Analysis on the impact of new energy automobile industry support policy on regional economy

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Abstract. From 2008 to 2018, the Chinese government has issued more than 200 policies on new energy automobile industry at the national, provincial and municipal levels in the past ten years. These policies systematically guide the new energy automobile industry to develop vigorously from the aspects of comprehensive promotion, energy-saving layout, price, charging equipment and batteries, subsidies, tax exemption, loans and investment, etc. The implementation of the support policy in the relevant areas of the development of new energy automobile industry will have a tremendous impact on the environmental protection, taxation, employment, scientific research, Power industry and related industries in the relevant areas, thus bringing the regional economic development to a new climax.

1. Preface
From 2008 to 2018, the policy warm wind frequently blows to the new energy automobile industry. New energy vehicles dominated by pure electric vehicles have won the favor of the Chinese government and the public because of their advantages of energy saving, environmental protection, high government subsidies and low cost. The industry expects that the domestic new energy automobile industry will usher in a period of rapid development during the 13th Five-Year Plan period. At the same time, the majority of new energy automobile enterprises are rooted in the relevant primary development areas of many cities (e.g. new urban areas, including economic development zones, University towns, economic cooperation zones, science and technology parks, etc.). The region itself is also in the early stage of planning and construction. It urgently needs the real economy to stimulate the economic growth of the region. Both sides are in a state of broad strategic objectives and prospects. Therefore, there is a win-win development relationship between the new energy automobile industry and the related regional economic development.

At home, economic experts have begun to study the new energy automobile industry. Cao Xia (2018) used evolutionary game theory and MATLAB software to simulate and analyze the impact of government regulation on the development of new energy automobile industry in his article "It is found that different intensity of supervision can have different effects on the healthy and orderly development of new energy automobile industry: Low intensity of supervision will disrupt the market order, while high intensity of supervision will inhibit the development of new energy automobile industry."[1] Cheng Yongwei (2018) research results: Under the "Double Integral System" of Fuel Consumption Integral and New Energy Vehicle Integral, he solved the production decision-making problem of automobile manufacturers, and established a joint decision between traditional energy
vehicles and new energy vehicles based on ownership ratio and internal option agreement. Policy model. [2]

From the above research literature, many domestic scholars have studied the development process, development trend and development methods of the new energy automobile industry. However, after the implementation of the relevant policies for the new energy automobile industry in the relevant regions, the literature on the impact of the new energy automobile industry on its regional economy is relatively rare. This paper sorted out more than 200 national, provincial and municipal policies on new energy automobile industry issued by the Chinese government in the past ten years (2008-2018). The policies were classified from the perspectives of comprehensive promotion, energy-saving layout, price, charging equipment and batteries, subsidies, tax exemption, loans and investment. Through the analysis of the policies, it is concluded that the implementation of the supporting policies in the relevant regions will lead to a new climax of development in the areas of environmental protection, taxation, employment, scientific research and related industries.

2. Combing the support policy of new energy automobile industry

2.1. Annual analysis of policy promulgation

From 2008 to 2018, the state promulgated more than 50 policies related to the new energy automobile industry. However, most of the policies have been introduced in recent years. Details can be found in the annual trend chart of the relevant national policies in the new energy automotive industry (Figure 1).

![Policy quantity](image)

**Figure 1.** Annual trend chart of relevant national policies for new energy automobile industry.

Based on the above Figure 1 and the specific policy documents, it is concluded that in January 2008, the State Council promulgated the first policy on the new energy automobile industry: the Notice on the Pilot Work of Energy Conservation and New Energy Vehicle Demonstration and Promotion. After four years, the second policy was promulgated in June 2012: Energy Conservation and New Energy Vehicle. Industrial Development Planning (2012-2020). This policy expands the pilot spirit of 2008 into a concrete development plan for eight years from 2012 to 2020, and has a rhythmic and step-by-step implementation policy between 2014 and 2017. In 2018, a policy blowout occurred. In the past ten years, the trend of policies to support the development of new energy automobile industry is enough to show the importance and development trend of the government to this industry. [3]

