power increases, this electrical grid will have to expand.

residential solar panels (perhaps with home electricity storage). Finally, because Chinese firms have the largest and earliest market for widespread charging infrastructure, they are global technological leaders and have begun building charging infrastructure elsewhere, such as Mexico and countries in Southeast Asia. In many of these countries, Chinese charging standards are likely to adopted de facto and, possibly, de jure. This expansion will almost certainly enable Chinese charging infrastructure firms to further increase their exports (Cao 2024).

Summary

China has the largest EV market by far and, unsurprisingly, given the early attention the Chinese government paid to the entire value chain and its deliberate effort to build ecosystems, a robust value chain. Chinese firms are also global leaders in many components. Non-Chinese manufacturers that already had electric motor–related skills (Nidec, Bosch, etc.) in some of them or in components (e.g., tires, shock absorbers, and steering components) remained competitive. However, even these non-Chinese firms have had to establish R&D facilities in China both to remain competitive and to learn from the market (presumably to export that knowledge to their home markets). The EV industry is most likely to be experiencing what David Harvey called a "spatial fix" that makes one place, such as Detroit for automobiles early on, the center of a particular industry.

Globalization

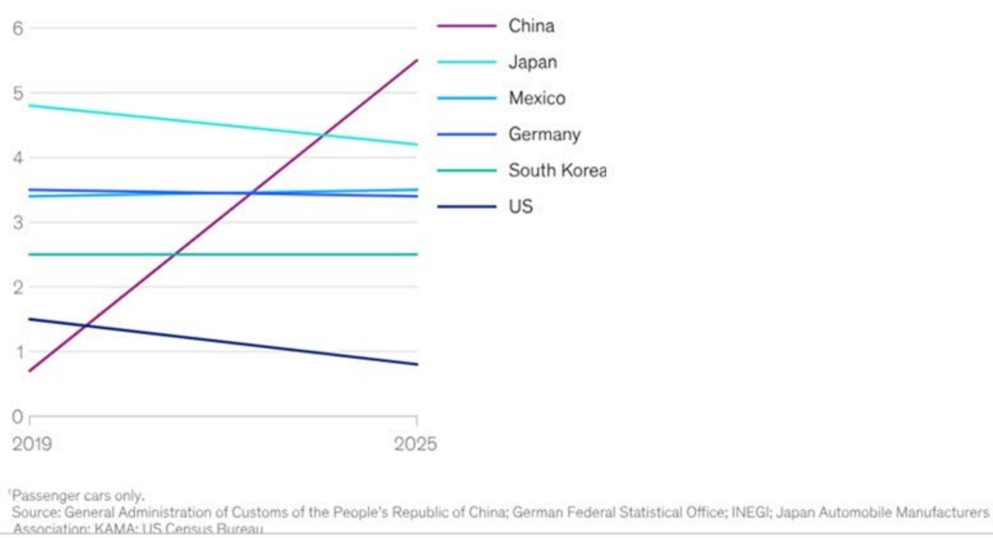
Only a decade ago, globalization and the Chinese automobile industry meant foreign direct investment (FDI) in the Chinese auto industry. But this has been reversed since approximately 2021. In 2025, an increasing number of foreign automakers shuttered their

Chinese JVs, as the market for their ICEVs declined rapidly. Moreover, the Chinese government granted Tesla the right to build a factory in Shanghai as a wholly owned subsidiary. At least some of these JVs are producing EVs not only for the Chinese market but also for export to the foreign partner's home market or to third-country markets (Chiang 2023). Finally, as discussed below, Chinese EV and battery makers are rapidly initiating manufacturing operations overseas. In the 1990s, China had only limited auto production expertise and embarked on a policy of encouraging FDI in JVs with Chinese SOEs. These were intended to accelerate technology transfer to the Chinese JV partners—a policy that was somewhat successful, though less so in key drivetrain technologies. The disruption caused by the emergence of EVs as competitive with ICEVs meant that new competitors, such as Tesla and the Chinese EV startups, could enter a market and not need a long period in which to catch up to global-class levels—and even become leaders. Thus, when Chinese EV producers enter foreign markets, they do not face deeply embedded EV incumbents—of course, there are embedded ICEV incumbents—using technology that is rapidly becoming obsolete. If unhindered, Chinese EV firms might become dominant in many foreign markets—a catastrophic outcome for incumbent transplants from, in particular, Korea, Japan, and Europe.

