

Electric Vehicles and Driving Technology

Thematic Investing

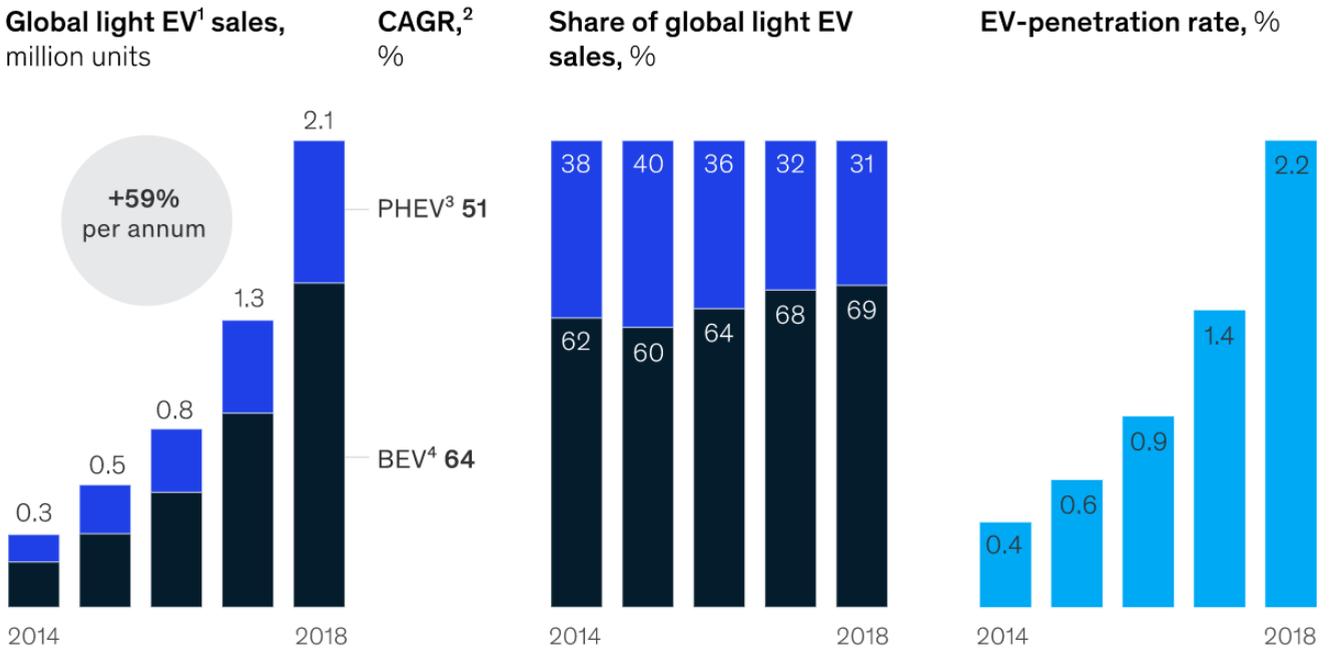
For the longest time, operating a car required the use of some sort of fossil fuel (e.g. petroleum or diesel) and also required a human being behind the steering wheel to guide the way. Today, things are changing at a fast pace.

Introduction

The internal combustion engine powered by fossil fuels has long dominated motorways all over the world. Throughout the past few years though, there has been an increase in the adoption of electric cars, benefiting the electric vehicle market. Based on data by McKinsey, the global market for electric vehicles has grown about 60% per annum, reaching 2.1 million in 2018 (Hertzke and Wu 2019).

Electric vehicles have been around for a while

Electric vehicles have actually been around since the late 1800s. The first successful electric car made its debut around 1832 thanks to a Scottish inventor called Robert Anderson. Anderson's pioneering work involved strapping a non-rechargeable battery and a motor onto a carriage to create the first ever horseless carriage. Over the next few years, there was a flurry of electric vehicles produced but this was curtailed by the discovery and extraction of huge reserves of petroleum across the globe.



¹Electric vehicle. ²Compound annual growth rate. ³Plug-in hybrid electric vehicle. ⁴Battery electric vehicle. Source: EV-Volumes.com; McKinsey analysis

Source: McKinsey

Figure 1: Global electric vehicle market

Roll forward to the 1990s, car manufacturers renewed their interest in producing electric vehicles. Amongst the first was General Motors (GM) with their EV1 produced and leased from 1996 to 1999. The Toyota Prius, released in Japan in 1997, became the world's first mass-produced hybrid electric vehicle. In 2008 Tesla launched its Roadster to market in 2008. Other major car brands were quick to follow. By 2010, the Chevy Volt (the first commercially available plug-in hybrid) and the Nissan LEAF (fully electric) were released in the US.