2.2. Analysis of departments promulgated according to policies

From 2008 to 2018, more than 50 new energy automobile industry policies were issued at the national level, including more than 20 departments. These departments include: the State Council, the General Office of the State Council, the Ministry of Finance, the Ministry of Science and Technology, the Ministry of Industry and Information, the Ministry of Transport, the Development and Reform Commission, the State Tax Headquarters, the State Energy Administration, the Ministry of Commerce, the Ministry of Communications, the Ministry of Propaganda, the State Asset Management
Commission, the State Administration, the Legal Office of the State Council, the General Administration of Taxation, the People's Bank of China, the Banking Regulatory Commission and the Commercial Ministry of Affairs, State Council Tariff and Tax Commission, China Automobile Association and China Automobile Power Battery Industry Innovation Alliance, China Intelligent Network United Automobile Industry Innovation Alliance, National Automobile Standardization Technical Committee, Intelligent Network United Automobile Sub-Technical Committee and so on. Details can be found in the national new energy automotive industry related policy promulgation Department data statistics chart (Figure 2).

According to Figure 2, under the guidance of the State Council, various departments at the national level have issued relevant policies, of which the Ministry of Industry and Information Technology accounts for the largest proportion, reaching 22%. Within ten years, more than 20 relevant policies have been issued. At the same time, the Development and Reform Commission accounted for 20%, second only to the Ministry of Industry and Information Technology. The Ministry of Science and Technology and the Ministry of Finance also cooperate actively and give full support in science, technology and finance.

2.3. Analysis by policy content
From 2008 to 2018, the relevant policies of the new energy automobile industry promulgated at the national level involve dozens of levels of the development of the new energy automobile industry, and give support to the new energy automobile industry in an all-round, multi-angle and in-depth manner. Details can be found in the national-level policy content scale chart of the new energy automobile industry (Figure 3).

According to Figure 3, under the guidance of the State Council, the Ministry of Industry and Information Technology, the Development and Reform Commission and other departments have issued corresponding comprehensive promotion policies. Then, as the guarantee parts of the core
endurance of new energy vehicles, batteries and charging facilities have been paid more attention by various departments, and 13 policies have been issued, accounting for 28% of the total number of policies. Secondly, tax exemption, energy-saving layout and subsidies have also received the attention of the government, accounting for 11%, 9% and 7% respectively.

Figure 3. Proportional chart of relevant national policies of new energy automobile industry.

3. Analysis of policy impact on regional economic development
From 2008 to 2018, every year, the relevant policies of the new energy automobile industry were issued, and some policies were issued in the state-level administrative departments, and some policies were issued in the provincial and municipal relevant departments. In this paper, the key words and key points of the policy from 2008 to 2018 are sorted out in detail. Based on the above chart and data, the author consults the relevant policies and clauses of the new energy automobile industry comprehensively and systematically, and finds out that the policies of the new energy automobile industry have the following effects on the regional economy.

3.1. Environmental protection
The development of new energy automotive industry is the first-rate interest in environmental protection, which is the country's century-long plan. This is fully reflected in the policies at the national level and at the provincial and municipal levels. In the past ten years, 13 policies have involved new energy storage batteries and charging equipment, and 4 energy-saving materials. Two of them directly mentioned the concept of environmental protection, such as the Notice of the Three-Year Action Plan for Winning the Blue Sky Defence War issued by the State Council in 2018. Thirteen policies concerning new energy storage batteries and charging equipment have played a fundamental role in environmental protection. Meanwhile, in February and March 2018, the Ministry of Industry and Information Technology and other seven departments jointly promulgated the Interim Measures for the Management of Recycling and Utilization of Power Batteries for New Energy Vehicles and the Pilot Implementation Plan for Recycling and Utilization of Power Batteries for New Energy Vehicles to carry out environmental protection work to the end. The implementation of these new energy vehicle environmental protection policies is a major factor to reduce environmental pollution. Because in good technical condition, a typical car without emission control device can emit more than 600 grams of pollutants a day (including carbon monoxide, nitric oxide and other solid particles, especially leaded gasoline, which have adverse effects on human body). According to the data of China Automobile Association, the production and sales volume of new energy vehicles are increasing year by year, as shown in Table 1. From 2011 to August 2019, the cumulative production and sales of new energy vehicles in China totaled 3.8403 million and 3.779 million respectively. Under the guidance of the
policy, these new energy vehicles replace the traditional vehicles, reducing pollutant emissions by about 2.344 million grams per day and about 4.193 billion grams per year (vehicle travel rate is calculated on 182 days per year). The above data reflect the great environmental protection role of these new energy vehicles.

