

Seize the Opportunity of a New Round of Kangbo Cycle to Build Guangdong's New Energy Automobile Industry

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Abstract: Based on the theory of Kang Bo cycle, based on the long-term observation of the new energy automotive industry of guangdong province and the survey data, from the aspects of economy, science and technology innovation, double carbon strategy as well as the contribution to the international trade and so on four aspects this paper expounds the construction of the importance of new energy vehicles industry in guangdong, lists the problems and difficulties of industrial development, Some solutions and suggestions for future research are put forward.

Keywords: kangbo period; new energy automobile; transformation and upgrading

1. Forward

With the progress of science and technology, economic development has a certain periodicity. As early as in the Communist Manifesto, Marx pointed out the great role of technological innovation in promoting economic development. From 1922 to 1925, Nikolai D. Kondratiev, an economist of the former Soviet Union, found through the analysis and empirical research on the economic data of Britain, France, the United States, Germany and other European and American countries that there were long-term fluctuations with an average length of 50 years in the economic development process of European and American developed countries. Academics named this cyclical fluctuation "Kondratiev Cycle", or "Kangbo Cycle" for short. Joseph Alois Schumpeter, an Austrian economist, further put forward the "long wave theory of technological innovation" (1939) on the basis of the "Kangbo cycle", revealing the attributes of technological innovation in the long cycle fluctuations of the economy. He believed that technological innovation was the root of the long wave rise, and the diffusion of technology between different regions had an important impact on the long wave synergy between regions.

From the First Industrial Revolution, the four Kangbo cycles experienced by the capitalist era basically coincided with the development process of the four industrial revolutions. The long-term fluctuations of the economy were dominated by technological innovation, and were also deeply affected by the economic cycle: when a large number of technological innovation achievements spilled over and spread to the economic system, the market flourished and capital expanded. When the market was satisfied with capital proliferation and ignored innovation, the foam burst and the economy declined, Circulate until entering the next "Kangbo cycle" (Li Wan [1] 2020). In the previous rounds of "Kangbo cycle", European and American capital host countries seized the historical opportunities and continued to rise. At the critical historical stage of the current fourth "Kangbo cycle" entering the fifth "Kangbo cycle", disruptive technologies and disruptive innovations emerge in endlessly

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(Hu Zhihao, Song Guokai [2], 2019). Although China is facing problems such as insufficient economic growth momentum and huge pressure on social structure adjustment, We will still firmly seize the favorable opportunity of the transition from the industrial age to the information age, and strive to create new opportunities for the development of the new era. As the leading area and front position of China's reform and opening up, Guangdong should play a greater role in the journey of the new era, take the lead in promoting industrial transformation and upgrading with scientific and technological innovation, provide continuous power for sustained and stable economic growth, and strive to draw a picture of Guangdong in the new era of high-quality development.

2. Importance of building new energy automobile industry in Guangdong

Although there is no final conclusion on the field of technological innovation and development trend to promote a new round of "Kangbo cycle", "green and low-carbon" has become the basic consensus of all mankind on building a community with a shared future for mankind in the new era. With the "double carbon" goal solemnly announced by China to the world in September 2020, "green science and technology" and "green economy" have become important hands of governments at all levels from the central to local levels. In the face of important historical opportunities, Guangdong Province should also actively adjust its industrial planning and formulate medium - and long-term development strategies. Among the existing advantageous industries and emerging industries, the new energy automobile industry is expected to play an important role in helping Guangdong continue to maintain its leading position in the scientific, technological and economic fields.

2.1. Economic significance of new energy vehicle industry

The new energy vehicle industry is expected to catch up with real estate and become a new pillar of the national economy (Fang Jianhua [3], 2022). According to statistics, China's vehicle manufacturing industry will account for 7.92% of GDP in 2020, which is 7.34% higher than that of real estate. With the promotion of the "dual carbon" goal, new energy vehicles will become the main part of the automobile manufacturing industry. Due to the longer industrial chain of new energy vehicles and the linkage with photovoltaic, energy storage and other industries, they will create greater market value. In 2021, China will sell 3.521 million new energy vehicles, ranking first in the world for seven consecutive years(Wu zheng, Liu jinzhou & Wu xiqing [4], 2022). It is estimated that by 2025, the number of new energy vehicles in China will reach 39.4 million, and the market size will reach more than 5 trillion. Its supporting industries, such as charging piles and new energy power generation, will all have a market size of trillion (Peng Hua [5], 2019).

