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## Korea-EU carbon neutrality policies and economic diplomacy

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POLICY INSIGHTS

# *Upgrading for 30-60 Targets: China's Policy Framework on Carbon Peaking and Carbon Neutrality*

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**Abstract**
*As the largest developing economy and the biggest emitter of greenhouse gases, China is contributing to global efforts to combat climate change by its commitment to curb carbon dioxide emission before 2030 and achieve carbon neutrality before 2060. Besides the considerations of fulfilling international obligations, China's 30/60 targets are the result of continual evolution and upgrading of domestic decarbonization policies. To this end, China is constructing a "1+N" policy system and upgrading existing policies such as "dual control" over energy consumptions, production capacity management, emissions trading, and green finance. At the same time, China is facing challenges such as onerous workload, bottlenecks of energy transition, regional imbalances, technological innovation and accounting and statistics of the GHG emissions. It is expected that these challenges will highlight the importance of transforming development paradigms and accelerating research and development, and will further stimulate the upgrading of China's policy system.*

## Introduction

Research indicates that since the industrial revolution the massive use of fossil fuels has led to a significant increase in emission of carbon dioxide and other greenhouse gases, resulting in a systemic change in global climate with global warming being the main characteristic.[1] Given the severity and urgency of the issue, the global goals for addressing climate change have been constantly upgraded, from the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" in United Nations Framework Convention on Climate Change (UNFCCC),[2] to 2C goal in the Copenhagen Accord,[3] then to the 1.5C goal[4] and "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century"[5] in the Paris Agreement.

In October 2018, the IPCC released a special report indicating that in order to achieve the 1.5C goal, global anthropogenic carbon dioxide emissions must reach net zero around 2050.[6] The report played a crucial role in pushing for global consensus and collective actions. In 2020, many countries made commitments to carbon neutrality or similar goals when updating their nationally determined contributions (NDCs). [7]

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In September 2020, China announced its goal to curb carbon dioxide emissions before 2030 and to achieve carbon neutrality before 2060. Overall, China's efforts to achieve carbon neutrality represent an extremely huge and complex systemic project with the largest scale of carbon emissions reduction, its envisioned quick speed of decline of carbon emissions, and the high costs for such transitions.[8]

This article attempts to explain how to understand the 30/60 targets in the context of China's domestic policies, and how China plans corresponding road maps and upgrades of existing policy systems, and, finally, what challenges China is likely to encounter, and what problems areas are likely to be prioritized in the process, thereby revealing the internal logic of China's decarbonization goals.

## 1. Evolution of China's decarbonization goals

### *1.1 Three stages of greenhouse gas emission reduction in developing countries*

Since becoming a party to the UNFCCC in 1992, China has been actively promoted energy conservation and emission reduction.[9] Research shows that the control of greenhouse gas emissions in developing countries generally passes through three stages: first, the GDP grows, energy consumption grows and greenhouse gas emissions rises; then GDP keeps increasing, but the growth rate of energy consumption slows down and the greenhouse gas emissions reaches the "peak", gradually the process passes the inflection point, from rising to falling stage; and finally, the GDP growth rate slows down, the growth rate of energy consumption slows down or even drops accordingly, and the greenhouse gas emissions continue to decline rapidly.[10] The evolution of China's carbon reduction goals is basically consistent with this pattern.

### *1.2 Carbon reduction targets in China's Five-Year Plan*

Every five years, China's central government enacts a new Five-Year Plan, and a series of social and economic development initiatives, for the upcoming five years. Before the reform and opening-up era, China's Five-Year Plans focused on the economy. Since the Sixth Five-Year Plan, which took effect in 1981, the top-level blueprint has incorporated social development as a new dimension in the plan.[11] The Five-Year Plan is an important mechanism for setting economic and social development goals and mobilizing resources. Since the 11th Five-Year Plan, China has set targets for tackling climate change in every subsequent Five-Year plan, and the State Council has formulated and implemented a comprehensive work plan for energy conservation and emission reduction.[12]

#### *1.2.1 Eleventh Five-Year Plan (2006-2010): energy intensity target*

The 11th Five-Year Plan put forward the concept of energy conservation and emission reduction for the first time, and set binding indicators such as reducing energy consumption per unit of GDP by about 20 percent compared with the end of the 10th Five Year Plan, and achieving 20 percent forest coverage. During the 11th Five-Year Plan period, the national energy consumption per unit GDP decreased by 19.1 percent, basically fulfilling the goals and tasks set in the 11th Five-Year Plan. According to the Seventh National Forest Resource Survey released in November 2009, the forest zone in China reached 195 million hectares, and the forest stock was 13.721 billion cubic meters. The forest coverage rate rose from 18.21 to 20.36 percent, achieving the goal of 20 percent forest coverage two years ahead of schedule.[13]

1. Service Center for Societies of China Association for Science and Technology, Climate Change, Carbon Peaking and Carbon Neutrality (China Meteorological Press, 2022) 5.

2. Art. 2, United Nations Framework Conventions on Climate Change, <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf>, accessed 29 December 2022.

3. Para 1, Copenhagen Accord, <https://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf>, accessed 30 December 2022.

4. Art. 2.1.a Paris Agreement, <https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf>, accessed 29 December 2022.

5. Ibid, art. 4.1

6. IPCC, 'Special Report: Global Warming of 1.5 °C' <https://www.ipcc.ch/sr15/chapter/spm/>, accessed 29 December 2022.

7. For concrete number of countries and territories that have made such commitments, see <https://zerotracker.net/>.

8. Jinnan Wang and Huaqing Xu (ed.), Introduction to Carbon Dioxide Peaking and Carbon Neutrality (China Science and Technology Press, 2023) Preface 1.

9. 'China's Mid-Century Long term Low Greenhouse Gas Emission Development Strategy' <https://unfccc.int/documents/307765> accessed 30 December 2022.

10. Junwu Chen and Xiangsheng Chen, 'A Preliminary Study on China's Long and Medium-Term Strategic Goals for Reducing Carbon Emission (I): Proposal on the Reduction Targets for 3 phases of implication in China' (2011) 5 Sino Global Energy, 1-2.

11. 'China's Five-year Plan Explained', <https://peoplesdaily.pdnews.cn/trending/china-s-five-year-plan-explained-184123.html>, accessed 30 December 2022.

12. Ying Chen et al, 100 Questions on Carbon Peak and Carbon Neutrality (People's Daily Press, 2021) 100.

13. Ibid., 100.

14. Ibid., 101.

15. Ibid, 101-102.

16. 'The Outline of the 14th Five-Year Plan for

*1.2.2 Twelfth Five-Year Plan (2011-2015): carbon dioxide intensity target*

The 12th Five-Year Plan set the goal of increasing the use of low-carbon energy and reducing fossil energy consumption: non-fossil energy would account for 11.4 percent of primary energy consumption. Meanwhile, energy consumption per unit of GDP would be reduced by 16 percent, and carbon dioxide emissions per unit of GDP would be reduced by 17 percent. The forest coverage rate would increase from 20.36 to 21.66 percent, and the forest stock would increase from 13.7 billion cubic meters to 14.3 billion cubic meters. During the Twelfth Five-Year Plan period, China's actual carbon intensity declined by about 20 percent. In 2015, the proportion of non-fossil energy in primary energy consumption reached 12 percent, the forest coverage rate were 21.66 percent, and the forest stock increased to 15.137 billion cubic meters—all of them exceeding the goals of the Twelfth Five-Year Plan. In addition, the installed capacity of renewable energy has accounted for a quarter of the world, and the newly increased installed capacity of renewable energy accounts for a third of the world, laying a solid foundation for the implementation of more ambitious carbon reduction goals.[14]

*1.2.3 Thirteenth Five Year Plan (2016-2020): "dual control" targets of energy intensity and total energy consumption*

The 13th Five-Year Plan sets binding targets for tackling climate change, including the following: non-fossil energy would account for 15 percent of primary energy consumption, energy consumption per unit of GDP would be reduced by 15 percent, and carbon emissions per unit of GDP would be reduced by 18 percent. The forest coverage rate would increase to 23.04 percent, and the forest stock would increase by 1.4 billion cubic meters. "The Comprehensive Work Plan for Energy Conservation and Emission Reduction during the 13th Five Year Plan" proposed the "dual control" goals, i.e., the control of energy intensity and total energy consumption. By 2020, the energy consumption per unit of GDP would be 15 percent lower than that in 2015, and the total energy consumption would be controlled within 5 billion tons of standard coal. According to the data released by the National Bureau of Statistics, the total energy consumption in 2020 was around 4.97 billion tons of standard coal, completing the task of controlling the total energy consumption in the 13th Five Year Plan. However, the decline of energy consumption intensity was about 13.79 percent, and the task of "energy consumption per unit of GDP is 15 percent lower than that in 2015" formulated in the 13th Five-Year Plan had not been completed. CO2 emissions per unit of GDP was reduced by about 22 percent, exceeding the target of 18 percent set in the Plan. By the end of the 13th Five-Year Plan, the coverage rate of forest increased to 23.04 percent, and the forest stock exceeded 17.5 billion cubic meters.[15]

*1.2.4 The Fourteenth Five Year Plan (2021-2025): new goals towards carbon peaking and carbon neutrality*

The 14th Five-Year Plan was adopted after China put forward the carbon peaking and carbon neutrality goals, and was regarded as a key step to achieve the goals. The 14th Five-Year Plan stipulates that "energy consumption and carbon dioxide emissions per unit of GDP will be reduced by 13.5 percent and 18 percent respectively, and forest coverage will be increased to 24.1 percent."[16] The above goals were repeated in the Working Guidance for Carbon Dioxide

National Economic and Social Development and Vision 2035 of the People's Republic of China', <http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm>, accessed 30 December 2022.

