

Research on R&D Investment of New Energy Companies under the Trend of Green Transformation

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Abstract

With the rapid development of new energy technology in the world and the deepening of green energy transformation, the Chinese government is paying more and more attention to the innovation and development of the new energy industry. In recent years, the total R&D investment of Chinese new energy companies keeps increasing and gradually becomes an important force to promote social and economic development. However, the low R&D investment intensity of new energy industry and the lack of innovation of new energy technology have become the key problems hindering the development of new energy in China. Based on the trend of green transformation, this paper compares the new energy industry policies of the UK, the US and other countries and combines the development status of China's new energy industry to explore a new development path for new energy companies, so as to gather the government, market, companies and other forces to accelerate the development of the new energy industry.

Keywords

Green Transformation, New Energy Company, R&D Investment, The Government Subsidies

1. Introduction

1.1. New Energy Companies' New Development Opportunities within the Trend of Green Transformation

Green transformation refers to the transformation of the development model to sustainable development with ecological civilization construction as the leading role, circular economy as the foundation and green management as the guaran-

tee, so as to achieve resource conservation, environmental friendly, ecological balance and harmonious development between man, nature and society. The development of sustainable energy and poverty reduction has been one of the major concerns of the United Nations and its agencies for nearly 40 years. As early as 2015, the United Nations Development Programme (UNDP) made sustainable energy services one of its priority areas in its efforts to achieve the Millennium Development Goals on environmental sustainability.

The UK government recently launched the “Net Zero Strategy” on green transformation, promising to achieve net zero emissions by 2050 and promote the development of clean and green energy in the UK. To speed up the green transformation, the Chinese government issued the Outline of the Vision Goal 2035 of the 14th Five-Year Plan of the People’s Republic of China for National Economic and Social Development, which sets the new energy development target as developing the new energy industry and accelerating the green transformation. Among them, new energy companies, as the main force to promote green transformation, have new development opportunities and challenges. In this regard, new energy companies must strengthen research and development investment, in order to improve the core competitiveness, to obtain the opportunity of survival and development.

According to the statistics of Wind database, the R&D expenditure of Listed new energy companies in China accounted for about 4% of the operating income in 2017, among which the R&D investment of listed new energy vehicle companies accounted for a higher proportion of the operating income, more than 7%, while the R&D expenditure of A-share listed companies accounted for only 1.95% of the operating income on average. According to EU statistical standards, R&D investment intensity of more than 5% is considered as high intensity level. It is found that the R&D investment level of Chinese new energy companies is generally low, and there is still a great space for development.

1.2. New Energy Companies Coping with Market Challenges Only through Attaching Importance to R&D Investment

The United Nations Conference on New and Renewable Energy held in 1980 defined new energy as: On the basis of new technology and new materials, making traditional renewable energy developed and utilized in a modern way, replacing the fossil energy with inexhaustible renewable energy that has limited resources and pollutes the environment, focusing on developing solar energy, wind energy, biomass energy, tidal energy, geothermal energy, hydrogen fuel and nuclear energy (nuclear power).

Under the guidance of China’s national policies, new energy companies continue to increase investment in research and development, accelerate innovation and development, and the new energy industry has achieved rapid development, especially the new energy automobile industry. As early as 1983, the Department of Science and Technology of the State Science and Technology Commission di-

rectly invested 880 million Yuan in R&D through the “Major Science and technology special Project for Electric Vehicles” in the National High-tech Research and Development Plan, encouraging new energy enterprises to increase R&D investment. In addition to relying on the support of the government, the progress of new energy technology cannot be separated from the attention of new energy companies to research and development investment.

At present, the scale of independent R&D investment of Chinese new energy companies is increasing every year, but there are widespread problems of insufficient R&D investment intensity and neglect of consumer demand, which seriously restrict the development of new energy technology. Based on the background of green transformation, this paper studies the R&D investment of Chinese new energy companies and proposes creative solutions to help Chinese new energy companies get out of the development dilemma by learning from the successful experience of overseas new energy development, so as to contribute more to the high-quality development of China’s economy.

