



Analysis of New Energy Vehicles' Development and Future

Zixu Tao¹, Chen Xu², and Junqiu Yan³(✉)

¹ Wuhan San New School, Wuhan 430100, China

² Suzhou North America High School, Suzhou 215100, China

³ Suzhou International Academy BFSU, Suzhou 215200, China
1533210866@xzyz.edu.cn

Abstract. This paper investigates the new energy vehicle industry. Under the problem of environmental pollution, China considers the new energy vehicle industry as an important sector. The Chinese government has heavily subsidized the industry and introduced many policies. Although the COVID-19 epidemic has had a serious impact on the world's economy, China's economy has maintained growth, providing a certain guarantee for the development of the new energy vehicle industry. Then we calculated the carbon emissions of traditional fuel vehicles and compared them with new energy vehicles. Then we analyzed the existing technologies in the industry and summarized two questions. Such as range issues and safety issues. And we discussed the reason why it happened and find the solution below, such as improving the battery quality and so on. Also, this paper looked forward to the future of new energy vehicles and we think the development prospects are very broad both in terms of environmental protection and economy.

Keywords: Autopilot · Battery durability · Self-ignite

1 Introduction

1.1 Background

Due to multiple factors such as global environmental problems and global warming, the pollution discharged by cars on the road can no longer be ignored. Some countries have proposed not to sell oil-burning cars, so new energy vehicles have become the best choice for less environmental pollution. In recent years, China has been encouraging the whole people to actively consume new energy vehicles. Therefore, China has issued many policies to improve the consumption situation that has not been improved. New energy vehicles are not outstanding. In the eyes of the general Chinese people, they only cause less environmental pollution. In addition, they are expensive, so the public still prefers traditional oil-fired vehicles. Since new energy vehicles have become the general trend of future vehicle development, many traditional vehicles have begun to study the models of new energy vehicles, and there are many new new new energy vehicle brands.

Z. Tao, C. Xu and J. Yan—These authors contributed equally.

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F. Balli et al. (Eds.): ESFCT 2022, AEBMR 226, pp. 689–699, 2022.

https://doi.org/10.2991/978-94-6463-052-7_79

For a time, many models emerge in endlessly, the development speed of new energy batteries is also rapid, the endurance capacity is greatly improved, and the field of new energy vehicles is developing rapidly. However, due to the government's subsidy policy, new energy vehicles' prices have decreased again and again, and many people have gradually accepted new energy vehicles, but the problems are slowly reflected with the purchase of the public.

1.2 Related Research

New energy vehicles are vehicles that use non-traditional fuels, electricity, and so on, which are strategically important to China. To achieve the strategic aims, the Chinese government has considered the NEV industry as one of the sectors that qualify for special incentives and public support. During the last decades, China's NEV industry has transformed from research to production [1]. Most countries now around the world are promoting new energy vehicles. They hope the new energy vehicles can replace traditional fueled ones and thus reduce dependence on non-renewable resources. Compared with China's new energy vehicle sales in 2018, the market share of new energy vehicles is still not large enough. The reasons why users do not accept new energy vehicles are low cruising range and long charging time [2]. The service life for a power battery in the EV is about 8 years due to degradation in capacity. Thus power batteries in EVs must be replaced before the capacity decreases to 70–80% of their original level, otherwise, it may cause unexpected driving malfunction and safety problems. As the EV market has developed significantly since 2012, some power batteries will face retirement [3].

Xiao's team introduced the development of electric vehicles' APU charging control and power management, the structure and energy management of electric vehicles, and various control strategies [4]. Andwaria's team evaluated the maturity of different parts of pure electric vehicle technology and identified areas where significant progress is expected. The barriers to market penetration of electric vehicles are analyzed [5]. Yong's team comprehensively reviews the current status, impacts and opportunities of EV deployment, as well as the latest development of EV technologies, and also summarized the impacts of EV rollout on the environment, economy and power grid. The government has published a series of incentive-based policies for EV purchase costs, and the development of charging infrastructure. In conclusion, the team points out that the global EV outlook looks very promising, even though there still have many challenges to solve [6]. Miao's team introduces several different types of lithium-ion batteries, their advantages, disadvantages and opportunities for lithium-ion storage, and the ways to improve the efficiency, capacity and battery life [7]. Hao's team first talks about the history of new energy development and the opportunities for the development. And then demonstrate that the development of new energy now should focus on the new energy battery, and next shows us the main problems that china face about the new energy car are the technology of developing new energy battery, the security performance and the pressure in the new energy battery markets. The author also gives his suggestions about these problems: (1) Increase investment in basic research and development. (2) Innovate production technology. (3) Enhance safety performance. (4) Improve supporting facilities and services. But I think we should also develop or give the place market for new energy batteries in China to encourage more companies to focus on new energy

development. This paper can help us achieve the carbon footprint target, protect the environment, give a new point to develop the new energy and clear the main aim for China in developing new energy [8].