The new energy vehicle industry has a huge multiplier effect on economic development. It is estimated that when the government's expenditure on the new energy vehicle industry increases by 1 million yuan (RMB), the national income will increase by 5 million yuan (RMB) (Gao xiuping [6], 2018). A study by the Development Research Center of the State Council shows that one unit of output of the vehicle industry can drive the overall increase of 10 units in all sectors of the national economy. This huge multiplier effect cannot be replaced by any other industry.

The new energy vehicle industry is expected to become a new growth point to increase government revenue. Although the direct contribution of the new energy vehicle industry to government revenue is not significant globally, for example, Tesla's state tax bill in the United States in 2021 will be only \$9 million, and the federal tax bill will be zero. However, in terms of personal income tax, Tesla's "leader" Mask will pay \$11 billion in taxes for the United States federal government. BYD, the leading enterprise of new energy vehicles in Guangdong Province, will pay a total tax of 3.035 billion yuan in 2021, which is far lower than the 5.867 billion yuan of financial subsidies at all levels that it received that year, but its contribution to government finance in other aspects cannot be underestimated. It is believed that after the industry matures in the future, the new energy automobile industry will inevitably become a stable tax source of government revenue.

2.2. Scientific and technological innovation significance of new energy vehicle industry

The new energy vehicle industry is a typical technology intensive and capital intensive industry, which has an extremely important positive effect on scientific and technological innovation in the new era, and can greatly

offset the crowding out effect and negative effect on scientific and technological innovation during the recession of traditional industries such as real estate. The new energy vehicle industry has a distinctive feature of joint development with high-end manufacturing, new materials, big data, artificial intelligence and other emerging technologies, which can inject new momentum into improving the overall efficiency of the innovation chain and strengthening the real economy. The new mode and new business form surrounding the development of new energy vehicle industry will also promote the innovation of business model, and further promote profound changes in vehicle product form, industrial chain ecology, transportation mode, energy consumption structure and other fields.

Guangdong's new energy vehicle industry has begun to take shape, and its scientific and technological innovation ability is among the best. By the end of 2021, there are 42300 new energy vehicle related enterprises in the province (400000 in China), and the number of new energy vehicle patents obtained is nearly 12000, ranking second in the provincial administrative region. As the leading enterprise of domestic new energy vehicles, BYD has ranked first in the innovation list of China's new energy vehicle enterprises with 9426 patents by June 2021, surpassing the sum of the second and third places. BYD's technology transformation capability is even more outstanding. It has realized the commercialization of core technologies in the fields of new energy vehicle architecture platform, blade battery and management module, Internet of Vehicles system, etc. Relevant models continue to sell well, ranking first in the sales volume of domestic new energy vehicles all the year round. The development of the new energy vehicle industry in Guangdong is conducive to fully mobilizing the advantages of the Guangdong-Hong Kong-Macao Greater Bay Area in terms of industrial foundation, financial center, human resources, scientific and technological research and development, becoming an important force to promote innovation in other industries, and making great strides towards the goal of building an industrial scientific and technological innovation center with global influence, an advanced manufacturing base with international competitiveness, and a two-way open hub with world cohesion.

2.3. The new energy vehicle industry is an important hand to realize the "double carbon" strategy

In the process of historical development, the automobile revolution has always been accompanied by the energy revolution. At present, China and even the world are facing the third energy revolution in the transition from fossil energy to renewable energy. The global energy structure is making great strides towards green and low-carbon. The electrification of the automobile industry is complementary to the development of clean energy technologies such as wind, light, tidal power generation, nuclear energy comprehensive utilization and hydrogen energy development. It is predicted that with the increase of renewable energy power generation, the carbon emissions per unit mileage of pure electric passenger vehicles will be reduced to 20g/km in 2035, more than 70% lower than that in 2021. In 2035, new energy vehicles will reduce carbon emissions in road traffic by about 200 million tons, with significant carbon reduction benefits. The development of new energy vehicles will help to achieve the goal of carbon peak and carbon neutral as soon as possible.

