



NDC ASPECTS

Country Report

Transition pathways for the People's Republic of China

September/ 2024

Teng Fei

Tsinghua University

NDC ASPECTS has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 101003866



Introduction and overview

The People’s Republic of China is a country located in eastern Asian on the western Pacific coast, with a vast land area of 9.6 million square kilometers and a huge population of 1.4 billion in 2022 [1]. As a rapidly developing nation, China is facing significant challenges in reconciling economic growth, improvement of people’s livelihoods, and sustainable environmental development. To address the crisis of global climate change, China has committed to reaching peak CO₂ emissions before 2030 and achieving carbon neutrality before 2060..

Long-term perspective: key transformations to reach carbon neutrality

During the 13th Five-Year Plan period (2016-2020), China has experienced a dramatic shift with a marked deceleration in population growth and a significant acceleration in urbanization. According to the National Bureau of Statistics' Yearbook 2023 [1], China’s permanent resident population reached 1.412 billion by the end of 2020, representing a continuous increase from 1.38 billion in 2015 with an average annual growth rate of approximately 0.41%. The urbanization rate increased significantly, rising from 57.3% in 2015 to 63.9% in 2020. **In addition, China's economy has grown steadily and undergone structural optimization during this period.** China’s economy has maintained a generally upward trend in constant 2015 prices, with the GDP growth rate fluctuating between 2.2% and 7%. From the perspective of industrial structure, China has witnessed a gradual decline in the proportion of the primary and secondary sectors during the 13th Five-Year Plan, contrasted by a consistent rise in the tertiary sector's share. The distribution across the three industries shifted from 8.4% for the primary, 40.8% for the secondary, and 50.8% for the tertiary in 2015, to 7.5%, 39.4%, and 53.1% respectively by 2020. **In parallel, during the 13th Five-Year Plan period, China has achieved a stable increase in new urban employment,** with 11.86 million new urban jobs added in 2020, which is 1.66 million less than the previous year [2]. For decades, China's economic growth has been primarily driven by extensive resource consumption, and it has not yet decoupled from carbon emissions. **As a result, China's carbon emissions are concentrated mainly in the power, industrial, building, and transport sectors** [3], with CO₂ emissions by sector in 2020 as shown in the figure below.

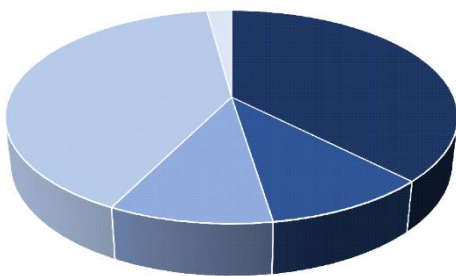


Figure 1: CO₂ emissions by sector in 2020.

China's Long-Term transition to low-carbon economy will be guided by the "1+N" policy framework. This framework centers on building a modern energy system that is green, low-carbon, efficient, and intelligent, ultimately achieving carbon peak and carbon neutrality goals. To be specific, China will undertake a series of key transformations across various sectors.

Power sector

China's power sector is undergoing a significant transformation [4]. To begin with, China is vigorously developing large-scale development of non-fossil energy, such as wind, solar, hydro, and nuclear power, concurrently exploring the development and utilization of geothermal and marine energy. In addition, China is establishing a new power system with renewable energy as the primary source and accelerating the large-scale application of new energy storage technologies, which aims to achieve coordinated operation of "source-grid-load-storage". Finally, China is accelerating the energy-saving and carbon reduction retrofitting of existing coal-fired power units, improving the clean and efficient utilization of coal-fired power, and applying carbon capture, utilization, and storage (CCUS) technology to reduce carbon emissions.

Industrial Sector

China is optimizing its industrial structure and promoting green, low-carbon development [5]. A key strategy is to curb high-energy-consuming, high-emitting, and low-quality projects. The government is actively supporting green industries, including deepening energy-saving and carbon-reduction efforts, adjusting the energy usage structure, promoting industrial energy electrification, constructing green microgrids, and upgrading energy-consuming equipment. In addition, to build a comprehensive green manufacturing system, China is promoting clean production practices, creating green factories, industrial parks, and supply chains, as well as implementing demonstration projects.

