



China Council for International Cooperation  
on Environment and Development

# SPECIAL POLICY REPORT

## Pathways for Achieving Carbon Neutrality and China's Role in Global Climate Governance



2023

---

## Special Policy Study Members

*Co-chairs\* (surnames in alphabetic order) :*

***International:***

Kate HAMPTON	CCICED Member, CEO, Children's Investment Fund Foundation
ZOU Ji	CCICED Special Advisor, CEO & President, Energy Foundation China

***Chinese:***

WANG Yi	CCICED Member, Member of Standing Committee, 14th National People's Congress of China; Vice Chairperson, National Expert Committee on Climate Change; Professor, Institutes of Science and Development, Chinese Academy of Sciences
---------	---

*Special Policy Study Members\* (surnames in alphabetic order) :*

***International:***

Jonathan PERSHING	CCICED Member, Program Director of Environment, William and Flora Hewlett Foundation
Ana TONI	National Secretary for Climate Change of the Ministry of Environment and Climate Change of Brazil
Laurence TUBIANA	CCICED Member, CEO, European Climate Foundation (ECF)

***Chinese:***

LI Zheng	Dean of the Institute of Climate Change and Sustainable Development, Tsinghua University
WANG Jinzhao	Research Fellow and Director General, Research Department of Industrial Economy, Development Research Center of the State Council (DRC)

---

WANG Zhongying	Former Director and Research Fellow of the Energy Research Institute of the National Development and Reform Commission
XU Huaqing	Director General, China National Center for Climate Change Strategy and International Cooperation
ZHANG Haibin	Associate Dean and Professor, School of International Studies, Peking University

***Research Support Team (surnames in alphabetic order) :***

***International:***

Manish BAPNA	CCICED Member, President and CEO, Natural Resources Defense Council
Jos DELBEKE	CCICED Member, The first EIB Chair on Climate Policy and International Carbon Markets of the European University Institute; Former Director-General of the European Commission's DG for Climate Action
Adrian FERNANDEZ	Executive Director, Climate Initiative of Mexico (ICM)
Alexander FISHER	Director Climate Ambition, ClimateWorks Foundation
Kelly Sims GALLAGHER	Dean Ad Interim at The Fletcher School, Tufts University
HAN Guoyi	Senior Research Fellow, SEI
Hal HARVEY	CCICED Member, CEO, Energy Innovation and President, Climate Imperative Foundation
Gørild Merethe HEGGELUND	Senior Research Fellow, Fridtjof Nansen Institute
Frank JOTZO	Professor, Crawford School of Public Policy, Director, Centre for Climate and Energy Policy, Australian National University
Rachel KYTE	Former Dean of The Fletcher School, Tufts University
Bernice LEE	CCICED Special Advisor, Research Director, Futures, Hoffmann Distinguished Fellow for Sustainability, Chair of Chatham House Sustainability Accelerator Advisory Board,

---

	Chatham House - Royal Institute of International Affairs
LEI Hongpeng	CCICED Special Advisor, Global Climate Director and Chief China Representative, Children's Investment Fund Foundation
Sonia MEDINA	Chief Ecosystem Development Officer and Executive Director of Climate, Children's Investment Fund Foundation
Janos PASZTOR	Executive Director, Carnegie Climate Geoengineering Governance Initiative (C2G2)
Harald WINKLER	Professor, Energy Research Centre, University of Cape Town

***Chinese:***

HE Kebin	CCICED Member, Member of Chinese Academy of Engineering; Professor of the School of Environment and Dean of the Institute for Carbon Neutrality at Tsinghua University
JU Jiandong	Chair Professor, PBC School of Finance in Tsinghua University
KANG Yanbing	Deputy Director General, National Energy Conservation Center
LI Junfeng	Executive Director of China Energy Research Association, Partner of Sequoia China Investment
TAN Xianchun	Professor, Institutes of Science and Development, Chinese Academy of Sciences
WANG Fengchun	Former First-level Inspector of the Act Office of the National People's Congress Environmental Protection Committee
WANG Pu	Academic Director, Associate Professor, Institute of Sustainable Development Strategy, Institutes of Science and Development, Chinese Academy of Sciences

***Coordinators:***

Xin Jianan	Chief of Staff, Energy Foundation China
------------	---

---

GU Baihe

Associate Professor, Institutes of Science and  
Development, Chinese Academy of Sciences

***Other participants:***

LIU Qiang

Deputy Chief Representative China,  
Children's Investment Fund Foundation

ZHAO Xiao

Children's Investment Fund Foundation

QI Yue

Children's Investment Fund Foundation

HAN Wei

Energy Foundation China

MENG Qi

Energy Foundation China

CAI Jingjing

Energy Foundation China

ZHANG Xiaohan

Energy Foundation China

ZHAO Wenbo

Energy Foundation China

PENG Linan

Energy Foundation China

WANG Chen

Sino-Danish College, UCAS

LI Jiaxin

School of Public Policy and Management,  
UCAS

LIU Yuxuan

Institutes of Science and Development,  
Chinese Academy of Sciences

*\* The co-leaders and members of this SPS serve in their personal capacities. The views and opinions expressed in this SPS report are those of the individual experts participating in the SPS Team and do not represent those of their organizations and CCICED*

---

## Executive Summary

The Special Policy Study on the Pathway to Carbon Neutrality and China's Role in Global Climate Governance is one of the research topics under the taskforce of Global Environmental Governance and Ecological Civilization of China Council for International Cooperation on Environment and Development (referred to as CCICED) from 2022 to 2023. The focus of the research project includes the judgment on the domestic and international situation of green and low-carbon transition, the analysis on progress of China's carbon dioxide peaking and carbon neutrality actions, as well as China's policy direction of deepening green and low-carbon transition.

At present, global climate governance has entered the stage of fully implementing the Paris Climate Agreement. Countries covering 83% of global carbon emissions, 91% of GDP and 80% of the world's population have put forward or are about to propose their "zero carbon" or "carbon neutrality" climate goals, and have actively promoted green and low-carbon transformation and innovation. However, as the international political and economic environment becomes more and more complex and severe, the resistance and differences in the global climate governance are also gradually increasing. There are still many competitions between countries around related issues such as climate goals and climate funding, and the positive attitude and mutual trust in advancing climate cooperation are also gradually decreasing, so the road to a global response to climate change still has a long way to go.

China attaches great importance to addressing climate change, works actively and prudently toward the goals of reaching peak carbon emissions and carbon neutrality. The framework of dual carbon "1+N" policy system, along with joint advancement in all aspects, continuously provide a steady and continuous momentum for the realization of the dual goals of carbon peaking and carbon neutrality. However, we must realize that carbon neutrality is a systematic project, a systematic action roadmap driven by a series of goals, technologies, funds, policies, etc. In the transformation process, it is necessary to grasp the opportunities and meet the challenges, by handling the basic relationship well, solving the short-term problems of high cost and difficulty in the transformation, as well as systemic challenges in the medium and long term.

Therefore, in order for global climate governance and the green and low-carbon transition to be successfully realized, on the one hand, all countries should cooperate pragmatically at the international level, especially coordination among major powers. A balance between different circumstances in different countries and their demanded interests can motivate all parties to actively address climate change together. On the other hand, China should continue to maintain its strategic strength and actively promote efforts to address climate change. On the basis of

---

scientifically evaluating the new changes in the international situation and China's policy orientation and impact after the 20th National Congress of the Communist Party of China, identify the key challenges and opportunities in climate governance and related actions to implement the low-carbon goals, formulate medium and long-term transformation strategies, policy design and the achievement of a comprehensive dynamic balance, and gradually build an institutional and governance system centered on promoting structural innovation, continuous improvement of environmental quality, and comprehensively green and low-carbon transition.

This report first scientifically judged the latest situation of green and low-carbon transition in the international and domestic contexts. Then, focusing on the progress of China's carbon dioxide peaking and carbon neutrality actions, it systematically compiled and summarized the progress made in various areas of China's current low-carbon transition process, as well as the achievements of the policy system, and proposed directions for further deepening and improving. On this basis, combined with China's national conditions and the current situation of green and low-carbon transition, it pointed out the future policy direction of deepening China's green and low-carbon transition in nine major aspects, such as green investment, carbon market, and just transition. Furthermore, the report also focused on the issue of gender equality, proposed the application of the gender mainstreaming analysis to the four main and feasible specific work areas of the climate action of China, provided policy recommendations for implementing China's vision and goals in terms of carbon neutrality and for promoting the international climate cooperation.

The main findings and conclusions of the research are as follows:

### **(I) Judgment on the domestic and international situation of green and low-carbon transition**

**The international situation of green and low-carbon transition:** **Firstly**, the current global situation is highly uncertain, and the deficit in global climate governance will become more prominent. **Secondly**, the long-term trend of global energy transition is clear, while the short-term energy crisis shall not be overlooked. **Thirdly**, the global green industrial revolution driven by climate change may reshape the competition and cooperation system in the fields of global trade, technology, and finance. **Fourthly**, southern countries and emerging economies are actively accelerating energy transition, but they still face a series of risks and challenges. **Fifthly**, under the new situation of multiple crises, the urgency of international climate cooperation has further increased.

**The domestic situation of green and low-carbon transition:** **Firstly**, under the downward trend of the economy, a great pressure is put on green and low-carbon transition, and the green transition of the development mode should be promoted through steady progress. **Secondly**, China's

---

development goals have shifted to synergistically promote climate response, economic growth, energy security, and ecological governance. **Thirdly**, China has the motivation for green and low-carbon transition and development, and has the objective conditions to transform climate actions into high-quality economic and social development. **Fourthly**, the long-term vision and goal for carbon neutrality are clear, and the short-to-medium-term structural transition will face challenges in terms of just transition, technological innovation and policy mechanisms. **Fifthly**, China continues to promote high-level opening up, and actively carries out international cooperation to advance global green recovery and low-carbon transition.

## **(II) The analysis on progress of China's carbon dioxide peaking and carbon neutrality actions**

Since China proposed the dual goals of carbon dioxide peaking and carbon neutrality, China has attached great importance to climate change, and its green and low-carbon transition process has achieved remarkable results. **Firstly**, the energy system is developing toward cleanliness and high efficiency. In recent years, China has witnessed a rapid development of non-fossil energy and a significant improvement in the level of clean and efficient utilization of fossil energy, which has contributed to a significant reduction in the energy consumption intensity and an accelerated transition to the clean and low-carbon energy consumption structure. **Secondly**, the transition of the industrial structure is developing toward green and intelligent. In recent years, China's industrial structure has been continuously upgraded and optimized, in which green and low-carbon industries are booming, digital information technology enables green and low-carbon upgrading of traditional industries, and in the meanwhile, the excess and backward production capacity has been optimized and eliminated and the development of "high energy-consuming, high-pollution, and low-level" projects have been strictly controlled. **Thirdly**, there are synergies between carbon reduction and economic development, pollution prevention and control. While ensuring sustained and rapid economic development, China has achieved remarkable results in reducing carbon and emissions. At the same time, China actively has promoted the coordinated governance of carbon reduction and pollution reduction, and given full play to the synergistic benefits between the two. **Fourthly**, the carbon sink capacity of ecosystems such as forests, grasslands and wetland has been significantly enhanced. In particular, in terms of forest carbon sinks, not only has the forest coverage rate and forest stock volume maintained "double growth" for more than 30 consecutive years, but China also has the fastest growing forest resources in the world. **Fifthly**, green and low-carbon life has gradually become a new fashion. China has always attached great importance to the continuous promotion of the construction and education of ecological civilization, and has also been highly focused on implementing the green and low-carbon concept in all aspects of the basic necessities of life of the public, where a green low-carbon lifestyle has been widely promoted and has begun to bear fruit.

In addition, China has made significant progress in building a policy framework around the dual-carbon goal, and has basically established a "1+N" policy system for carbon dioxide peaking and carbon neutrality with clear goals, reasonable division of labor, effective measures, and orderly



---

connections, which is characterized by the following four main features: **Firstly**, the "1+N" system for carbon dioxide peaking and carbon neutrality implements the mid-to-long-term dual-carbon goal through practical actions in multiple fields. **Secondly**, the "1+N" policy system for carbon dioxide peaking and carbon neutrality provides a solid guarantee for low-carbon transition through systematic institutional construction and capacity building. **Thirdly**, the "1+N" policy system for carbon dioxide peaking and carbon neutrality plays the role of multiple subjects in multiple fields to form a good pattern of joint efforts of the whole society to reduce emissions. **Fourthly**, the "1+N" policy system for carbon peaking and carbon neutrality shows that China will continue to uphold the image of a responsible major country with an open and inclusive attitude, and continue to promote the construction of a new pattern of multi-party win-win climate cooperation.

Through an analysis of China's progress in both dual-carbon actions and policies, this report recognizes China's achievements in the field of dual-carbon, but also points out that China needs to further deepen and improve its dual-carbon policies and actions, mainly in the following four areas: **Firstly**, China needs to further improve the management system and mechanism for carbon peaking and carbon neutrality and further strengthen the synergistic benefits among the policies for carbon peaking and carbon neutrality. **Secondly**, China needs to further clarify its short- and medium-term roadmap for low-carbon energy transition. **Thirdly**, China needs to further leverage the role of the market in the work relating to carbon peaking and carbon neutrality. **Fourthly**, China needs to attach importance to the fairness and justice of regional development in the process of transition.

### **(III) China's policy direction of deepening green and low-carbon transition**

**In general**, take carbon reduction as a guide and promote overall green and low-carbon transition of whole economy and society. **Firstly**, promote green investment, low-carbon consumption, and trading of low-carbon products for the purpose of injecting new impetus into economic growth. **Secondly**, optimize the spatial structure of the territory and construct a new spatial pattern meeting the requirements for carbon peaking and carbon neutrality. **Thirdly**, complete the mechanism and institution for management over carbon peaking and carbon neutrality and focus on building the local capacity to achieve the dual carbon goals. **Fourthly**, push forward the transition and transformation of key mechanisms and accelerate the transition from the control over both of the total amount and the intensity of energy consumption to the control over those of carbon emissions. **Fifthly**, speed up the carbon pricing and the carbon market mechanism building of China. **Sixthly**, focus on achieving just transition at the industrial and the regional levels. **Seventhly**, push forward the perfection of the investment and financing policies relating to climate so as to promote the transition to carbon neutrality. **Eighthly**, lead a new global green development pattern and continue to deepen the international cooperation in climate changes.

---

#### **(IV) Necessity of and recommendations for mainstreaming gender issue in climate and environment related work**

Women are more vulnerable than men to the impact of a climate change. At the same time, due to taking on more work to sustain family livelihoods, women have a deeper knowledge and understanding of local climatic and environmental conditions, which can help them provide more practical and feasible solutions for adaptation to and mitigating climate changes. In the work of climate changes, full consideration should also be given to the participation and contribution of women by all stakeholders, to ensure that their perspectives are expressed and reflected and achieve the synergy between the sustainable development goals of climate action and gender equality.

#### **Recommendation on mainstreaming gender in climate and environment related work:**

**Firstly**, give full play to women's leadership in climate change-related affairs and improve women's participation and representativeness in climate decision making. **Secondly**, actively drive just transition and promote women's equal employment through the opportunities of climate transition. **Thirdly**, improve women's ability of being adapted to climate change and achieve a multi-win situation featured by adaptation to climate change, increased benefits for low-income groups, and uplifted gender equality. **Fourthly**, consider the social impacts of overseas green investments and aids in a strengthened way, promote gender equality, and give play to the leading role of China in global climate governance.

#### **(V) Policy recommendations on promoting China's implementation of carbon dioxide peaking and carbon neutrality**

**Firstly**, accelerate coordinated efforts in green economic development, energy security, and combating climate change. **Secondly**, take comprehensive consideration of various factors (such as energy security, economic costs, etc.) and gradually promote coal power transition and accelerate the development of a new energy system dominated by renewable energy based on China's situation. **Thirdly**, improve green and climate finance system that supports low-carbon transition and innovation. **Fourthly**, accelerate the transformation of key policies and mechanisms, especially from energy dual control to carbon dual control. **Fifthly**, continue to deepen international cooperation on climate change, and promote the global climate governance for win-win cooperation, including sustainable supply chains.

**Key words:** Carbon neutrality, Climate governance, Green and low-carbon transition, Policy synergies

---

# CONTENT

<b>EXECUTIVE SUMMARY .....</b>	<b>I</b>
<b>1 FOREWORD.....</b>	<b>1</b>
<b>2 JUDGMENT ON THE DOMESTIC AND INTERNATIONAL SITUATION OF GREEN AND LOW-CARBON TRANSITION.....</b>	<b>2</b>
2.1 THE JUDGMENT ON INTERNATIONAL SITUATION .....	2
2.2 ANALYSIS OF THE DOMESTIC SITUATION .....	7
<b>3 THE ANALYSIS ON PROGRESS OF CHINA'S CARBON DIOXIDE PEAKING AND CARBON NEUTRALITY ACTIONS .....</b>	<b>14</b>
3.1 ANALYSIS ON THE PROGRESS OF CHINA'S LOW-CARBON TRANSITION .....	14
3.2 CHINA'S "1+N" POLICY SYSTEM FOR CARBON DIOXIDE PEAKING AND CARBON NEUTRALITY .....	22
3.3 BRIEF SUMMARY .....	28
<b>4 CHINA'S POLICY DIRECTION OF DEEPENING GREEN AND LOW-CARBON TRANSITION .....</b>	<b>29</b>
4.1 TO TAKE CARBON REDUCTION AS A GUIDE AND PROMOTE OVERALL GREEN AND LOW-CARBON TRANSITION OF WHOLE ECONOMY AND SOCIETY .....	29
4.2 TO PROMOTE GREEN INVESTMENT, LOW-CARBON CONSUMPTION, AND TRADING OF LOW-CARBON PRODUCTS FOR THE PURPOSE OF INJECTING NEW IMPETUS INTO ECONOMIC GROWTH ..	30
4.3 TO OPTIMIZE THE SPATIAL STRUCTURE OF THE TERRITORY AND CONSTRUCT A NEW SPATIAL PATTERN MEETING THE REQUIREMENTS FOR CARBON PEAKING AND CARBON NEUTRALITY .....	31
4.4 TO COMPLETE THE MECHANISM AND INSTITUTION FOR MANAGEMENT OVER CARBON PEAKING AND CARBON NEUTRALITY AND FOCUS ON BUILDING THE LOCAL CAPACITY TO ACHIEVE THE DUAL CARBON GOALS .....	32
4.5 TO PUSH FORWARD THE TRANSITION AND TRANSFORMATION OF KEY MECHANISMS AND ACCELERATE THE TRANSITION FROM THE CONTROL OVER BOTH OF THE TOTAL AMOUNT AND THE INTENSITY OF ENERGY CONSUMPTION TO THE CONTROL OVER THOSE OF CARBON EMISSIONS...	33
4.6 TO SPEED UP THE CARBON PRICING AND THE CARBON MARKET MECHANISM BUILDING OF CHINA .....	33
4.7 TO FOCUS ON ACHIEVING JUST TRANSITION AT THE INDUSTRIAL AND THE REGIONAL LEVELS .....	34
4.8 TO PUSH FORWARD THE PERFECTION OF THE INVESTMENT AND FINANCING POLICIES	

---

RELATING TO CLIMATE SO AS TO PROMOTE THE TRANSITION TO CARBON NEUTRALITY .....	35
4.9 TO LEAD A NEW GLOBAL GREEN DEVELOPMENT PATTERN AND CONTINUE TO DEEPEN THE INTERNATIONAL COOPERATION IN CLIMATE CHANGES .....	35
<b>5 ANALYSIS OF GENDER MAINSTREAMING .....</b>	<b>36</b>
5.1 TO GIVE FULL PLAY TO WOMEN’S LEADERSHIP IN CLIMATE CHANGE-RELATED AFFAIRS AND IMPROVE WOMEN’S PARTICIPATION AND REPRESENTATIVENESS IN CLIMATE DECISION MAKING .....	37
5.2 TO ACTIVELY DRIVE JUST TRANSITION AND PROMOTE WOMEN’S EQUAL EMPLOYMENT THROUGH THE OPPORTUNITIES OF CLIMATE TRANSITION.....	38
5.3 TO IMPROVE WOMEN’S ABILITY OF BEING ADAPTED TO CLIMATE CHANGE AND ACHIEVE A MULTI-WIN SITUATION FEATURED BY ADAPTATION TO CLIMATE CHANGE, INCREASED BENEFITS FOR LOW-INCOME GROUPS, AND UPLIFTED GENDER EQUALITY .....	39
5.4 TO CONSIDER THE SOCIAL IMPACTS OF OVERSEAS GREEN INVESTMENTS AND AID IN A STRENGTHENED WAY, PROMOTE GENDER EQUALITY, AND GIVE PLAY TO THE LEADING ROLE OF CHINA IN GLOBAL CLIMATE GOVERNANCE .....	40
<b>6 POLICY RECOMMENDATIONS .....</b>	<b>41</b>
6.1 ACCELERATE COORDINATED EFFORTS IN GREEN ECONOMIC DEVELOPMENT, ENERGY SECURITY, AND COMBATING CLIMATE CHANGE .....	41
6.2 TAKE COMPREHENSIVE CONSIDERATION OF VARIOUS FACTORS (SUCH AS ENERGY SECURITY, ECONOMIC COSTS, ETC.) AND GRADUALLY PROMOTE COAL POWER TRANSITION AND ACCELERATE THE DEVELOPMENT OF A NEW ENERGY SYSTEM DOMINATED BY RENEWABLE ENERGY BASED ON CHINA’S SITUATION .....	41
6.3 IMPROVE GREEN AND CLIMATE FINANCE SYSTEM THAT SUPPORTS LOW-CARBON TRANSITION AND INNOVATION .....	42
6.4 ACCELERATE THE TRANSFORMATION OF KEY POLICIES AND MECHANISMS, ESPECIALLY FROM ENERGY DUAL CONTROL TO CARBON DUAL CONTROL .....	42
6.5 CONTINUE TO DEEPEN INTERNATIONAL COOPERATION ON CLIMATE CHANGE, AND PROMOTE THE GLOBAL CLIMATE GOVERNANCE FOR WIN-WIN COOPERATION, INCLUDING SUSTAINABLE SUPPLY CHAINS .....	43
<b>REFERENCES .....</b>	<b>44</b>
<b>ACKNOWLEDGMENTS .....</b>	<b>46</b>
<b>ATTACHMENTS .....</b>	<b>47</b>

---

# Pathway to Carbon Neutrality and China's Role in Global Climate Governance

## 1 Foreword

Since China proposed the dual goals of carbon dioxide peaking and carbon neutrality, China has steadily pushed forward its dual-carbon efforts, making the response to climate change a national strategy and incorporating it into the overall layout of the construction of an ecological civilization and the overall situation of economic and social development. The report of the 20th National Congress of the Communist Party of China further emphasized that it is necessary to “carry out coordinated industrial restructuring, pollution control, ecological conservation, and climate response, promote concerted efforts to cut carbon emissions, reduce pollution, expand green development, and pursue economic growth, prioritize ecological protection, conserve resources and use them efficiently, and pursue green and low-carbon development”, “work actively and prudently toward the goals of reaching peak carbon emissions and carbon neutrality”, “get actively involved in global governance in response to climate change”. Various regions, departments, industries and enterprises have focused on the dual goals of carbon dioxide peaking and carbon neutrality, implemented policies and measures, strengthened pragmatic actions, and pushed forward the key work in a forceful, orderly and effective manner. In the meanwhile, China has actively participated in international work in the area of climate change, unswervingly followed the path of ecological priority and green development, and is an important participant, contributor and leader in the construction of a global ecological civilization.

However, carbon neutrality is a systematic project, a systematic action roadmap driven by a series of goals, technologies, funds, policies, etc. At present, China's green and low-carbon transition still faces a series of challenges. On the one hand, the international situation is uncertain, the deficit in global climate governance is obvious, the energy crisis is still the focus of attention of all countries in the short term, and the localization and regionalization of industrial chains and supply chains are conspicuous. The global journey to address climate change will remain long and challenging. On the other hand, the domestic green low-carbon transition is under pressure, and short and medium-term structural transformation still faces a series of challenges in terms of just transition, technological innovation and policy mechanisms. Responding to climate change requires not only actively analyzing changes in the domestic situation, but also identifying the key challenges and opportunities in climate governance and related actions to implement the low-carbon goals, and actively and steadily promoting carbon neutrality. At the same time, it also needs the concerted efforts of all countries in the world, and more importantly, consultation and cooperation at the international level, and work together to actively address climate change on the basis of meeting and balancing the core interests and common interests of all parties. Therefore, how to further improve China's dual-carbon policy system, how to scientifically respond to changes in the domestic and international situation, how to deepen policy actions in order to play China's key role in the climate change field, and how to promote international cooperation on climate change are the key issues that need to be studied at present.

Under this background, this year, the special policy research team on the *Pathway to Carbon*

---

*Neutrality and China's Role in Global Climate Governance* firstly analyzed the current domestic and international situation of green and low-carbon transition, summarized the international experience and best practices of the United States, Europe and other major economies in responding to climate change and improving low-carbon policies, and sorted out the necessity of climate cooperation as well as the current situation of China's energy transition and low-carbon development under the new circumstances. In the meanwhile, the special policy research team further analyzed the progress of the China's "1+N" policy system for carbon dioxide peaking and carbon neutrality, and proposed the direction for improvement of China's dual-carbon actions based on the analysis of the progress of domestic green and low-carbon transformation. Finally, based on the above analysis, it proposed the direction of policy deepening for China in nine aspects, such as the green investment, territorial spatial structure, dual-carbon management system and mechanism and so on.

This report consists of six parts: Part 1 is the foreword. Part 2 analyzed the trend of the domestic and international situation of green and low-carbon transition. Part 3 sorted out the progress of China's dual-carbon policy actions in five areas: clean and efficient use of energy, industrial structural adjustment, synergies between carbon reduction and pollution reduction, enhancement of ecosystems' carbon sink capacity, and green and low-carbon life. It also summarizes the dual-carbon "1+N" policy system, and proposed the direction for improvement of China's dual-carbon actions. Part 4, based on the previous analysis, further proposed China's Policy Direction of Deepening Green and Low-Carbon Transition. Part 5 explicitly focused on women's influence and potential in the climate field, proposed the application of the gender mainstreaming analysis to the four main and feasible specific work areas of the climate action of China. Part 6 proposed the policy recommendations to promote the implementation of China's carbon peaking and carbon neutrality policy and to actively promote and participate in international climate governance and cooperation.

