# China Market Prospect in Electric Vehicle

Air pollution has become a common topic being debated as a hindrance towards reaching a sustainable future nowadays. Particularly in China, this problem has been aging since 1970s where thick smog became the characteristic of Chinese Industrial Cities (He, Huo and Zhang, 2002)[1]. One main reason that cause air pollution still rooting in China is the smog produced by the production or manufacturer factories. According to "2021 China Mobile Source Environmental Management Annual Report" issued by Ministry of Ecology and Environment of the People's Republic of China[2], that they recorded in 2020, the total number of engine-powered vehicles reached 372 million, an increase of 6.9% over 2019. These vehicles produce 4 kinds of pollutants (CO, HC, $NO_x$, PM) which totalled for 15.93 million tons emission by 2020. Out of total, 90% of pollutant emissions are come from the car's engine-powered, which are the main vehicles emission contributor. Similar findings, the "third round of PM2.5 source analysis" data released by the Beijing Municipal Ecological Environment Monitoring Center[3] on 6 September this year, they found that the transportation sector emitted 46% of Beijing's local emissions by 2021, where mostly are come from the diesel and gasoline powered vehicles.

*Smog on polluted day in Beijing, China (James Riker on Jan, 2017)*

As we can see the rise of the air pollution in China has concern not only the residents but also the government. Many alternatives have been set to mitigate the spread of increase in the air pollution. For instance, in late 1987 the Chinese government set the "Air Prevention and Control Law" which is an early attempt to reduce pollution into lower levels (China Environmental Problems) [4]. Later on, as the pollution getting more severe especially on larger cities like Shanghai and Beijing, in 2016 Shanghai host a G20 Summit which set to improve air quality ahead (Davies & Westgate, 2016)[5]. In the summit, they set to improve air quality by limit the factory production throughout years particularly petrochemical and power plant factories that primary source is coal. They also banned "Highly Polluting" vehicle in Hangzhou, which helps the reduction of pollution by the vehicles. In 2017, China's Ministry of Ecology

and Environment (SCMP)[6] banned the use of coal-fire stove. Instead, they subsidized local residents in Hebei, Shandong, Henan and Shanxi provinces to install electric heaters which is more environment friendly around 3 million homes.

Renewable energy is also another goal need to be achieved by China towards more sustainable future. Our world energy resources like gas, oil and other fossil fuels are limited and at some point, we might run out of it. At 2014 oil & gas summit in Norway, Tesla CEO Elon Musk stated that such resources will not last long in upcoming century because non-renewable resources are temporary. Therefore, nowadays many expertise are researching for cleaner energy and inventing technologies for renewable energy. It is believed that we are currently accelerating on this transition (Video)[7]. In Brown (2020)[8], Elon also added that the clean energy transition will require at least 25 years include the fact the world stopped building fossil fuels by tomorrow.

Currently, China is accelerating the green and low-carbon transformation of its energy system, promoting clean and renewable energy have become one of the pathways to reach these goals. According to "2021 Renewable Energy Capacity Statistics" released by IRENA (2021)[9] that China, as the world's largest renewable energy market has added 136 GW of installed capacity last year, including 72 GW of wind energy and 49 GW of solar energy. The total capacities installed have contributed towards global clean energy market.

In spite of these solutions towards the future sustainable goals, recently there is one feasible solution that can tackle both problems at once, it is the "Electric Vehicle". In China, the practice of adopting culture of Electric Vehicle (EV) is still new. International Energy Agency or IEA (2020)[10] shows that the China EV market started in 2012 which later had significant rise between 2017 and 2020. This is due to government and enterprise subsidies towards the EV, either the charging station or the incentive given.

Before getting deeper into China EV market analysis, firstly it is better to understand the impact of EV towards both air pollution and renewable energy. According to Sandalow (2019)[11] on the report "2019 Guide to Chinese Climate Policy", 30 Metric Tons of CO2 emissions is avoided through implementation of EV in China on 2018. Moreover, the researcher in Qiao (2017)[12] found that the EV in China improved the quality of $CO_2$ emission life-cycle which shows greater result compare to vehicles with internal combustion engine. In the medium to long term, vehicle electrification will be crucial to reach low-carbon economy goals which set by the Chinese government.

