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3%

China's share of global EV sales, 2011

26%

China's share of global EV sales, 2015

>50%

China's share of global EV sales, 2018

Clean Energy Trade Policy Case Study: China

As the economic opportunities presented by the transition to a lower-carbon economy have become more apparent, individual nations have sought to implement policies specifically intended to subsidize directly their domestic clean energy manufacturers, erect barriers to protect them from foreign competition, or some combination of both. We examine here China's policy supports for electric vehicle manufacturing and deployment.

- In 2012, China published its *Energy-Efficient and New-Energy Vehicles Industrial Plan*, which explicitly stated the central government's intention to foster development of a domestic electric vehicle and battery industry.
- The motivation was partly to become a global exporter of electric vehicles, to reduce local air pollution and cut China's consumption of oil and its reliance on energy imports.
- Beyond 2015, the focus shifted to the mass rollout of EVs. The plan included explicit targets for reducing the cost of batteries and clearly stated goals for boosting the number of EVs on China's roads by 2020.
- Direct purchase subsidies for EVs were key to boosting sales. In addition, China's current system forces automakers to sell an escalating percentage of EVs each year.
- There were fewer specific policies to support the battery industry in China, but the EV subsidy scheme boosted demand for batteries which in turn benefitted local companies.
- The push to improve energy density and battery performance also forced Chinese battery manufacturers to focus on technology development.
- The Chinese government also introduced supply-side restrictions to protect local automakers and battery suppliers by issuing only a limited amount of permits for automakers. Foreign automakers were required to set up joint-ventures with 50:50 stakes in the country.
- These restrictions have since been lifted. Overseas carmakers can now invest in wholly-owned subsidiaries and manufacturing plants.
- A clear national strategy to develop EVs and batteries coupled with specific policies and financial support to sustain it has boosted EV uptake. China's share of total EVs sold globally rose from 3% in 2011, to 26% in 2015 and exceeded 50% in both 2018 and 2019.
- The policy has yet to create an internationally-competitive automotive industry although this may still materialize. However, it did spur development of an internationally-competitive upstream EV supply chain. This includes the battery, electric controller and motors.
- China's battery manufacturers are now established among the leaders of the lithium-ion industry. They supply domestic and international automakers alike.

1. The NEV Industrial Plan

In 2012, China published its *Energy-Efficient and New-Energy Vehicles Industrial Plan*, which explicitly stated the central government's intention to foster development of a domestic electric vehicle and battery industry. As China lagged behind in internal combustion engine vehicle technologies the hope was to position the country better for the electric vehicle era. The nine-year

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plan's near-term focus was on the rollout of conventional hybrids and more efficient gasoline vehicles while research and development work continued on EVs.

Beyond 2015, the focus shifted to the mass rollout of EVs. The plan included explicit targets for reducing the cost and improving the performance of propulsion batteries and clearly stated goals for boosting the number of BEVs and PHEVs on China's roads by 2020. It also sought to raise the average fuel efficiency of new vehicles sold in China.

The government then followed through on these pronouncements with specific policies that supported both the supply and demand for EVs. The government also mandated that any foreign automaker operating in China looking to sell EVs would have to establish a 50:50 joint-venture with a locally owned manufacturer.

Today, China is the largest EV market in the world. A holistic combination of supply- and demand-side policies was key to achieving this. While these policies have yet to create an internationally competitive automotive industry, this may yet materialize. In the meantime, they have spurred development of an internationally competitive upstream EV supply chain. This includes mass production of batteries, electric controllers and motors.

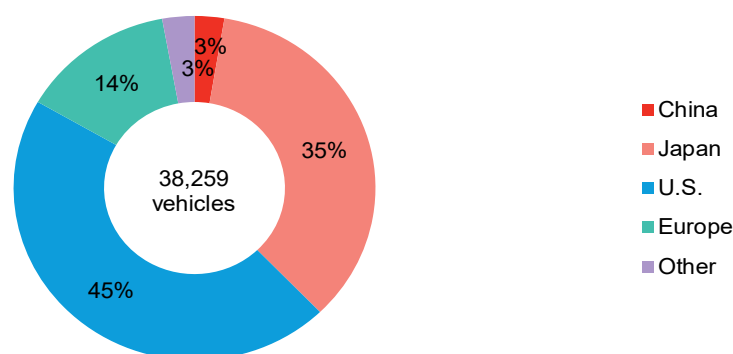
2. Policy goal

Only 40,000 electric vehicles were sold in 2011 globally and the industry was concentrated in the U.S., Japan and Europe. Just 1,000 electric vehicles were sold in China that year and the country was by no means a leading manufacturer or exporter. Things were definitely not going according to plan, as far as Chinese policymakers and industry leaders were concerned.