## 2 Judgment on the Domestic and International Situation of Green and Low-

### Carbon Transition

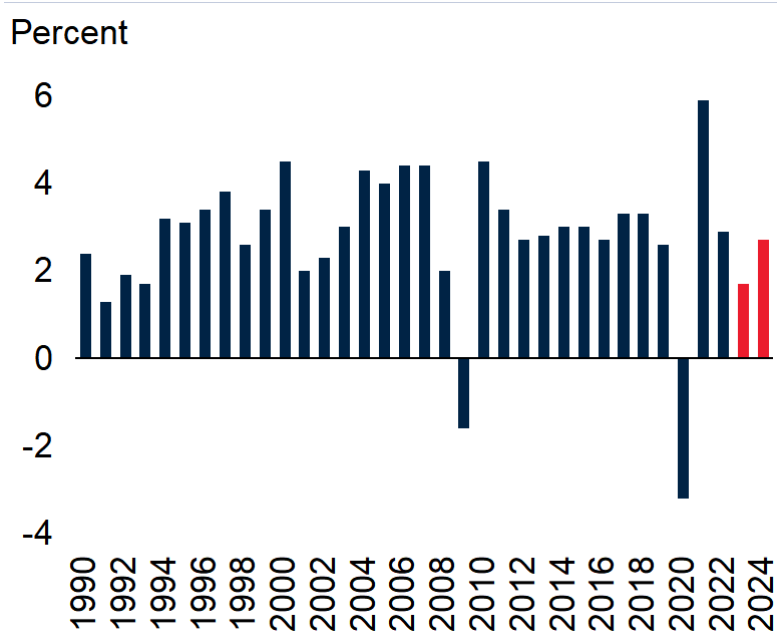
#### 2.1 The judgment on international situation

*2.1.1 The current global situation is highly uncertain, and the deficit in global climate governance will become more prominent*

In recent years, the international security situation has undergone profound and complex changes where great power competition and geopolitical competition are heating up. Under this circumstance, many have predicted that the global economy will grow negatively, and the deficit in climate governance will become prominent. Firstly, the technological competition among countries and international competition of different industries has become more intense. Country's political and social conflicts are accumulating, which greatly damaged the strategic trust among countries and created challenges of international multilateral cooperation. This situation will prevent all parties from jointly solving global crises such as food security, energy crises, and nuclear proliferation. Secondly, the global economic growth rate is declining and has entered a low-to-medium growth track. The World Bank has significantly lowered the forecast of global economic growth rate for 2023 from 3.0% to 1.7% (see Fig.2-1). Furthermore, in the report *World Economic*

*Situation and Prospects in 2023* released by the United Nations, the expected world's economic growth rate in 2023 was reduced to 1.9%, which was 1.1% lower than the forecast value in mid-2022; besides, the report also called for attrition on inflation, interest rates, exchange rates, debts, energy and other risks and challenges. The macro policies of the world's major developed economies are facing a dilemma of maintaining economic growth and restraining inflation<sup>1</sup>.

Meanwhile, destabilizing factors in global climate governance still exist. The short-term and long-term impacts of climate change on human beings are becoming more and more prominent. The international community's game over climate change governance is intensifying, resulting in the absence of strong leadership in Global climate change. In terms of climate financing, other countries failed to commit to allocating more climate funds as Germany does. Consequently, the climate financing became insufficient, the investment in climate change decreased and the governance deficits became more prominent. While the COVID-19 pandemic continues to have severe impacts globally, especially on developing countries, a more pressing issue in front of countries is how to promote economic and social recovery.



**Fig.2-1 The Trend of Global Economy Growth**

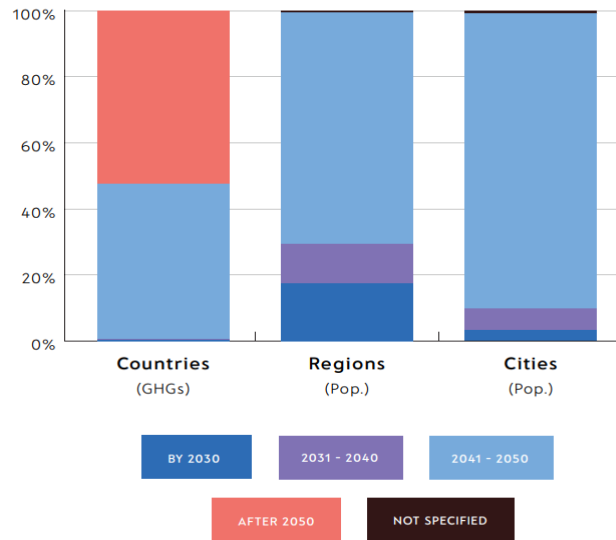
Source: World Bank

*2.1.2 The long-term trend of global energy transition is clear, while the short-term energy crisis shall not be*

*overlooked*

The long-term trend of current global energy low-carbon transition is clear, and countries have proposed goals for carbon neutrality. So far, more than 130 countries and regions are preparing to or have proposed goals for carbon neutrality (see Fig.2-2). In general, countries' strong objective to achieve carbon neutrality is clear. It is foreseeable that with the advancement of technology and further reduction of costs, the development and utilization of renewable energy will become more extensive, and will continue to promote the low-carbon transition of energy. Although after the outbreak of geopolitical conflict between Russia and Ukraine, Germany, Austria, Greece, Netherlands and other countries have reactivated coal power, countries are still working towards the goal of carbon neutrality in the long run.

<sup>1</sup>China Development Network, 2023. In the spring of hope - Remarks of the expert symposium on "How to see the world economy in 2023". <https://baijiahao.baidu.com/s?id=1757869289742659148&wfr=spider&for=pc>



**Fig.2-2 Net Zero Target Dates of Countries, Regions, and Cities that are preparing to or have proposed Carbon Neutrality Targets**

Source: NET-ZERO TRACKER

In the short term, energy crisis is still the focus of all countries. Europe has raised the energy security to a strategic position. Renewable energy production capacity is still insufficient whereas energy demand rises, and so there is still a certain degree of dependence on fossil energy<sup>[1]</sup>, creating a short-term imbalance in energy supply and demand during energy transition process. In addition, negative external factors such as the pandemic, monopoly, and geopolitical conflicts also have had a certain impact on the stability of global energy supply, which further triggered short-term imbalance in energy supply and demand. China is also facing energy crisis, where Sichuan, Yunnan and other hydropower provinces experienced electricity restrictions in the past two years. Pakistan and Bangladesh proposed to reduce work hours in order to save energy and respond to the soaring energy prices. Japan and South Korea are considering to reactivate nuclear power. India's coal imports once hit a record high. Many emerging economies and underdeveloped economies that rely on energy imports have to bid high prices for energy with developed economies. This situation has also triggered a fierce restructuring of the global energy market that U.S. energy exporters have seen their profits soar, and North Africa and other regions with high natural gas reserves are also trying to increase exports.

*2.1.3 The global green industrial revolution driven by climate change may reshape the competition and cooperation system in the fields of global trade, technology, and finance*

Currently, a new round of global technological and energy revolution is accelerating, and great powers are accelerating the deployment of renewable energy as a new driving force for green growth. Global installed power capacity by renewable energy has reached 3,372 GW as of the end of 2022 with a record of 9.6% (295 GW) increase in renewable energy stock<sup>2</sup>. The installed capacity of wind and solar power is increased by 15 times in terms of the accelerated and net zero, and increased by 9 times in terms of new momentum<sup>3</sup> (See Fig.2-3). By the end of 2022, China's installed power capacity by renewable energy has reached 1.213 billion kilowatts, accounting for 47.3% of the total installed power generation capacity nationwide, which has officially surpassed the installed coal power capacity<sup>4</sup>. The unit cost of some low-emission technologies, such as solar power, wind power, and lithium-ion batteries, has continued to decline since 2010. The latest report from IPCC has

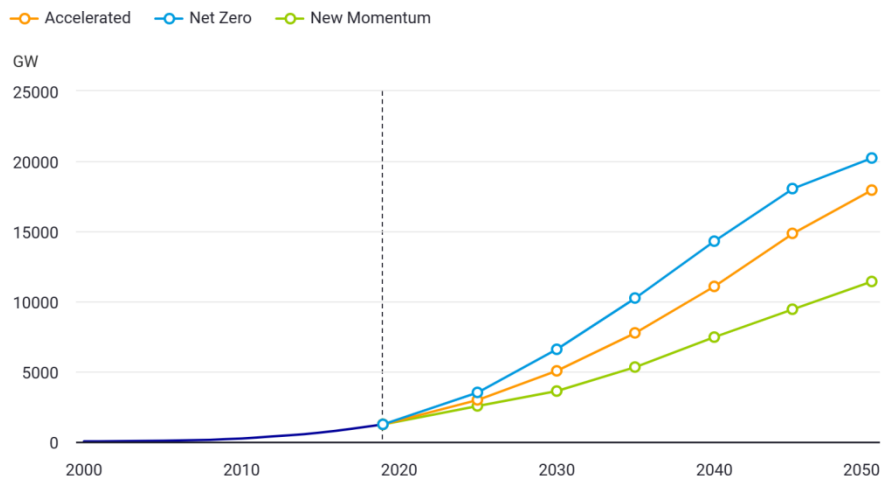
<sup>2</sup>IRENA, 2023. RENEWABLE CAPACITY STATISTICS 2023

<sup>3</sup>BP, 2023. bp Energy Outlook 2023 edition.

<sup>4</sup> National Development and Reform Commission, 2023. Renewable energy development in China in 2022. [https://www.ndrc.gov.cn/fggz/hjzyzj/jnhnx/202302/t20230215\\_1348799\\_ext.html?eqid=f14a9865000e350c000000036465c976](https://www.ndrc.gov.cn/fggz/hjzyzj/jnhnx/202302/t20230215_1348799_ext.html?eqid=f14a9865000e350c000000036465c976)

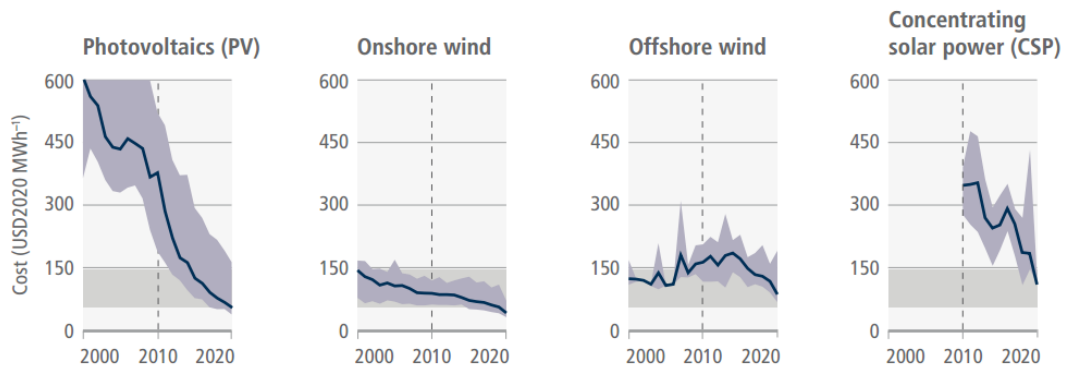


shown that the costs of solar photovoltaic and onshore wind power generation are already far below fossil fuel power generation (see Fig.2-4). In the future, the cost of new energy will be further reduced, and it will gradually replace fossil energy as the main force of the energy system and will play an important role in economic growth.



**Fig.2-3 Global Installed Capacity of Wind and Solar Power**

Source: BP



**Fig.2-4 Global Trend of Reduced Costs of Renewable Energy**

Source: IPCC AR6

However, in the background of difficult recovery and deep adjustment of the global economy, many economies have introduced various trade restrictions and investment protection measures. There has been an obvious trend of localization and regionalization of industrial chains and supply chains, and the contradictions and problems in the supply of energy and bulk commodities are becoming more and more prominent, which seriously threatened the recovery and sustainable growth of the global economy<sup>[2]</sup>. On August 16, 2022, President Biden signed the *Inflation Reduction Act of 2022* (IRA) passed by both houses of Congress, which imposed restrictions on some supply chains, for example, automobiles must be assembled in North America, otherwise subsidies cannot be obtained; a certain proportion of key minerals must be mined or processed in the countries of North American Free Trade Agreement or have to be recycled in North America; a certain proportion of battery components must be manufactured in North America. The act caused many manufacturing companies to reinvest in the United States. In addition, the European Union established the Carbon Border Adjustment Mechanism (CBAM) and proposed to completely cancel free carbon emission quotas for related industries in the EU by 2035; meanwhile the European Commission proposed the *European Green Deal Industrial Plan*. The essence of these policies and actions is to protect domestic industries and accelerate the construction of their own green industry system through a great number of subsidies and incentives, which is a competition around the clean energy industry and green technology. Healthy competition will promote the accelerated deployment of new energy industries and technologies, but excessive trade barriers will increase the

---

prices of new energy products, which is not conducive to the advancement of clean energy transition.

*2.1.4 Southern countries and emerging economies are actively accelerating energy transition, but they still face*

*a series of risks and challenges*

With the continuous innovation and popularization of renewable energy technologies, as well as the constant decline in costs, southern countries and some emerging economies have gradually begun to pay attention to the deployment and planning of renewable energy development (see Table 1). All countries are actively taking actions to accelerate the process of global energy green and low-carbon transition by formulating relevant coal reduction and renewable energy development goals. In 2020, China proposed the vision to reach carbon dioxide peak before 2030 and carbon neutrality before 2060, and basically formed the "1+N" policy system for carbon dioxide peaking and carbon neutrality, mobilizing multiple subjects to participate extensively. India set targets to reduce greenhouse gas emission intensity by 50% from the level in 2005 and increase the share of non-fossil energy sources in the power sector to 45% by 2020. Brazil has proposed a 37% reduction of GHG emissions by 2025 and a 43% reduction by 2030 relative to the level in 2005. In the *ASEAN Plan Of Action For Energy Cooperation (APAEC) 2016-2025 Phase I: 2016-2020*, ASEAN set an overall regional target to increase the component of renewable energy to 23% by 2025 in the ASEAN energy mix, and the member countries set national targets accordingly.

However, these countries still have certain risks and challenges in accelerating energy transition. Firstly, due to the sluggish green recovery of the global economy after the pandemic, the interrupted industrial chains and supply chains has not yet fully restored, and the willingness of developed countries to invest in climate has weakened, so there is a large gap in climate funds. For example, Vietnam has planned and approved a number of renewable energy projects, but due to insufficient funds, the conversion rate is very low. Secondly, some countries are highly dependent on coal power, and the accelerated transition of coal power will further increase the mismatch between energy supply and demand in these countries, which would trigger an energy security crisis. Moreover, the stranded capital cost from withdrawal of fossil energy is relatively high, which can easily lead to collapse of asset prices or huge debt defaults. The withdrawal of fossil energy may also cause a significant impact on traditional enterprises and employees which would lead to social turmoil. Thirdly, at the technical level, a large number of southern countries are insufficient in the innovation of renewable energy technologies, which restricts its development. Currently, the power grid infrastructure in southern countries and emerging economies is weak, and the power interconnection among countries is limited, which brings great difficulties to the integration of renewable energy into the grid. Failure to promote green and low-carbon transition in an orderly and smooth manner may lead to energy security risks.

*2.1.5 Under the new situation of multiple crises, the urgency of international climate cooperation has further*

*increased*

The current world political and economic landscape is full of uncertainties, and countries are facing multiple challenges including geopolitical conflicts, industrial and supply chain security, inflationary pressures, and energy crises. Under this circumstance, climate governance has become one of the important areas for international cooperation. According to the research by the United Nations Environment Programme, world faces a 2.8-degree warmer future by 2100 based on the current global climate policies<sup>5</sup>. The urgency of human beings to deal with climate change is increasing day by day. To achieve the goals of the Paris Agreement, developed countries must take the lead in increasing emission reduction and take concrete actions to implement them. Developing countries have made a lot of efforts to deal with climate change, but limited by the technology and financial capabilities, they have not been able to make great progress; developing countries need financial and technical support from developed countries. Tackling climate crisis is a collective action that requires countries to actively implement corresponding measures. Strengthening solidarity and cooperation is the only way to tackle the challenge of climate change. But we must

---

<sup>5</sup>Source: UNEP

---

continue to uphold the principle of common but differentiated responsibilities, which is related to international fairness and justice. Deviation from this principle will seriously damage the solidarity and cooperation of the international community in tackling climate change.

Strengthening global climate governance requires the concerted efforts of the international community. It is necessary to further highlight the core position of climate issues in the international agenda, continue to promote bilateral and multilateral climate dialogues and cooperation, rebuild mutual trust among all parties, take concrete actions to deal with climate change, and promote comprehensive green transition and global cooperation for carbon neutrality. Meanwhile, the actions of great powers are crucial that they should proceed from the common interests of all mankind, seek more consensus on cooperation, prioritize climate issues in international cooperation, and actively implement the consensus and commitments reached under bilateral and multilateral frameworks, in order to lay a solid foundation for international climate cooperation<sup>[3]</sup>.

## 2.2 Analysis of the domestic situation

*2.2.1 Under the downward trend of the economy, a great pressure is put on green and low-carbon transition,*

*and the green transition of the development mode should be promoted through steady progress*

The downward pressure on the economy is great. **From the perspective of domestic influencing factors**, although the situation of the COVID-19 pandemic in China becomes stabilized in the past two years, the Chinese economy is still in the recovery stage. The effective demand of various domestic industries is insufficient, and it is difficult for the consumer side to fully stimulate the supply side to maintain sufficient economic development momentum. In 2022, the total retail sales of consumer goods in China were 43,973.3 billion yuan, a decrease of 0.2% over the previous year; the national per capita consumption expenditure of residents was 24,538 yuan, a decrease of 0.2% after deducting price factors; the value added showed negative growth in industrial sectors such as textiles (down 2.7%) and general equipment manufacturing (down 1.2%), as well as service sectors such as transportation, storage and postal services (down 0.8%)<sup>6</sup>. **From the perspective of foreign influencing factors**, the negative impact of supply chain decoupling and high inflation caused by COVID-19 pandemic continues. The negative impact of the Russia-Ukraine conflict on the stability and recovery of the global economy continues to expand. The growth momentum of global economy and trade has weakened and uncertainties have increased significantly, which exerted a strong downward pressure on China's economic development. According to the estimation of IMF, in 2022, the global economic growth rate was 3.4%, 2.6 percentage points lower than the previous year, and will further lower to 2.8% in 2023; the global trade growth rate will reduce to 2.4% in 2023 from 5.1% in 2022<sup>[4]</sup>.

We should adhere to seeking improvement in stability, promote the transition of the economic structure to a green, low-carbon and intelligent model, lead more investment into strategic emerging industries and green and low-carbon industries such as big data and renewable energy, and guide green consumption. According to the *Government Work Report* for 2023, China's GDP growth target for 2023 is still around 5%, and economic development should prioritize stability. Meanwhile, it is clearly emphasized in both the *Government Work Report* and the report to the 20<sup>th</sup> National Congress of the Communist Party of China that we should accelerate the green transition of the development mode, vigorously develop green and low-carbon industries, actively cultivate strategic emerging industries, and promote the formation of green and low-carbon modes of production and life. In recent years, China has taken industrial structure as the main direction of economic structure optimization and upgrading, vigorously promoted the development of strategic emerging industries and green and low-carbon industries such as big data, artificial intelligence, and renewable energy, and guided more investment and consumption to flow into these industry fields. In 2021, the added value of China's strategic emerging industries continued to rise as a percentage of GDP, reaching 13.4%, an increase of 1.7 percentage points over 2020 and a cumulative increase of 5.8 percentage points over 2014<sup>7</sup>. In addition, China's investment in the field of renewable energy has also ranked

---

<sup>6</sup>National Bureau of Statistics of China, 2023. Statistical Communiqué of the People's Republic of China on the 2022 National Economic and Social Development. [http://www.gov.cn/xinwen/2023-02/28/content\\_5743623.htm](http://www.gov.cn/xinwen/2023-02/28/content_5743623.htm)

<sup>7</sup>China Government Network, 2023. National Bureau of Statistics explains China's new momentum index for economic

---

first in the world for many years in a row, and it reached \$98 billion in the first half of 2022, accounting for 43% of the global total. China is the global leader in the field of renewable energy investment. Its investment in large-scale solar power projects was \$41 billion, an increase of 173% over 2021. The investment in new wind power projects was \$57.8 billion, a year-on-year increase of 107%<sup>[5]</sup>.

We should continue to promote the construction and improvement of a green, low-carbon, efficient and standardized, fair and orderly, open and unified large market environment to support high-level and high-quality opening up. Since the 18<sup>th</sup> National Congress of the Communist Party of China, China has attached great importance to the construction of the business market environment. By deepening the reform of "reforms to delegate power, streamline administration and optimize government services", China has lowered the market access threshold and simplified the approval process, innovated market supervision methods, and optimized market service concepts, mechanisms and processes to create an efficient and fair market environment. The *Opinions of the CPC Central Committee and the State Council on Accelerating the Construction of a Unified National Market* clearly pointed out that we should speed up the construction of a national unified market that is highly efficient, well-regulated, conducive to fair competition, and fully open; we should elaborated once again on the relaxation of government control, the improvement of regulatory capabilities, and the optimization of the market service system and other aspects; the opinions also emphasized the unification and connectivity of basic market rules, carbon, energy, data and other elements and resource markets, as well as quality, standards, and service systems across the country, promoting the smooth flow of commodity elements and resources in a wider range to strengthen the market scale, effectiveness, and competitiveness<sup>[6]</sup>. With a unified national market as an important support, China continues to promote opening up on a wider scale, in wider sectors and at deeper levels. China also constantly innovates the development mechanism of service trade, actively builds a high-standard free trade zone network oriented to the world, and accelerates the construction of pilot free trade zones, the Hainan Free Trade Port, and the Belt and Road Trade Cooperation Platform. The free trade zones has effectively improved the quality and level of trade and investment cooperation, and also promoted the efficient allocation and utilization of factor resources on a global scale<sup>[7]</sup>.

*2.2.2 China's development goals have shifted to synergistically promote climate response, economic growth,*

*energy security, and ecological governance*

The synergy effect of climate change and economic growth, environmental governance, and ecological protection has been scientifically proven. For example, air pollutants and greenhouse gases are homologous, and the realization of the synergistic governance of greenhouse gases and air pollutants will not only help reduce the total cost of air pollution control and greenhouse gas emission reduction, but also help avoid high carbon lock-in effects<sup>[8]</sup>. At present, China's air pollution control measures have shifted from terminal control to source control, which is highly coordinated with the goal of low-carbon transition. There is also obvious synergy effect between ecological protection and climate change. Ecosystems such as forests, grasslands, and wetlands are the main sources of carbon absorption and sequestration, and increasing the area and quality of ecosystems such as forests, grasslands, and wetlands is also an important means for increasing the amount of carbon sequestration<sup>[9]</sup>. In addition, long-term economic gains will be achieved by tackling climate change. According to the research of OECD, compared with continuing existing policies, implementing a package of climate-compatible policies can increase the medium- and long-term GDP levels of G20 countries by an average of 2.8% in 2050. When the positive effects of preventing climate change are taken into account, the net effect on GDP of G20 developed and developing economies will rise to nearly 5% in 2050<sup>[10]</sup>.

The coordinated advancement of climate change, energy, economy, environmental ecology and other aspects is an inevitable choice for China's green and high-quality development. As early as in 2015, at the Fifth Plenary Session of 18<sup>th</sup> CPC Central Committee, President Xi Jinping proposed a new development idea of innovative, coordinated, green, open, and shared development, emphasizing the need to solve the problems in such aspects as balance, justice, and harmony

---

between man and nature in economic and social development, and no longer taking single high-speed economic growth as the core indicator. Shortly after China's dual carbon goal was put forward, the Central Committee incorporated carbon dioxide peaking and carbon neutrality into the overall layout of ecological civilization construction, and made the major judgment that "ecological civilization construction has entered a critical period of promoting the synergistic interaction of pollution reduction and carbon reduction with carbon reduction, promoting green transformation of all society, and achieving quantitative change to qualitative change of the ecological environment quality as the key strategic direction." Subsequently, in order to solidly promote the strategic goals for carbon dioxide peaking and carbon neutrality, China has gradually built the "1+N" policy system for carbon dioxide peaking and carbon neutrality, and from the central government to local governments to enterprises, systematically planned the carbon dioxide peaking and carbon neutrality work in energy, industry, transportation, construction, ecological carbon sink and other fields from top to bottom, which runs through the entire process of economic and social development, laying a solid foundation for the coordinated promotion of carbon dioxide peaking and carbon neutrality work in multiple fields. The *report to the 20<sup>th</sup> National Congress of the Communist Party of China* further emphasized that we should "coordinate industrial restructuring, pollution control, ecological conservation, and climate response, and will promote concerted efforts to cut carbon emissions, reduce pollution, expand green development, and pursue economic growth", which once again gives the highest political guidance for promoting coordinated efforts in multiple fields.

In the current new round of technology and industrial revolution, traditional boundaries between technologies and between industries are being gradually broken, adapting to the ever-changing world, and new-generation information technologies represented by artificial intelligence, Internet of Things, quantum computing, etc. are blending with low-carbon technologies represented by new-type industries and towns, renewable energy, green buildings and transportation to form new industries and new business forms<sup>[11]</sup>. Therefore, China will pay more and more attention to the innovation and development of integrated technologies, contribute effective solutions to the increasingly complex and changeable systemic challenges involving climate change, public health, pollution control, etc., and ultimately realize the multi-objective balanced and all-round and systematic development in economy, energy, environment and other fields.

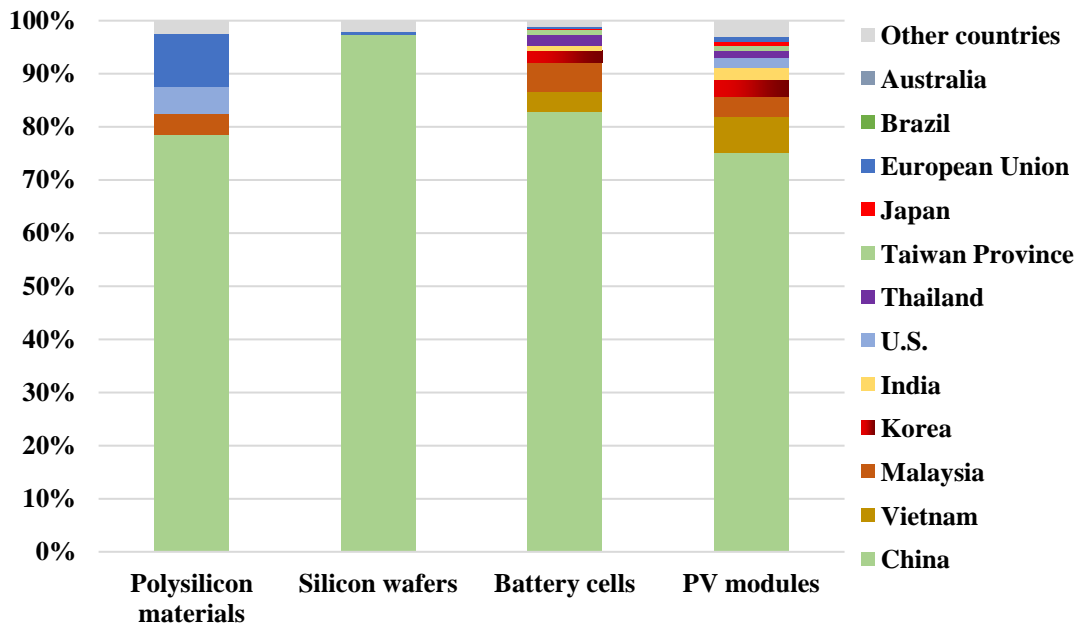
### *2.2.3 China has the motivation for green and low-carbon transition and development, and has the objective*

#### *conditions to transform climate actions into high-quality economic and social development*

Industrial transition is an objective requirement for China's green and low-carbon development. China's traditional industrial structure characterized by high emissions, high pollution, and low added value has been difficult to meet the requirements of high-quality development. Not only the low factor utilization efficiency is difficult to maintain medium and high-speed economic growth, but also related climate disaster, environmental pollution and other problems are becoming more prominent, and the potential hidden costs caused by these problems are getting higher and higher, which will in turn hinder China's economic and social development. It is estimated that by the end of the century, the GDP at risk of the Shanghai and Guangzhou metropolitan areas due to climate change-induced sea level rise (in 2019 purchasing power parity terms) could exceed \$1.6 trillion and \$291 billion per year, respectively<sup>[12]</sup>. Meanwhile, population structural contradictions centered on population aging have become increasingly prominent, and the elderly have higher requirements for the ecological environment and air pollution. The study found that from 2002 to 2017, the total population growth and population aging in China increased the risk of PM<sub>2.5</sub>-related deaths by 1.09 million people<sup>[13]</sup>. Moreover, with the popularization of green and low-carbon education, the current people, especially young people, are gradually mastering the relevant knowledge of climate change, with the aware of green and low carbon gradually improved, and they are more advocating green and environmentally friendly lifestyle, which also provides a strong impetus for China's green and low-carbon development.