17. 'Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy' <http://www.gov.cn/zhengce/2021-10/24/content_5644613.htm>, accessed 30 December 2022.

18. 'Statement by H.E. Xi Jinping President of the People's Republic of China at the General Debate of the 75th Session of the United Nations General Assembly', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202009/t20200922_678904.html>, accessed 3 January 2023.

19. See for example, 'Standing Together to Fight COVID-19, Promote Recovery and Safter Peace: Speech by H. E. Xi Jinping President of the People's Republic of China at the Official Ceremony of the Third Edition of the Paris Peace Forum, Beijing, 12 November 2020', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202011/t20201112_678928.html>, 'Fighting COVID-19 in Solidarity and Advancing BRICS Cooperation Through Concerted Efforts: Remarks by H. E. Xi Jinping President of the Peoples' Republic of China at the 12th BRICS Summit, Beijing, 17 November 2020', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202011/t20201117_678932.html>, 'Remarks by President Xi Jinping at Leader's Side Event on Safeguarding Planet of G20 Riyadh Summit, Beijing, 22 November 2020', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202011/t20201122_678944.html>, accessed 3 January 2023.

20. 'Statement on Past Achievements and Launching a New Journey for Global Climate Actions: Statement by H. E. Xi Jinping President of the People's Republic of China at the Climate Ambition Summit, Beijing, 12 December 2020',< https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202012/t20201213_678958.html>, accessed 3 January 2023.

21. 'For Man and Nature: Building a Community of Life Together: Remarks by H. E. Xi Jinping President of the People's Republic of China at the Leaders' Summit on Climate, Beijing, 22 April 2021', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202104/t20210422_9170542.html>, accessed 3 January 2023.

22. Yanlong Zhang (ed.), A Implementation Guide for Carbon Peaking and Carbon Neutralization, (Chemical Industry Press 2022) 13.

23. Honghui Yu (ed.), Theory and Practice of Carbon Neutrality (China Environment Publishing Group 2022) 15.

Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy jointly issued by the CPC Central Committee and the State Council, with two goals added, namely, the proportion of fossil energy consumption should reach about 20 percent and the forest stock should reach 18 billion cubic meters by 2025.[17]

To sum up, China's carbon reduction goals reflect the process of transition from relative goals (energy and carbon intensity goals), through "dual control" goals of energy intensity and total volume, to absolute goals (carbon peaking and carbon neutrality goals), with constantly upgrading controlling methods and expanding controlled scope.

### *1.3 Proposal and concretization of China's carbon peaking and carbon neutrality targets*

On 22 September 2022, President Xi Jinping pointed out in the general debate of the 75th session of the United Nations General Assembly that "China will scale up its national independent contribution by adopting more vigorous policies and measures. We aim to have CO2 emissions peak before 2030 and achieve carbon neutrality before 2060."[18]In a series of subsequent speeches,[19]President Xi Jinping repeated the above goals.

On 12 December 2020, in his speech at the Climate Ambition Summit, President Xi Jinping proposed more specific goals on carbon peaking and carbon neutrality:

> *[Before 2030] China will lower its carbon dioxide emissions per unit of GDP by over 65 percent from the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 25 percent, increase the forest stock by 6 billion cubic meters from the 2005 level, and bring its total installed capacity of wind and solar power to over 1.2 billion kilowatts.*[20]

On 22 April 2021, Xi Jinping delivered a speech at the Leaders' Climate Summit, clarifying the relationship between 30/60 targets and 14th Five-Year Plan and 15th Five-Year Plan, as well as some possible policies and measures:

> *Last year, I made the official announcement that China will strive to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060. This major strategic decision is made based on our sense of responsibility to build a community with a shared future for mankind and our own need to secure sustainable development. China has committed to move from carbon peak to carbon neutrality in a much shorter time span than what might take many developed countries, and that requires extraordinarily hard efforts from China. The targets of carbon peak and carbon neutrality have been added to China's overall plan for ecological conservation. We are now making an action plan and are already taking strong nationwide actions toward carbon peak. Support is being given to peaking pioneers from localities, sectors and companies. China will strictly control coal-fired power generation projects, and strictly limit the increase in coal consumption over the 14th Five-Year Plan period and phase it down in the 15th Five-Year Plan period. Moreover, China has decided to accept the Kigali Amendment to the Montreal Protocol and tighten regulations over non-carbon dioxide emissions. China's*

24. 'Working Together to Build a Community of All Life on Earth, Keynote Speech by H. E. Xi Jiping, President of the People's Republic of China. at Leaders' Summit of the 15th Meeting of the Conference of the Parties to the Convention on Biological Diversity, 12 October 2021', <https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/zyjh_665391/202110/t20211015_9550771.html>, accessed 3 January 2023.

25. Office of Leading Group of Carbon Peak and Carbon Neutrality, Cadres Readings on Carbon Peaking and Carbon Neutrality (CPC Reading Materials Publishing House 2022) 17-18. There are two different views on the connotation of "1" in the "1+N" policy system. The difference is that whether the Action Plan should be regarded as "1" or "N". Some people think that the Action Plan should be regarded as the leading document of "N". See, for example, 'China's' 1+N" Policy Framework ',< http://us.china-embassy.gov.cn/eng/zt/climatechange/202111/t20211117_10449121.htm> and 'Key Documents for China's' 1+N Framework to Achieve the 30/60 Targets Published', <https://climatecooperation.cn/climate/key-documents-for-chinas-1n-framework-to-achieve-the-30-60-targets-published/>, accessed 4 January 2023. Another view is that the Action Plan should be considered as part of "1".The National Development and Reform Commission of China, which is responsible for coordinating the carbon peaking and carbon neutrality policies, holds this position. For example, Mr. Xiang Wang, Deputy Director of the High Technology Department of the National Development and Reform Commission, mentioned this position in his speech at the press conference, <https://www.ndrc.gov.cn/xwdt/wszb/qncy/wzsl/202203/t20220323_1320057.html?code=&state=123>, also see Ministry of Ecology and Environment, '2022 Annual Report on China's Policies and Actions to Address Climate Change', <https://www.mee.gov.cn/ywgz/ydqhbh/syqhbh/202210/W020221027551216559294.pdf>, accessed 4 January 2023. This paper takes the latter position.

26. Dimitri De Boer and Danting Fan, 'How is Progress in China's 1+N Policy Framework', <https://cciced.eco/climate-governance/how-is-progress-in-chinas-1n-policy-framework/>, accessed 5 January 2023.

27. 'Action Plan for Carbon Dioxide Peaking before 2030', <.http://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm>, accessed 5 January 2023.

28. 'The Comprehensive Work Plan for Energy Conservation and Emission Reduction for the "12th Five-Year Plan" Period', < http://www.gov.cn/gongbao/content/2011/content_1947196.htm>, accessed 8 January 2023.

29. 'The 12th Five Year Plan for Energy Development', <https://cn.pornhub.com/view_video.php?viewkey=ph609977f07636e> accessed 8 January 2023.

*national carbon market will also start trading.*[21]

The commitments of carbon peaking and carbon neutrality marks that China, as the largest developing country in the world and the largest country in coal production, consumption and trade, promises to the world to achieve the goal of carbon neutrality in 40 years, to make significant contributions to achieving the goal set by the Paris Agreement (to control the global average temperature rise at a level of 2C compared with the pre-industrial level, and strive to control the temperature rise at 1.5C compared with the pre-industrial level).[22] Achieving the goal of carbon peaking and carbon neutrality is a long-term, comprehensive and systematic project, as well as a broad and profound economic and social change, covering energy, economy, society, climate, environment and many other fields, involving government, enterprises, the public and other entities, which requires systematic and complete policy design.[23]

## 2. China's policy system for carbon Peaking and Carbon Neutrality

### *2.1 Introduction to the "1+N" policy system of carbon peaking and carbon neutrality in China*

President Xi stated in his speech at the opening segment of COP15 in Kunming in October 2021 that China would "put in place a '1+N' policy framework for carbon peaking and carbon neutrality."[24] Since then, a series of climate-related policy documents have been issued, stipulating many explicit quantitative targets.