Zhang's team introduces the analysis of China's NEV batteries, such as the lack of patented technology and low-end overcapacity, and puts forward suggestions for the future development of products from multiple perspectives to enhance the innovation ability and competitiveness of products [9]. The new energy vehicles give advantages of energy-saving to humans. These years, the new energy vehicles have quickly developed because of the support and the encouragement from the governments. But recently, as these policies fade, the momentum of new energy vehicles is drastically reducing. There are some problems with this industry. Chen's team using several scientific finds that the development of new energy vehicles will cause the reduction of human's health index because of the heavy metals it is just a kind of method used to transfer the emergency danger instead of removing the danger, in order to prevent the happening of the similar danger again, the companies and government should put efforts to into how to recycle the batteries. Also, there is still quite a large number of consumers being sensitive to the price, so after the governments' encouragement and the public opinion's influences. The new energy vehicles may draw in the market, so the impending problem is that the new energy vehicles industry need to work out how to pull the price down. In another word, this industry needs quite an amount of capitals. For these problems, the author gives the governments several suggestions: (1) Continues to promote the development of NEV technology. (2) Put effort into finding the methods to prevent the pollution as soon as possible in order to realize the sustainable development of the NEV industry. 3. After solving the emergency problems nowadays, we should find other new energies that we haven't realized instead of staying there [10].

1.3 Objective

This paper aims to analyze the development of new energy vehicles in China. Using the data and examples given by China's current market, this paper points out the common problems of new energy vehicles and provides corresponding solutions. Our team used PEST analysis to comprehensively analyze the current development of new energy vehicles from four aspects: politics, economy, society and technology. Then we analyze the development situation and problems of the new energy vehicle market from the aspects of market investment trends and comparison among manufacturers. Finally, we give solutions from the two general directions of new energy vehicle endurance and safety.

2 PEST

2.1 Political Factor

Nowadays, China considered the new energy vehicles to contribute to the national development significantly. The report of the 19th CPC National Congress proposed that China should strengthen China's energy conservation and environmental protection industry, cleaner production industry and clean energy industry. The Chinese government proposes to build a market-oriented green technology innovation system, and the new energy

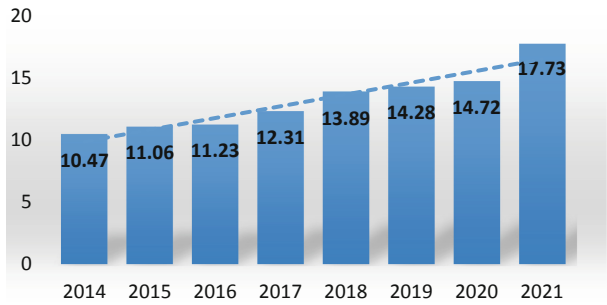


Fig. 1. National GDP between 2014 ~ 2021 in dollars

Table 1. China’s policies on new energy vehicles in recent years

Times	Names	Contents
October 2019 (2021–2035)	Ministry of industry and information technology issued the new energy vehicle industry development plan	Pointed out that the sales of new energy vehicles in China will reach about 20% of the total sales of new vehicles in 2025 and 40% in 2030.
December 2020	Ministry of industry and information technology and other four ministries and commissions	Issued the notice on further improving the financial subsidy policy for the promotion and application of new energy vehicles.
March 2021	The outline of the 14th five-year plan and the relocation target in 2035 (National People’s Congress developed)	The plan pointed out to break through the key technologies such as high-safety power battery, high-efficiency drive motor and high-performance power system of new energy vehicles.

vehicle industry has long been listed as one of China’s strategic emerging industries. As an industry strongly supported by the government, the subsidy policy plays a strong guiding role, and the subsidy has a significant impact on the sales of new energy vehicles throughout the year. In recent years, China has many policies for the new energy vehicles.

2.2 Economic Factor

The sudden outbreak of the COVID-19 has influenced the global economy significantly. Under this situation, China has maintained its economic growth. With the rapid development of China’s economy, the disposable income per Chinese resident has increased, as shown in Fig. 1 (Table 1).

With the continuous rise of the disposable income per Chinese resident, the purchasing power of consumers has also increased, which provided strong support for the development of the new energy vehicle industry, as shown in Fig. 2.