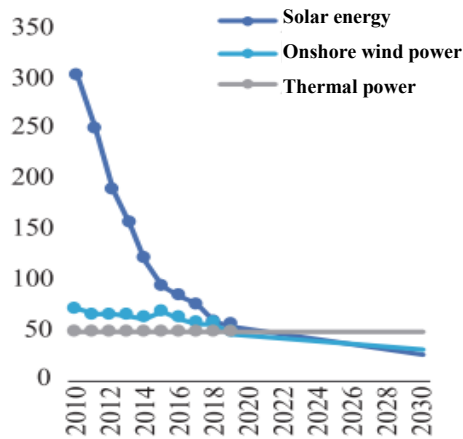
China's manufacturing capacity and green financial system provide a solid guarantee for green and low-carbon transition. **On the one hand**, China has obvious advantages in renewable energy, electric vehicles and other fields, and has a complete manufacturing supporting system, with the industrial foundation and strength for high-quality green and low-carbon transition. China's wind

power industry, photovoltaic industry and related equipment parts manufacturing industry also have a pivotal leading position in the world. In 2021, in the four major photovoltaic supply chain links of polysilicon materials, silicon wafers, cells and photovoltaic modules, China's production capacity accounted for more than 70% of the world (see Fig.2-5). In addition, China's renewable energy power generation technology is also developing vigorously. The cost of wind power and photovoltaic power has dropped significantly (see Fig.2-6), and the proportion of installed power capacity and generation capacity has increased year by year. By the end of 2022, China's installed power capacity of renewable energy exceeded that of coal power, accounting for 47.3% of the national total installed power generation capacity, and the annual power generation accounts for 31.6% of the electricity consumption of the whole society, equivalent to the annual electricity consumption of the European Union in 2021 (see Fig.2-7). **On the other hand**, China's green financial system is gradually improving, and financial instruments and products such as green loans and green bonds are also developing vigorously and constantly innovating. More financial resources are invested in green and low-carbon industries and fields, and the green financial market is gradually growing. As of the end of June 2022, the balance of green loans in domestic and foreign currencies in China reached 19.55 trillion yuan, an increase of 40.4% year-on-year; the stock of green bonds was 1.2 trillion yuan, ranking second in the world<sup>[14]</sup>.



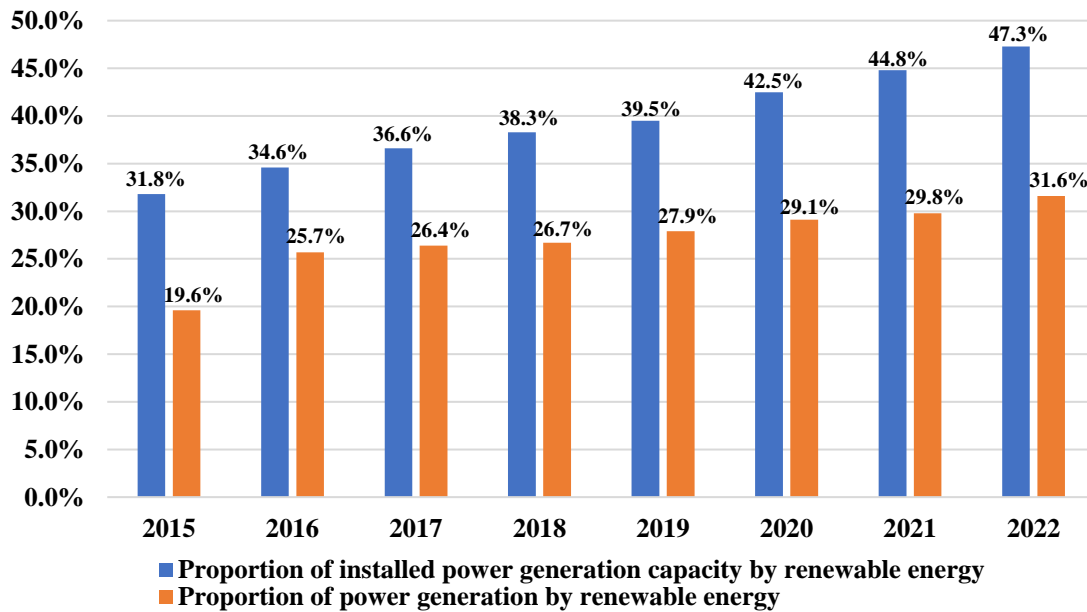
**Fig.2-5 Proportion of production capacity of major countries and regions in the four major photovoltaic supply chain links of polysilicon materials, silicon wafers, cells, and photovoltaic modules in 2021**

Source: CPIA, NREL, EIA, Solar Europe, IEA, BNEF



**Fig.2-6 Trends in costs of three power generation technologies including solar power, onshore wind power and thermal power in China from 2010 to 2030**

Source: World Bank, IRENA, Carbon Tracker Initiative, Wood McKenzie



**Fig.2-7 Proportion of installed power generation capacity and power generation by China's renewable energy**

Source: National Energy Administration

*2.2.4 The long-term vision and goal for carbon neutrality are clear, and the short-to-medium-term structural*

*transition will face challenges in terms of just transition, technological innovation and policy mechanisms*

Even in the face of challenges such as tight time windows, large emission reductions, and heavy transition tasks, China remains firm in its 2030 and 2060" goals for carbon dioxide peaking and carbon neutrality. Compared with Europe and the United States, China needs to make more efforts to achieve the carbon neutrality goals. China has about 30 years from carbon dioxide peaking to carbon neutrality, compared to 60-70 years of developed countries. That means China needs more efforts to achieve carbon neutrality than developed countries and the difficulty and efforts in GHG emission reduction are far higher. In fact, regardless of whether developed countries or developing countries, the emission reduction routes of different sectors are roughly the same, but China's implementation period is shorter. As a big country, the requirements for economic structural

---

transition, technological innovation, and capital investment in the emission reduction process are also higher.

In the process of promoting structural transition, China will face problems such as cost increase and just transition. **On one hand**, based on China's basic national conditions of taking coal as the primary energy, the transition of energy and industrial structure will inevitably lead to the transition and elimination of coal, coal power and related enterprises, and the handling of related stranded asset risks and structural unemployment will get tougher and more intractable<sup>[15]</sup>. **On the other hand**, China's regional economic and social development is uneven. Ningxia, Xinjiang, Shanxi, Inner Mongolia and other northern and western provinces are less developed in economy and more dependent on coal and heavy industry, the cost and risk involved in their transition process are higher, and they will face greater pressure in the adjustment of the industrial structure, local finance and employment structure. If it is not handled properly, it may exacerbate the transition gap between regions and further expand the spatial imbalance of income and welfare<sup>[16][17]</sup>.

Technological innovation, market mechanism and other aspects will also pose related challenges in China's promotion of structural transition. **On one hand**, currently China's key technologies in some fields are still immature and are only in the prototype or demonstration stage, and further technological innovation is needed to achieve large-scale promotion and application of such technologies, while these key technologies are crucial to China's energy transition process, especially for heavy industry, long-distance transportation and other sectors that are difficult to decarbonize. Key technologies such as electrification technology, CCUS technology, hydrogen energy technology, bioenergy technology will face greater pressure in innovation<sup>[18]</sup>. **On the other hand**, currently China's market-based policies related to energy and carbon emissions are not perfect enough to provide the institutional flexibility needed in the transition of the energy system. Most of the policy mechanisms in China's energy and low-carbon transition process are command-and-control mechanisms, which are difficult to provide the mechanism flexibility needed in the energy system transition, for example, it is difficult to match the flexibility required for new power systems with a high proportion of renewable energy. In addition, command-and-control policies pay less attention to the cost of emission reduction, resulting in the neglect of the hidden costs of technology research and development paid by enterprises for emission reduction, which will lower the competitiveness of enterprises to a certain extent<sup>[19]</sup>.

#### *2.2.5 China continues to promote high-level opening up, and actively carries out international cooperation to*

#### *advance global green recovery and low-carbon transition*

In recent years, China has actively sought cooperation with developed and developing countries in the fields of climate and energy, contributing to the global green recovery and low-carbon transition.

With the help of important platforms such as South-South cooperation and the Belt and Road Initiative, China actively carries out climate cooperation with developing countries, and fully supports and promotes their green and low-carbon transition process in the form of cooperation and joint construction. Since 2016, China has launched 10 low-carbon demonstration zones, 100 climate change mitigation and adaptation projects, and 1,000 climate change training quota cooperation projects in developing countries, and implemented more than 200 foreign aid projects to address climate change. Moreover, China has jointly launched the Belt and Road green development partnership initiative with 31 co-construction countries, and established the Belt and Road energy partnership with 32 co-construction countries<sup>8</sup>.

China and developed countries such as Europe and the United States are also gradually building consensus in the field of climate change, and have signed relevant climate agreement documents and joint statements, such as the *U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s*, *China-U.S. Joint Statement Addressing the Climate Crisis*, *Joint Declaration between the People's Republic of China and the French Republic*, *Beijing Call for Biodiversity Conservation and Climate Change*, *China-EU Leaders' Statement on Climate Change and Clean Energy*, and *Joint Statement On the Implementation of the China-EU Cooperation on Energy*, laying a solid foundation for cooperation between China, the United States and Europe in the fields of

---

<sup>8</sup>State Council Information Office, 2023. White Paper on *China's Green Development in the New Era*

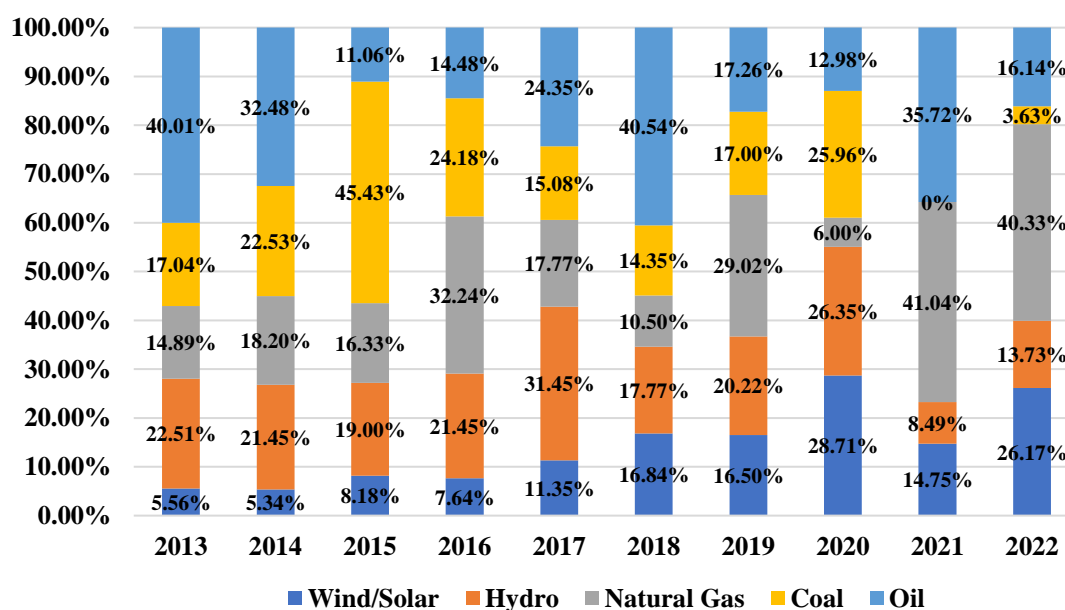


energy, transportation, and construction. In the future, China will continue to actively seek opportunities for climate cooperation with developed countries such as Europe and the United States, explore their respective comparative advantages in key technologies, equipment manufacturing, business models, finance and other fields, share best practices, and carry out third-party cooperation so as to contribute to the green and low-carbon transition process of developing countries and the world while advancing their own climate governance process.

China's overseas investment in the energy field is gradually becoming cleaner, and the proportion of renewable energy investment is gradually increasing. In September 2021, President Xi Jinping announced at the general debate of the 76<sup>th</sup> session of the United Nations General Assembly that China would no longer build new overseas coal power plants. According to statistics, China's investment in coal power in the Belt and Road countries is almost zero in 2021, and the direct investment and construction project contract value of wind power, photovoltaic and hydropower increase from \$1.3 billion and \$1.4 billion in 2021 to \$2.3 billion and \$3.5 billion in 2022 (as shown in Fig.2-8).

As the world's largest consumption and trade market, China can fully inject sufficient impetus into global green trade and green investment, and effectively drive the global green recovery. In 2021, China's green trade volume reached \$1,161.09 billion, surpassing the European Union to become the world's largest green trading country, accounting for 14.6% of the world, an increase of 1.5 percentage points compared to 2020<sup>[20]</sup>.

Although the current international climate cooperation is facing many obstacles, tackling climate change is inseparable from the joint response of all countries, and countries need to jointly find solutions through active dialogue, cooperation and experience sharing. China will still adhere to the principles of openness, inclusiveness and win-win cooperation, adhere to a high level of opening up, continue to promote climate cooperation with other countries, and better support the green and low-carbon transition process of the world, especially developing countries.



**Fig.2-8 Changes in structure of China's total investment and construction projects in energy sectors of Belt and Road countries from 2013 to 2022**

Source: China Belt and Road Initiative (BRI) Investment 2022

### 3 The Analysis on Progress of China's Carbon Dioxide Peaking and

#### Carbon Neutrality Actions

##### 3.1 Analysis on the Progress of China's low-carbon transition

In recent years, China has placed climate change at the forefront of national governance and development. The Outline of the 14<sup>th</sup> Five-Year Plan has set four quantitative goals around carbon dioxide peaking and carbon neutrality, including reducing energy consumption per unit of GDP by 13.5% (binding), reducing carbon dioxide emissions per unit of GDP by 18% (binding), forest coverage reaching 24.1% (binding), and non-fossil energy accounting for about 20% of total energy consumption (anticipatory). By 2022, China's energy consumption per unit of GDP was 2.8% lower than that in 2020, carbon dioxide emission per unit of GDP was 4.6% lower than that in 2020, non-fossil energy accounted for 17.5% of total energy consumption, and the forest coverage rate was 24.02%. Overall, China is steadily advancing towards the above four quantitative goals in the Outline of the 14<sup>th</sup> Five-Year Plan.

Under the guidance of the dual-carbon goals, China has made remarkable achievements in clean and efficient use of energy, industrial restructuring, synergistic interaction of carbon reduction and pollution reduction, improvement of ecosystem carbon sink capacity, and green and low-carbon life, etc.

##### 3.1.1 The energy system is developing toward cleanliness and high efficiency

**The clean and low-carbon transition of the energy consumption structure is accelerating, and non-fossil energy is developing rapidly.** In the process of clean and low-carbon transition of the energy system, China insists on establishing before breaking down, and gradually realizes the orderly replacement of fossil energy on the basis of vigorously developing non-fossil energy. From 2013 to 2022, the proportion of China's non-fossil energy consumption increases from 10.2% to 17.5%, while the proportion of coal consumption decreases from 67.4% to 56.2% (see Fig.3-1).

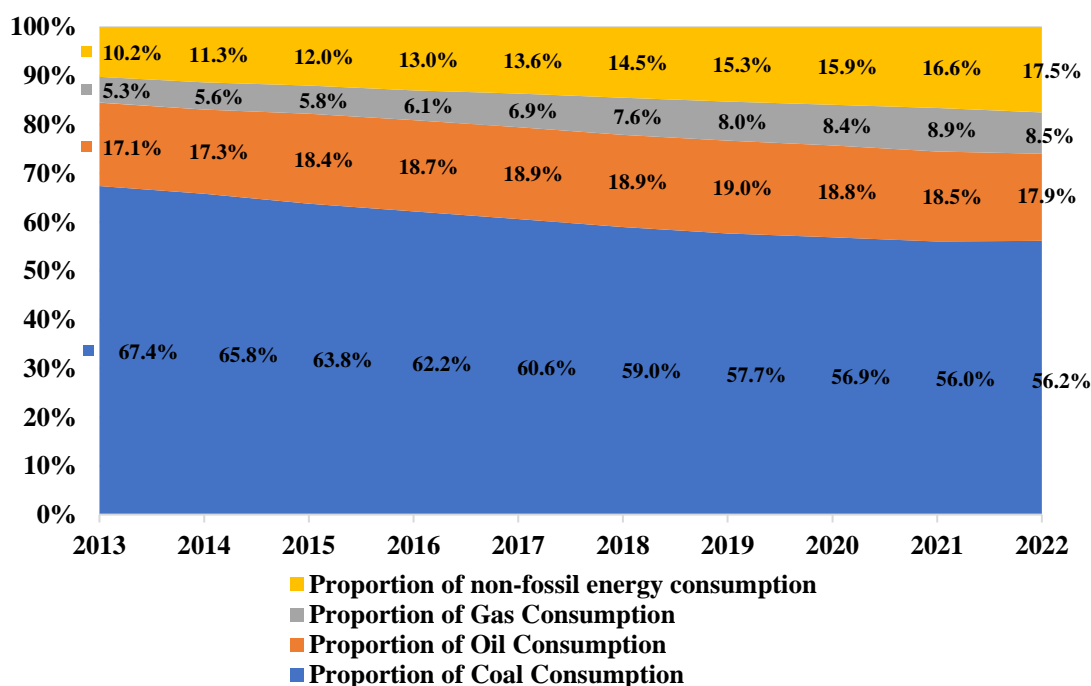


Fig.3-1 Changes in China's overall energy consumption structure from 2013 to 2022

Source: National Bureau of Statistics, National Development and Reform Commission

The development of China's renewable energy field has been acknowledged throughout the world. The construction of large-scale wind power, photovoltaic, hydropower and other renewable energy bases is advancing in an orderly manner. The installed capacity and power generation of renewable energy have maintained rapid growth and the total volume has ranked first in the world for many years in a row. China has planned to build 450 million kilowatts of large-scale wind power photovoltaic bases in deserts, Gobi, and desert areas, and the construction of 100 million kilowatts projects has started<sup>9</sup>. By the end of 2022, China's installed power capacity by renewable energy reached 1.213 billion kilowatts, accounting for 47.3% of the country's total installed generation power capacity (see Fig.3-2), surpassing the installed coal power capacity. Among them, the installed power capacity of wind power, solar power, and conventional hydropower reached 365, 393, and 368 million kilowatts respectively. In 2022, China's renewable energy power generation capacity was 2.7 trillion kWh, accounting for 31.6% of the electricity consumption of the whole society (see Fig.3-3). In terms of proportions in the world, the installed power capacity and power generation of China's renewable energy accounted for 32.8% and 30.9% of the world's total in 2022, surpassing the sum of the United States and the European Union (see Fig.3-4).

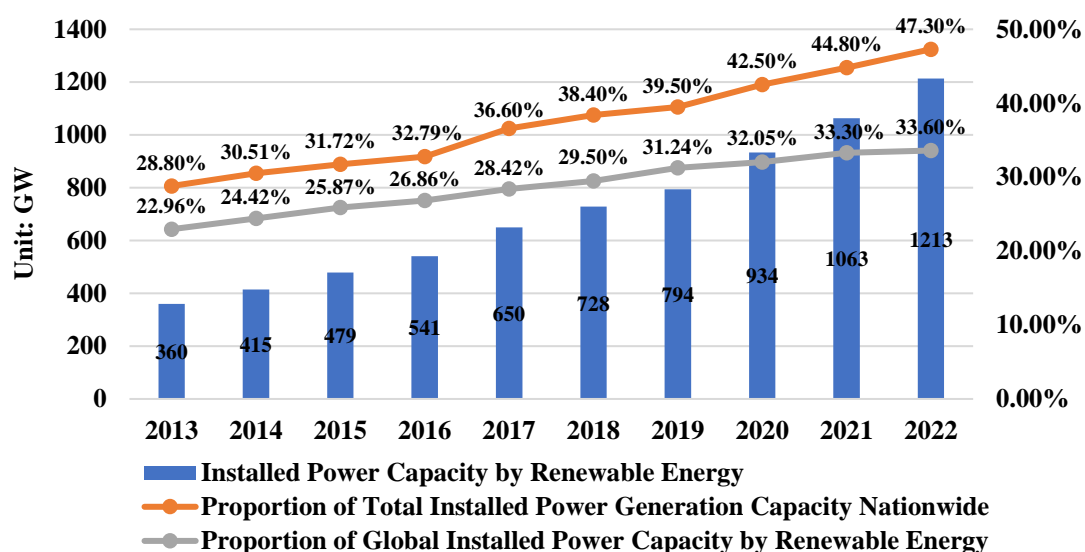


Fig.3-2 Changes in installed power capacity by China's renewable energy from 2013 to 2022

Source: National Energy Administration, China Electricity Council, IRENA, IEA

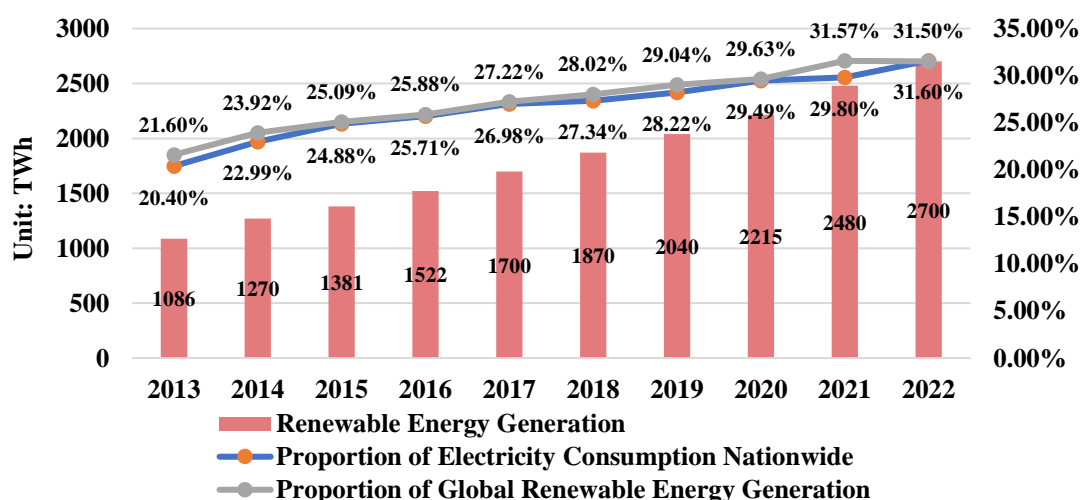
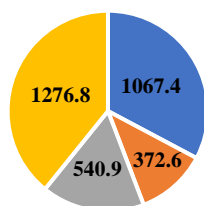


Fig.3-3 Changes in power generation by China's renewable energy from 2013 to 2022

Source: National Energy Administration, China Electricity Council, IRENA, IEA

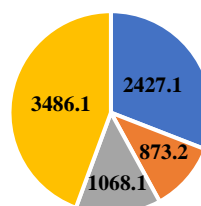
<sup>9</sup>Ministry of Ecology and Environment, 2022. *2022 Annual Report on Responding to Climate Change: China's Policies and Actions*

**Installed power capacity by renewable energy (Unit: GW)**



■ China ■ U.S. ■ EU ■ Other countries

**Power generation by renewable energy (Unit: TWh)**



■ China ■ U.S. ■ EU ■ Other countries

**Fig.3-4 Installed power capacity and power generation by renewable energy in China, U.S. and EU in 2021**

Source: IEA

**The level of clean and efficient utilization of fossil energy has been significantly improved.** Based on the basic national conditions of taking coal as the primary energy, China continues to promote the clean and efficient transition of coal utilization. By the end of 2021, China's large coal mines with an annual output of more than 1.2 million tons accounted for about 85% of the output<sup>10</sup>; bulk coal consumption was cut by about 440 million tons, a 58.7% drop from 750 million tons in 2015<sup>11</sup>. Meanwhile, China actively eliminates outdated production capacity of coal power, and vigorously promotes the "the linkage of three transitions" of coal power units in terms of energy saving and carbon reduction transition, flexibility transition, and heating transition, so as to continuously improve the level of clean and efficient development while ensuring that the coal power industry plays a backstop role. By the end of 2021, China had phased out and shut down more than 100 million kilowatts of outdated coal power production capacity<sup>11</sup>; China had accumulatively implemented the energy saving and carbon reduction transition of nearly 900 million kilowatts of coal-fired generating units, and the flexibility transition of more than 100 million kilowatts, and realized the ultra-low-emission emission transition of 1.03 billion kilowatts, accounting for 93% of the total installed power capacity, building the world's largest clean coal power system<sup>12</sup>.

