Article

The Enlightenment of French Standardization Strategy on China's Electric Vehicle Breakthrough Development Bottleneck in the Context of Energy Crisis

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[Abstract] The problems of operating range and costs are the two most critical bottlenecks restricting the extensive application of electric vehicles at home and abroad**.** There are also some prominent problems in China's electric vehicles, such as slow improvement of electric vehicle's operating range, difficulty in charging, slow charging, low utilization efficiency of charging resources, and high battery cost for electric vehicles, which lead to poor competitiveness of electric vehicles compared with traditional internal combustion engine (I.C.E.) vehicles. This paper analyzes the key factors restricting the development and popularization of electric vehicles in China from the aspects of strategic policy, sales situation and self problems. Through summarizing the experience and lessons of French standardization development strategy and electric vehicle development mode, this paper puts forward the hypothesis leading the development of electric vehicles through standardization to enhance their competitiveness, gives the specific suggestions, and briefly analyzes the feasibility from the aspects of product situation. The research content of this paper provides a certain basis and ideas for the future research work.

Keywords: China; Electric vehicle; Development bottleneck; French Standardization; Enlightenment

1. Introduction

Sorrell et al. [1]have proposed that conventional oil would be physically depleted by 2030. The energy crisis has aroused people's more attention of pure electric vehicles. However, the problems of vehicle range and costs are the two most critical bottlenecks restricting the extensive adoption of electric vehicles. Over the years, a lot of research has been done at home and abroad, and a lot of research results have been achieved in this field. However, there is still no breakthrough in the actual research and application to improve the operating range of electric vehicles, and there is still a big gap between the cruising range of most domestic electric vehicles and the actual demands, which is a big problem that has plagued domestic and foreign researchers for many years. Compared with traditional I.C.E. vehicles, the competitiveness of electric vehicles has no advantage. The slow development of electric vehicles, rather than replacing traditional I.C.E. vehicles, may aggravate urban traffic congestion, thus increasing energy consumption and air pollution. How to improve the market competitiveness of electric vehicles, rather than relying on policy survival and development is a problem worth pondering. The release of the French standardization strategy (2019 edition) [2], as well as the exploration and valuable lessons learned by France in the field of electric vehicles, can povide very good roadmap for China to overcome the bottleneck problems during electric vehicle development.

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2. Analysis of domestic situation

2.1. Analysis of strategic policy

China has issued a lot of relevant strategic policies and plans for the development of electric vehicles. For example, the "Industry development plan on energy saving and new energy vehicles (2012-2020)" was published in June 2012 in the form of State Council Announcement, guiding the direction of China's new energy vehicle development and automobile industry transformation from a strategic perspective, and pointing out and determining the important position of electric vehicles. In addition, the energy-saving and new energy vehicle industry, represented by electric vehicles, has become one of the seven strategic emerging industries in the 12th Five Year Plan period. Secondly, a series of policies such as promotion and application, subsidy and tax-free charging facilities construction and unlimited travel have also been introduced, which has played a great role in promoting the sales and use of electric vehicles. In order to encourage the development of electric vehicles, China has put forward various policies to promote the development of supporting facilities. For example, the guidelines for the development of electric vehicle charging infrastructure (2015-2020) specify that 4.8 million charging poles shall be used to meet the demand of China's new energy vehicle ownership in 2020. In addition, the newly-built residential areas are required to build or reserve areas for charging poles. On October 9, 2020, the State Council deliberated and passed the "New energy vehicle industry development plan" to promote the high-quality development of new energy vehicle industry and the construction of automobile power. The plan clarifies the division of labor between the government and enterprises. Enterprises focus on playing the main role in the selection of technical solutions, while the government plays a better role in the development of standards and regulations, quality and safety supervision, mainly playing the role of guiding, standardizing and promoting the division of labor, so as to enhance the market competitiveness of electric vehicles in China. [3]

2.2. Analysis of sales

According to the statistics of China Automobile Industry Association and China Passenger Car Association, the sales volume of electric vehicles has shown a rapid growth. However, the sales volume of electric vehicles is still in sharp contrast with that of overall automobile sales. The market suare of electric vehicles in passenger cars is still very low. Compared with previous years, there is no significant increase, and the data is still under the situation of the State's policy intervention to restrict the registration of I.C.E. vehicles in some cities. It can be seen that a series of measures in the field of electric vehicles, such as policies, related technical progress and infrastructure construction, have not promoted the explosive growth of electric vehicle sales, and people's adoption of electric vehicles has not been fundamentally changed. [3-4]

Table 1 Sales comparison of electric vehicles and passenger cars in recent years.

