

Analyze The Economic and The Sustainable Environmental Impact of The Policy in The New Energy Vehicles and Lithium Battery Industry

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Abstract. Due to the vigorous promotion and production of new energy vehicles, the lithium battery industry is closely connected with them and also developed a lot, resulting in vertical integration. There are various new energy vehicle policies in the world that are specific to the situation of each country. Policies aim at the consumption and supply of new energy vehicles and the R & D of energy technologies such as lithium batteries can have related impact. Its positive role is to increase the output of new energy vehicles, reduce environmental pollution, encourage the progress of lithium battery research and improve the sustainable development. However, the reduction of subsidies and the improvement of selection criteria need to be in line with market conditions and the progress of relevant energy research. Excessive subsidies will also bring greater economic pressure to the country. Only by balancing economic effects and improving energy utilization can sustainable development be achieved.

Keywords: New Energy Automobile industry, Lithium Battery Industry, Economic Impact, Policy.

1. Introduction

As people gradually realize that the emission pollution caused by traditional automobiles accounts for a large part of overall pollution and its impact, new energy vehicles have attracted much attention. Air pollution is brought on by the significant amount of carbon monoxide, hydrocarbons, nitrogen oxides, fine particles, and sulfur dioxide that are released when typical motor vehicles are used. Through atmospheric chemical reactions, these primary pollutants will simultaneously produce photochemical haze, acid deposition, and other secondary pollutants. Automobile exhaust also has a number of harmful effects on the ecosystem, human health, and urban atmosphere. Many countries try to promote the output of new energy vehicles, but the proportion of new energy vehicles is low due to the limitations of their research and development process and high energy consumption. The policies and plans put forward by the government try to bring more positive effects to the industry, protect the environment, and bring more sustainable development.

With the gradual introduction of the plan of automobile enterprises to stop selling fueled vehicles and the successive implementation of carbon neutrality policies in various countries, new energy vehicles will undoubtedly become the development direction of the automobile industry in the future [1]. New energy vehicles encourage the transformation of cars from conventional vehicles to mobile intelligent terminals, energy storage units, and digital spaces by integrating new energy, new materials, the Internet, big data, artificial intelligence, and other technologies.

The power battery technology employed in electric vehicles nowadays is lithium-ion. This is because this sort of smaller battery operates with quality and density at a reasonable price due to its high energy density and the higher power in single cells. At present, these batteries can drive electric vehicles for about 150km. Lithium is inserted into the electrode of a lithium-ion battery, that is, the electrode material is a carrier of lithium ions. Research shows that the power (800 ~ 2000W / kg) and energy density (100 ~ 250wh / kg) of lithium-ion batteries used in electric vehicles have increased.

With the promotion of a series of policies, the relationship between the new energy vehicle industry and the upstream energy power battery industry has become closer and closer, and vertical integration has gradually formed to achieve higher efficiency. Vertical integration describes the behavior of the enterprise of extending the existing business scope by developing to the upstream or

downstream of the existing business on the basis of the existing business to form the integration of supply and production. It also describes the combination of users of enterprise products or the suppliers of raw materials or the expansion to these business areas on their own. [2]. Therefore, there is a close relationship between the new energy vehicle industry and the lithium battery industry.

In this essay, I try to explore the relationship between the economic impact of the change in the new energy automobile industry after the policy and the sustainable environmental impact caused by the change of the lithium battery industry. It will cover the discussion of policies related to the new energy vehicle industry and the lithium battery industry, and analyze the economic and environmental effects of these policies from different perspectives, as well as their advantages and disadvantages.

2. Overview of domestic targeted policies for new energy vehicles and lithium batteries and the industry's present situation

2.1. Changes in subsidy policies for domestic new energy vehicles

Under the guidance of state policies, China's new energy vehicle industry has developed rapidly. From 2014 to 2017, the number and amount of investment and financing in China's new energy vehicle related industries showed a rapid increase, and from 2018 to 2021, the trend was gentle and showed a downward trend [3].

