The Opportunities and Challenges of Carbon Neutrality to China's Macro-Economy

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Abstract: Chinese President Xi Jinping announced that China will achieve a carbon peak by 2030 and carbon neutrality by 2060. In the past two years, China has successively published the work plan and roadmap for carbon peak and carbon neutrality and continued to push this target forward. This paper reviews the impact and challenges of carbon neutrality on China's macro economy.

Keywords*:* Carbon Neutrality; China's Macro-Economy; Opportunities and Challenges

Introduction

China is the world's largest energy consumer and greenhouse gas emitter and it has a long way to go to achieve rapid emission reduction while maintaining sustained economic and social development.

China needs to make breakthroughs in four aspects to achieve carbon neutrality: 1) adjusting the energy structure; 2) enhancing the carbon sinks; 3) developing key technology paths; 4) Promoting the development of carbon trading markets.

1. The opportunities

1.1 Additional investment

China's low-carbon commitment represented that the carbon-neutral target has become a new driving force for the country's inbound and outbound investment). China's move to carbon neutrality over the next three decades may require an additional investment of several trillion yuan, which will promote the growth of domestic demand.

China's carbon-neutral investments will be in four industrial chains: 1) the industrial sector; 2) the energy sector; 3) the construction sector.

1.1.1 Industry

There are two main aspects to achieving carbon neutrality in industrial sectors. Firstly, using electrification, low-carbon energy, and low-carbon raw materials can give assistance to the transformation of current industrial processes; secondly, developing products for a circular economy can help companies reap more value from the energy and resources they use. Energy efficiency improvement is an important measure for deep carbon reduction in the steel industry. From the perspective of technology maturity and carbon reduction, efficient electric furnace steelmaking, and hydrogen-rich steelmaking are the main methods to improve the energy efficiency of steel mills, and the future investment scale will reach one trillion (Yang et al., 2021).

1.1.2 Hydrogen energy

Hydrogen energy is one of the clean energy sources with the most potential for development in the world. It can replace some traditional energy sources and it is mainly applied in the upstream and downstream industries of fuel cells. The electrochemical energy storage market also ushered in a high growth stage; the global lithium battery demand is expected to reach 1187GWh in 2025. The scale of the upstream and downstream industries of hydrogen fuel vehicles is at the level of ten trillion, and its comprehensive replacement of fossil fuels can lead to a reduction of 500 million tons of carbon dioxide per year (Alvera, 2021).

1.1.3 Building

Compared with traditional buildings, prefabricated buildings have the advantage of saving water, energy, land, and materials (Li Xin, 2020). Moreover, the carbon emission per unit area of prefabricated housing is 8-22 kg CO2 lower than traditional buildings. The 13th Five-Year Action Plan for Prefabricated Buildings published by the Ministry of Housing and Urban-Rural Development of the Peoples of China pointed out that prefabricated buildings will account for 30 percent of new buildings nationwide by 2025, and the investment scale will reach 2 trillion yuan.

1.2 Increasing Employment

A study of the impact of climate and energy policy pathways on global energy system jobs represented that climate targets will lead to more than 8 million energy jobs by 2050 under a 2 ° C temperature rise scenario (Sandeep et al., 2021). Under the “dual-carbon” goal, job opportunities would grow in low-carbon manufacturing, carbon finance, and carbon management. According to the report on talent attraction, a career social software company in China, new energy power generation, new energy vehicles, and intelligent manufacturing are the three industries with the fastest job growth in 2021.

In addition to low-carbon manufacturing, the carbon finance sector will also provide a large number of job opportunities under the "dual-carbon" target. China’s pilot carbon emissions trading programs were launched in 2013, and related industries such as CCER intermediary trading, carbon quota trading, international carbon sink trading, carbon inventory and verification, and green finance will provide more jobs after the “dual-carbon” target.

Carbon management encompasses a wide range of processes involved in the management of emissions. With the continuous promotion of China's “dual-carbon” target, more and more companies have been realizing the importance of carbon management and starting to recruit carbon monitoring positions. Correspondingly, the government and financial investment institutions also need to verify the carbon emissions of enterprises. Therefore, the carbon management industry will also provide a large number of employment opportunities in China's dual carbon process.

1.3 Innovation in low-carbon technology

Low-carbon technology (LCT) innovation is the key pathway to transforming the production pattern of manufacturing into green production (Rui et al., 2021). China accounted for 15.9% of global import volume, ahead of the United States (13.2%) and Germany (6.9%) in 2016. Meanwhile, China's low-carbon technology exports account for 16.8% of the world's total (The World Bank, 2020). The development of low-carbon technology has two advantages: on the one hand, it can promote the green transformation of industry and promote China's sustainable development; on the other hand, it can reduce the cost of inflation.