"1" includes two top-level designs, namely, the *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy* (Working Guidance) issued by the CPC Central Committee and the State Council on 22 September 2021, and the *Action Plan for Carbon Dioxide Peaking Before 2030* (Action Plan 2030) issued by the State Council on 24 October 2021. "N" includes action plans for carbon peak in key areas such as energy, industry, transportation, urban and rural construction, agriculture and rural areas, implementation plans for carbon peak in key industries such as coal, oil, natural gas, steel, non-ferrous metals, petrochemical industry, building materials, as well as supportive plans of scientific and technological support, financial support, green finance, green consumption, ecological carbon sink, pollution reduction and carbon reduction, statistical and accounting, standards and measurements, training and other supportive schemes regarding carbon peaking and carbon neutrality.[25]

### *2.2 Current situation of China's "1+N" policy system for carbon peaking and carbon neutrality*

After the release of the Working Guidance and the Action Plan 2030 as "1", the documents as "N" are growing. However, at present, there is no clear statement of which documents belong to "N".[26] In the Action Plan 2030, it was proposed that:

> *[T]he goal to peak carbon dioxide emissions permeates the whole process and every aspect of economic and social development. Particular focus will be placed on implementation of ten major peaking carbon dioxide emissions actions, which are the action for green and low-carbon energy transition, the action for energy saving, carbon emission mitigation and efficiency improvement, the action for peaking carbon dioxide emissions in industry sector, the action for peaking carbon dioxide emissions in*

30. Proposal of the Central Committee of the Communist Party of China on Formulating the 13th Five Year Plan for National Economic and Social Development, <http://www.gov.cn/xinwen/2015-11/03/content_5004093.htm>, accessed 8 January, 2023.

31. 'Comprehensive Work Plan for Energy Conservation and Emission Reduction for the 13th Five-Year Plan.', <http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm >, accessed 8 January 2023.

32. 'Responding to the Climate Change: China's Policies and Actions'. <http://english.scio.gov.cn/whitepapers/2021-10/27/content_77836502_5.htm>, accessed 8 January 2023.

33. Ibid.

34. Dian Xie et al, 'Research on the Implementation Path of the Transition from Dual Control on Energy Consumption to Dual Control on Carbon Emission', (2022)7 Integrated Intelligent Energy 73-80.

35. 'The Outline of the 14th Five-Year Plan for National Economic and Social Development and Vision 2035 of the People's Republic of China', <http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm>, accessed 30 December 2022.

36. 'Communiqué of the Central Economic Work Conference 2021', <.http://www.china-cer.com.cn/guwen/2021121016039.html >, accessed 8 January 2023.

37. Dian Xie et al, 'Research on the Implementation Path of the Transition from Dual Control on Energy Consumption to Dual Control on Carbon Emission', (2022)7 Integrated Intelligent Energy 73-80.

38. Xinhua News Agency, 'Xi Jinping Presided over the 36th Collective Study of the Political Bureau of the CPC Central Committee and Delivered an Important Speech', <.http://www.gov.cn/xinwen/2022-01/25/content_5670359.htm> accessed 8 January 2023.

39. 'Full text of the report to the 20th National Congress of the Communist Party of China', <https://english.www.gov.cn/news/topnews/202210/25/content_WS6357df20c6d0a757729e1bfc.html>, accessed 8 January 2023.

40. 'The Plan for Improving the Dual Control of Energy Consumption Intensity and Total Amount', <https://www.ndrc.gov.cn/xxgk/zcfb/tz/202109/t20210916_1296856.html>, accessed 8 January 2023.

41. 'The Notice on Further Improving the Work Related to the Exclusion of Raw Material Energy from Total Energy Consumption Control',

*urban-rural development area, the action for promoting green and low-carbon transportation, the action for promoting circular economy in carbon mitigation purpose, the action for advancing green and low-carbon technology innovation, the action for consolidating and enhancing carbon sink, the action for green and low-carbon society, the action for promoting all regions peaking carbon dioxide emissions hierarchically and orderly.*[27]

For a concise overview of the current status of the "1+N" policy system, the paper has summarized the development of the system by the end of 2022 with the "ten major peaking carbon dioxide emissions actions" as the analytical framework and the content relevance as the standard for screening. (See Annex.)

## 3. Upgrading of China's policy instruments to achieve decarbonization targets

Since China has been controlling greenhouse gas emissions, it has gradually formed a series of carbon reduction policy instruments system combining "command-and-control" instruments and market-based instruments. After the 30/60 targets were proposed, China has upgraded many policy instruments to meet the requirements of more stringent greenhouse gas emission control.

### *3.1 From "dual control" of energy consumption to "dual control" of carbon emissions*

#### *3.1.1 Establishment and development of China's energy consumption "double control" system*

With the rapid growth of energy consumption, the importance of energy conservation has become increasingly prominent, and more binding policy measures are needed. For the first time, China's 11th Five-Year Plan outlined energy consumption per unit of GDP as a binding indicator, clearly requiring that energy consumption per unit of GDP in 2010 be 20 percent lower than that in 2005, strengthening the binding force of energy conservation goals.

During the 12th Five-Year Plan period, in order to further promote energy conservation and consumption reduction, while continuing to take energy consumption per unit of GDP as a binding indicator, controlling the total amount of energy consumption had become the focus of energy conservation policies. In October 2010, the Fifth Plenary Session of the Seventeenth Central Committee of the Communist Party of China adopted the Proposal on the Twelfth Five-Year Plan and put forward the requirements for reasonable control of total energy consumption. In September 2011, the State Council issued the Comprehensive Work Plan for Energy Conservation and Emission Reduction for the 12th Five-Year Plan Period, which requires "to adhere to the combination of reducing energy consumption intensity, reducing total emissions of major pollutants, and reasonably controlling total energy consumption, to form an reverse coercion mechanism to accelerate development and transform the mode of economic development".[28] In January 2013, the State Council issued the Twelfth Five-Year Plan for Energy Development, which proposed to implement dual control of energy consumption intensity and total consumption, and stipulated the total energy consumption during the Twelfth Five-Year Plan period.[29]

During the 13th Five-Year Plan period, China has formed a relatively comprehensive "dual control" system over energy consumption. In October 2015, the Fifth Plenary Session of the 18th Central Committee of the Communist Party of

<.https://www.ndrc.gov.cn/xxgk/zcfb/tz/202211/t20221101_1340642_ext.html>, accessed 8 January 2023.

42. Jinnan Wang, 'Design of Institutional Framework and Roadmap of China's "Double Control" System of Carbon Emission', <https://www.163.com/dy/article/HMV79PID0535NJ1G.html> accessed 8 January 2023.

43. Xiangzhao Feng, Rupu Yang, and Yuanyuan Li, 'Some Thoughts on the System Construction of Controlling the Total Amount and Intensity of Carbon Emission', (2022)11 China Sustainability Tribune 49-51.

44. 'Responding to the Climate Change: China's Policies and Actions'. <http://english.scio.gov.cn/whitepapers/2021-10/27/content_77836502_5.htm>, accessed 8 January 2023.

45. 'The Notice on Further Strengthening the Work of Eliminating Backward Production Capacity', http://www.gov.cn/gongbao/content/2010/content_1585425.htm

46. 'The Guiding Opinions on Resolving the Serious Overcapacity', <http://www.gov.cn/zhengce/content/2013-10/18/content_4854.htm>, accessed 10 January 2023.

47. "The Notice on Resolutely Curbing the Blind Expansion of Industries with Severe Overcapacity', <https://www.ndrc.gov.cn/xwdt/gdzt/hjcnyzgsmd/zjgx/201310/t20131031_1197892.html>, accessed 10 January 2023.

48. 'The Guiding Opinions on Using Comprehensive Standards to Promote the Quit of Backward Capacity in accordance with Laws and Regulations', <https://www.miit.gov.cn/zwgk/zcwj/wjfb/zh/art/2020/art_1d1e1daed5cb4803be67004ac46d8288.html>, accessed 10 January 2023.

49. 'The Notice on Resolving Overcapacity in Key Fields', <https://www.ndrc.gov.cn/xxgk/zcfb/tz/201804/t20180420_962714.html>, accessed 10 January 2023.

50. Biao Song, 'Research on the Legalization of the Government's Resolution of Overcapacity" (2017)2, Social Scientist, 101-106.

51. Renhu Tang and Jieting Zhou, A Concise Action Guide for Carbon Dioxide Peaking and Carbon Neutrality (China Environment Publishing Group, 2022) 73-83.

52. Renhu Tang and Zhibin Chen, China's Carbon Emission Trading Market: From Theory to Practice (Electronic Industry Press, 2022) 21-22.