**The energy consumption intensity is significantly reduced.** China's energy consumption per unit of GDP in 2021 was 26.4% lower than that in 2012, with an average annual decrease of 3.3%, equivalent to saving about 1.40 billion tons of standard coal<sup>13</sup>. This is due to China's implementation of new energy efficiency standards in important fields such as industry, construction, and transportation, the formulation of corresponding energy efficiency improvement plans, and the active promotion of upgrading and transition in various industrial fields through technology promotion, process innovation, and equipment improvement. In 2021, the average coal consumption of China's thermal power supply dropped to 302.5 grams of standard coal/kWh, a decrease of 6.9% from 2012<sup>14</sup>; the comprehensive energy consumption per unit of crude steel, electrolytic aluminum, and ethylene products decreased by 9.0%, 4.7%, and 4.9% respectively compared with ten years ago; in the construction field, over 13.9 million square meters of ultra-low and near-zero energy consuming buildings have been built; the electrification rate of railways reached 73.3%, and the

<sup>10</sup>National Bureau of Statistics, 2022. Energy transition continues to advance and remarkable results have been achieved in saving energy and reducing consumption - the 14<sup>th</sup> report in a series of reports on Achievements in Economic and Social Development since the 18<sup>th</sup> CPC National Congress. [http://www.stats.gov.cn/xxgk/jd/sjjd2020/202210/t20221008\\_1888971.html](http://www.stats.gov.cn/xxgk/jd/sjjd2020/202210/t20221008_1888971.html)

<sup>11</sup>National Energy Administration, 2022. Summary of Reply to Proposal No. 02486 of the Fifth Session of the 13<sup>th</sup> CPPCC National Committee. [http://zfxgk.nea.gov.cn/2022-08/09/c\\_1310668930.htm](http://zfxgk.nea.gov.cn/2022-08/09/c_1310668930.htm)

<sup>12</sup>Ministry of Ecology and Environment, 2022. *2022 Annual Report on Responding to Climate Change: China's Policies and Actions*

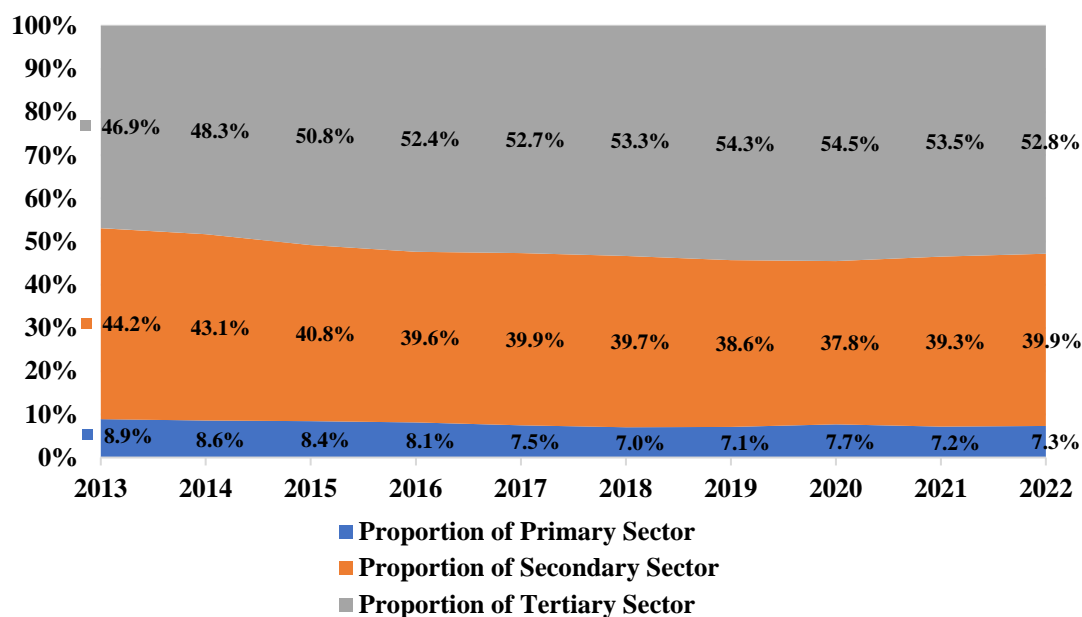
<sup>13</sup>www.gov.cn, 2022. National Bureau of Statistics: Over the past 10 years, China's energy consumption per unit of GDP has dropped by an average of 3.3% per year. [http://www.gov.cn/shuju/2022-10/08/content\\_5716737.htm](http://www.gov.cn/shuju/2022-10/08/content_5716737.htm)

<sup>14</sup>Ministry of Ecology and Environment, 2022. *China's Progress Report on Implementation of Intended Nationally Determined Contributions (2022)*

comprehensive energy consumption of national railway unit transportation workload decreased by 3.9% over the previous year<sup>15</sup>. Meanwhile, China is also actively developing new clean process transitions such as hydrogen energy steelmaking and green hydrogen to replace coal at the source, so as to promote the gradual green and low-carbon transition of terminal energy consumption in various industrial fields.

### 3.1.2 Green and intelligent transition of industrial structure

In recent years, China's industrial structure has been continuously upgraded and optimized, and the proportion of the added value of the tertiary industry in GDP has gradually increased. In 2022, the added value of China's tertiary industry was 63,869.8 billion yuan, a year-on-year increase of 2.3%, accounting for 52.8% of the country's total GDP, an increase of 5.9 percentage points over 2013 (see Fig.3-5).



**Fig.3-5 Changes in the proportion of the added value of China's three major industries in GDP from 2013 to 2022**

Source: National Bureau of Statistics

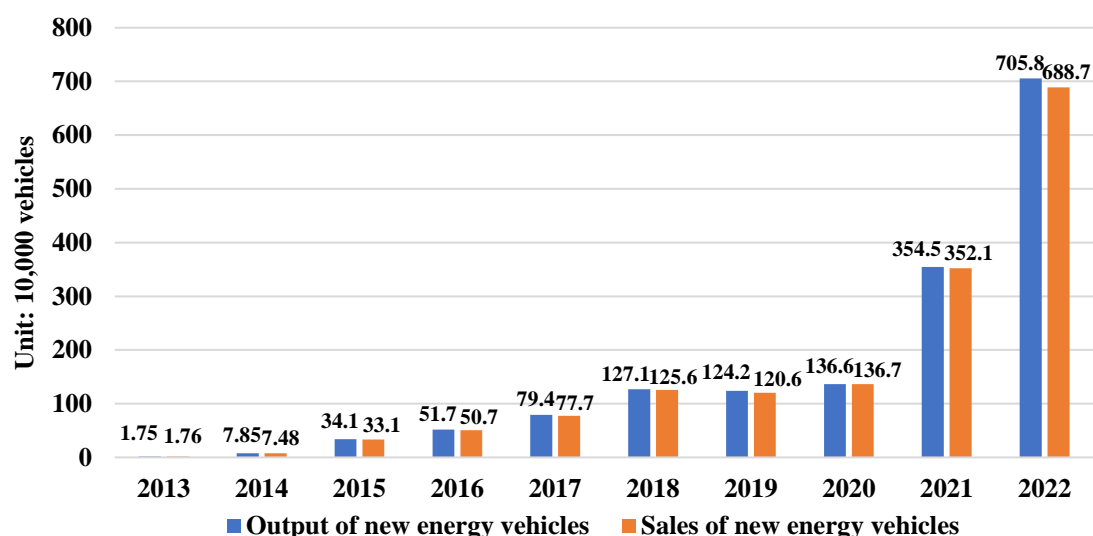
**Green and low-carbon industries are booming.** In recent years, China's new energy industry has developed rapidly. China's renewable energy manufacturing system is becoming more and more perfect, and its technological level and manufacturing scale are among the top in the world. The production scale of wind power, photovoltaic and other clean energy equipment ranks first in the world. In 2021, China accounted for more than 70% of global output in all links of the photovoltaic industry chain, including polysilicon, silicon wafers, cells and modules, and has become the world's largest new photovoltaic market for eight consecutive years<sup>16</sup>. The production and sales of new energy vehicles in China have also ranked first in the world for eight consecutive years. Among them, the sales of electric cars account for half of the world, and the sales of electric buses and electric trucks account for more than 90% of the world<sup>22</sup>. In 2022, China's new energy vehicles showed explosive growth, with production and sales of 7.058 million units and 6.887 million units, respectively, a year-on-year increase of 96.9% and 93.4%, respectively (see Fig.3-6). In the past ten years, China's energy-saving environmental protection and ecological environmental protection industries have gradually grown in scale. In 2021, the output value of China's energy-saving environmental protection industry reached 8 trillion yuan, with an average annual growth rate of more than 10%<sup>17</sup>. The scale of the ecological environmental protection industry is also continuing

<sup>15</sup>Ministry of Ecology and Environment, 2022. *2022 Annual Report on Responding to Climate Change: China's Policies and Actions*

<sup>16</sup>China Economic Weekly, 2022. Photovoltaics Becomes "New Business Card" for Industrial Economic Development. [https://paper.people.com.cn/zgjzjk/html/2022-12/30/nw.zgjzjk\\_20221230\\_5-03.htm](https://paper.people.com.cn/zgjzjk/html/2022-12/30/nw.zgjzjk_20221230_5-03.htm)

<sup>17</sup>[www.gov.cn](http://www.gov.cn), 2022. The output value of China's energy-saving environmental protection industry reaches CNY 8 trillion. [https://www.gov.cn/xinwen/2022-07/05/content\\_5699273.htm](https://www.gov.cn/xinwen/2022-07/05/content_5699273.htm)

to grow, its national operating income reached about 2.18 trillion yuan in 2021, an increase of 11.8% over 2020, and the direct contribution rate to the national economy is 1.8%<sup>18</sup>.



**Fig.3-6 Changes in production and sales of new energy vehicles in China from 2013 to 2022**

Source: National Bureau of Statistics, China Association of Automobile Manufacturers

**Digital information technology enables green and low-carbon upgrading of traditional industries.** Catalyzed by a new round of global technology and industrial revolution, emerging technologies such as the Internet, big data, artificial intelligence, and 5G are booming in China, and are deeply integrated with traditional industries such as manufacturing and service industries to release their multiplier effect on traditional industries and promote the high-end and intelligent upgrading of traditional industries. Studies have shown that by 2030, with the continuous improvement of the digitalization level of various industries, digital technology will enable China's entire society to reduce carbon by about 12%-22%, and enable various industries to grow by 10%-40%<sup>[23]</sup>. From 2012 to 2021, the scale of China's digital economy jumped from 11 trillion yuan to 45.5 trillion yuan, ranking second in the world for many years<sup>19</sup>; the proportion of value added of the core industry of the digital economy - information transmission, software and information technology service industry in GDP also increased by 2.3 percentage points<sup>20</sup>, and the business revenue of the software and information technology service industry jumped to the level of 10 trillion yuan for the first time in 2022, almost tripling its 2014 operating revenue<sup>21</sup>. In 2022, China's high-tech manufacturing and equipment manufacturing industries grew by 7.4% and 5.6% year-on-year respectively, and their proportions in the added value of industries above designated size increased from 9.4% and 28% in 2012 to 15.5% and 31.8% in 2022, respectively<sup>22 23</sup>.

**The green and low-carbon transition of traditional industries is accelerating. In the industrial field,** China continues to improve the overall level of clean production in the industrial field, carries out the construction of a green manufacturing system, and accelerates the construction of a green supply chain from the construction of green factories and green parks to the design of green products and the use of green environmental protection equipment. By 2020, China's carbon dioxide emissions per unit of industrial added value dropped by about 22% compared to 2015<sup>24</sup>. By the end of 2022, China has accumulatively built 2,783 green factories, 223 green industrial parks,

<sup>18</sup> www.gov.cn, 2022. The scale of China's ecological environmental protection industry continues to expand. [http://www.gov.cn/xinwen/2022-08/24/content\\_5706583.htm](http://www.gov.cn/xinwen/2022-08/24/content_5706583.htm)

<sup>19</sup>China Financial Information Network, 2023. Digital economy continues to drive high-quality economic development and its share of GDP expected to rise to 41% by 2022. [https://www.cnfin.com/hg-lb/detail/20230312/3821292\\_1.html](https://www.cnfin.com/hg-lb/detail/20230312/3821292_1.html)

<sup>20</sup>www.gov.cn, 2022. Report shows: the added value of China's service industry has grown by an average of 7.4% in the past ten years. [https://www.gov.cn/xinwen/2022-09/20/content\\_5710807.htm](https://www.gov.cn/xinwen/2022-09/20/content_5710807.htm)

<sup>21</sup> www.gov.cn, 2023. Statistical Bulletin on Software and Information Technology Service Industry in 2022. [http://www.gov.cn/xinwen/2023-02/02/content\\_5739630.htm](http://www.gov.cn/xinwen/2023-02/02/content_5739630.htm)

<sup>22</sup>National Bureau of Statistics, 2023. Statistical Communiqué of the People's Republic of China on the 2022 National Economic and Social Development. [http://www.gov.cn/xinwen/2023-02/28/content\\_5743623.htm](http://www.gov.cn/xinwen/2023-02/28/content_5743623.htm)

<sup>23</sup>www.gov.cn, 2023. The strength of scale has been further strengthened! China's manufacturing value-added has increased to nearly 30% of the global share. [https://www.gov.cn/xinwen/2022-06/14/content\\_5695609.htm](https://www.gov.cn/xinwen/2022-06/14/content_5695609.htm)

<sup>24</sup>State Council Information Office, 2021. White Paper on China's Policies and Actions for Addressing Climate Change

---

296 green supply chain enterprises, and released more than 20,000 green design products<sup>25</sup>. **In the field of construction**, China has issued the “Development Plan for Building Energy-Saving and Green Building During the 14<sup>th</sup> Five-year Plan Period”, and has gradually improved building energy-saving and renewable energy utilization standards, and green energy-saving buildings have grown by leaps and bounds. By the end of 2021, new green buildings accounted for 84% of new buildings in urban areas in the year, and the area of energy-saving buildings accounted for more than 63.7% of the area of urban civil buildings. China has accumulatively built more than 8.5 billion square meters of green buildings and nearly 27.7 billion square meters of energy-saving buildings<sup>26,27</sup>. **In the field of transportation**, China continues to improve the comprehensive transportation network system, promotes the transfer of bulk cargo transportation from “road to water” and from “road to railway”, and actively builds an urban low-carbon transportation system to speed up the construction of green transportation infrastructure. In 2021, China's freight volumes of railway and waterway were 4.774 billion tons and 8.240 billion tons, respectively, a year-on-year increase of 4.9% and 8.2%, and their proportions in the total social freight volume increased from 7.8% and 14.1% in 2017 to 9.2% and 15.8%, respectively<sup>28-29</sup>. By 2022, China has accumulatively built 5.21 million charging piles and 1,973 battery swapping stations, of which 2.593 million new charging piles were built in 2022, almost the sum of previously built charging piles<sup>30</sup>.

**Optimize and eliminate excess and backward production capacity and strictly control the development of “high energy-consuming, high-pollution, and low-level” projects.** While ensuring the security of industrial chains and supply chains, China implements a policy of replacement with equal or reduced production capacity for industries with high energy consumption and high emissions, such as steel and cement industries, to eliminate and resolve backward and excess production capacity, and ensure the high efficiency and high quality of their production capacity. During the 13<sup>th</sup> Five-Year Plan period (2016-2020), a total of over 150 million tons of excess steel production capacity and 300 million tons of cement excess production capacity had been eliminated, all substandard steel capacity had been cleared, and backward production capacity in electrolytic aluminum, cement and other industries had been basically cleared<sup>31</sup>. China implements list-based management, classified disposal, and dynamic monitoring for projects with high energy consumption, high emission, and low level (“two-high and one-low”), strictly controls the environmental access of such projects, and revises and improves the environmental impact assessment approval procedures and environmental access conditions. In 2021, the number of environmental impact assessment approvals for construction projects in related industries in China dropped by more than 30% year-on-year, rejecting more than 350 “two-high and one-low” projects to be launched, and reducing the new demand for energy consumption by 270 million tons of standard coal<sup>32</sup>.

### *3.1.3 Synergy of carbon reduction, economic development, and pollution control*

While ensuring sustained and rapid economic development, China has achieved remarkable results in reducing carbon and emissions. From 2013 to 2021, China's economy grew at an average annual rate of 6.6%, much higher than the world average growth rate (2.6%) during the same period, and its average contribution rate to global economic growth reached 38.6%, exceeding the sum of the G7 countries, becoming the primary driving force for world economic growth<sup>33</sup>. While

---

<sup>25</sup>Drcnet, 2023. The green manufacturing system is moving towards a new journey of high-quality development. <https://h5.drcnet.com.cn/docview.aspx?version=emerging&docid=6755168&leafid=28071&chnid=5553>

<sup>26</sup>Sina Finance, 2022. Ministry of Housing and Urban-Rural Development: Intensify the promotion of building energy efficiency, green buildings and green construction. [https://finance.sina.com.cn/esg/2022-09-16/doc-imqmmtha7455132.shtml?cre=tianyi&mod=pcpager\\_news&loc=16&r=0&rfunc=2&tj=cxvertical\\_pc\\_pager\\_news&tr=174&wm=#/index/1#250579937](https://finance.sina.com.cn/esg/2022-09-16/doc-imqmmtha7455132.shtml?cre=tianyi&mod=pcpager_news&loc=16&r=0&rfunc=2&tj=cxvertical_pc_pager_news&tr=174&wm=#/index/1#250579937)

<sup>27</sup>Ministry of Ecology and Environment, 2022. *2022 Annual Report on Responding to Climate Change: China's Policies and Actions*

<sup>28</sup>Ministry of Transport, 2022. Statistical bulletin on the development of the transportation industry in 2021. [https://xxgk.mot.gov.cn/2020/jigou/zhghs/202205/t20220524\\_3656659.html](https://xxgk.mot.gov.cn/2020/jigou/zhghs/202205/t20220524_3656659.html)

<sup>29</sup>www.gov.cn, 2023. National Development and Reform Commission press conference to introduce the “14th Five-Year Plan of modern logistics development”. [https://www.gov.cn/xinwen/2022-12/30/content\\_5734915.htm](https://www.gov.cn/xinwen/2022-12/30/content_5734915.htm)

<sup>30</sup>www.gov.cn, 2023. China's new energy vehicle production and sales have ranked first in the world for 8 consecutive years. [https://www.gov.cn/xinwen/2023-01/24/content\\_5738622.htm](https://www.gov.cn/xinwen/2023-01/24/content_5738622.htm)

<sup>31</sup>State Council Information Office, 2023. White Paper on *China's Green Development in the New Era*

<sup>32</sup>Ministry of Ecology and Environment, 2022. *China's Progress Report on Implementation of Intended Nationally Determined Contributions (2022)*

<sup>33</sup>www.gov.cn, 2022. Contributing an average of 38.6% to the world's economic growth from 2013-2021 - China becomes the

---

maintaining medium-to-high-speed economic growth, China has achieved a continuous decline in carbon emission intensity. In 2020, China's carbon emission intensity was reduced by 48.4% compared with 2005, and China had overfulfilled the goal of a reduction of 40%-45% by 2020 promised to the international community. The cumulative reduction of carbon dioxide emissions was about 5.8 billion tons, basically reversing the rapid growth of carbon dioxide emissions<sup>34</sup>. From 2021 to 2022, China's carbon emission intensity further decreased by 0.8%, and the process of carbon reduction and emission reduction moved forward steadily<sup>35</sup>.

China actively promotes the coordinated governance of carbon reduction and pollution reduction, and give full play to the synergistic benefits between the two. China has always paid attention to the synergy between carbon reduction and pollution control. In 2022, China introduced the *Implementation Plan for Synergizing the Reduction of Pollution and Carbon Emissions* to explore the establishment of a "source-process-end" whole-process synergy system for pollution reduction and carbon reduction. In 16 prefectures and cities, China organized and carried out the "Three Lines and One List" collaborative control pilots for pollution reduction and carbon reduction, and promoted the collaborative control of pollutants and carbon emissions in terms of data collection, technical methods and management paths, making full use of the synergy between the two to improve environmental quality and achieve a win-win situation of climate and environmental benefits. During the three-year period of China's implementation of the *Three Year Plan of Action for Winning the War to Protect Blue Skies*, not only the national emissions of sulfur dioxide, nitrogen oxides, and primary PM<sub>2.5</sub> decreased by about 3.67 million tons, 2.1 million tons, and 1.25 million tons, respectively, but also the emissions of carbon dioxide were reduced by 510 million tons, fully reflecting the synergy between air pollution control and carbon reduction<sup>36</sup>. In addition, relevant studies have shown that China's carbon dioxide peaking and carbon neutrality goals can fully accelerate the green and low-carbon transition of its energy system, transportation structure, and industrial structure, thereby bringing about significant pollutant emission reduction effects. Without the drive of carbon dioxide peaking and carbon neutrality goals, the average concentration of PM<sub>2.5</sub> in China can only drop from 33  $\mu\text{g}/\text{m}^3$  to about 25  $\mu\text{g}/\text{m}^3$  from 2020 to 2060; if carbon dioxide peaking would be realized in 2030, the national average concentration of PM<sub>2.5</sub> will drop to 20  $\mu\text{g}/\text{m}^3$  in 2060, and meanwhile, the average concentration of nitrogen oxides will also drop significantly. After 2035, the average concentration of ozone will drop to about 130  $\mu\text{g}/\text{m}^3$ , and after 2060, it will be stable at 100  $\mu\text{g}/\text{m}^3$ <sup>[24]</sup>.

#### *3.1.4 The carbon sink capacity of ecosystems such as forests and grasslands has been significantly enhanced*

In recent years, China has insisted on taking multiple measures to actively carry out large-scale land greening actions, and implement projects for the protection and restoration of ecosystems with important ecological impacts such as shelterbelts, natural forest protection and restoration, and returning farmland to forests and grasslands to promote the continuous increase in the area of important ecosystems such as wetlands and soils. From 2000 to 2017, the global green area increased by 5%, to which China contributed about 25%<sup>[25]</sup>, and the carbon sink capacity of the ecosystem has been significantly enhanced.

**In terms of forest carbon sinks**, China's forest protection and restoration work has been carried out in an orderly manner and has made remarkable achievements. Forest ecosystems have gradually shifted from carbon source to carbon sink, and the intensity of carbon sink has gradually increased<sup>[26]</sup>. In 2022, China's forest area was 231 million hectares, the forest coverage rate reached 24.02%, and the forest stock volume reached 19.493 billion cubic meters. Not only has the forest coverage rate and forest stock volume maintained "double growth" for more than 30 consecutive years, but China also has the fastest growing forest resources in the world. (see Fig.3-7 and Table 3-1). Since the 18<sup>th</sup> National Congress of the Communist Party of China, China has completed a total of 960 million mu of afforestation, and the total carbon reserve of forest vegetation has

---

world's top economic growth driver. [https://www.gov.cn/xinwen/2022-10/02/content\\_5715614.htm](https://www.gov.cn/xinwen/2022-10/02/content_5715614.htm)

<sup>34</sup> www.gov.cn, 2021. White paper: China has basically reversed the rapid growth of carbon dioxide emissions. [http://www.gov.cn/xinwen/2021-10/27/content\\_5646822.htm](http://www.gov.cn/xinwen/2021-10/27/content_5646822.htm)

<sup>35</sup> www.gov.cn, 2023. In 2022, China's energy consumption per CNY 10,000 of GDP decreased by 0.1% compared with the previous year. [http://www.gov.cn/xinwen/2023-02/28/content\\_5743710.htm](http://www.gov.cn/xinwen/2023-02/28/content_5743710.htm)

<sup>36</sup> Ministry of Ecology and Environment, 2022. *2022 Annual Report on Responding to Climate Change: China's Policies and Actions*



increased by net 1.375 billion tons to 9.2 billion tons<sup>37</sup>.

**In terms of grassland carbon sinks**, China has promoted the transition of grassland management from production-based to ecology-based management through the incentives of the grassland ecological subsidy and reward policy, and actively carried out a series of grassland ecological restoration projects such as returning grazing land to grassland and improving degraded grasslands, thus significantly enhancing the carbon sequestration capacity of grasslands. In the past ten years, China has accumulatively improved 600 million mu of grass, and 3.8 billion mu of grasslands have been recuperated due to measures such as grassland grazing prohibition and fodder-livestock balance<sup>38</sup>. At present, the annual carbon sequestration capacity of China's grasslands can reach 100 million tons<sup>39</sup>.

**In terms of wetland carbon sinks**, China continues to improve the wetland protection system, and promotes wetland protection and restoration work such as returning farmland and fisheries to wetlands, replenishing water in wetlands, and controlling wetland pests. The area of wetlands has changed from a decreasing trend to a recovery trend, and the carbon sink function of wetlands has been significantly improved. In the past ten years, China has implemented more than 3,400 wetland protection projects, adding and restoring more than 800,000 hectares of wetlands<sup>40</sup>. From 2015 to 2020, China's wetland area increased by 903 square kilometers, and the total area was about 412,000 square kilometers in 2020, ranking first in Asia. At present, the total aboveground carbon sequestration of herbaceous swamp vegetation in China is about 22.2 million tons, and the total soil organic carbon reserve of swamp wetlands is 9.9 billion tons<sup>[27]</sup>.

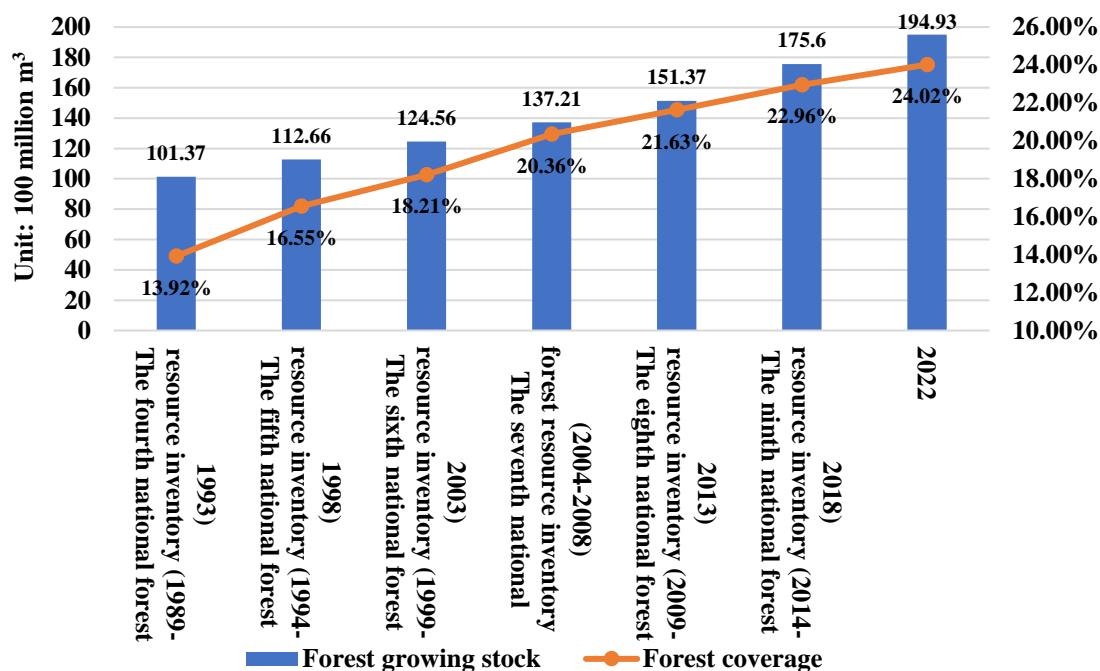


Fig.3-7 Changes in forest stock volume and forest coverage in China in the past 30 years

Source: National Forestry and Grassland Administration

<sup>37</sup> National Forestry and Grassland Administration, 2022. Continue to increase the reserve of forest “carbon sinks”. <http://www.forestry.gov.cn/main/586/20220507/083059960668959.html>

<sup>38</sup> www.gov.cn, 2022. Protection and restoration: China's grassland construction management has entered a new stage. [http://www.gov.cn/xinwen/2022-10/14/content\\_5718270.htm](http://www.gov.cn/xinwen/2022-10/14/content_5718270.htm)

<sup>39</sup> National Forestry and Grassland Administration, 2022. Grasslands have important functions as carbon pools - Relevant persons in charge of the Management Department of the State Forestry and Grassland Administration explain the functions of the “four pools” of grasslands. <http://www.forestry.gov.cn/main/586/20220614/083858613965364.html>

<sup>40</sup> Ministry of Natural Resources, 2022. Building Consensus on Cherishing Wetlands, Promoting Cooperation and Facing the Future - Written on the occasion of the 14th Conference of the Parties of the Ramsar Convention. [https://m.mnr.gov.cn/dt/pl/202211/t20221107\\_2763886.html](https://m.mnr.gov.cn/dt/pl/202211/t20221107_2763886.html)

Table 3-1 Global Top 10 countries with average annual net increase of forest area from 2010 to 2020

Ranking	Country	Net annual change	
		1000 hectares/year	Change rate (%)
1	China	1937	0.93
2	Australia	446	0.34
3	India	266	0.38
4	Chile	149	0.85
5	Vietnam	126	0.90
6	Turkey	114	0.53
7	The U.S.	108	0.03
8	France	83	0.50
9	Italy	54	0.58
10	Romania	41	0.62

Note: The rate of change (%) is calculated as a compound annual rate of change.