The growth in Chinese ICEV, EV, and battery exports has been remarkably rapid. Until 2020, China imported far more vehicles than it exported. Chinese exports began to increase at the end of 2020 and then grew enormously in 2022—just when auto manufacturers in the G7 countries abandoned the Russian market. Most of the vehicles going to the Russian market were ICEVs.

However, after 2022, NEVs began to dominate Chinese exports, as internal competition heated up, and capacity was recklessly expanded. **Figure 5** illustrates the speed of the expansion, as auto exports from China exceeded those from Japan in 2023 and continued to grow in 2025, widening the distance between its exports and those from other exporting countries. According to one estimate, auto exports from China are expected to reach 10 million by 2030 <compared to approximately 5 million in 2025 (*China Economic Review* 2025).

Figure Five: Global Car Exports by Region in millions of vehicles



Source: Reprinted from McKinsey (2025), https://www.mckinsey.com/featured-insights/weekin-charts/china-drives-to-the-top/

These Chinese car exports include ICEVs and PHEVs but increasingly consist of NEVs. Their growth created trade tension with many of the importing countries, even though the domestic manufacturers in developing countries often originated in the G7 countries in Europe, Japan, and Korea—which would be displaced by this growth in Chinese imports. Although BYD already had e-bus assembly facilities in several countries, after 2022 Chinese firms began to build assembly facilities and battery factories abroad, as a result of the tensions with these importing countries. **Table 1** shows that these facilities were concentrated in Southeast Asia, Brazil, Spain, and Morocco. Little investment was made in North America (other than two operations in the US), Africa (with the exception of Morocco and Egypt), and Russia. In the EU, Germany and Hungary have some factories, but it appears that Spain and Morocco might become the European hub for Chinese EV production.

Table 1. Chinese Overseas Factories, Product, Ownership, and Year of Opening

Chinese Firm	Location	Product	Ownership	Year of Opening
BTR	Morocco	Battery materials	Wholly owned	2026
BYD	Brazil	Buses	Wholly owned	2015
BYD	Brazil	Batteries	Wholly owned	2020
BYD	Brazil	Autos	Wholly owned	2025
BYD	Hungary	Buses	Wholly owned	2018
BYD	Hungary	Autos	Wholly owned	2026
BYD	France	Buses	Wholly owned	Closed
BYD	US	Buses	Wholly owned	2014
BYD	Canada	Buses	Wholly owned	2019
BYD	Thailand	Autos	JV	2024
BYD	Thailand	Seats	JV	2024
BYD	Indonesia	Autos	JV	2026
BYD	Brazil	Autos	Wholly owned	2026
BYD	Brazil	Buses	Wholly owned	2015
BYD	Türkiye	Autos	JV	2026
BYD	Malaysia	EV CKD	Wholly owned	2025
BYD	Uzbekistan	EVs CKD	Wholly owned	2024
CATL	Germany	Battery	Wholly owned	2018
CATL	Hungary	Battery	Wholly owned	Under construction

CATL	Spain	Battery	JV Stellantis	Under construction
CATL	Indonesia	Integrated	JV	2026
CATL	Morocco	Battery materials	Wholly owned	2026
CATL	US	Battery	Tech ties w/Ford	2025
CATL	US	Battery	JV Tesla	2025
CATL	Thailand	Battery	JV Arun	2024
Chery	Russia	EV CKD	Wholly owned	2024
Chery	Spain	EV	JV	2025
Chery	Brazil	EVs CKD	JV	2024
Chery	Türkiye	EVs CKD	Wholly owned	Under construction
Chery	Kazakhstan	EVs CKD	Wholly owned	2024
Chery	Egypt	EVs CKD	Wholly owned	2024
Chery	Malaysia	EVs CKD	Wholly owned	2024
Envision	France	Battery	Wholly owned	2025
Eve Energy	Thailand	Battery	JV	2023
Gotion	Thailand	Battery	JV	2023
Gotion	US	Battery (Storage)	Wholly owned	2023
Great Wall	Brazil	Autos (ICE)	Wholly owned	2025
Hailiang	Morocco	Materials	Wholly owned	2026
Great Wall	Brazil	EV	Wholly owned	2025
Geely	Malaysia	EV	Proton acquired	2025
SAIC (SOE)	Thailand	Batteries	JV	2023
SAIC (SOE)	Indonesia	Autos (ICE)	Wholly	2015
SAIC (SOE)	Indonesia	Batteries	JV	2025
SAIC (SOE)	India	Autos (ICE)	JV	2019
Sunwoda	Morocco	Battery	Wholly owned	2026
Tinci	Morocco	Battery materials	Wholly owned	2026

Zhongde	Morocco	Anode materials	Wholly owned	2026

Source: Author compilation from various sources. SOE = state-owned enterprise. ICE = internal combustion engine. JV = joint venture.