53. Dewen Mei, Jiantao Li and Zisheng Jin, 'How to Achieve Carbon Neutrality from 10 Bil-

China adopted the Proposal of 13th Five-Year Plan, and suggested that "the dual control of total amount and intensity over energy and water consumption, as well as lands for construction purpose."[30]According to the Comprehensive Work Plan for Energy Conservation and Emission Reduction for the 13th Five-Year Plan,

> *[...] the national total energy consumption control and energy conservation goals should be broken down to all regions, major industries and key energy consuming units. All regions should clarify the annual work goals according to the tasks assigned by the state and implement them layer by layer, and clarify the responsibilities of the next level of government, relevant departments, and key energy consuming units. The State Council should organize the assessment of the provincial people's governments for energy conservation and emission reduction goals every year, and the assessment results should be used an important part of the assessment of leading groups and cadres. The provincial people's governments that fail to achieve the goal of reducing energy consumption intensity shall be held accountable, and those that fail to achieve the goal of controlling the total amount of energy consumption assigned by the state shall be criticized publicly and be summoned for regulatory talks.*[31]

*3.1.2 Effectiveness of the implementation of the "dual control" system for energy consumption*

- The growth of energy consumption slowed down significantly. During the 13th Five-Year Plan period, China required that the energy consumption per unit GDP in 2020 be 15 percent lower than that in 2015, and the total energy consumption be controlled within 5 billion tons of standard coal. In 2020, China successfully achieved the goal of total energy consumption, with energy intensity down 13.2 percent from 2015, and basically achieve the goals of the 13th Five-Year Plan. During the "13th Five-Year Plan" period, China fueled an average annual economic growth of 5.7 percent with an average annual energy consumption growth of 2.8 percent, and the amount of energy it saved accounted for about half of the global energy savings in the same period. [32]
- The proportion of coal consumption continues to decline. The proportion of coal in the total energy consumption decreased from 69.2 percent in 2010 to 56.8 percent in 2020, exceeding the goal of reducing coal production capacity and eliminating backward coal power production capacity in the 13th Five-Year Plan. China's carbon intensity in 2020 was 18.8 percent lower than that in 2015, a better result than the binding target set in the 13th Five-year Plan (2016-2020). The figure was also 48.4 percent less than that in 2005, which means that China had fulfilled more than its commitment to the international community - to achieve a 40-45 percent reduction in carbon intensity from the 2005 level by 2020. The drop in carbon intensity translates to a total reduction of about 5.8 billion tonnes of carbon dioxide emissions from 2005 to 2020. [33]
- All regions actively implement the "dual control" policy of energy consumption. Many provinces have successively introduced a series of measures to limit the energy consumption of energy-intensive enterprises, such as differential electricity prices and other means to control the total amount of energy consumption and reduce the intensity of energy consumption.

lion Tons of Annual Emissions? Nine Shifts China's Carbon Market Needs', in Honghui Yu (ed.), Theory and Practice of Carbon Neutralization (China Environment Publishing Group 2021) 149-155.

54. Research Bureau of the People's Bank of China, 'Improving the Green Financial System to Promote Green, Low Carbon and High Quality Development', <.http://www.pbc.gov.cn/redianzhuanti/118742/4657542/4669784/index.html>, accessed 12 January 2023.

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57. Jun Ma (ed.), Roadmap for Financing China's Carbon Neutrality (China Finance Press 2022) 226-236.

58. Junfeng Li, 'Opportunities and Challenges for China to Achieve Carbon Dioxide Peaking and Carbon Neutrality', in Honghui Yu, Theory and Practice of Carbon Neutrality (China Environment Publishing Group 2021) 37-42.

59. '13th Five Year Plan for Energy Development', <http://www.nea.gov.cn/135989417_14846217874961n.pdf> accessed 14 January 2023.

60. Building a Modern Energy System (China Planning Press 2020) 153-160.

61. Can Wang and Jiutian Zhang, Carbon Peaking and Carbon Neutrality: Towards a New Development Path (The Central Party School Publishing House) 211.

62. Afton Clarke-Sather et al., 'Carbon Inequality at the Sub-national Scale: A Case Study of Provincial-level Inequality in CO2 Emissions in China 1997-2007', (2011) 9 Energy Policy 5420-5428.

63. Xiangjing Song, Xiaona Song, and Jiutian Zhang: 'Research and Suggestions on Regional Carbon Neutrality Pathways', (2022)4 China's Land and Resources Economy, 81-87.

64. Yue Qu et al. 'Regional Coordination of Carbon Peaking and Carbon Neutralization: Empirical Study and Path', (2022) 11 Financial Science 55-70.

65. Chunmei Jing and Yan Chen, 'Seven Hurdles in the Process of Achieving Carbon Dioxide Peaking and Carbon Neutrality during the 14th Five-Year Plan', in State Power Investment Cooperation Ltd. and China Center for International Economic

However, it is still difficult to achieve control objectives in some areas.[34]

*3.1.3 Necessity of transformation from "dual control" over energy consumption to "dual control" over carbon emissions*

In the 14th Five-Year Plan issued in March 2021, China proposed to "improve the dual control system over total energy consumption and intensity, and implement a system that focuses on carbon intensity control, supplemented by total carbon emission control".[35]At the Central Economic Work Conference at the end of 2021, it was further proposed that "new renewable energy and energy used as raw materials should not be included in the total energy consumption control, and conditions should be created to realize the transformation from 'dual control' over energy consumption to 'dual control' over total carbon emissions and intensity as soon as possible, so as to accelerate the formation of an incentive and constraint mechanism for reducing pollution and carbon emission."[36]The necessity of switching from "dual control" over energy consumption to "dual control" over carbon emissions lies in:

- The "dual control" over energy consumption can no longer fully meet the development needs of the economy. "Dual control" over energy consumption restrains the total amount of energy consumption, including not only traditional fossil energy, but also nuclear energy, renewable energy and other non-fossil energy. Non-fossil energy is renewable and clean energy, which should be encouraged. In addition, energy consumption for the purpose of raw materials is also part of "dual control" over energy consumption. Raw material energy refers to energy products such as oil, coal and natural gas that are not used as fuels but used as raw materials for production. In general, only about 20 percent of the carbon in this part of fossil energy is emitted into the atmosphere as carbon dioxide. On the contrary, the total carbon emission control focuses on the total consumption of fossil energy. The implementation of total carbon emission control can effectively avoid the shortcomings of the total energy control system, and encourage the development of renewable energy while controlling the consumption of fossil energy.
- The "dual control" over energy consumption has limited effect on reducing carbon emissions in non-energy fields. At present, China's carbon emissions from energy activities account for 88 percent of the total carbon emissions, and non-energy fields such as industrial processes and land use account for 12 percent of the total carbon emissions. With the promotion of clean energy transformation, carbon emissions in non-energy fields become a hard nut to crack for emission reduction. At present, the role of "dual control" over energy consumption in reducing carbon emissions in non-energy fields is very limited. On the basis of maintaining the effectiveness of "dual control" of energy consumption, taking "dual control" over carbon emissions as binding targets are a necessary condition for achieving the 30/60 targets.
- The "dual control" over carbon emissions is conducive to promoting the development of green technology. The total amount and intensity control of carbon emissions will help promote the progress of low-carbon/zero carbon/negative carbon technologies and their application in related fields. With the development of renewable energy, energy storage and hydrogen energy, especially the application of carbon capture, utiliza-

Exchanges (ed.) Report on the Peak Carbon Emission and Carbon Neutrality (Social Sciences Academic Press 2021) 214-219.

66. Guiyang Zhuang and Hongchun Zhou, China's Pathway to Carbon Peaking and Carbon Neutrality (China Financial and Economic Publishing House 2021) 101.

67. Office of Leading Group of Carbon Peak and Carbon Neutrality, Cadres' Readings on Carbon Peaking and Carbon Neutrality (CPC Reading Materials Publishing House 2022) 128.

68. Min Yin and Xuanzi Xie,'Some Opinions on Optimizing the Statistical and Accounting System of Carbon Emission', (2022)5 China Statistics 57-58.

69. 'Implementation Plan for Accelerating the Establishment of a Unified and Standardized Statistical and Accounting System for Carbon Emissions', <http://www.gov.cn/zhengce/zhengceku/2022-08/19/5706074/files/a924a706a96645f1a4eee8981e7da686.pdf>, accessed 15 January 2023.

70. BCG China Climate and Sustainable Development Center, General Guidelines for Carbon Neutrality in China (CITIC Publishing Group 2021) 19-24.

71. Zhongli Ding, et al, Carbon Neutrality: Internal Logics and Technical Requirements (Science Press 2022) 77.

tion and storage technology (CCUS) and bioenergy with carbon capture and storage technology (BECCS), carbon emissions from fossil energy consumption will be significantly reduced, and the coupling relationship between energy consumption and carbon emissions will be further weakened. The implementation of "dual control" over carbon emissions will help promote the development of clean energy technology, as well as scientific and technological innovation in green transportation, low-carbon buildings, new materials and other fields, and drive the joint development of upstream and downstream industries.[37]

*3.1.4 Progress in transformation from "dual control" over energy consumption to "dual control" over carbon emissions*