Two years earlier, in 2009, leading Chinese automakers had announced plans to start mass production of hybrid or electric cars by 2010. The government had outlined in its Automobile Industry Restructuring and Revitalization Plan a goal of raising annual production capacity to 500,000 electric cars and buses by the end of 2011. This was accompanied by a raft of supportive policies including subsidies, investment in public charging infrastructure and municipal procurement programs for taxis, buses and other vehicles. Many of the municipal efforts fell under the government's *Ten Cities Thousand Vehicles* plan.

What few EV sales there were in China during these years mainly were to public bodies. In November 2011, the government issued a notice entitled *Taking the Next Steps in the Promotion of Energy Efficient and New Energy Vehicle Pilots*, which encouraged municipalities to fulfil their existing obligations but was not a new policy in itself. It helped allay fears that the government would abandon its electric vehicle ambitions, but questions remained on approach.

Figure 1: Global electric vehicle sales by market, 2011



Source: BloombergNEF, Marklines. Note: Refers to both battery electric vehicles and plug-in hybrids. Depicts where vehicle is sold.

China may not have been a leading producer of EVs, but it did already have a foothold in the consumer battery industry. This is important since many of the leading electric vehicle and stationary storage battery manufacturers in 2020 had their origins in the consumer battery industry.

The Chinese government refreshed its approach with the publication of its *Energy-Efficient and New-Energy Vehicles Industrial Plan 2012-2020* in April 2012. The overarching goal remained the same: to foster development of a domestic electric vehicle and battery industry. The motivation was partly to become a global exporter of electric vehicles, to reduce local air pollution and crucially to reduce China's consumption of oil and its reliance on energy imports. China lagged in internal combustion engine vehicle technologies, so the hope was to position China better for the electric vehicle era.

The nine-year plan set a more sensible pace than previous efforts. Its near-term focus was on the rollout of conventional hybrids and more efficient gasoline vehicles while research and development work continued on EVs. Beyond 2015, the focus shifted to the mass rollout of EVs.

The plan outlined the following development tasks:

1. Increase research and development in key EV and energy-efficient vehicle technologies. This was perhaps the most important development area for the Chinese EV industry. It envisaged a ramp in R&D funded by the government and done through national research labs, universities and companies throughout the supply chain, from battery materials and batteries to vehicle control technologies and motors. A key developmental target here was the cost and cycle life of batteries.
2. Better industry planning. To avoid overcapacity issues seen in the PV industry and in the early electric vehicle battery market, the government aimed to develop two to three leading companies in each stage of the value chain, mainly batteries, battery materials, motors and transmissions.
3. Accelerate vehicle demonstration and rollout. The government would more closely monitor the 25 demonstration cities in the *Ten Cities Thousands Vehicles* plan to ensure public purchases of EVs actually occurred. It would also use average corporate fuel consumption targets to encourage uptake.
4. Increase charging infrastructure build-out. The plan called for another plan to be designed specifically for charging infrastructure to address questions of technology choice, standards, regulation and business models. Lack of clarity on these points had stymied consumer uptake of EVs in the country.
5. Invest in recycling and reuse of electric vehicle batteries. The government committed to drafting regulations on how to recycle and which companies would be responsible.

The 2012 plan had three specific initial targets (later adjusted):

