ISSN: 2710-0170

Effects of Climate Change on Future Chinese Economic

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Abstract

This article explains the future development direction of China's manufacturing industry under the current global climate change and the importance of environmental protection technology to economic development, with a focus on the metallurgical industry.

Keywords

Climate Change; China's Manufacturing Industry; Environmental Protection Technology; Metallurgical Industry; Economic Development.

1. Background of Carbon Reduction Policies

1.1. Global Climate Change Caused by Carbon Emissions has Seriously Threatened the Economy and Production Security

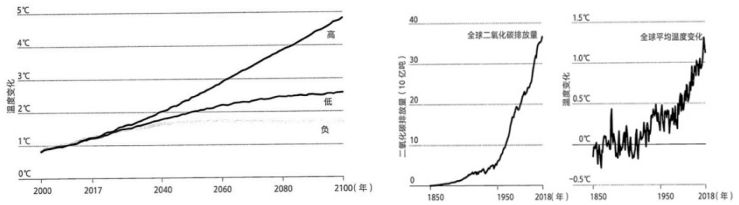

Fig 1. Global temperature change and CO2 emission

The threat posed by global climate change to human survival is becoming increasingly impossible to ignore. From 1850 to 2020, the earth's average temperature rose by 1.2 degrees, as Figure 1 indicates. In recent years, extreme weather events have been occurring all over the world, and if global warming is not brought under control, it will be self-destructive. A growing body of research suggests that the safe line for future temperature targets is no more than 2 degrees, or, more safely, no more than 1.5 degrees, which is basically what the world agreed to in the 2015 Paris Agreement. Therefore, China's commitment to achieving the goal of carbon peak by 2030 and carbon neutral by 2060 is not only a requirement of climate compliance but also an international obligation of a responsible major country.

1.2. The Negative Impact of Global Climate Change on China's Economy cannot be Underestimated

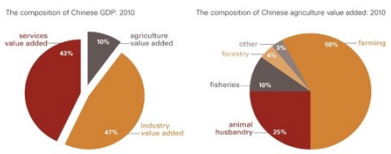

Fig 2. The composition of Chinese GDP in 2010 (Source: Australian Government Department of Foreign Affairs and Trade)

ISSN: 2710-0170

Although agriculture did not account for a large share of China's GDP in 2010, it accounted for many jobs. Due to its special production nature, agriculture is very dependent on the environment and climate stability and has become the industry most affected by climate change in recent years among the three major industries. When agricultural production is affected by climate change caused by excessive carbon emissions, it will directly lead to a surge in China's unemployment rate, followed by stagflation due to the rising unemployment rate, and the ensuing economic depression will have an incomparable impact on China's economy than any other economic crisis.

As shown in Figure 2, animal husbandry and agriculture account for a large proportion of China's GDP. When global warming becomes more and more serious, its impact on China's economy will be devastating.

1.3. China has Made Positive Progress Towards Peak Carbon Neutrality through the Promulgation of Relevant Policies

To achieve this goal, the Chinese government proposed a "dual control" energy consumption policy in 2015, which has been continuously improved during the 13th and 14th Five-Year Plans to reduce energy consumption intensity (energy consumption per unit of GDP) and total energy consumption (energy consumption quota). The concept of "dual control of energy consumption" was first proposed at the CPC's fifth Plenary Session of the 18th CENTRAL Committee on October 26, 2015. During the 13th Five-Year Plan period, we will implement "dual control" of energy consumption and intensity, which requires that by 2020, energy consumption per unit GDP will be reduced by 15% compared with 2015, and total energy consumption will be controlled within 5 billion tons of standard coal. The State Council has divided the target of "dual control" into different regions and made a comprehensive deployment of the "dual control" work. The "14th Five-Year Plan" further proposes to improve the dual control degree of energy consumption and energy intensity, focusing on the control of fossil energy consumption. By 2025, energy consumption per unit GDP and carbon emission will be reduced by 13.5% and 18% respectively compared with 2020.

