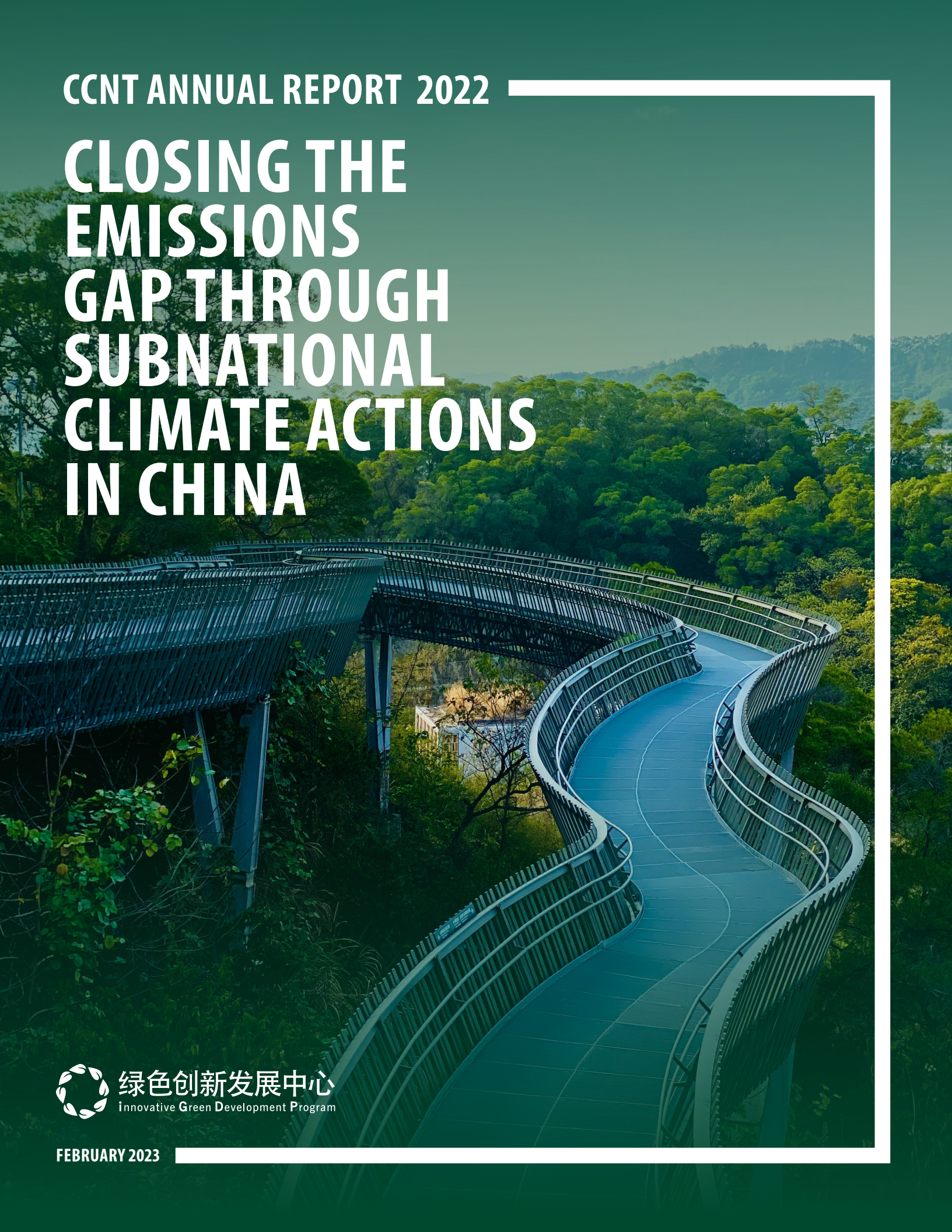
CCNT ANNUAL REPORT 2022

CLOSING THE EMISSIONS GAP THROUGH SUBNATIONAL CLIMATE ACTIONS IN CHINA



绿色创新发展中心
Innovative Green Development Program

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CONTENTS

The content of this report is based on the CCNT database, publicly available information and other vetted data and aims to facilitate discussion. The CCNT database assembles policy documents from the following publicly accessible sources:

- Government documents:
  - China's Nationally Determined Contribution
  - China's annual report on climate change policies and actions
  - Economic and social development plans, such as the 13th Five-Year Plan and related special plans for key sectors, such as energy, transportation, industry, etc.
- Provincial and municipal carbon peaking action plans and urban low-carbon development plans
  - National, provincial and municipal government websites

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EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

China is striving to implement its climate pledge of peaking carbon emissions before 2030 and achieving carbon neutrality by 2060, the so-called "dual-carbon goals". To deliver on its pledge, China has established an "1+N" policy framework[1], within which China's provinces are tasked with designing and implementing climate actions. As such, achieving China's climate pledge will depend to a large extent on policy implementation with robust climate actions at the subnational level.

This report provides an overview of subnational climate actions in China's provincial regions. It draws on information from China Carbon Neutrality Tracker (CCNT), a climate action database maintained by innovative Green Development Program. Using a multi-dimensional framework [Box 1], the report aims to (1) understand carbon emission trends and mitigation progress in each provincial region, (2) track how each provincial region is implementing the nation's dual-carbon goals, (3) assess regional implementation capacity by measuring how subnational energy and climate goals were implemented between 2015-2020, (4) determine whether the policies currently in place will be sufficient to achieve subnational dual-carbon goals, and (5) identify gaps and opportunities to enhance subnational climate actions.

ACTION PROGRESS

China's provincial regions are highly diverse, varying in terms of economic development, energy mix and resource endowment[2]. The per capita GDP of China's provincial regions ranges from the level of Namibia (Gansu) to Portugal[3] (Shanghai & Beijing). Each provincial region also has huge mitigation potential. In 2019, the total emissions of Shandong province, the second largest emitter among all provinces, were twice as high as Germany's. In fact, over 10 provincial regions emitted more CO_2[4] than the United Kingdom that year.

