The Development of New Energy Industry under the Implementation of China's Environmental Protection Policy -- The Forecast of Lithium Ion and Sodium Ion Battery Industry

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ABSTRACT

"Carbon Peak" and "Carbon Neutral" are Long-term policies to protect the environment, low-carbon development and cope with global warming. The "double carbon" policy has spawned a trillion-dollar market for new energy vehicles. China overtook Japan in 2018 to become the world's leading market and supplier of electric vehicles. But fierce competition and huge production demand have led to higher prices for lithium battery raw materials, yet nearly 60 percent of the world's proven reserves of lithium are in Argentina, Chile and Bolivia, where a recent wave of overheated mining has sparked labour disputes that have led to a surge in the price of lithium raw materials. Sodium-ion batteries are essentially the same as lithium-ion batteries, but at least 30% lower in cost. This paper focuses on the future development direction of China's new energy vehicle power battery industry. Through an extensive collection of information and price data on lithium and sodium, it is found that the continuous rise of lithium raw materials is actually a problem of price reaction to the limited and uneven distribution of raw materials used in the production of key materials for lithium-ion batteries. On the basis of summarizing the advantages of sodium ions, the paper puts forward the view that low-cost, abundant raw materials sodium ion batteries will become the main development direction of the power battery industry.

Keywords: *Carbon peak and neutrality, Power battery industry, Lithium ion battery,Sodium ion battery*

1. INTRODUCTION

In 2018, global emissions of carbon dioxide into the atmosphere reached an all-time high of 33.1 billion tons. In order to mitigate the greenhouse effect and avoid climate catastrophe, humanity needs to stop emitting greenhouse gases into the atmosphere and achieve zero emissions. In response, in 2020, the Chinese government proposed a "double carbon" target based on the current state of global warming and the need to maintain sustainable economic development. In 2021, the Chinese government reaffirmed this goal in its work report. In recent years, China's new energy industry has developed well. Power battery is the core component of new energy vehicles, but the main raw material of power battery lithium ore since the outbreak price has risen sharply. Lithium ore reserves are limited, and uneven global distribution, and China's new energy industry's global position does not match. July 29, 2021, power battery industry leader Ningde era released the first generation of sodium ion battery, so can sodium battery replace lithium-ion battery? Compared with lithium-ion batteries, the biggest advantage of sodium-ion batteries is that they are cheap and have abundant stock of sodium, but they also face the problem of low energy density. Based on the combination of policy and the background of the recent progress in the research and development of sodium ion battery, this paper puts forward the view that sodium ion battery is expected to replace lithium-ion battery as the main development direction of the power battery industry in the foreseeable future, and makes predictions for the future development of power battery.

2. "CARBON PEAK AND NEUTRALITY" POLICY

"Carbon peak" and "carbon neutral" are China's

long-term policies for environmental protection, low-carbon development, and global warming. "Peak CO2 emissions" refers to a region or industry's annual CO2 emissions reaching the highest value in history, and then entering the process of continuous decline. This marks the decoupling of carbon emissions from economic development. "Carbon neutrality" means that human activities directly or indirectly emit carbon dioxide in a certain area within a certain period of time (usually a year), offsetting the carbon dioxide absorbed by afforestation, etc., and achieving "net zero-emission" of carbon dioxide. In 2020, the Chinese government put forward the goal of reaching a peak in carbon emissions in 2030 and achieving carbon neutrality by 2060. In addition to China, major countries and economies in the world have passed legislation or policies to clarify the time for carbon neutrality. Among them, the United Kingdom, France, Hungary and other countries have legislated to achieve carbon neutrality by 2050.

"Dual Carbon" is a forty-year-long goal-oriented policy that is bound to cause an energy revolution and a social revolution. In the foreseeable future, renewable energy represented by wind, solar, nuclear, tidal, and hydrogen will replace fossil energy; high-carbon emission industries represented by construction, electricity, and energy will rely on new technologies to achieve zero carbon emissions. The transformation of a low-carbon society has been gradually established. The ecological environment has been continuously improved, and a green economic socio-economic development model has become a social consensus.