Source: *Global Forest Resources Assessment 2020*

### 3.1.5 Green and low-carbon life has gradually become a new fashion

**Continue to promote the construction and education of ecological civilization.** China has always attached great importance to the publicity and education of ecological civilization, in order to strengthen citizens' awareness of ecological civilization of thrift, greenness and environmental protection, and to form corresponding life concepts and habits. Under the guidance of the dual carbon goals, China has continued to carry out long-term themed publicity activities such as National Energy Conservation Publicity Week, National Low-Carbon Day, and World Earth Day to citizens to actively popularize climate change knowledge and strengthen green and low-carbon awareness. Meanwhile, China has also issued the *Implementation Plan for the Construction of the National Education System for Green and Low-Carbon Development*, which clearly proposes to guide young people to firmly establish the concept of green and low-carbon development, and build a national education system for green and low-carbon development with distinctive features, coherence, and rich content. In addition, China has also issued the *Ten Codes of Conduct for Citizens' Ecological Environment*, which aims to guide citizens to consciously implement and practice the concept and awareness of ecological civilization of green, low-carbon and environmental protection, and establish a good social atmosphere of green, low-carbon and environmental protection in society.

**Widely promote a green and low-carbon lifestyle.** While paying attention to the education of ecological civilization, China has also been highly focused on implementing the green and low-carbon concept in all aspects of the basic necessities of life of the public, so as to create a green, low-carbon and environmentally friendly lifestyle at the level of the whole society. Green cities, green communities, green schools and other green activities have been carried out in full swing. As of January 2023, 70% of the country's county-level and above party and government agencies have been established as energy-saving agencies, nearly 100 colleges and universities have realized intelligent supervision of water and electricity consumption, and 109 cities have participated in green travel creation actions in a high-quality manner. Various green and low-carbon actions such as "clean plate campaign", garbage sorting, water and electricity saving, and environmental protection decoration have become popular in the whole society, and a simple, moderate, green, low-carbon, civilized and healthy lifestyle has gradually become a new social trend.

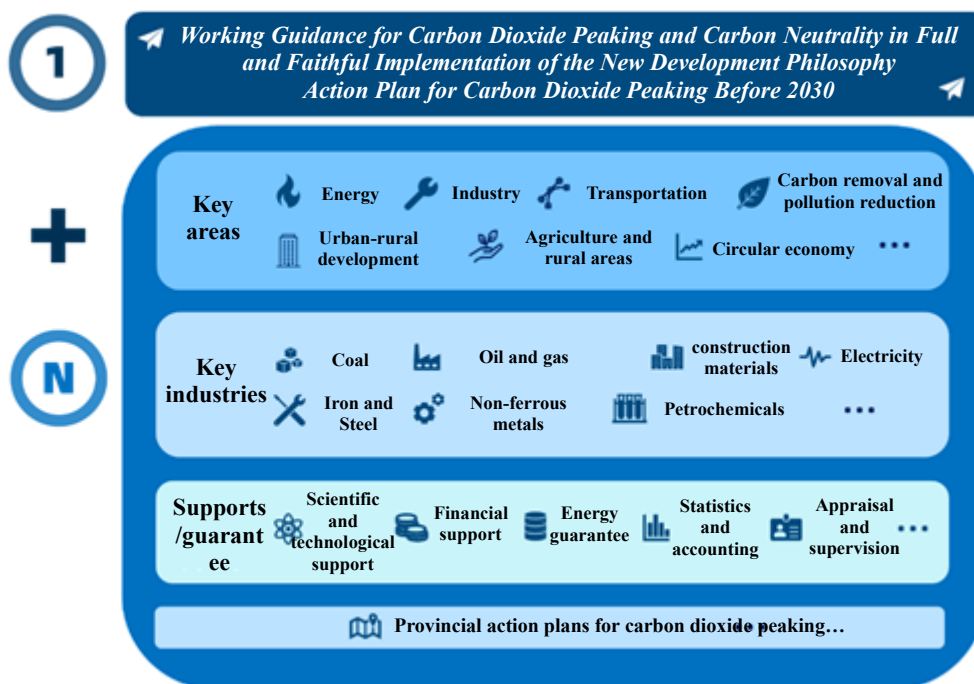
## 3.2 China's "1+N" policy system for carbon dioxide peaking and carbon neutrality

### 3.2.1 China has basically established a "1+N" policy system for carbon dioxide peaking and carbon

*neutrality with clear goals, reasonable division of labor, effective measures, and orderly connections*

In October 2021, China successively issued the *Working Guidance For Carbon Dioxide Peaking And Carbon Neutrality In Full And Faithful Implementation Of The New Development Philosophy* (hereinafter referred to as the *Working Guidance*) and the *Action Plan for Carbon Dioxide Peaking Before 2030* (hereinafter referred to as the *Action Plan*), as the overall

programmatic documents for the "1+N" policy system for carbon dioxide peaking and carbon neutrality, which is the "1" in the "1+N" system for carbon dioxide peaking and carbon neutrality, and "N" is the implementation plans for key areas and key industries and related supporting plans, including implementation plans for key areas such as energy, industry, transportation, urban and rural construction, agriculture and rural areas, pollution and carbon reduction, implementation plans for key industries such as coal, oil and gas, steel, non-ferrous metals, petrochemicals, and building materials, as well as supporting plans for scientific and technological support, financial support, statistical accounting(as shown in Fig.3-8).



**Fig.3-8: Diagram of "1+N" policy system for carbon dioxide peaking and carbon neutrality**

The "1+N" policy system for carbon dioxide peaking and carbon neutrality will provide a steady stream of working momentum for the realization of the carbon dioxide peaking and carbon neutrality goals, and provide comprehensive and multi-level guidance for China's carbon dioxide peaking and carbon neutrality work. Specifically: First, the policy design covers all key areas and key sectors related to decarbonization, including energy, energy saving and emission reduction, circular economy, industry, urban and rural construction, transportation, agriculture and rural areas, green consumption, pollution reduction and carbon reduction, etc., and action plans for key industries such as iron and steel, non-ferrous metals, petrochemicals, building materials, oil and gas, hydrogen energy, and new infrastructure. Secondly, it pays attention to providing practical guarantee for the carbon dioxide peaking and carbon neutrality work through scientific and technological innovation, financial support, price reform, scientific and technological support, personnel training and other support measures. Thirdly, it reflects the extensive participation of the whole society and is a vivid embodiment of the modernization of the national governance system and governance capabilities. The participants involve various departments of the State Council, local governments, industries, parks, enterprises, and individuals. Finally, the "1+N" policy system also seeks to promote broader cooperation, including the Belt and Road energy green development and international cooperation policy design in various industries and departments. Meanwhile, we must also pay attention to the long-term and arduous nature of the carbon dioxide peaking and carbon neutrality work, and its path and policy need to be constantly and dynamically adjusted according to the changes in the domestic and foreign situation.

---

### 3.2.2 The "1+N" system for carbon dioxide peaking and carbon neutrality implements the mid-to-long-

*term dual-carbon goal through practical actions in multiple fields*

The "1+N" policy system for carbon dioxide peaking and carbon neutrality clarifies the goals of carbon dioxide peaking before 2030 and carbon neutrality before 2060, providing a clear vision and transition signal for the whole society, and implementing the goals through actions in multiple fields (see Table 2).

**In the field of energy**, China will accelerate the planning and construction of a new energy system. The *Action Plan* pointed out that during the 14<sup>th</sup> Five-Year Plan period, the growth of coal consumption will be strictly controlled, and coal consumption will be gradually reduced during the 15<sup>th</sup> Five-Year Plan period (2026-2030). China will promote the clean and efficient use of coal, and promote energy-saving and carbon-reducing transition, flexibility transition, and heating transition of coal power plants. From 2021 to 2025, the proportion of renewable energy consumption increment in China's primary energy consumption increment will exceed 50%, and the proportion of renewable energy power transmission in new transmission channels will not be less than 50%<sup>41</sup>. Meanwhile, China will actively and orderly develop advanced nuclear energy systems. By 2025, the operating installed capacity of nuclear power will reach 70 million kilowatts<sup>42</sup>.

**In the industrial field**, the *Development Plan for Green Industry During the 14th Five-Year Plan Period* pointed out that during the 14<sup>th</sup> Five-Year Plan period, the carbon dioxide emissions per unit of industrial added value will be reduced by 18%, and the energy consumption per unit of added value of industrial enterprises above designated size will be reduced by 13.5%. China will continue to promote the optimization and adjustment of industrial structure and build an industrial layout that is conducive to carbon emission reduction; continue to resolutely curb the blind development of high energy-consuming, high-emission and low-level projects, and take effective measures to implement list-based management, classified disposal, and dynamic monitoring of high energy-consuming, high-emission and low-level projects. China will vigorously develop green and low-carbon industries, focus on strategic emerging industries such as new energy, new materials, and new energy vehicles, and build advanced manufacturing clusters with obvious low-carbon transition effects to drive industrial green transition.

**In the field of transportation**, China will greatly improve the green development level of transportation, reduce the intensity of carbon dioxide emissions, reduce the total discharge of major pollutants, and accelerate the formation of green and low-carbon transportation methods. China will actively expand the application of new energy and clean energy such as electricity, hydrogen energy, natural gas, and advanced bio-liquid fuels. It is planned to increase the proportion of new energy and clean energy-powered vehicles to about 40% by 2030, and vigorously promote the application of electric trains and hydrogen cell vehicles. In addition, China will also speed up the construction of port collection and distribution railways and special railway lines for logistics parks and large-scale industrial and mining enterprises, promote the transfer of bulk cargo and medium and long-distance cargo transportation from "road to water" and from "road to railway", and promote the development of multimodal transportation such as railway-water, road-railway, road-water, and air-land.

**In the field of construction**, China will improve the quality of green and low-carbon development of buildings, reduce energy consumption, promote the intensive group development of cities, and control the excessive growth of new construction land; improve the level of building efficiency to increase the energy efficiency of new residential buildings and public buildings in cities and towns by 30% and 20% respectively<sup>43</sup> by 2025; actively promote the improvement of building energy structure, increase the proportion of building electricity consumption in energy consumption to 65% by 2030, and promote the full electrification of more than 20% of buildings<sup>44</sup>; further improve the level of green and low-carbon design and construction of farm houses, formulate and

---

<sup>41</sup>Source: IRENA

<sup>42</sup>National Development and Reform Commission, National Energy Administration, 2022. *Plan for Modern Energy System During the 14<sup>th</sup> Five-Year Plan Period*

<sup>43</sup>Ministry of Housing and Urban-Rural Development, 2022. *Development Plan for Building Energy-Saving and Green Building During the 14<sup>th</sup> Five-year Plan Period*

<sup>44</sup>Ministry of Housing and Urban-Rural Development, National Development and Reform Commission, 2022. *Plan for Carbon Peaking Implementation in Urban and Rural Construction*

---

improve relevant standards for farm house construction, and promote clean technologies such as solar greenhouses, high-energy-efficiency lighting and stoves according to local conditions. China will vigorously promote the clean heating of rural houses in the north, and carry out energy-saving renovation.

**In the fields of agriculture, forestry and ecological carbon sinks,** Studies have shown that the global greening area increased by 5% between 2000 and 2017, of which 25% came from China [25]. Of this, forests and agricultural land contributed 42% and 32%, respectively. China will accelerate the coordinated work of addressing climate change and ecological environment protection to enhance the carbon sink capacity of the ecosystem; further promote agricultural and rural carbon sequestration, implement the national black soil protection project, improve soil organic carbon reserve, strengthen the comprehensive utilization of crop straws and the resource utilization of livestock and poultry manure; improve the utilization capacity of renewable energy in rural areas, and promote low-carbon agricultural models such as agricultural-PV complementation, "PV + facility agriculture", and "offshore wind power + marine ranch". China will take measures such as optimizing the development of land and space, implementing major ecological protection and restoration projects, and establishing an ecosystem carbon sink monitoring and accounting system to consolidate and improve carbon sink capacity and increase carbon sink increment.

**In the field of circular economy,** China will further promote economical and intensive utilization of resources, and build a resource recycling industrial system and a waste material recycling system; and focus on promoting the circular development of industrial parks, strengthening the comprehensive utilization of bulk solid waste, improving the resource recycling system, and promoting reduction and recycling of domestic waste to play the key role of synergy between resource and energy conservation and pollution and carbon reduction. By 2025, the comprehensive utilization rate of bulk solid waste will reach 60%<sup>45</sup>, the comprehensive utilization rate of construction waste will reach 60%, the utilization of waste paper will reach 60 million tons, the utilization of scrap steel will reach 320 million tons, the output of recycled non-ferrous metals will reach 20 million tons, the resource utilization rate of domestic waste will increase to about 60%, and the output value of the resource recycling industry will reach 5 trillion yuan<sup>46</sup>. By 2030, the annual utilization of bulk solid waste will reach about 4.5 billion tons, and the resource utilization rate of urban solid waste will increase to 65%<sup>47</sup>.

### *3.2.3 The "1+N" policy system for carbon dioxide peaking and carbon neutrality provides a solid guarantee*

*for low-carbon transition through systematic institutional construction and capacity building*

**Strengthen the building of the capacity related to carbon emission accounting and accelerate the establishment of a unified and standardized carbon emission accounting system.** China has introduced the *Implementation Plan for Accelerating the Establishment of a Unified and Standardized Statistical Accounting System for Carbon Emissions*, indicating that we should continuously strengthen capacity building in terms of statistical basis, accounting methods, technical means, and data quality of carbon emissions, and promote the formation of an orderly and standardized carbon emission statistics and accounting system covering the national, local, industrial, enterprise and key product levels, so as to provide comprehensive, reliable and scientific data support for China's carbon dioxide peaking and carbon neutrality work.

**Clarify the special direction of technology innovation for carbon dioxide peaking and carbon neutrality, scientifically deploy industry-wide technological breakthroughs, and promote the output and demonstration of core key technological achievements.** The *Implementation Plan for Science and Technology Support for Carbon Dioxide Peaking and Carbon Neutrality (2022-2030)* proposes the direction of China's green and low-carbon scientific and technological innovation on the premise of scientifically judging the emission reduction needs and technology gaps of China's key industries and fields, and plans specific measures and actions for basic research, base construction, personnel training, international cooperation and other aspects

---

<sup>45</sup>National Development and Reform Commission, 2021. *Guiding Opinions on Comprehensive Utilization of Bulk Solid Waste during the 14<sup>th</sup> Five-Year Plan Period*

<sup>46</sup>National Development and Reform Commission, 2021. *Development Plan for Circular Economy During the 14<sup>th</sup> Five-Year Plan Period*

<sup>47</sup>State Council, 2021. *Action Plan for Carbon Dioxide Peaking Before 2030*

---

related to low carbon, zero carbon and negative carbon, so as to effectively promote the technology research, achievement output and application demonstration of low carbon, zero carbon and negative carbon technologies, and provide scientific support for realizing carbon dioxide peaking and carbon neutrality goals.

**Promote the construction and reform of market-oriented mechanisms, strengthen the construction of a unified national carbon market and electricity market, and coordinate the connection between different markets, so as to effectively stimulate the transition momentum of various market players.** In terms of carbon market construction, the *Carbon Emissions Trading Management Measures (Trial)* pointed out that we should clarify the entry threshold of the national unified carbon market, gradually enrich the trading varieties and trading methods in the existing carbon market pilots, and promote local pilot carbon markets to gradually transition to the national carbon market, and finally form a national unified carbon market system. In terms of electricity market construction, the *Guidelines on Accelerating to Build a Unified National Power Market System* pointed out that we should improve the multi-level and cross-regional electricity market system, and clarify the functions and values of different market modules such as the electricity spot market, the medium and long-term market, and the auxiliary service market, and effectively realize that the unified electricity market can adapt to and promote the construction of a new power system characterized by a high proportion of renewable energy.

**Establish and improve the dual-carbon indicator assessment system and the related laws and regulations.** On the one hand, with the gradual deepening of carbon dioxide peaking and carbon neutrality work, China will gradually promote the transition from the control over both of the total amount and the intensity of energy consumption to the control over both of the total amount and the intensity of carbon emission. On the other hand, the *Working Guidance* pointed out that we should comprehensively clean up the contents of the current laws and regulations that are not suitable for the carbon dioxide peaking and carbon neutrality work, study and formulate special laws for carbon neutrality, and promptly revise the Energy Conservation Law, Electricity Law, Coal Law, Renewable Energy Law, Circular Economy Promotion Law, etc. to enhance the pertinence and effectiveness of relevant laws and regulations; improve the standard measurement system for carbon dioxide peaking and carbon neutrality, and improve the energy consumption monitoring and measurement system in the power, steel and other industries.

**Accelerate the establishment of a world-class talent system for carbon dioxide peaking and carbon neutrality.** Sufficient talent guarantee and intellectual support are necessary conditions for the realization of the dual-carbon goals. The *Work Plan for Strengthening the Construction of the Higher Education Talent Training System for Carbon Dioxide Peaking and Carbon Neutrality* pointed out that we should strengthen the forecast of talent demand in key industries related to "carbon dioxide peaking and carbon neutrality", and promote the upgrading and transition of "carbon dioxide peaking and carbon neutrality" related majors such as energy, transportation, and management; first build a batch of new disciplines and new majors, as well as high-level scientific research platforms and core technology research platforms in the green and low-carbon field, explore effective talent cooperation and exchange paths, and finally build a world-class talent training system for carbon dioxide peaking and carbon neutrality with Chinese characteristics to provide solid and reliable talent support for China's journey towards carbon dioxide peaking and carbon neutrality.

*3.2.4 The "1+N" policy system for carbon dioxide peaking and carbon neutrality plays the role of multiple*

*subjects in multiple fields to form a good pattern of joint efforts of the whole society to reduce emissions*

**At the central level, the CPC Central Committee and the State Council play a key role in overseeing the overall situation and coordinating all parties.** The Central Committee attaches great importance to the dual carbon tasks, incorporates the dual carbon work into the overall layout of economic and social development and the overall layout of ecological civilization construction, and systematically deploys the main goals, key tasks, and key actions of carbon dioxide peaking and carbon neutrality, and effectively promotes the formation of a collaborative work system of all parties at all levels, laying a solid foundation for ensure the effective implementation of follow-up carbon dioxide peaking and carbon neutrality work, and the establishment of a "1+N" policy system with clear goals, reasonable division of labor, powerful measures, and orderly connection.

---

**Local governments formulate action plans and implementation plans for carbon dioxide peaking and carbon neutrality according to local conditions to effectively promote the decomposition and implementation of the dual-carbon goals and tasks at the regional level.** In order to actively respond to the Party Central Committee's overall planning and overall deployment of carbon dioxide peaking and carbon neutrality work, local governments actively formulate action plans and implementation plans for carbon dioxide peaking and carbon neutrality that are in line with the actual conditions of the region and the positioning of subject functions, forming same-direction but asynchronized local action systems for carbon dioxide peaking and carbon neutrality. At present, most provinces in China have issued action plans and implementation plans for carbon dioxide peaking and carbon neutrality (see Table 3).

**At the enterprise level, the central enterprises formulate action plans for carbon dioxide peaking in the principle of “one policy for one enterprise” and play a leading role.** In December 2021, the State-owned Assets Supervision and Administration Commission of the State Council issued the *Guidelines on Promoting the High-quality Development of Central Enterprises and Performing the Carbon Dioxide Peaking and Carbon Neutrality Work*, and made arrangements for central enterprises to formulate and implement the action plans for carbon dioxide peaking. Subsequently, the *Guidelines for the Preparation of Action Plans for Carbon Dioxide Peaking by Central Enterprises (Draft for Comment)* was released, and all central enterprises were required to complete the preparation of their own action plans for carbon dioxide peaking by the end of 2022. At present, central enterprises such as State Grid Corporation of China, China Three Gorges Corporation, and China Baowu Group have issued action plans for carbon dioxide peaking and carbon neutrality. Driven by the leadership of central enterprises, private enterprises such as Tencent and Alibaba also actively responded to the call and released their own action reports on carbon neutrality to contribute to China's carbon dioxide peaking and carbon neutrality actions.

**At the public level, the public consciously participates in green and low-carbon activities, strengthens green and low-carbon education, and effectively promotes green and low-carbon life to become a new social trend.** On October 26, 2022, the Ministry of Education issued the *Implementation Plan for the Construction of the National Education System for Green and Low-Carbon Development*, which clearly proposed to build a national education system for green and low-carbon development with distinctive features, coherence, and rich content, and guide young people to firmly establish the concept of green and low-carbon development, to lay a solid thought and action foundation for achieving carbon peaking and carbon neutrality goals. China is also exploring the development of an innovative voluntary emission reduction mechanism---carbon inclusiveness. Some provinces and cities have introduced carbon inclusiveness management measures to create "carbon inclusiveness" applications and encourage the whole society to participate in carbon emission reduction. At present, more than 200 million trips are made per day by the urban public transport dominated by buses and subways in China, the construction of urban slow-moving systems such as riding and walking is steadily advancing, the concept of green and low-carbon travel has gained popular support, and a simple, moderate, green, low-carbon, civilized and healthy lifestyle has gradually become a new social trend.

*3.2.5 The "1+N" policy system for carbon peaking and carbon neutrality shows that China will continue to uphold the image of a responsible major country with an open and inclusive attitude, and continue to promote the construction of a new pattern of multi-party win-win climate cooperation*

**China will provide assistance and support within its capacity to developing countries in coping with climate change.** China will, by following the principle of achieving shared benefits through extensive consultation and joint contribution, continue to promote the establishment of green climate partnerships with developing countries through the Belt and Road South-South Cooperation Initiative on Climate Change, the Belt and Road Energy Partnership, and the BRI International Green Development Coalition as important media. The *Guideline on Promoting Green Development under the Belt and Road Initiative* clearly pointed out that we should make overall arrangements for advancing the cooperation with the "Belt and Road" countries in 9 key areas such as green infrastructure, green energy, and green technology with the goals of high standards, sustainability, and improving people's livelihood, provide support and assistance for the “Belt and

---

Road” countries in terms of infrastructure, technology, talents, funds, etc. through cooperation and joint contribution, so as to effectively promote the low-carbon transition process of energy, industry and other aspects of the Belt and Road countries.

**China will continue to seek cooperation with developed countries in the fields of economy, trade, standards, technology, and finance to provide more public goods for global climate change actions.** China will continue to actively seek opportunities to cooperate with developed countries in Europe and America on a larger scale, in a wider field, and at a deeper level. China will continuously optimize the trade structure through cooperation, deliver high-quality, high value-added green trade products to the world; continuously optimize the formulation of the green standard system, promote the formation of a global green standard evaluation system and mutual recognition mechanism; continuously promote green technology research to contribute to global low-carbon, zero-carbon, and negative-carbon technology breakthroughs; continuously improve the green financial system, and continuously strengthen the role of green financial instruments such as green credit and green bonds in supporting the global green and low-carbon transition process.

### 3.3 Brief summary

#### *3.3.1 China has made progress in the field of carbon peaking and carbon neutrality*

To achieve carbon peaking by 2030 and carbon neutrality by 2060 are major strategic decisions made by the CPC Central Committee after careful consideration. The central government has incorporated them into the overall layout of economic construction and ecological civilization construction and the local governments have responded positively and put forward their respective schedules and roadmaps<sup>[28]</sup>. In 2022, China’s energy consumption per unit GDP accumulatively decreased by 44.1% when compared with that in 2005. The low-carbon transition of energy was continuously deepened, the production of clean energy grew rapidly, and the proportion of non-fossil energy consumption continued to increase. In 2022, the proportion of the consumption of non-fossil energy in the total energy consumption was 17.5%, presenting an increase of 0.8 percentage point on a year-on-year basis<sup>48</sup>; and the installed capacity and the power generation of photovoltaic and wind power both ranked first in the world. In addition, China basically established a “1+N” policy system for carbon peaking and carbon neutrality, laying a solid policy foundation for establishing and improving a comprehensive policy guarantee system in various fields and for all parties to participate in the action of carbon peaking and carbon neutrality in all aspects. In the future, under the guidance of the 20<sup>th</sup> National Congress of the Communist Party of China, China will further steadily promote the work relating to carbon peaking and carbon neutrality, based on its own energy resources, adhere to the principle of "construction before destruction", and implement the action of carbon peaking and carbon neutrality in a planned and step-by-step manner.

#### *3.3.2 China needs to further deepen and perfect its policies and actions for carbon peaking and carbon*

#### *neutrality*

It is a tightly scheduled and arduous task for China to achieve the goals of carbon peaking and carbon neutrality. To complete its transition from the largest emitter in the world to a country featured by carbon neutrality within 30 years, China needs to reduce emissions faster and more vigorously than developed countries such as Europe and the United States did so as to achieve comprehensive green and low-carbon transitions of economic and social development patterns. This requires China to further deepen and improve its policies and actions for carbon peaking and carbon neutrality.

**China needs to further improve the management system and mechanism for carbon peaking and carbon neutrality and further strengthen the synergistic benefits among the policies for carbon peaking and carbon neutrality.** At present, China has established a "1+N" policy system for carbon peaking and carbon neutrality, planning as a whole and coordinating the work of various entities and fields relating to carbon peaking and carbon neutrality. However, the work stated above is a systematic project that involves multiple sectors and departments, featured

---

<sup>48</sup>Data source: the National Bureau of Statistics



---

by difficult coordination among different departments and institutions, and there are some misunderstandings of policies for carbon peaking and carbon neutrality as well as conflicts of policies during the implementation of these policies, causing the effects of such implementation to be less effective than expected.