The speed of expansion in Chinese exports, followed by the establishment of EVs and battery production facilities is unprecedented, and it exceeds that of, for example, Japanese auto manufacturers in the 1980s and 1990s (Mair et al. 1988; Sturgeon and Florida 2000). Chinese EVs are likely to most directly affect the offshore operations of Japan, Korea, and Germany, among the developed countries. The new Chinese battery factories might prove to be potent competitors to European automakers that have had little success in developing competitive battery makers thus far. Because of Chinese production for its domestic market and exports to its capacity added in various countries, China seems certain to benefit enormously from economies of scale and learning that come with higher volume, and it is possible that a significant proportion of global demand for EVs will be satisfied by Chinese firms.

Conclusion

Chinese success in EVs and batteries resulted from a unique model that combines evolving goal setting and support by the central government, grassroots entrepreneurial initiatives, and local government experimentation with a large variety of initiatives aimed at supporting local entrepreneurs. It is based, in part, on the early adoption and massive investment in the improvement of LFP batteries, which enabled firms that use them to outflank Chinese and Korean competitors that relied on more expensive battery chemistries. The extent of this success and the current dominance of LFP batteries is illustrated by the fact that CATL and BYD together provide more than 55 percent of all EV batteries. Moreover, Chinese battery firms, in particular CATL, are investing in potential replacement chemistries, such as sodium. This success is the evolutionary result of more than 25 years of research, development, demonstration, and commercial production. Not only has China built a supply chain for EVs and LFP batteries encompassing their entire life cycle, from mining minerals to recycling, but it is dominant in many of the nodes of this supply chain. Extension of this trendline, especially if seen as part of a larger cleantech transition comprising solar- and wind-generated energy, could have profound implications.

Yet the Chinese development model also has some contradictions that are important to acknowledge. Ample evidence shows that Chinese workers receive low wages and have been widely documented to suffer abuse. Moreover, during the recent price wars, auto assemblers have delayed paying suppliers to such an extent that the central government has stepped in to demand prompt payment for deliveries. Finally, government subsidies, particularly at the local level, have contributed significantly to the excess capacity and ongoing ruinous price wars, which not only affect profitability in China but also incentivize the current tsunami of exports. These Chinese exports are so inexpensive that they are rapidly gaining market share from incumbents in the importing countries. Some of these exports are going to Russia, one of China's largest overseas markets, from which European and Japanese firms withdrew due to sanctions imposed because of the military actions in Ukraine. Another rapidly growing market and offshore production base from which the Chinese auto and battery producers will also export to third countries consists of the member countries of the Association of Southeast Asian Nations (ASEAN). Moreover, an increasingly large number of Chinese-made automobiles and EVs are sold to countries in Latin America, especially Brazil and Mexico (though Mexico is under tremendous pressure to halt

Chinese imports), and in Africa. If the current trajectory continues, Chinese EV producers might become dominant globally, catering not only to their home market but capturing much of the market in the rest of the world other than North America, Western Europe, Japan, Korea, and a few countries, such as India, that have significant political differences with China. And in many of these other countries, Chinese firms might provide the batteries and drivetrains (e.g., Toyota purchases batteries from CATL and BYD). The massive export push has also come to include the building of factories overseas.

At present, China and the LFP battery technology have the upper hand in global EVs. However, the industry is still in flux, with new entrants, particularly in batteries, that could develop and introduce new batteries that upend the industrial order. Further, governments in Europe and/or the US might erect barriers to Chinese imports or investment so as to protect their domestic producers until they can develop sufficient scale, business models, and technology to become globally competitive.

The future is difficult to predict, but the disruption caused by BEVs has created an opportunity for Chinese automakers to reclaim their domestic market from the JVs between SOEs and foreign automakers, as they rapidly and apparently decisively enter the global market. Dominance in EVs will, almost certainly, result in dominance in batteries and determine which country will benefit the most in the transition to an electricity-centric economy and society. If the current trajectory of Chinese EV and battery development continues, the domestic industrial and environmental policies of other countries will be shaped by a recognition of China's vital role in the dawning electric-centric energy paradigm.