The rest of this paper is organized as follows: The second section describes the relationship between government funding and R&D investment; The third section introduces the new energy policies of Britain and the United States and other countries. The fourth section takes BYD Company as an example to explore the R&D investment status of Chinese new energy companies; The fifth section, based on the analysis of the first two sections, points out that there are problems in the R&D investment of new energy companies; The sixth section puts forward countermeasures from the perspective of government and company in view of the problems raised in the previous section. This is summed up in Section seven.

2. New Energy R&D Investment Intensity and Government Funding Acting as Important Research Objects

Government funding has a positive effect on the R&D investment of new energy companies. [Levin & Reiss \(1984\)](#) made a regression analysis of the sample of funded American enterprises, and concluded that government subsidies can promote R&D investment of enterprises. [Tassey \(2004\)](#) believes that R&D investment of enterprises can promote technological innovation, but innovation achievements have spillover effects and may be free rider by other members of the society. Therefore, it is necessary for the state to subsidize R&D innovation to compensate for such negative externality, so as to encourage enterprise innovation. [Jung \(2016\)](#) used different research methods and data samples to study and found that government subsidies can promote enterprises’ R&D investment.

R&D investment level is an important standard to measure the innovation capability of an enterprise or even a country. R&D investment level is generally evaluated by R&D investment intensity. [Jiang et al. \(2021\)](#) believe that in general, R&D investment intensity can be calculated by calculating the proportion of total R&D investment in operating revenue. However, operating income is not equal to the real income of the enterprise. Operating income may include taxes,

surcharges and bad debt losses. If these factors are not excluded, the R&D investment level of the enterprise will be underestimated. In addition, there is no unified standard for the calculation of R&D investment, which will lead to a large error in the evaluation of R&D investment (Ma & Huang, 2021).

3. Overview of Policies Supporting R&D Investment of New Energy Companies in the UK and the US

3.1. United Kingdom: New Energy Development Is Guaranteed by Law and Regional Energy Cooperation System Is Established

In 1989, the Electricity Act marked the beginning of the development of renewable energy in the UK. In 1990, the British government formally implemented the Renewable Non-fossil Fuel Obligation system (NFFO), which laid the legal foundation for the development of renewable energy in the UK. Since 2002, China has gradually implemented and improved the Renewable Energy Obligation Order, adapting to the national conditions of renewable energy development in the UK, and making constructive achievements in the fields of nuclear energy, wind power, tidal power and other new energy. As one of the core members of the EU, the UK has actively advocated the development of new energy at EU conferences. The coalition members of the European Union launched the green of the EU energy policy, in order to realize the sustainable, competitive and supply security as the goal, proposed the internal gas and electricity markets, to strengthen the regulation of the European Union's energy market, the member countries open energy market, energy technology strategy planning and unified foreign energy policy. All these laid a solid legal foundation for the R&D investment of British new energy companies and even the development of EU new energy industry.

3.2. The United States: Actively Reduce Carbon Dioxide Emissions and Vigorously Develop New Energy Vehicles

The US government enacted the Energy Policy and Conservation Act of 1975, which required a gradual reduction in the use of fossil fuels in favor of renewable energy sources. Obama administration to further improve the new energy, environmental protection policy, stressed the importance of green energy and low carbon economy, and said the US. Government will be put into \$150 billion over the next decade (including R&D subsidy) fund of renewable energy research, in order to reduce 5 billion tons of carbon dioxide emissions, and make contributions to solve the problem of global climate. In addition, new energy vehicle companies enjoy more convenient concessions. Obama has pledged to pass new legislation to cut domestic greenhouse gas emissions 80 percent from 1990 levels by 2050 and provide tax credits to encourage consumers to buy fuel-efficient cars.

