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# THE GLOBAL ELECTRIC-VEHICLE MARKET IS AMPED UP AND ON THE RISE

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China remains firmly in the lead on our Electric Vehicle Index. But other pockets of growing public- and private-sector commitment to these vehicles have emerged.

Last year, for the first time, global sales of new electric vehicles (EVs)<sup>1</sup> passed a million units (Exhibit 1), according to McKinsey's Electric Vehicle Index (see box "What is the Electric Vehicle Index?" below). Under the current growth trajectory, EV producers could almost quadruple that achievement by 2020, moving 4.5 million units, around 5 percent of the overall global light-vehicle market.

Pure electric vehicles (BEVs) currently make up 66 percent of the global EV market. BEV sales are growing faster than those of plug-in hybrid vehicles (PHEV). However, specific markets have very different powertrain preferences, which are influenced by regulatory actions, customer choice, and the availability of specific models.

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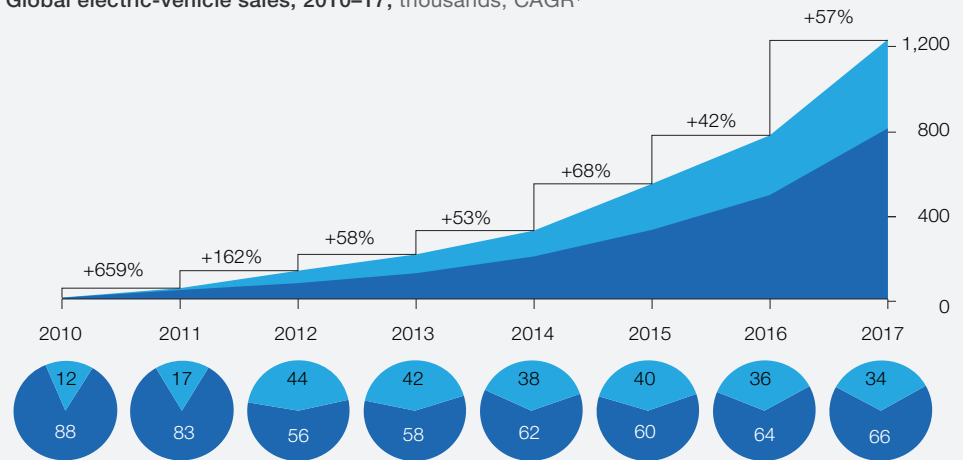
<sup>1</sup> Electric vehicles are defined as light vehicles that are either pure electric vehicles (BEVs), range-extended electric vehicles, or plug-in hybrid vehicles (PHEVs).

## Exhibit 1

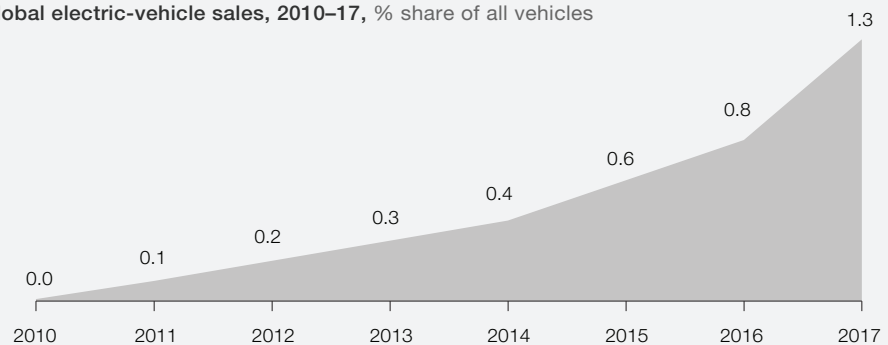
Last year, for the first time, global sales of new electric vehicles passed a million units.

■ Plug-in hybrid-electric vehicle ■ Battery-electric vehicle

Global electric-vehicle sales, 2010–17, thousands, CAGR<sup>1</sup>



Global electric-vehicle sales, 2010–17, % share of all vehicles



<sup>1</sup>Compound annual growth rate.

McKinsey&Company | Source: EV-volumes.com; McKinsey analysis

### China solidifies its leadership position in EV sales

The Chinese market expanded by 72 percent over the previous year in 2017, solidifying China's leadership position in EV sales. The country now has a larger EV market—primarily BEVs—than Europe and the United States combined. With a sales share of around 94 percent, domestic OEMs currently dominate the Chinese EV market.

Generous subsidies and tight regulation continue to drive much of the growth. Electric vehicles are exempt from license-plate lotteries and auctions in some Chinese cities, and this still plays an instrumental role in promoting EVs. After a successful pilot program in selected cities, the Chinese government decided last year to introduce green license plates for new

energy vehicles (NEVs) across the country. At the end of 2017, the plates were rolled out to all provincial capitals and other selected major cities, with the remaining cities to follow in the first half of 2018. Car owners with these license plates will be eligible for preferential treatment. Furthermore, China's national and local subsidies for electric vehicles are among the world's highest, reducing consumer concerns about the comparatively high up-front cost.