3. THE PRESENT SITUATION OF THE POWER BATTERY INDUSTRY

Under the guidance of the “Carbon peak and neutrality” goal, the Chinese government has given greater support to the new energy vehicle industry. As the core component of new energy vehicles, the entire industry is also developing rapidly. According to the Lithium Branch of the China Nonferrous Metals Association, China's lithium demand in 2020 will be equivalent to about 237,000 tons of lithium carbonate equivalent, an increase of 23.4% year-on-year. It will reach 293,000 tons in 2021, an increase of 23% year-on-year. It is estimated that by 2025, the global demand for lithium resources will be about 877,000 tons. Thus, the power battery industry in the future development is of full power. [1]

Although hydrogen fuel cell vehicles have obvious advantages in energy density, environmental pollution, charging speed, and battery life compared to pure electric vehicles equipped with lithium-ion batteries, the development of the new energy vehicle industry to the present is still based on lithium batteries as the main power According to the current situation, hydrogen fuel is difficult to be used on a large scale like lithium batteries at this stage. The installed capacity of power batteries has increased by 72 times from 2013 to 2018. However, in 2019, the Chinese government’s subsidy for new energy vehicles has shrunk, and sales of new energy vehicles have declined significantly, and the growth rate of installed power batteries has fallen below 10%. Therefore, the power battery industry is closely related to the prosperity of the new energy vehicle market. [2]

The power battery is composed of four parts: positive electrode, negative electrode, electrolyte, and separator. The positive electrode material accounts for about 30% of the cost and is the most important part of the battery. According to the global electric vehicle lithium battery market assessment report issued by the Fraunhofer Association for the Promotion of Applied Research in Germany, China surpassed Japan in 2018 to become the world’s leading market and leading supplier of electric vehicles. All aspects rank first in the world.[3] At the same time, the total number of listed companies in China's A-share power lithium battery industry has reached 46, covering multiple production links such as battery cathode materials, anode materials, electrolytes, separators, and battery packs. The government support policies and incentive programs that began in 2015 have led to a significant increase in the demand for electric vehicles from 2016 to 2018, resulting in a huge and fast-growing market for domestically produced lithium batteries. At the same time, the promising market and huge consumer potential have further attracted investment. There are a large number of lithium battery companies and fierce competition in the industry.

Fierce competition and huge production demand have led to higher raw material prices. Since 2015, the price of lithium carbonate in China, which is used to produce positive materials, has started to rise significantly. In addition, the price of lithium carbonate fluctuates greatly. By September 2021, the price of lithium carbonate has risen to 150,000 RMB per ton, and is in a continuous rise.

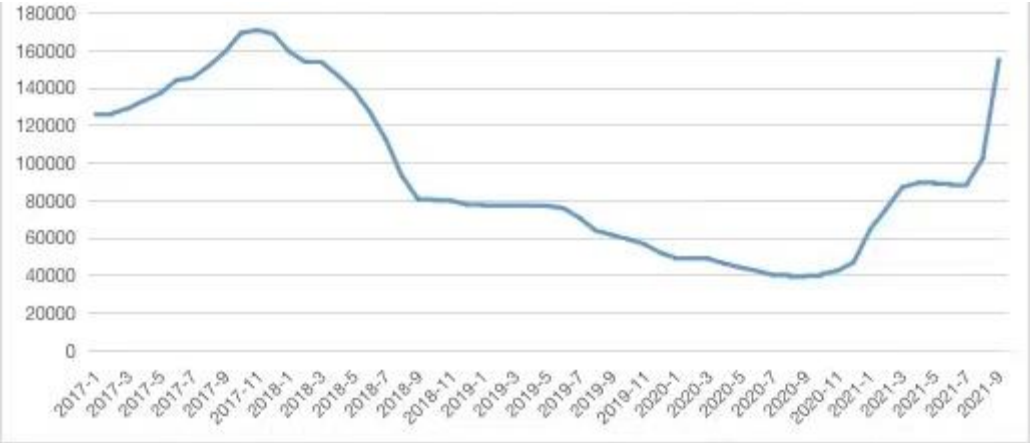

Figure 1 The prices of lithium carbonate(≧95%) from 2017 to 2021

In addition, not only in China, but all countries in the world have formulated plans and policies, such as establishing a carbon budget system, formulating an energy transition schedule, controlling traditional energy vehicles, and gradually transitioning to the new energy era. These actions have directly or indirectly caused the price of lithium raw materials to rise.