The impact of EV in succeeding the renewable and clean energy could be seen from the statement and advice from the Tesla CEO Elon Musk. As previously, Elon stated the world currently is in the transition towards the era of renewable, circular and cleaner energy. Tesla as one of the leading EV company in the world which is one of the examples of product leading towards sustainable energy. Similarly, in China, the government took a measure to limit the use of fuel consumption vehicles. Using multiple incentives, the Chinese government start to encourage the transition towards EVs in 2018.

China has become a leading country with highest EV sales every year since 2016 (IEA, 2020)[10]. In fact, Europe as a whole region placed second for the total EV sales after China. This implies on the massiveness of China EV community regardless the consumers, subsidisers or vendors. This can be seen from a Shenzhen (China) as one of the most mature EV markets in the world. According to McLane and Liu (2020)[13] that Shenzhen is the perfect instance represent the future EV development in China. One reason is all buses and taxis have been electrified since 2017. Yet, the process will not be successful without stable public charging infrastructure. By the end of 2020, Shenzhen has built more than 90,000 public charging piles across the whole

city. As the result, the residents can find charging station within 3 km in Shenzhen (深圳特区报, 2021)[14].

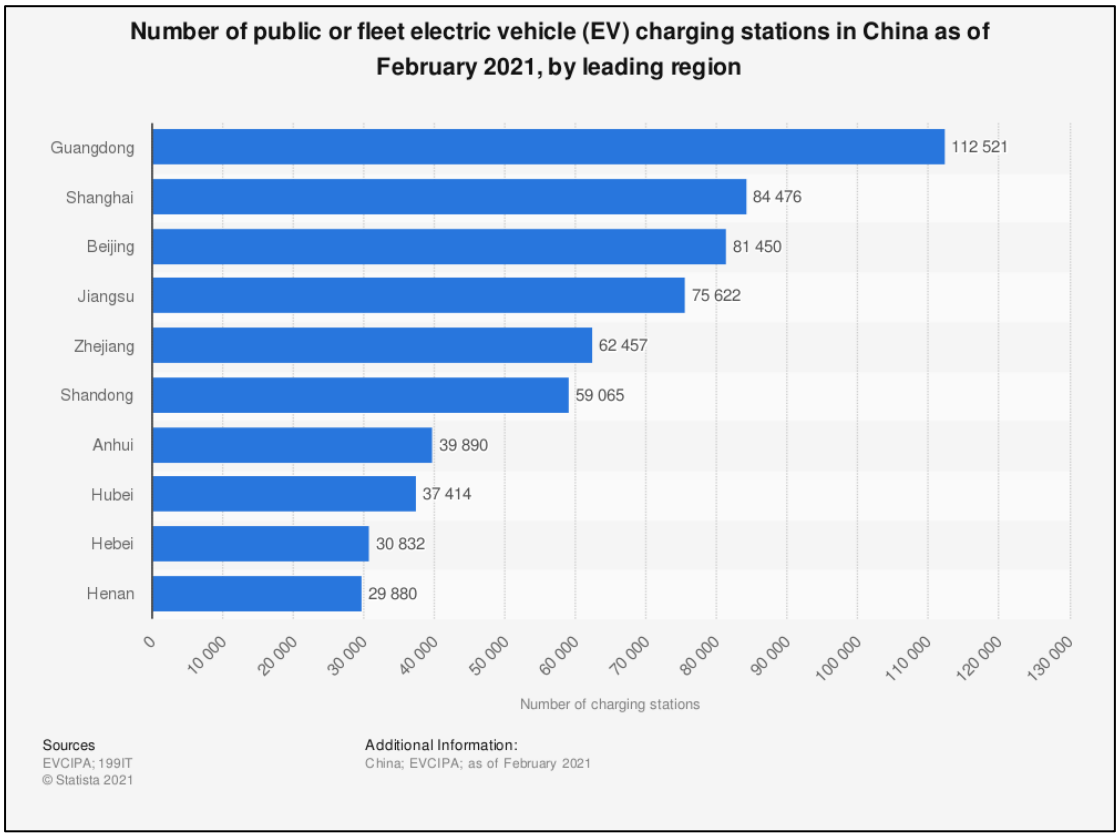


