Research on the Popularization and Application of New Energy Vehicles in China

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Keywords: New energy vehicle, Promotion directory, Policy, Subsidy.

Abstract. The Chinese government attaches great importance to the development of new energy automotive industry driven by the pure electric vehicle. The subsidies, in recent years, has become an effective tool to promote the development of new energy automotive industry, and has played a positive role in promoting. This paper expounds the current situation of China's new energy automobile industry from two aspects: the current situation of new energy production in China and the new energy automobile technology route in China. And then, one suggestion that China should adopt the combination of tax and subsidy and adopts more diversified subsidy mode policies is put forward, by comparing the subsidy policy of new energy vehicles in China and abroad. Finally, this paper analyzes the declaration of 7 batch of new energy promotion catalogue by 2017, comparing the number and trend of each batch, the proportion of different types of new energy automobile products and the trend of quantity change, which reflects the development trend of new energy vehicles in China.

Introduction

Automobile industry is an important pillar industry of our economy and plays an important role in national economy and social development. As the rapid development of China’s economy and urbanization process acceleration, energy tension and environmental pollution are becoming more and more serious. The Chinese government attaches great importance to the development of new energy automotive industry driven by the pure electric vehicle, and makes it as the one of seven strategy of future economy and social development, which is of great significance for future economic growth. In June 2012, the state council published no.22 file, energy saving and new energy automobile industry development plan (2012-2020), which further defined pure electric drive as the national strategy of electric vehicle development, and specifically requested to actively carry out pilot demonstration, accelerate the cultivation time, and vigorously promote the popularization of energy-saving vehicles. In 2009, the government began to formulate relevant policy support infrastructure and put in a lot of funds to build charging stations and charging piles in pilot cities. These policy measures promoted the further development of the new energy automobile industry [1]. With the continuous development of new energy automotive technology in recent years, the subsidies has declined year by year, since 2010, the implementation of new energy vehicles subsidies. At the same time, the subsidy standard of vehicles has increased year by year. The continuous reduction of government's fuel consumption limits of automobile enterprises shows the government hopes of promoting the development of new energy vehicles by market forces.

Development Status of New Energy Vehicles Industry

Development Status of New Energy Vehicles Industry in China

In recent years, vehicle sales volume in China is in a vigorous growth, especially the year 2009 which is called the era of China automotive industry has made China the largest automotive production and marketing country. Until 2013, the automotive sales volume in China has reached 21.98 million. In the end of 2013, the number of vehicles has broken through 250 million of which automotive reached...
137 million. The continuously rising of automotive ownership has led to the high consumption of petroleum in China and the foreign-trade dependence of petroleum also increasingly rises. According to the target of “Energy Development ‘The 12th Five-Year Plan’”, the foreign-trade dependence of petroleum should be controlled within 61% until the year 2015. However, the present number is close in on the limitation. The data display that in 2009, China foreign-trade dependence of petroleum has broken through 50% and until 2012 this number rose to 56.4% and in 2013 even reached to 58.1% [2].

![Figure 1. 2010-2016 new energy vehicle production / sales.](image)

In 2016, new energy vehicle production volume has reached to 517000 and sales volume has reached to 507000 and the year-on-year growth is 51.8% and 53.1%. The growth rate of new energy vehicles in 2016 has slowed down; of which BEV has the production volume of 417000 and the sales volume of 409000. The year-on-year growth is 63.9% and 65.1%. PHEV has the production volume of 99000 and the sales volume of 98000. The year-on-year growth is 15.7% and 17.1%. Among new energy passenger vehicles, pure electric passenger vehicle has the production volume of 263000 and the sales volume of 257000. The year-on-year growth is 73.1% and 75.1%. The plug-in hybrid energy passenger vehicle has the production volume of 81000 and the sales volume of 79000. The year-on-year growth is 29.9% and 30.9%. The reason why the growth rate of new energy vehicle in 2016 slowed down is from the influence of industry subsidy fraud. According to the CAAM data, in 2015 the sales volume of new energy vehicle is 330000. The total number of involved vehicles is in excess of on quarter of 2014 which means in 2015 each of 4 sold new energy vehicles has one involved for fraud. Therefore, China enhanced punishment intensity for new energy subsidy fraud enterprises. Without subsidy preference, the new energy vehicles have no attraction for customers.