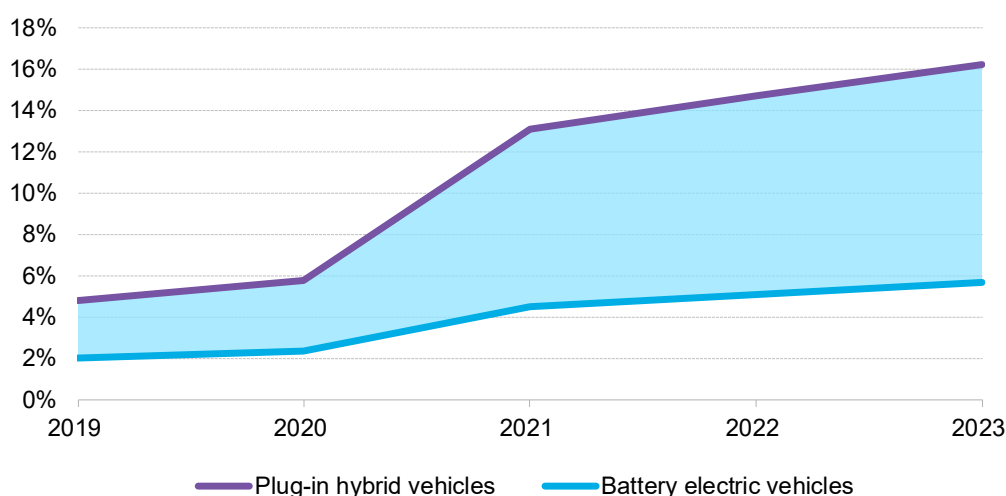
- Battery costs and performance – Battery modules should cost less than CNY 2000/kWh (\$314/kWh) and have a life of more than 2000 cycles or 10 calendar years by 2015; and should cost less than CNY 1500/kWh (\$235/kWh) by 2020.
- Vehicle sales – by 2015, cumulative sales of BEVs and PHEVs should reach 0.5m; by 2020, cumulative sales should reach 5 million and annual production capacity should reach 2 million.

- Average fuel efficiency – by 2015, passenger vehicles manufactured in that year should have an average fuel efficiency of at most 6.9 liters per 100km and energy-efficient passenger vehicles should have an average fuel efficiency of at most 5.0 liters per 100km; by 2020, these targets will fall to 5.0 liters per 100km for passenger vehicles and 4.5 liters per 100km for energy-efficient ones.

The Chinese government has since updated the specific targets on a number of occasions, but the direction remained broadly consistent with the aims above.

- In April 2017, the government issued its *Medium to Long-Term Plan for the Auto Industry*, which retained the original 2-million 'New Energy Vehicle' (NEV) sales target in 2020, and increased it to 7 million by 2025. The updated plan also aimed to double average battery pack energy density from 2016 levels by 2020, and lower the battery pack price by a third to \$150/kWh.
- In June 2020, China ratified the NEV mandate for 2021-2023, aiming to speed EV adoption while improving the fuel efficiency of internal combustion cars. Changes, such as increased NEV targets and tighter fuel consumption requirements, will put more compliance pressure on automakers.
- The November 2020 *New Energy Vehicle Industry Development Plan* aims for battery electric vehicle to make up the majority of auto sales by 2035.

Figure 2: EV share of annual China passenger vehicle sales needed to meet the government's New Energy Vehicle targets



Source: BloombergNEF. Note: Required EV share of sales (the blue shaded area) will vary depending on the mix of battery electric and plug-in hybrid vehicles sold.

2.1. Implementation

The Chinese government used a combination of demand and supply side policies to further its high-level EV goals. Local governments also provided additional, but narrower support.

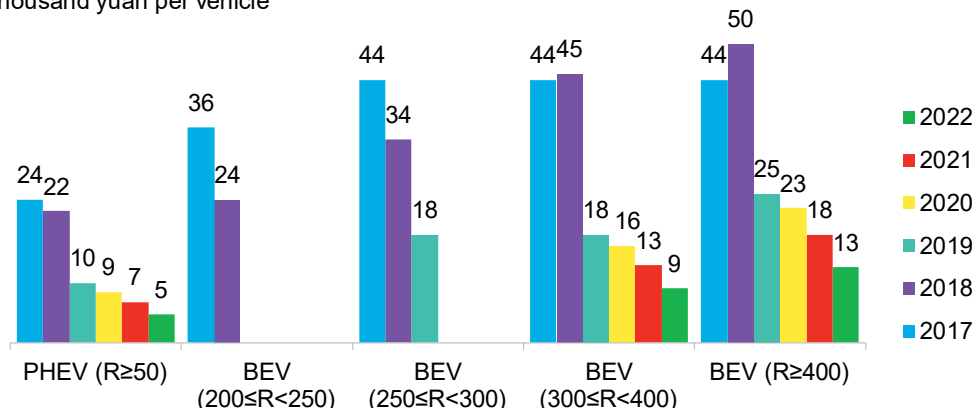
Demand-side

Direct purchase subsidies for EVs were key to boosting sales. The focus on range and battery energy density also directed automakers' model design and chemistry choices (Figure 3). The

specific criteria have been amended a number of times over the last few years but the principle has remained consistent.