However, in an attempt to reduce spending on subsidies while still encouraging EV sales, the government recently communicated a change in the incentive policy. On the one hand, it raised the minimum range to qualify for any incentive to 150 kilometers (up from 100) and the energy-density requirement to 105 watt-hours per kilogram (up from 90). On the other hand, the subsidies for long-range BEVs (400 kilometers or more) rose by 14 percent, to 50,000 renminbi (\$7,900). Monetary support for plug-in hybrid vehicles fell by around 8 percent, to 22,000 renminbi (\$3,500).

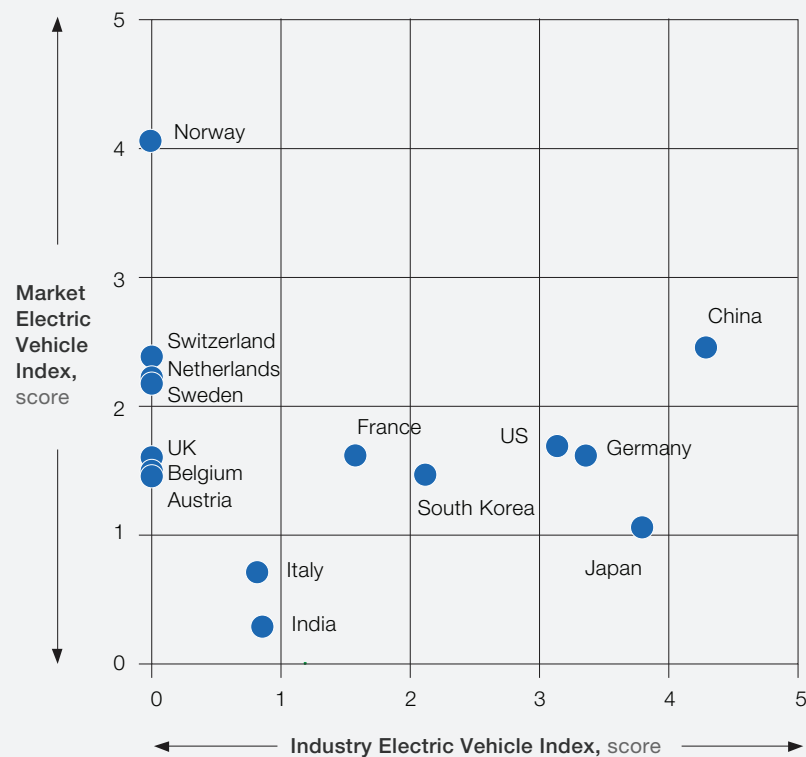
In absolute terms, China's EV-sales performance is quite remarkable. Yet the adoption rate represents only 2 percent on a national level—a limited number of large cities (such as Beijing, Hangzhou, Shanghai, Shenzhen, and Tianjin) account for a majority of EV sales. Nonetheless, China's positive market performance helped put the country in a strong, well-balanced position in McKinsey's latest overall EVI rankings (Exhibit 2): it was outperformed only by Norway in the EVI market score and reinforced its leading position—ahead of Japan, Germany, and the United States—in the industry EVI analysis (the “supply” side of the equation). However, given today's EV-battery economics, leadership in EVI scores comes at a price: China and Norway have some of the world's highest levels of spending on consumer and supply-side subsidies, at the taxpayers' expense.

## Exhibit 2

China moves into the lead in global electric mobility.

Electric Vehicle Index (EVI) development of selected countries, score out of five

Market Electric Vehicle Index, rank



- 1 Norway
- 2 China
- 3 Switzerland
- 4 Sweden
- 5 Netherlands
- 6 US
- 7 France
- 8 UK
- 9 Austria
- 10 Belgium
- 11 South Korea
- 12 Germany
- 13 Japan
- 14 Italy
- 15 India

- Industry Electric Vehicle Index, rank
- 1 China
  - 2 Japan
  - 3 Germany
  - 4 US
  - 5 South Korea
  - 6 France
  - 7 India
  - 8 Italy