REFERENCES

Breznitz, D., & Murphree, M. (2011). *Run of the Red Queen: Government, Innovation, Globalization, and Economic Growth in China*. New Haven: Yale University Press.

Cao, Y. (2024). China's charging pile expertise sought-after in overseas countries. *China Dail*y (April 22). https://www.chinadaily.com.cn/a/202404/22/WS6625c372a31082fc043c3329.html.

Chiang, S. (2023). BMW says diversifying risks does not mean it is leaving China. CNBC (October 25), https://www.cnbc.com/2023/10/26/bmw-says-diversifying-risks-does-not-mean-itis-leaving-china.html.

China Economic Review (2025). China to export 10mn cars per year by 2030. (September 24). https://chinaeconomicreview.com/china-to-export-10mn-cars-per-year-by-2030/.

Chow, L. C. H. (1992). The changing role of oil in Chinese exports, 1974–89. *China Quarterly*, 131, 750-765.

Deloitte (2021). Rethinking auto semiconductor strategy in an uncertain era. (November). https://www2.deloitte.com/cn/en/pages/consumer-business/articles/automotive- semiconductors-strategic.html.

Evans, L. (2025). Global EV patent counts are growing, with BYD in the lead. https://cleantechnica.com/2025/08/22/global-ev-patent-counts-are-growing-with-byd-in-thelead/.

Ezell, S. (2024). How innovative is China in the electric vehicle and battery industries? (July 29). https://itif.org/publications/2024/07/29/how-innovative-is-china-in-the-electric-vehicle-andbattery-industries/.

Gong, H., & Hansen, T. (2023). The rise of China's new energy vehicle lithium-ion battery industry: The coevolution of battery technological innovation systems and policies. *Environmental Innovation and Societal Transitions*, *46*, 100689.

Greitemeier, T., Kampker, A., Tübke, J., & Lux, S. (2025). China's hold on the lithium-ion battery supply chain: Prospects for competitive growth and sovereign control. *Journal of Power Sources Advances*, 32, 100173.

Greitemeier, T., & Lux, S. (2025). The intellectual property enabling gigafactory battery cell production: an in-depth analysis of international patenting trends. *Journal of Energy Storage*, 108, 115083.

He, L. (2010). China's climate-change policy from Kyoto to Copenhagen: domestic needs and international aspirations. *Asian Perspective*, 34(3), 5-33.

Helveston, J. P., Wang, Y., Karplus, V. J., & Fuchs, E. R. (2019). Institutional complementarities: The origins of experimentation in China's plug-in electric vehicle industry. *Research Policy,* 48(1), 206-222.

International Energy Agency. (2025). *Global EV Outlook 2025*. https://www.iea.org/reports/global-ev-outlook-2025/trends-in-electric-car-markets-2/.

International Energy Agency. (2023) *Global EV Outlook 2023*. https://www.iea.org/reports/global-ev-outlook-2022

International Energy Agency. (2022) *Global EV Outlook 2022*. https://www.iea.org/reports/global-ev-outlook-2022

Jin, L. Z., He, H., Cui H.Y., Lutsey, N., Wu, C.Q., & Chu, Y.D. (2021). Driving a green future: A retrospective review of China's electric vehicle development and outlook for the future. International Council on Clean Transportation. (January 14). https://theicct.org/publication/driving-a-green-future-a-retrospective-review-of-chinas- electric-vehicle-development-and-outlook-for-the-future/.

Kenney, M., Lewin, A, Shu, E., and Mei, L. 2025. *The Demise of the Global ICE Industry: China's Stunning Role in Leading the BEV Revolution*. Cambridge: Cambridge University Press

Kennedy, S. (2024). The Chinese EV dilemma: Subsidized yet striking. Johns Hopkins, Center for Strategic and International Studies. https://www.csis.org/blogs/trustee-china-hand/chineseev-dilemma-subsidized-yet-striking/.

Leung, A. (2025). CATL says next-gen sodium-ion battery supports 500 km range, readies for 2026 mass production. *CarNewsChina* (September 18), https://carnewschina.com/2025/09/18/catl-says-next-gen-sodium-ion-battery-supports-500-kmrange-readies-for-2026-mass-production/.