**China needs to further clarify its short- and medium-term roadmap for low-carbon energy transition.** At present, China has established long-term goals and directions for low-carbon energy transition, including a quantitative goal of making the non-fossil energy consumption above 80% by 2060, to promote renewable energy to gradually replace fossil energy which is playing a dominant role. However, the near/medium-term roadmap for China's low-carbon energy transition is not clear. How coal power, gas-based power, and stored energy systems to be built in future, featured by a high proportion of renewable energy, play different roles during different stages, how industrial development matches with energy supply in respect of location space, and how electric power market plays a regulating role have not been determined at present.

**China needs to further leverage the role of the market in the work relating to carbon peaking and carbon neutrality.** Currently, China's policies for carbon peaking and carbon neutrality are mainly based on commands and controls and the market-oriented policy mechanism has not played a role in resource allocation. In respect of such market mechanisms as carbon emissions trading and green finance, there is a great potential to guide various resources and elements to gather in green and low-carbon industries and thus to stimulate the endogenous power and innovation vitality of various market players for green and low-carbon transition. China should promote the improvement of the current mode of realizing the goals of carbon peaking and carbon neutrality, featured by "Big Administration, Small Market", give play to the initiative of market players, and drive the coordinated efforts of the government and the market, for the purpose of maximizing the efficiency in the realization of the goals of carbon peaking and carbon neutrality.

**China needs to attach importance to the fairness and justice of regional development in the process of transition.** One of the main principles of the work relating to carbon peaking and carbon neutrality in China is to insist on overall planning. China has a vast territory and there are significant differences among different regions in terms of industrial structure, economic development, and emission intensity. Some provinces with weak economic foundations and high dependence on fossil fuels will face more severe challenges and pressure from finance, taxation, employment, and other aspects during transition. Therefore, China should attach much importance to the issue of fairness and justice among regions during transition, introduce relevant policies, and provide corresponding incentives and supports for some provinces and regions, such as subsidies, tax reductions, and employment supports, so as to ensure the smooth and orderly low-carbon transition.

## 4 China's Policy Direction of Deepening Green and Low-Carbon Transition

### 4.1 To take carbon reduction as a guide and promote overall green and low-carbon

#### transition of whole economy and society

The goals of carbon peaking and carbon neutrality are inherent requirements for high-quality development, reflections of responsibilities of great powers, and systematic approaches of ecological civilization construction with a focus on carbon reduction as a key strategic direction. The realization of medium- to long-term deep emission reduction not only helps to mitigate climate change but also brings economic, social, and environmental benefits. Achieving carbon peaking and carbon neutrality is a systematic extension and deepening of ecological civilization construction, providing China with an implementation framework for medium and long-term visions, comprehensive goals and systems<sup>[29]</sup>.

Development remains the key to solving all the problems in China facing the future and the necessity and urgency of transforming the development mode have become even more prominent. It is necessary to accelerate the adjustment and optimization of the industrial structure. Deep decarbonization will expedite a new industrial revolution and new competitive advantages will be formed around the upgrading of industries with decarbonization as the core. Attention should be

---

paid to the improvement of quality and efficiency, the elimination of outdated production capacities, the promotion of industrial transition and upgrading, and the increase of the proportion of green and low-carbon manufacturing industry. The reduction of new energy cost, the breakthroughs in process, reengineering, and technology, and the gradual improvement of carbon pricing mechanism will be considered so as to gradually complete the green and low-carbon transition, structural upgrading, and re-layout of the high energy carrying industry, by means of scientifically developing a decarbonization roadmap for the steel industry and a defueling path for the petrochemical industry, etc.

A circular economy oriented to carbon emission reduction should be developed. We should give full play to the synergistic effects of carbon reduction, pollution reduction, and green growth through green design as well as green and low-carbon full product lifecycle and supply chain and further improve the extended producer responsibility system that connects enterprises, governments, and consumers through goals of renewable resources and incentive mechanisms, so as to promote the development of the circular economy. We should make innovative technologies and modes of utilizing greenhouse gases like carbon dioxide as resources and focus on such issues as wastes from emerging industries during transition: For example, we should well treat and dispose retired facilities for new energy and batteries of electric vehicles and conduct assessments over the full life cycle of infrastructure and products. We should also deepen the pilot work of the program of “waste-free cities” and expand it to regional and urban agglomerations.

## **4.2 To promote green investment, low-carbon consumption, and trading of low-carbon**

### **products for the purpose of injecting new impetus into economic growth**

The investments relating to carbon neutrality will provide considerable impetus for economic growth during the period of the “14<sup>th</sup> Five-Year Plan” and the next three to four decades and thus economic growth can be organically combined with transition for carbon neutrality. By 2050, the direct investments oriented to carbon neutrality can reach at least CNY 140 trillion. In consideration of related investments, the actual investment potential will be much greater than this scale. Based on the analysis of Energy Foundation China, during the 14<sup>th</sup> Five-Year Plan, the total investment potential in the fields of digital economy and digital upgrading and green transition of traditional industries, green and low-carbon urbanization and modern urban construction, green and low-carbon consumption, and construction of renewable energy, environmental-friendly energy, and power systems can reach CNY 44.6 trillion, with an annual average investment of about CNY 8.9 trillion, accounting for about 1/6<sup>49</sup> of the total social investments in 2021 (Table 4-1). By industries, the demand for green investments in electricity, transportation, and construction is greatest.

From the perspective of consumption needs, although only less than 30% of China’s population is currently in the middle-income category, this proportion will continue to increase and the consumption of this part of the population is the main growth point of the Chinese consumer market. An important consumption need of the middle-income group is life health and safety as well as comfortable enjoyment of clean environment. Areas such as construction, transportation, travel and vacation, and electrical appliances will see increasing consumption demands, which can be very effective under certain institutional arrangements to stimulate the willingness and the ability to pay in the market and then become a new driver of economic growth. We can guide more low-carbon consumers to purchase low-carbon products via policies, which will further boost economic growth while improving energy security and reducing emissions of greenhouse gases.

---

<sup>49</sup>Energy Foundation, 2022. Focus on Stable Growth · Experts’ Talk about Green Investments Supporting Green Recovery. <https://www.efchina.org/News-zh/Program-Updates-zh/programupdate-comms-20220527-zh>

Table 4-1 Key areas of the 14<sup>th</sup> five-year plan and green stimulus measures (accumulative investments of CNY 44.6 trillion)

Category	Priority area	Investment scale (2021-2025)	Source/channel of funding
Information infrastructure	5G base station	CNY 2.5 trillion	Based on public + market debts and loans
	Artificial intelligence and big data center	CNY 2 trillion	Based on market debts, loans, and stocks
	Industrial Internet	CNY 800 billion	
Renewable energy / environmental-friendly energy/power system	Centralized/distributed renewable energy, power system flexibility, and smart grid, etc.	CNY 4.7 trillion	Based on public + market debts and loans
Green and low-carbon urbanization and modern cities	Public service facilities, low-carbon buildings, clean heating and cooling, charging piles for electric vehicles, and high-speed railway and intercity transportation of urban agglomerations	CNY 7.8 trillion	Based on market debts, loans, and stocks
Digital upgrading and green re-construction of traditional industries	Digital applications of specific scenarios; electrification of specific departments and processes; re-structuring of integrated supply chain of medium and small enterprises in specific regions and urban agglomerations; and improvement of environmental quality and ecological remediation (in consideration of carbon emission)	CNY 16.5 trillion	Based on market debts, loans, and stocks
Expansion and re-shaping of green consumption	Consumption of green and low-carbon products: high-efficiency electric appliances and electric vehicles Low-carbon lifestyle in smart cities: medical treatment, supporting for old people, sports, education/training, and entertainment	CNY 5.5 trillion	Based on public + market debts, subsidies, and loans
Innovative infrastructure	Significant infrastructure for science and technology, science and education, and innovation of industrial technologies	CNY 300 billion	Based on public + market debts and loans

Data source: From Green Stimulus and the 14th Five-Year Plan to China's Modernization: Writing a New Growth Story Around Natural Capital, by Energy Foundation China.

In terms of low-carbon trading, China also has great potential, with comparative advantages mainly including renewable-energy equipment and related parts, high-speed trains, ultra-high-voltage direct current transmission equipment, electric vehicles, low-carbon electrical appliances, and high-energy efficiency refrigeration and other equipment. China also has a comparative advantage in the manufacturing of green and low-carbon equipment and can supply products with competitive prices to the global market to reduce energy transition costs globally. For example, among the top ten manufacturers of wind power and photovoltaic modules in the world, respectively six and eight come from China. In 2021, the output of the photovoltaic modules of China reached 182GW in total, including over a half exported to overseas markets. Developed countries such as the United States and those in Europe have advantages in core technologies, applications, business models, and market expansions, which can strongly complement with China's advantages in techniques, standards, and industries. Both sides can promote global technological developments and efficiency improvements through healthy and fair market competition and cooperation. The mechanism of working groups can also be established within the framework of the WTO for the purpose of carrying out dialogues and cooperation in respect of policies relating to tariff and management over intellectual property rights as well as coordination in equipment standards.

### 4.3 To optimize the spatial structure of the territory and construct a new spatial pattern

#### meeting the requirements for carbon peaking and carbon neutrality

We should take into account regional differences, comprehensive resource endowments, new-

---

energy developments and costs, carbon neutral industrial layout of industrial transformation strategies and the integration of the three major spaces of the regional low carbon transformation partnership, use controls and dual carbon targets, formulate a mixed land use policy in favor of large-scale and high-proportion developments of renewable energy sources, promote the protection, development and utilization of biomass energy, reduce carbon emissions, increase carbon sink, and be adapted to and protect biodiversity synergistically. We should build intensive, intelligent, low-carbon, resilient, and sustainable urban and rural infrastructure by reshaping, enhance the sustainable development capacity of cities, promote urban operation to guarantee green transition, and achieve low-carbon and high-quality urban development, to form a new pattern of land space development and protection as well as a system of natural reserves.

We should establish a system of natural reserves with national parks as the main body and stabilize the carbon sequestration function of existing forest, grassland, wetland, ocean, soil, permafrost, karst, etc.<sup>[30]</sup>, improve the carbon sink capacity and the adaptive capacity of the ecosystem, complete the MRV system and the statistical accounting of natural carbon sink, and strengthen the overall management of specific regions within the national territory, such as “mountains, rivers, forests, fields, lakes, grasslands, sand, ice” and “oceans, bays, islands, reefs, and shores”, and provide nature-based solutions, develop nature benefiting economy, reduce costs and improve sustainability, and perfect integrated ecosystem management, as well as encourage the development of various nature reserves, including those for public welfare, and support social capital to participate in the entire process of investment, design, restoration, and management of ecological protection and restoration projects.

#### **4.4 To complete the mechanism and institution for management over carbon peaking and carbon neutrality and focus on building the local capacity to achieve the dual carbon goals**

We should improve the management and coordination mechanism for various departments and fields and promote the participation of various stakeholders. We should give full play to the role of the National Leading Group on Climate Change, Energy Conservation, and Emission Reduction and enhance the overall planning. Then, we should further complete the duties and the working procedures of the related departments, reach a wider consensus and a normalized coordination mechanism. We should also strengthen the building of the capacities of various regions in addressing climate change and low-carbon transition issues from the perspectives of institution, human resources, and law enforcement and should promote communication and coordination between departments.

We should break through the departmental barriers in fundamental institutional systems for carbon peaking and carbon neutrality, strengthen the overall coordination and connection of carbon emissions trading, energy use rights trading, and electricity trading, establish a mechanism for collaboration and sharing of statistical data on energy consumption and greenhouse gas emissions to improve data consistency and timeliness, as well as clarify the division of labor and the allocation of rights and responsibilities among departments, clarify the responsibilities of all parties, strengthen the cooperation among departments, and ensure that governmental departments at all levels, local governments, and enterprises orderly implement the goals of carbon neutrality and carbon peaking.

We should also strengthen the local awareness of carbon peaking and carbon neutrality and the local capacity of achieving the goals of carbon peaking and carbon neutrality. From the perspective of awareness, we should enhance a local government’s awareness and understanding of the goals of carbon peaking and carbon neutrality, stimulate its enthusiasm and initiative in governance, and formulate differentiated regional low-carbon development paths. From the perspective of capacity building, we should enhance the local capacity and level of construction of carbon peaking and carbon neutrality, cultivate relevant technical and management talents, make up for the shortage of technological talents, improve the innovation ability of enterprises and the development potential of resource-based enterprises, and promote the transition and upgrading of local industries.

---

#### **4.5 To push forward the transition and transformation of key mechanisms and accelerate**

##### **the transition from the control over both of the total amount and the intensity of energy**

##### **consumption to the control over those of carbon emissions**

We should further complete the system for the control over both of the total amount and the intensity of energy consumption. The elasticity of the total amount of energy consumption should be enhanced and the relevant statistics and assessment systems should be improved so as to ensure the energy use of raw materials or new renewable energy will not be included in the total amount of energy consumption for control. A mechanism for the coordinated development of key projects and renewable energy sources should be established and the local governments should be encouraged to overcome the restraints of energy consumption indicators for key projects and to break through the bottlenecks in the development of renewable energy sources with various methods. Then the direction of assessment over the newly-added nuclear power consumption should be figured out during the control over the total amount and the intensity of energy consumption and the corresponding assessment indicator system should be improved as well. The policy system for cross-provincial allocation of clean energy should also be consummated for the purpose of establishing a collaborative working mechanism for trading of clean power and carbon reduction between supplying and receiving provinces on the principles of fairness and efficiency.

We should establish a sound system of laws and regulations on carbon dioxide peaking and carbon neutrality and develop a framework of laws on addressing climate change or promoting carbon neutrality as soon as possible. The principle of “establishing institutions first and breaking them later” shall be adhered to define the short-, medium- and long-term roadmap for institutional transformation. During the middle and later periods of the “14th Five-Year Plan”, we should select some provinces and cities, key emission departments and industries as soon as possible to carry out pilot projects of assessing the total amount and intensity of carbon emissions, together with assessing the total amount and intensity of energy consumption, and conduct follow-up study. During the early period of the 15th Five-Year Plan, we should pilot the system of “assessing the total amount and intensity of carbon emissions” throughout the country, with the intensity as binding target and the total amount as the anticipated target. After 2030, the carbon emission reduction system shall be improved with a focus on the total carbon control system, while the carbon intensity index and energy consumption intensity index will be mainly reflected in the emission benchmarking of sectors and products. In terms of the carbon emission quota allocation, the national carbon market and provincial administrative bodies should establish a two-track mechanism of total carbon control target breakdown while the responsibilities and powers between the central and local governments shall be reasonably divided.

We should promote the updating, improvement, and development of the supporting system for renewable energy. Local consumption and expansion as well as cross-regional transmission of renewable energy should be promoted by relying upon mutual complementation among several energy sources like wind, photovoltaic energy, hydro-energy, and coal, interconnection among power grids, energy storage, and reform of electricity market; the land use planning should be optimized; the area and the scope of a site for a renewable energy project should be planned properly; and the factors such as distribution of renewable energy resources, environmental sensitivity, and social influence should be taken into full consideration for the purpose of scientific land use planning and coordination and co-existence of renewable energy projects and other land utilization. The relevant procedures and links should be streamlined; the corresponding approval process should be improved, and an electronic approval system should be established to realize online applications and approvals and reduce the use and delivery of paper documents. A mechanism for connecting renewable energy projects with carbon market should be set up as well, which should cover registration and recognition processes as well as reporting and verification requirements, so as to integrate a renewable energy project into the carbon market.

#### **4.6 To speed up the carbon pricing and the carbon market mechanism building of China**

We should consolidate the political, legal, policy, and management mechanism foundation for

---

the construction of the carbon market. As a support for achieving the national goals of carbon peaking and carbon neutrality from the resource allocation mechanism, it is necessary to make carbon resource a production factor and construct, reform, and cultivate the carbon market as a component of the production factor market. A legal footing should be also established and completed for the carbon market, which should cover the connection with the existing management regulations for the production factor market as well as the special legislation.

We should establish a total carbon emission constraint mechanism for enterprises on the carbon market and set an annual proportion of increase or decrease in the total carbon emission of an industry involved in the carbon market based on the characteristics of the industry. The scope of industries covered by the carbon market should be expanded as appropriate, by prioritizing the early introduction of renewable energy to the national carbon emissions trading system with the power industry as the main part and gradually including other key industries of iron and steel, electrolytic aluminum, cement, chemical engineering, and petrochemical engineering, featured by large-scale emissions. Emission intensive enterprises should be included to the carbon trading system while an enterprise with a low emission intensity should be included to the carbon tax system. If the carbon pricing system develops slowly, it is necessary to consider using other methods of value transfer, like providing franchise incentives and permits for horizontally-mixed businesses to investors featured by carbon reduction (such as an energy enterprise to carry out profitable operations of finance, real estate, and water), to form sufficient incentives of return on investment.

We should promote the connection and coordination between the carbon market and other markets and policies, by enhancing the compatibility and cooperation of the carbon market with market-oriented reforms such as electricity market reform and related policy mechanisms such as renewable energy quota mechanism and energy use rights trading mechanism and evaluating the impacts of different policies and market-oriented reform methods on the quota, pricing, and other aspects of the carbon market so as to prevent the risk of conflicts between them and fully explore and leverage their synergistic effects<sup>[31]</sup>.

#### **4.7 To focus on achieving just transition at the industrial and the regional levels**

**We should formulate a series of policies and measures relating to financial assistance for coal and related enterprises. On the one hand,** the government can directly provide assistance to affected coal and related enterprises through existing public funds, subsidies, tax abatements, or establishment of special support funds. **On the other hand,** the government can also help reduce the losses of coal and related enterprises by providing them with preferential financing policies in the field of transition finance, such as helping them obtain capital at lower interest rates and releasing simpler and more convenient fund application processes.

**We should make a package of policies and measures relating to compensation, job replacement, and retraining for unemployed laborers in the coal and related industries. On the one hand,** for unemployed individuals in coal and related industries during transition, sufficient compensation should be provided for them through the social security system. **On the other hand,** differentiated job placement and retraining for unemployed groups should be carried out through the reform of the education system so as to adapt them to the structural changes in the job market. At the same time, governmental agencies, colleges and universities, vocational skills training institutions, and enterprises should be coordinated to cooperate with each other to ensure large-scale supply and sustained support of laborers.

**We should lay down relevant policies and measures to promote the diversified economic development of coal-intensive and underdeveloped areas and enhance their "hematopoietic function". On the one hand,** policies on special financial support and economic diversification should be made for the purpose of providing financial and industrial supports (including basic public services and social security funds as well as green transition funds for green infrastructure, urban greening, etc.) for coal-intensive and underdeveloped areas, **On the other hand,** it is necessary to guide coal-intensive and underdeveloped areas to identify opportunities for value transfer and reuse, such as utilizing raw coal assets to develop logistics and warehousing businesses and achieving the transition of the industrial structure and the diversification of economic development.

---

#### **4.8 To push forward the perfection of the investment and financing policies relating to**

##### **climate so as to promote the transition to carbon neutrality**

We should establish a natural capital accounting system that can fully reflect the scarcity of natural resources as well as the corresponding financial incentives and regulatory models, set up a special financial performance evaluation mechanism for climate-related public financial budgets and subsidies, increase public capital input in the green field, mobilize and motivate more social capital to invest in high-tech, high-benefit and low-emission industries, more effectively curb investments in fields featured by high input, large-scale emission and unsustainability, encourage financial institutions to expand their financing channels and enrich their products and services relating to green finance and carbon finance, and provide climate-friendly enterprises that meet relevant standards and conditions more opportunities of financing and refinancing through the capital market.

We should improve the taxonomy for investment and financing projects relating to climate and gradually promote the synergy of the taxonomy with those of developed economies in Europe and America. At present, China's construction of the taxonomy for investment and financing projects relating to climate is still in the initial stage and there is still a certain gap between such taxonomy and those of developed countries in Europe and America. Now, China should gradually improve the work of legal basis, principles, standards, and indicators setting for the taxonomy of investment and financing projects relating to climate based on our own development status in the field of climate investment and financing and gradually promote the consistency and synergy with the taxonomy of developed economies in Europe and America as well as facilitate the realization of cross-border climate investment and financing activities and contribute to the global convergence of climate investment and financing taxonomies.

We should strengthen the assessments over environmental and climate risks of the financial industry and especially climate risks in industries presenting high energy consumption such as coal, heavy industry, and thermal power, and effectively filter out projects with high risks of stranded assets and/or high financial risks. Then, risk monitoring should be carried out throughout the entire process of approved projects and especially to strictly prevent enterprises from using investment and financing to engage themselves in non-green, non-low-carbon, and non-environmentally-friendly projects which may result in the risk of "greenwashing". We should also promote the mandatory disclosure of climate related information by financial institutions as well as establish green taxonomy for overseas investment and financing and compliance and accountability mechanisms for financial institutions.

#### **4.9 To lead a new global green development pattern and continue to deepen the**

##### **international cooperation in climate changes**

As a major economy that affects global economic and social development and green and low-carbon transition, China has been always performing the responsibilities of a major power with the idea of building a community with a shared future for mankind. China always believes that climate change is a comprehensive issue concerning global healthy development and in line with the common interest of all countries. Therefore, in the future, China will continue to uphold the principle of openness and inclusiveness, deepen and expand climate cooperation with developing and developed countries in policy, technology, and other aspects, and promote the construction of a new global climate cooperation pattern for a win-win situation.

To utilize multi-lateral cooperation mechanisms to reunite consensus: On the one hand, we will continue to engage in dialogues and cooperation via the main channel of the governance mechanisms under the United Nations Framework Convention on Climate Change (UNFCCC) and the *Paris Agreement*, in order to increase trust and resolve doubts. For example, based on the results of the Global Stock Take, major emitters can, through closed-door discussions, candidly exchange views on their respective climate change actions and propose more practical goals for the updating of their own Nationally Determined Contributions (NDC). On the other hand, we should explore multilateral climate cooperation outside the UNFCCC, such as making use of the G20 to discuss

---

green finance and green financial policies for promotion of green and low-carbon recovery and to explore cooperative investments in low-carbon infrastructure. We should also establish a working group mechanism within the framework of the WTO to hold dialogues and explore innovative policies and mechanisms in respect of tariff policies and intellectual property management policies for low-carbon products as well as coordination and mutual recognition of equipment standards. In addition, we should increase the supports of multilateral financial institutions for addressing climate change.

To actively share best practices and experience during transition with developing countries as well as continuously enrich and expand the forms and levels of cooperation and co-construction to support their green and low-carbon transition: On the one hand, we should focus on key areas and anchor our own advantages and continue to deepen green cooperative projects with developing countries. In response to the urgent demand of developing countries for low-carbon energy infrastructure and cutting-edge green technologies during their respective green and low-carbon transition in developing countries, we should leverage our manufacturing and production advantages in new energy industries such as renewable energy and electric vehicles, actively establish energy transition partnerships with developing countries, and continue to expand the huge market for energy transition in developing countries. On the other hand, we will actively expand and widen the forms and the scale of cooperation with developing countries, continue to support the green and low-carbon transition of developing countries through multilateral cooperation mechanisms such as the Belt and Road Initiative, and improve our leadership in the global climate governance pattern, and will also actively expand the types of dialogue and exchange mechanisms, create diversified forms of dialogues at ministerial, provincial, and municipal levels, and enrich levels of dialogues.

To promote pragmatic cooperation between China, the United States, and Europe in green industries and technologies: We should actively seek opportunities for cooperation with the United States and Europe in various fields such as technologies, talents, and policies as our manufacturing advantages in new energy and other fields and their advantages in core technologies, business models, and other aspects can achieve mutual complementarity and we should also actively and properly dialogue and discuss with them in aspects of tariff policies and coordination of green standards, so as to realize fair, reasonable, interactive, effective, and win-win cooperation through healthy and fair market environment and rules. In addition, as the leading forces in the process of global climate governance, China and developed countries in Europe and America should cooperate to strengthen the cooperation on third-party markets and leverage their respective comparative advantages through financial assistance, technology sharing, and talent cultivation for the purpose of jointly promoting the low-carbon energy transition of developing countries.

## 5 Analysis of Gender Mainstreaming

Women and girls make up a half of the population of the world. Gender equality is a fundamental human right as well as an important prerequisite for fully unleashing human potential, promoting sustainable development, and ultimately achieving a peaceful society. The empowerment for women also has a promoting effect on productivity improvement and economic growth. Women are more vulnerable than men to the impact of a climate change. At the same time, due to taking on more work to sustain family livelihoods, women have a deeper knowledge and understanding of local climatic and environmental conditions, which can help them provide more practical and feasible solutions for adaption to and mitigating climate changes. In the work of climate changes, full consideration should also be given to the participation and contribution of women, to ensure that their perspectives are expressed and reflected and achieve the synergy between the sustainable development goals of climate action and gender equality.

In China, gender equality is a basic state policy for promoting national and social development. The *Outline for Development of Women in China (2021-2030)* has identified Women and Environment as one of its eight major themes. However, in the fields of environment and climate, China shows a lack of gender consciousness as well as a gap with the international community. At present, China's economy has shifted from a stage of rapid growth to a stage of high-quality development, and in order to make the development achievements better benefit all people and continuously realize their aspirations for a better life, it is necessary to make coordinated promotions



---

of multiple goals such as economic growth, climate response, energy security, ecological governance, rural revitalization, fair transition, and gender equality. Adopting the gender mainstreaming analysis in the work of carbon peaking and carbon neutrality, fully considering the impacts on different gender groups during policy formulation and implementation, and ensuring equal benefits for men and women can not only end or reduce inequality but also give full play to women's abilities and potential and further promote the realization of sustainable development goals, to finally provide a multiplier effect for guaranteeing sustainable development and to greatly enhance China's image in the international community as well. In this chapter, we will propose the application of the gender mainstreaming analysis to the four main and feasible specific work areas of the climate action of China.

## **5.1 To give full play to women's leadership in climate change-related affairs and improve**

### **women's participation and representativeness in climate decision making**

Women and girls are disproportionately affected by climate change and thus fully considering the perspective of women during the decision-making of mitigation of and response to climate change can ensure that the formulation and implementation of climate policies are more pertinent and effective. At present, women's participation level in climate-related work is even less than a half, which is not directly proportional to the impact of climate change upon them. In 2020, only 15% of the leaders of the environmental departments throughout the world were women<sup>50</sup> and the average proportion of female employees was only one-third<sup>[32]</sup>. In China, only one of the seven ministerial-level leaders of the Ministry of Ecological Environment was a woman<sup>51</sup>. Therefore, more women should be promoted to participate in the making of decisions about mitigation of and response to climate change and in the meanwhile, a focus should be placed on the cultivation of the social gender awareness of the existing leaders and the importance of gender mainstreaming in decision-making should be clarified. In rural areas, the left-behind women account for about two-thirds of the workforce<sup>52</sup> and they have a deeper knowledge and understanding of local climatic and environmental conditions, enabling them to propose practical and feasible solutions for adaptation to and mitigation of climate change as per local conditions. Therefore, strengthening women's leadership in the community at the micro level can fully unleash the development potential of rural areas as well as promote gender equality, to achieve synergistic gains.