In 2017, the governmental subsidy policy gradually shifted to promote the progress of driving mileage, so as to solve the biggest shortcoming of new energy vehicles - driving mileage. The subsidy benchmark is dropping while the technical criterion is rising year over year. More often announced policies have been released in recent years to continue accelerating the loss of subsidies. To create the framework for future subsidy policy adjustments, it was stated in the existing policy that "the relevant commissions will constantly adapt and improve according to the technological progress, industrial growth, promotion and application scale of new energy vehicles."

From the perspective of passenger cars, although the subsidies received by models with high range and power battery energy density during the transition period are only 0.7 times of the 2017 standard, they are generally higher than the subsidies obtained after the implementation of the new subsidy policy [4]. The intention behind the policy adjustment is obvious. The policies adjusted and improved in 2018 reflect the policies' orientation of "supporting the superior and strong products". While the technology threshold is greatly raised, the subsidy amount for high-level products is increased, highlighting the encouraging effect on technological progress [5].

Such a simple reliance on subsidies to guide the market and blindly increase the range also initiated certain safety risk issues for battery safety. In order to get the highest subsidies, new energy vehicle enterprises blindly increase the number of batteries and improve the energy density, ignoring the battery safety problem. From time to time, there are news of spontaneous combustion of new energy vehicles, which also leads to the public's still skeptical of new energy vehicles.

2.2. Power battery as an important factor and its related enterprise

As a key step in the production, design and application of power battery system, power battery system assembly is the core link connecting the production of upstream battery cells and the application of downstream vehicles. If the cell is one, the total achievement of the system is all. The energy density of a single cell is not enough to affect the driving range of a vehicle, but it is directly determined by the energy density of the system assembly. These related technologies directly affect the efficiency of batteries and related environmental benefits [6].

Facts have proved that this is becoming more and more important. On February 13, 2018, the four national ministries and commissions issued the notice on adjusting and improving the financial subsidy policy for the promotion and application of new energy vehicles (hereinafter referred to as the "new subsidy policy"). The policy environment was better than expected, which not only provided a buffer period for the decline of the policy, but also gave higher subsidies to enterprises that exceeded

the driving range. For example, the new subsidy policy increases the subsidies for pure electric vehicles with a range of more than 300 kilometers, and increases the subsidies for those with a range of more than 400 kilometers, The subsidy increased by 13.63%. This positively encouraged automobile enterprises to choose higher energy density and lighter powertrain systems, and indirectly promoting the development of enterprises in this direction.

Power battery enterprises are being squeezed by upstream enterprises. The price of resources and raw materials has been rising rapidly [7]. The resources represented by lithium will become scarce resources, and vertical integration of industrial chain enterprises will become a trend. Since 2021, the price of lithium has continued to rise. The price of lithium carbonate in positive electrode materials has almost doubled compared with the same period last year. Battery grade lithium carbonate has increased from 38000 yuan / T to 90000 yuan / T in one year. The price of raw materials such as ternary precursor, lithium-iron phosphate and lithium hydroxide has increased by nearly 50%.

In a word, the policies for new energy vehicles and lithium battery industry are mainly divided into the following categories. The first one is mainly reflected in the purchase subsidies and production subsidies for direct consumers and producers to promote the new energy vehicles, but the number of subsidies has become less and less, and even will be abolished soon. The second is in the application of infrastructure in urban transportation, such as the extensive laying of power grids for new energy vehicle charging base stations and the large number of regulations on public transport vehicles requiring the use of new energy vehicles. Finally, policies that directly affect the lithium battery industry will play more important role in the upgrading of lithium batteries, mainly subsidies for high-efficiency lithium batteries, which will not be available if they do not meet the standards. These policies mainly put forward greater requirements for the sustainable use of batteries. Only with higher endurance and utilization can more energy be saved to achieve the goal of sustainable development. The related requirements on the echelon utilization and recycling of lithium batteries are also one of the key points. In order to meet the higher safety and environmental protection requirements, it is necessary to improve science and technology and innovation of lithium battery technology to reduce the higher cost and obtain more benefits [7].