3.3. India: Set up New Energy Management Department to Develop Solar Photovoltaic Power Generation Industry

India, Asia's third-largest oil consumer, has been dependent on oil imports be-

cause of its large population and a severe shortage of domestic reserves. Under the pressure of insufficient energy supply, India held a five-year plan meeting on new and renewable energy in 2008, and listed solar photovoltaic power generation and wind power generation as key research projects in the future, and invested more than 10 billion dollars in new energy project research every year. In addition, India has set up a special administrative department, The Ministry of New and Renewable Energy (MNRE), to lead India in the in-depth development of solar energy, wind energy and other fields.

4. Case: Summary of R&D Investment of “BYD Company”

4.1. “BYD Company” Expands R&D Investment Scale

BYD Company Limited (This paper is referred to as “BYD Company”, Stock Code: 002594) is a high-tech enterprise listed in HongKong and Shenzhen, with business layout covering electronics, automotive, new energy and rail transportation. Since its birth, BYD has been committed to building a zero-emission new energy system in an all-round way. It won the United Nations Special Energy Award and the “Zayed Future Energy Award” large enterprise category, ranking the first in China’s new energy vehicle enterprises.

According to the data in **Table 1**, R&D investment of BYD Company Limited shows a trend of annual growth, with a significant increase from 2017 to 2018, and has always maintained a high capitalization rate. However, many companies such as FAW Group, SAIC Group and Dongfeng Motor still maintain the capitalization rate of R&D investment of zero or very low, and take a cautious accounting attitude towards R&D investment. In addition, the capitalization rate of R&D investment in the whole new energy vehicle industry has also maintained a low level in recent years (Gu, 2020).

In the most important automotive business, the proportion of new energy vehicles is gradually rising. According to BYD’s 2018 sales report, 221,004 new energy vehicles were sold, accounting for 48% of the total vehicle sales, among which passenger car sales accounted for 92% of the new energy vehicle sales.

4.2. Changes in R & D Investment Structure of “BYD”

As can be seen from **Table 2**, BYD’s R&D investment is mainly in automobile and auto-related industries (the proportion of R&D investment in automobile sector accounts for 60% or more of the total R&D investment all the year round). However, in recent years, BYD’s R&D investment shows an increasing trend in absolute amount. However, from the perspective of the proportion of the relative amount and operating income, it shows a trend of first decline and then growth.

Although the Chinese government continues to raise the subsidy standards for new energy companies, BYD has been closely following the national policy and continuously developing clean, efficient and satisfying new energy vehicles. As shown in **Table 3**, from 2014 to 2015, affected by subsidy withdrawal and

Table 1. R&D investment of BYD company.

	2014	2015	2016	2017	2018
R&D investment (RMB 100 million)	243.12	284.25	334.88	380.67	505.09
Capitalization rate of R&D Investment (%)	20.16	19.51	17.98	22.26	33.47

Source: Wind Database.

Table 2. Financial data of BYD R&D investment from 2014 to 2018.

	2014	2015	2016	2017	2018
Total R&D investment (RMB 100 million)	36.80	36.75	45.22	62.66	85.36
R & D investment-Automobile (RMB 100 million)	24.66	22.62	28.12	41.64	50.82
Proportion of automobile R&D investment in total R&D investment (%)	67.01	61.53	62.19	66.45	60.54
Proportion of R&D investment in operating income (%)	6.32	4.59	4.37	5.92	6.56
Proportion of R&D investment in operating income (automobile) (%)	9.10	5.56	4.93	7.35	6.69

Source: Wind Database.

internal rectification, BYD company's access to government subsidies declined. Since then, BYD has learned from experience and promoted the "7 + 4" strategy of new energy, gained government subsidy amount increasing year by year, and become the leader of new energy vehicles.