This regional diversity leads to variation in climate mitigation priorities. It also poses a challenge to researchers and policymakers who hope to make sense of the myriad actions that China is taking on the ground to advance its climate goals. This report aims to systemically track these actions. The key takeways include:

One-third of China's provincial regions have already achieved decoupling of carbon emissions and GDP growth

Most provincial regions, containing the majority of China's population, are still at an upper-middle-income economic level, with per capita energy-related carbon emissions that are still growing [Figure 10]. With only a few exceptions, most of China's provincial regions still rely on fossil fuel energy. Per capita energy-related carbon emissions in half of China's provincial regions were below six tons of CO_2 in 2020. The carbon intensity levels of the three provincial regions at the top are over three times the levels of the seventeen provincial regions at the low end [Figure 7]. However, one-third of China's provincial regions have seen clear decoupling of carbon emissions and GDP growth. That is, total economic growth has been achieved while total carbon emissions have remained stable or

1. China Climate Change Policy and Actions 2022 Annual Report, Ministry of Environment and Ecology, Page 3. "China has established the "1+N" policy framework." https://www.mee.gov.cn/ywgz/ydqhbh/syqhbh/202210/W020221027551216559294.pdf
2. The provincial regions in this brief refer to provincial administrative regions (PAR), including 23 provinces, 4 municipalities, 5 autonomous regions and 2 special administrative regions. The data collection in this report does not include Tibet, Taiwan, Hong Kong and Macao, though they are also PAR.
3. Foreign countries per capita GDP data is acquired from the World Bank at https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
4. China's provincial CO_2 emission data is from Carbon Emission Accounts & Datasets (CEADs) at https://www.ceads.net/data/province/by_apparent_accounting/ ; Foreign countries' CO_2 emission data is from BP Statistical Review of World Energy 2021 at https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/co2-emissions.html

even decreased. However, several provional regions still show a trend of rising carbon emission intensity in recent years [Figure 8].

"1+N" systems at the provincial level have been established following the national framework

China has established an "1+N" climate policy system at the national level [Table 1], setting cross-cutting and sectoral climate targets for 2025 and 2030. To implement these targets, regions have been setting up a comprehensive set of low-carbon actions, local "1+N" systems. As of the end of December 2022, 27 regional governments have released guiding documents for carbon reduction actions within their jurisdictions. These guiding documents either present a series of comprehensive actions toward carbon peaking[5] or lay out a set of principles for both carbon peaking and carbon neutrality[6]. Meanwhile, regional governments have also developed local sectoral five-year plans (2021- 2025) in energy transition, high-quality economic growth, green buildings, clean transportation or carbon markets. These FYPs can support the implementation of the regional guiding documents. As of December 2022, CCNT has collected 449 regional climate plans that were released since 2021. Of these, 22% are cross-sectoral, 16% focus on the energy sector, 14% on the transportation sector, 10% on buildings, and 11% on the industry sector.

Provincial climate ambitions center on sectoral actions rather than peaking goals

As illustrated in Figure 1 (carbon intensity reduction target/carbon peaking year), only a small number of provincial regions have shown the ambition to either peak carbon emissions earlier than 2030 or reduce carbon intensity earlier than the national goal. Most regions use the language of "following central government requirements" instead of setting their own quantitative carbon intensity reduction targets. Also, although some provincial regions have set a goal of carbon neutrality, no region has developed a roadmap for it. As the central government does not set specific requirements for local government, the provincial regions have not yet developed and released a roadmap for carbon neutrality.

On the other hand, there is no shortage of ambition on expanding clean energy technologies by setting sectoral targets. When the policy targets from the 14th FYPs for energy development issued by each provincial region are taken as whole, the total wind and solar capacity planned between 2021 and 2025 amounts to more than 600GW. China could meet its 2030 renewables target at least five years early if all this planned capacity is built.

To promote energy efficient buildings, over half of China's provincial regions are implementing or developing building codes for ultra-low energy buildings or near-zero energy buildings. These goals are more ambitious than national requirements, as the latter only require all newly built buildings to meet green building codes by 2025.

New actions are still necessary to meet China's 2060 neutrality goal

To evaluate whether current policy actions can achieve China's dual carbon goals, iGDP has conducted quantitative analyses on GHG emissions trends at the national level and selected provincial regions with the Energy Policy Simulator (EPS)[7]. Results show that although the national "1+N" policy system will lead to China's carbon emissions peaking in the early part of the 15th FYP period, a gap will be left in reaching carbon neutrality by 2060.

Using EPS, iGDP also analyzed emissions projections in two selected provinces: Guangdong and Jiangxi.

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5. Refers to documents titled "Action Plan for Carbon Peaking"
6. Refers to documents titled "Guiding Principles for the Dual-Carbon Goals"
7. Energy Policy Simulator (China 2021) is a system dynamics model that simulates and evaluates the impact of energy and climate policies on energy consumption, greenhouse gas emissions, pollutant emissions, investment demand, and related macro-level social and economic indicators. The online tool can be found here: https://china-igdp.energypolicy.solutions/

Guangdong is one of the most developed regions in China, while Jiangxi is a province at China's average level of income. Taking into account all targets and policies set in their 2030 action plans and 14th FYPs, these EPS analyses indicate that Guangdong's carbon emissions could already be starting to plateau, and Jiangxi's carbon emissions could peak before 2030.

These modeling results show that while actions toward China's carbon peaking goal are on the right track, current policies may not be able to provide the relatively rapid decline in carbon emissions that are necessary after peaking to achieve carbon neutrality by 2060. This means that further mitigation actions for China to deliver on its climate pledge will be needed [Figure 30, Figure 31, and Figure 32].

Policy implementation is crucial to deliver or overperform on climate ambition

Evaluating climate action performance in the past five years sheds light on the implementation capacity of China's provincial regions and the progress each has made. Most provincial regions have achieved the carbon intensity reduction (CIR) and energy intensity reduction (EIR) targets set by the central government. Twenty-one have overperformed on CIR while twenty-three have overperformed on EIR targets (see Glossary). Two provincial regions, however, have not met EIR targets. At the national level, China has overperformed on its renewable energy development goals in past decades. The same is true for many provincial regions.

This shows that China's climate mitigation effectiveness depends not only on forward-thinking and ambitious policy but also on strong implementation. This will continue to be true going forward, at the national and provincial levels.

Remaining uncertainty around emission trends relates to economic incentive measures, end-use energy consumption patterns and the pace of coal phase-down

Although China's central government is committed to turning high-quality growth rhetoric into reality, an iGDP analysis of project numbers listed into key projects for public finance in the past three years (2020-2022)[8] indicates that there is no significant evidence showing that provincial regions' public finance investments are prioritizing more green projects, and that some provincial regions are still investing in high-energy intensive industries. Green projects account for less than 50% of the total, while around 5% of projects are marked by high energy-intensity. Alternative economic incentive measures would lead to improved carbon emission trajectories.