In addition to enjoying the benefits of environmental protection in the national environment, the primary development areas related to the development of new energy automobile industry also attract new energy automobile enterprises and their supply chains by virtue of their low land prices, convenient transportation, geographical location of the center, sufficient technicians and fast communication. Downstream enterprises (including vehicle manufacturing enterprises, battery manufacturing enterprises, Internet enterprises, research institutions and industrial investment enterprises) take root in the region. While creating a good ecological environment in the region, it also promotes regional economic development.

Table 1. Statistics of New Energy Vehicle Production and Sales in 2011-2019.

| Time  | New Energy Vehicle | Pure electric type | Plug-in type |
|-------|--------------------|--------------------|-------------|
|       | Output | Sales volume | Output | Sales volume | Output | Sales volume |
| 2019.08 | 79.92  | 79.34       | 64.33  | 62.9        | 15.55  | 16.37       |
| 2018   | 127.22 | 125.67      | 98.65  | 98.4        | 28.38  | 27.11       |
| 2017   | 79.44  | 77.74       | 66.72  | 65.32       | 12.8   | 12.53       |
| 2016   | 51.7   | 50.72       | 41.78  | 40.96       | 9.91   | 9.85        |
| 2015   | 34.05  | 33.11       | 25.46  | 24.75       | 8.58   | 8.36        |
| 2014   | 7.85   | 7.48        | 4.86   | 4.51        | 2.99   | 2.97        |
| 2013   | 1.75   | 1.74        | 1.42   | 1.41        | 0.33   | 0.31        |
| 2012   | 1.26   | 1.28        | 1.12   | 1.14        | 0.13   | 0.14        |
| 2011   | 0.84   | 0.82        | 0.57   | 0.56        | 0.27   | 0.26        |
| Total  | 384.03 | 377.9       | 304.91 | 299.95 | 78.94 | 77.9        |

3.2. Taxation
In August 2017 and April 2018, the Ministry of Finance, the General Administration of Taxation, the Ministry of Industry and Information Technology and the Ministry of Science and Technology jointly promulgated the Catalogue of New Energy Vehicle Types Exempting Tax on Purchase of Vehicles, which refines the tax-free policy and strengthens the implementation of the tax-free policy. In September 2018, the Ministry of Industry and Information Technology issued the Catalogue of New Energy-saving Vehicle Types Enjoying Preferential Tax Reduction and Exemption for Vehicles and Vessels. From Figure 4: New Energy Automobile Industry Policy Tax Impact Model Diagram, we can draw the following conclusions: These policies are ostensibly to reduce government tax revenue, and in the short run they are indeed reducing government tax revenue such as vehicle purchase tax and vehicle and ship tax. However, in the long run, due to the implementation of relevant policies in the new energy automotive industry, all enterprises in the supply chain of the new energy automotive industry (including vehicle manufacturing enterprises, battery manufacturing enterprises, Internet enterprises, scientific research institutions, industrial investment enterprises, and even the flourishing development of the logistics industry) will increase. The government's income on enterprise income tax. From the perspective of amount, quantity and timeliness, the income of enterprise income tax is larger, more and longer than that of vehicle purchase tax and vehicle and ship tax. In addition to the increase in income from corporate income tax, the government will also increase the income from personal income tax. Because the presence of these enterprises is the increase of a large number of jobs, a large number of local and foreign workers will pay a huge amount of personal income tax. [4-5]
3.3. Obtain employment

All enterprises in the supply chain of the new energy automobile industry are providing jobs for the region. Whether in front-line production or administrative work, professional and technical personnel are needed, which provides a large number of jobs for the society. The emergence of new energy automobile enterprises or industry itself provides a large number of management, production, finance, technology research and development, sales and maintenance jobs related to the industry. These new and vacant jobs create a lot of employment opportunities for the society. [6] Some of the less technically demanding jobs are filled by local residents who have lost their land. Some highly technical and professional employment opportunities attract a large number of foreign workers to enter the region, while stimulate the needs of the whole region for food, clothing, housing and transportation, and promote the economic development of the region.