Figure 3: China national passenger EV subsidies by vehicle range

Thousand yuan per vehicle



Source: BNEF, China's Ministry of Finance Note: "R" refers to electric range as measured in kilometers. BEV = battery electric vehicle, PHEV = plug-in hybrid electric vehicle.

There were fewer specific policies to support the battery industry in China, but the EV subsidy scheme boosted demand for batteries which in turn benefitted local companies. The push to improve energy density and battery performance also forced Chinese battery manufacturers to focus on technology development.

Supply-side

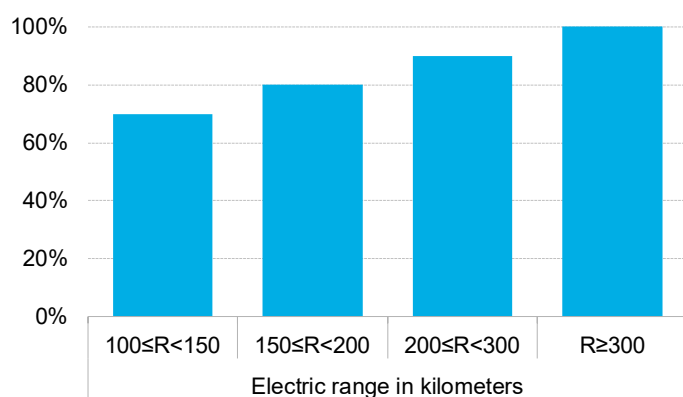
The Chinese government also introduced supply-side restrictions to benefit local automakers and battery suppliers. In 2015, the National Development and Reform Commission (NDRC) and Ministry of Industry and Information Technology (MIIT) jointly issued the New Investment Electrified Vehicles Corporation Management Regulation, which served as the basis for EV production permits. The government began making permits available in March 2016 and by May 2018 had issued a total of 15. Securing a permit was step one for automakers seeking to sell EVs and receive government subsidies. Foreign automakers were also required to set up joint-ventures with 50:50 stakes in the country.

These restrictions have since been lifted. In April 2018, for instance, the National Development and Reform Commission announced plans to remove the restrictions on foreign automakers' investments in China. Overseas carmakers would be able to invest in wholly owned subsidiaries and manufacturing plants, rather than being required to set up 50-50 joint ventures. This restriction was lifted for EV manufacturing in 2018 and for commercial vehicles in 2020. It is scheduled to be lifted for all vehicles in 2022.

China also introduced a New Energy Vehicle (NEV) credit program in 2012. Similar to California's Zero Emissions Vehicle (ZEV) mandate, China's system forces automakers to sell an escalating percentage of EVs each year. New Energy Vehicles in China includes battery electric vehicles (BEVs), plug-in hybrids (PHEVs) and fuel cell vehicles (FCVs). As with the direct subsidy program, the policy differentiated between performance characteristics of different technologies. For 2020 for instance, the baseline NEV credits generated per battery electric vehicle are a function of the vehicle's range. If the electric range is lower than 100 kilometers, it will receive zero NEV credits; if it is between 100-150 kilometers, it will get one credit. There are additional

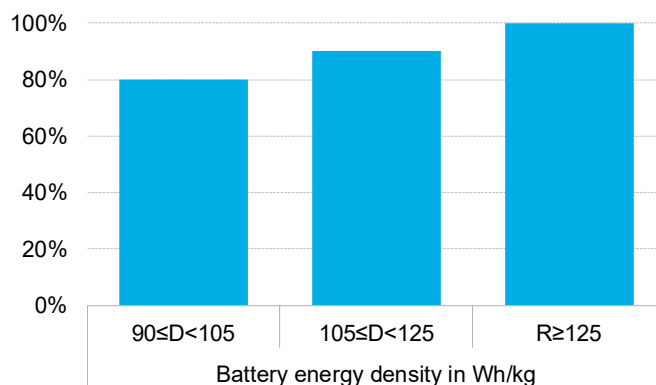
bands for longer-range vehicles with an upper limit of 3.4 NEV credits. There are also three multipliers – which are based on range, battery energy density and vehicle efficiency – that are applied to the baseline NEV credits.