Phasing down coal use is at the core of China's climate action. However, over half of the world's new coal power plants in construction are in China[9]. To achieve China's and the world's climate goals, phasing down existing and new coal power plant capacity is essential. Not doing so decelerates movement toward to carbon neutrality and could exacerbate the problem of stranded assets.

End-use energy consumption, especially in buildings and transportation, continues to grow, even while building codes have tightened and the EV market has boomed [Figure 17 and Figure 18]. This is true even though building codes and vehicle fuel economy standards have been enhanced between 2016 and 2020. Accordingly, there is still a need to continuously strengthen building codes and vehicle fuel economy standards during the 14th FYP, as well as optimize the energy mix and better manage transport demand. As people's income levels continue to rise, this has been pushing up the consumption of energy, food and natural resources, which could lead to higher carbon emission levels.

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8. Liu Xueye. (2022). "Public Investment Progress Towards Dual-Carbon Goal: A Review of Key Investment Projects of China" draft report, iGDP, 2022
9. Xiaoying You. (March 29, 2022). What does China's coal push mean for its climate goals? https://www.carbonbrief.org/analysis-what-does-chinas-coal-push-mean-for-its-climate-goals/

ACTION GAPS

Develop long-term subnational climate action plans toward 2060

At present, as there are no specific requirements from the central government, very few provincial regions have developed or published roadmaps toward local carbon neutrality. However, many regional think tanks and research institutions have started to carry out research on local medium- and long-term economic, energy, and carbon emissions trends. Taking early action on research and long-term local climate action planning are important for policy coherence and consistency of action. Early action can also help policymakers find the right balance between decision making on near-term needs and long-term investment. For example, developing natural gas infrastructure to reach households in mid- to small-sized cities might help reduce emissions in the short term, but the alternative approach of promoting electrification of the building sector overall could avoid natural gas lock-in and help reach zero-emissions in the buildings sector in the long-term. This kind of analytical conclusion is only possible with robust analytical capacity and a forward-thinking climate action plan.

Bridge the emissions gap with local pilots and best practices

Provincial regions can explore different local practices in emissions reduction based on their energy mix, resources endownment and economic development. In doing so, they can promote knowledge sharing and peer learning between different areas. For example, the *Clean Energy Vehicle Development Plan of Hainan Province* made Hainan the first province in China to ban the sale of fossil fuel-powered vehicles by 2030. It also set an ambitous roadmap for clean transportation. Hainan's comprehensive efforts to promote electric vehicles is facilitated by favorable geographic and economic features. The province of Hebei also has many experiences to share related to its research and policy implementation regarding nearly zero energy buildings. Shandong and Jiangsu, meanwhile, have accumulated rich experience and institutional capacity in energy saving and consumption reduction in the industrial sector.

Take early action to tackle hard-to-abate emissions and reduce non-CO2 GHG emissions

There is still a policy gap in non-CO_2 mitigation in China's hard-to-abate industry, agriculture and waste management sectors[10]. Data from the *Second Biennial Update on Climate Change of the People's Republic of China* shows that China's non-CO_2 GHG emissions exceeded 2 billion tons of carbon dioxide equivalent (CO_2e) in 2014, accounting for 18% of the total GHG emissions in that year. Other studies have also estimated non-CO_2 GHG emissions trends in China. These estimates show that China's non-CO_2 GHGs will continue to rise from 2015 to 2050 and are expected to reach about 3.4-3.7 billion tons of CO_2e by 2050, an increase of nearly half from 2015[11]. Methane is projected to account for a significant share of the increase, while F-gas emissions exhibit the fastest growth.

These emissions are not yet included in China's 2030 carbon peaking goal but can play a crucial role in achieving China's carbon neutrality. Indeed, China will not be able to be carbon neutral without tackling methane mitigation. Fortunately, there are many low-cost mitigation opportunities for methane emissions in agriculture, waste management and the energy sector. There is also the possibility of pursuing low-emission cooling options to reduce F-gases emissions as city infrastructure expands and household income rises. China would do well to develop sub-national non-CO_2 GHGs emission plans or methane reduction plans to tap the mitigation potential in these areas.

Engage non-state stakeholders and leverage capacity-building opportunities

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10. Non-CO_2 GHG emissions mainly including six types of gases, namely methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

11. iGDP. (2022). Non-CO_2 GHG Emissions Mitigation in China. iGDP. Beijing.

Since the announcement of the dual carbon goals, there has been widespread interest in carbon peaking and carbon neutrality. Different stakeholders have been actively engaged in awareness raising, consumption guidance, education, training and investment. Most provinces, cities, universities and large state-owned enterprises have established new institutions or teams to research carbon neutrality.

The CCNT team has identified over 50 research institutions on carbon neutrality established or announced after 2020. Many corporations and investors have commissioned studies to explore strategic switch or business opportunities under China's new carbon neutrality paradigm. State-owned enterprises in the oil, electricity, transportation, construction and communication industries have issued green and low-carbon initiatives[12]. Leveraging this capacity would make a profound and positive impact on the implementation of subnational climate actions.

BOX 1. An overview of the indicator framework for subnational climate actions

Ambition

Mitigation performance		Climate actions	
Economy-wide	Carbon intensity reduction	Economy-wide	Carbon intensity reduction targets
	Carbon emissions per capita		Energy intensity reduction targets
	Energy intensity reduction	Energy	Coal consumption targets
Energy	Coal consumption		Non-fossil fuel share target
	Renewables	Industry	Energy intensity reduction targets for industry value added
Industry	Energy consumption in industry value added	Transport	Percentage of new energy vehicles in total car sales
Transport	Transportation energy consumption per capita		Carbon emissions reduction targets in per unit transportation turnover of operating vehicles
Building	Building energy consumption per capita	Building	Targets for ultra-low energy or nearly zero buildings
Environment	Forest coverage		Building codes for ultra-low energy and nearly zero buildings
	Municipal solid waste generation per capita	Environment	Forest coverage
		Public investment	Green projects share in key construction projects

Implementation

12. Ministry of Ecological Environment (MEE). (2022). China's Policies and Actions to Address Climate Change Annual Report 2022.