3. The role of different policies on new energy vehicles and lithium battery industry from different perspectives

3.1. Policies directly affect the demand and supply of new energy vehicles

From the described policies on the new energy vehicle industry and the lithium battery industry, and some related phenomena, we can analyze what impact they bring to the economy and how the sustainable development of energy use is realized in terms of environmental protection. First, subsidies for consumption and production of new energy vehicles. Originally, the cost of developing new energy vehicles was very high, and the immature technology made it waste a lot of energy and maintenance costs. In order to share the production costs and ensure that new energy vehicles have sufficient safety factors, the price of new energy vehicles is set high, which leads to a great reduction in consumer demand for them. There are many alternatives to traditional vehicles at the same price. New energy vehicles are not competitive enough to occupy a lot of market shares. However, in the previous years when the government promoted new energy vehicles, the subsidies were very strong, according to figure 1, a large part of the costs were reduced, the supply of the new energy vehicle increase and shift to right, made the price of new energy vehicles decrease and become highly competitive, and the demand of consumers for new energy vehicles at this price is higher and producers obtained more benefits, further attracted more and more companies to enter the market, increased competition and improved scientific and technological progress to achieve greater efficiency [8].

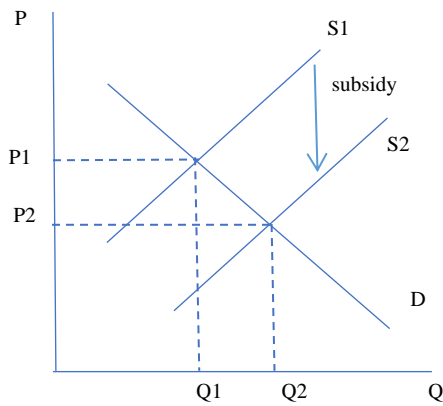


Figure 1. Subsidy

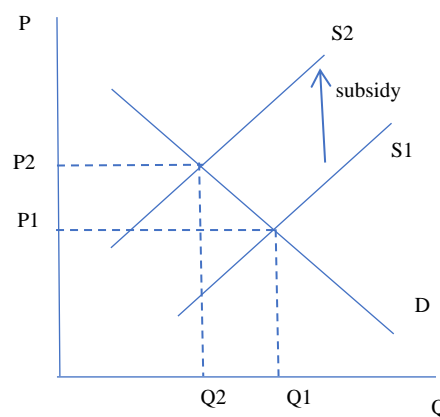


Figure 2. Reduce subsidy

In recent years, lithium battery technology has developed rapidly and its driving mileage has been greatly improved, because only higher efficiency can occupy more market share. The larger share of new energy vehicles in the market also means that the sustainable development of the industry has made progress, because it reduces emissions, the negative externalities caused by emission pollution from traditional vehicles, etc. lithium batteries, as a power battery, have relatively long endurance, almost no heavy metal pollution, and can be recycled and reused, which makes them very environmentally friendly and can promote the sustainable development of the energy industry. Similarly, these policies have also brought some disadvantages to a large number of companies joining the market. Because the policies point to environmental protection purposes and there are scientific research restrictions, many companies only use low-end materials and manufacturing methods to carry out cheap but inefficient production and earn profits through subsidies, which leads to low market enthusiasm, in addition to the leading enterprises, it has no positive impact on the improvement of new energy related technologies. So, after realizing this, the direct subsidies for consumption and production in the policy are gradually decreasing. According to figure 2, the subsidy is reduced and the supply of new energy vehicles decreased and shift to left, the price increased. In order to get the benefit and be more competitive, the companies should lower their cost of production, which means they should increase their efficiencies. Many previously inefficient companies found that they could not make profits in the original way, and either chose to upgrade their technology and reduce costs, or chose to withdraw from the industry. The market competition has gradually become benign, and the innovation of the lithium battery industry is also proceeding at a high speed.

The second point is that the government invests in the network of urban new energy vehicle charging stations and compulsorily allocates new energy vehicles for public transport. This is equivalent to increasing the social demand for new energy vehicles directly through the government, and making the use of new energy vehicles more efficient and convenient to attract the attention of consumers, indirectly increasing the consumption for new energy vehicles.