**Figure 1.** *Ranking of total public or fleet charging stations in China by Regions recorded on February 2021* (STATISTA)[15]

This also supported by **Figure 1**, where Guangdong is the region that has the most EV charging stations in China and Shenzhen as part of Guangdong province definitely contributes much to it. As we can see, Guangdong contribute to China's total charging stations with 112,521 charging stations, later followed by Shanghai and Beijing with 84,476 and 81,450 stations respectively.

To see better picture about China's EV growth, below is the data on China's EV sales from 2012 to 2020. The colour on **Figure 3** represents the source obtained.

- The first source (Blue) came from IEA (2020)[10]. It shows the sales between 2012 and 2018.
- The second source (Red) came from Gersdorf (2020)[16]. It shows the sales on 2019.
- Finally, the 2020 data (Green) came from Canalys (2021)[17].

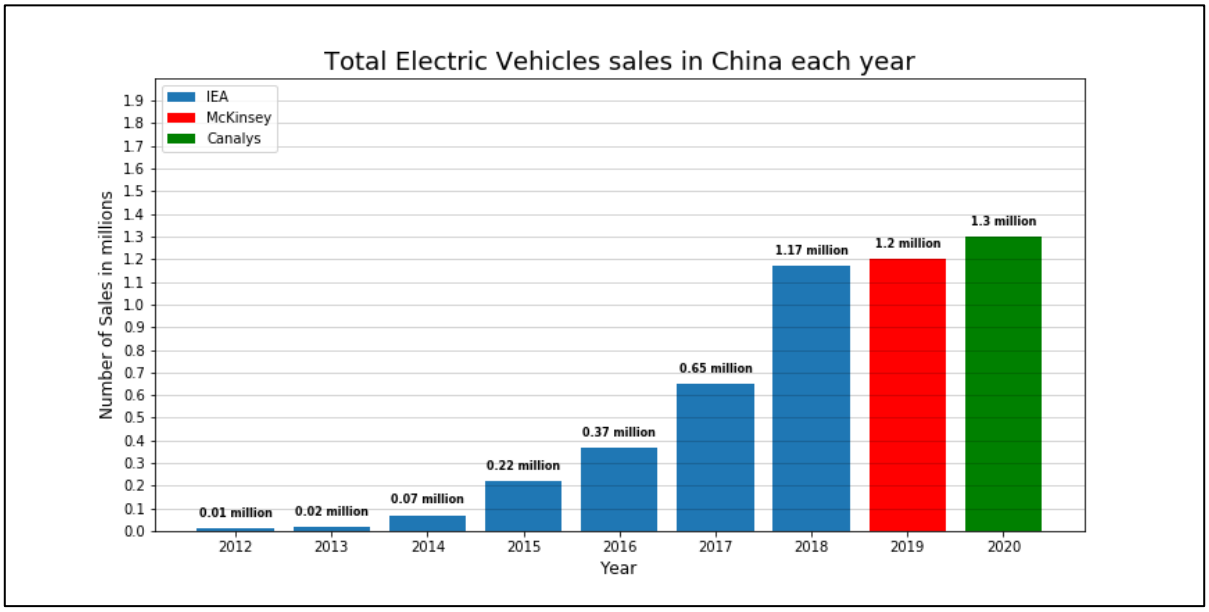


**Figure 2.** *The EV sales in China from 2012 to 2020.*

As we can see, in 2012 the number of EVs still not popular enough with only total of 0.01 million sales. They have steady increase every year until 2014 and suddenly there is small leap in 2015. In 2015 the central government just set a goal towards their plan in future about subsidies on charging infrastructure (State Council, 2015)[18], which give a positive sentiment to China's EVs market. Due to this, there is more than 50% increases in 2016 sales and almost 100% sales growth in 2017 and 2018. Despite, the China's automotive sales fell by 2.8% in 2018 but the New Energy Vehicles (NEV) sales still maintain in rapid growth, which can be seen in **Figure 3** (XinhuaNet, 2019)[19].