1

"1+ N" CLIMATE POLICY FRAMEWORK

Photo by Marcin Jozwiak on Unsplash

1. "1+N" CLIMATE POLICY FRAMEWWORK

1.1 National "1+N"

At the national level, China has developed the "1+N" climate policy framework, with "1" standing for an overarching climate strategy and "N" standing for a range of climate action plans. At the subnational level, local governments have begun to formulate their own "1+N" climate strategies. As of the end of December 2022, 23 provincial governments and four municipalities have released local "1+N" strategies for carbon peaking and carbon neutrality.

1.1.1 Policy System

As of October 2022, the "1+N" policy system contains two overarching guiding documents and over 10 sectoral and supplementary documents, plus over 60 sectoral 14th Five-Year Plans with detailed actions.

TABLE 1. The "1+N" climate policy system and sectoral action plans for China's dual-carbon goals

	TOP LEVEL DESIGN	SECTORAL ACTION PLANS
	• Opinions on the Complete and Accurate Implementation of the New Development Concept of Carbon Peaking and Carbon Neutrality • Action Plan for Peaking Carbon Dioxide Emissions Before 2030	
Energy	• Action Plan on Standardized Improvement of Carbon Peaking and Carbon Neutrality in the Energy Sector • Opinions on Improving the Institutional Mechanism and Policy Measures for Energy Green and Low-Carbon Transformation	• Renewable Energy Development in the 14th Five-Year Plan • Implementing the High-Quality Development of New Energy in the New Era • Scientific Innovation in the Energy Sector during the 14th Five-Year Plan • Medium and Long-Term Development of the Hydrogen Industry (2021-2035) • The Modern Energy System in the 14th Five-Year Plan • New Energy Storage in the 14th Five-Year Plan • Regarding Promotion of the Development of New Energy Storage
Industry	• Carbon Peak Implementation Plan for Industrial Sectors	• Action Plan for Improvement of Energy Efficiency in Industry • Regarding Promotion of High-Quality Development in Light Industry • Regarding Promotion of High-Quality Development of the Petrochemical Industry in the 14th Five-Year Plan • Regarding Promotion of High-Quality Development in the Iron and Steel Industry • Intelligent Manufacturing Development in the 14th Five-Year Plan • Promoting High-Quality Development in Natural Resource Based Local Economies in the 14th Five-Year Plan • Green Industrial Development in the 14th Five-Year Plan • Regarding Strengthening Industrial Integration and Promoting Green Industrial Development • Regarding the Use of Strict Energy Efficiency Constraints to Promote Energy Conservation and Carbon Emissions Reduction in Key Areas • Action Plan for Strict Energy Efficiency Constraints in Metallurgy and Building Material Industries to Promote Energy Conservation and Carbon Reduction (2021-2025) • Action Plan for Strict Energy Efficiency Constraints in the Petrochemical and Chemical Industries to Promote Energy Conservation (2021-2025) • Action Plan for Carbon Neutrality and Carbon Peaking in the Coking Industry • Development of the Digital Economy in the 14th Five-Year Plan • High-Quality Development of the Coal Industry in the 14th Five-Year Plan
Building	• Implementation Plan for Carbon Peaking in Urban and Rural Construction	• Energy Conservation and Green Development of the Construction Industry in the 14th Five-Year Plan • Development of the Construction Industry in the 14th Five-Year Plan • Development of the Building Materials Industry in the 14th Five-Year Plan • Regarding Promotion of the Green Development of Urban and Rural Construction • The Role of Public Institutions in Leading and Implementing Green Development and Carbon Peaking • General Codes for Building Energy Conservation and Renewable Energy Use • Three-Year Action Plan for Development of New Data Centers (2021-2023) • Energy and Resource Conservation in Public Institutions in the 14th Five-Year Plan • Implementing Carbon Peaking and Carbon Neutrality Goals while Promoting Green and High-Quality Development in New Infrastructure Such as Data Centers and 5G

TABLE 1. The "1+N" climate policy system and sectoral climate plans for China's dual-carbon goals

	TOP LEVEL DESIGN	SECTORAL ACTION PLANS
Transport	• Opinions on the Complete and Accurate Implementation of the New Development Concept of Carbon Peaking and Carbon Neutrality	• Views on the High-Quality Development of Cold-Chain Transportation • Views on Improving the Service Capacity of Electric Vehicle Charging Infrastructure • The Development of a Modern Transportation System in the 14th Five-Year Plan • Work Plan to Promote the Optimization and Adjustment of Multimodal Transport Development (2021-2025) • Plan for Integrated Transportation Services in the 14th Five-Year Plan • Regarding Accelerating the Green and Intelligent Development of Inland Waterway Vessels • Plan for Accelerating the Construction of Charging Infrastructure Along Highways • Green Transportation in the 14th Five-Year Plan
Agriculture and Forestry	• Implementation Plan for Agricultural and Rural Emission Reduction and Carbon Sequestration	• Promoting the Modernization of Agriculture and Rural Areas in the 14th Five-Year Plan • Ecological Protection and Economic Transformation in the Greater and Lesser Xing'an Mountains in the 14th Five-Year Plan • Agricultural Green Development in the 14th Five-Year Plan • Outline of the 14th Five-Year Plan for Forestry and Grassland Protection and Development • Master Plan for Major Projects in Ecosystem Protection and Restoration (2021-2035)
Waste		• Plan for Harmless Treatment and Resource Utilization of Sludge • Regarding Promotion of Textile Waste Recycling • Regarding Utilization of Bulk Solid Waste during the 14th Five-Year Plan • Developing the Circular Economy during the 14th Five-Year Plan • Waste-Free City Construction during the 14th Five-Year Plan • Domestic Waste Classification and Development of Disposal Facilities during the 14th Five-Year Plan
Economic policies	• Launching Pilot Projects for Climate Investment and Financing • Financial Support for Reaching Carbon Neutrality and Carbon Peaking • Plan for Promoting Green Consumption • Views on Promoting the High-Quality Development of Stated-Owned Enterprises while Achieving Carbon Peaking and Carbon Neutrality	
Cross-sector	• Plan for the Synergistic Strengthening of Pollution Reduction and Carbon Mitigation • Regarding Advancing Infrastructure Building in Urban Areas • The Integrated Work Plan for Energy Conservation and Emissions Reduction in the 14th Five-Year Plan • Views on Accelerating the Construction of a National Electricity Market System • Plan for Science and Technology to Support Carbon Peaking and Carbon Neutrality	
Others	• Cold Chain Logistics Development in the 14th Five-Year Plan • Plan for Carbon Neutral Scientific and Technical Innovation in Colleges and Universities • Strengthening Training Programs for Carbon Peaking and Carbon Neutralization among Higher-Education Personnel • Energy Conservation and Eco-Environmental Protection Measures in State-Owned Enterprises • Accelerating the Establishment of a Unified and Standardized Carbon Emission Statistics and Accounting System • Carbon Peaking Through the Leadership of Public Institutions	

1.1.2 Policy Goals

In addition to the 2030 peaking pledge, the central government has set a series of sectoral targets, some of which have been included in China's NDC.