2. Conflict between Dual-Control Policy and Metallurgical Industry Development

2.1. Specific Measures and Economic Principles of the Dual-Control Policy

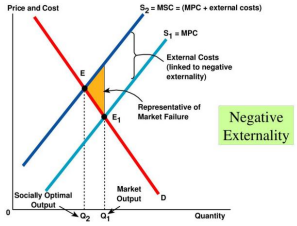

Fig 3. Negative externality of the industrial production

Under the dual-control policy, financial departments at all levels will increase energy conservation and emission reduction efforts in factories and industrial production, make overall arrangements for relevant special funds to support the construction of key energy conservation and emission reduction projects, gradually standardize and cancel inefficient fossil energy subsidies, and reward regions that exceed their emission reduction targets. From an economic perspective, the government provides subsidies to producers that use clean energy, scrapes the subsidy for fossil energy, and adds a per unit tax to producers with high carbon emissions. Thus, the Marginal social cost of production and Demand will cross at the socially optimal output level. That is to reduce Negative Externality (in this case carbon

ISSN: 2710-0170

emissions) generated in the industrial production process of factories, and ultimately control and eliminate deadweight loss in the market.

2.2. Influence of Dual-Control Policy on Metallurgical Industry Development

In response to the dual control policy on energy consumption, provinces across the country have introduced a series of measures to promote energy consumption reduction by limiting the total amount of electricity used by high-energy-consuming enterprises such as metallurgy, raising electricity prices, and limiting the time for consumption. If the existing factories are affected by the restriction of electricity hours, the efficiency of their production equipment will be greatly reduced. The production equipment used by many factories has high start-up cost, which is also known as fixed costs in economics. The factory can reduce the average fixed cost by using the equipment continuously and avoiding restarting the equipment.

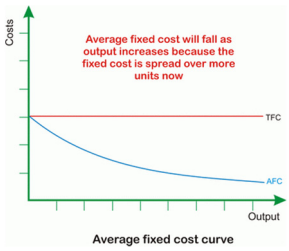

Fig 4. Average fixed cost curve

However, the discontinuous power supply period after the implementation of the dual-control policy makes it impossible for factories to avoid the high cost of restarting equipment, so many factories, and enterprises have increased production costs and reduced production efficiency. From the output of major industrial products released by the National Bureau of Statistics, we can observe the influence of the tightening policy of "dual control of energy consumption" on the production of high-energy-consuming industrial products. For example, in August, the country's electricity production fell from the previous month, while coking coal, crude steel, and cement production fell significantly from the previous year. Aluminum production also contracted from the previous month.

It is optimistic that the implementation of dual control policy is effective in reducing carbon emissions and pollution in the metallurgical industry. After relevant personnel research in 2019, the key statistics of metallurgical enterprises SO2, smoke dust emissions compared with 2018 decreased by 7.27% and 10.07%; Total waste-water discharge, COD, and ammonia nitrogen discharge decreased by 7.72%, 14.23%, and 25.90% compared with 2018. Among them, the total discharge of major waste gas pollutants and wastewater decreased by more than 7%, and the total discharge of COD and ammonia nitrogen decreased by more than 14% year on year. (cited from the Technical Department of the Metallurgical And Environmental Protection Commission of the People's Republic of China) it can be seen that the governance of the metallurgical industry has achieved initial results.

2.3. Influence of Metallurgical Industry Restriction on the Chinese Economy

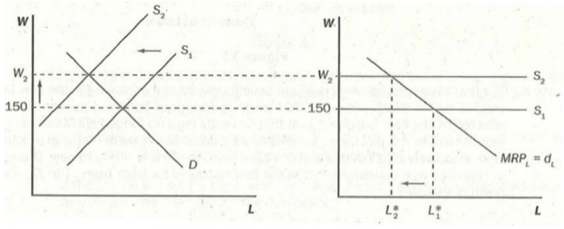

Fig 5. Labor Market

ISSN: 2710-0170

Metallurgical The metallurgical industry, as one of the pillar industries of Chinese industry, provides many jobs for society. According to relevant statistics, the employment ratio of industrial production in China reached 28.18% in 2020, with about 209 million employed people. Due to the impact of the dual control policy, the short-term cost is that the AVC of metallurgical enterprises raises above the market price, many small enterprises will shut down, and other large metallurgical enterprises also commonly lay off workers, leading to a large-scale cyclical and structural unemployment in the Chinese economy in the short term, metallurgical enterprises will lead to supply shortage and left shift of supply curve, lowering the GDP of the country. While the short-term benefits are as the unemployment rate rises, government spending on unemployment benefits increases, potentially mitigating the reduction in national GDP. The long-term benefit is the effective environmental management of wastewater and exhaust gas treatment. Since the metallurgical industry is a necessary intermediate commodity for industrial and military production, it will be subsidized by the state, while at the same time creating more jobs due to the treatment of waste gases and wastewater to reduce the long-term natural unemployment rate. The long-term costs are such that we cannot guarantee that the results of this policy will be what we expect, and there may be some undesirable results that we do not want to see.