Under the framework of the United Nations Framework Convention on Climate Change (UNFCCC), a practical and effective measure of promoting women's leadership in the climate-related work is to elect China's National Gender & Climate Change Focal Point (NGCCFP)<sup>53</sup>. The UNFCCC encourages the signatories to appoint and support gender and climate change focal points responsible for climate-related negotiations, implementation, and monitoring. By August 2023, 107 countries and regions have designated their respective gender and climate change focal points, presenting an increase by 13 countries when compared to that in 2022, while China has not yet taken any action. The 27<sup>th</sup> Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27), held in Sharm el-Sheikh in 2022, mentioned that the work and role of gender and climate change focal points was constantly evolving and led by the Parties and also encouraged the Parties to incorporate the work of the nominated national gender and climate change focal points into the relevant national policy-making and decision-making structure<sup>54</sup>. China's accession and participation cannot be delayed. The gender and climate change focal points of

---

<sup>50</sup>Achieving Gender Equality and Creating Sustainable Future: Why Women Are of Great Importance in Beating Climate Change.

<https://china.un.org/zh/174134-%E6%80%A7%E5%88%AB%E5%B9%B3%E7%AD%89%E5%85%B1%E5%88%9B%E5%8F%AF%E6%8C%81%E7%BB%AD%E6%9C%AA%E6%9D%A5%EF%BC%9A-%E4%B8%BA%E4%BB%80%E4%B9%88%E5%A5%B3%E6%80%A7%E5%9C%A8%E8%B7%91%E8%B5%A2%E6%B0%94%E5%80%99%E5%8F%98%E5%8C%96%E4%B8%8A%E8%87%B3%E5%85%B3%E9%87%8D%E8%A6%81>

<sup>51</sup>For the institutional framework of the Ministry of Ecological Environment, please visit <https://www.mee.gov.cn/zjhb/>.

<sup>52</sup>Gender Mainstreaming and Women's Participation in Practices of Carbon Peaking and Carbon Neutrality. [https://www.women.org.cn/art/2021/6/22/art\\_25\\_166547.html](https://www.women.org.cn/art/2021/6/22/art_25_166547.html)

<sup>53</sup>National Gender & Climate Change Focal Points. [https://newsroom.unfccc.int/topics/gender/resources/list-of-gender-focal-points-under-the-unfccc?gclid=Cj0KcQjwk7ugBhDIARIsAGuvpZiNjNjGCU6IXYExhqI0lhoQOLE50lqUro3TMmItDefX3ugZnQVeWrUaApz8EALw\\_wcB](https://newsroom.unfccc.int/topics/gender/resources/list-of-gender-focal-points-under-the-unfccc?gclid=Cj0KcQjwk7ugBhDIARIsAGuvpZiNjNjGCU6IXYExhqI0lhoQOLE50lqUro3TMmItDefX3ugZnQVeWrUaApz8EALw_wcB)

<sup>54</sup>Conference of the Parties · 27th Conference, Proposal of Gender and Climate Change Chairman-Draft Decision-/CP.2-Interim Review of Implementation of Gender Action Plan. [https://unfccc.int/sites/default/files/resource/cp2022\\_L15C.pdf](https://unfccc.int/sites/default/files/resource/cp2022_L15C.pdf)

---

various countries mainly come from such governmental departments as Environment, Climate, and Diplomacy. If the Chinese government designates some persons of the Ministry of Ecological Environment to act as its gender and climate change liaisons responsible for coordinating gender-related work, participating in international discussions, and promoting capacity building, etc., it will be a simple, practicable, and effective step to enhance gender considerations in the work relating to carbon peaking and carbon neutrality.

## **5.2 To actively drive just transition and promote women's equal employment through the opportunities of climate transition**

Fair transition refers to considering everyone involved as fairly and inclusively as possible and creating decent job opportunities, without anyone falling behind, in the process of green transition<sup>55</sup>. At present, in China, discussions on fair transition mainly focus on issues such as placement of unemployed workers and energy availability to consumers but rarely on reducing the risk of deteriorated gender inequality. In fact, as a vulnerable group, women may suffer from greater losses during transition: For example, they are more likely to lose economic security and access to energy, especially when they are unable to fully and timely participate in the post-transition economic and social systems.

Based on the research by the International Labor Organization, without the policies for fair transition, even in emerging green industries, the existing gender employment stereotypes will continue<sup>[33]</sup>. The realization of the goals of carbon peaking and carbon neutrality requires a systematic transition of the economic structure and will fundamentally change the job market. The failure to pay attention to the female groups affected by the transition may further limit their potential in entering the new job market after the transition, to pose a risk of exacerbating gender inequality. However, the policies and measures for fair transition are expected to bring opportunities to promote gender equality, which will thus tap into the underutilized potential of female human capital and further drive the transition.

According to the data provided by the International Labor Organization, if actions are taken in the energy sector to control the global warming within 2 °C by the end of this century, approximately 24 million job opportunities can be created<sup>[34]</sup>. The majority of new employment opportunities in emerging industries, which are undergoing low-carbon transition, are concentrated in industries currently dominated by men, such as renewable energy, manufacturing, and construction. Relevant departments need to take the following pertinent measures to narrow the gender gap in these industries and ensure that women can also participate and contribute.

The first is to include gender considerations in macroeconomic and industrial development policies to ensure the fairness and inclusiveness of the transition, and at the same time, in terms of employment policies, to consummate the considerations in respect of support for female entrepreneurs in emerging industries, skill development and work safety and health of female workers, and employment discrimination so as to ensure that women have equal access to training and employment opportunities.

The second is to include the goal of fair transition or gender considerations in the *Nationally Determined Contributions*. As of 2021, only 14% of the Parties had not mentioned gender in their *Nationally Determined Contributions*<sup>[33]</sup>, indicating that the majority of countries had stronger awareness and willingness to address gender equality and other issues in the climate-related work. When submitting *Nationally Determined Contributions*, other countries should incorporate into their goals the fairness and inclusiveness in transition in combination of the concept of high-quality development.

The third is to make full use of the role of climate-related investment and financing, guide funds towards projects of fair transition, ensure the direct participation and profitability of women in project design, decision-making, and implementation, and take into account the social disciplines and the other challenges to be faced by women during transition.

---

<sup>55</sup> Frequently Asked Questions on just transition. [https://www.ilo.org/global/topics/green-jobs/WCMS\\_824102/lang-en/index.htm](https://www.ilo.org/global/topics/green-jobs/WCMS_824102/lang-en/index.htm)

---

### 5.3 To improve women's ability of being adapted to climate change and achieve a multi-win

**situation featured by adaptation to climate change, increased benefits for low-income groups, and uplifted gender equality**

Being adapted to climate change refers to “strengthening identification and management of risks in natural ecosystems and economic and social systems, taking adjustment measures, fully utilizing favorable factors and preventing unfavorable factors, and mitigating the adverse effects and potential risks caused by climate change”<sup>56</sup>. Females are more vulnerable to climate due to their own characteristics and gender inequality in society and are thus confronted with greater difficulties and risks while adapting themselves to climate change. For example, due to physical fitness, local infrastructure, and social discipline, females lack of the ability of self-rescue and recovery in natural disasters caused by climate change, when compared to males<sup>57</sup>. For the reason of social and cultural norms, women often assume more responsibilities for taking care of their families. Climate change may make women pay more for maintaining household health and may also exacerbate women's inequality in resource acquisition. Especially for impoverished female groups, poverty increases their risks and costs of adapting themselves to climate change and their vulnerability to climate may further exacerbate gender inequality and poverty. The economic impact of the COVID-19 makes this phenomenon more prominent.

Therefore, the special needs of women should be included in the decision-making mechanisms for formulating policies on adaptation to climate change. If the different needs of both genders are taken into account in countermeasures, strengthening women's resilience and adaptability to the adverse effects of climate change and natural disasters<sup>58</sup> and enhancing the empowerment for women in adaptation to climate change can promote the triple effects of addressing the challenges of climate change, improving the well-being of impoverished women and their families, and promoting the gender equality.

The first is to introduce a gender perspective when formulating a policy relating to adaptation to climate change, fully consider the needs and roles of women, use women's experience in adaptation to climate change as a reference for decision-making, and promote women's participation in the making of decisions about adaptation to climate change. The *National Strategy of Adaptation to Climate Change by 2035*, jointly released by 17 departments including the Ministry of Ecological Environment does not mention the situation of women in adaptation to climate change or the relevant and countermeasures. Similarly, in the gender-related policies should the content concerning climate change be clearly defined and the challenges women face during their coping with climate change be considered from the perspective of gender equality. The *Outline for Development of Women in China (2021-2030)* has the content relating to women and environment but lacks of the special content concerning women and climate change.

The second is to ensure that women can sustainably utilize natural resources<sup>[35]</sup>, adapt themselves to changes in natural resources to be brought about by climate change, and enhance their economic empowerment during pre-disaster preparedness, post-disaster relief, and long-term recovery and reconstruction processes. On the one hand, it means that it is necessary to take into account the needs of the female group for being adapted to climate change, use best efforts to reduce the risks during females' adaptation to climate change, and improve the economic benefits of the female group<sup>59</sup>, during infrastructure construction. For this infrastructure construction, the economic recovery in the post-epidemic era provides more opportunities, and we should encourage the inclusion of the perspective of gender equality in the making of decisions about investments in new construction of local infrastructure; and on the other hand, it means that it is necessary to

---

<sup>56</sup> The Ministry of Ecological Environment, *National Strategy of Adaptation to Climate Change in 2035*. <https://www.mee.gov.cn/xxgk/xxgk03/202206/W020220613636562919192.pdf>

<sup>57</sup>ZHU Lei, Her Power of Promoting Climate Change Action. <https://fisf.fudan.edu.cn/ffr/content/375>

<sup>58</sup> The UN Women, Political Declaration about 25<sup>th</sup> Anniversary of 4<sup>th</sup> World Conference on Female Problems. <https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/CSW/64/CSW64-Declaration-CH-Fin-WEB.pdf>

<sup>59</sup>For example, to build greenhouses adapted to local climate change and similar facilities in respect of agriculture, water use, and energy consumption, which can help local women to obtain food with balanced nutrition for their families and sell such food on the market so as to improve their economic benefits.

---

establish projects for building of women's capability of adapting themselves to climate change and especially help the female group to master the knowledge, technology, and capability of adaptation to climate change based on the capability building mechanism of the community.

The third is to provide financing mechanisms for women (especially impoverished women) to be adapted to climate change at the local level, or to support females to strengthen their capabilities of adapting themselves to climate change through special funds for gender equality, and to help low-income women to reduce poverty and lift themselves out of poverty, and prevent them from being trapped in further poverty and avoid exacerbating gender inequality due to climate change.

#### **5.4 To consider the social impacts of overseas green investments and aids in a strengthened way, promote gender equality, and give play to the leading role of China in global climate governance**

Overseas investments and aids will not only have economic impacts on the host country but also generate significant social and environmental impacts. Currently, in China's overseas investment and aid projects (and especially green overseas investment and aid projects), the environmental impacts of these projects have been fully considered and recognized but the recognition and management of their social impacts have been still in the initial stage. During the construction of such projects stated above, it is necessary to consider the vulnerability of the local female group, emphasize the protection of female laborers' basic rights and interests, reduce the differences between the two genders in respect of income and social status, and prevent such projects from causing or exacerbating local gender inequality. In overseas green investments and aids, considering the factor of genders and promoting gender equality can avoid the risk of social impacts of the projects, drive the social development of the host country, help obtain the recognition of the local society, and enhance the international reputation of China as a responsible great power.

The first is to complete the standards and guidelines for overseas investments and aids by taking gender equality into account. In terms of environmental protection, the *Guidelines for Ecological Environment Protection in Overseas Investment Cooperation Construction Projects*<sup>60</sup>, jointly printed and issued by the Ministry of Ecological Environment and the Ministry of Commerce in 2022, provide guidance and standards for Chinese enterprises in overseas investments, environmental impact assessments, and environmental management. In future, the release of the guiding ideas on social impacts of overseas investments can be considered, to drive Chinese capital to make overseas green investments and aids as well as to require that such investments and aids should accept full social impact assessments including gender mainstreaming analysis.

The second is to consider incorporating gender issues into the information disclosure dimension of an overseas investment project through the self-discipline pact on the overseas investment project. When a Chinese enterprise carries out an overseas investment or aid project, it should pay attention to disclosing the information about the project to the local community, government, people, and other stakeholders, including the target and plan and the possible gender and social impacts of the project, and should also improve the sustainability and the social influence of the project. The Association of Enterprises can issue the *Self-discipline Pact of Chinese Enterprises on Overseas Investments* and a participating enterprise should voluntarily abide by the Pact, perform its social responsibilities and obligations of being supervised as required by the Pact, include gender issues in its code of conduct and principles as stipulated by the Pact, and contribute to the improvement of the image and competitiveness of Chinese enterprises.

The third is to provide training and technical support for women in combination of the characteristics of local industries and culture. At the stage of the planning of a project, the local historic cultural features should be properly combined so as to develop the relevant geographical indication products which can increase the income of women and drive women and men to jointly and equally participate in the related progress and enjoy the related achievements. When training and technical support are provided in the local place, the proportion of participating women should

---

<sup>60</sup>The General Office of the Ministry of Ecological Environment and the General Office of the Ministry of Commerce, On Print and Issue of the *Guide for Environmental Protection in Overseas Investment Cooperation*. [https://www.mee.gov.cn/xxgk/2018/xxgk/xxgk05/202201/t20220110\\_966571.html](https://www.mee.gov.cn/xxgk/2018/xxgk/xxgk05/202201/t20220110_966571.html)

---

be ensured. The gender equality should be combined with the localization and the sustainability of projects to promote the long-term social effects of the overseas investment projects.

The fourth is to strengthen international cooperation, promote knowledge sharing and gender mainstreaming as well as encourage more stakeholders to participate in gender equality issues. In 2018, during the Global Climate Action Summit, the Global Green Bond Partnership was established<sup>61</sup> aiming to promote the issue and investment of green bonds and support the sustainable development of enterprises. In future, China can consider setting up a similar partnership mechanism for the purpose of establishing similar partnerships with local governments, international organizations, non-governmental organizations, and other stakeholders, ensuring the social impacts and the sustainability of projects are taken into full consideration, and provide better supports for women and vulnerable groups.

## 6 Policy Recommendations

### 6.1 Accelerate coordinated efforts in green economic development, energy security, and combating climate change

Green and low-carbon investment is the connecting point of cross-cycle and countercyclical measures, which can organically combine economic growth and carbon neutral transition. Approximately 140 trillion RMB of green investment will be needed to achieve carbon neutrality by 2060, with power, transportation, and building sectors as the major green investment targets. From 2020 to 2022, China's new installed renewable capacity exceeded 120 million kW annually. With a powerful governance of the system, party, and the government, and the strong manufacture sector and market, China's renewable energy is expected to develop with momentum and huge potential. Electric vehicle as well has entered the fast lane, with 13.1 million units by the end of 2022 and expected growth of more than 10 million units in 2023 alone. While other products face challenges in export in the current international landscape, EV export still demonstrates a strong momentum. Also, 90% of the production capacity of heat pump is in China. Exports of solar modules, high-efficiency cooling equipment, and ultra-high voltage DC transmission equipment have become a new highlight in China's international trade business, and the export mix and global market share of China are becoming more matched with China's economic performance. With the recovery of China's economic growth, the overlap among energy security, climate change, and environment targets will increase, therefore enhancing the coordination between China's modernization and achieving the dual carbon targets.

### 6.2 Take comprehensive consideration of various factors (such as energy security, economic costs, etc.) and gradually promote coal power transition and accelerate the development of a new energy system dominated by renewable energy based on China's situation

**President Xi Jinping has announced that China will strictly control coal power, and will peak coal consumption in the 14th five-year-plan (FYP) period and phase down coal consumption in the 15th FYP period. Globally, coal phase-out is also an irreversible trend. Firstly**, emergency power safety and long-term supply guarantee cannot be equated. It is important to understand that the renewable-dominated new power system is the long-term basis of China's energy and power security. **Secondly**, comprehensive comparison among different coal power transition paths in terms of security, cost-effectiveness, and sustainability should be made, thus to

---

<sup>61</sup> The World Bank, 2018. Launch of the Global Green Bond Partnership. <https://www.worldbank.org/en/news/press-release/2018/09/13/launch-of-the-global-green-bond-partnership>

---

formulate better and more economic systematic transition plan. **Thirdly**, the overall time frame of coal power transition needs to be clearly planned, and the opportunity window of coal power transition and exit needs to be well managed in consideration of the “three cycles”<sup>62</sup> the lifespan of coal power units, technology iteration for new energy system, and fixed asset investment to solve employment and other just transition issues in the process. **Fourthly**, we need to accelerate the development of renewable energy, promote investment on energy storage, grid interconnection, and long-distance power transmission, and accelerate R&D on V2G policy and technologies to coordinate EV development with construction of the new power system.

### **6.3 Improve green and climate finance system that supports low-carbon transition and innovation**

**Firstly**, to enhance carbon pricing through a comprehensive set of instruments, including taxes, prices, subsidies, procurement, etc. to motivate diversified green climate investment and financing mechanisms. **Secondly**, to improve taxonomies for climate investment and financing, and gradually enlarge the common ground with those of Europe, the United States, and other regions. **Thirdly**, to promote financial sector to enhance environmental and climate risk assessment, and effectively filter out high risk projects to avoid stranded asset and to avoid “green washing”. **Fourthly**, to promote mandatory disclosure of climate-related information for financial institutions and establish green standards for oversea financing and investment projects and compliance and accountability mechanisms for financial institutions. **Fifthly**, raise the standards for overseas green investment and establish mechanisms for compliance and accountability.

### **6.4 Accelerate the transformation of key policies and mechanisms, especially from energy dual control to carbon dual control**

**Firstly**, to establish a sound system of laws and regulations on carbon peaking and carbon neutrality and formulate a framework law on addressing climate change and/or promoting carbon neutrality as soon as possible. **Secondly**, adhere to the principle of “establish before break down” and define the short-, medium- and long-term roadmap for institutional transformation. It is recommended during the mid and late 14<sup>th</sup> Five-Year period, select some provinces/cities and key emission departments/industries as soon as possible to pilot carbon dual control in parallel of energy dual control and study the implementation process; in early 15<sup>th</sup> Five-Year period, implement nationwide carbon dual control, with the intensity as the binding target and the total amount as an indicative target. After 2030, refine the climate policy system with the carbon cap as the core measure and carbon/energy intensity benchmarks embedded in industry and product standards. **Thirdly**, further improve China’s ETS through establishing the property right of carbon assets, including carbon intensive industries such as iron and steel into the ETS, and coordinating the study on CBAM with domestic ETS development.

---

<sup>62</sup>The first cycle is the lifespan of coal power units. The average service time of coal power units is about 20 years nationwide, and about 1200 GW coal power plants will be retired around 2040. By then, the increase of coal power and other fossil energy should be strictly controlled and replaced by non-fossil energy. The second cycle is cycle of technology iteration for new energy systems. Based on the technology of renewable energy, energy storage, power transmission, smart grid, and demand-side management, a modern energy system with high penetration of renewable energy will be established in the next two decades. In the last decade, 90% of the cost of electricity generation from renewable energy has reduced. With technology iteration and market development under the technology cycle, a more significant economic scale will be reached. The third cycle is the investment boom cycle under the economic environment. Under the general trend of resisting recession, China’s relatively loose fiscal and monetary policies, as well as flexible bonds and commercial loans, will together create a favorable investment environment. Over the next two decades, development of renewable energy production and consumption will be accelerated, and the increase of fossil energy will be strictly controlled. During the “15<sup>th</sup> Five-Year Plan” period, the incremental electricity demand is expected to be fully supported by renewable energy.

---

## 6.5 Continue to deepen international cooperation on climate change, and promote the

### global climate governance for win-win cooperation, including sustainable supply chains

**Firstly**, to promote global green transition and carbon neutrality process under the *United Nations Framework Convention on Climate Change* and its *Paris Agreement*, and strengthen multilateral climate cooperation on other key platforms such as G20 and WTO; **Secondly**, to reform global finance architecture to support developing countries facing poly-crises, and to increase support for climate actions, debt restructuring, etc. **Thirdly**, to actively establish cooperation partnerships with developing countries on energy transition and continue expanding and enlarging the fields, forms, and scale of cooperation. For the African countries who boast significant potential in terms of renewable energy generation and low-emission manufacturing, China can lead to unlock Africa's sustainable development by facilitating them to move up the global value chains, building on the China-Africa Strategic Partnership. **Fourthly**, to actively seek for opportunities of cooperation with the United States, Europe and other developed countries in technology transfer, talent, policy, and manufacturing, thus to carry out fair, reasonable, effective, and win-win cooperation by complementing to each other. **Fifthly**, to enhance efforts to optimise global supply chains, accelerate the development of strategy and policy to shape new multinational corporations, and explore partnerships and collaborative solutions to the increasing competition in clean energy manufacturing and supply, across critical minerals, materials, and modules. It is also important to increase new production capacity of bulk soft commodities in regions with rich renewable resources. These collaborative bilateral and regional partnerships should cover enhanced and cooperative green standards, certification, and traceability; enhanced security; and work to reduce carbon intensity of supply chains for more secured supply chains.

---

## References

- [1] People's Forum. Possible impacts and implications of the European energy crisis[EB/OL]. (2022-12-16)[2023-04-14]. <http://www.rmlt.com.cn/2022/1216/662687.shtml> (in Chinese)
- [2] China Youth Net. Maintaining the stability of the global industrial chain supply chain[EB/OL]. (2022-09-20)[2023-04-10]. <https://baijiahao.baidu.com/s?id=1744465088297889045&wfr=spider&for=pc> (in Chinese)
- [3] People's Daily Online. The international community needs to work together to address the climate crisis[EB/OL]. (2023-06-05)[2023-06-10]. <http://v.people.cn/n1/2023/0605/c177969-40006809.html> (in Chinese)
- [4] International Monetary Fund. World Economic Outlook[R]. Washington, DC, 2023.
- [5] Bloomberg New Energy Finance. Renewable Energy Investment Tracker 2H 2022[R]. New York. 2022.
- [6] The State Council of the People's Republic of China. Opinions of the state council of the central committee of the Communist Party of China on accelerating the construction of a nationally unified big market[EB/OL].(2022-03-25)[2023-02-28]. [http://www.gov.cn/zhengce/2022-04/10/content\\_5684385.htm](http://www.gov.cn/zhengce/2022-04/10/content_5684385.htm) (in Chinese)
- [7]Xinhua News Agency. Xi Jinping: Hold high the great banner of socialism with Chinese characteristics and strive in unity for the comprehensive construction of a modernized socialist country--Report at the 20th National Congress of the Communist Party of China[EB/OL].(2022-10-25)[2023-03-08]. [http://www.gov.cn/xinwen/2022-10/25/content\\_5721685.htm](http://www.gov.cn/xinwen/2022-10/25/content_5721685.htm) (in Chinese)
- [8] Wang C et al. The outlook for research on synergistic management of greenhouse gases and air pollutants[J]. Chinese Journal of Environmental Management, 2020,12(04):5-12.DOI:10.16868/j.cnki.1674-6252.2020.04.005. (in Chinese)
- [9] Dong Z F et al. The research on synergistic policies of addressing climate change and ecological environmental protection[J]. Chinese Journal of Environmental Management, 2021,13(01):25-34.DOI:10.16868/j.cnki.1674-6252.2021.01.025. (in Chinese)
- [10] OECD. Investing in Climate, Investing in Growth[R]. Paris. 2017.
- [11] Energy Foundation. From green stimulus and the 14th Five-Year Plan to China's modernization: Building a new growth story around natural capital[EB/OL]. (2020-07-03)[2023-02-27]. <https://www.efchina.org/News-zh/EF-China-News-zh/news-efchina-20200703-zh> (in Chinese)
- [12] Bernard, S., C. Shepherd. China's sea-level rise raises threat to economic hubs to extreme[EB/OL]. (2021-06-12)[2023-03-12] <https://www.ft.com/content/4dd9860b-664e-4ca0-86a4-5a935d2a22f1>
- [13] Geng G, Zheng Y, Zhang Q, et al. Drivers of PM<sub>2.5</sub> air pollution deaths in China 2002–2017[J]. Nature Geoscience, 2021, 14(9): 645-650.
- [14] The People's Bank of China. Improve the green financial system to facilitate green, low-carbon and high-quality development[EB/OL]. (2022-09-29)[2023-03-09]. [http://gdjr.gd.gov.cn/gdjr/jrzx/jryw/content/post\\_4021789.html](http://gdjr.gd.gov.cn/gdjr/jrzx/jryw/content/post_4021789.html) (in Chinese)
- [15] China Council for International Cooperation on Environment and Development(CCIECD). Measures and implementation pathways toward the goals of carbon peaking and carbon neutrality[R]. Beijing. 2022. (in Chinese)
- [16] World Bank. China country climate and development report [R]. Washington. 2022.
- [17] Zhang Y. Challenges and countermeasures for China's coal transformation[J]. Environmental Protection, 2018,46(02):24-29.DOI:10.14026/j.cnki.0253-9705.2018.02.005. (in Chinese)
- [18] IEA. An energy sector roadmap to carbon neutrality in China[R]. Paris. 2021.
- [19] Zhu T. Reflections on international rules and domestic mechanisms for "carbon reduction"[J]. Wind Energy, 2023(03):8-11. (in Chinese)
- [20] Chinese Academy of International Trade and Economic Cooperation. China green trade development report (2022)[R]. Beijing. 2023. (in Chinese)
- [21] Natural Resources Defense Council. China comprehensive coal management research report (2022)[R]. Beijing. 2022. (in Chinese)



- 
- [22] The International Council on Clean Transportation. Driving a green future: A retrospective review of China's electric vehicle development and outlook for the future[R]. Washington. 2021.
- [23] China Academy of Information and Communications Technology(CAICT). White paper: Digital carbon neutrality(2022)[R]. Beijing. 2021. (in Chinese)
- [24] He K B. Academician He Kebin: China's synergistic path to carbon neutrality and clean air[J]. High-Technology & Commercialization, 2023,29(02):54-57. (in Chinese)
- [25] Chen C, Park T, Wang X, et al. China and India lead in greening of the world through land-use management[J]. Nature sustainability, 2019, 2(2): 122-129.
- [26] Yang Y H et al. Characterization of carbon sinks in terrestrial ecosystems and their contribution to carbon neutrality in China and the world[J]. Scientia Sinica(Vitae), 2022,52(04):534-574. (in Chinese)
- [27] Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. China wetland research report[R]. Changchun. 2022. (in Chinese)
- [28] Central People's Government of the People's Republic of China. Striving to achieve carbon emission peaking by 2030 and carbon neutrality by 2060 - Winning the hard battle for a low-carbon transition[EB/OL]. (2021-04-02)[2023-04-15]. [https://www.gov.cn/xinwen/2021-04/02/content\\_5597403.htm](https://www.gov.cn/xinwen/2021-04/02/content_5597403.htm) (in Chinese)
- [29] National Development and Reform Commission. Integration of carbon emission peaking and carbon neutrality into the overall layout of economic and social development and ecological civilization construction[EB/OL]. (2021-10-29)[2023-04-20]. [https://www.ndrc.gov.cn/xxgk/jd/jd/202110/t20211029\\_1302188\\_ext.html](https://www.ndrc.gov.cn/xxgk/jd/jd/202110/t20211029_1302188_ext.html) (in Chinese)
- [30] State Council of the People's Republic of China. Action Plan for Carbon Dioxide Peaking Before 2030[EB/OL]. (2021-10-24)[2023-04-26]. [https://www.gov.cn/zhengce/content/2021-10/26/content\\_5644984.htm](https://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm) (in Chinese)
- [31] Fan Y, Mo J L. Major issues and suggestions for the top-level design of China's carbon market[J]. Bulletin of Chinese Academy of Sciences, 2015,30(04):492-502.DOI:10.16418/j.issn.1000-3045.2015.04.008. (in Chinese)
- [32] UNDP. Gender Equality in Public Administration[R]. New York. 2021.
- [33] UNFCCC. Just transition: An essential pathway to achieving gender equality and social justice[R]. Bonn. 2022.
- [34] International Labour Office. World Employment and Social Outlook 2018: Greening with jobs[R]. Geneva. 2018.
- [35] Liu B H, Wang X B. Social gender and climate change[J]. Journal of Shandong Women's University, 2011(06):1-9.