Leung, G. C. (2011). China's energy security: Perception and reality. *Energy Policy*, 39(3), 1330-1337.

Li, Y., Zhan, C., de Jong, M., & Lukszo, Z. (2016). Business innovation and government regulation for the promotion of electric vehicle use: lessons from Shenzhen, China. *Journal of Cleaner Production*, 134, 371-383.

Liu, Y. Q. (2024). *Research on Innovation and Development of China's New Energy Vehicle Industry*. Science Press (in Chinese).

Magna (2017). News Release: Magna forms e-powertrain joint venture in China. https://www.magna.com/company/newsroom/releases-archive/release/2017/10/18/news- release--magna-forms-e-powertrain-joint-venture-in-china/.

Mair, A. (2024). Maximizing efficiency: The next frontier in electric motor technology. Power and Motion (July 15), https://www.powermotiontech.com/technologies/motors/article/55093806/maximizingefficiency-the-next-frontier-in-electric-motor-technology/.

Mair, A., Florida, R., & Kenney, M. (1988). The new geography of automobile production: Japanese transplants in North America. *Economic Geography*, 64(4), 352-373.

Mathews, J. A. (2014). *Greening of Capitalism: How Asia Is Driving the Next Great Transformation*. Stanford University Press.

McKinsey (2025), https://www.mckinsey.com/featured-insights/week-in-charts/china-drives-tothe-top/

McKinsey (2023). Automotive powertrain suppliers face a rapidly electrifying future. (March).

Miao, L. (2025). China sets world's strictest EV battery standard: "No Fire, No Explosion" rule effective July 2026. *Car News China* (April 17), https://carnewschina.com/2025/04/17/chinabans-ev-battery-fires-and-explosions-with-groundbreaking-safety-standard-starting-july-2026/.

Qiong, Y. (2017). Seven Chinese automakers punished for electric-vehicle subsidy fraud. (February 2). https://news.cgtn.com/news/3d51544e77496a4d/share_p.html.

Shubbak, M. H. (2019). The technological system of production and innovation: The case of photovoltaic technology in China. *Research Policy*, 48(4), 993-1015.

Sturgeon, T., & Florida, R. (2000). Globalization and jobs in the automotive industry. *Final Report to the Alfred P. Sloan Foundation.* International Motor Vehicle Program, Center for Technology, Policy, and Industrial Development, Massachusetts Institute of Technology.

Sun, J. and Kenney, M. 2025. Central-local government interactive learning and the rise of innovative industries: Reconsidering the Chinese National Innovation System. Unpublished monograph

Victor, D. G., & Davidson, M. R. (2024). Accelerating the Clean Energy Revolution by Working with China. Washington, DC: Brookings Institution.

Volkswagen Group (2021). Volkswagen Group closes 2020 stronger than expected and accelerates transformation. https://www.volkswagen-group.com/en/press-releases/volkswagengroup-closes-2020-stronger-than-expected-and-accelerates-transformation-17127/.

Waldersee, V., Amann, C., & Steitz, C. (2024). China, price cuts and costs: the fuel driving Volkswagen's crisis. Reuters (September 8), https://www.reuters.com/business/autostransportation/china-price-cuts-costs-fuel-driving-volkswagens-crisis-2024-09-06/.

Wang, B. (2025). CATL sodium ion batteries lower cost than lithium-ion batteries. (August 15). https://www.nextbigfuture.com/2025/08/catl-sodium-ion-batteries-lower-cost-than-lithium-ionbatteries.html.

Wang, J.Y., Liu, Y.Q., & Kokko, A. (2012). Comparative study on the policies and effects of the "Ten Cities, One Thousand Vehicles" demonstration project. *Scientific Decision Making*, 12, 114. (in Chinese)

Weinert, J., Ma, C., & Cherry, C. (2007). The transition to electric bikes in China: history and key reasons for rapid growth. *Transportation*, 34, 301-318.

Wong, B. (2025). The foreign policy significance of China's "anti-involution" campaign. *China Focus* (September 19), https://www.chinausfocus.com/finance-economy/the-foreign-policysignificance-of-chinas-anti-involution-campaign/.

Yan, F., & Dou, M. (2016). What does an incomplete list of companies engaged in new energy vehicle subsidy fraud mean? *People's Daily Online* (September 11), http://auto.people.com.cn/n1/2016/0911/c1005-28706880.html.