There is no doubt, the reason behind this, was the regulations and stimulus that carried out by the government. For instance, the government state-owned enterprises like State Grid Corporation of China (国家电网) and China Southern Power Grid (中国南方电网). They used social responsibility budgets to cover the costs of construction and upgrades for public charging station (Liu and McLane, 2021)[20]. It is estimated there are total of 196,484 charging stations from State Grid (国家电网) and 40,886 stations from Southern Power Grid (中国南方电网) by February 2021 (STATISTA, 2021)[21]. This also supported by China-Briefing Media, they agreed that EVs charging station is one of the government integrated infrastructure subsidies. Another alternative is the monetary incentives such as government tax exemption until 2020. With tax exemption, it is expected that there will be more people choose EVs instead of conventional vehicles until 2020 (Xue et. al., 2021)[22].

However, the sales growth in 2019 had sudden discrepancy compare to previous 3 years. According to Gersdorf (2020)[16], in 2019 only accounted for almost 3% growth from previous year, due to central government elimination of some monetary incentives such as purchase subsidies for vehicles that achieve electric ranges (e-ranges) of less than 200 kilometers and reduced subsidies by 67% for battery electric vehicles (BEVs) with e-ranges above 400 kilometers. Moreover, it is estimated in early Quarter 1 of 2020, the EVs sales dropped by 57% from Quarter 4 of 2019. This is due to the effect of Covid-19 pandemic. Nevertheless, with tax exemption extended to 2022, China's EVs sales still manage to recover at the end of 2020 with almost 8% increase compare to 2019 (Canalys, 2021)[17].

Moreover, like stated before, charging stations are very essential especially public one. Below is the number of public charging stations in China from 2015 to 2020,

