

# How to Develop the Traditional Automobile Industry under The Dual-Carbon Background

## Current Situation and Problems of New Energy Vehicles in China

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### ABSTRACT

The development of the traditional automobile industry has brought great convenience to people, but at the same time, it has brought huge carbon emissions, which not only pollute the environment but also waste a lot of energy. With the policy of "Carbon Peak" and "Carbon Neutrality" proposed in China, the automotive industry has become a key area of decarbonization and transformation. The development of new energy vehicles has brought new opportunities to the Chinese auto industry, and the transformation of traditional auto companies is imminent. Because of the current development of China's new energy vehicles, this study analyzes the advantages and disadvantages of energy, technology, and market conditions, focuses on analyzing the current market environment of new energy vehicles and the core three-electric system, points out the current problems of new energy vehicles, and puts forward suggestions for the development of new energy vehicles in China. It also provides a useful reference for the transformation and upgrading of China's automobile industry.

**Keywords:** *New energy vehicles, Three Electric System, National policy*

## 1. INTRODUCTION

### 1.1. Background

Since the reform and opening-up, China's economic development has achieved world-renowned achievements. The traditional automobile industry has also achieved rapid development in the process of economic prosperity, which has brought great convenience to people's lives. However, a series of problems such as the energy crisis and environmental pollution have formed a bottleneck for the development of the traditional automobile industry, which is insurmountable. While the automobile changes human life and production methods, it also brings huge carbon emissions, which is a key area of decarbonization transformation. In this context, the ban on the sale of fuel vehicles has been a hot topic in recent years, and many countries and regions have also issued a timetable for the ban on the sale of fuel vehicles, the transformation of traditional cars are urgent. China's automobile industry is

basically at the manufacturing end, especially a large number of parts and components companies, mostly in traditional fields, small in scale, weak profitability, and consume a lot of materials and energy to maintain business operations. The pressure and difficulty of China's auto industry's decarbonization transformation far exceed those of developed countries. China has the world's largest car ownership and the largest emissions, and the total emissions are far from reaching their peak. The Chinese auto industry is facing the heaviest emission reduction task of the global auto industry. For Chinese car companies, the risks of decarbonization transformation outweigh the opportunities.

### 1.2. Related Research

China's annual output of carbon emissions accounts for a large proportion of the world. To adhere to sustainable development, scholars have proposed some model buildings to prove the spillover characteristics of space carbon emissions. Yang et al. with other

professional guys finally came up with some effective suggestions: the Chinese government should put forward different governance strategies for different places. The government should monitor the surrounding environment more effectively to ensure that carbon emissions are not exceeded. There is also hope that the government will formulate new and novel policies to achieve a win-win situation at home and abroad [1]. Low-carbon development has become a matter of concern to everyone, and Seyfang finding effective methods is the key to achieving low-carbon growth. It has been found that there is a negative correlation between resource richness and carbon emission efficiency. The richer the resources, the lower the emission efficiency, but the potential for emission reduction still depends on the economic scale. If resources are too dependent, it is not conducive to the rationalization and improvement of the industrial structure, which will affect the efficiency of carbon emissions from the side [2]. The development of the automotive industry is an area worth looking forward to in the future. At the same time, innovative market entrants are also beginning to change the automotive industry. Wang et al. initially discovered the central role of mobile service platforms, emerging disruptive technology providers, and industry communications. Automakers can apply this model to position their markets and identify possible disruptive actors or potential business opportunities [3]. The automotive industry is facing unprecedented changes, and its impact is far-reaching. The transformation of the automotive industry will be driven to a large extent by a young, tech-savvy generation. Kuhnert and Strummer figure out, now the younger generation will be an important driving force for maintaining sustainable development. By 2030, the establishment of autonomous electric taxis and the widespread electrification of public transportation will play an important role in this transformation. Manufacturers and suppliers need to rethink their business models to manage changes in the five dimensions of the "easy" model because focusing solely on the production and sales of cars will no longer be sufficient. It is predicted that the comprehensive and rapid restructuring of the automotive industry will have a profound impact on the entire industry and its value chain [4].