Seen from 2016 new energy vehicle sales construction (Figure 2), the pure electric passenger vehicles take up 51% of total sales, then is pure electric commercial vehicles. The passenger vehicle includes car and bus. The commercial vehicle mainly refers to special car and cargo transport vehicle and so on. The proportion of new energy vehicle in buses, taxies and logistics distribution vehicles has significantly risen. As the combined production of fuel vehicles and BEVs, the recycle of PHEV’s power assembly, battery management system, driving motor and braking energy recovery is more difficult with higher production cost. PHEVs have relatively lower popularity among customers.
Beijing, Shanghai, Guangzhou, Shenzhen and other first-tier cities have issued a series of energy and new energy vehicle supportive policies and measures in order to promote the rapid development of new energy vehicle industry. In 2015, Beijing had published fiscal subsidies relevant policies on purchasing BEV products and public charging facilities construction and usage related methods. In 2015, Beijing has 15 billion income from BEV sales. Shanghai municipal Party committee has published management regulations on electric vehicle charging facilities and promotion policies on time-sharing rental charge of electric vehicles. According to the data from Shanghai statistical bureau, in 2015 the production value of Shanghai new energy vehicle manufacturing was about 9.2 billion. The year-on-year growth is 32%. In 2015 Shenzhen has altogether published 5 supportive policies on new energy automotive promotion. Shenzhen has promoted 28608 new energy vehicles in 2015 and established 135 centralized charging stations, 3869 fast-charging stations, originally forming a charging service network covering the whole city. The Table 1 summarizes the electric vehicles promotion number of China major cities.

<table>
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Status of International New Energy Vehicle Industry

In recent years, Europe, America, Japan and other automotive powerful industrial countries all issued the state plan on promoting new energy vehicle (including hybrid power automotive) industry development.

In 2009, Obama administration chose to prioritize PHEV and signed “Revitalization and Reinvestment Act”, striving for being the country with 1 million PHEV on road until 2015. Different from Chinese market, American pure electric passenger vehicle and plug-in hybrid power passenger vehicle take up a portion of 54% and 46% which is more balanced. This is related to American auto enterprises products and policy limitation. Therefore, its products are more diversified [4].

As an auto technical power, the development of hybrid power vehicles and electric vehicles in Japan far exceeded the other countries. Meanwhile, Japan is also the most popularized country for hybrid power vehicles. “The next generation auto strategy 2020” of Japan government aims that the next generation new vehicle sales volume takes up 20%-50% of the total amount of new vehicle sales volume and electric vehicle takes up 20% of the new vehicle sales volume.
In the face of increasingly stringent European Union emission regulations, the German government and auto industry began focusing on the investment of new energy vehicles in order to keep pace with the world new energy vehicle technology. The German government released the “German federal government national electric vehicle development plan” which requested to increase the production of new energy vehicles. It is expected that by the end of 2020, Germany's new energy automobile production will reach to 1 million and until 2030, the production of new energy vehicles in Germany will reach to 5 million. By 2050, all German passenger vehicles will achieve zero emission targets. At the same time, the construction of the smart grid will also be able to ensure new energy automobile's power supply, thus reducing emissions of greenhouse gases. On August 19, 2009, the German government has passed the electric vehicle national development plan. In 2010, in the German government and German industry hosted “Electric Automotive Summit”, “Electric automotive national platform” has announced to be established. This platform plans to produce at least 1 million electric vehicles before 2020 and take a leading status both in technical research and development and marketing development in the world.