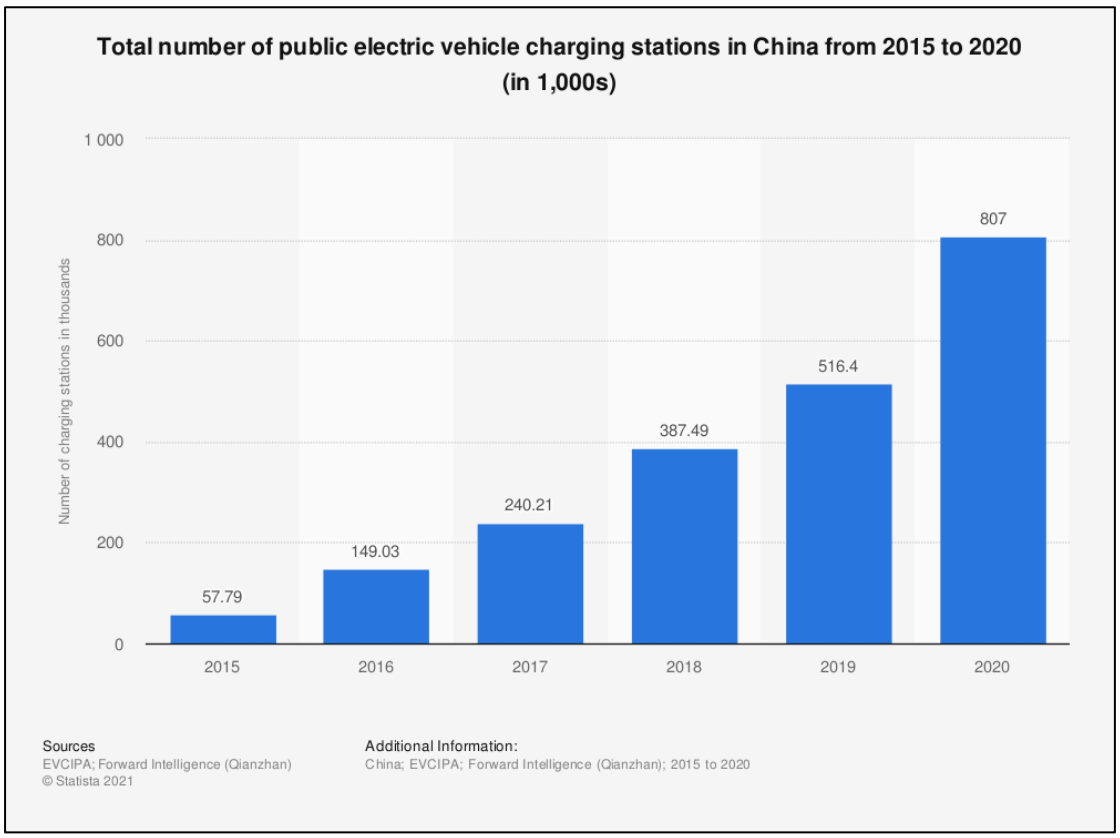


**Figure 3.** *Number of China's Public Charging Stations between 2015 and 2020*. (STATISTA, 2021)[23]

**Figure 3** shows the similar trend towards the **Figure 2.** Every year, the growth has significant increased with almost 100,000 stations in 2015 and 2016. Until, in 2020 with almost 300,000 new charging stations was built. This significant numbers came from both the private enterprise and government. Such incentive from private enterprise is a good example to boost future EV users in China.

China as one of many countries which ahead in technologies. Resulting in many EV local brand start appearing, especially after the announcement of the government incentives towards China's EV market, such as, Xpeng (小鹏) and NIO (蔚来). As a young rising star in the Chinese electric vehicle industry, Xpeng managed to track a record by selling 3,479 units in Quarter 3 of 2020. Moreover, 31% sales increase only in one month from August to September 2020. This is one reason behind the number of total China's EV sales being maintained in 2020 despite the Covid-19 pandemic (Shahan, 2020)[24]. However, such China local company should not only rely on government's subsidies to success the China's EV market. Yet, the private EV company need to give helping hands as well. For example, NIO (蔚来) and Aulton New Energy are the two main battery swapping station operator in China with 123 and 183 stations respectively (Yuanyuan, 2020)[25]. This service only requires approximately 3 minutes which manages to help the consumers be able to deal with slow charging problem especially in the business hours. Similarly, Xpeng (小鹏) also managed to expand network of free EV charging stations in China to 1,140 across 164 cities. According to company statement, "Xpeng is the first new EV maker in China to offer free lifetime charging services for its customers" (Liannane, 2021)[26].

In fact, with more EVs sales do not mean that China has solved the air pollution and renewable energy problem immediately. Instead, China still needs to maintain the consumer to keep on using the vehicle. One way is by giving more subsidies like we stated before, the other one is providing excellent customer service. Therefore, it is important to know the main incentives that would motivate the Chinese costumers to buy electric car.