Building Sector

China is proactively improving its urban structure and layout to promote green and low-carbon development [6]. The government strongly advocates for the construction of green and low-carbon communities and buildings, and is working to improve infrastructure energy efficiency. Additionally, the integration of solar photovoltaic systems into buildings is being actively promoted to achieve energy self-sufficiency for buildings. Based on regional resource endowments, China is implementing targeted initiatives to promote geothermal, biomass, and other renewable energy sources to reduce fossil fuel dependence and carbon emissions. High-efficiency electric heating technologies such as air source heat pumps are being vigorously encouraged to improve the energy efficiency of heating and hot water supply. To accelerate electrification, China is promoting the use of electricity for building heating, domestic hot water, and cooking to reduce direct coal combustion. Meanwhile, smart microgrids, photovoltaic-storage-direct-flexible technologies, and thermal energy storage technologies are being actively promoted to improve energy utilization flexibility and efficiency.

Transport Sector

China is making concerted efforts to optimize its transportation infrastructure layout and accelerate the

construction of green highways. The government is simultaneously promoting green ports, waterways, and public transportation to encourage the shift of bulk and long-distance cargo from road to rail and waterway. Additionally, China is working to improve transportation efficiency through multimodal solutions. In urban transportation, China is also investing in urban rail transit and bus rapid transit as the backbone of public transportation systems while promoting clean energy vehicles to reduce emissions.

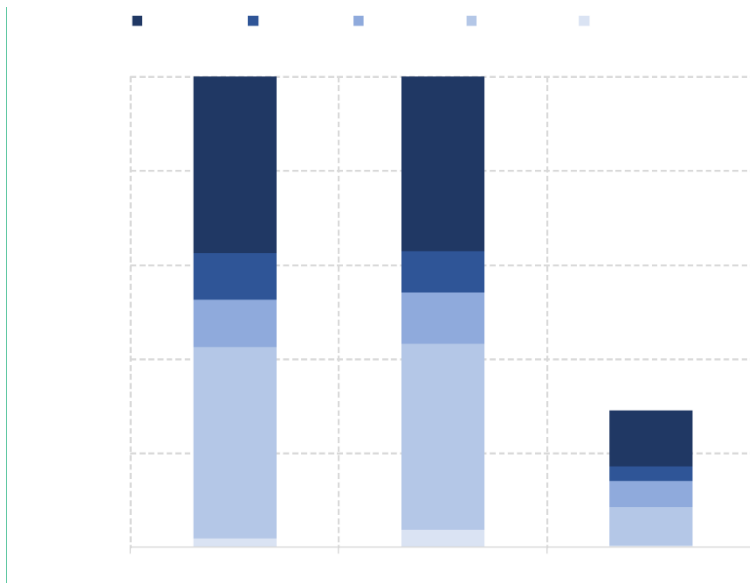


Figure 2 CO₂ emissions by sector from 2020 to 2050 in 2 °C target

China's long-term transition to low-carbon energy can yield significant benefits, including stimulating economic growth through investments in new technologies and industries, creating jobs and fostering innovation. According to the study, China's GDP exhibits a steady increase over the period from 2020 to 2050 across various scenarios. In addition, policy scenarios significantly influence the investment patterns. More ambitious climate targets (1.5°C and 2°C scenarios) require substantially higher total investments, highlighting the need for financial commitments to achieve these goals. By 2050, the total investments are projected to reach between 70.51 and 174.38 trillion RMB.

At the international level, China is committed to achieving the Paris Agreement's goal of limiting global temperature rise to well below 2°C above pre-industrial levels and is actively pursuing efforts to limit the increase to 1.5°C. Domestically, China is coordinating the two-step strategic plan for building a great modern socialist country in all respects [8] and dual carbon goals. In the short term, China aims to basically realize socialist modernization from 2020 through 2035 as well as reaching peak CO₂ emissions before 2030. In the long term, China plans to build a great modern socialist country that is prosperous, strong, democratic, culturally advanced, harmonious, and beautiful by 2050, meanwhile aligning with the goal of carbon neutrality before 2060.