As resource scarcity and environmental degradation have aroused global concern, new energy vehicles have become the developing trend of the automobile industry all over the world. However, there is a lack of incentive for innovations on more environmentally friendly automobile technology. Zhang introduces endogenous and directed technology progress into the growth model to analyze the decision-making on R&D of environmental technology and concludes that automobile enterprises are less willing to engage in the energy-saving technological innovation as traditional fossil-fuel-based automobile technology is relatively mature. Therefore, it

is necessary for the government to formulate some temporary supportive policies at the initial stage of the development of the new energy automobile industry in China, to stimulate the initiative of vehicle manufacturers to innovate on environmental automobiles [5]. Wang provides a framework by which China should accelerate the development and production of new energy vehicles, which should effectively address current energy and environmental pressures while promoting the sustainable development of the automotive industry, which is an urgent task. The results of this study show that the optimal short-term development strategy for China's new energy automotive industry is to increase the construction of new energy vehicle-related facilities, while the best long-term development strategy is to use local advantages and resources, through cost control measures which increase competition within the local new energy automotive industry [6]. The empirical findings demonstrate that firm-level technological capability is positively related to eco-innovation performance, and state ownership intensifies this positive relationship. Surprisingly, increasing government subsidies tends to weaken this correlation. The results also show that firms with higher technological capabilities prefer cooperative R&D, while those with lower technological capabilities tend to choose internal R&D. These findings promote the understanding of the cost-effectiveness of R&D investment in the NEV industry, and also shed light on the interactions of internal and external resources. The study offers managerial implications to promote the prosperity of the NEV industry [7]. The review provides insight into the circumstances and causes of vehicle-induced air pollution and outlines recent progress in policy-makers long-term strategies and regulations. The development of an integrated mechanism of social participation, technical revolution, and regulatory innovation in vehicles, fuel, and roads is suggested to break the stalemate between air pollution and the automobile boom in China; the implications of this review extend to other countries facing the similar atmospheric pollution problems [8].

Existing patent data reveals: On the one hand, European and American automakers have absolute leadership and control over internal combustion engine technology. On the other hand, Toyota's breakthrough in hybrid technology shows the feasibility of breaking the monopoly of European and American internal combustion engines. The patent data also reflects that new energy vehicles based on electric drive systems are still in the blue ocean, which proves that this change provides a breakthrough path for developing countries represented by China to break the technological monopoly of the automobile industry in developed countries [9]. Xue et al. used the social-technical theory mentioned the transformation of traditional vehicles requires the coordinated development of many elements such as technology, market, consumer habits, policy,

culture, and infrastructure. However, in the early stage of the development of new energy vehicles, the feedback mechanism and dynamic relationship between these elements have caused the locking mechanism and path dependence of the current traditional vehicle domain, which constitutes a huge obstacle to the transformation. At the same time, the innovation and development in microhabitat are not perfect, and the deficiencies in technology and cost performance hinder its further diffusion [10]. Xing and Wang mentioned that the feasible development ideas of new energy vehicles in China are as follows: first develop hybrid electric vehicles, first develop "weak hybrid" and continuously accumulate and improve relevant technologies to reduce costs, and then develop strong hybrid (including plug-in dual-mode); In terms of market introduction, priority should be given to the development of public transport vehicles, so that hybrid electric vehicles will take the lead in industrialization and popularization. With the increasing maturity of a battery pack and management system in hybrid electric vehicles, cost reduction, and continuous improvement of related infrastructure, the relatively mature product technology, management technology, and industrial foundation of hybrid electric vehicles are used to develop pure electric vehicles from medium and small power, and then develop high-power pure electric vehicles [11]. Wang et al. used Kuhn's scientific paradigm for reference proposed that in the transformation period from traditional diesel locomotive to new energy vehicle driving technology paradigm, the construction of technical standards plays a decisive role in realizing the healthy and orderly development of China's new energy vehicle industry and gaining a voice in the development of the world's new energy vehicle industry. It is necessary to establish the policy guidance aiming at the construction of standard alliance and industrial standardization as soon as possible, and carry out the construction of China's electric vehicle standard system with international vision and strategic thinking. In this process, it should further clarify the patent R & amp [12].

### 1.3. Objective

Aiming at the development status of China's new energy vehicles, this article mainly analyzes the current Chinese government's encouragement and support policies for new energy vehicles, investigates the market conditions of new energy vehicles, and analyzes the current energy and energy consumption problems of China's new energy vehicles. The technical advantages and disadvantages of China's three-electric system, survey the status quo of various new energy automobile companies and make recommendations.