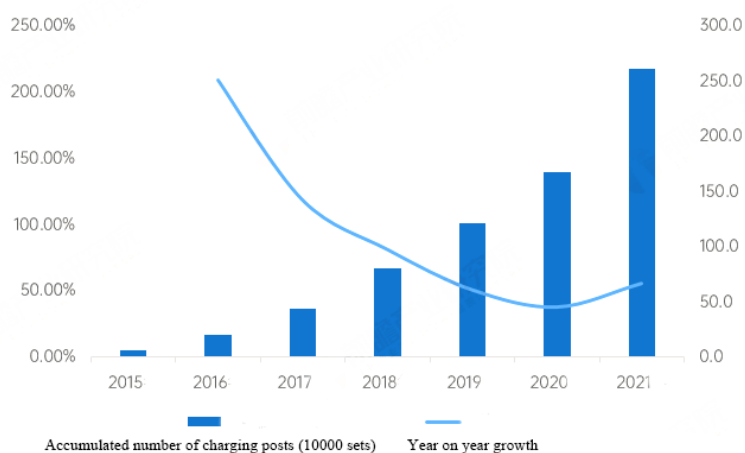


Figure 3. Number of public charging station

Source: <https://www.qianzhan.com/analyst/detail/220/211210-66d573ca.html>

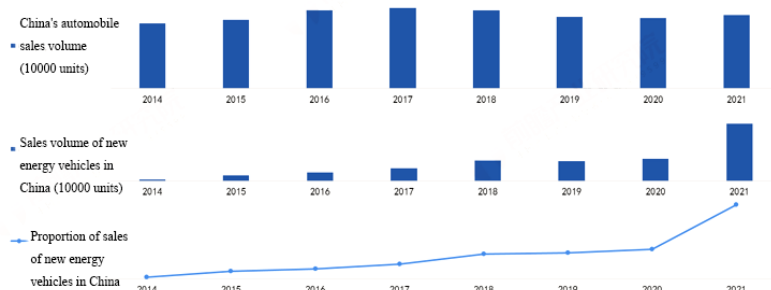


Figure 4. Consumption of new energy vehicles

Source: <https://www.qianzhan.com/analyst/detail/220/220802-f23521c4.html>

According to figure 3 and figure 4, they both show positive trend on the number of public charging station and the number of public charging station. The relevant policies consume a lot of governmental expenditure, but the previous reduction in consumption and production subsidies has also made up for some of the excess governmental expenditure. What's more, the public transportation can be replaced by new energy vehicles.

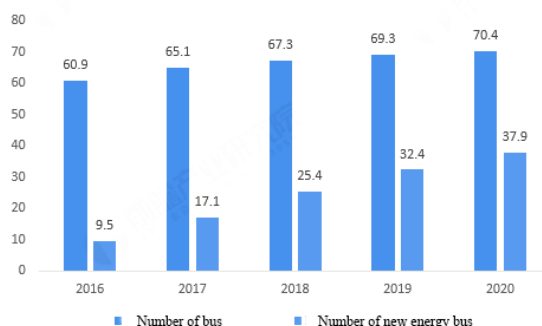


Figure 5. The number of new energy bus

Source: <https://www.qianzhan.com/analyst/detail/220/210929-1ad86392.html>

According to the figure 5, the proportion of new energy bus becomes larger and larger. This has the advantage that the implementation of the policy is very direct and efficient, public transport is controlled by the government, can be quickly replaced by new energy vehicles, and has a better effect in places with complex transportation systems and large populations, greatly reducing the emissions caused by private traditional vehicles, and reducing the negative externalities of traditional public transport. The more extensive and large-scale construction of new energy vehicle charging stations

can enable new energy vehicles to operate better in cities and reduce the inconvenience of their original supplementary energy so that more people can choose to use them. The replanning of urban transportation caused by this policy has further affected sustainable development. The new energy charging station has been set in a suitable position, made up for the omissions in the original transportation network, gradually replaced the traditional automobile network, and improved the overall energy utilization rate more efficiently and environmentally without affecting the original people's transportation, so as to achieve better sustainable development. But with it comes high manufacturing costs and maintenance costs. The high-intensity use of public transport also means that the use of lithium batteries has become a core issue. It also needs longer endurance and service life, and needs to be more efficient and safer in maintenance. Because the number of government orders is very large, the company can obtain a lot of benefits, so its competition is strong. This led to the need for the company to further develop technology and improve the efficiency of lithium batteries in order to win the bid in the government tender.