Informing the national NDC process : key short term actions necessary to put the country on track to reach long term goals

To align with China's goal of achieving carbon neutrality by 2060, a substantial reduction in carbon emissions is necessary by 2035 compared to 2030 levels. Total CO₂ emissions in 2035 vary significantly among different scenarios, ranging approximately from 6 to 10 GtCO₂. Among all, the 1.5°C scenario demonstrates the lowest emissions, while the policy scenario exhibits the highest emissions.

Power Sector

In the short term, China aims to significantly develop non-fossil energy and establish a new power system primarily reliant on renewable energy. The power sector will strive to peak emissions before the broader energy system, with all new electricity demand being met by clean energy sources.

Industrial Sector

Industrialization has been substantially achieved, accompanied by a peak and subsequent decline in the production of major energy-intensive products. The industrial sector's share of the national economy has stabilized, while the industrial structure has undergone continuous optimization. Low-energy high-value-added advanced manufacturing and production-oriented services have emerged as the primary drivers of industrial growth.

Building Sector

Key short-term actions for the building sector include enhancing standards for new buildings, fostering the development of ultra-low/nearly zero-energy buildings, conducting comprehensive energy-saving retrofits for existing buildings, improving the efficiency of equipment systems, and upgrading intelligent energy consumption monitoring systems. Concurrently, efforts should be made to promote building electrification and continuously advance the optimization of heat sources.

Transport Sector

The road transport sector will undergo a substantial transition towards renewable energy, with a marked increase in the use of electricity, biomass fuels, and hydrogen.

China's transition to a low-carbon economy presents both socio-economic trade-offs and synergies. On the one hand, the shift away from fossil fuels could lead to job losses within traditional carbon-intensive industries, and the transition to renewable energy sources may lead to higher energy prices for households and businesses in the short term. The economic impacts of the transition may vary across different regions of China, potentially exacerbating existing inequalities. On the other hand, reducing reliance on fossil fuels can significantly improve air quality, leading to public health benefits and lower healthcare costs. Investments in renewable energy and energy-efficient

technologies can create new jobs and stimulate economic growth. By reducing dependence on imported fossil fuels, China can enhance its energy security and mitigate its vulnerability to geopolitical risks.

A comprehensive package of policies aligned with existing Chinese policies and decisions related to climate change, energy, and economic development could be necessary. This could include, but not be limited to, a national carbon emissions trading scheme, a carbon tax, renewable energy investment incentives, etc.

Cooperation needs identified to accelerate climate action in the country

China can collaborate with other nations to develop and implement international agreements that promote climate action and facilitate research and development into low-carbon technologies. Additionally, China can work with international financial institutions to mobilize climate finance for investments in low-carbon initiatives.

Some key areas where international cooperation can play a significant role include joint research and development of clean technologies, mobilizing climate finance, maintaining a stable global supply chain for green technologies, linking carbon market with other international ETS, and building capacity in renewable energy, energy efficiency, and climate change mitigation.

References

National Bureau of Statistics of China, 2023: National Bureau of Statistics' Yearbook.

National Bureau of Statistics of China, 2021: Statistical Communiqué of the People's Republic of China on The 2020 National Economic And Social Development.

J. He, Z. Li, X. Zhang, et al. Comprehensive report on China's Long-Term Low-Carbon Development Strategies and Pathways. Chinese Journal of Population, Resources and Environment, Volume 18, Issue 4, 2020, Pages 263-295. <https://doi.org/10.1016/j.cjpre.2021.04.004>.

National Development and Reform Commission. The 14th Five-Year Plan for Modern Energy System Development. 2022.

Ministry of Industry and Information Technology of the People's Republic of China, National Development and Reform Commission, and Ministry of Ecology and Environment of the People's Republic of China. Action Plan for Achieving Peak Carbon Emissions in the Industrial Sector. 2022.

Ministry of Housing and Urban-Rural Development of the People's Republic of China, National Development and Reform Commission. Action Plan for Achieving Peak Carbon Emissions in the Urban and Rural Construction Sector. 2022.





NDC ASPECTS

COUNTRY REPORT

Transition pathways for the People's Republic of China

Corresponding Author

Teng Fei

tengfei@tsinghua.edu.cn

PARTICIPANTS



NDC ASPECTS has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 101003866

www.ndc-aspects.eu