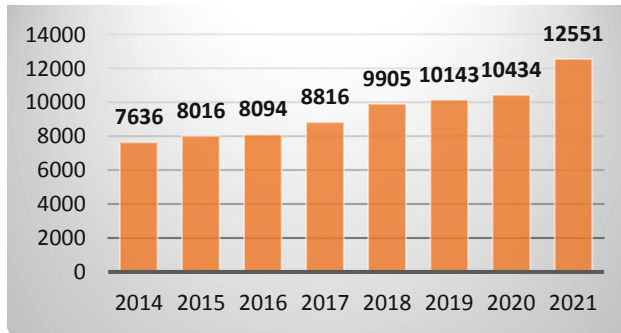


Fig. 2. Per Capita Disposable Income between 2014 ~ 2021 in dollars

2.3 Social Factor

Recently, global warming worsens, to reduce carbon emissions leads to a negative increase rate of climate change to make our global economy go back to normal is a global responsibility. According to the internet, the carbon emissions per 100 km will be 18.9 kg, thus if the car runs 40 km and back every day, running 1200 km every month, its monthly carbon emission will be 226.8 kg, and 2721.6 kg a year. In terms of sales of new energy vehicles, data shows that in 2021, China's sales of new energy vehicles reached 3.5 million, an increase of 1.6 times year-on-year, and the number of new energy vehicles reached 7.8 million, accounting for 2.6% of the total vehicles in China and about half of the global new energy vehicles. Compared with traditional fuel vehicles, existing new energy vehicles reduce carbon emissions by about 15 million tons a year.

2.4 Technology Factor

New energy vehicle technology uses batteries as the main energy source to run cars. This technology replaces the non-renewable energy of gasoline with batteries. This can greatly reduce the pollution of the environment and air pollution by gasoline. And using the battery as the main energy can reduce the costs as oil becomes more expensive and batteries are relatively cheaper nowadays. But the new energy vehicle industry also has obvious shortcomings, such as short-range and project safety. As a new technology, it is still very good because it can not only replace the non-renewable resources and reduce the use of non-renewable resources but also effectively improve environmental pollution and reduce greenhouse gas emissions greatly in the long run.

3 Market Analysis

3.1 Investment Trend

The future of new energy vehicles will slowly overturn the traditional fuel cars, when many people see social changes, the leading benefit of the company's stock has risen sharply, and the shares of the damaged company have fallen to the floor. Just like new

energy vehicles, the proportion of new energy vehicles is still very low, only about 2%, when the proportion of more than 10%, the related companies may have been a world difference, so we should look for a long term result when investing.

The life cycle of industry mainly depends on permeability. The penetration rate of new energy vehicles in the U.S. is currently around 3.5 percent. The goal for the U.S. is to reach 50 percent penetration by 2030. Japan has an even bigger goal of 100% electric car sales by the mid-2030s at the latest.

China's penetration rate increased from 0.2% in 2012 to 4% in 2020. In the Development Plan for New Energy Vehicle Industry from 2021 to 2035, it is clear that the penetration rate of electric vehicles will reach 25% in 2025. In fact, at a compound global growth rate of 47% from 2012 to 2020, the goal can come true.

In general, new energy vehicles are worth to invest. Not only because of the current environmental problems, but the new energy vehicles will also become a major trend in car purchases.

3.2 Manufacturer Comparison

Tesla has had a lot of negative news at one time, but it is still the world leader in high-end electric vehicles and is selling far more than other brands at very high prices. Model 3 has received the highest safety ratings from NHTSA and European NCAP, as well as IIHS in the United States, with an AP auto-assisted driving system. The Supercharging station V3 only needs 35 min to charge up to 90%. Or charge for 5 min and travel 120 km. Tesla batteries attenuate slightly. Excellent hedging rate: Model 3 has a hedging rate of 64.3%. With excellent battery life, the Model 3 long-range version can drive for more than 660 km. All series of Tesla have auto-driving, even if the technology is not quite mature.

Li Auto is a new energy vehicle enterprise founded by Li Xiang. In October 2018, the company launched the first new energy vehicle, Li ONE, which carries leading extended-range electric technology and smart technology. In 2020, Ideal ONE won the sales championship of China's new energy SUV market. The Li ONE is an enhanced electric vehicle with no navigation anxiety, low power consumption, large interior space, excellent ride comfort experience, comprehensive safety configuration, excellent interior trim and the most advanced devices on the market.