## 2. THE DEVELOPMENT OF THE CURRENT SITUATION

### 2.1. Policies (state encouragement, support, subsidies) Background

In the context of the development of the times and dual-carbon, the country is paying more and more attention to the transformation of the traditional automobile industry to new energy vehicles. In China, from the end of 2020 to 2021, the state has successively issued many policies, research and development plans, and guidance. On March 12, 2021, the 13th National People's Congress passed and issued the long-term goal outline. The outline pointed out that looking forward to 2035, my country will widely develop a green production and lifestyle. After the peak of carbon emissions, there will be a steady decline, and carbon emissions will be reduced this puts forward higher requirements for promoting the development of new energy vehicles. The new energy vehicle subsidy standard issued by the state clearly states that the subsidy standard is determined according to the energy of the power battery pack. For new energy vehicles that meet the support conditions, a subsidy of 3,000 yuan/kWh will be given. The maximum subsidy for plug-in hybrid passenger vehicles is 50,000 yuan per vehicle; the maximum subsidy for pure-electric passenger vehicles is 60,000 yuan per vehicle. This has greatly improved the competitiveness of new energy vehicles and expanded the market. In addition, in terms of infrastructure construction, China has also strengthened the construction of new energy vehicles. On February 2, 2021, the State Council issued a guiding opinion stating that to promote green and low-carbon transportation, ports and airport service buses, urban logistics and distribution, postal express, and other fields should give priority to the use of new energy or clean energy vehicles. The State Council also requires localities to strengthen the construction of charging piles, which will provide more guarantee for the promotion of the development of new energy vehicles this year and later. Relevant policies are shown in **Table 1**.

**Table 1.** Policies related to new energy vehicles in China

Time	Policy	Content
2021.2.2	Guiding Opinions of the State Council	Strengthen the infrastructure construction of new energy vehicles.

2021.3.1 2	Outline of long-term goals	Looking forward to 2035, carbon emissions will decrease after reaching the peak, reducing carbon emissions.
2021.3.1 6	Key points of work issued by the Ministry of Industry and Information Technology	Intensify efforts to formulate standards for fuel cell vehicles and power battery recycling.
2021.6.2 8	Key points of work issued by the Ministry of Industry and Information Technology	Strengthen the safety of electric vehicles, focus on the use of fuel cell vehicles, and support the innovative development of power exchange models.

**2.2. Schedule (country, car company)**

As the fire of new energy vehicles is getting more and more prosperous, the sound of a "burning ban" is endless. As shown in **Table 2** and **Table 3**.

**Table 2.** time when countries (regions) around the world ban the sale of fuel vehicles [13]

Time	Region
2024	Rome, Italy
2025	Norway, Mexico, Athens, Greece, Madrid, Spain, Paris France
2029	California, U.S.
2030	Hainan, China, Netherlands, India, U.K, Israel, Tokyo, Japan
2035	Canada
2040	Spain

**Table 3.** Time for auto companies to stop production and sell fuel cars [14]

Time	Auto companies' plan
2025	Honda plans to increase the proportion of new vehicles in the European market to two-thirds by 2025  BAIS Group proposes that by 2025, its brands will completely stop selling fuel vehicles in China  Changan Automobile proposes to stop selling fuel vehicles in 2025
2030	Centrify all models by 2030, and sales of traditional fuel vehicles.

As early as 2024, Rome will implement a ban on the sale of fuel vehicles. Two years ago, Hainan announced a plan to ban the sale of fuel vehicles in 2030 and implemented the "Hainan Province Clean Energy Vehicle Development Plan." The plan points out that the public service sector will strive to achieve clean energy in 2020; the social operation sector will strive to achieve clean energy in 2025; the province's clean automotive energy will reach the international benchmark level in 2030, as shown in **Table 2**.

**In addition, some auto companies have announced plans to ban the sale of new energy vehicles, as shown in Table 3. On September 4, Feng Xingya, general manager of GAC group, said that by 2025, the sales of new energy vehicles will account for more than 25%. It is worth mentioning that last year, the relevant departments issued the notice on improving the financial subsidy policy for the promotion and application of new energy vehicles, extending the period of the financial subsidy policy for the promotion and application of new energy vehicles to 2022, further promoting the development of the new energy market.**

**2.3. Market (Development of new energy)**

With the development of my country's social economy and the improvement of people's living standards, the demand for cars has increased year by year.