However, by 2021, nearly 60% of the world's proven lithium resource reserves are located in Argentina, Chile and Bolivia. Therefore, these areas are called "lithium triangles." [4]Yet the recent overheated mining wave has also triggered more labor disputes and exacerbated the rise in raw material prices.

The price of spodumene concentrate, which is used to produce lithium carbonate, rose to $979 / ton by September 2021. Compared with 2020, the price increased by USD 561.5 / ton, a jump of 134.5%.

4. FORECAST OF THE FUTURE DEVELOPMENT OF THE POWER BATTERY INDUSTRY

Compared with lithium-ion batteries, the biggest advantage of sodium-ion batteries are their low cost and abundant reserves. In recent years, lithium-ion batteries have dominated application scenarios that require rechargeable batteries, including mobile phones and electric vehicles. However, on a global scale, the production of lithium-ion batteries continues to create new highs, and the overall price of lithium-ion batteries has fallen sharply, and the prices of some raw materials used to produce lithium-ion batteries have increased significantly. In fact, this is a response to the limited and unevenly distributed prices of raw materials (lithium ore, cobalt ore, etc.) used to produce cathode materials for lithium-ion batteries. The sodium-ion battery and the lithium-ion battery have the same composition, but the reserves of sodium are extremely abundant on the earth and are inexhaustible. According to estimates from China's leading sodium-ion battery company Haina Battery, sodium-ion batteries are at least 30% less expensive than lithium-ion batteries.

There are currently three main cathode materials for lithium-ion batteries, one is nickel-cobalt manganese lithium ternary lithium-ion batteries, the other is lithium iron carbonate batteries, and the third is a new generation of solid-state lithium batteries that have not been used on a large scale. Sodium-ion batteries and lithium-ion batteries are the same as the diaphragm material. The anode material uses carbon-based materials instead of graphite, and the electrolyte uses sodium hexafluorocarbonate. Under the existing technical conditions, the existing sodium ion battery cathode materials mainly use metal oxides such as iron manganese copper, polyanionic materials, and Prussian blue compounds. But the biggest shortcoming of sodium ion batteries is that the energy density is too low. [5]Compared with the energy density of 180Wh/kg of lithium iron carbonate batteries, the energy density of sodium ion batteries is generally concentrated between 125Wh/kg and 150Wh/kg, not to mention the difference Compared with ternary lithium-ion batteries with better performance and longer cruising range, the application scenarios of sodium-ion batteries under current technical conditions can only be limited to markets such as energy storage, base stations, low-speed vehicles, and low-end passenger vehicles.

In July 2021, China's leading power battery company CATL released the first generation of sodium-ion batteries, using Prussian blue compounds as cathode materials, and their energy density greatly exceeded expectations, reaching 160Wh/kg. Haina Battery, which holds more than 50 patents for sodium-ion batteries, has an energy density of 150Wh/kg for its sodium-ion batteries. It has launched the first low-speed sodium-ion battery electric vehicle and the first 100kWh sodium-ion battery energy storage power station. In September 2020, the company achieved mass production of sodium ion battery products.

In August 2021, the Chinese government's industrial information department proposed to formulate industry standards for sodium-ion batteries, and the road to industrialization of sodium-ion batteries has begun.[6]

All in all, there are gaps and hidden dangers in the supply of raw materials for lithium-ion batteries. Coupled with the high price of lithium raw materials, the search for alternatives to lithium-ion batteries has been carried out. Sodium-ion battery is an important strategic alternative to lithium-ion battery. Despite its many advantages, sodium ion batteries are expected to dominate only some of the low-grade power battery market in the next three to five years due to their low energy density, and are expected to become the main energy storage area. In the long run, sodium-ion batteries are expected to replace lithium-ion batteries under the premise of technological breakthroughs.

5. CONCLUSION

"Carbon neutrality" is a global consensus, and the "carbon peak and neutrality" goal has given birth to a trillion-level market. New energy vehicles are an important part of global carbon neutrality. It is a choice to ensure energy security and expand technological reserves. It is also a necessary choice to promote the human energy revolution and achieve "carbon neutrality" and sustainable development. Compared with lithium-ion batteries, sodium-ion batteries have huge advantages in terms of cost, resource reserves, safety, and environmental friendliness. Although they have the problem of low energy density, they seem to be difficult to use as power batteries under existing conditions. They are accompanied by the advent of sodium ion industrialization, sodium ion batteries will become the main development direction of the power battery industry in the future.

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