4.3. Comparative Analysis with "Tesla" in the United States

Tesla is a giant of American automobile manufacturing operations, mainly engaged in the production and marketing of pure electric vehicles, and has been leading the electric vehicle industry with advanced automation and intelligence level, belonging to the department of energy companies. This is closely related to the long-term high investment in research and development. According to Tesla's 2018 annual report, Tesla invested \$1.46 billion in research and development, accounting for 7% of its revenue, which was significantly lower than 12% in 2017 due to the sharp increase in revenue. Although the total R&D investment of BYD company is similar to that of Tesla Company, the R&D investment of BYD company is largely dependent on government subsidies, and the ratio of R&D to revenue of BYD company is obviously lower than Tesla Company.

5. Problems Existing in R&D Investment of New Energy Companies

According to the above experience and lessons of promoting R&D investment of

Table 3. Government subsidy amount of BYD from 2014 to 2018.

	2014	2015	2016	2017	2018
Government subsidies (RMB 100 million)	8.0	5.8	7.1	12.7	19.8

Source: Wind Database.

new energy companies at home and abroad, especially in the management situation of BYD company's R&D investment, the following problems are summed up, which also has certain inspiration for other new energy companies.

5.1. Government Subsidies Have No Obvious Impact on R&D Investment of the Company

Since the 1990s, developing new energy industries and vigorously promoting low-carbon economy have become the consensus of economic development in all countries around the world. Government subsidies are a common incentive to encourage the development of new energy industries. China has listed the new energy industry as one of the seven strategic emerging industries, and the government has also given a large number of subsidies to support the development of the new energy industry (Gu, 2020). For example, in 2020, the governments of Guangzhou, Wuhan and other places will give qualified new energy vehicles an annual comprehensive subsidy of 10,000 Yuan.

Government subsidies can have a negative impact on R&D investment by new energy companies. According to the crowding out effect, government investment occupies the space of private investment, so that the positive effect of government investment on national income growth is offset by the decrease of private investment. Although government subsidies are growing, they hinder new energy companies from absorbing external capital and consumers from buying new energy products. In addition, the government subsidy itself is a kind of non-operating income, easy to make the development of new energy companies overly dependent on government subsidies, resulting in slow innovation speed, lax internal management and other problems, thus reducing the production efficiency of enterprises, leading to enterprise research and development investment is difficult to implement.

5.2. The Company's R&D Investment Ignoring Consumer Demand

At present, China's new energy industry is gradually transitioning from high-speed development stage to high-quality development stage, but China's new energy companies are still in the exploratory stage of high-quality development, there are still blind expansion of enterprise scale, ignore the phenomenon of economic benefits. Monopolistic new energy companies, in the name of national policy and with strong capital power, occupy the domestic market from the coast to the interior, rather than really producing new energy products that meet the needs of the public and focus on high-quality development. New energy compa-

nies, represented by scenery, pay more attention to whether the product is environmentally friendly and safe. For this reason, they invest a lot of money and develop products with high prices, which cannot meet the requirements of the market for good quality and low price. Another typical case is the new energy vehicles, although new energy electric vehicle power battery from 17 years of less than 1000 yuan for 1800 yuan to 20 years, but the new energy vehicles of the core components related research and development ability and battery charging range, convenience problem has been the development of China's new energy automobile enterprise pain points, the latter is questioned by the consumers. Although the market of new energy vehicles looks hot, it will be difficult for new energy vehicles to achieve independent development if they do not really solve the pain points of consumers.

5.3. The Unreasonable Structure of the Company's R&D Investment

From the perspective of the structure of R&D activities, China is more inclined to experimental development, and the proportion of expenditure on basic research and applied research is seriously low, while the proportion of basic research and applied research in developed countries is generally over 20%. In 2021, basic research and applied research accounted for just over 6% of the total R&D investment of Chinese enterprises, while experimental development accounted for about 93% of the total R&D investment, indicating that China has not established itself as an innovative country. Due to the late start of new energy development, Chinese new energy companies are more likely to adopt the development mode of technological catch-up, mainly to learn and imitate foreign advanced new energy technologies, while the investment in independent research and development is at a low level.