According to the data of national enterprise credit system, taking Jiangsu Province as an example, with the implementation of relevant policies in recent 10 years, the number of new energy automobile enterprises registered in the last 1-5 years is 5,908. The number of new energy automobile enterprises registered in the past 5-20 years is 1,418. That is to say, the number of new energy automobile enterprises in the past five years is 4.17 times the total number in the past 15 years, which shows the same trend as the time of relevant policies (see Figure 1 for details). As of August 2019, the number of new energy automobile enterprises in Jiangsu Province was 9,698. Assuming that each enterprise employs an average of 100 employees, that is to say, it directly provides 1 million jobs for Jiangsu Province, which does not include the number of new jobs created by other enterprises in the supply chain caused by new energy enterprises.

3.4. Scientific research technology

The development of new energy automobile industry can also drive the development of scientific research technology, such as Jiangsu Province. Jiangsu Province is a big province of Education. According to the latest statistics of the Ministry of Education, there are 167 universities (including undergraduates and specialties) in Jiangsu Province, all of which are research bases. Most of the campuses of these universities are located in the university towns of the provincial cities, which are an important part of the new urban areas. On May 7, 2018, the Ministry of Science and Technology published the List of the 2018 Projects of the Key Research and Development Program "New Energy Vehicle", which includes the key technical issues of the power battery system for safe and high specific energy passenger vehicles, the solid-state lithium battery technology with high specific energy, the test and evaluation technology for self-driving electric vehicles, and the full-power fuel cell. The power system platform of passenger car and the whole vehicle are 25 key projects. Researchers in university towns are surrounded by new energy automobile enterprises and new energy automobiles, which provides scientific research inspiration, practical experience and practical basis for academic research. [7-8]
According to CNKI data, from 2010 to October 2019, the number of professional papers and graduation papers related to new energy vehicles totaled 17,913. The publishing institutions of research papers include East China Electric Power University (1877), Tsinghua University (736), Chinese Academy of Electric Power Sciences (310), State Grid Energy Research Institute (252), China Automobile Technology Research Center (237), hundreds of universities and scientific research organizations. The number of invention patents related to new energy vehicles is 17,052, including new energy vehicles (7,708), charging piles (1077), new energy vehicle batteries (671), and so on.

3.5. Power industry
The development of new energy automobile industry can also drive the development of electric power industry. The development of new energy automotive industry has a great impact on power consumption, transmission, storage and other aspects of the power industry. New energy vehicles are not only environmentally friendly and pollution-free, but also create significant economic benefits of electricity.

![Figure 5. Trend map of national production and sale of new energy vehicles in 2011-2018. (Unit: 10,000 vehicles)](image)

Firstly, from the aspect of electricity consumption, taking BYD E6 new energy vehicle as an example, according to the vehicle usage data, the power consumption for two hours of fast charging is 57 degrees, driving 300 kilometers. According to the current average value of commercial electricity price for charging new energy vehicles in Jiangsu Province, it is estimated that about 0.6 yuan per kilowatt hour and 34.2 yuan per 300 kilowatt hour. For traditional fuel vehicles, taking 93# gasoline as an example, it costs about 7.15 yuan per liter and 8 litres per 100 kilometres, and 171.6 yuan per 300 kilometres. The power expenditure of traditional vehicles is about five times that of new energy vehicles. From the above data, it can be seen that the use of new energy vehicles greatly reduces the power cost of consumer endurance. At the same time, the power consumption of new energy vehicles has caused a sharp increase in the national power consumption. According to the data of China Automobile Association, the production and sales of new energy vehicles are increasing year by year, as shown in Figure 5. By August 2019, the national production and sales of new energy vehicles increased by 799,000 and 793,000 respectively in the eight months of 2019. That is to say, from 2011 to August 2019, the cumulative production and sales of new energy vehicles in China were 3.8403 million and 3.779 million respectively. According to the calculation that each new energy vehicle charges about 60 degrees per day, the power consumption of new energy vehicles in the whole country increases by about 230.4 million degrees. The increasing demand for electricity brings opportunities for the development of power production industry. The charging speed, power consumption effect and
power consumption of charging piles and batteries of new energy vehicles are the key factors affecting the endurance of new energy vehicles. The soaring use of new energy vehicles has brought great demand for charging piles or batteries for new energy vehicles. At the same time, there are many policies on charging piles or batteries for new energy vehicles in the policies of the new energy automobile industry, which guide and standardize the healthy, harmonious and substantial development of the electric power operation industry.