- The political decision-making process has been completed. After the Central Economic Work Conference at the end of 2021 put forward the idea of transition from "dual control" over energy consumption to "dual control" over carbon emissions, it was proposed again in January 2022 at the 36th collective learning of the Political Bureau of the Central Committee of the CPC that "we should improve the standards regarding carbon dioxide peaking and carbon neutrality, build a unified and standardized carbon emission statistical accounting system, and promote the transformation from 'double control' over energy consumption to 'double control' over carbon emissions and intensity."[38] In October 2022, the report of the 20th National Congress of the CPC proposed that "We will exercise better control over the amount and intensity of energy consumption, particularly of fossil fuels, and transition gradually toward controlling both the amount and intensity of carbon emissions."[39]
- The key steps of optimizing measures for the transition from "dual control" over energy consumption to "dual control" over carbon emissions have been put in place. In September 2021, NDRC issued the Plan for Improving the Dual Control of Energy Consumption Intensity and Total Amount, making arrangements for the new renewable energy not to be included in the "dual control" over energy consumption. Considering the renewable energy power consumption and green power certificate transactions in each province (autonomous region, municipality directly under the Central Government), for regions that have overfulfilled the incentive renewable energy power consumption share, the consumption exceeding the minimum renewable energy consumption share will not be included in the region's annual and five-year planning total energy consumption..[40] On 27 October 2022, the NDRC and the National Bureau of Statistics issued the Notice on Further Improving the Work Related to the Exclusion of Raw Material Energy from Total Energy Consumption Control, which stipulates that "in the national assessment of of provincial people's governments for energy conservation goals during the 14th Five-Year Plan period, the energy consumption of raw materials will be deducted from the total energy consumption of each region, and the energy intensity reduction indicators of each region will be calculated accordingly. When calculating energy intensity, the consumption of raw materials will be deducted from the total energy consumption of each region, but the regional GDP will not be adjusted accordingly."[41]
- Technical details for transition towards "dual control" over carbon emission still need to be improved. The "dual control" system over carbon

emissions is a policy instrument that affect significantly Chinas decarbonization targets, and its technical details are still in the design. Experts believe that, considering the need of the carbon peaking target, China can firstly focus on carbon emission intensity control, supplemented by total amount control during the 14th Five-Year Plan period; then during the 15th Five-Year Plan period, the focus would switch to total carbon emission control.[42] At the same time, it is necessary to improve carbon emission monitoring technology, establish a complete carbon emission accounting system, and establish a reasonable total target decomposition system.[43]

### *3.2 Continuous management of production capacity in energy-intensive industries*

According to Kaya formula, the decrease of carbon intensity per unit of GDP is related to two factors: the intensity of carbon dioxide per unit of energy consumption and the energy intensity per unit of GDP. The former reflects the low-carbon degree of the energy system, while the latter can be seen as two factors: industrial structure and energy intensity of each unit of output. Consistent with the emission reduction patterns revealed by this formula, during the 13th Five-Year Plan period, the production capacity expansion of China's energy-intensive consuming projects was effectively controlled, and the transformation and upgrading of key industries such as petrochemical, chemical, steel and other industries were accelerated. For example, the goal of reducing the 150 million ton of steel production capacity in the 13th Five-Year Plan was completed two years ahead of schedule.[44]

In fact, China's industrial restructuring reform has two sets of policy systems: one is the control of excess capacity for the purpose of macroeconomic equilibrium, and the other is the control of so-called "outdated or backward production capacity" which is energy-intensive and high pollution industries for the purpose of environmental protection and tackling climate change. Since most excess capacities are also energy-intensive and high pollution production capacity, the two policy systems overlap in scopes and effects.

The State Council issued the Notice on Further Strengthening the Work of Eliminating Backward Production Capacity in 2010.[45] In 2013, the Guiding Opinions on Resolving the Serious Overcapacity was issued by the State Council.[46] The NDRC and MIIT issued the Notice on Resolutely Curbing the Blind Expansion of Industries with Severe Overcapacity in 2013.[47]In 2017, 16 ministries including MIIT issued the Guiding Opinions on Using Comprehensive Standards to Promote the Quit of Backward Capacity in accordance with Laws and Regulations.[48] Later, 6 Ministries including NDRC issued the Notice on Resolving Overcapacity in Key Fields in 2018.[49] The above policy documents set up a policy system to control excess production capacity and backward production capacity.

In the process of capacity control of energy-intensive industries, the Chinese government's policy instruments are listed in the following:

#### *3.3.1 Adjusting the negative list and strictly implement the approval procedure*

The negative list prohibits or restricts industrial incremental capacity and forces the existing capacity to be eliminated, transferred or upgraded, which

constitute the "red line" for government approval and enterprise operation.

*3.3.2 Dealing with the capacity under construction and new capacity by suspending construction, postponing construction, capacity replacement, etc.*

Suspension and postponement are applicable to projects under construction that violate laws and regulations or do not have complete approval procedures. Capacity replacement is a mechanism that allows local governments to replace newly added capacity with eliminated capacity under the national aggregate control. Production capacity replacement can take place between regions.

*3.3.3 Differentiated treatments of "zombie enterprises" and backward production capacity*

"Zombie enterprise" is a terminology used by official documents in recent years which refers to the enterprise that has lost their viability and is hard to operate in the foreseeable future, and includes three categories: first, enterprises that should be liquidated and deregistered due to closure or revocation of license, etc., but failed to declare in time or to enforce the law to liquidate and deregister. For these "Zombie enterprises", the governments may strengthen the survey of their financial positions and urge them to exit the market. Second, if the bankruptcy application is not filed or the court does not accept the application, the government may urge the enterprises to review the current situations and see if they can file the applications again. Third, the distressed enterprises that are protected from bankruptcy by bank credits or government supports belong to the narrow sense of "zombie enterprises", so improper supports should be canceled then the enterprises should go. Backward production capacity refers to the production capacity that does not meet the requirements of technology, environmental protection, product quality, safety production, etc., and can be applied to closure, merger and reorganization and other measures.

*3.3.4 Facilitating capacity transfer through regional cooperation*

Capacity transfer may be realized by enterprise relocation, plant establishment in different places, and industrial chain extension, which are jointly completed by the governments and enterprises. The governments of the regions where the production capacity is transferred out and the regions where the production capacity is transferred in are responsible for the supervision of industrial access and exit, tax sharing, policy guidance, etc. The enterprises select the regions where they move in, the partners, and the business methods according to the market conditions and the governmental guidance. The markets such as property rights trading, financing, technology, information, and legal service provide professional services for the production capacity transfer.[50]

### *3.3 Upgrading and improvement of emission trading system*

*3.3.1 A brief review of the development of the ETS in China*

In October 2011, the NDRC issued the Notice on Pilots Emission Trading, approving the pilot emission trading in Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong and Shenzhen. After 2-3 years of preparation, the pilot projects started trading from June 2013 to April 2014. By the end of 2020, the cumulative trading volume of allowances of the seven pilot programs is about 430 million tons of CO2 equivalent, and the cumulative trading volume is nearly

10 billion RMB.

In 2012, the NDRC issued the Interim Measures for the Administration of Voluntary Greenhouse Gas Emission Reduction Transactions and the Guidelines for the Validation and Certification of Voluntary Greenhouse Gas Emission Reduction Projects, which basically established the workflow of application, validation, filing, certification, issuance, etc. of China's voluntary emission reduction projects. The launch of voluntary greenhouse gas emission reduction (CCER) has enriched the carbon trading market, reduced the performance costs of controlled emission units, and improved the activity and operating efficiency of the carbon market.

The carbon trading pilots have improved the enterprise's ability to implement carbon assets management and participate in carbon trading. It has provided valuable experience for the design and operation of the nation-wide carbon market in carbon emission verification, intensity-based allowances allocation system, and offset mechanism based on voluntary emission reduction trading, and has trained professionals and transaction intermediaries.

In December 2017, the National Carbon Emission Trading Market Construction Plan (Power Generation Industry) was issued, and the construction of the national carbon market was officially launched. In April 2018, the division in charge of carbon trading were transferred from the NDRC to MEE, according to the Restructuring Plan of the State Council. In 2019, as the supporting infrastructure for carbon emission trading, the national carbon emission registration system and trading platform were designed and constructed in Hubei and Shanghai respectively. On July 16, 2021, the trading of national carbon market officially commenced. As for now, China's carbon market is the one with the largest amount of greenhouse gases covered in the world.[51]

*3.3.2 The role of China's carbon market in achieving carbon peaking and carbon neutrality*

- Changing the situation of excessively relying on "command-and-control" means. When relying on "command-and-control" means, although carbon emissions can be controlled in the short term, the regulation costs are high and the long-term effect is not so good. The implementation of carbon emission trading system can play a decisive role in resource allocation by market mechanism, urge energy-intensive and high emission enterprises to strengthen emission management, and strengthen the innovation and application of low-carbon technologies.
- The carbon price signal can reduce the emission reduction cost of the whole society and mobilize the enthusiasm of enterprises to reduce emissions. Market transactions are suppose to incentivize funds to flow into industrial enterprises with high emission reduction potential, and reduce the cost of emission reduction in the whole society. In the long run, the carbon price signal can incorporate carbon costs into corporate decision-making, promote green and low-carbon technological innovation, and provide an effective tool to handle the relationship between economic development and carbon emission reduction.
- Carbon emission trading requires a third-party agency to verify the enterprise energy consumption and emission data, which can provide accurate data that support the government's energy conservation and emission reduction and even industrial policy adjustment.
- By building a carbon market offset mechanism, it can provide additional financial support for forestry carbon sink, renewable energy and other carbon

reduction technologies, and help regional coordinated development and ecological protection compensation. On this basis, it may gradually increase the proportion of auctioned allowance allocation and develop financial innovation based on the carbon market, which can provide investment and financing channels for industries and regions to transform to green and low-carbon development and achieve carbon peaking and carbon neutrality.[52]

*3.3.3 Ongoing and upcoming improvements in China's carbon market*

China needs a stable, effective and flexible carbon market that can reflect the marginal emission reduction costs and external costs to achieve carbon peaking and carbon neutrality. Experts suggest that to realize these functions, China's carbon market should be reformed in the following aspects, and some of them are in progress.