Today, there are around 40 models of Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV), with the most popular models coming from Tesla, including the Model 3, Model S and Model X.

Drivers of the electric vehicle market

Growing consciousness of the effects of fossil fuels and government measures

Roughly half of the global oil production goes to road vehicles, and 22% of the world's annual greenhouse gas emissions come from oil-powered transportation – mainly cars, trucks, and buses.

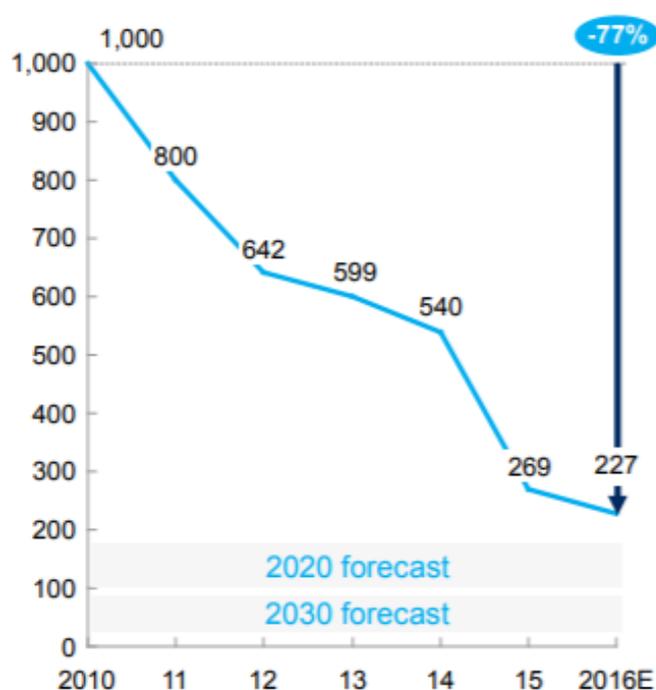
Consumers are becoming more aware of the greenhouse gasses emitted by the internal combustion engine and hence have switched to less polluting transportation. Governments are also incentivising citizens to purchase electric vehicles through tax breaks.

Some countries are taking bold steps to cut emissions from road vehicles. Norway, for example, announced 100% EVs in 2025. Meanwhile, Germany targets to have 7 - 10 million EVs on the road by 2030 (Nicholas and Wappelhorst, 2020); and India aims for 30% of new vehicle sales to be EVs by 2030 (Sahay 2020). The US state of California, France and UK are also targeting 0 internal combustion engine vehicles sold by 2040.

Some governments are providing incentives to their citizens to switch from internal combustion engine vehicles to electric vehicles. The Canadian government is offering a rebate of up to CAD5,000 to buyers of electric vehicles while the German government is providing up to EUR9,000 subsidy for electric vehicle cars that cost less than EUR40,000.

Cheaper battery prices

From 2010 to 2016, battery pack prices fell roughly 80% from ~\$1,000/kWh to ~\$227/kWh. Current projections suggest the potential for pack prices to fall below \$100/kWh by 2030. Lower costs for battery packs could potentially bring base versions of the Chevy Bolt below \$30,000, and base versions of the Tesla Model 3 below \$40,000 after the \$7,500 federal tax subsidy is applied (Hertzke and Wu 2019).