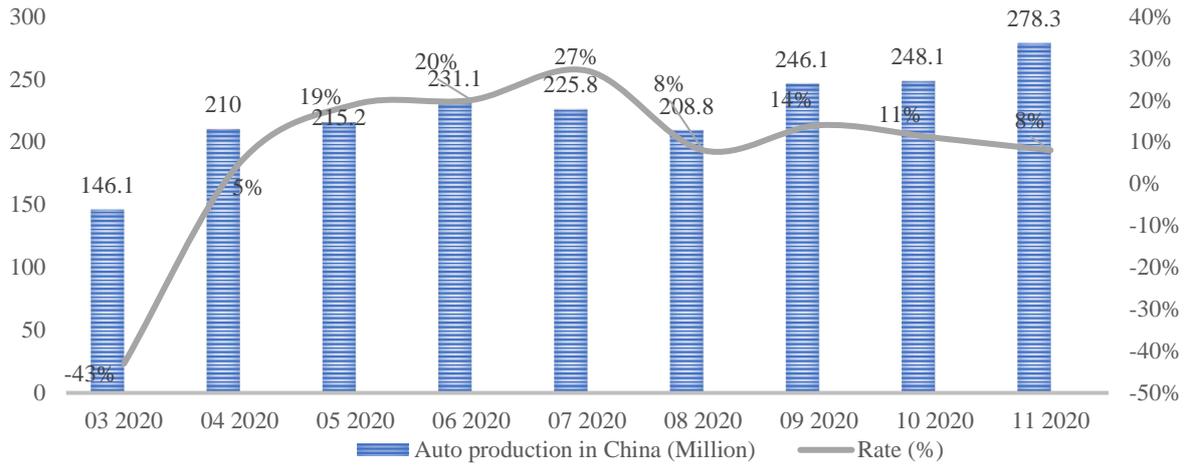


Figure 1. China's automobile production trend in 2020 (Unit: Million, %) [15]

As shown in Figure 1, the production trend of sedan cars rose steadily last year. It is believed that the Chinese market is now beginning to move from real estate to automobiles, and automobile consumption has become an important force driving economic growth and will be an important part of it in the next few years. The main new energy sources on the market now include wind energy, solar energy, fuel cells, biomass energy, and new energy vehicles. For the development of new energy vehicles in China, pure electric vehicles and hybrid electric vehicles are the main common ones. Although China's new energy vehicles started late, China has abundant natural resource advantages and huge market demand space. With government encouragement or policy support, the new energy sector can become a hot spot for investment, to slowly open up the market. But the main limitation issues now are the expensive battery version of new energy vehicles and export issues. The main cost of electric vehicles is spent on battery packs. Buyers need to replace expensive battery packs or single cells within a few years. Coupled with the conservative thinking of the Chinese people, it has become the biggest bottleneck in the commercialization of electric vehicles. The new energy vehicle industry chain is still incomplete, and supporting services are still incomplete. For example, the improvement of the new energy auto parts supply chain and infrastructure is a key link in the construction of its industrial chain.

### 3. TRANSITION PROBLEMS

#### 3.1. Energy and endurance issues

Energy vehicles are currently facing big problems in terms of energy and battery life, which is why many people are now unwilling to choose to buy them. The first problem is charging. Energy-energy vehicles are difficult to charge and slow to charge. As the popularity of new energy vehicles is not very high, it is difficult to charge them. Moreover, in remote urban and rural areas, there is

a situation where there is money to buy a car but no place to charge. Even if a portable charger is plugged into a 220V socket to charge, most new energy vehicles on the market will take about 20 hours to fully charge. The second is the installation of the charging pile. If users install the charging pile yourself, you must first have a fixed parking space. Even if there is a fixed parking space, you may not be able to install the charging pile. Some community properties will prevent electric vehicle owners from installing charging piles on the grounds of old circuits and potential safety hazards. Moreover, the charging pile can not be installed immediately after application. There is a set of procedures to go, and it usually takes about a month to install. In contrast, a traditional fuel vehicle requires only a few minutes to refuel, and it does not take long to line up during peak hours, which saves time and worry. At present, China is working hard to support and subsidize new energy vehicles and has introduced a series of programs for the development of new energy vehicles, and is working hard to strengthen the construction of new energy vehicle charging piles and the improvement of infrastructure.