Year / Sales volume	2013	2014	2015	2016	2017	2018	2019
Total sales volume of domestic passenger cars (unit: 10000)	2114.62	1970.16	1792.95	2437.69	2471.83	2370.98	2144.4
Sales volume of electric vehicles in China (unit: 10000)	1.01	4.32	19.11	25.7	46.8	78.8	103.83
The proportion of sales volume of electric vehicles in the sales volume of passenger cars (%)	0.048	0.219	1.066	1.054	1.893	3.324	4.842

From the perspective of Europe, according to the statistics of Zhiyan consulting network, the market suare (electrification rate, which refers to the proportion of the use of electric vehicles in daily passenger vehicles) for European vehicles in 2019 was 2.9%, among which the permeability of Norwegian vehicles was the highest, accounting for 44.1%. The second and third ranking were Netherlands (14.9%) and Sweden (10.4%), while the sales volume of Germany, Britain and France are all within 3%. Comparing these

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data with China's data, as shown in Fig. 1, compared with some European countries, China's permeability has a higher proportion, but there is still a big gap compared with the European countries with higher permeability. The reality is not in line with the original intention of developing electric vehicles in China.

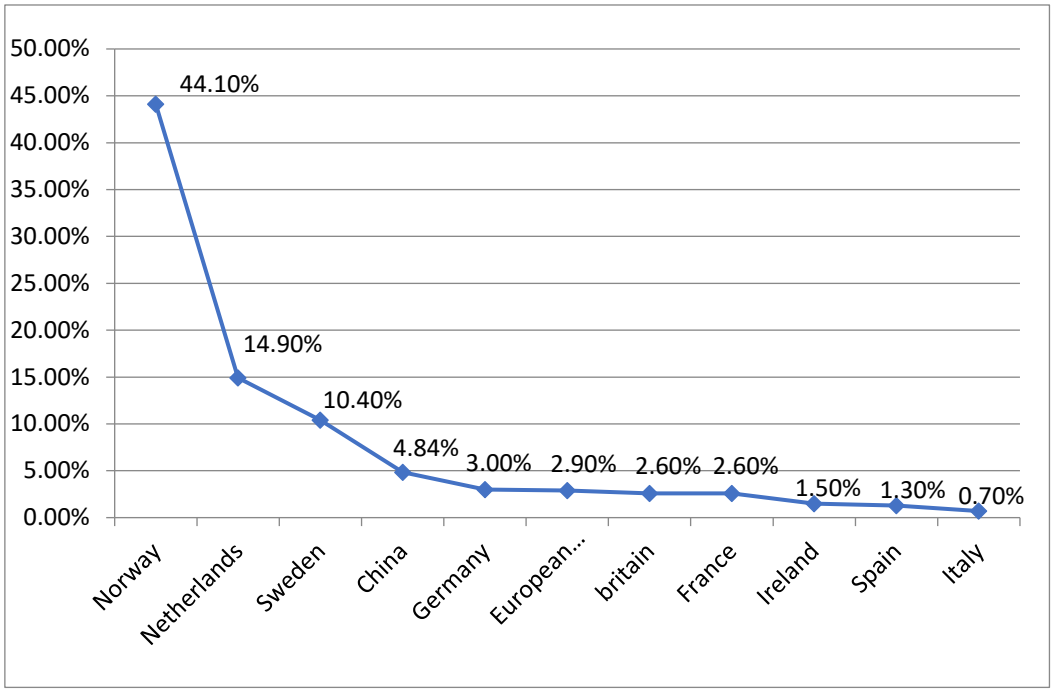

Fig. 1. Comparison of European countries with higher electric vehicle permeability and China's electric vehicle permeability in 2019.