As a new brand, Li ONE has made great achievements. In the case of fierce peer competition, it has sold more than 90,000 sets. Tesla Model 3 at the same price is its best competitor. Both of them have good cost performance. Model3 has more patent support in vehicle safety, such as AP assisted driving system. The auxiliary driving of the Li ONE will be relatively weak. The endurance of Model 3 will be strengthened, but due that Li ONE being equipped with an increased program hybrid system, it can turn gasoline into electric energy to continue driving even without the battery function, so Li ONE has no fear of insufficient endurance. The interior and comfort of Li ONE are far better than that of Model 3. Li ONE can seat up to six people, with large space, high comfort and advanced multimedia functions. The interior of Model 3 is a little bit rough, and multimedia is not as advanced as Li ONE. In general, Li ONE is more cost-effective, but the hedging rate of Model 3 will be much higher (Figs. 3 and 4).

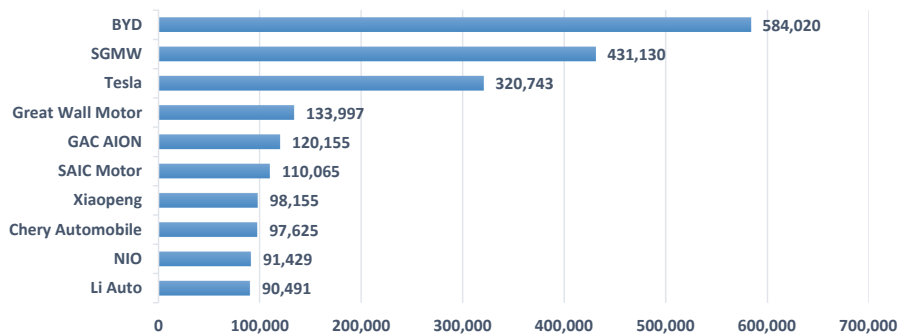


Fig. 3. Top 10 new energy vehicle enterprises in 2021

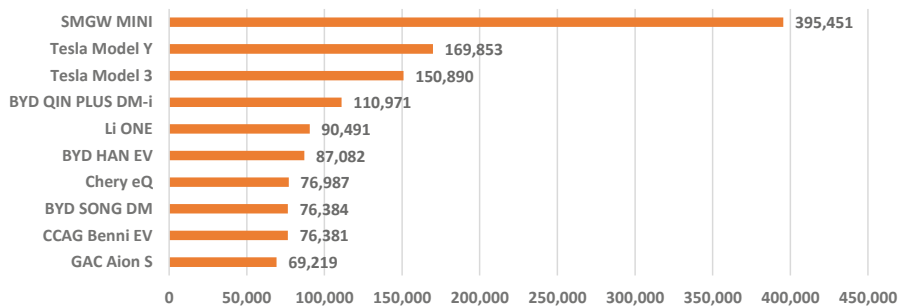


Fig. 4. Top 10 new energy vehicle sales in 2021

3.3 Problems

As a new industry, new energy vehicles still have many technical problems. The main problems now are: (1) The battery life mileage is limited due to the limited capacity of the battery. At present, most new energy vehicles have a range of only 60–300 km, while the range of ordinary fuel vehicles is between 500 km and 1,000 km. If the energy density of the battery is increased, it will increase the dangers caused by the heat control of the battery. Driving a new energy vehicle at low temperatures will lead to a decrease in battery mileage and life, resulting in a significant increase in charging time. The charging time of a car is 5–8 h. (2) The battery life of new energy vehicles is shorter than ordinary fuel vehicles, the safety of the battery cannot be guaranteed, and the inspection and repair of battery health is very costly and the accuracy is insufficient. It causes the second-hand batteries can’t be the resources to reuse.

4 Discussion

4.1 Solutions

4.1.1 Battery Durability

Now the mainstream of new energy vehicle batteries on the market can reach about 500 km. For example, the lithium cobalt battery used by Tesla has a range of 480km-613km,

with good comprehensive performance but high cost. For example the 4680 batteries, compared with 2170 batteries, the battery capacity is increased by 5 times, the endurance of the whole vehicle is increased by 16%, and the charging and discharging speed is increased by 6 times. The disadvantage is that it may lead to the problems of increasing the difficulty of internal heat dissipation, cell expansion and shortening the service life of the battery. Moreover, for lithium batteries, the material cost is very high. At present, ternary lithium is generally carried in high-configuration vehicles. For Tesla Model 3, the ternary lithium version is at least tens of thousands more expensive than the lithium iron phosphate version. The most widely used battery on the market is lithium iron phosphate battery, which is rich in raw materials so the cost is relatively low. In addition, this battery has high safety, good high-temperature performance, high charge and discharge efficiency and environmental protection. For example, our daily pure electric passenger cars use this battery. Although the battery life data on the market is excellent, due to the influence of various external factors, such as severe power failure caused by cold weather, these factors greatly reduce the life, and some models will lose the average life mileage. In the case of battery technology can not be improved immediately, manufacturers have focused on the charging speed rather than long endurance.