2.4. Contribution of new energy vehicle industry to international trade

The automobile industry occupies an important position in international trade. According to McKinsey's calculation, the total market size of the global automobile industry is expected to increase to about 6700 trillion US dollars by 2030 (Mc Kinsey [7], 2021). China's new energy automobile industry has obvious advantages of backwardness and huge export potential. From the perspective of the rise and fall cycles of major countries in the world in history, the automobile industry is the most critical factor determining whether a country or region can have core competitiveness in traditional manufacturing. As a major foreign trade province, Guangdong Province can continue to maintain its leading position in reform and opening up only by creating more internationally competitive commodities.

At present, China has become the world's largest consumer market for electric vehicles. The cumulative sales of electric passenger vehicles account for 45% of the global total, and the sales of electric buses and electric trucks account for more than 90% of the global total; China has built more public charging piles than the United States, Europe and Japan combined; With leading mass production power battery technology, China is the most

active region in the innovation of electric travel business model worldwide. In the process of global automobile electrification, China took the lead in taking an important step, occupying the first mover advantage, and greatly enhancing the confidence of enterprises and the nation.

To sum up, the scientific and technological innovation of the current new energy automobile industry is more significant than its economic significance, but it has obvious supporting effect on economic development and huge potential. Vigorously cultivating and developing the new energy automobile industry can make it a new growth point of Guangdong's economy and drive the development and upgrading of its related industries.

3. Importance of building new energy automobile industry in Guangdong

3.1. Industrial guidelines need to keep pace with the times

Although as early as June 2018, the People's Government of Guangdong Province released the Opinions on Accelerating the Innovative Development of the New Energy Vehicle Industry [8], which laid out the new energy vehicle industry earlier, the main target set at that time was 2018–2020, which could not adapt to the new situation. Especially in November 2020, the General Office of the State Council issued the New Energy Vehicle Industry Development Plan (2021–2035) [9], outlining a new blueprint for the development of the next generation of new energy vehicle industry. In order to further seize the commanding heights of a new round of industrial reform and cultivate new driving forces for economic development, local governments are accelerating the layout, strengthening the guidance and support of corresponding policies, and actively promoting the promotion and application of the next generation of new energy vehicles and the construction of an industrial ecosystem. In February 2021, the Shanghai Municipal Government issued the Implementation Plan of Shanghai to Accelerate the Development of the New Energy Vehicle Industry (2021–2025) [10]. In November 2021, the Jiangsu Provincial Government issued the "Fourteenth Five Year Plan" for the Development of the New Energy Vehicle Industry in Jiangsu Province [11]. The latest in Guangdong Province is only December 2021. The Guangzhou Municipal Development and Reform Commission issued the "Fourteenth Five Year Plan" for the Innovative Development of Intelligent and New Energy Vehicles in Guangzhou [12], lacking top-level design, it will directly restrict the future development of the new energy vehicle industry in Guangdong Province. Guangdong urgently needs to formulate the new energy vehicle industry plan according to the new national industrial plan and the actual situation of the province.

3.2. The industry is large but not strong, and the development encounters bottlenecks

The new energy vehicle industry in Guangdong Province is large in scale and growing rapidly. In 2021, the new energy vehicle production will reach 535400 units, the sales volume will reach 414000 units, and the production and sales volume will reach a new record high. However, from a nationwide perspective, the advantages are not obvious. After entering 2020, the new energy vehicle industry in the Guangdong Hong Kong Macao Bay Area will encounter bottlenecks in terms of technical level and promotion and application, and the growth rate will slow down. In that year, it was surpassed by Shanghai for the first time, in the same year, the output of new energy vehicles in neighboring Guangxi achieved nearly twice the year-on-year growth rate, and the output is close to that of Guangdong. In 2021, the output of new energy vehicles in Liuzhou, Guangxi alone will reach 482000, approaching the output of new energy vehicles in Guangdong Province.