The sales of electric vehicles are affected by many factors. Xu Guohu et al. [5]found that the factors that affect whether consumers buying electirc vehicles are: herd effect, vehicle performance, sales price, use feasibility, cruising range, after-sales guarantee and other factors. Zhang X [6]found that consumers are more concerned about the performance indicators of electirc vehicles. Niu Liwei [7]found through questionnaire surveys and analysis that environmental cognition has a significant impact on consumers' willingness to purchase, and pointed out that government incentives have an important impact on consumers' willingness to purchase electirc vehicles. The research of Hao Y et al. [8]confirms that household income, household car ownership, and vehicle comfort also significantly affect consumers' willingness to purchase electirc vehicles. In addition, the city of residence and marital status have also been proved to be important determinants of consumers' purchase of electirc vehicles. Wang S [9]evaluated the impact of various policies on the purchase of electric vehicles by Chinese consumers, and divided the policy measures into fiscal incentive policy measures, information provision policy measures, and convenience policy measures, and found that the three types of policy measures are related to electric vehicle sales. Significant positive correlation, among which, convenience policy measures are the most relevant. Sun Xiaohua et al. [10] found that price is an important variable that determines whether consumers choose electirc vehicles, government subsidies can promote consumers to purchase electirc vehicles, but the effect of government subsidies is relatively weak. In addition, the use cost, time cost, and whether there are charging piles and other vehicle attributes and government policy variables, as well as the educational background, the number of existing cars, the annual mileage, the number of monthly trips, the degree of understanding of preferential policies, environmental awareness and technical trust, etc. also affect consumer choice. Based on the above research, it is found that the endurance and price of electric vehicles are the two most im-

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portant factors that affect consumers' purchase. Solving problems from these two perspectives is also the most effective way to increase sales of electric vehicles. In addition, the first batch of electric car buyers in my country are currently experiencing serious battery damage and are facing the problem of replacement. Poor customer experience is bound to affect the entry of a new batch of consumers.

2.3. Brief analysis of own problems

Due to development mode and the inherent properties of battery products and materials, the performance improvement of electric vehicles is difficult to overcome in a short time.

2.3.1. Analysis of performance problems

At present, the performance of electric vehicles in China still has the following three problems.

2.3.1.1. Energy storage capacity

Research on improving battery capacity at home and abroad is mainly focused on two aspects. On the one hand, it is to increase the battery energy density and battery quantity, and on the other hand, it is to reduce the battery's weight. Increasing the number of batteries invisibly increases the vehicle quality and space occupancy of electric vehicles, and affects the vehicle's mobility and space layout design. Researchers at home and abroad have conducted a lot of research and exploration on the lightweight design of battery packs [11-14]. However, separate research on batteries of different structures, sizes and performance has led to scattered scientific research forces, which is not conducive to rapid technological breakthroughs. It is also the direct cause of the slow improvement in the operating range of electric vehicles in recent years.

2.3.1.2. Short life

Battery life is a key factor affecting the cost performance of electric vehicles. It is generally believed that when battery charge capacity is dimissed to 80% or less of the rated capacity indicates its failure. As far as the most widely used lithium battery for electric vehicle power batteries in China, its capacity decay is its inherent property, affected by complicated factors [15-17]. Studies [18]have found that the current capacity decay of most batteries is roughly exponential decay. The speed of the decay depends on the stability of the battery material and the rate of side reactions. It is also affected by many factors such as ambient temperature, deep discharge, and attenuation is an irreversible process. The daily use of electric vehicle batteries, under the combined effect of multiple factors, shows a continuous decay in capacity at different speeds. When the decay is too serious to meet the daily use required by the users, it has reached its actual service life. However, due to the lack of technical awareness of general users, coupled with non-standard battery management, and various uncertain and harsh charging and discharging environments, the battery capacity decay is often accelerated, resulting that its lifetime is much lower than expected design life.

In summary, battery systems of electric vehicles urgently need a unified, professional and standardized management team to improve their safety and lifespan. In addition, the design of the battery box for electric vehicles shall consider not only the temperature control requirements, but also moisture-proof, impact resistant and explosion-proof. Currently, there is no recognized widespread design standard of battery box structures with comprehensive performance. Therefore, it is necessary to standardize battery management by adopting a relatively optimal standardized design based on the optimized solution of technical problems base on today's best practices.

