

Building a Greener EV Industry in China

DENG Xi, PetroChina RIPED, 86-10-83595990, xdeng8@petrochina.com.cn
GAO Feng, PetroChina RIPED, 86-10-83592419, gaofeng-hw@petrochina.com.cn
ZHAO Zhe, PetroChina RIPED, 86-10-83592165, zhaozhe76@petrochina.com.cn

Overview

The paper consists of four parts.

First, it introduces the brief history of electric vehicles (EVs) and different types of EVs in marketplace.

The history of EVs dates back to nearly two centuries ago. The first EV was built in 1835 while the first successful and practical one was created in 1891. By the end of the 19th century, more than 4,000 EVs were produced in the US. Nevertheless, EVs became less popular after the mass production of gasoline-powered cars starting from the 20th century. In the following decades, gasoline-powered cars kept developing and turned into the mainstream means of transportation around the world. However, with growing environmental concerns and mounting oil price caused by oil embargo, EVs came into sight once again in the 1970s. Although there is a general title of EV, it can be divided into four types due to their different functional principles: hybrid electric vehicles (HEV), plug-in hybrid vehicles (PHEV), battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV).

Second, it analyzes the current development and government policies towards EVs in China.

In 2016, the global EV sales reached 750 thousand and the global EV stock was more than 2 million. EVs are more prevailing and popular in Europe with highest ratio of EV consumption among all passenger light-duty vehicles (PLDVs). For instance, in 2016, EV sales accounted for 29% of PLDV sales in Norway and the number was 6.4% in Netherland, representing the top two countries concerning the ratio of EV sales. Moreover, Norway, the Netherlands and the UK has announced that they are going to allow only EV sales by 2020s. China is also chasing the pace of those leading countries with regard to the development of EV industry. Even though the promotion of EVs in China started later than developed countries, Chinese EV consumption is undergoing fastest development in the world thanks to positive government support. It took up 40% of global EV market sales and became the largest EV consumption country in the world in 2016. In the meantime, China, surpassing the US, ranked as the number one country of EV stock and made up of one third of total global EV stock.

Unlike EU countries and other developed countries such as Japan, China has focused on the promotion of BEVs instead of HEVs and PHEVs since the incipient stage. China initiated the large-scale development of EVs in 2009, when the Chinese State Council passed a plan to carry out the electric cars strategy in both supply and demand sides. Under this strategy, China plans to meet the goal of 500,000 EV production and 5% market share of EV sales in three years. However, the EV market sales increased by a 60% year-on-year growth to 75,000, accounting for merely 0.85% of all the PLDV sales. Consequently, the Chinese government continues and enlarges the promotion of EVs. The Ministry of industry and information has enacted a new plan, which says EV sales should reach 20% of the total PLDV sales by 2025. In order to accomplish this goal, the Chinese government is taking various measures. The supporting policies by the government contain subsidies, tax exemption and license plate incentives. Currently, consumers who purchase BEVs will obtain subsidies ranging from RMB 30,000-66,000 (roughly USD 4,620-10,163) from both the central and local governments based on different mileage scales EVs can travel. In addition, BEV consumers will be exempted from paying purchase tax. It is worth noting that the subsidies and tax exemption regulations are applicable for only domestic EV brands. In other words, those measures could stimulate both the production and sales of EVs within China. What's more, BEV consumers will acquire license plates for free or with high probabilities. In many Chinese metropolis, such as Beijing, Shanghai and Guangzhou, local governments implemented purchase restrictions and license plate lotteries for conventional gasoline-powered cars in order to control the rising number of vehicles and the execrating air conditions. Nevertheless, BEVs are exempt from those regulations and restrictions. In Beijing, citizens are able to buy a BEV directly without competing in the license plate lotteries for conventional gasoline-powered vehicles, which has a 0.11% low success rate. Similarly, in Shanghai, where the license plates can only be purchased by auction with prices no less than RMB 80,000 (approximately USD 12330), the local government provides additional 20,000 license plates every year for BEVs without any charge.

Third, it tries to explain whether EVs in China are environmental friendly or not.