- The basic design of the ETS should change from the current intensity-based allowance allocation to the more stringent absolute cap control.
- The accounting and verification method of carbon emissions should change from carbon emission factor method and mass balance method to direct measurement method represented by CEMS online monitoring, so as to achieve strong comparability, high accuracy and high practicability.
- The market participants should change from controlled emission enterprises only to a diversified market subjects with equal emphasis on controlled emission enterprises, non-controlled emission enterprises, financial institutions, intermediaries and individuals. A fair and reasonable carbon price will be formed through sufficient market entities with different risk preferences and expectations.
- Instruments transacted in the market should shift from focusing only on spot market to a diversified structure of spot, futures and derivatives. The carbon market should play multiple functions of swap and risk management.
- The allowance allocation mode should change from free allocation to "free & auction" distribution.
- The coverage of ETS should shift from enterprises to emission facilities that meet certain emission threshold.
- The role of financial institutions should shift from intermediary services for account opening and settlement to more active management pattern such as market makers.
- Intermediaries should shift from providing consultation and monitoring services to more professional carbon neutrality services.
- The market should range from one industry to eight industries, from regions to the whole country, and from focusing on the domestic market to linking with the international markets.[53]

### *3.4 Supporting carbon reduction goals with green finance*

*3.4.1 Development of green finance in China*

In recent years, green finance has developed rapidly in China, including continuously improving the green finance standard system to provide an accurate basis for the development of green finance; steadily promoting environmental information disclosure and create an open and transparent market environment for the development of green finance; constantly improving the incentive and constraint mechanism, and guiding more financial resources to invest in green

and low-carbon fields; encouraging innovation in green financial products and services, and fostering and expanding green financial markets; carrying out stress tests on energy-intensive industries in pilot provinces to explore beneficial paths for orderly prevention of climate risks; promoting the regional pilot of green finance to accumulate experiences for the construction of the national green financial system; and deepening international exchanges and cooperation in green finance and facilitating cross-border green investment and financing.[54]

By the end of 2022, the balance of China's domestic and foreign green loans was 22.03 trillion yuan,[55]and it supports saving more than 600 million tons of standard coal and reducing carbon dioxide equivalent by more than 1 billion tons every year.[56]

*3.4.2 Greening financial system for 30/60 targets*

Experts suggest that China's financial sector should begin to plan a green roadmap to support carbon peaking and carbon neutrality. Some of the recommended measures are already being implemented.

- Revising green financial standards with carbon neutrality as the constraint. The green credit and green industry standards should be revised according to the carbon neutral goal, and the standards of green fund and green insurance should be established. At the same time, the projects that meet these green standards should not have a significant negative impact on other sustainable development goals. In the process of formulating and revising green financial standards, the environmental and climate objectives pursued by the standards should be clearly stated, and how to implement the "no significant harm principle" should be well defined. The corresponding technical indicators or thresholds should be listed for all economic activities contained in the green financial standards or directories as far as possible. In the formulation of future green finance standards, full consideration should be given to the elements of transformation finance and the need to protect biodiversity.
- Financial institutions should calculate and disclose the risk exposure of carbon assets and the carbon footprint of major assets. The financial supervisory authorities shall clearly put forward specific requirements for financial institutions to carry out environmental and climate information disclosure, including the information on green and brown assets held by financial institutions, as well as the carbon footprint of these assets.
- Encouraging financial institutions to carry out environmental and climate risk analysis and strengthen capacity building. In the second half of 2021, the People's Bank of China organized 23 major banks to run the first round of assessment of the climate risk stress test. The pressure test is limited to several industries, and the assumed external impact is mainly the rise of carbon price. In the future, the climate stress test should be gradually extended to all carbon-intensive industries, and the impact of other variables other than carbon price should also be considered.
- Clarifying the operational guidance of "carbon emission reduction support tool" and establish a more powerful green financial incentive mechanism. The People's Bank of China officially announced the launch of the "carbon emission reduction support tool" in November 2021 to provide low-cost funds for low-carbon projects such as clean energy and industrial energy efficiency projects. In the process of implementing the "carbon emission reduction support tool", the key points should include: firstly, clearly defining the purpose of the loan, including project loans, working capital, trade financing

and other loan varieties in line with the investment directions. Secondly, information disclosure standards for carbon emission reduction support tools should be introduced to guide financial institutions to develop operational and traceable measurement methods and disclosure procedures. Thirdly, selecting qualified third-party institutions, or setting the standards that the third-party institutions need to meet. And fourthly, expanding gradually the scope of distribution of carbon emission reduction support tools, and allowing more banks to participate in the implementation of carbon emission reduction support tools.

- Foreign exchange regulatory authority, Sovereign funds and social security funds should actively carry out sustainable investment to lead the participation of private sector.
- Encouraging financial institutions to explore transformation financing, including setting up transformation funds and issuing transformation bonds. To achieve carbon neutrality, it is not only necessary to support pure green projects (such as clean energy, green transportation, green buildings, etc.), but also to support the transformation of fossil energy enterprises to clean energy, green low-carbon transformation of old buildings, energy conservation, emission reduction and carbon reduction projects of carbon-intensive enterprises. Financial institutions should be encouraged to launch transformation funds, transformation loans, transformation bonds, transformation insurance and other financial instruments, and establish mechanisms to support transformation financing.[57]

## 4. Major challenges facing China's carbon peaking and carbon neutrality

### *4.1 China is under a huge pressure of transformation due to a very short time window for carbon peaking and carbon neutrality*

Many European countties reached its carbon peak in the 1980s and 1990s, and realized it after its occurrence. After reaching the peak, carbon emissions began to decline slowly after a long plateau period, and now it is about to move towards carbon neutrality with rapid decline in emissions. The time span between the carbon neutrality committed by the EU and the carbon peak is 65-70 years. China has set a schedule for reaching the carbon peaking in advance. At present, carbon dioxide emissions are still rising, and hard work needs to be made to achieve the peaking. The time span for China between carbon peaking and carbon neutrality is 30 years, which means that the plateau period after peaking is very ting, requiring rapid reduction of carbon emissions. On the other hand, energy intensity and carbon emission intensity of China's GDP are quite high. The energy intensity of China's per unit GDP is more than twice of the world average, and the carbon emission intensity per unit GDP is more than 3 times of the world average. As a result, carbon peaking and carbon neutrality largely depend on the transformation of economic development mode to reduce energy consumption and carbon emissions.[58]

### *4.2 Bottleneck in energy transition*

In the 13th Five-Year Plan for Energy Development, the dual replacement strategy of "replacing coal with oil and gas and replacing fossil energy with non-fossil energy" was proposed.[59]

In terms of replacing coal with oil and gas, China has weaknesses in the supply of oil and gas resources. China has few oil and gas reserves, relatively poor

mineral grade and high exploration and development costs. In 2019, China's domestic conventional oil development cost was more than 40 dollars/barrel. With the exploration of the oil, the proportion of heavy oil and low abundance oil has increased, the exploitation cost has increased, and the economic benefits have declined accordingly. In 2019, China's domestic crude oil production was about 190 million tons, and the reserve/production ratio was only about 18 years. Although the production capacity of natural gas has grown rapidly in recent years, the increase in output is far less than the increase in consumption, and the dependence on import continues to grow too fast. The reserve/production ratio of natural gas in China is only about 36 years. The new production capacity in the future will mainly come from complex gas reservoirs such as ultra deep, low permeability, tight, high sulfur and volcanic rocks, which will significantly increase the difficulty and cost of exploration and development.