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2.3.2. Analysis of development mode

China's existing development presents the development mode of separate research and mutual competition. Electric vehicle enterprises are numerous, and the category is complex. Compared with foreign countries, China has more brands and electric vehicles. In addition, under the guidance of various incentive policies and the influx of a large number of new independent brand car making forces, China's electric vehicles are facing the situation of great development, but also facing all kinds of market chaos and problems. Therefore, on the whole, the development of electric vehicles is an effective way to solve the energy crisis at present and in the future. The basic conditions for promotion and development are already available. However, due to the existence of technical bottlenecks that are difficult to overcome in the short term, it is imperative to explore positive and effective promotion and application mode. According to the statistics of researches on the development of shared cars in China, more than 300 companies in China have entered into the market, and the number of "shared" electric vehicles of most companies is around a few hundred. A large number of companies hope to obtain venture capital from investment institutions to survive. In addition, "shared" cars are different from shared bicycles. Because of the high cost of battery, it is difficult for general start-up enterprises to increase the number of electric vehicles online to meet actual needs. A single profit mode is usually difficult to make up for the high cost of its operation.

3. Analysis of French standardization strategy and development

3.1. Introduction to relevant contents

In 2019, the French Association for Standardization (AFNOR) released the latest version of standardization strategy (2019 Edition), which proposed that French standardization would focus on seven major cross-functional and sectional (Sustainable and smart cities and communities, Trust and excellence for services, Ecological transition. Autonomous and remotely controlled mobility and logics etc.) and five specific topics (Artificial intelligence, Energy storage-batteries, Security, etc.). It has mentioned the important role of standardization in identifying and sustaining support for technological and social trends. It captures market demand in terms of openness, supporting the competitiveness of French companies and creating a framework for the harmonious development of activities and new jobs. Standardization can also support legislation and regulations, to help limit the spread of laws and regulations. In the current international, this development trend is becoming faster and faster.

The French standardization strategy points out that standardization will help our society to cope with three major challenges: fight against climate change, controlled digitization and to create a more inclusive society. It is mentioned in "Fight against climate change" that the mobilization of carbon neutrality in Europe by 2050 can continue at the local, national and international levels. Voluntary standardization helps to promote this progress in all sectors, namely the effective deployment of climate change on the basis of streamlined and effective management of resources, materials and energy and their use.

In the "a more inclusive society" section, it is mentioned that the consideration of multiple individuals and education and income levels through common rules is a major social issue. Standardization is one of the tools used to integrate differences from the design stage. Standardization, which benefits diversity, is not as contradictory as it seems. Standardization leverages the know-how to provide solutions.

3.2. Brief analysis of related enlightenment

3.2.1. Technical standardization support policy implementation

France is creating technical standards as technical tool that can support legislation and regulations, and standardization, as a means of consolidifying technological achievements, promots application of best parctices in the technical field. In the field of electric

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vehicle development, China has issued many related policies and measures to encourage sales and use, and the scientific aspects of the policies are also constantly improving.

However, in terms of the specific implementation of the policy, there may be some deviation in the understanding of the policy by all parties in the technical field, there is still a certain gap in the follow-up of the implementation of the new policy at the technical level. The most effective tool to combine technology and policy is standardization. In the field of standardization, the development and implementation of mandatory standards are the most closely combined with best practices.

3.2.2. Technology standardization promotes energy conservation and emission reduction

On the one hand, electric vehicles are planned to play an important role in addressing climate change as an alternative to traditional I.C.E. vehicles. However, the most important problem to be solved is to improve its operating range capacity on the premise of ensuring safety, so as to enhance its competitiveness relative to I.C.E. vehicles, thus to achieve additional market share. On the other hand, in the effective management of batteries, it is important to consider the recycling and depletion of batteries, so as to reduce the environmental pollution impacts, and achieve the overall treatment and efficient recycling of electric vehicle battery materials.

3.2.3. Technical standardization helping cost control

At present, the adoption of electric vehicles still has a key problem to be solved, that is too high. The price remains high, causing many consumers not to buy it. The French standardization strategy mentions that the common rules of standards are used to comprehensively take into account multiple individual needs. Standardization in the field of electric vehicles requires comprehensive consideration of the interests of multiple parties. From the development policy of electric vehicles to the design of related products, various differences shall be considered at all stages, so as to achieve standardization and mass production while taking into account the interests of all parties, so as to achieve the optimal allocation of resources, and ultimately reduce the overall cost and price of electric vehicles.