Of course, the increasing demand for new energy automotive power brings both opportunities and challenges to the development of the power industry. For example, the charging of new energy vehicle battery belongs to non-linear load, and the ramp wave generated during charging process will cause the problem of excessive heat and loss of line transformer; the power metering device (meter) must have the ability of carrying large load current and accurate metering of large load and so on. Opportunities and trials go hand in hand to stimulate the rapid development of the entire power industry.

3.6. Related industries
The new energy automobile industry policy not only promotes the development of its industry, but also promotes the development of related industries in the economic region, such as logistics industry. On January 23, 2018, the State Council promulgated "Opinions on Promoting the Cooperative Development of E-commerce and Express Logistics". Its policy key point is to encourage Express Logistics to accelerate the use of new energy vehicles and fuel vehicles meeting higher emission standards, and gradually increase the proportion of new energy vehicles. Taking Jiangsu, Zhejiang and Shanghai as an example, Jiangsu, Zhejiang and Shanghai are the top three provinces and municipalities in the network trade of parcel posts. The fundamental reason is that the logistics industry is mature. The new urban area of Jiangsu, Zhejiang and Shanghai has attracted many logistics enterprises to settle down here because of its low land price, convenient transportation and good road conditions. For example, "Opinions on Promoting the Cooperative Development of E-commerce and Express Logistics" and other related policies were promulgated. Logistics enterprises use new energy vehicles instead of traditional vehicles, not only enjoy policy and economic support and benefits, but also reduce the operating costs of their enterprises, after all, transportation costs account for the largest proportion of the cost of logistics enterprises. It is assumed that under the condition of constant operating income, the reduction of operating costs without any new raw materials or new input factors of fixed assets will directly lead to the increase of gross profit of logistics enterprises. The increase of gross profit of logistics enterprises not only promotes the healthy and vigorous development of logistics enterprises in the region, but also brings considerable fiscal and tax revenue increase to local governments. At the same time, it also promotes the economic development of the region from the perspective of stimulating consumption.

According to the official data of national industry and commerce tax (see Figure 6 for details). Taking Jiangsu Province as an example, according to the time of registration, 44,934 new logistics enterprises were added between 1-5 years, which is about 2.38 times of the number of new logistics enterprises between 5-10 years and 8.60 times of the number of new logistics enterprises between 10-15 years, accounting for the total number of logistics enterprises in Jiangsu Province. 63.18% of the total. According to enterprise information registration, the proportion of new energy vehicles and new energy mini-trucks for short-distance transportation in newly added logistics companies is as high as 70%. Among them, pure electric mini-trucks are the most widely used.

4. Summary analysis
From 2008 to 2018, the Chinese government has issued more than 200 policies for the new energy automobile industry at the national, provincial and municipal levels in the past ten years. The relevant policies systematically guide the new energy automobile industry to develop vigorously from the aspects of comprehensive promotion, energy-saving layout, price, charging equipment and batteries, subsidies, tax exemption, loans and investment. The implementation of the support policy in the
relevant areas of the development of new energy automobile industry will have a tremendous impact on the environmental protection, taxation, employment, scientific research and related industries in the relevant areas, thus bringing the regional economic development to a new climax.

Figure 6. Trend map of logistics enterprise registration increase in Jiangsu Province.

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