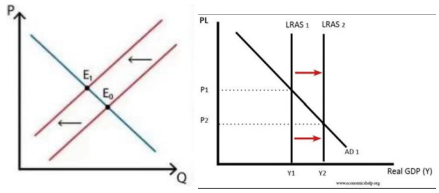

Fig 6. Short-run product market and Long-run AD-AS model

2.4. Alternative Policy

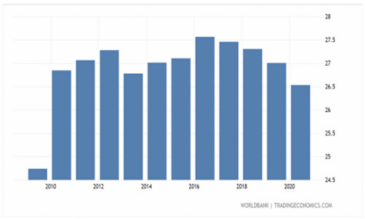

Fig 7. Proportion of steel industry in Germany's GDP

Germany is a country with a very developed steel industry, which accounts for more than 25% of its GDP, and is one of the most successful countries in low-carbon economic transformation. The costs and benefits of Germany's decision to transition to a low-carbon economy are the same as those faced by China. Low carbon economic transformation will increase the unemployment rate, slow down industrial economic growth, and reduce the steel industry's share in the country's total GDP, but the benefits of low carbon transformation are greater than its costs. As for Germany, the EU carbon emission Trading system, the market institutional framework, has been established, and la ow-carbon low-carbon transition can promote the stability of the whole European trading system. At the same time, it promotes the transformation of traditional industries, put forward new business models, promotes business innovation, and improves economic growth. In economics, Germany's LRAS moves to the right and its PPC moves outward. But whether China can use the same policies to transform its economy into a low-carbon one is open to debate.

Medium and long-term action plans of the three German governments play a leading role in the process of the ow-carbon transition. The EU Action Plan on Climate Change, the German National Action Plan on Energy Efficiency, and the German Energy and Climate Package provide

ISSN: 2710-0170

strong policy support. The EU climate Action Plan was launched in 2000, and by 2004 all 25 EU countries had achieved reductions of 8% or more from the base year. The basic goal of Germany's National Energy Efficiency Action Plan is to reduce the total energy consumption of Germany's final energy consumption sector outside the EU ETS by 9% over 5 years from 2008 to 2016. Germany's energy and climate package was introduced in 2007 and could make an important contribution to achieving a 40% reduction in emissions by 2020. The duration of these three policies is 4 years, 8 years, and 13 years respectively, and different emission reduction targets have been achieved successively. Thus, the German government has a very strong implementation force. In addition, Germany has achieved the goals of these three government plans and achieved the goal of carbon emission reduction.

China, by contrast, is hard to implement. First, Germany's GDP per capita in 2000 was 24,000 US dollars, while China's GDP per capita in 2020 was 11,300 US dollars. The living standards of the two countries are quite different. The Opportunity cost for Germany to implement such a policy is smaller than that for China. Second, as a member of the EU, Germany can stabilize the trading system of the whole European Union and promote trade after a low-carbon transformation, while China has not participated in a similar organization. If China adopts the same policy as Germany, it will not have the benefit of stabilizing the trading system.