Development of New Energy Vehicle Promotion Policies

Development Status of Domestic New Energy Vehicle Promotion Subsidy Policy

In July 2011, the ministry of science and technology issued the 12th five-year plan for science and technology development, which made clear that it would fully implement the "pure electric drive" technology transformation strategy and implement new energy vehicle science and technology industrialization project. It is said that government should adhere to the research and development layout of "three vertical and three horizontal", and establish "three longitudinal three chain" industry technical innovation strategic alliance. To make China one of the advanced countries in new energy automobile industry, the construction of new energy vehicle infrastructure, industrial standard system and inspection and testing system is requested [3]. The world's automobile technology is developing towards low carbonization, informationization and intelligence. Though the overall technical level of automobile enterprises in China has improved significantly, and the research and development capabilities of independent brand enterprises have come a long way, there are still shortcomings. In recent years, the new energy vehicles of plug-in hybrid and pure electric vehicles launched, whose overall level gradually close to international advanced level, and made significant progress in key technologies, such as drive motor, power battery technology, fuel cell technology and lightweight car body technology. These new energy technology development play the role as economic development, social progress, the industrial revolution of technical support, and satisfy the industry strategic positioning, energy and environment pressure and traffic safety upgrade the proposed requirements.

In 2016, China’s energy saving and new energy vehicle technology roadmap was released, and the roadmap of the product roadmap and the technological roadmap for supporting the development of key products were respectively formulated. The roadmap clearly demands that the new energy and energy saving vehicles should attach great importance on hybrid drive, which supported by advanced electronic appliances and upgrading power train, and that the fuel-efficient level and technology of traditional vehicles should be fully promoted. We will pay more attention to energy conservation and energy saving, and accelerate the promotion of compact models and smaller models to significantly increase the proportion of small models. It has formed the development environment of national strategy guidance and multi-link policy support.

After more than ten years of exploration and development, China has gradually entered the mature stage. In 2009 the ministry of finance and ministry of science and technology jointly issued the "energy saving and new energy vehicle demonstration to promote fiscal subsidy funds management interim measures" to foster energy saving and new energy automobile market in 33 cities in China [5]. In the following year, four ministries jointly issued "the private purchase of new energy vehicles pilot financial aid funds management interim measures", select the six cities to carry out the private purchase of new energy vehicles subsidies pilot work. In 2013, four ministries jointly issued "about
continue to carry out the work of new energy automobile application notice [6], continually relying on the big cities with more serious air pollution, high enthusiasm of the super-large city or urban agglomeration to popularize and apply new energy cars. April and May 2015, the Ministry of Finance have issued a "2016 - 2020 new energy vehicles to promote the use of financial support policies notice" and "on the improvement of urban bus oil price subsidies to speed up the application of new energy vehicles to promote the notice. From 2016 – 2020, the central government would continue to implement the new energy vehicles to promote the application of subsidy policy [7], to reduce fuel bus subsidies, oil supplement and the new energy bus and to promote the completion of the link, clear the new energy bus operating subsidies policy [8].

The preferential tax policy is also the support policy for the promotion and application of new energy vehicles in China. In our country, new energy automobile products can enjoy the tax, purchase tax, consumption tax and tariff, etc. In accordance with relevant conditions, new energy automobile enterprises can enjoy the preferential policies of enterprise income tax and business tax [9]. The related policies include the notice on the reduction of vehicle and ship tax policy for the use of new energy vehicles for energy conservation, and the notice on the exemption from the purchase and purchase of new energy vehicles.

To promote the new energy automotive technology progress, the government issued polices to increase research strength and capital investment, which provided the advantageous resources and environment for the ascension of the new energy automotive technology. A series of science and technology support projects have provided financial support and development platform for new energy vehicles and related parts technology and industrial innovation.

Development Status of International New Energy Vehicle Promotion Subsidy Policy

In recent years, the new energy vehicles driven by the United States government subsidies policy, has experienced a rapid growth. The United States adopted a variety of ways in the new energy vehicles promotion and subsidy policy, one is stepwise tax credits instead of subsidies; Another way is to use soft loans and subsidies to support development, support enterprises in large sums of money in power battery and key components technology research and development and production, forming the added tax credits policy. In addition to the federal government's subsidies, state governments adopted cross subsidies methods for purchasing vehicles in order to reduce the purchase cost; Also to reduce the cost from the use end subsidies, such as remitting charging infrastructure and the electricity charge, reducing the new energy vehicle parking toll and transit toll, providing convenience for users of new energy vehicles. From the point of view of supporting the new energy automobile enterprises, the United States also adopts zero emission integral transaction mechanism. Tesla new energy auto enterprises was created from these measures which mobilizing the development of global new energy auto industry.