3.3. Brief analysis of electric vehicle development in France

3.3.1. Development profile

The development of electric vehicles in France can be described as groundbreaking. A tricycle powered by lead-acid battery invented by French engineer Gustav Truff was launched in 1881, which was the first electric vehicle in the world. From the current point of view, in order to promote the development of electric vehicles, France has adopted measures similar to those of the United States, Germany and China, including technical support, incentives for consumers, and promotion of infrastructure construction. The French government's goal is to reach 7 million charging poles in France by 2030. They have also achieved better results in their domestic product sales. In addition, they have also conducted research on the grid load problems caused by the popularization of electric vehicles and charging poles and business model of used batteries (2018). By comparing the sales statistics of electric vehicles in different European countries in recent years, Fig. 2 shows that before 2016, France had long been the country with the highest sales of electric vehicles in Europe. Subsequently, due to factors such as industrial development and policy support in neighboring countries, France has faced more competition. It's getting more intense. Therefore, France has mentioned “Implementing circular economy” in the theme of “Ecological transformation” of the 2019 standardization strategy, and has pointed out in its leadership goal that “by proposing the positions and initiatives of French actors on the circular economy at the international level, to strengthen France’s leadership in addressing climate change.” In recent years, the French government's incentives for electric vehicles have gradually reduced. Lévay et al. [19]have sorted out the purpose of

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the incentive policies for new energy vehicles in various countries and pointed out that while reducing CO2 emissions, France hopes to ensure the competitiveness of the French automobile industry.

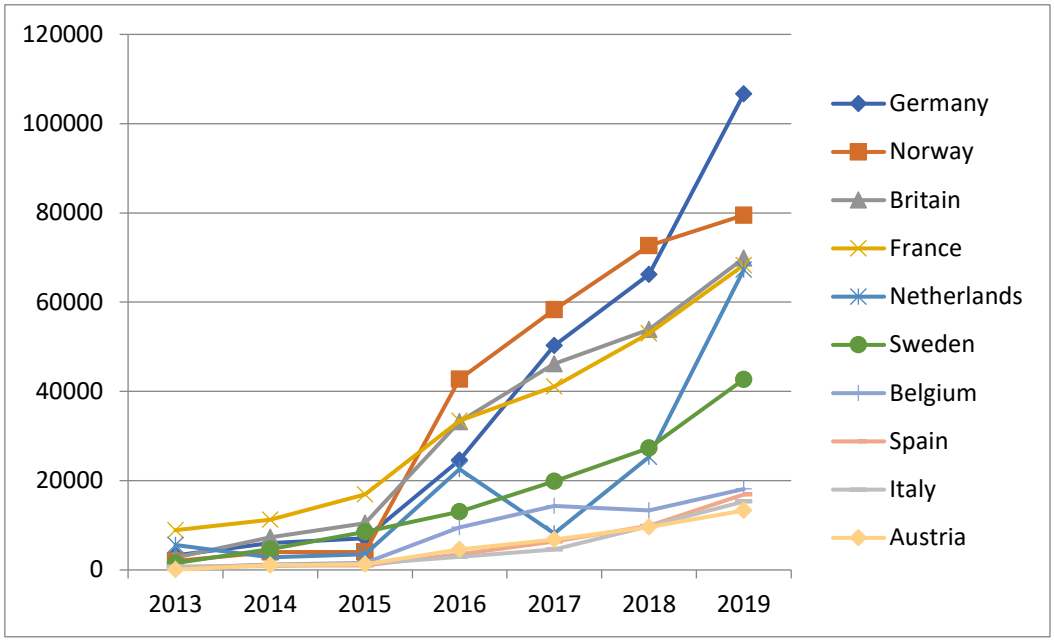

Fig. 2. Comparison of sales statistics of electric vehicles in different European countries in recent years.

To sum up, the development of electric vehicles in France not only has the historical origin of early development, but also has the influence of its policies, standards, technology, economy, management and environmental conditions. Among them, France has played an important role in maintaining its industry competitiveness by monitoring and regularly updating the standardization strategy. In addition, French standardization strategy has played an important role in stimulating the enthusiasm of stakeholders.