#### 3.2. Technical advantages and problems

In the future pure electric era, the three-electric system will be the core standard for investigating a car. Generally speaking, they are the battery, the motor, and the electronic control system. In China, the battery technology of new energy vehicles is world-class or even super-class. The CATL as a representative is already on the front line. China's battery advancement is all-around. From battery cells to battery pack integration, battery control BMS, and battery production equipment suppliers (LEAD INTELLIGENT, Yinghe Technology), China has formed a set of battery-based upstream and downstream industrial chains, from mineral resources to research and development to production, is completely independent. Relative to the second-tier level is the motor body. At present, various domestic OEMs are developing

their motors, and there is a large gap of talents for high-efficiency driving motors. The main gap between domestic and foreign is in the use of new materials, the design of the rotor, the arrangement of the magnets, and the optimization of the stator winding design. The current situation of electronic control is more complicated. The control software itself is already at the first-class level in China. It can complete the independent development of the upper and lower control software, and can also meet the software requirements of the latest AUTOSAR architecture and functional safety. But on the other hand, the domestic electronic control hardware is still at the second-rate level, especially the controller itself. In general, the domestic push for new energy in recent years is indeed effective, at least the core system of batteries is at the forefront. Motors and electronic controls can also meet some of the low-end localization needs, but there is still a lot of room for improvement in the matching of high-end products. This is also the part that currently has the most shortage of domestic talents.

### **3.3. Marketing**

Since the beginning of this year, the production and sales of new energy vehicles in China have been prosperous, and the industry is booming. In this context, the development of the new energy automobile industry is very strong, and it gradually becoming mature. In the future, it is expected to gradually expand its market share in overseas markets, and the potential of market space is huge. While new car-building forces continue to deepen the new energy vehicle market, traditional car companies are also actively exploring the new energy vehicle market on a large scale. A few days ago, BYD sold 67,600 passenger vehicles in August, a year-on-year increase of 90.5% and a month-on-month increase of 18.7%. Among them, in the field of new energy products, new energy sales reached 60,500 in August, an increase of 331.9% year-on-year, of which 30,100 were sold for DM models and 30,300 for EV models. It is worth mentioning that in July this year, BYD beat Tesla with 46,900 sales, becoming the number one brand in global new energy vehicle sales that month. SAIC's performance is also quite outstanding. SAIC's August production and sales bulletin data show that SAIC achieved sales of 453,000 vehicles in August, an increase of 28.6% from the previous month. Among them, the sales of new energy vehicles were 71,000, a year-on-year increase of 171.2%, setting a record for the monthly sales of new energy vehicles in China. It can be seen from the sales data that the leapfrog development of new energy vehicles has indeed brought opportunities for China's auto industry. At present, not only the half of production of electric vehicles is in China, and also half of the market is in China. The battery industry and electric drive industry brought out by this chain have firmly occupied a place in the world.

## **4. TREND OF DEVELOPMENT**

### **4.1. Sodium batteries, blade batteries, hydrogen energy**

In the development stage of new energy vehicles, it is necessary to grasp the core issue of the power battery endurance of new energy vehicles, research and develop key points around technical congestion, and reduce the attenuation of power batteries by optimizing the power battery management system and actively exploring the use of new materials. Speed up the elimination of battery fear of cold, high-speed power loss, and other problems, and develop high-efficiency batteries that can adapt to more application scenarios. At present, the types of new energy electric vehicle batteries are roughly classified into several categories, such as lead-acid batteries, nickel-metal hydride batteries, lithium manganese batteries, lithium iron phosphate batteries, and ternary lithium batteries. These types of batteries currently have certain defects in different aspects. Therefore, in terms of battery selection, new energy vehicles need to face a huge innovation. From a business perspective, performance and cost are the main criteria for considering a product. Sodium-ion batteries have the characteristics of being safer and more reliable, long cycle life, high specific energy, and environmentally friendly. Therefore, sodium-ion batteries will be a breakthrough in the battery life of new energy vehicles. At present, my country's lithium materials for the production of lithium batteries mainly rely on imports, but there are extremely rich sodium resources. It is destined that the cost of sodium-ion batteries is lower than that of lithium-ion batteries. At the current price, the cost of sodium-ion batteries is only two-thirds of that of lithium-ion batteries. In recent years, there have been too many fires and explosion accidents in charging stations around the world, and fire accidents in electric bicycles have also occurred in China from time to time. These charging stations or trams where the accident occurred all use lithium-ion batteries. It is a high-quality solution to replace lithium batteries with sodium-ion batteries with higher safety performance.