Figure 4: NEV credit multiplier by range, 2020



Source: BloombergNEF, Ministry of Industry and Information Technology

Figure 5: NEV credit multiplier by battery energy density, 2020



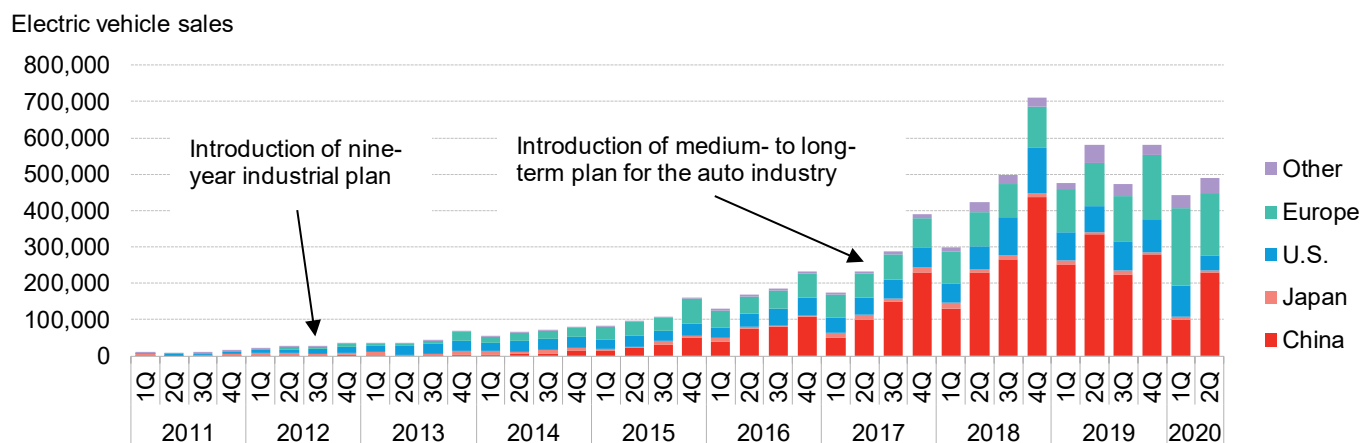
Source: BloombergNEF, Ministry of Industry and Information Technology

Local governments have also enacted policies to attract investment in battery industries in their respective regions. These have ranged from preferential loans to simplified administrative procedures.

3. Market impact

The combination of a clear national strategy to develop EVs and batteries, and specific policies and financial support to sustain it has boosted EV uptake. China's share of total EVs sold globally rose from 3% in 2011 to 26% in 2015 and exceeded 50% in both 2018 and 2019 (Figure 6).