The original intention of EV expansion in China is to reduce pollution and enhance air qualities. Indeed, the consumption of oil will be lessened with the rising proportion of EV sales and ownership, it is not meeting the initial goal as refer to environmental protection. It is true that the energy saved by EVs, especially BEVs is less than conventional gasoline-powered vehicles when travelling on the road, the overall fossil fuel consumption and pollution is not lower than gasoline-powered cars if a whole industrial chain is taken into account. To begin with, the non-green fact of EV is depend on current Chinese electricity structure. It is well known that certain amount of energy should be used to generate electricity, which is the fuel resource of electric cars. In China, coal is the primary

resource within the energy mix to generate electricity, with 70% electricity generated by coal-fired power plants in 2016. Other clean resources, such as nuclear, solar, hydro and wind make up only 29% in the total consumption of fuels used to generate electricity. By contrast, in US, coal-fired power plants generated 34% of electricity in 2016 while natural gas and nuclear accounted for 27% and 22% respectively. As for Norway, where 96.3% electricity was based on hydro power in 2016, achieved real environmental friendly from the electricity generation perspective. Coal, without any processings before burning in the coal-fired power plants, will impose very negative impact on environment when generate electricity. The pollutants emit by coal-fired power plants cover noxious fumes, such as sulfur dioxide and nitrogen oxide, and greenhouse gas. In 2015, the proportion of waste gas emissions by coal-fired power plants among all the industrial waste gas emmissions was 30% in China. That is to say, electricity, which is the fuel resource of EVs, is not environmental friendly. Secondly, the promotion of EVs in current stage will lead to imbalanced environmental development among Chinese cities. At present, the EVs are comparatively prosperous in metropolis. Meanwhile, coal-fired power plants are withdrawing from urban to rural areas. For instance, Beijing shut all the power plants based on coal in 2016 while the Togtoh coal-fired power plant located in inner Mongolia is supplying 1/4 of Beijing's electricity. Consequently, the environment situation in metropolis is improving while the environment in rural area is exacerbating. In this way, the promotion of EVs in China will not be beneficial for environment from the nationwide angle. Finally, battery pollution is another negative environmental problem generated by EVs. China is still in the incipient stage of EV sales with most of the cars are equipped with newly-produced lithium batteries. However, China is facing the first phase of massive battery decommissioning in eight to ten years. The pollutants within abandoned batteries include cobalt, fluorine, ammonia-nitrogen wastewater and heavy metal wastewater. It will be a serious problem when recycling and dealing with those pollutants from waste batteries in the near future.

Fourth, this paper offers several suggestions for building a greener EV industry in China.

In order to build a greener EV industry in China, this paper proposes three suggestions. First of all, promoting PHEV instead of BEVs. As mentioned above, since the primary resource of electricity generation in China is coal, HEVs and PHEVs are more environmental friendly than BEVs. According to data, in California, the state with the highest ratio of clean energy-generated electricity in the US, CO₂ emission by BEV is 100 grams/mile, which is only half of PHEV's. Nevertheless, in the middle-west and southern states of the US, where coal is the primary electricity resource, CO₂ emission of PHEV is less than that of a BEV. Consequently, PHEVs are greener than BEVs if China sustains current electricity structure. Second, increasing the proportion of natural gas in the energy mix to generate electricity. Natural gas power plants are more environmental friendly since the sulfur dioxide and smoke emissions are nearly zero while the nitrogen oxide emission is only 1/10 of coal-fired power plants. However, the Chinese government should solve the problem of natural gas price regime since natural gas is much more expensive than coal. Meanwhile, there is still a long way to go concerning the natural gas infrastructure constructions. Third, improving clean coal technologies and enhancing efficiencies of coal-fired power plants. Based on energy production mix, China is rich in coal. It is not complying with national condition if China abandon the use of coal. Thus, how to utilize coal more efficient and more environmental friendly is the superior issue. Technologies concerning dust elimination, desulphurization, denitrification and waste water disposal should be applied to coal-fired power plants in the current stage.

Methods

The paper adopted interdisciplinary research, case study and statistical analysis methods.

Results

By researching on Chinese EV policies, the paper considers that EVs are not achieving the initial goal as improving environment according to coal-based electricity structure and battery pollutions. Thus, in order to build a greener EV industry in China, the government should promote PHEV, increase natural gas to generate electricity and apply clean coal technologies.

Conclusions

With increasing environmental concerns and energy security considerations, people draw more attention to EVs. The EV sales and stocks keep increasing worldwide, especially in EU countries. China, which has promoted EVs in recent years, is the most promising country concerning EV consumption. The Chinese government enacted various policies, including subsidies, tax exemption and license plate incentives, to support the EV development. Even though the initial goal of EV promotion by Chinese government is to improve environment, EVs in China are not as green as advertised if coal-based electricity structure, policy-caused imbalanced pollution among cities and battery recycling problems are taken into account. Consequently, several measures, covering promoting PHEV instead of solely BEV, increasing the use of natural gas for electricity generation and applying clean coal technologies in large-scale, should be taken in order to build a greener EV industry in China.