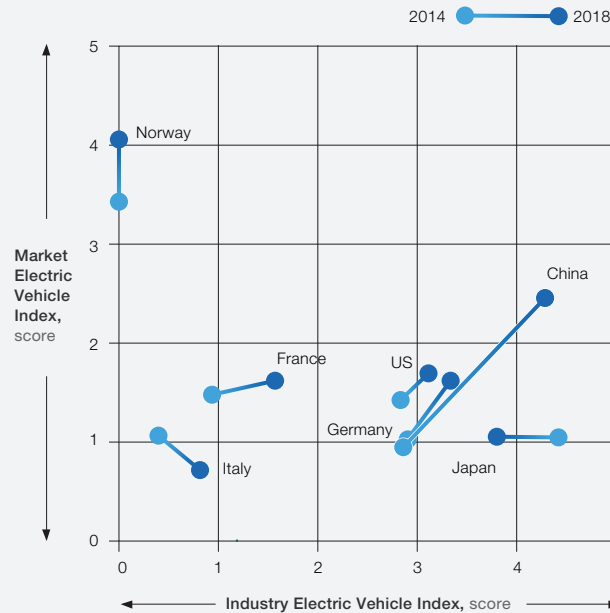
McKinsey&Company | Source: McKinsey analysis

A comparison of EVI performance over time reveals that China has rapidly overtaken the United States and Germany in combined EVI scores. Exhibit 3 shows China and Germany occupying roughly the same position in 2014, for example. Yet by 2018, China had far outpaced Germany in both market and industry EVI scores. In the market EVI scoring, China improved through higher EV sales, significant monetary and nonmonetary incentives, a greater variety of models, and the investment intensity of the charging infrastructure. China also excelled on industry scoring, significantly increasing its EV production and component shares. Major restrictions on local content—especially approved battery suppliers—keep a large portion of China’s EV profit pool locally based.

### Exhibit 3

China's positive performance put the country in a strong position in McKinsey's latest overall Electric Vehicle Index rankings.

**Electric Vehicle Index (EVI) development of selected countries, score out of five**



#### Examining the details

**China** is outperforming other countries on both market side (EV penetration rose from 0.3% to 2.2%, available models number almost 100, intense investment in charging infrastructure) and industry side (higher EV and component share)

**France's** EV market increased slowly, from 0.7% to 1.7% adoption rate; gains on industry side driven by insourcing of EV components

**Germany** had equal though slow improvement on both market and industry side as a result of higher sales (from to 0.4% to 1.5%) and vehicle production

**Italy's** market-side performance decreased because of stagnant market; missing industry focus on e-mobility slowed progress on supply side

**Japan** lost ground on industry side because of falling market share in EV and component production; slight improvement on market side given slow sales development (from 0.6% to 1.1%)

**Norway** increased EV penetration from 11% to 32% in 4 years, thanks mainly to significant monetary and nonmonetary incentives and larger choice of EV models

The **US** had few positive dynamics on both market and industry side; while EV model availability and market share (from 0.7% to 1.2%) rose slightly, vehicle and component production share decreased

McKinsey&Company | Source: McKinsey analysis

### Germany and Norway led growth in the European Union

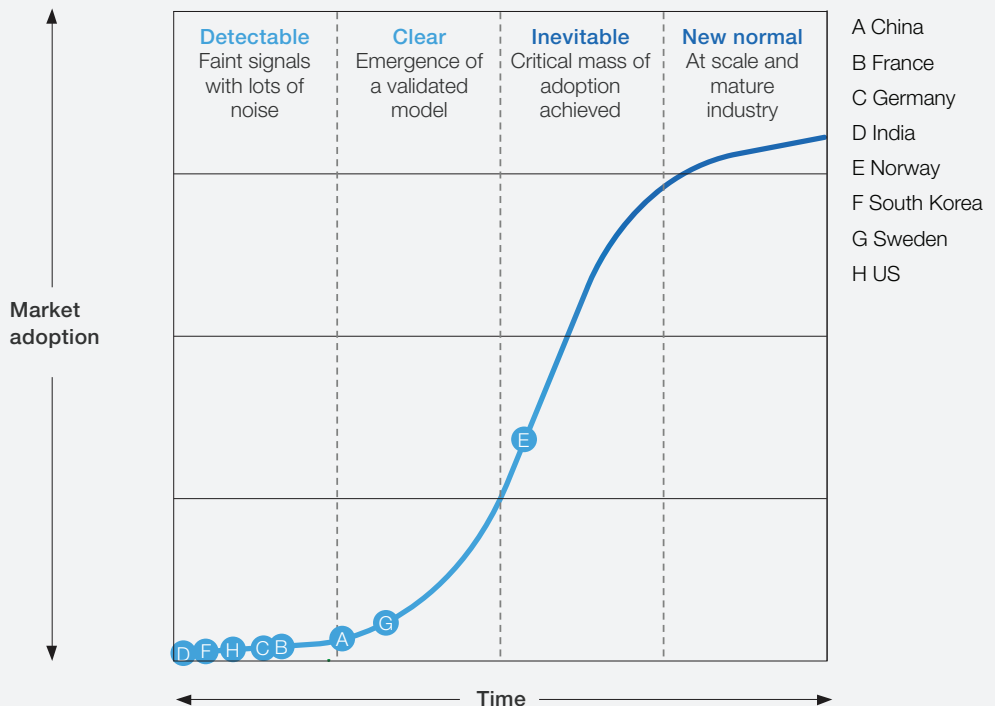
Europe's EV market grew by nearly 40 percent from 2016 to 2017, albeit from a small sales base. A variety of factors contributed, such as the ongoing headwinds for diesel technology and increasing customer interest in EVs. Much of the regional momentum emerged in Germany, where the EV market more than doubled. That country is now Europe's second-largest EV market, outperformed only by Norway.