The Japanese government has formulated a series of policies when developing new energy automotive industry, including fiscal policies, technical support policies and related infrastructure construction policies, etc. These policies have been clear about the Japan's new energy development goal and the duty. The Japanese government successively developed a series of regulations like "The special law about promoting new energy utilization", "The special law about electric power enterprise using new energy to generate electricity", "The law on renewable energy quota system", etc. There are two ways to promote the consumption of new energy vehicles. Tax cuts policy includes green car tax cuts and new green car purchase and trade-in policy. Through purchasing "next generation automobiles" defined by Japanese government, customers can be exempted from purchase tax and weight tax. Meanwhile, in order to stimulate the car market and replace older vehicles, the Japanese government has issued "Trade-in" policy to boost sales of 1 million new vehicles.

Compared with other automobile countries, Germany's development of new energy vehicles before 2015 was characterized by not directly subsidizing enterprises and consumers, but adopting policies to reduce the cost of cars. Germany rules that consumers who buy electric cars before 2015 can enjoy a 10-year exemption from driving taxes. In order to boost electric vehicles sales in Germany, it aims to bring 500,000 electric vehicles on road by 2020. From June 2016, a new policy has been introduced
to increase subsidies for electric vehicles. The French government has introduced a fiscal policy to promote electric vehicles since 1995 and introduced a new car replacement policy since 2008.

Compared with the finance subsidy form of domestic electric automobile industry, the foreign financial subsidy method is more abundant. Its main characteristic is the combination of fiscal subsidy and tax preferential means. Tax incentives can make emerging new energy companies more actively investing in research and development which is more flexible than providing financial subsidies. And some developed countries have adopted policies to replace them with old ones, making subsidies more diversified. From the perspective of policy coverage, the promotion of electric vehicles in foreign countries covers the whole industry, and promotes the development and promotion of the electric vehicle industry through the influence of different steps [10].

Analysis of 2017 New Energy Vehicle Promotion Catalogue

On December 29, 2016, the notice on adjusting the subsidy policy for the promotion of new energy vehicles was introduced, and the threshold of the recommended model was raised and adjusted dynamically. The performance requirement of power consumption requirement of 100km, the threshold of the vehicle’s driving range, the safety of power battery, the cycle life of battery and the performance of charging and discharging are increased in the notice. On January 10, 2017, the China Vehicle Technology Service Center (CVTSC) issued notice of adjusting the application work of the catalog of new energy automobile application recommended models. The 2193 models that had already in the catalog in previous period should be reapproved and re-declared by the company, and the only those who entered the catalogue can be paid.

Analysis of Declaration of Enterprise

As of August 1, 2017, the new energy promotion catalogue published a total of seven group, declare a total of 189 enterprises, accumulative total product combined 2264 models. There are 39 enterprises in the first declaration group, 40 in the second declaration group, 82 in the third declaration group, 97 in the fourth and fifth declaration group, 58 in the sixth declaration group and 89 enterprises in the declaration group.

The largest number of top 10 enterprises in the first seven new energy promotion directory were zhengzhou yutong Bus Co., Ltd., Zhongtong Bus Holding Co., Ltd., foton motor Co., Ltd., dongfeng automobile company and so on. (See in Figure 3) Through the analysis of the products of the top 10 companies declare data, it can be concluded that the products of Donfeng Automobile Company concentrated on the pure electric truck or car, and the rest focused on pure electric passenger cars and hybrid buses.

![Top 10 enterprises of 1-7 batch number of year 2017](image)

Figure 3. Top 10 enterprises of 1-7 batch number of year 2017.

Among the 2264 products in the catalogue, there are 1028 pure electric passenger car products, accounting for 45% of the total, compared with the 14.9% reduction in pure electric bus products in the 2016 catalogue. (See in Figure 4) Pure electric goods vehicles and special vehicles accounted for 27 percent of the 608 products, with a year-on-year growth of 43.4 percent in the 2016 directory. Hybrid passenger car products have 335 models, accounting for 16%, and the hybrid passenger car
products decreased by 3% year on year in 2016. It is important to note that the number of product promotion directory in 2016 is the data for the whole year, from 2017 years ago 7 batch directory number, the number of each model will be more than 2017 full year 2016 level. The reasons for this phenomenon is mainly due to full review of promotion directory of 2016. Some declaration models of 2017 has already been declared in 2016. Another reason is that the subsidy for new energy vehicles started to decrease since 2016, however, the effect of subsidy mechanism truly began to affect in 2017 because of the influence of expense investigate and delay issuing mechanism. Therefore, domestic new energy car companies will strive to receive more subsidies in the later years of subsidies and try to add more models to the recommended catalogue.