6. Countermeasures for New Energy Companies to Strengthen R&D Investment Management

6.1. The Government Shall Improve the Management of Subsidies for New Energy Companies

On the one hand, the overall development of China's new energy industry is not mature and its economic benefits are low, so it cannot attract a large amount of social capital. Therefore, government subsidies are needed to make up for the early-stage R&D expenditure, so as to promote the technological progress of the new energy industry and improve the R&D capability of new energy core technologies. On the other hand, the government supports the R&D investment of new energy companies mainly through the establishment of special financial funds to achieve. Such a completely dependent administrative allocation makes limited funds unable to be allocated to competitive enterprises, and also faces great risks of corruption. In view of the above problems, the Chinese government should adopt a combination of fiscal subsidies, tax incentives and govern-

ment procurement to formulate a reasonable subsidy scheme, improving the subsidy standard of new energy companies and appropriately reduce the total subsidy amount. It is worth noting that the amount of government subsidies should not fall too fast, and the subsidy of more than 10,000 yuan for each new energy vehicle should be maintained for at least two years.

6.2. New Energy Companies Shall Strengthen Cooperation with Financial Markets to Raise Funds at Low Cost

New energy companies must continue to invest a lot of money in the initial stage of research and development, but only relying on national financial subsidies can not meet the needs of long-term research and development investment. If new energy companies want to attract foreign capital extensively, they should first improve the company's internal technology research and development system, lay a solid foundation for technological innovation, reducing the company's product cost and improve the company's profitability. Next, we should actively cooperate with banks, securities, insurance and other financial institutions to establish a financial information sharing platform, building a risk prevention and control mechanism, and closely combine R&D investment, social capital and risk prevention and control.

6.3. New Energy Companies Shall Strengthen Financial Management and Improve Capital Use Efficiency

New energy companies should put financial accounting in the first place, establishing an information system based on financial accounting and implementing effective control of the company's various businesses. Also, they provide comprehensive and accurate financial analysis, reasonably plan the raising and use of limited funds, and finally achieve fine financial management. Specifically, the company should take a comprehensive inventory of fixed assets at least twice a year and review the income and expenditure of funds regularly every month. For the use of funds, take special funds for special use, try to get the right to use machines and equipment by leasing, rather than directly buying machines, so as to reduce manufacturing costs. It is necessary to establish and perfect personnel training and incentive mechanism and mobilize the enthusiasm of financial personnel.

6.4. New Energy Companies Shall Strengthen Cooperation with Scientific Research Institutes and Concentrate Resources on Innovation

New energy companies often encounter difficulties or even stagnate in the research of new energy core technologies due to financial constraints and limited scientific research capacity. To solve these difficulties, more capital needs to be invested, which will lead to higher costs and lower economic efficiency. Therefore, new energy companies should strengthen cooperation with national scientific research institutions and university academic institutions in research and

development, and jointly solve the core problems in new energy technology. New energy companies to provide funds, scientific research institutions to provide equipment and technology, institutions of higher learning to provide excellent talents, the three clear division of labor, complementary advantages, can better accelerate the new energy core technology research and development, so as to reduce the cost of new energy products, improve the market competitiveness of new energy companies.

7. Conclusion

The increase of R&D investment is the source of scientific and technological innovation. The scale and effect of R&D investment directly affect the independent innovation ability and competitiveness of new energy companies. Under the new situation of fierce competition in science and technology and complex and changeable economic environment, China's energy structure transformation is in the most critical period. As an important force to promote China's energy reform, new energy companies must establish the spirit of innovation, improve the intensity of research and development investment, and cultivate independent innovation ability. In addition, the government also needs to guide new energy companies to actively carry out international exchanges and cooperation, and strive to create conditions for cooperation with overseas research teams. On the basis of learning from overseas experience, we will deepen basic scientific research, cultivate high-quality innovative talents, and take the road of independent research and development. The deficiency of this paper is that the author cannot further study the structure and proportion of R&D investment in the industry temporarily because some new energy companies have not disclosed the relevant data of R&D investment, and a few new energy companies are not listed yet.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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