3.3.2. Brief analysis of French electric vehicle rental mode

In 2011, France launched an electric car rental public service project (autolib) in Paris. The government tried to reduce the purchase of private cars in this way, so as to achieve the purpose of energy conservation and emission reduction and alleviate urban traffic congestion. After several years of exploration, it gradually turned losses into profits. In 2014, the net profit of the project reached 10.9 million euro. Although the operation, management and other factors eventually failed to last, the autolib project in Paris of France is a relatively mature and worthy of learning electric vehicle time-sharing leasing mode. Other countries have also made some explorations in the field of electric vehicle leasing, such as Zipcar, a representative company of time-sharing leasing in the United States, Maven of GM and Drive Now of BMW. France and the United States as well as others' early exploration, research and attempt on the development mode and integration of electric vehicles [20-22]have provided us with good experience and lessons. We shall add more research and analysis to explore the development mode applicable for China's actual situation.

Electric vehicles are different from other shared electrical equipment. Firstly, from the user's point of view, electric vehicles are different from sharing mobile power supply and sharing bicycles. The feeling of people using shared cars is affected by the comfort of the internal environment, the convenience of taking vehicles and the cost of using shared cars. The current operation mode of electric vehicles is difficult to meet the demand of daily convenience. At the same time, people's requirements for the comfort of automobile

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environment are higher than that of shared bicycles. From the perspective of operators, electric vehicles are different from common shared products. Due to the high product cost, land resources and enterprise funds, it is difficult to launch electric vehicle sharing services on a large scale to meet the actual needs of users. Based on the above reasons, this mode has not been well developed in China, and in recent years, many electric vehicle rental companies in China are in a state of bleak operation or even bankruptcy.

4. Standardized solutions

4.1. Analysis of standardization restriction factors

In view of the various problems existing in the development of China's electric vehicle industry, it is important to standardize. According to the analysis of the current national standards related to lithium-ion power batteries for electric vehicles in China, there are about 30 national standards (Table 2), most of which are recommended standards. In terms of mandatory national standards, there are only a few safety related standards for electric vehicles. In addition, there is a guiding technical document related to the performance of lithium-ion power batteries. The recommended national standards generally focus on battery performance, battery management, charging facilities and battery recycling. In addition, there are relevant standards for battery size and replacement. However, the standards about battery size and battery recycling are only recommended standards, and there is no compulsory national requirement for China. The reason is related to the current development mode of electric vehicles in China.

Table 2 Summary of relevant standards for electric vehicle batteries in China.

Number of standard	Name of standard	Standardization field
GB 8897.4-2008	Primary batteries - Part 4: Safety of lithium batteries	Performance of battery pack
GB 18384-2020	Electric vehicles safety requirements	Performance of battery pack
GB 38031-2020	Electric vehicles traction battery safety requirements	Performance of battery pack
GB/T 8897.1-2013	Primary batteries	Performance of battery
GB/Z 18333.1-2001	Lithium-ion batteries for electric road vehicles	Performance of single cell battery
GB/T 20234-2015	Connection set for conductive charging of electric vehicles	Battery charging device
GB/T 29316-2012	Power quality requirements for electric vehicle charging/battery swap infrastructure	Charging and changing facilities
GB/T 29317-2012	Terminology of electric vehicle charging/battery swap infrastructure	Charging and changing facilities
GB/T 29772-2013	General requirements of electric vehicle battery swap station	Battery replacement station
GB/T 31467-2015	Lithium-ion traction battery pack and system for electric vehicles	Performance of battery system
GB/T 31484-2015	Cycle life requirements and test methods for traction battery of electric vehicle	Performance of battery
GB/T 31486-2015	Electric performance requirements and test methods for traction battery of electric vehicle	Performance of battery cell and module
GB/T 31525-2015	Graphic signs—Electric vehicle charging and battery swapping infrastructure signs	Charging and changing facilities
GB/T 33059-2016	Methods for disposal and recycling of lithium ion battery material wastes	Battery recycling
GB/T 33060-2016	Treatment and disposal methods for the waste liquid from the treatment of waste batteries	Battery recycling