In addition, the new energy vehicle industry in Guangdong Province mainly focuses on the production of hybrid and pure electric vehicles, lacking in energy types, and the field of hydrogen fuel cell vehicles is basically blank. In November 2020, the Guangdong Provincial Government issued the "Implementation Plan for Accelerating the Development of the Hydrogen Fuel Cell Vehicle Industry in Guangdong Province", and began to actively explore the development of hydrogen energy. However, on the whole, policies and practices have lagged behind other provinces. The lagging development of Guangdong in the field of hydrogen fuel cell vehicles is inconsistent with its position as a strong province of new energy vehicles. In recent years, Guangdong has vigorously promoted hydrogen fuel cell vehicles. By the end of 2020, 2450 hydrogen fuel cell vehicles had been connected, ranking first in the provincial administrative region, but all of them were purchased outside the province, with obvious disadvantages in the field of hydrogen fuel cell vehicles. As a major energy consumption province,

Guangdong's fossil energy is completely dependent on imports. The energy required for electric vehicle charging is still unable to meet the "double carbon" goal. The hydrogen energy industry will be an important breakthrough to improve the energy structure.

Guangdong's new energy vehicle industry products lack international competitiveness, and even lack competitive advantages in Hong Kong and Macao, which belong to the Greater Bay Area. From January to July 2022, Tesla Motors sold 4125 vehicles in Hong Kong, accounting for more than 80% of the sales volume of pure electric vehicles in Hong Kong in the same period. It is the highest selling passenger car brand in Hong Kong.

3.3. Insufficient power supply under the target of "double carbon"

At present, new energy vehicles mainly use electric energy as the power source, and a few of them use clean energy such as solar energy. Compared with the gasoline, diesel and natural gas used by traditional vehicles, new energy vehicles do not consume any fossil energy and produce any harmful exhaust gas in the use process. They can completely achieve zero carbon dioxide emissions, which is an important way to achieve the goal of carbon neutrality. However, new energy vehicles, especially pure electric vehicles, need sufficient power supply to achieve the corresponding functions. In contrast, the power supply structure of Guangdong is relatively stable. From the perspective of energy structure, the proportion of coal power in Guangdong is about 45%, the proportion of power transmission from the west to the east is about 30%, and the proportion of gas and electricity is about 20%, followed by nuclear power, wind and other new energy. Coal and natural gas power generation accounts for about 65% in total, and traditional fossil energy power generation is still the main power source in Guangdong (Liu qian [13], 2021). Guangdong's power supply is excessively dependent on fossil energy, and it is precisely lack of such energy. For users, mileage anxiety and charging anxiety are one of the important factors affecting the purchase and use of new energy vehicles. In August 2022, new energy vehicles in Sichuan will face problems such as difficulty in charging due to the temporary shortage of power supply, which has flooded the front pages of various media. Guangdong also experienced power rationing in 2021. The problem of power supply will become a bottleneck in the development of Guangdong's new energy industry in the future.

4. Guided by new energy vehicles, build an innovative ecological Guangdong paradigm

4.1. Do a good job in top-level design and formulate medium and long-term industrial planning

Guangdong should follow the national development strategy in the new energy automobile industry, actively play its own advantages, aim at the domestic first-class and international leading development goals, do a good job in top-level design, and formulate medium and long-term industrial planning as soon as possible. We should follow the law of the development of emerging industries, handle the relationship between the government and the market, accelerate the transformation of government functions, and focus on setting strategic guidelines, creating a good policy environment, and improving service quality. Give full play to the guiding role of industrial policies, give full play to the incentive effect of fiscal policies, adhere to multi sectoral cooperation, properly handle the coordination problems in the process of industrial development, promote the integrated allocation of projects, bases, talents and funds, innovate the management mechanism of horizontal coordination and vertical integration, and all departments work together to promote the formulation of macro strategies and top-level design at multiple levels of industry, science and technology, finance and taxation, infrastructure, transportation, energy, etc. Solve major problems and bottlenecks in the development process through inter-ministerial joint meetings and other systems, coordinate relevant departments, formulate departmental plans and supporting policies and measures according to the division of functions, pay attention to the goal of coordination with related departments, urge grass-roots governments to actively implement, and form a strong support at the specific implementation level.

4.2. Make up for weaknesses and improve industrial structure

To develop the new energy automobile industry in Guangdong, it is necessary to face the major strategic needs, implement the policy of "unveiling the list and taking the lead", comprehensively promote the innovation and upgrading of upstream and downstream industries, and promote the reconstruction of industrial ecology

through the transformation of the new energy automobile industry chain and supply chain into a network system covering automobile, transportation, energy, communication, Internet and travel.