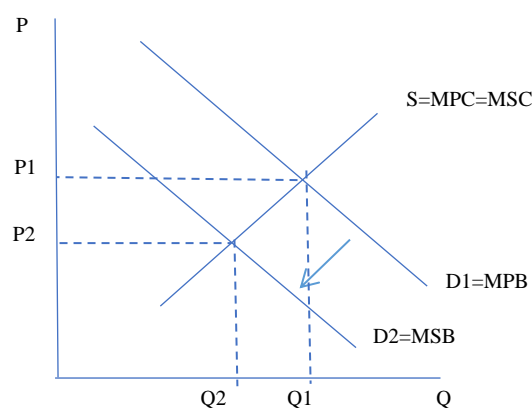


Figure 6. Reduce negative consumption externality

All the policies encouraged the demand and supply of the new energy vehicles is to reduce the demand of traditional vehicles. According to figure 6, since traditional vehicles cause a lot of pollution which has negative effect to all the people, its marginal social benefit is quite low. If people shift to buy the new energy vehicles this externality can be reduced.

3.2. The policies directly affect the Lithium battery industry

The above two points mainly play a role in the demand and supply of new energy vehicles. With the substantial increase in the output of new energy vehicles, the demand for lithium batteries has also increased, and the output of lithium batteries and charging piles has also increased. However, from the perspective of subsidy policy, only with sufficient efficiency can subsidies be obtained. As one of the most core materials of lithium batteries, positive electrode materials account for about 40% of the total cost of lithium batteries, and their technical development level will greatly affect the performance of lithium batteries. Since 2011, the state has put forward technical standard requirements related to positive electrode materials of lithium batteries in relevant industry catalogues and industry specification documents. Specific capacity, that is, energy density, is one of the core indicators of lithium battery efficiency. With the development of the industry, its technical standards are constantly improving. In 2020, the state's specific capacity requirements for positive electrode materials of power batteries for new energy vehicles reached more than 180MAH / g. The batter cycle life reaches 2000 times and the capacity retention rate reaches more than 80%. Therefore, all companies can only meet the requirements by making continuous technological progress, otherwise the supply of new energy vehicles and market competitiveness will be affected by the high cost.

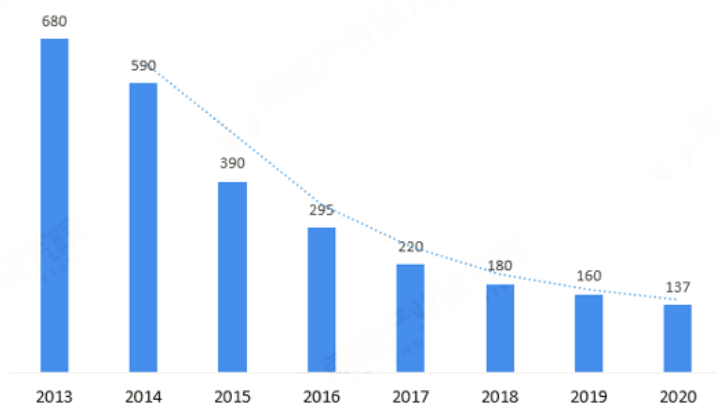


Figure 7. Average cost of lithium battery

Source: <https://www.qianzhan.com/analyst/detail/220/210819-a2485957.html>

According to the figure 7, the cost of making lithium battery becomes lower and lower which fits the aim of improving efficiencies by the policies.