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GB/T 33143-2016	Aluminum and aluminum alloy foil for lithium ion battery	Battery recycling
GB/T 33341-2016	General requirements for swapping battery pack rack of electric vehicle	Battery replacement
GB/T 33598-2017	Recycling of traction battery used in electric vehicle—Dismantling specification	Recycling of battery pack and module
GB/T 33598.2-2020	Recycling of traction battery used in electric vehicle——Recycling——Part 2: Materials recycling requirements	Recycling of battery pack and module
GB/T 33824-2017	Aluminum and aluminum alloys plates, sheets and strips for cans and caps of new energy power batteries	Battery packaging
GB/T 34013-2017	Dimension of traction battery for electric vehicles	Specification and size of battery unit and module
GB/T 34014-2017	Coding regulation for automotive traction battery	Management of battery pack
GB/ T 34015-2017	Recycling of traction battery used in electric vehicle—Test of residual capacity	Recycling of battery pack
GB/T 34015.2-2020	Recycling of Traction Battery Used in Electric Vehicle - Echelon Use - Part 2: Removing Requirements	Recycling of battery pack
GB/T 38661-2020	Technical specifications of battery management system for electric vehicles	Battery management system
GB/T 38698.1-2020	Recycling of traction battery used in electric vehicle--Management specification--Part 1: packing and transporting	Battery recycling

4.2. Suggestions for solutions using standardized methods

To sum up, through combing and analyzing the relevant standards at home and abroad, the commonly used power battery standards for electric vehicles in China have covered product specifications and dimensions, basic performance requirements, safety requirements, test methods and recycling. However, the current development mode relying on the slow development of technology to improve the operating range capacity can not meet the actual needs. The research and practical experience of France and Norway are good reference for the improvement of the core competitiveness of electric vehicles in China. The France/Norway model is an effective way to solve the battery problem from the perspectives of technology, policy and mode to find a new mode which is conducive to promoting the division of labor and concentrating the dominant forces to tackle key technologies. We recommend action in the following areas.

4.2.1. Accelerate the development of national standards for electric vehicle batteries

One study [23]has found that the current rate of constant current charging in the current charging cycle is not uniform or clear among multiple standards. In order to find the best comprehensive charging method for specific types of batteries, it is necessary to standardize the charging process and speed up the development of mandatory standards for electric vehicle batteries and related fields. Compared with some European countries with small demand for electric vehicles, standardization has more important significance for China, because China's market scale is huge and there are many automobile enterprises suppling vehicles to the market. Through the standardized management and specification of electric vehicle batteries, the cost can be reduced. Through the development and implementation of mandatory standards related to the size and structure of batteries, we can concentrate our dominant forces to tackle key technical problems, so as to improve the efficiency of research and development of electric vehicle related products.

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4.2.2. Promote the close cooperation of relevant institutions

The development and implementation of the standards need the support of relevant policies, and the development plan of new energy automobile industry has been deliberated and approved. We shall speed up the integration of related resources in the field of electric vehicles, gather advantageous resources, promote the collective tackling of key problems by electric vehicle enterprises, electric power industry and scientific research institutions, unify the management and operation of batteries, and implement the mode of combining battery leasing with self charging. Specifically, for managers, the implementation of the power change mode means that consumers only need to buy a car without battery. For this kind of special vehicle without power, corresponding policies shall be issued; for automobile enterprises, it is necessary to speed up the adaptation to new standards, promote standardization, modularization and serialization of related products, and strengthen technical cooperation between enterprises and focus on research; for the power industry, it is necessary to strengthen the power distribution management, ensure the power supply guarantee of the electric vehicle exchange station and give preferential prices; for the battery replacement station, it shall be equipped with standardized battery pack related products and scientific operation management scheme for daily use, so as to strengthen the scientific management and efficient distribution of batteries.

4.2.3. Promote the combined application of standardization and smart phone applications

Smart phone applications has developed very rapidly in China, and it has penetrated into people's production and life. Smart phone applications can promote the integration and better utilization of resources. We shall strengthen the combination of standardization and smart phone applications, that is to promote the research and application of this technology in the field of battery replacement of electric vehicles under the new development mode. For example, through the design of standardized mobile phone applications or small programs that can be implanted into other applications, electric vehicle owners can easily query the battery storage status of peripheral charging or battery changing stations through the relevant applications on their mobile phones, so as to improve the confidence of electric vehicle owners under the new development mode.