TABLE 2. Key climate targets under China's "1+N" climate policy system

	2020	2025 TARGET	2030 TARGET	2060 TARGET
Decrease in the intensity of CO_2 emissions per unit of GDP	18.80%[a]	18%[b]		
Intensity of energy consumption reduction per unit of GDP		13.50%[b]		
Energy consumption share from non-fossil fuel sources	15.9%	20%	25%	80%
Total installed capacity of wind and solar power	0.53 billion kW		>1.2 billion kW	
Installed capacity of new energy storage	3.3 million kW	>30 million kW		
Pumped hydro storage station installed capacity			0.12 billion kW	
Green building standards for new buildings in urban areas	77%	100%		
Percentage of star-rated green buildings		>30%		
Renewable energy substitution rate of urban buildings	6%	8%		
Rooftop photovoltaic coverage rate of new public buildings and factories		50%		
Increase in the proportion of new energy and clean energy-powered vehicles in the given year			40%	
Fall in the carbon intensity of operated vehicles in converted turnover, relative to 2020			9.50%	
Proportion of green transport in cities with a resident population higher than 1 million			>70%	
Annual utilization of bulk solid waste	2 billion tons[c]	4 billion tons	4.5 billion tons	
Recycling volume of 9 major recyclable resources[d]		0.45 billion tons	0.51 billion tons	
Resource utilization as a proportion of domestic waste		60%	65%	
Forest coverage	23.04%	24.10%	25%	
Forest stock volume	17.56 km^3	18 km^3	19 km^3	

Note: [a] Compared to 2015.
[b] Compared to 2020.
[c] The annual utilization of bulk solid waste in 2020, http://www.gov.cn/zhengce/2022-02/17/content_5674097.htm
[d] Nine major recyclable resources refer to scrap iron and steel, copper scrap, aluminum scrap, lead scrap, zinc scrap, paper scrap, plastic scrap, rubber scrap, glass scrap

Source: *National White Report on China's Policies and Actions to Address Climate Change, the 14th Five-Year Plan for Energy Conservation for Constructions and Green Construction Development, Opinions of the Central Committee of the Communist Party of China and the State Council on Completely, Accurately and Fully Implementing the New Development Concept on Carbon Peaking and Carbon Neutralization the Carbon Peaking Action Plan before 2030.*

1.2 Provincial "1+N" Progress

1.2.1 Overarching Climate Action Plans (the "1" documents) Developed by Provincial Regions

Twenty-seven provincial regions have released overarching climate action plans toward the dual-carbon goals.

TABLE 3. Subnational guiding documents for dual-carbon goals

	SUB-NATIONAL TOP LEVEL DESIGN FOR CARBON PEAKING AND CARBON NEUTRALITY
Beijing	• Beijing Carbon Peaking Implementation Plan
Shanghai	• Shanghai Carbon Peaking Implementation Plan
Tianjin	• Tianjin Carbon Peaking Implementation Plan
Chongqing	• Working Guidance for Carbon Peaking And Carbon Neutrality by Faithfully Implementing the New Development Philosophy in Chongqing
Henan	• Henan Carbon Peaking Pilot Plan
Ningxia	• Ningxia Hui Autonomous Region Carbon Peaking Implementation Plan
Hunan	• The Views of Hunan Provincial Committee of the CPC and the Hunan Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy • Hunan Carbon Peaking Implementation Plan
Hubei	• Hubei Science and Technology Innovation Action Plan for Carbon Peaking and Carbon Neutrality
Zhejiang	• The Views of Zhejiang Provincial Committee of the CPC and Zhejiang Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Anhui	• The Views of Anhui Provincial Committee of the CPC and Shaanxi Provincial People's Government on Carbon Peaking and Carbon Neutrality Through • Implementation of the New Development Philosophy • Anhui Carbon Peaking Implementation Plan
Shannxi	• The Views of Shaanxi Provincial Committee of the CPC and Shaanxi Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Yunnan	• The Views of Yunnan Provincial Committee of the CPC and Yunnan Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Guizhou	• Guizhou Carbon Peaking Implementation Plan
Hebei	• The Views of Hebei Provincial Committee of the CPC and Hebei Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Guangdong	• The Views of Guangdong Provincial Committee of the CPC and Guangdong Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Heilongjiang	• The Views of Heilongjiang Provincial Committee of the CPC and Heilongjiang Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy • Heilongjiang Carbon Peaking Implementation Plan
Jiangxi	• Jiangxi Province Carbon Peaking Implementation Plan • The Views of Jiangxi Provincial Committee of the CPC and Jiangxi Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Qinghai	• The Views of Qinghai Provincial Committee of the CPC and Qinghai Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy • Qinghai Carbon Peaking Implementation Plan
Hainan	• Hainan Carbon Peaking Implementation Plan
Sichuan	• The Views of Sichuan Provincial Committee of CPC and People's Government of Sichuan on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy • Sichuan Carbon Peaking Implementation Plan