Figure 6: Electric vehicle sales



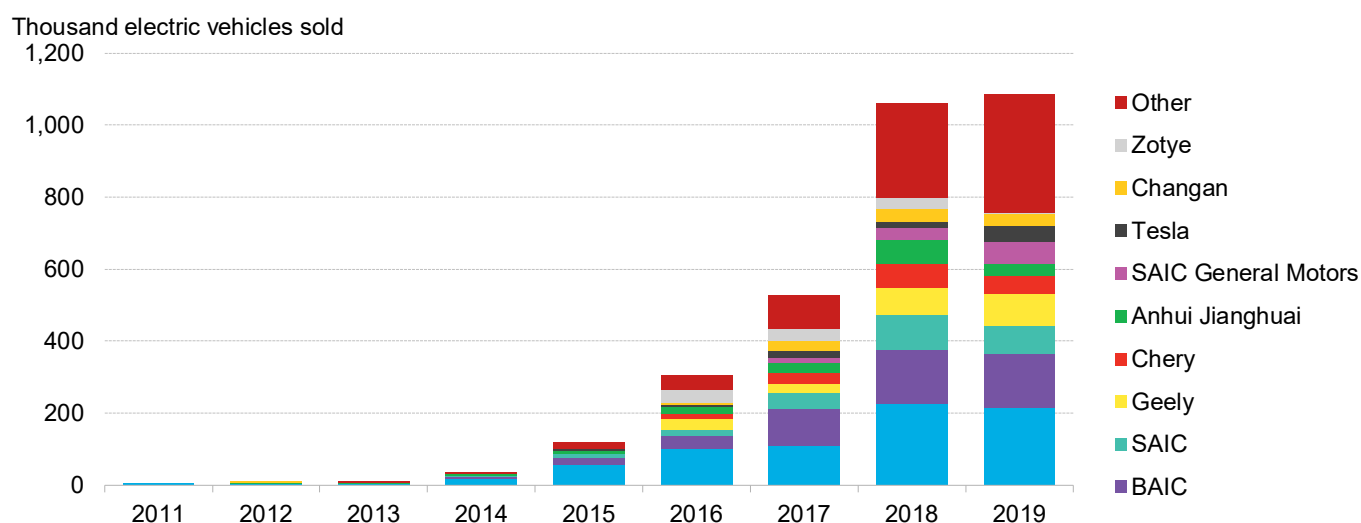
Source: BloombergNEF, Marklines

4. Did it succeed?

As overall EV sales have surged in China, domestic automakers have reaped the benefits. Among the top 10 manufacturers serving the market from 2011-2019, just two were not entirely Chinese-owned: California-based Tesla Motors and a SAIC-General Motors joint venture (Figure 7). Shenzhen-based BYD topped the list, followed by Beijing-based BAIC.

Direct subsidies supporting EV purchases have had the greatest market impact to date. Fuel economy regulations and the NEV credit requirements have been relatively easy for automakers to meet so far. This is likely to change though as the direct subsidies expire in 2022 and targets ratchet up to put more compliance pressure on automakers.

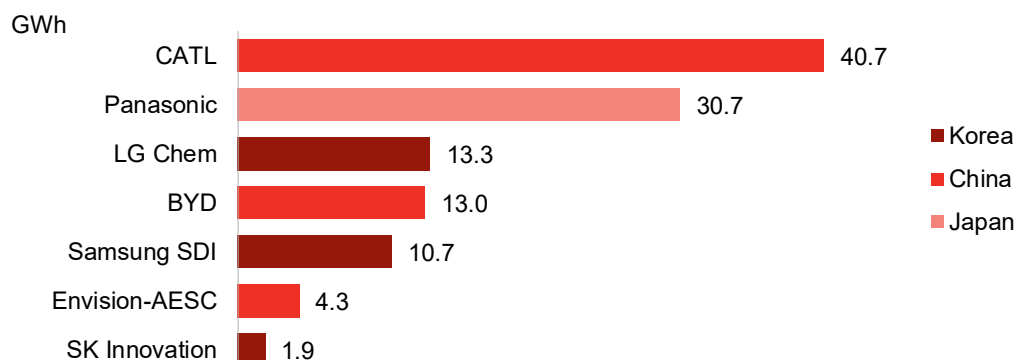
Figure 7: Electric vehicle sales in China



Source: BloombergNEF

The combination of national and local policies has also led to Chinese battery manufacturers establishing themselves as top-tier battery suppliers. China's CATL was the world's largest supplier of batteries for EVs and for stationary storage in 2019 (Figure 8).

Figure 8: Total passenger EV and stationary storage battery shipments in 2019 by leading manufacturers



Source: BloombergNEF

The policy has succeeded in creating a domestic electric vehicle automotive industry. China is and will continue to be the world's largest for the next decade or more based on annual sales and fleet size for both passenger and commercial vehicles. The combination of policies ensured that Chinese automakers and battery manufacturers were able to scale.

Outside China, Chinese automakers have so far yet to establish major footholds, however. Growing EV demand in other countries is mainly met by U.S., Japanese or European carmakers.

More recently, China's government has begun to open the market to foreign companies to boost competition. As a result, Tesla is rapidly expanding market share in the country. If Chinese automakers can sharpen their product offerings to compete on their home turf with the best the West has to offer, the recent change may ultimately help China achieve its objective of becoming the world's leading EV supplier. Or domestic manufacturers could see their market shares shrink.

Things are more clear-cut on the battery side: China's battery manufacturers are now established among the leaders of the lithium-ion industry. They supply domestic and international automakers alike.

5. The current situation

Despite Covid-19 related disruptions, China continues to be the world leader in terms of EVs purchased and manufactured. Supportive central and municipal government policies in the short term, including extended purchase incentives, fuel efficiency regulations, the New Energy Vehicle mandate, and city restrictions on internal combustion engine vehicles, should propel the industry further in the next several years. Rising automaker commitments and growing investment in charging infrastructure are poised to speed mass-market adoption over the next decade and solidify China's leadership position. To date, Chinese policymakers have demonstrated flexibility in adjusting policies as market conditions have fluctuated. This suggests they will be open to further changes if required in the years ahead to achieve the country's overall strategic goals.

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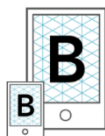
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