The explosive growth of renewable energy installed capacity has brought great challenges to the stable operation of the grid system. China's power grid system has sufficient flexibility resources, but lacks the mechanism to stimulate the use of these flexible resources. The auxiliary service market, demand side management, energy storage services, etc. need to be developed as soon as possible.[60]

### *4.3 Coordinating carbon peaking among different regions*

China has a vast territory, and there are huge differences in energy endowment, energy consumption, carbon emissions and forestry carbon sinks among regions.[61] Relevant research shows that the energy intensity of high-income regions in China is lower than that of low-income regions.[62] In this case, there may be a problem that low-income areas need to undertake more emission reduction tasks. For example, in energy rich areas such as Shanxi Province and Inner Mongolia Autonomous Region, their economic development is relatively backward, but the carbon reduction tasks is more heavy, and the pressure of transformation may be greater than that of developed coastal areas. Therefore, the top-level design needs to take regional differences into consideration. On the basis of scientific assessment of regional development stages, economic strength, energy structure, resource endowments, etc., a roadmap for different regions to reach the peak in different stages should be formulated, and the time limit and key tasks for reaching the peak in different regions should be defined.[63]

The empirical research shows that the CO2 emission patterns of different provinces in China conform to the inverted "U" shape of the EKC curve to a certain extent, but there are obvious differences between the realization path of the carbon peak goal and the value of peak point due to the factors such as the economic development, industrial structure and population density. Experts suggest that, in view of the imbalance of China's economic development, the realization 30/60 targets must be differentiated according to the specific conditions of each province (autonomous region, municipality directly under the Central Government).The high-tech leading regions represented by Beijing, Shanghai and Tianjin are the forerunners in the implementation of carbon peaking and carbon neutrality goals. They should take the lead in achieving technological breakthroughs in carbon capture, carbon sink and other fields. The main task of light industry leading provinces represented by Henan, Hunan and Fujian are to realize industrial upgrading based on modern technologies such as artificial intelligence. The heavy industry provinces represented by Hebei, Shandong and Inner Mongolia are facing the heaviest carbon reduction task. They need to use national policy support to develop green industries, including new energy, and

complete the upgrading of high pollution and high emission industries as soon as possible.[64]

### *4.4 Problems in scientific and technological innovation*

The key technologies to achieve carbon neutrality can be divided into three categories: The first is smart grid, energy storage and other technologies that adapt to a high proportion of renewable energy. The second is to realize the substitution of hydrogen energy and biomass energy for fossil energy in the processes that are difficult to decarbonize in the fields of industry, transportation and construction. Finally, negative carbon technology, including carbon capture, utilization and storage (CCUS), bioenergy with carbon capture and storage (BECCS), etc.[65]

Technology development regarding carbon peaking and carbon neutrality also faces challenges as listed in the subsequent sub-sections:

#### *4.4.1 Gap between the domestic technical level and the international advanced level*

The independent innovation ability of climate technology in China is relatively weak. About 10 percent of the technical areas are in the international leading position, 35 percent are in parallel, 55 percent are in the following position, and the overall technology gap is about 15 years. Moreover, it is difficult to introduce key technologies from developed countries, which is restricted by the willingness of developed countries to transfer technologies, market competitions and other factors.

#### *4.4.2 The overall ratio of technology conversion into practice is not high enough*

Firstly, the supply and demand of technology to deal with climate change failed to be effectively matched. Although more than 30000 scientific and technological achievements at or above the provincial and ministerial level are produced every year, and the number of patents is huge, only about 36 percent of the technologies have entered the industrialization stage, of which only 10-15 percent can be widely promoted and produce economies of scale (the ratio is 40 percent in developed countries). Secondly, the costs of technology R&D and application are generally too high. Thirdly, the roles of market mechanism in technology promotion, transformation and application are relatively limited. Fourthly, the national technology intermediary agencies are underdeveloped, and the accreditation and certification mechanisms for low-carbon technology products are not standardized, which affects the efficiency of technology transformation.[66]

### *4.5 Building carbon emission statistical accounting system*

Authoritative and accurate carbon emission data statistics and accounting system is a crucial foundation for achieving carbon peaking and carbon neutrality. Prior to the proposal of 30/60 targets, China's carbon emission statistical accounting system mainly served the needs of compliance of UNFCCC, and was carried out in the form of preparing a national greenhouse gas inventory.[67]In addition, during the construction of the pilot ETS and the national carbon market, the MRV guidelines of relevant industries were published.

At present, the problems of carbon emission statistical accounting in China are listed in the following sub-sections:

*4.5.1 It is difficult to give consideration to both comprehensiveness and timeliness in the selection of measurement methods*

If the method of preparing greenhouse gas emission inventory to calculate carbon emissions is adopted, the carbon emissions can be comprehensively and accurately assessed, but the data acquisition and preparation process is complex, and the calculation cycle is time-consuming, which is difficult to meet the requirements of regular monitoring of carbon reduction goals. The method of using the energy balance sheet to obtain the data of relevant activities and calculate carbon emissions, although simple and timely, only involves carbon emissions of several energy categories, such as coal, oil, natural gas and electricity.

*4.5.2 The calculation of emission factors is difficult to meet the practical needs*

The existing accounting methods rely on greenhouse gas emission factors, which are provided by the relative authorities in a unified manner and are relatively slow to update. Taking electricity as an example, with the growth of renewable power such as photovoltaic power generation, wind power and hydropower, the power supply structure has changed significantly. The grid emission factors are actually in the process of declining year by year, but the emission factors cannot be updated in time, which is difficult to reflect the emission reduction effect brought by the optimization of power supply structure.

*4.5.3 The measurement methods specified for regions and industries are not clear enough*

The statistics and accounting methods for regions, as well as those for some industries with special attributes, such as civil aviation, still need to be improved.[68]

In order to meet the requirements of statistical accounting system in policy formulation, assessment, and implementation of 30/60 targets, the NDRC, the National Bureau of Statistics and the MEE jointly issued the Implementation Plan for Accelerating the Establishment of a Unified and Standardized Statistical and Accounting System for Carbon Emissions in August 2022, which aims to build a unified and standardized carbon emission statistical accounting system by 2023-2025. The key tasks include: establishing the national and local carbon emission statistical and accounting system, improving the carbon emission accounting mechanism of industrial enterprises, establishing and improving the carbon emission accounting method of key products, and improving the national greenhouse gas inventory preparation mechanism.[69]

## 5. Conclusions

### *5.1 Upgrading from objectives to policies*

China's 30/60 targets are an upgrade of China's carbon reduction goals that have evolved gradually since the 11th Five-Year Plan. Carbon peaking and carbon neutrality are not only out of the needs for China to fulfill its international obligations, but also will open up a new path for its long-term development and bring new opportunities. Higher carbon reduction targets can help China reduce foreseeable natural disasters, improve people's quality of life, improve China's medium and long-term GDP and employment rate, and significantly reduce dependence on imported and non-renewable energy.[70]China's policy instruments to achieve decarbonization have been gradually developed from long-term carbon reduction practices, and have been upgraded and improved to be adaptive

to 30/60 targets, combining the command-and-control approaches and market incentives. As China's carbon reduction goals face enormous challenges, it can be predicted that the upgrading and improvement of policies will be a continuous process. In the future, China should gradually establish a legal framework suitable for the 30/60 targets, a multi-level governance system, and a mechanism for equitable sharing of carbon reduction costs among regions and industries.

*5.2 Will China achieve the goal of carbon neutrality?*

Despite many challenges, research shows that China is expected to achieve the goal of carbon neutrality in 2060.

At present, China's annual carbon dioxide emissions are about 10 billion tons. With the development of renewable energy and the use of other technologies, it is estimated that 2.5-3 billion tons of carbon dioxide will be emitted in 2060.The oceans can absorb 575-690 million tons, the terrestrial ecosystems can absorb 1.3 billion tons, and other natural processes outside the ecosystems can absorb about 200 million tons, with a total absorption of about 2.2 billion tons. On this basis, if the development of 500 million tons of CCUS projects are in place, it can roughly achieve carbon neutrality.[71]