Taking Tesla as an example, Tesla has developed the third generation charging pile (Supercharger) and has applied for a patent. The maximum charging power of this charging pile reaches 250KW, which is greatly improved compared with the 150KW of the second generation. Using the Supercharger, the Model 3 can add about 120km in about 5 min, and other Models can also obtain about 250km in 15 min under peak power. This means that when you drive out for dinner or shopping, find the nearest charging pile to charge your car. When you return, your car can continue to drive for hundreds of kilometers, which is very convenient. In addition, Tesla's Supercharger production project in China has been officially implemented by the end of 2021. It is equipped near large shopping malls. There are more than 900 charging stations and more than 7000 Superchargers in China. Tesla's charging network has covered more than 330 cities in China.

4.1.2 Safety

According to the data from the Internet, in the first quarter of 2022, there were 640 new energy vehicle fires, with an annual increase rate of 32%, which is equivalent to an average of 7 new energy vehicles burning every day. The relevant laboratory of the Beijing Institute of Technology has also classified the causes of fire accidents. The data shows that the fire caused by battery failure accounted for 33%, chassis collision or traffic accident accounted for 15.4%, user modification caused by driving or static fire accounted for 12%, and electronic and electrical faults caused by fire accounted for 11%. Take The blade battery as an example, The blade battery has made BYD stand out in the new energy vehicle market, but two years later, the continuous fire of some models of BYD, especially Tang DM, has greatly questioned the safety of the blade battery. BYD decided to recall 9663 electric vehicles of some Tang DM models from April 29, 2022. The reason is that due to manufacturing reasons, the installation surface of the tray vent valve is uneven and there is a risk of water ingress on the power battery pack tray of some vehicles. This may cause electrical circuit failure of the power battery system.

In extreme cases, there is a risk of thermal runaway of the power battery and potential safety hazards.

However new energy vehicle companies and battery manufacturers are now still devoted to promoting battery technology progress for long battery life which may raise the cell energy density but lead to a decrease in cell stability. According to the report, "electricity lock" is probably a common operation of many car companies to lock car power through OTA upgrades, such as Tesla. But it will reduce battery life which infringes on consumers' rights. Thus locking car power can not be the final solution to prevent the car from burning.

For some old cars with parts that are difficult to replace, the car companies may take the initiative to strengthen the maintenance of key parts and timely find the potential fire hazard caused by battery pack loss. The recommended electrical changing mode recently is also a method to ensure the health and safety of battery packs. In response to the risk of battery pack wear and tear caused by the high-load characteristics of operating vehicles, BAIC and third-party operator Aulton have also set up several electrical charging stations for commercial operators.

In the future, new energy vehicle companies also need to find a balance between lightweight and safety and strive to further improve the strength of the battery pack shell on the premise of maintaining lightweight, to ensure higher safety in the event of accidents and collisions.

4.2 Expectation

Based on solving these two problems, there are lots of great prospects for new energy vehicles because of their renewable characteristics. With the gradual reduction of energy, new energy vehicles will be popularized in the next few years and begin to gradually replace traditional fuel vehicles. And in this era of rapid development of information technology and science technology, New energy vehicles can be combined with artificial intelligence to provide more user-friendly and convenient services. This can create great economic benefits for sellers. The technology of new energy vehicles can also be used in other products. For example, planes and ships. They can use this technology as a reference to develop new energy products.

5 Conclusion

This paper introduces the current development of the new energy vehicles and their development potential. This paper studies the existing problems and the solutions to deal with the problems, analyzing the investment trend of new energy vehicles, the comparison of companies and the future development trend.

This paper found that new energy is very worthy of long-term investment. Due to political, economic and environmental reasons, new energy vehicles will become the mainstream trend in the future. But the current development of new energy vehicles is not perfect, there are still some problems, such as the battery durability is not enough and there are some safety risks.

Due to the development of electric vehicles, the energy infrastructures will change significantly in the future. Charging, changing, mobile charging of batteries, and hydrogenation will constitute integrated infrastructure. It will become a highlight in the development of electrification and also a hot spot for investment in the industry in the near future.

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