5. Feasibility analysis

For the standardization, it is necessary to objectively analyze the types of electric vehicle batteries. According to the statistics of Research Department of power battery application branch, China YiWei Institute of Economics, and China's new energy vehicle industry development report, from 2018 to April 2020, ternary materials and lithium iron phosphate batteries are mainly used in electric vehicle batteries in China, and the development trend of battery type proportion is shown in Figure 3. We find that although there are various types of batteries involved in the field of electric vehicles, in addition to ternary material batteries and lithium iron phosphate batteries, lithium manganate batteries, lithium titanate batteries, multi-element composite cells and nickel hydrogen batteries, etc. are also involved, but in the field of electric vehicles, power batteries has gradually developed into ternary materials batteries.

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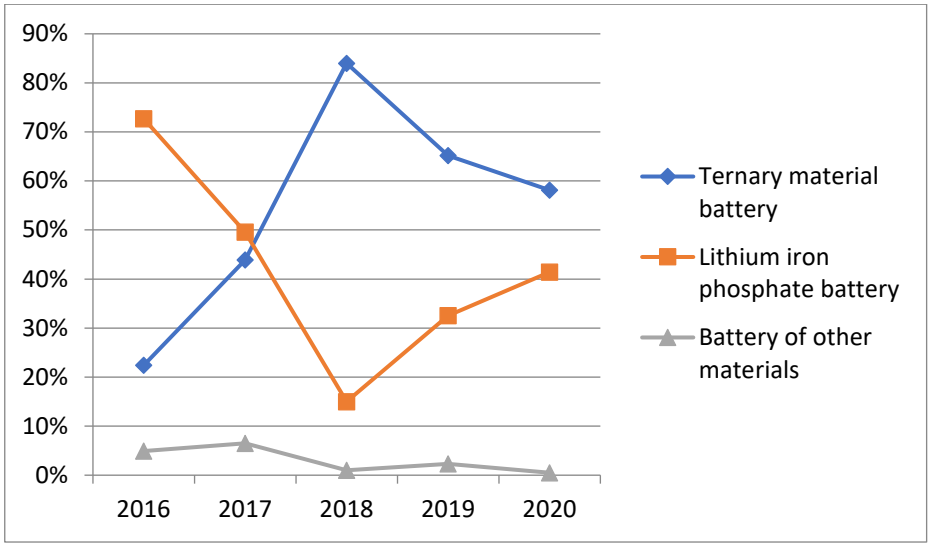

Figure 3 Development trend of battery type of electric vehicles in China in recent years.

In terms of the business mode of battery product delivery, according to the survey, the current electric vehicle battery manufacturers in China mainly have the following product delivery methods: the first is to directly deliver the battery cell to the electric vehicle enterprise, who will design and develop the module and organize the production; the second is to deliver the module to the electric vehicle enterprise, who will complete the battery pack assembly; the third is to directly deliver the battery packs to the electric vehicle enterprise. At present, there are still some differences in the space structure of battery packs stored in different modes, which leads to the low proportion of battery packs directly delivered to electric vehicle enterprises at this stage compared with commercial vehicles. Once the standardization lead is achieved, it will directly promote the relevant design improvement, greatly increase the proportion of battery pack delivery, and enhance the comprehensive operating range of electric vehicles, which can quickly solve the bottleneck problem under the current battery technology level.

6. Conclusion

Increasing sales of electric vehicles in China is slow due to the limitation of inherent properties of materials, technology development level and development mode. The development and implementation of French standardization strategy and its exploration and practice in the field of electric vehicles provide China with a good reference. This paper analyzes the relevant policies, sales influencing factors and problems in the development process of electric vehicle related fields in China, combs the related problems restricting its rapid development, analyzes the French standardization strategy and the enlightenment and experience and lessons of electric vehicle development, and gives the specific and feasible standard solution to promote the rapid development and popularization of electric vehicles in China at the strategic and policy levels. Its feasibility is analyzed. The content of this paper provides a certain basis and ideas for the future research work.

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