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| Category | Title of the document | Issuing authority | Time of Issuance |
|---|---|---|---|
| The action for green and low-carbon energy transition | Benchmark Levels and Advanced Levels of Energy Efficiency in Key Fields of Energy-Intensive Industries (2021 Version) | NDRC, MIIT, MEE, SAMR, NEA | 15 Nov. 2021 |
| | Opinions on Improving the System, Mechanism and Policy Measures on Energy Green and Low-carbon Transformation | NDRC, NEA | 30 Jan 2022 |
| | The 14th Five-Year Plan for Modern Energy System | NDRC, NEA | 22 Mar. 2022 |
| | Medium and Long-term Plan for the Development of Hydrogen Energy Industry (2021-2035) | NDRC, NEA | 23 Mar. 2022 |
| | Benchmark Levels and Advanced Levels in Key Fields of Clean and Efficient Utilization of Coal (2022 Version) | NDRC | 10 May 2022 |
| | 14th Five-Year Plan for Renewable Energy Development | NDRC, NEA, MOF, MNR, MEE, MHURD, MARA, China Meteorological Administration, National Forestry and Grassland Administration | 1 June 2022 |
| | The Action Plan to Standardize Carbon Peaking and Carbon Neutrality in Energy | NEA | 20 Sept. 2022 |
| The action for energy saving, carbon emission mitigation and efficiency improvement | Several Opinions on Strict Energy Efficiency Constraints to Promote Energy Conservation and Carbon Reduction in Key Fields | NDRC, MIIT, MEE, SAMR, NEA | 18, Oct. 2021 |
| | Comprehensive Work Plan for Energy Conservation and Emission Reduction for the "14th Five-Year Plan" Period | the State Council | 24 Jan. 2022 |
| | Implementation Guide for Upgrading Energy Conservation and Carbon Reduction Transformation in Key Fields of Energy-intensive Industries (2022 Version) | NDRC, MIIT, MEE, NEA | 3 Feb. 2022 |
| | Implementation Plan for Synergistic Efficiency through Coordinated Pollution Reduction and Carbon Reduction | MEE, NDRC, MIIT, MHURD, MOT, MARA, NEA | 13 June 2022 |
| | Advanced Levels, Energy Saving Levels, and Access Levels of Energy Efficiency of Key Energy-using Products and Equipment (2022 Version) | NDRC, MIIT, MOT, MHURD, SAMR | 17 Nov. 2022 |
| The action for peaking carbon dioxide emissions in industry sector | The 14th Five-Year Plan for Green Industrial Development | MIIT | 3 Dec. 2021 |
| | The 14th Five-Year Plan for the Development of Pharmaceutical Industry | MIIT, NDRC, MOST, MOFCOM, National Health Commission, MOEM, National Healthcare Security Administration, National Medical Products Administration, and National Administration of Traditional Chinese Medicine | 22 Dec. 2021 |
| | Guiding Opinions on Promoting High Quality Development of Iron and Steel Industry | MIIT, NDRC, MEE | 7 Feb. 2022 |
| | Guiding Opinions on Promoting the High Quality Development of Petrochemical and Chemical Industry during the 14th Five-Year Plan | MIIT, NDRC, MOST, MEE, MOEM, NEA | 28 Mar. 2022 |
| | Guiding Opinions on High Quality Development of Chemical Fiber Industry | MIIT, NDRC | 12 April 2022 |
| | Guiding Opinions on High Quality Development of Industrial Textile Industry | MIIT, NDRC | 21 April 2022 |
| | Guiding Opinions on Promoting the High Quality Development of Light Industry | MIIT, Ministry of Human Resources and Social Security, MEE, MOFCOM, SAMR | 8 June 2022 |
| | Industrial Water Efficiency Improvement Action Plan | MIIT, Ministry of Water Resources, NDRC, MOF, MHURD, SAMR | 21 June 2022 |
| | Industrial Energy Efficiency Improvement Action Plan | MIIT, NDRC, MOF, MEE, SASAC, SAMR | 23 June 2022 |
| | Implementation Scheme of Carbon Peaking in Industrial Field | MIIT, NDRC, MEE | 7 July 2022 |
| | Action Plan for Green and Low Carbon Development of Information and Communication Industry (2022-2025) | MIIT, NDRC, MOF, MEE, MHURD, SASAC, NEA | 22 Aug.2022 |
| | Implementation Plan for Carbon Peak in Nonferrous Metals Industry | MIIT, NDRC, MEE | 10 Nov. 2022 |
| The action for peaking carbon dioxide emissions in urban-rural development area | Guidance on Promoting Green Development of Urban and Rural Areas | General Office of the CPC Central Committee and General Office of the State Council | 21 Oct. 2021 |
| | The 14th Five-Year Plan for Construction Industry Development | MHURD | 19 Jan. 2022 |
| | The 14th Five-Year Plan for Promoting Agricultural and Rural Modernization | the State Council | 11 Feb. 2022 |
| | The 14th Five-Year Plan for Scientific and Technological Development of Housing and Urban Rural Construction | MHURD | 1 Mar. 2022 |
| | The 14th Five-Year Plan for Building Energy Efficiency and Green Building Development | MHURD | 11 Mar. 2022 |
| | Implementation Plan for Agricultural and Rural Carbon Reduction and Carbon Sink | MARA, NDRC | 30 June 2022 |
| | Implementation Plan for Carbon Peak in Urban and Rural Construction | MHURD, NDRC | 13 July 2022 |
| | Implementation Plan for Carbon Peak in Building Materials Industry | MIIT, NDRC, MEE, MHURD | 2 Nov. 2022 |
| The action for promoting green and low-carbon transportation | The 14th Five-Year Plan for Green Transport Development | MOT | 29 Oct. 2021 |
| | Development Plan for Modern Comprehensive Transportation System during the 14th Five-Year Plan | the State Council | 18 Jan. 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | MOT, State Railway Administration, Civil Aviation Administration of China, State Postal Bureau | 18 April 2022 |
| The action for promoting circular economy in carbon mitigation purpose | Circular Economy Development Plan of the 14th Five-Year Plan | NDRC | 1 July 2021 |
| | Implementation Plan on Accelerating the Comprehensive Utilization of Industrial Resources | MIIT, NDRC, MOST, MOF, MNR¤ MEE¤MOFCOM, STA | 27 Jan. 2022 |

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| **The action for advancing green and low-carbon technology innovation** | The 14th Five -ear Plan for Scientific and Technological Innovation in Energy Field | NEA, MOST | 29 Nov. 2021 |
| | Implementation Plan for Science and Technology Support for Carbon Dioxide Peaking and Carbon Neutralization (2022-2030) | MOT, NDRC, MEE, MHURD, MOT, Chinese Academy of Sciences, Chinese Academy of Engineering, NEA | 24 June 2022 |
| **The action for consolidating and enhancing carbon sink** | Accounting Method for Economic Value of Marine Carbon Sink | MNR | 21 Feb. 2022 |
| **The action for green and low-carbon society** | Working Plan for Strengthening Higher Education Talent Training System for Carbon Dioxide Peaking and Carbon Neutrality | MOE | 7 May 2022 |
| | Implementation Plan for National Educational System for Green and Low Carbon Development | MOE | 8 Nov. 2022 |
| **Provincial (municipality direct under the central government, autonomous region) carbon dioxide peaking and carbon neutrality implementation plan** | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Jilin Provincial Committee and Jilin Provincial People's Government | 30 Nov. 2021 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Hebei Provincial Committee and Hebei Provincial People's Government | 5 Jan. 2022 |
| | Joint Action Plan for Carbon Dioxide Peaking and Carbon Neutrality of Chengdu Chongqing Economic Circle | General Office of Chongqing Municipal People's Government, General Office of Sichuan Provincial People's Government | 15 Feb. 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Zhejiang Provincial Committee and Zhejiang Provincial People's Government | 17 Feb. 2022 |
| | Henan Province's 14th Five-Year Plan on Modern Energy System and Carbon Dioxide Peaking and Carbon Neutrality | People's Government of Henan Province | 23 Feb. 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Hunan Provincial Committee and Hunan Provincial People's Government | 22 Mar. 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Sichuan Provincial Committee and Sichuan Provincial People's Government | 31 Mar. 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Jiangxi Provincial Committee and Jiangxi Provincial People's Government | 6 April 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Guangxi Zhuang Autonomous Region Committee, Guangxi Zhuang Autonomous Region People's Government | 13 May 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Inner Mongolia Autonomous Region Committee, Inner Mongolia Autonomous Region People's Government | 28 June 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Jiangxi | Jiangxi Provincial People's Government | 18 July 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Guangdong Provincial Committee and Guangdong Provincial People's Government | 25 July 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Shanghai | Shanghai Municipal People's Government | 28 July 2022 |
| | Implementation Opinions of the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy | CPC Chongqing Municipal Committee and Chongqing Municipal People's Government | 29 July 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Jilin | Jilin Provincial People's Government | 1 Aug. 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Hainan | Hainan Provincial People's Government | 22 Aug. 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Tianjin | Tianjin people's government | 25 Aug. 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Jiangsu | Jiangsu Provincial People's Government | 2 Oct. 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Beijing | Beijing Municipal People's Government | 11 Oct. 2022 |
| | Implementation Plan of Carbon Dioxide Peaking in Guizhou | People's Government of Guizhou Province | 4 Nov. 2022 |
| | Implementation Plan for Carbon Dioxide Peaking in Inner Mongolia Autonomous Region | People's Government of Inner Mongolia Autonomous Region | 17 Nov. 2022 |
| **Supportive schemes** | Guiding Opinions on Promoting the High Quality Development of Central Government-owned Enterprises for Carbon Dioxide Peaking and Carbon Neutrality | SASAC | 27 Nov. 2021 |
| | Implementation Plan for Accelerating the Establishment of a Unified and Standardized Statistical and Accounting System for Carbon Emissions | NDRC, National Bureau of Statistics, MEE | 22 April 2022 |
| | Guidelines on Green Finance for the Banking and Insurance Industries | China Banking and Insurance Regulatory Commission | 13 May 2022 |
| | Guidelines for Tax Preferential Policies to Support Green Development | SAT | 31 May 2022 |
| | Opinions on Financial Support for Carbon Dioxide Peaking and Carbon Neutralization | MOF | 31 May 2022 |
| | Implementation Plan for Establishing and Improving the Measurement System for Carbon Peaking and Carbon Neutrality Standards | SAMR, NDRC, MIIT, MNR, MEE, MHURD, MOT, China Meteorological Administration, State Forestry and Grass Administration | 18 Oct. 2022 |

Table 1: Overview of carbon peaking and carbon neutrality policy system

| Abbreviation | Ministry |
|---|---|
| MARA | Ministry of Agriculture and Rural Affairs |
| MEE | Ministry of Ecology and Environment |
| MHURD | Ministry of Housing and Urban-Rural Development |
| MIIT | Ministry of Industry and Information Technology |
| MNR | Ministry of Natural Resources |
| MOE | Ministry of Education |
| MOEM | Ministry of Emergency Management |
| MOF | Ministry of Finance |
| MOFCOM | Ministry of Commerce |
| MOST | Ministry of Science and Technology |
| MOT | Ministry of Transport |
| NEA | National Energy Administration |
| NDRC | National Development and Reform Commission |
| SAMR | State Administration of Market Regulation |
| SASAC | State-owned Assets Supervision and Administration Commission |
| STA | State Taxation Administration |

Table 2: Overview of carbon peaking and carbon neutrality policy system

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