TABLE 3. Subnational guiding documents for dual-carbon goals

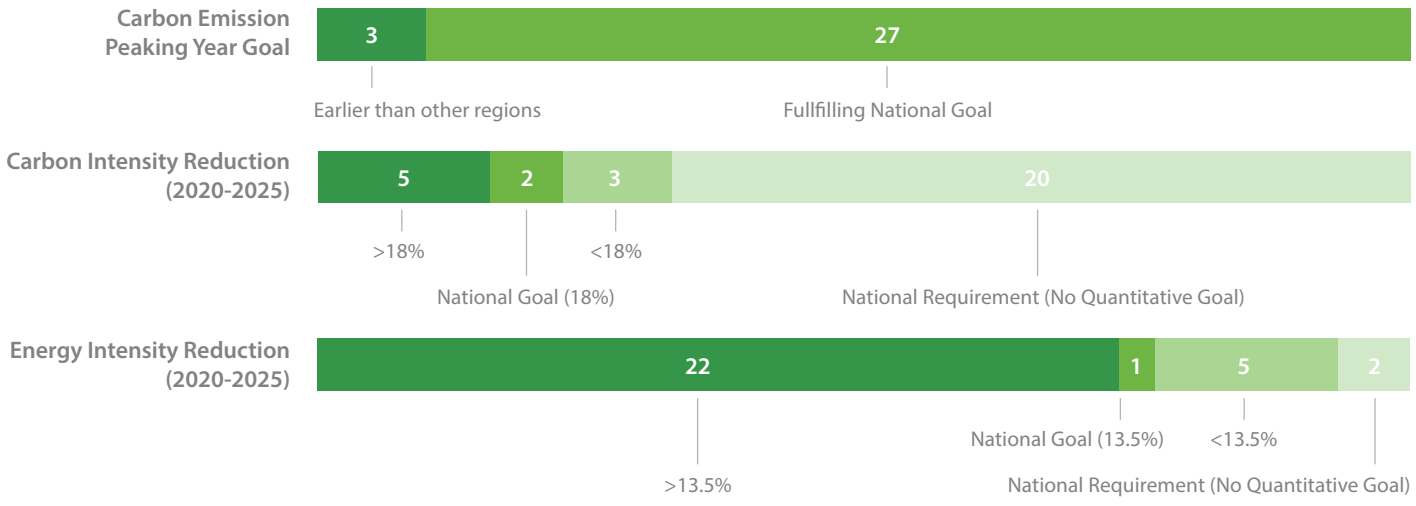
	SUB-NATIONAL TOP LEVEL DESIGN FOR CARBON PEAKING AND CARBON NEUTRALITY
Jiangsu	• The Views of Jiangsu Provincial Committee of the CPC and Jiangsu Provincial People's Government on Promoting High-Quality Development and Reaching Carbon Peaking and Carbon Neutrality • Jiangsu Carbon Peaking Implementation Plan
Guangxi	• The Views of Guangxi Zhuang Autonomous Region on Reaching Carbon Dioxide Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Fujian	• Fujian CPC Provincial Committee and Fujian Provincial People's Government: Views on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Inner Mongolia	• The Views of the Inner Mongolia Autonomous Region on Reaching Carbon Dioxide Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy • Inner Mongolia Autonomous Region Carbon Peaking Implementation Plan
Jilin	• Jilin Carbon Peaking Implementation Plan • The Views of Jilin Provincial Committee of the CPC and Jilin Provincial People's Government on Carbon Peaking and Carbon Neutrality Through Implementation of the New Development Philosophy
Liaoning	• Liaoning Carbon Peaking Implementation Plan
Shandong	• Shandong Carbon Peaking Implementation Plan

Note: As of the end of December 2022, 27 provincial regions have publicly released their top-level design plans for achieving the dual-carbon goals.
Source: CCNT

1.2.2 Overarching Climate Goals Set by Provincial Regions

Thirty provincial regions have committed to peak carbon emissions before 2030, though only a small number aim to peak earlier than other regions. Most provincial regions have not specified quantitative goals for carbon intensity reduction by 2025, but almost half have set energy intensity reduction targets higher than the national goal.