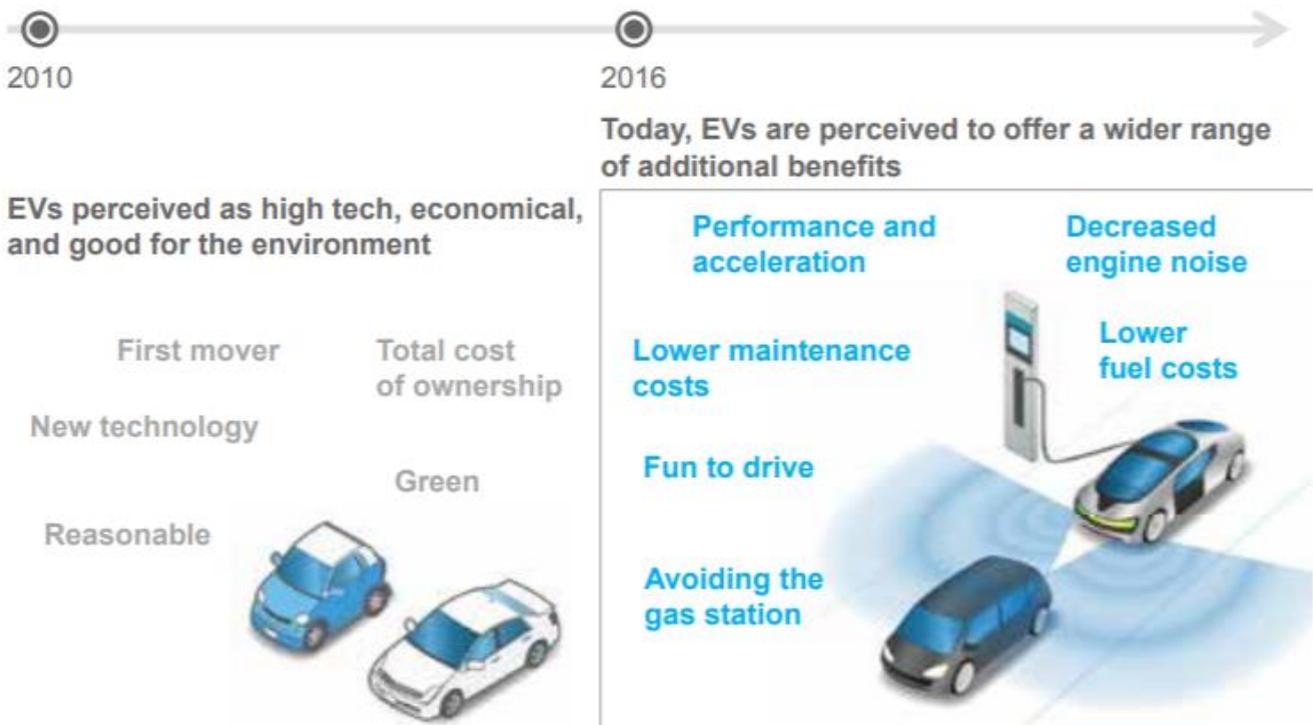


Source: McKinsey

Figure 2: Average battery pack prices, \$ per kWh

Changing perception on the benefits of EVs

While early adopters of EVs were focused on high-tech features and sustainability, research shows that many potential buyers now cite a wider set of perceived benefits. Exemplifying this shift, acceleration and driving performance are now among the top benefits that many potential buyers now cite when considering EVs. The benefit of instant torque from e-motors was not a part of the consumer conversation for early EV models (Hertzke and Wu 2019).



Source: McKinsey

Figure 3: Global electric vehicle market

Artificial intelligence is also being leveraged to replace humans behind the wheel

For most people, driverless cars remain a science fiction concept. However, they already exist today. Autonomous vehicles developed by several different firms have already safely driven millions of miles over the past few years.

Vehicles tested by Google's Waymo have driven twenty million miles and now clock up 25,000 miles every day. Autonomous shuttles by companies such as Nuvia are operating in public areas in Switzerland, Germany, France and the US. Furthermore, driverless taxis are being tested on the streets of Pittsburgh by Uber and Volvo, and of Singapore by Nuro.

Benefits of driverless vehicles

A key driver for the adoption of autonomous vehicles would be the massive improvement in road safety for all users. According to the World Health Organization:

- Every year, 1.35 million people die of road traffic crashes: and
- Road crashes are the leading cause of death among young people ages 15-29.

Various studies have identified that the vast majority of car crashes are down to human error. According to Google's Waymo, 94% of crashes in the US involve human error.

This can be mitigated with autonomous vehicles that:

- Can see around the vehicle in all directions;
- Uses radars to detect cars that have slowed down ahead of it;
- Makes use of infrared to detect a pedestrian on a dark night; and
- Utilises lasers to map an incredibly detailed view around them and learn from other cars in real-time. This means that when one car sees a new pothole or construction detour, the whole fleet will know about this immediately.

The other benefit of driverless cars is improving mobility for people who can't drive. Self-driving cars offer convenient door-to-door transportation that is as fast as driving yourself for the price of taking the bus. In particular, the technology would benefit people with low vision, the disabled and senior citizens who can't operate cars today.

The market for these technologies is set to grow strongly

Looking ahead, analysts expect exponential growth in the electric vehicles market in the coming years, with a very significant inflexion point around 2025-2030. According to data from the Carbon Tracker Initiative, electric vehicles are expected to represent 8-15% of global car sales by 2025, and 35-55% by 2040 (Sussams and Leaton 2017).