Excluding the Netherlands, where an incentive shift from PHEVs to BEVs led to a significant drop in overall EV sales, European markets underlined the regional growth trajectory. Norway's EV sales-penetration rate reached 32 percent in 2017, and by December every second passenger car sold there was an EV. Norway stands largely alone in its mass-market embrace of electric vehicles, so it provides a real-world picture of future EV sales proportions that developed markets could experience over the next five to ten years. Exhibit 4 shows the four stages of a disruptive trend. Having reached a critical mass of EVs, Norway is clearly ahead of other countries—the EV disruption is inevitable. Most other countries are still in the first stage, except for China and Sweden, which have already advanced to the second: disruption is somewhat more clear, with EVs emerging as a validated model.

## Exhibit 4

In Norway—which is clearly ahead of other countries—the electric-vehicle disruption is inevitable.

The 4 stages of a disruptive trend—focus on electric-vehicle market adoption



Source: Chris Bradley, Martin Hirt, and Sven Smit, Strategy Beyond the Hockey Stick, McKinsey, 2018

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The rollout of more attractive, better-performing EVs in key high-demand segments is another major driver for sales uptake, both in Europe and the United States. Nevertheless, at 27 percent, US growth lagged behind that of China and the European Union, since fuel prices remain low, reducing the operating-cost advantage of EVs. Likewise, the US Environmental Protection Agency recently announced that it would revise existing vehicle-emission standards (set by the previous administration), which require cars and light trucks to average more than 50 miles a gallon by 2025. It is still unclear what the new standards will look like, but the regulations, or the time frame for their adoption, will probably be relaxed. However, California and 12 states that follow its lead are determined to maintain stronger air-pollution standards than the federal government does.

India is new to the EVI this year. Both EV market acceptance and EV industry dynamics are at an early stage: the EV-adoption rate is less than 1 percent and domestic OEMs are just starting to launch EV models. Although the government rolled out a new tax policy to encourage EV adoption, a clear strategic road map is still missing. Demand comes mainly from commercial

owners and the public sector, and the country has almost no charging infrastructure. Since India's carbon-dioxide levels from electricity generation are among the world's highest, it also needs more renewable-energy sources for its EVs to achieve true "well-to-wheel" zero-emission status.

### **New models (and regulations) to stoke markets**

Global automakers will reportedly launch approximately 340 BEV and PHEV models in the next three years, significantly reducing supply as a barrier to further market uptake. The OEMs' increased attention mainly reflects tougher emissions targets, especially in China and Europe, and announcements that several countries, as well as cities around the world, will set end dates for the sale of diesel- and gasoline-powered vehicles. Norway, for example, wants BEVs to account for 100 percent of its new-car sales by 2025. California, France, and the United Kingdom have proclaimed that they will end sales of ICEs by 2040.

China too seems to be developing a long-term plan to abandon vehicles powered by fossil fuels: a new EV policy, which will become effective by 2019, requires automakers to comply with a mandatory EV credit target. As a result, several international automakers announced new joint ventures with domestic Chinese brands to develop and produce numerous EVs together.

#### **What is the electric vehicle index?**

McKinsey's proprietary Electric Vehicle Index (EVI) assesses the e-mobility performance of 15 key countries around the world. Since the creation of the EVI, several years ago, it has served as a critical tool to help organizations exposed to the automotive, mobility, and energy sectors understand how electric-vehicle (EV) dynamics have evolved at a granular level and where they are trending for the future.

The index explores two important dimensions in the advance of electric mobility: markets and demand, on the one hand, and industries and supply, on the other. On the market side, it analyzes the share of electric vehicles in the overall market. It also looks at incentives, such as subsidies, the existing infrastructure, and the range of electric vehicles available. The industry side determines how successfully the automotive sector in each country has supported electric mobility. It involves analyzing a range of factors such as the current and future share of electric vehicles in the global production of vehicles and incorporates key components, such as e-motors and batteries.

Every country is assessed on the key performance indicators and accumulates a score from zero to five. These are transferred into an overall weighted score, which is the basis for the final EVI matrix and country ranking.



Electric vehicles have made meaningful progress in several regions and countries as they passed the milestone of one million sales, in 2017. With demand rising and manufacturers ramping up production capacities, the market will continue to grow. Looking forward, the confluence of government action, greater attention by OEMs, rising customer acceptance, and ingenious suppliers could accelerate the segment's profitability until the early to mid-2020s.

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