---

## Acknowledgments

We are very grateful to the China Council for International Cooperation on Environment and Development(CCICED) for setting up and supporting the policy research project of the Pathway to Carbon Neutrality and China's Role in Global Climate Governance, which provides a platform for Chinese and foreign experts to completely discuss and communicate. Special thanks to Mr. Xie Zhenhua, Vice-Chairman of CCICED, for his careful guidance on this research, and thanks to Mr. Liu Shijin, Chinese Chief Advisor of CCICED; Mr. Scott Vaughan, Chief Foreign Advisor of CCICED; Dr. Arthur Hanson, former Chief Foreign Advisor of CCICED; and to Dr. Knut Alfsen from the support expert group of chief advisors; Ms. Zhou Guomei, Director of the Department of International Cooperation, the Ministry of Ecology and Environment; Mr. Li Gao, Director of the Department of Climate Change, the Ministry of Ecology and Environment; and Mr. Li Yonghong, Deputy Director of the Foreign Cooperation and Exchange Center, the Ministry of Ecology and Environment, and Assistant Secretary General of CCICED for their recommendations during the implementation of the project. In addition, we should also express our thanks to Mr. Zhang Huiyong, Director of CCICED Secretariat, Ms. Liu Kan and Ms. Tang Huaqing, Deputy Directors of CCICED Secretariat, as well as the CCICED Secretariat and International Support Office for their help in the organization and coordination of the project.

## Attachments

Table 1 Renewable-energy development goals/plans of some southern countries and emerging economies

Country	Policy	Renewable-energy development goal/plan
China	<i>Working Guidance For Carbon Dioxide Peaking And Carbon Neutrality In Full And Faithful Implementation Of The New Development Philosophy</i>	By 2025, the proportion of the consumption of non-fossil energy can reach 20% or so; by 2030, the proportion of the consumption of non-fossil energy can reach 25% or so; and by 2060, the proportion of the consumption of non-fossil energy can reach 80% or so.
	<i>Action Plan for Carbon Peaking by 2030</i>	
	<i>Guidance for Energy Work in 2022</i>	In 2022, the proportion of non-fossil energy in the total energy consumed will be increased to 17.3% or so and the proportion of wind power and photovoltaic power to be generated will take up about 12.2% of the total electricity consumption.
	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>	By 2025, the proportion of the consumption of non-fossil energy will be increased to 20% or so, the proportion of the electricity to be generated by non-fossil energy will be up to 39% or so, and the installed capacity of conventional hydropower will reach around 380 million kw.
The Republic of Korea	<i>9<sup>th</sup> Basic Plan for Long-term Electricity Supply and Demand (BPLE) (2020-2034)</i>	As planned, the installed capacity of renewable energy power generation will reach 40% by 2034.
Indonesia	<i>PLN's Electricity Supply Business Plan (RUPTL) in 2021-2030</i>	By 2030, the newly-increased installed power generation capacity can reach 40.6 GW, including 20.9 GW to be newly increased by renewable energy projects, occupying 51.6%. The proportions of renewable energy respectively in 2025 and 2050 will be at least 23% and 31% in the overall energy structure of the entire industry and will be at least 23% and 28% in the electrical energy structure.
	<i>National Energy Policy No.79/2014</i>	By 2025, new energy and renewable energy can occupy at least 23% of the primary energy supply; and by 2050, new energy and renewable energy can occupy at least 31% of the primary energy supply.
Malaysia	<i>Generation Development Plan of Peninsular Malaysia (2020-2030)</i>	The proportion of renewable energy power generation will reach 20% by 2025.
The Philippines	<i>Philippine Energy Plan (2020-2040)</i>	The renewable energy can take up 35.0% in the total power generation mix by 2030 and is expected to exceed 50% by 2040.

	<i>The PHILIPPINES: National Climate Change Action Plan (NCCAP) (2011-2028)</i>	To increase the hydropower capacity from 3,478 MW in 2010 to 7,534 MW in 2030, the wind power generation capacity from 33 MW in 2010 to 1,018 MW in 2030, the solar power generation capacity from 6.74 MW in 2010 to 85 MW in 2030, and the biomass power generation capacity from 75.5 MW in 2010 to 93.9 MW in 2030.
Thailand	<i>Power Development Plan of Thailand (2018-2037)</i>	To increase the proportion of renewable energy power generation to 30% by 2037, which requires that the installed capacity of renewable energy power generation should increase by 56,431 MW.
	<i>Alternative Energy Development Plan (AEDP) (2018-2037)</i>	To increase the proportion of renewable energy and alternative energy by 30% (in the form of electricity, thermal energy, and biofuel) by 2037
Vietnam	<i>Power Development Plan 8 (PDP8)</i>	The proportion of renewable energy in the power generation structure will reach 32% by 2030, 40.3% by 2040, and 43% by 2050.
	<i>No. 55 Resolution on Strategic Orientation of National Energy Development 2020</i>	The total supply of primary energy will reach 175-195 million TOE by 2030 and reach 320-350 million TOE by 2045.
	<i>National Energy Development Strategy by 2030 and Vision for 2045</i>	The proportion of renewable energy in the power generation structure will reach 15% ~ 20% by 2030 and 25% ~ 30% by 2045.
Italy	<i>Integrated National Energy and Climate Plan</i>	By 2030, the consumption of renewable energy will occupy 30% of the total energy consumption; the renewable energy will take up 55% in the electric power sector, 33.9% in the heating sector (heating and cooling), and 22% in the transportation sector.
Poland	<i>Energy Policy of Poland by 2040 (EPP2040)</i>	In 2030, the consumption of renewable energy will occupy at least 23% in the consumption of end-use energy and at least 32% in the electric power sector.
Portugal	<i>National Energy and Climate Plan of Portugal for 2021-2030 (NECPs)</i>	The proportion of the consumption of renewable energy in the total energy consumption will reach 47%, which means that about 80% of the energy to be consumed by the electric power sector will be renewable energy and about 20% of the energy to be consumed by the transportation sector will be renewable energy, through conversion.
Greece	<i>National Energy and Climate Plan of Greece for 2021-2030 (NECPs)</i>	By 2030, the consumption of renewable energy will occupy at least 35% in the consumption of end-use energy and at least 60% in the end-use electricity consumption.
Panama	<i>Panama First NDC (Updated)</i>	To make 30% of the electric power be generated by renewable energy like wind energy and solar energy by 2050

Cuba	<i>Cuba First NDC (Updated)</i>	By 2030, the electric power production based on renewable energy sources (RES) in the electric power matrix of Cuba will reach 24%.
Morocco	<i>Morocco First NDC (Updated)</i>	By 2030, 52% of the installed power generation capacity will come from renewable energy, including 20% from solar energy, 20% from wind energy, and 12% from hydraulic energy.
Zimbabwe	<i>System Development Plan in 2017</i>	By 2025, the scale of solar power generation will be expanded to 300 MW.
Chile	<i>Energy Compact</i>	The participation rate of renewable energy in national power generation will reach 40% by 2030 and Chile will become one of the largest exporters of green hydrogen in the world in 2030, possessing the cheapest green hydrogen.
Uruguay	<i>Uruguay First NDC (Updated)</i>	If there are no conditions in favor, by 2025, the installed power generation capacities of wind energy, solar energy, and biomass energy will respectively reach 1,450 MW, 220 MW, and 160 MW, to respectively occupy 32%, 5%, and 4% of the installed capacity of the national grid system. If there are conditions in favor, technologies of electric power storage including electric storage and pumping systems will be ushered in; 300 MW will be installed by 2025; and in the meanwhile, the water-source power generation technology (micro-hydraulic stations) will be popularized and the installed capacity will be 10 MW by 2025.
Brazil	<i>Nationally Determined Contribution – NDC (Brazil) (2020)</i>	The full economic NDC of Brazil covers CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, SF <sub>6</sub> , perfluorocarbon (PFC) and fluorohydrocarbon (HFC). This is an absolute target with Year 2005 as a reference year. The target raised by Brazil is to achieve a reduction of 37% by 2025 and of 43% by 2030, when compared with that in 2005.
Turkey	<i>Nationally Determined Contribution – NDC (Turkey)</i>	In the NDC of Turkey, there is a goal that the greenhouse gas emission will decrease by 21% under the circumstance of BAU by 2030.
Egypt	<i>National Plan (2018-2022)</i>	By 2022, the proportion of renewable energy will be 23%, which will be divided into the installations of 2,550 MW concentrated solar power generation capacity, 500 MW photovoltaic array, and 1.2-million-m <sup>2</sup> solar water heater.
Cambodia	<i>Power Development Masterplan in 2021-2040</i>	The installed solar power generation capacity will increase to 1,000 MW by 2030 and further to 3,155 MW by 2040.

Table 2 Summary of carbon peaking and carbon neutrality sub-goals (main quantitative goals) of various industries and fields in China

Field	Sub-field/industry	Policy goal	Policy document
Energy	Energy production	In 2025, the annual comprehensive energy production capacity will reach 4.6 billion tons of standard coal.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>

	Installed electricity capacity	In 2025, the total installed electricity capacity will reach approximately 3 billion kw.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Energy utilization structure	In 2025, the proportion of electric energy in end-use energy will reach around 30%.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Power generation structure	In 2025, the non-fossil energy generation capacity will reach around 39%.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Electricity demand	In 2025, the per capita yearly domestic power consumption will reach around 1,000 kwh.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
		In 2025, the response capacity at the electricity demand side will reach 3% ~ 5% of the maximum electrical load.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
		In 2025, the proportion of flexibly regulated power will reach around 24%.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Renewable energy	By 2025 and during the 14 <sup>th</sup> Five-Year Plan period (2021-2025), the total consumption of renewable energy will reach around 1 billion tons of coal equivalent. During 14 <sup>th</sup> Five-Year Plan period, the consumption of renewable energy will account for over 50% in the increased primary energy consumption.	<i>14<sup>th</sup> Five-Year Plan for Development of Renewable Energy</i>
		By 2025 and during the 14 <sup>th</sup> Five-Year Plan period (2021-2025), the yearly power generation capacity of renewable energy will reach around 3.3 trillion kwh. During the 14 <sup>th</sup> Five-Year Plan period, the increased power generation capacity of renewable energy will exceed 50% in the increased power consumption throughout China while the power generation capacity of wind energy and solar energy will be doubled.	<i>14<sup>th</sup> Five-Year Plan for Development of Renewable Energy</i>
		By 2025, the non-electric use scale including utilization of solar heat, biomass fuel, biomass heating, and heating with geothermal energy will exceed 60 million tons of coal equivalent.	<i>14<sup>th</sup> Five-Year Plan for Development of Renewable Energy</i>
		In 2025, the responsibility weight of the total consumption of renewable energy electricity throughout China will reach around 33% and that of the non-hydropower consumption of renewable energy electricity will reach around 18%; and the utilization rate of renewable energy will be kept at a reasonable level.	<i>14<sup>th</sup> Five-Year Plan for Development of Renewable Energy</i>

	Wind and photovoltaic energy	In 2030, the total installed capacity of wind power and solar power will exceed 1.2 billion kw.	<i>14<sup>th</sup> Five-Year Plan for Development of Renewable Energy</i>
	Hydroelectric energy	In 2025, the installed capacity of conventional hydropower will reach around 380 million kw.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Nuclear energy	In 2025, the installed capacity of nuclear power operation will reach around 70 million kw.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Hydrogen energy	In 2025, the hydrogen production capacity of renewable energy will reach 100,000 – 200,000 tons/year, which will become an integral part of the newly-increased hydrogen energy consumption, and the CO <sub>2</sub> emissions will be reduced by 1-2 million tons per year.	<i>Medium and Long-term Plan for Development of Hydrogen Energy Industry (2021-2035)</i>
	Coal	During the 14 <sup>th</sup> Five-Year Plan period (2021-2025), the increase of the coal consumption will be strictly and reasonably controlled; and during the 15 <sup>th</sup> Five-Year Plan period, the coal consumption will be gradually reduced.	<i>Action Plan for Carbon Peaking by 2030</i>
		During the 14 <sup>th</sup> Five-Year Plan period (2021-2025), the outdated capacity of coal power will be phased out in an orderly way and 30-million-kw units (including those to retire upon expiry of their service life) will be eliminated.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
		In 2025, in the key areas for air pollution control, the scattered coal and the coal-fired boilers with the evaporation capacity of 35 tons/hour will be basically eliminated.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
		During the 14 <sup>th</sup> Five-Year Plan period (2021-2025), to vigorously push forward the linkage of the three transitions, heating transition, flexibility transition, and energy conservation and carbon reduction transition of coal power and make sure the scale of the energy conservation transition will not be less than 350 million kw.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
		In 2025, the flexibility transition scale of coal power units will exceed 200 million kw accumulatively.	<i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i>
	Energy storage	By 2025, the installed capacity of new energy storage will exceed 30 million kw.	<i>Guidelines on Accelerated Promotion of Development of New Energy Storage</i>
		In 2025, the total scale of the pumped storage to be put into operation will exceed 62 million kw.	<i>Medium and Long-term Plan for Development of Pumped Storage (2021-2035)</i>

		In 2030, the total scale of the pumped storage to be put into operation will be around 120 million kw.	<i>Medium and Long-term Plan for Development of Pumped Storage (2021-2035)</i>
		In 2025, the performance of the technology of electrochemical energy storage will be improved further and the system cost will decrease by over 30%.	<i>Implementation Plan for Development of New Energy Storage During 14<sup>th</sup> Five-Year Plan Period</i>
Industry	Total	In 2030, the total CO <sub>2</sub> emission of the industry will peak.	<i>Implementation Plan for Carbon Peaking in Industrial Field</i>
		In 2025, the CO <sub>2</sub> emission will decrease by 18% per industrial added value.	<i>14<sup>th</sup> Five-Year Plan for Industrial Green Development</i>
		In 2025, the decline of the CO <sub>2</sub> emission per industrial added value will be greater than that throughout China.	<i>Implementation Plan for Carbon Peaking in Industrial Field</i>
		In 2025, the energy consumption of the industry above the designated size per added value will decrease by 13.5% when compared with that in 2010.	<i>Implementation Plan for Carbon Peaking in Industrial Field</i>
	Energy utilization structure	In 2025, the proportion of the electric energy consumption in the energy consumption of industrial terminals will be around 30%.	<i>Industry Energy Efficiency Improvement Action Plan</i>
	Iron & steel	In 2030, carbon peaking will be achieved.	<i>Guidelines on Promotion of High-quality Development of Steel &amp; Iron Industry</i>
		In 2025, the comprehensive energy consumption per ton of steel will decrease by more than 2%.	<i>Guidelines on Promotion of High-quality Development of Steel &amp; Iron Industry</i>
		In 2025, the transition of ultra-low emission will be completed for over 80% of the steel & iron production capacity.	<i>Guidelines on Promotion of High-quality Development of Steel &amp; Iron Industry</i>
		In 2025, the transition of ultra-low emission will be completed for 530-million-ton iron & steel.	<i>14<sup>th</sup> Five-Year Plan for Green Industrial Development</i>
	Building materials	In 2025, carbon peaking will be achieved in the industry of building materials.	<i>14<sup>th</sup> Five-Year Development Implementation Opinions for Industry of Building Materials</i>
		In 2023, carbon peaking will be achieved in the cement industry.	<i>14<sup>th</sup> Five-Year Development Implementation Opinions for Industry of Building Materials</i>
		In 2025, the comprehensive energy consumption of a single cement clinker product will decrease by 3.7%.	<i>14<sup>th</sup> Five-Year Plan for Development of Industry of Raw Materials</i>
		In 2025, the cement production capacity will not increase but only decrease.	<i>14<sup>th</sup> Five-Year Plan for Development of Industry of Raw Materials</i>



	Non-ferrous metals	<p>During the "14th Five-Year Plan" period, the structure of non-ferrous metal industry and the structure of energy consumption will be optimized significantly; important progress will be made in the research and development and application of low-carbon technology; the energy consumption and carbon emission intensity per unit of product of key varieties will be further reduced; and the supply of recycled metal will account for more than 24%. During the "15th Five-Year Plan" period, the structure of energy consumption of the non-ferrous metal industry will be substantially improved; the proportion of renewable energy used in aluminum electrolysis will reach more than 30%; and the green, low-carbon and recycling development of the industrial system will be basically established. Ensure that the non-ferrous metal industry achieves carbon peaking by 2030.</p>	<p><i>Implementation Plan for Carbon Peaking in Industry of Non-ferrous Metals</i></p>
		<p>In 2025, the carbon emission of electrolytic aluminum will decrease by 5%.</p>	<p><i>14<sup>th</sup> Five-Year Plan for Development of Industry of Raw Materials</i></p>
		<p>In 2030, the proportion of the renewable energy to be used by electrolytic aluminum will be lifted to over 30%.</p>	<p><i>Implementation Plan for Carbon Peaking in Industrial Field</i></p>
Transportation	New-energy vehicles	<p>In 2025, the sales volume of newly-produced new-energy vehicles will take up about 20%.</p>	<p><i>14<sup>th</sup> Five-Year Plan for Modern Energy System</i></p>
		<p>In 2025, the new-energy vehicles in the fields of urban buses, taxis (including online car-hailing), and urban logistics and distribution will respectively account for 72%, 35%, and 20%.</p>	<p><i>14<sup>th</sup> Five-Year Plan for Development of Green Transportation</i></p>
		<p>In 2030, the proportion of the newly-increased transports of new energy and clean energy and power will reach 40% or so.</p>	<p><i>Implementation Plan for Carbon Peaking in Industrial Field</i></p>
	Emission reduction	<p>In 2025, the CO<sub>2</sub> emission per transport volume for operating vehicles will drop by 5% when compared with that in 2020.</p>	<p><i>14<sup>th</sup> Five-Year Plan for Development of Green Transportation</i></p>
		<p>In 2030, the CO<sub>2</sub> emission intensities of new passenger vehicles and commercial vehicles will respectively decrease by 25% and 20% in comparison with those in 2020.</p>	<p><i>Implementation Plan for Carbon Peaking in Industrial Field</i></p>
		<p>In 2025, the CO<sub>2</sub> emission per transport volume for operating ships</p>	<p><i>14<sup>th</sup> Five-Year Plan for Development of Green Transportation</i></p>

		will drop by 3.5% when compared with that in 2020.	
	Transport structure	In 2025, the yearly average growth rate of the combined railway and water transport of containers will be 15%.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Transportation</i>
Buildings	Green buildings	In 2025, the total consumption of primary and secondary energy sources for the operation of buildings will be 1.15 billion tons of coal equivalent.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, there will be over 50 million square meters of buildings featured by ultra-low and even zero energy consumption.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, energy-saving transition will be completed for over 350 million square meters of existing buildings.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, the newly-constructed buildings in urban areas will meet the standards for green buildings.	<i>14<sup>th</sup> Five-Year Plan for Promotion of Clean Production Throughout China</i>
	Energy utilization structure	In 2025, the electricity consumption in the energy consumption of buildings will exceed 55%.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, the renewable-energy substitution rate of buildings in urban areas will reach 8%.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
	Building energy efficiency	In 2025, the energy efficiency level of the newly-constructed residential buildings in urban areas will be upgraded by 30%.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, the energy efficiency level of the newly-constructed public buildings in urban areas will be upgraded by 20%.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
		In 2025, the overall energy efficiency of the public buildings along the Yangtze River Economic Belt will be improved by no less than 15% after relevant energy efficiency improvement and reconstruction.	<i>14<sup>th</sup> Five-Year Action Plan for Promotion of Development of Yangtze River Economic Belt and Urban-Rural Construction</i>
	Photovoltaic roof	In 2025, the installed capacity of solar and photovoltaic energy will be 500 million kwh for newly-increased buildings.	<i>14<sup>th</sup> Five-Year Plan for Development of Green Buildings and Energy Conservation of Buildings</i>
	Public institutions	In 2025, the total carbon emission of the buildings of public institutions will be controlled within 400 million tons.	<i>14<sup>th</sup> Five-Year Plan for Energy and Resource Conservation of Public Institutions</i>
	Construction industry	In 2025, the prefabricated buildings will occupy more than 30% of the newly-constructed buildings.	<i>14<sup>th</sup> Five-Year Plan for Development of Construction Industry</i>

Table 3 Summary of carbon peaking and carbon neutrality action/implementation plans of various provinces in China

Province	Date	Carbon peaking and carbon neutrality action/implementation plan
Beijing	October 13, 2022	<i>Carbon Peaking Implementation Plan of Beijing Municipality</i>
Fujian	August 21, 2022	<i>Opinions of the CPC Committee and the People's Government of Fujian Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
Hainan	August 22, 2022	<i>Carbon Peaking Implementation Plan of Hainan Province</i>
Jilin	November 30, 2021	<i>Opinions of the CPC Committee and the People's Government of Jilin Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	August 1, 2022	<i>Carbon Peaking Implementation Plan of Jilin Province</i>
Liaoning	September 29, 2022	<i>Carbon Peaking Implementation Plan of Liaoning Province</i>
Shanghai	July 28, 2022	<i>Opinions of the CPC Committee and the People's Government of Shanghai Municipality on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	July 14, 2022	<i>Carbon Peaking Implementation Plan of Shanghai Municipality</i>
Guangdong	July 25, 2022	<i>Opinions of the CPC Committee and the People's Government of Guangdong Province on Complete, Accurate, and Full Implementation of New Development Idea and Promotion of Carbon Peaking and Carbon Neutrality</i>
	February 7, 2023	<i>Carbon Peaking Implementation Plan of Guangdong Province</i>
Jiangxi	April 6, 2022	<i>Opinions of the CPC Committee and the People's Government of Jiangxi Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	July 21, 2022	<i>Carbon Peaking Implementation Plan of Jiangxi Province</i>
Inner Mongolia	June 27, 2022	<i>Opinions of the CPC Committee and the People's Government of Inner Mongolia Autonomous Region on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	November 16, 2022	<i>Carbon Peaking Implementation Plan of Inner Mongolia Autonomous Region</i>

Zhejiang	February 17, 2022	<i>Opinions of the CPC Committee and the People's Government of Zhejiang Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
Guangxi	May 13, 2022	<i>Opinions of the CPC Committee and the People's Government of Guangxi Zhuang Autonomous Region on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>

	January 30, 2023	<i>Carbon Peaking Implementation Plan of Guangxi Zhuang Autonomous Region</i>
Sichuan	March 14, 2022	<i>Opinions of the CPC Committee and the People's Government of Sichuan Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	January 5, 2023	<i>Carbon Peaking Implementation Plan of Sichuan Province</i>
Hunan	March 13, 2022	<i>Opinions of the CPC Committee and the People's Government of Hunan Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	October 28, 2022	<i>Carbon Peaking Implementation Plan of Hunan Province</i>
Hebei	May 5, 2022	<i>《Opinions of the CPC Committee and the People's Government of Hebei Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality》</i>
	January 17, 2023	<i>Carbon Peaking Implementation Plan of Hebei Province</i>
Heilongjiang	September 5, 2022	<i>Carbon Peaking Implementation Plan of Heilongjiang Province</i>
Jiangsu	January 5, 2022	<i>Opinions of the CPC Committee and the People's Government of Jiangsu Province on Promotion of High-quality Development and Achievement of Carbon Peaking and Carbon Neutrality</i>
	October 14, 2022	<i>Carbon Peaking Implementation Plan of Jiangsu Province</i>
Gansu	July 21, 2022	<i>Opinions of the CPC Committee and the People's Government of Gansu Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
Shaanxi	August 13, 2022	<i>Opinions of the CPC Committee and the People's Government of Shaanxi Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	February 17, 2023	<i>Carbon Peaking Implementation Plan of Shaanxi Province</i>
Qinghai	March 13, 2022	<i>Opinions of the CPC Committee and the People's Government of Qinghai Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	December 19, 2022	<i>Carbon Peaking Implementation Plan of Qinghai Province</i>
Ningxia	January 14, 2022	<i>Opinions of the CPC Committee and the People's Government of Ningxia Hui Autonomous Region on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	October 28, 2022	<i>Carbon Peaking Implementation Plan of Ningxia Hui Autonomous Region</i>
Tianjin	September 14, 2022	<i>Carbon Peaking Implementation Plan of Tianjin Municipality</i>
Chongqing	July 29, 2022	<i>Opinions of the CPC Committee and the People's Government of Chongqing</i>

		<i>Municipality on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
Guizhou	November 7, 2022	<i>Carbon Peaking Implementation Plan of Guizhou Province</i>
Anhui	November 29, 2022	<i>Opinions of the CPC Committee and the People's Government of Anhui Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	December 7, 2022	<i>Carbon Peaking Implementation Plan of Anhui Province</i>
Shanxi	January 16, 2023	<i>Opinions of the CPC Committee and the People's Government of Shanxi Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>
	January 9, 2023	<i>Carbon Peaking Implementation Plan of Shanxi Province</i>
Shandong	December 28, 2022	<i>Carbon Peaking Implementation Plan of Shandong Province</i>
Henan	February 6, 2023	<i>Carbon Peaking Implementation Plan of Henan Province</i>
Yunnan	December 14, 2022	<i>Opinions of the CPC Committee and the People's Government of Yunnan Province on Complete, Accurate, and Full Implementation of New Development Idea and Achievement of Carbon Peaking and Carbon Neutrality</i>