3. Suggestions for the Current Dual Control Policy

3.1. Modernize the Supply Chain of the Metallurgical Industry Chain

Advanced industrial base and modernization of industrial chain are important measures to promote the formation of a more innovative, higher value-added, safe, and reliable industrial chain supply chain. In the face of the new requirements for the metallurgical industry in terms of carbon neutrality, the metallurgical industry should improve the level of industrial base modernization through service transformation and digital transformation internally and give full play to the advantages of horizontal and vertical industrial chain synergy through collaborative transformation to shape new advantages of innovation-driven development. The service transformation of resource-based industries is an industrial transformation and upgrading mode that realizes the transformation of resource-based industries from production-oriented to service-oriented by enhancing service consciousness, increasing service input, and increasing service output. The direction of service transformation of the metallurgical industry includes production service and service production, among which, service production mainly includes four implementation paths of scientific mining, deep processing, green transformation, and green waste reduction; production service mainly includes three implementation paths of logistics service, engineering technology service and financial service. Internally, the transformation of digital intelligence, Internet+, artificial intelligence, cloud computing, big data, 5G, digital twin, and other technologies are applied to the operation and management of metallurgical enterprises to improve the scientific management of metallurgical enterprises. External vertical alliance with downstream metallurgical demand industry, logistics service industry such as railroad, and the financial industry can deepen business connections, strengthen technology penetration, extend the industrial chain, enhance the advantages of the whole industrial chain of metallurgical industry, and improve the modernization level of the supply chain of metallurgical industry. The development of these applications in the metallurgical industry can move the PPC curve of the industry outward, which means that the production level and efficiency of the whole industry will be improved.

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3.2. Pay Attention to the Transformation and Exit Resettlement of the Metallurgical Industry

With the implementation of a series of policies to control carbon emissions such as the dual control policy, many enterprises and employees in metallurgical and other high pollution and high energy consumption industries will face the challenge of withdrawing from the market or transforming and upgrading. One of the most urgent issues is to solve the problem of employee resettlement, and asset and debt disposal for the exiting industry. These problems are difficult to be solved by enterprises alone and need to be solved by policy synergy and help and support from the government and all stakeholders. It is recommended that the state set up a fund related to industrial transformation to help and support the training and job transfer of workers from the exiting industry, reducing the number of structurally unemployed workers in the transformation. At the same time, the disposal of assets and debts requires the assistance and support of financial institutions. Different localities should promote the transformation and upgrading of the metallurgical industry according to the resource situation and market conditions, and the government can provide subsidies for enterprises that need to transform and upgrade, to encourage the development of wind power, solar power, and hydrogen energy industries or the development of clean energy industries such as industrial tourism industries or high-tech industries. At the same time, the increased government spending is a kind of expansionary fiscal policy, which can alleviate the side effects of the double control policy on China's economic growth.

3.3. Encourage Development and Investment in Research and Use of CCUS (Carbon Capture Utilization and Storage) Technologies

Even though China has set carbon peak and carbon neutral targets in terms of carbon emission reduction and implemented strict dual control policies to limit carbon emissions, as a developing country, the level of industrial manufacturing is still in the upgrading stage, and China cannot reach the carbon neutral target in a short period like some developed European countries. Therefore, the government and enterprises can focus on carbon capture, carbon utilization, and carbon storage technologies such as CCUS (Carbon Capture Utilization and Storage) for sustainable development. CCUS includes methods and technologies to remove carbon dioxide from flue gases and the atmosphere, then recycle the carbon dioxide and identify safe and permanent storage options, which can provide a way to achieve negative emissions, close to or even at the goal of zero emissions that is not economically or technically achievable for China's developing industrial production. To achieve this goal, the government can still cover the technology research and development costs by providing subsidies to plants or companies that actively use CCUS technology in their production processes.

3.4. Raising Awareness of Property Rights

Since the Chinese market is dominated by the public-owned economy, it is more difficult to implement the policy of protecting property rights in China compared with other countries. The lack of property right protection leads to many copyright issues in China, which makes China's low-end industries more developed and high-end technology industries relatively scarce. The development of middle and low-end industries results in pollution and high carbon emissions. Therefore, we can encourage the development of cutting-edge technology industries by improving property right protection, so that the low-end industries can transform into cutting-edge technology industries.

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4. Conclusion

After our group discussion, we believe that the dual control policy is generally sustainable and that achieving the joint growth of carbon neutrality and industrial production may be possible after China partially adjusts the regulation of enterprises.

In the short run, China's economy will be partially affected, but in the long run, it will greatly increase potential output and shift the AS and PPC curves to the right, while there will be a short period of cyclical unemployment in employment, but in the long run, it will provide more new jobs and lower the natural unemployment rate.

In addition, local enterprises can bypass the assessment of total energy consumption by using a large amount of renewable energy power, in exchange for the space for industrial development, so China's energy structure adjustment is expected to accelerate. (Improve the energy consumption intensity and the total amount of dual control degree program especially encourages the local increase of renewable energy consumption).

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ISSN: 2710-0170

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