For driverless technology, on the other hand, McKinsey estimates that, by 2030, fully autonomous cars could represent up to 15% of passenger vehicles sold worldwide. This could rise to 80% by 2040, depending on factors such as regulatory challenges, consumer acceptance and safety records (Kaas and Mohr 2016).

A few of the large car manufacturers such as Volvo and Mercedes currently have vehicles with some form of automation but require the driver to be present in the car. Over the next few years though, more automation will be introduced such that there will not be a need for a human being in the driver's seat.

Investing in the "Electric Vehicle and Driving Technology" trend with Crea8

An obvious way would be to invest in the companies that are building these electric vehicles and self-driving vehicles. Leaders in this space include the likes of GM, Mercedes and BMW.

Next would be the companies producing lithium-ion batteries that power electric vehicles such as Panasonic and the makers of the sensors, software, and computing hardware required to make vehicles self-driving such as Nvidia, Qualcomm and Microchip Technology.

Through Crea8's 'Global Electric Vehicles and Driving Technology' theme, you get to invest in companies that are leading the way for this trend, including the likes of Tesla, GM and Nvidia.

The convergence of Electric Vehicle and Driving Technology trends into the "Global Electric Vehicles and Driving Technology" theme gives you access to a long-term investment theme that can outperform the market and is also diversified.

Through Crea8's Factor Based Thematic Investing Service, you get the opportunity to invest in this trend.

Put your own spin on things

Crea8 allows you to adopt our professionally built strategies, such as "Global Electric Vehicle and Driving Technology", and put your own spin on things.

If you are concerned about sustainability, Crea8 has also incorporated Environmental Social and Governance (ESG) factors into our portfolio construction, thereby, ensuring that your portfolio is consistent with your ESG principles.

Alternatively, with Crea8's Analytics, you can use our screener to identify other stocks to add to the strategies, while Crea8's Advisory allows you to use our algorithm add factor tilts to these strategies.

We monitor your plan to ensure you can sleep easy

When you set up an investment plan or strategy with us, your investment plan or strategy is rebalanced automatically, or we will send you a reminder to do so. This way, you can relax knowing that your investment plan is diversified and on track to meet your goals.

Crea8 offers free and automatic portfolio monitoring

In between the rebalancing date, we suggest that you enter cut loss and take profit orders. By using smart algorithms, we aim to cut your losses and let your profits run. Hence, you can sleep well knowing that your portfolio is monitored and up-to-date.

Backtest your strategies with 'what ifs' before investing

For any of the investment plans or strategies that you create, we let you backtest them and evaluate 'what-ifs' before committing your capital.

Crea8's Suite of Thematic Strategies

FinTech and Digital Security

Ageing Society

Electric Vehicles and Driving Technology

Smart Cities and Smart Homes

Millennials and Sharing Economy

AI and Blockchain

Smart Factory

Bibliography

Hertzke, Patrick, and Ting Wu. 2019. "Expanding Electric-Vehicle Adoption Despite Early Growing Pains". *Mckinsey.Com*. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/expanding-electric-vehicle-adoption-despite-early-growing-pains>.

"Road Traffic Injuries". 2020. *Who.Int*. <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>.

Sussams, Luke, and James Leaton. 2017. "The Disruptive Power Of Low-Carbon Technology". *Carbontracker.Org*. http://carbontracker.org/wp-content/uploads/2017/02/Expect-the-Unexpected_CTI_Imperial.pdf.

Kaas, Hans-Werner, and Detlev Mohr. 2016. "Automotive Revolution – Perspective Towards 2030". *Mckinsey.Com*. <https://www.mckinsey.com/~media/mckinsey/industries/automotive%20and%20assembly/our%20insights/disruptive%20trends%20that%20will%20transform%20the%20auto%20industry/auto%202030%20report%20jan%202016.pdf>.

Nicholas, M. and Wappelhorst, S., 2020. *REGIONAL CHARGING INFRASTRUCTURE REQUIREMENTS IN GERMANY THROUGH 2030*. [online] theicct.org. Available at: <<https://theicct.org/sites/default/files/publications/germany-charging-infrastructure-20201021.pdf>> [Accessed 10 December 2020].

Sahay, Richa. 2020. "How Can India Transition To Electric Vehicles? Here's A Roadmap". *Weforum.Org*. <https://www.weforum.org/agenda/2019/10/how-can-india-transition-to-electric-vehicles-heres-a-roadmap/>.