In terms of energy, we will vigorously promote structural adjustment, strengthen the construction of clean energy and power infrastructure, continue to increase the construction of nuclear, solar, wind, tidal and other clean energy power stations, and strive to constantly improve the energy structure of Guangdong Province while developing the new energy automobile industry.

It is necessary to strengthen the construction of the technological innovation system of the hydrogen energy industry. Guided by the National Medium and Long term Plan for the Development of the Hydrogen Energy Industry (2021–2035), we should actively play the key role of hydrogen energy in hydrogen fuel cell vehicles and electricity peak shaving, encourage and support relevant enterprises to carry out research and development of hydrogen fuel cell vehicles, wind and solar power + hydrogen energy storage technology innovation, hydrogen power generation and construction of hydrogen energy storage power stations, and form a hydrogen electric vehicle industry chain.

4.3. Science and technology lead innovation

Actively implement the strategic deployment of the national "three vertical and three horizontal" technology system to support the scientific and technological innovation of new energy vehicles, and further increase support for the scientific and technological innovation of new energy vehicles along the development direction of electrification, intelligence and networking.

Actively cultivate and introduce high-tech talents, support provincial colleges and universities to strengthen the construction of relevant disciplines in the field of new energy vehicles and key parts, establish a stable and long-term talent training mechanism, attract outstanding scientific and technological talents at home and abroad through policies, and establish a sound human resources guarantee mechanism to retain talents.

Integrate the scientific research advantages of the Greater Bay Area of Guangdong, Hong Kong and Macao, increase support for basic research, promote the transformation and application of basic research achievements in the technical research field of the new energy automobile industry, reduce the marginal cost of enterprise research and development, and increase the enthusiasm of enterprise research and development investment. Give full play to the government's guiding and coordinating role in the R&D process of the new energy vehicle industry, and promote the transformation of research achievements of universities and research institutes into the production field.

The government will make overall plans to support enterprises to tackle key common technologies such as batteries, chips, the Internet of Things, and control systems through integration of production and education, international exchanges, etc., and actively build scientific and technological innovation platforms such as new energy vehicle technology innovation centers to provide support for the research and development of common key technologies in the industry, and establish an independent and controllable intelligent supply chain system.

4.4. Give full play to the financial advantages of Guangdong Hong Kong Macao Greater Bay Area and build a new energy vehicle supply chain financial system

Guangdong should give full play to the regional advantages of Hong Kong Shenzhen financial center. On the one hand, it should take multiple measures to introduce foreign capital and tap its own financial potential to expand the financing channels and scale of the new energy automobile industry. On the other hand, it should guide and encourage angel funds, venture capital, incubation funds, etc. to extend to the early stage of technology research and development, and improve the efficiency and income of scientific and technological innovation resource allocation.

We should start with the establishment of a new energy vehicle financial security system, guide banks and non-bank financial institutions to provide financing security for each stage of the new energy vehicle supply chain through the construction of the supply chain financial system, and improve the overall efficiency of the entire new energy vehicle industry.

4.5. Cultivate a leading enterprise of world-class new energy vehicles

Encourage and support ecological leading enterprises to become bigger and stronger. In key areas such as vehicle manufacturing, power batteries, core chips, operating systems, and charging facilities, support leading backbone enterprises to gather high-end production and innovation elements, take the lead in building a sound industrial ecology covering applications, standards, testing, safety, services, etc., form an industrial cluster network led by core enterprises, and gradually build a leading enterprise with global competitive advantages.

Focusing on the supporting industry of new energy vehicles, we will cultivate a number of specialized, special and new "unicorn" enterprises with strong innovation ability and excellent quality and efficiency, vigorously promote the improvement of core basic parts and components, basic software, advanced basic processes, key basic materials, and industrial technology fields, and form a number of specialized, special and new enterprises with "unique skills".

Innovate the market environment, actively play the guiding role of policies and finance, create a strong atmosphere of technological innovation competition, force new energy automobile enterprises to obtain and consolidate their market competitive advantage by continuous innovation, accelerate the technological progress of the whole industry, and lay a material and technological foundation for the sustainable and leading development of the new energy industry.

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The authors declare no conflict of interest.

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