The scientific and technological innovation of the high-quality development of "double carbon enterprises" mainly focuses on hard and soft technology. Hard technology refers to the improvement of production technology, upgrading of production equipment, and innovation of production mode. Soft technology refers to the improvement of carbon emission

monitoring capacity, including information statistics, monitoring, and controlling capacities.

Technological progress reduces the risk of inflation as well. Over the past decade, technological advances in photovoltaic and wind power equipment have reduced costs by 80%, and there is still plenty of room for the future. If other new energy sources such as hydrogen energy and offshore wind gain huge technological breakthroughs, the overall costs of energy could fall dramatically and continuously.

2. The challenges

Compared with the developed countries using more than 60 years from Carbon Peak to carbon neutrality, China will achieve carbon neutrality with tight deadlines. China needs to achieve carbon reduction in energy structure and urbanization while ensuring rapid development only half the time in developed countries. Various plans and policies of carbon neutrality are continuing to advance with the firm will of the Chinese government. However, major challenges remain in its impact on economic growth in the short term and its core technologies.

2.1 The impact of carbon emission constraints on economic growth

Dual-carbon targets may have a great effect on boosting economic growth as "reform". However, various production factors cannot have significant expansions under the rigid constraint of the carbon emission allowance, and otherwise, it will run counter to the goal of continuous carbon emission reduction. In short, economic growth and carbon reduction targets are at odds in the short term. The negative effect of transforming processes, such as high-carbon factory closure, and laborers from the high-carbon industry out of work.

In addition, policies of carbon neutrality may have a negative impact on investment in energy-intensive industries. To be specific, the policy may lead to no new production capacity in energy-intensive industries but only technological reform of existing capacity, which may lead to a 15% reduction in manufacturing investment. If strict carbon-neutral restrictions are applied only to the 20 high-energy industries in the top 11 provinces with energy consumption per unit of GDP higher than the national average, the reduction in manufacturing investment would be reduced by 1.5% (Yu Zhang and Yinbo Lu, 2021). For regions where the whole economy mainly depends on carbon, such as Shanxi, the proportion of economic sectors directly related to coal reaches 60%. If these regions unilaterally emphasize the development of low-carbon industries and cut down on high-carbon industries, it may bring dual problems to the local economy and employment. Thus, for the formulation of carbon neutrality targets in provinces with high carbon intensity, regional positioning should be fully considered, and specific paths, phased key tasks, and major measures to achieve carbon peaking and carbon neutrality should be scientifically and reasonably defined based on the actual situation and the law of social and economic development of the provinces (Dongxu Sun, 2021).

Different provinces in China have different implementations of the carbon peaking target. Only one-third of the provinces set a specific time for carbon peaking or specified emission reduction targets and paths in the 14th Five-Year Plan (Table 1). The provinces with high-carbon-emissions industries will likely find the transition more difficult. But the transition in some coal-rich provinces is also complicated by the fact that municipal and other governments are still adding coal capacity. It is difficult for local coal in Shaanxi, Shanxi and Inner Mongolia, which are big coal-producing provinces, to have funds to support the technological changes needed for low-carbon transformation. Therefore, the local coal transformations will rely more on the financial support of local governments, which will put increasing financial pressure on local governments and affect their economic society and people's livelihood.

2.2 Lack of core carbon neutral technologies

The lack of core technologies is also a crucial challenge for China to achieve carbon neutrality. Although China has a

certain market and competitive advantage in wind power, solar photovoltaic, and other fields, the production technology of core components such as bearings and converters has not overcome the difficulties. Moreover, China lags far behind developed countries in forward-looking technologies such as high-performance battery materials, battery standards and production, hydrogen power and biofuels, and green shipping.

3. Conclusion

Achieving the dual carbon goal will be hugely transformative for China over the next 40 years, and in general, the opportunities outweigh the challenges. China's macroeconomic challenges in achieving carbon neutrality are reflected in its overall understanding of it and the implementation of the policy regime, as well as the technological and investment uncertainties it creates.

References

[1] Zhu L, Yong G, Lindner S, et al. Uncovering China's greenhouse gas emission from regional and sectoral perspectives[J]. Energy, 2012, 45(1):1059-1068.

[2] Saunois M, Stavert AR, Poulter B, et al. The Global Methane Budget 2000–2017[J]. Earth System Science Data, 2020, 12(3):1561-1623.

[3] Wang Y, Guo CH, Chen XJ, et al. Carbon peak and carbon neutrality in China: Goals, implementation path and prospects[J]. Geology of China, 2021, 4(4):27.

[4] Yan C, Xiaofeng Q, Lingxin K, et al. Green Manufacturing: Looking at carbon emission reduction path from green premium.

[5] Qi BK, Zhu Y, Ma B, et al. Research on comprehensive benefits analysis method of prefabricated building [J]. Construction Technology, 2016, 45(4):5.

[6] Xie WJ, Li XJ, Yang T, et al. Research on Carbon emission estimation of prefabricated buildings during construction [J]. Journal of Engineering Management, 2022, 36(3):6.