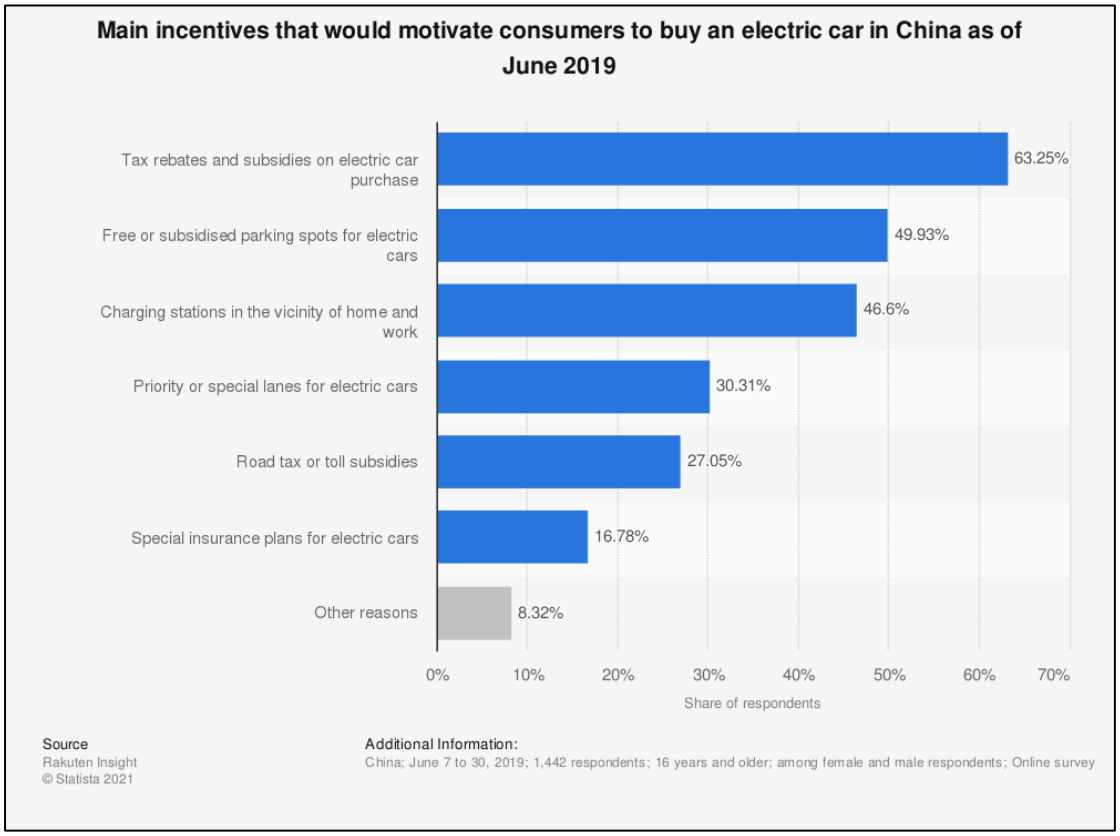


**Figure 4.** *Main incentive that drives Chinese customers motivation to buy electric car in China as of June 2019.* (STATISTA, 2021)[27]

Based on **Figure 4**, we can see that 'tax rebates and subsidies' is the highest motivation for Chinese customer to purchase EV with 63.25%. Moreover, it is also supported in **Figure 5** below, which display 'tax rebates and subsidies' as the second highest for the main reason of Chinese customers choose EV over conventional cars with almost 60%. Whereas, the actual reason people favouring in EV is because it is more environmentally-friendly (65.9%) which has been addressed previously (less carbon and pollution).

Back to **Figure 4**, the second main reason which motivate consumer to buy EV is the 'free or subsidies parking spot for EV', then follow by the availability of charging station publicly and privately with 49.93% and 46.6% respectively. As stated before, both the free subsidies and the number of charging infrastructure have significant growth by 2020. Furthermore, the Xpeng (小鹏) managed to enliven the China's EV market in the end of 2020 with their "free charging campaign".