In 2021, China's new energy vehicle sales volume was 3.52 million, a year-on-year increase of 157%, and the China Association of automobile industry predicted that it would reach 5.5 million in 2022, a year-on-year increase of more than 56%. According to figure 8 and the data of China automotive power battery industry innovation alliance, the output of lithium iron phosphate power batteries in China in 2021 is 125.4gwh

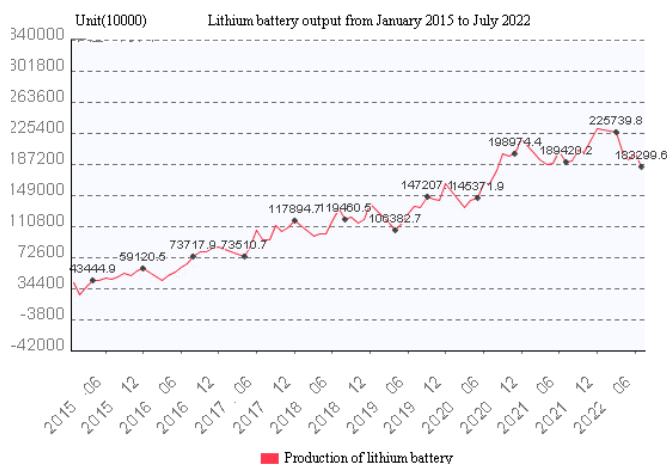


Figure 8. The production of lithium battery

Source: <https://ytl.com/datas/battery1-ou>

Most of the global lithium, cobalt and nickel mines are distributed outside China, and the development of new energy vehicles will continue to increase its dependence on imports. Among them, Chile's lithium concentrate, Congo's cobalt ore and Australia's nickel ore are all monopolized by the leading mining group, which has strong control over price negotiations. Since Chile was sealed off due to the epidemic, the global price of lithium ore began to soar. Although there are lithium mineral resources in Qinghai, China, the mining cost is extremely high due to low purity and many associated minerals. After the introduction of the carbon neutral and carbon peak plans, the demand for new energy vehicles has driven the global supply of power battery materials to exceed demand. Just like the chip crisis, the supply and demand of battery raw materials are extremely unbalanced. In addition, the United States, Europe and China are all trying their best to promote the new energy vehicle market, resulting in a blowout of demand for materials.

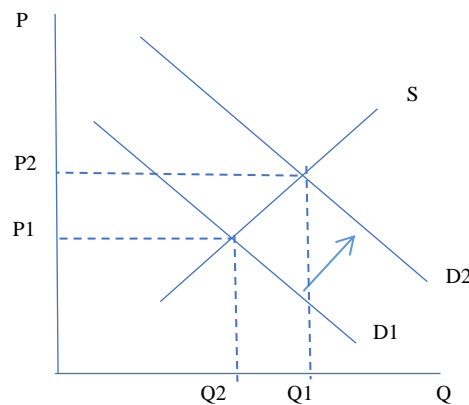


Figure 9. Increase in demand of lithium battery

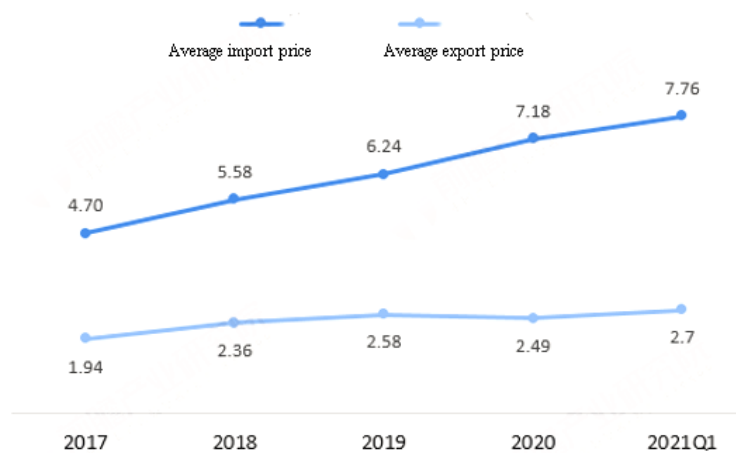


Figure 10. The import and export price of lithium battery

Source: <https://www.qianzhan.com/analyst/detail/220/210819-a2485957.html>

According to the figure 9, the increase in demand of lithium battery leads to the higher price of materials and the price of the lithium battery. The lack of material aggravated the effect. the international trade on the lithium battery increase, according to the figure 10, the import and export price of lithium battery both increased.