![Model proportion of 1-7 batch of catalog of year 2017](image)

Figure 4. Model proportion of 1-7 batch of catalog of year 2017.

From the analysis of the first to the seventh batch of declaration of quantity each month, it indicates that quantity of the third batch of application directory is much more than the first two batches, a total of 633 products, in which the bus directory number and structure is rich. However, from the fourth batch to the sixth batch, the number of each month's declaration has been decreasing, and the trend from the seventh batch has been shown to rise, which is shown in Figure 5. The cause of this trend are: 1. The adjust of application of the catalog of new energy automobile application recommended models informed officially released in January, and each vehicle manufacture need to prepare for related products that conform to the requirements of the "directory" the application in January and February. Therefore, the centralized declaration showed up in March, and generally kept smoothly in the following months. It can be inferred from the data of previous months that the declaration quantity of the rest several months would be steady at about 250. The second reason is that after the new declaration notice after the release of directory, enterprises in the first, maintain a wait-and-see attitude. The new requirements such as "pure electric bus safety technical conditions", "conformity" and "platform conformity", which most enterprises have not done testing for, was not understand maturely by most of enterprises. Thus, the number of products meet the relevant requirements of declaration at early stage is less.
By analyzing the perspective of the declaration directory models, we can infer that the quantity of pure electric bus declared in each period is the highest, followed by pure electric truck and car. (See in Figure 6) It can be seen that the pure electric bus declared monthly has the same trend with the total amount declared in the same direction. Although total number from the third batch of declaration to the fourth batch decreased significantly, the pure electric truck and car in these two months the number of maintained stable or has a small increase. From the fourth batch, the number of hybrid buses maintained at a stable point, and there is no significant change in the pure electric car category from the second to the seventh batch. The fuel cell new energy vehicle has only seven products in total.

Through summarizing the first seven batches of new energy vehicle energy system, in the pure electric vehicles, the main types of batteries contain lithium ion battery, manganese acid lithium batteries, lithium iron phosphate batteries, lithium titanate batteries and batteries in ternary material. In the first seven batches of the vehicle, most complete vehicle enterprises have adopted lithium iron phosphate batteries, of which 1311 vehicles used lithium iron phosphate battery as their energy system, 729 products used lithium-ion battery as energy, 623 products used manganese acid lithium battery, 622 products used batteries in ternary material, only 53 products used lithium titanate battery as the energy system, and lithium titanate is mainly used in pure electric buses.

**Summary**

2016 is the eighth year of the implementation of China's new energy subsidy policy, and the development of China's new energy automobile industry has achieved remarkable results. Since 2016, the major enterprises have formed a relatively complete R&D system, and have certain production capacity and service guarantee ability [11], with the improvement of industrial technology level,
government departments need to adjust and perfect policies advancing with the times and gradually raise the entering threshold for enterprises and products and strengthen online supervision.

Summarizing the current situation of China's new energy subsidy policy and the application status of promotion catalogue application, most enterprises still have certain dependence on the state financial subsidy. The key technologies of China's new energy vehicles include batteries, motors and electronic control systems, which still need to be improved. And enterprises need to reduce production costs by improving r&d technology and manufacturing technology level. With the dual influence of new energy automobile subsidies "Go Backwards" policy and the recent issued "double integral" policy, enterprises that rely on subsidies to increase the output of new energy model have gradually withdrew from the historical stage. In the future, it is important to develop the international cooperation in technology and industrialization on the basis of independent research and development. From the national policy promotion aspect, China has issued a series of policies on strategy, technology R&D and promotion. Now government has high executive forces on national policies. Government departments and standard drafting units will continue to strictly improve relevant policies and standards, and still need to introduce important policies on investment, taxation, subsidies and standards.

Reference