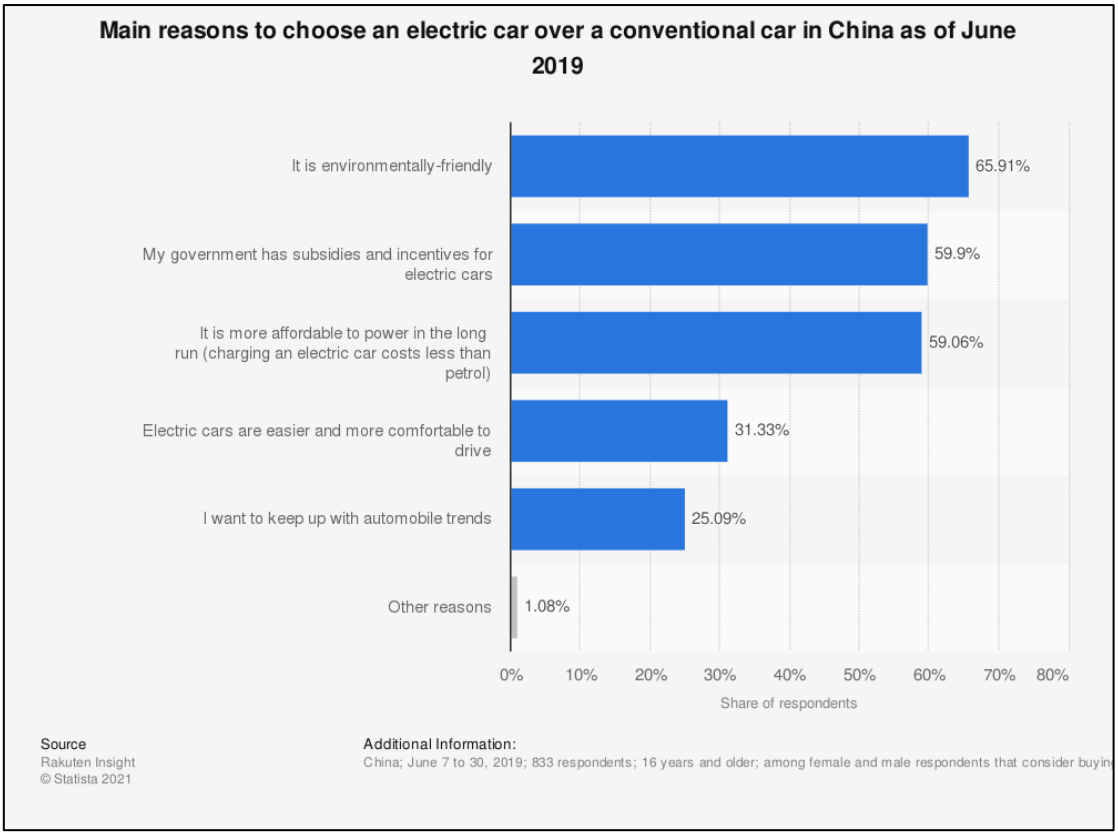


**Figure 5.** *The main reasons China Residents to choose EV over Conventional Car as of June 2019.* (STATISTA, 2021)[28]

Nevertheless, with all of this incentives and motivation, there will be always one question to ask which is "How is the China's EV market future holds". First of all, if we see based on the current data on China's charging station availability, the first impression is "Very Massive". Even Germany targeting 1 million charging stations being built by 2030, yet China currently almost reached that numbers with 807,000 stations at the moment (Mclane and Liu, 2020)[20].