3.3. Vertical integration of new energy vehicle industry and the Lithium battery industry

The electric car market in China has so far progressively shifted from being entirely driven by policies to being driven by both policies and markets. It is important to note that in recent years, state subsidies for electric vehicles have decreased while the technical standards necessary for receiving subsidies have improved, introducing new demands for electric vehicle businesses. In some ways, the changes in the subsidy policy have encouraged automakers to advance technology research and development, increase production volume to save costs, and promote the survival of the fittest in the electric car market [9].

In the new energy industry chain, the importance of upstream resources has gradually become prominent in this cycle. Investment around resources has been rising one after another, and participants have covered all links in the industry chain. In addition, some traditional industry giants (like Huawei and MIUI) have also joined the ranks of resource competition because they are optimistic about the future development direction of new energy. The industrial chain is vertically connected and surging. All enterprises are secretly laying out plans and making efforts in the rapid development track of the industry. Among them, vertical integration has become a strategic choice of many enterprises. The bank is optimistic about actively promoting industrial chain integration and is expected to achieve the target of valuation repair against the background of high profitability

3.4. International policies on the new energy vehicles industry and new energy industry

China's regulations for electric cars have recently been relatively beneficial, and industry investment has soared. All types of capital, including social capital, state-owned capital, and internet behemoths, have begun to put money into the electric vehicle sector. It is important to note that although there have been less investments made in the sector since 2019, there have been more of them overall. On the one hand, it demonstrates that the industry's investment strategy has started to favor mature, high-quality businesses with greater growth, while businesses with low levels of competitiveness would progressively disappear owing to a lack of funding.

In terms of strategic planning, in 2013, the U.S. Department of Energy released the blueprint of the electric vehicle that by 2022 in terms of consumer purchase costs, key technical indicators, charging facilities, etc., the goals of reducing the cost of power batteries and electric drive systems to \$125 and \$8 per kWh respectively, and reducing the curb weight by 30%.

The U.S. government supports the research and innovation of new energy vehicles through special grants, tax relief, low interest loans and other means, forming a new energy vehicle technology mechanism led by enterprises and participated by scientific research institutions. According to a 2019 announcement by the U.S. Department of Energy, up to \$59 million would be made available to promote research and development in innovative batteries, electric drive systems, energy-saving technologies, and effective power systems.

According to data from the Norwegian Road Traffic Information Council (ofv), in 2021, Norwegian dealers sold a total of 176,276 vehicles, of which 65% were pure electric vehicles and 28% were hybrid vehicles. This achievement is closely related to Norway's measures to promote the use of electric vehicles, which include reducing vehicle purchase tax, license plate tax, annual vehicle tax and parking fees in public places. Electric vehicles can also use the same lane as public transport. However, due to the tax relief, the Norwegian government had a fiscal gap of \$3.41 billion in 2021. Last year, the Norwegian legislature was discussing reducing the tax relief for electric vehicles, which may impose a 25% surcharge on electric vehicles selling for more than 600,000 Norwegian kroner (about 435,000 yuan).

From the perspective of benchmarking the international technology development level, there is a gap between the domestic pure electric vehicle technology level and the foreign products. It mainly lags behind foreign countries in key technologies, and pure electric vehicles are relatively short of batch production technology, quality control and reliability; Cost control also needs to be further improved; The involvement of enterprises is not high, and the investment in this respect is less [10].

4. Conclusions

According to my investigation and research, due to the vigorous promotion and production of new energy vehicles, the lithium battery industry is closely connected with them, resulting in vertical integration. Policies aimed at the consumption and supply of new energy vehicles and the R & D of energy technologies such as lithium batteries can have related impact. Its positive role is to increase the output of new energy vehicles, reduce environmental pollution, encourage the progress of lithium battery research and improve the sustainable development. However, the reduction of subsidies and the improvement of selection criteria need to be in line with market conditions and the progress of relevant energy research. Excessive subsidies will also bring greater economic pressure to the country. Only by balancing economic effects and improving energy utilization can sustainable development be achieved.

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