FIGURE 1. Overarching climate goals by provincial region

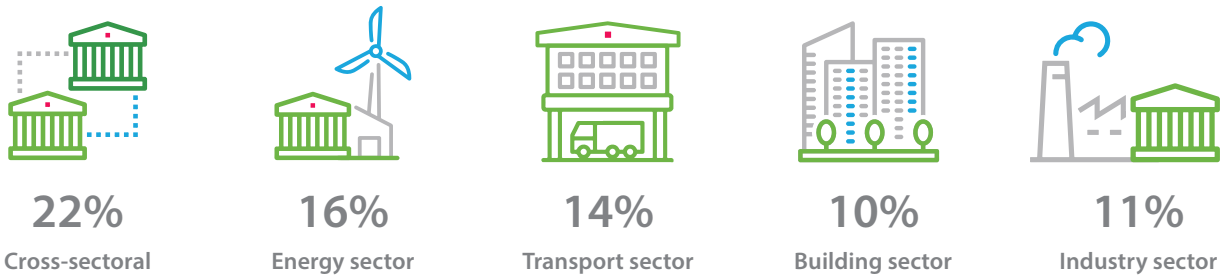


Source: CCNT

1.2.3 Provincial Climate Plans at a Glance

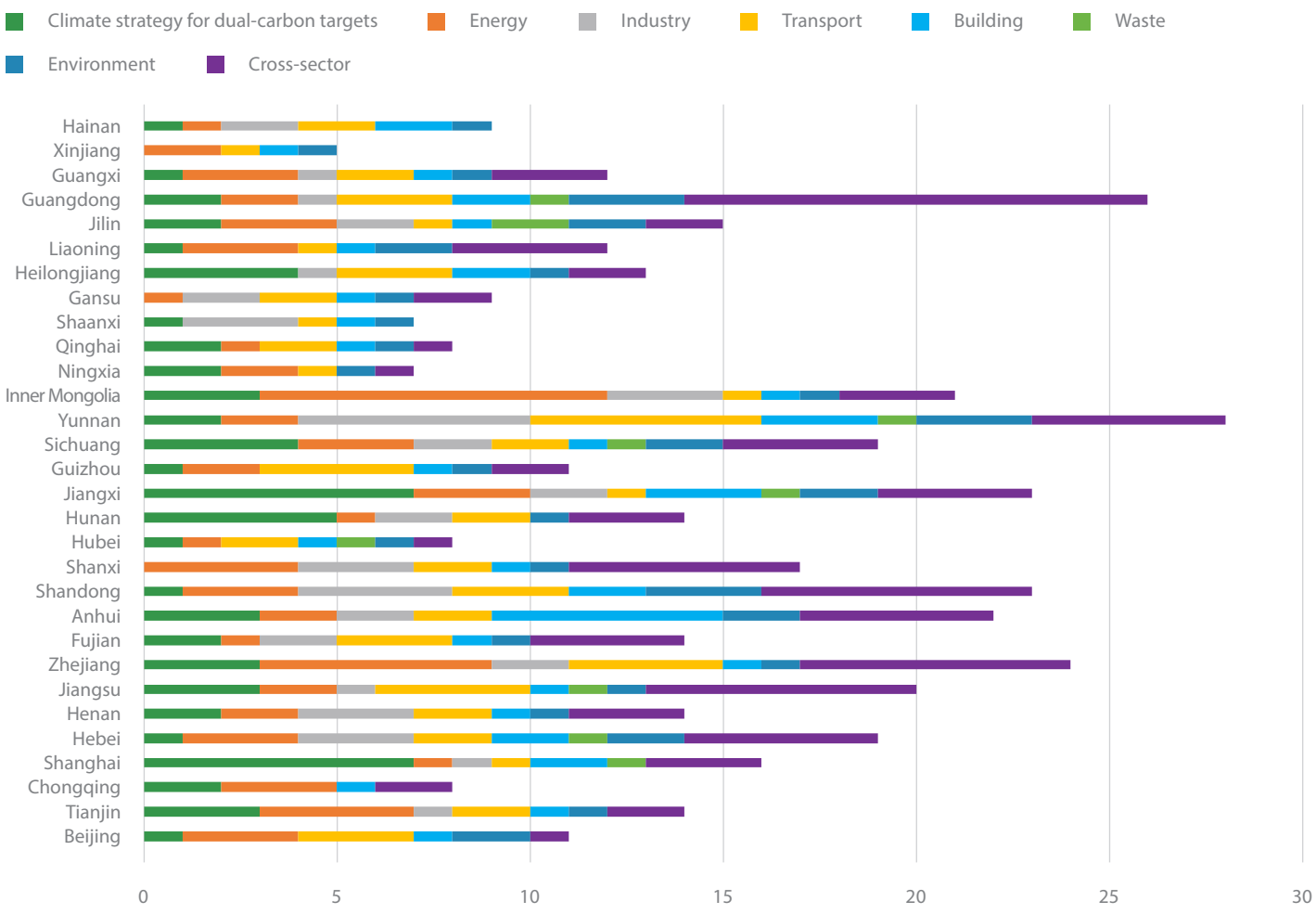
From the beginning of 2021 through December 2022, CCNT collected 449 provincial climate action plans, most of which are subnational sectoral 14th FYPs. These action plans cover most of the main climate mitigation sectors.

FIGURE 2. Provincial climate plans by sector



Source: CCNT

FIGURE 3. Subnational climate plans by provincial region (2021-present)



Source: CCNT

2

DIVERSITY AND DECOUPLING PROGRESS

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2. DIVERSITY AND DECOUPLING PROGRESS

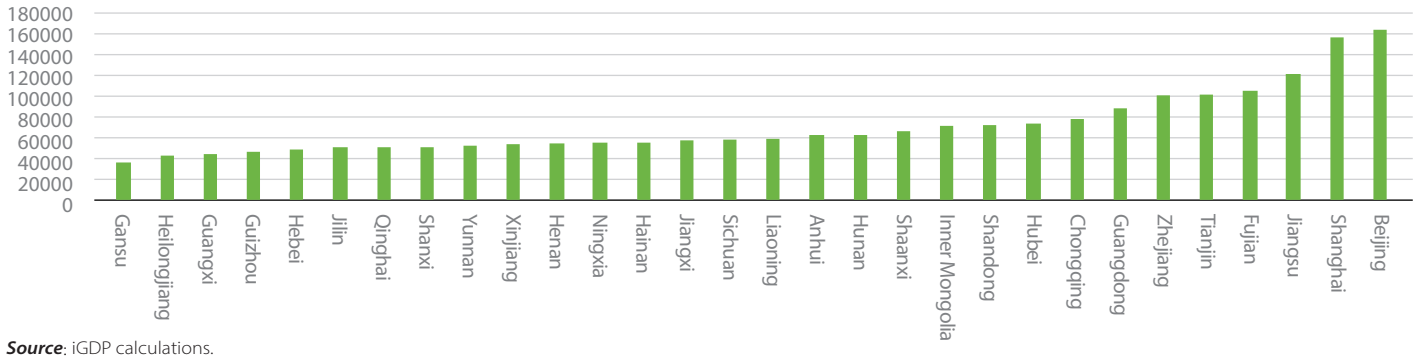
2.1 Diversity

As mentioned above, China's provincial regions are highly diverse, varying in terms of economic development, energy mix and per capita carbon emissions. China's geographic diversity also results in both highly unequal low-carbon energy resources. For this reason, the climate mitigation priorities vary among regions.

2.1.1 Per Capita GDP by Provincial Region

The economic vitality of China's provincial regions ranges from the level of Namibia (Gansu) to Portugal[13] (Shanghai & Beijing). Most regions, containing the majority of China's population, are still at a upper-middle-income[14] economic level.

FIGURE 4. Per capita GDP by provincial region (RMB/cap, 2020 price)

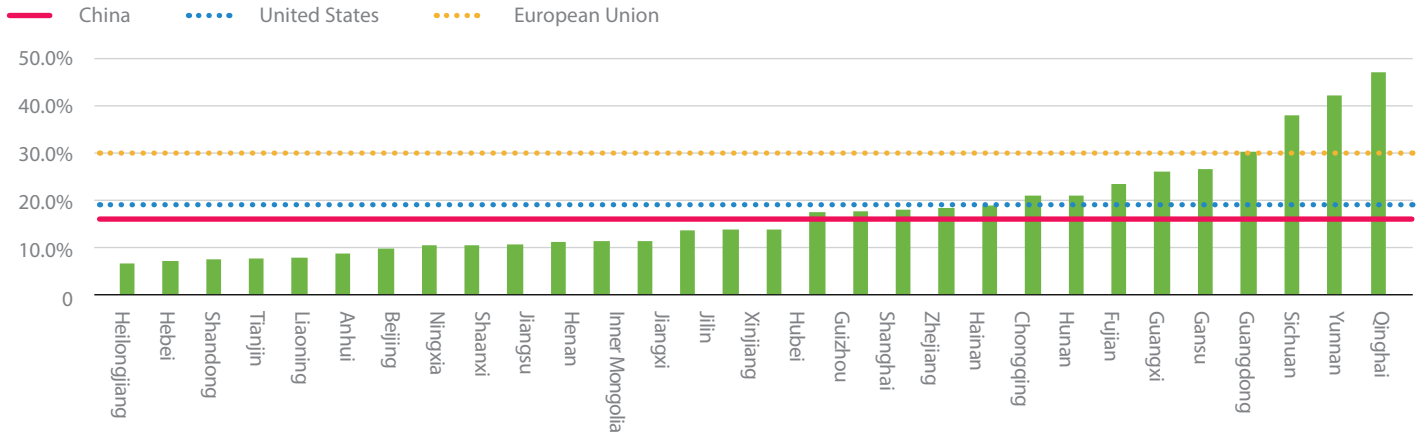


Source: iGDP calculations.