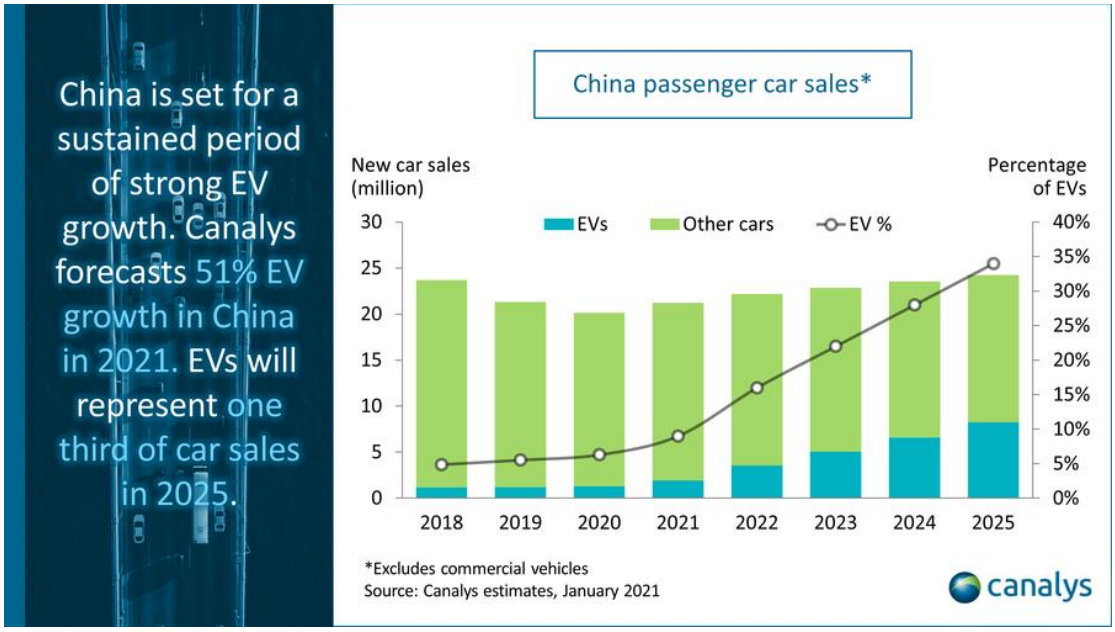


**Figure 6.** *2018 to 2025 China EV and conventional car sales (**Bar graph-Left**) and percentage of EV each year in China (**Line graph-Right**)* (Canalys, 2021)[17]

The **Figure 7 (Canalys prediction)** shows by 2025, China has almost 7 million EV sales and 35% of China vehicles will be all electrified. They also forecast 1.9 million EVs will be sold in China in 2021 (around 51% growth from 2020). Deign (2016)[29] also forecasts by 2030, the EV penetration could hit 60% in China's major cities.

On top of that, Technology road map of the Ministry of Industry and Information Technology (MIIT)[30] claimed EVs could reach 40% of new vehicle sales in China by 2030. Another varies study from Bloomberg New Energy Finance (2017)[31], they forecast EVs to reach 10% of Chinese new vehicle sales by 2025 and surpass 50% by 2035.

Regardless of the various forecast from experts, yet they all point out to one similar thing which is the positive sentiment towards future of China's EV market. Moreover, with the incentive to reach 2060 of carbon neutral which was officially announced by President Xi Jinping in 2020 UN general assembly (Xinhuanet, 2020)[32]. This definitely will bring a bright future towards China's EV industry.

One findings from Qiao and Lee (2019)[33] on their paper about "The Role of Electric Vehicles in Decarbonizing China's Transportation Sector" stated, considering total mileage, the Green House Gases (GHG) emissions produced by EV is 43% lower than the conventional engine vehicles. However, due to GHG emissions from EV manufacturing phase, the reduction efficiency of GHG in EV is lowered from 43% to approximately 36%. Despite the reduction, the GHG emissions from manufacture actually can be cut by half (from 7% to 3.5%) if 100% EVs are recycled. Thus, Qiao and Lee (2019)[33] projected by 2030, there will be up to 6.2% GHG emissions reduction in China's transportation sector through EVs. This also includes GHG emissions in the manufacturing phase.

Finally, it is true that EV has huge impact towards the air pollution in China. This also the reason that drive the Chinese consumer to buy EV instead of conventional cars. Moreover, EV also one solution towards future clean and renewable energy which is electricity. Electricity could be generated from solar, wind and water source. Many experts also very confident with the future of China's EV market. Currently, it can be seen from some young rising star enterprise which start to occur in China's EV industry like Xpeng (小鹏) and NIO (蔚来). It is believed with more new EV private enterprise, it could solve the current operational and consumer problems in the future. To boost the market, customer service definitely needs to be improved. Especially, campaign and incentive given, with addition convenient charging station idea or efficiency charging option in the future (more fast charging plugs).

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