### **4.2. Competition**

Throughout the world, most new energy vehicle companies currently do not have their R&D capabilities for three-electric systems. Among the new car forces that have attracted much attention, everyone is generally in the form of procurement. For example, Xiaopeng's motor comes from Jingjin Electric, NIO's battery cell module comes from the Ningde era, and Weimar's motor comes from BorgWarner. For core technologies such as electronic control, some companies have begun to actively research and develop. At present, Toyota, Tesla, and other car companies have made some breakthroughs in battery life extension. If independent brands want to provide consumers with better services, then they must

try to increase the battery life cycle mileage as much as possible. The electric drive consists of three parts: transmission mechanism, motor, and inverter. At present, the transmission mechanisms of electric vehicles at home and abroad are all single-motor deceleration, that is, there is no clutch and no speed change. In the future, electric vehicle companies will increase the complexity of the transmission mechanism, while reducing the demand for motors and motor rheostats, that is, improving performance and reducing costs. It is worth noting that under the background of many companies actively promoting product upgrades and developing "three-in-one" integrated products, products are accelerating toward miniaturization, lighter weight, and low cost; with the mass production of new energy vehicles, The power system has a trend of high integration, high power density, motor permanent magnet synchronization, multi-speed deceleration system, and diversified cooling system.

**4.3. Momentum of Growth**

Back in the year when Tesla was introduced to China. Although at that time, the new energy vehicles seemed to be just learning to walk, the market was introduced to Tesla, which was regarded by many as attracting wolves into the house. On July 30, 2021, Tesla officially announced that the price of the upgraded version of the Tesla Model 3 standard battery life will be reduced by 15,000 yuan. As Tesla's domestic sales continue to rise, as far as the current market with limited penetration of new energy vehicles is concerned, it has had a significant sales impact on other brands.

**Table 4.** September 2021 SUV Sales Ranking (Unit: Amount) [15]

NO.	SUV	2021.9	2020.9	Rates
1	Tesla (Model Y)	33,033	-	-
2	BYD	23,341	14,173	-40.4%
3	Volkswagen Tiguan	21,222	19,722	49.7%
4	HondaXR-V	18,358	16,984	-6.9%
5	Geely	16,143	16,984	-5.0%
6	CCAG (CS75)	15,853	17,513	-9.5%
7	LAVIDA	15,644	25,180	-37.5%
8	Honda (R-V)	14,648	14,259	2.7%
9	Toyota (RAV4)	14,051	27,447	-48.8%
10	Qashqai	13,740	18,318	-25%
11	CHANGAN Auto	13,588	15,553	-12.6%
12	Auchan Auto	12,612	80	15665.0%
13	VEZEL	12,403	17,072	-27.3%

14	Hong Qi (HS5)	10,868	10,313	5.4%
15	ROEWE (RX5)	10,720	18,630	-42.5%

Look at the table above and compared it with traditional fuel vehicles. It is obvious to see energy vehicles are more environmentally friendly. With the continuous development of industry technology, new energy vehicles have also entered a rapid growth situation. Many traditional auto companies have also transformed and entered the new energy vehicle industry. Today, the global market share of new energy vehicles is increasing rapidly, especially in China ushered in substantial growth. Relevant data shows that from January to June this year, the global sales of new energy vehicles have reached 2.45 million, and the sales of China's new energy vehicles in the first half of the year reached 1.799 million, a year-on-year increase of two times. These data have maintained steady growth in recent years. Therefore, it is foreseeable that under the vision of carbon neutrality, China's new energy industry is accelerating its entry into a user-led market operation stage.

**5. CONCLUSION**

As for the dual-carbon policy, traditional cars have high carbon dioxide emissions and serious pollution, which has become a key issue. The emergence of new energy vehicles has brought a great turn for the transformation of the traditional automobile industry, but the development of new energy vehicles is not yet mature. This article focuses on the research from the three aspects of the market, core three-electric system, battery life, and energy, and analyzes the current problems of new energy vehicles. The study found that the current market for new energy vehicles is not mature, the technical level of the core three-electric system needs to be improved, and the battery life is short and unstable. In response to the above problems, relevant suggestions are put forward for the future development of new energy vehicles: perfect the market, improve the level of the three-electric system, and use sodium batteries as new batteries.

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