2.1.2 Energy Mix

With only a few exceptions, most of China's provincial regions still rely on fossil fuel energy.

FIGURE 5. Non-fossil fuel share in primary energy consumption (%, 2020)



Source: Energy Development Plan during the 14th FYP, Ecological and Environmental Protection Plan during the 14th FYP and statistical yearbook of each provincial region, and BP Statistical Review of World Energy 2022

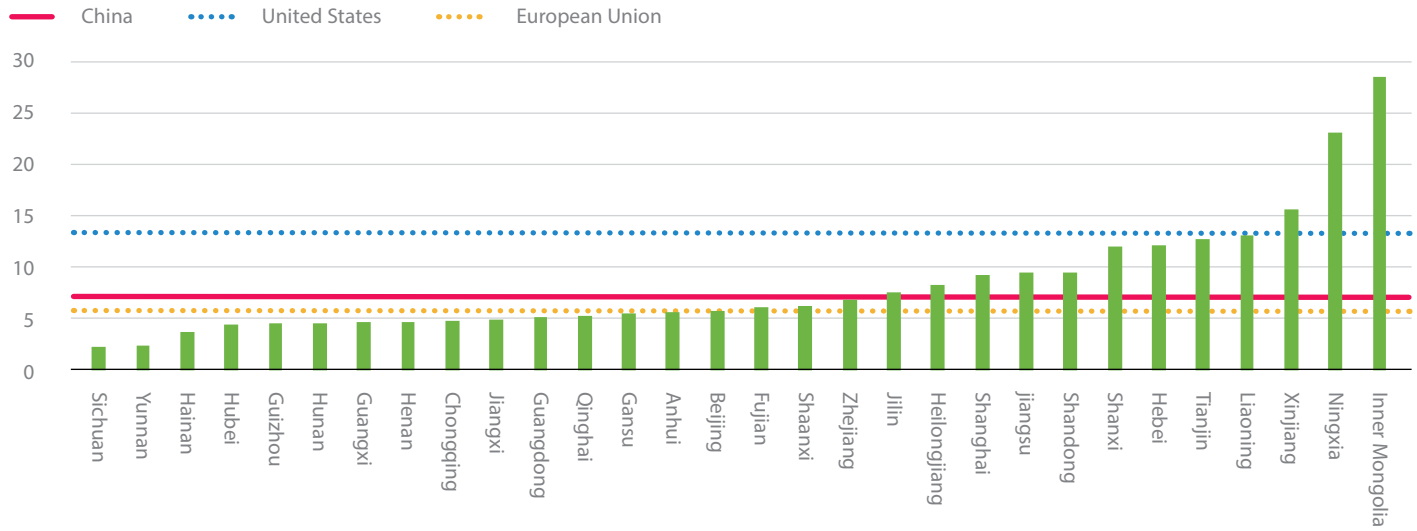
13. Foreign countries per capita GDP data is acquired from the World Bank at https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

14. The World Bank. (2020). World Bank country classification by income level: 2020-2021. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

2.1.3 Per Capita CO_2 Emissions

Per capita CO_2 emissions in half of China's provincial regions were below 6 tons of CO_2 in 2020.

FIGURE 6. Per capita CO_2 emission by provincial region (tCO_2/capita, 2020)

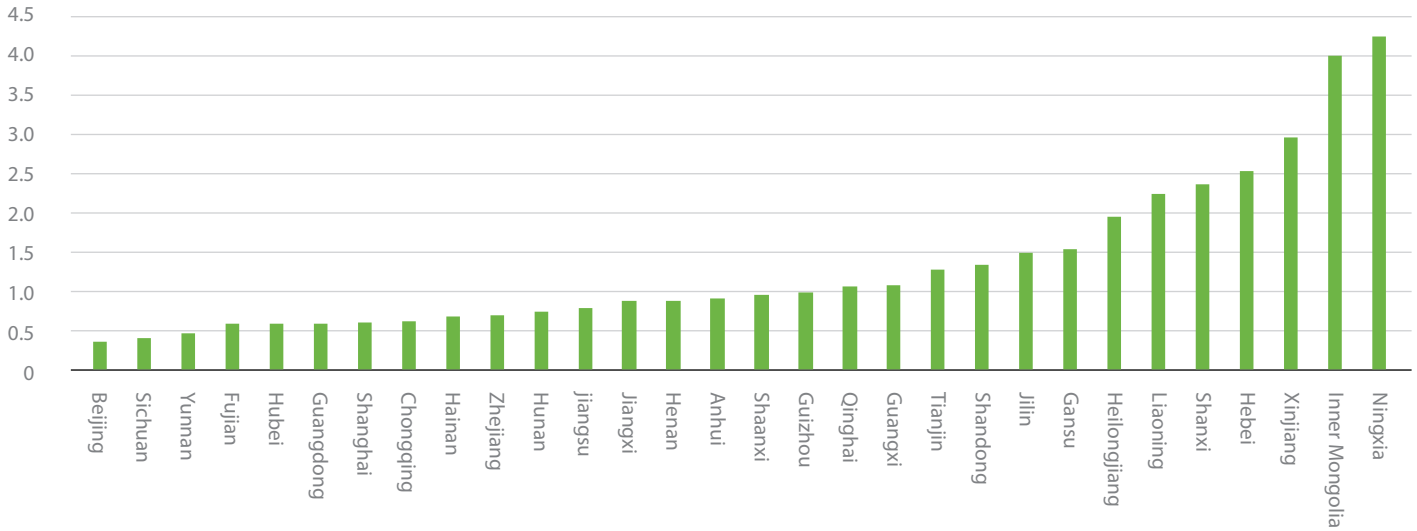


Source: Population data comes from National Bureau of Statistics. Energy-related CO_2 emissions data is calculated by iGDP based on provincial energy balance sheets from China Energy Statistical Yearbook (electricity import and export emissions accounted for). Energy and process CO_2 emissions data of the US and EU comes from IEA and population data comes from the World Bank.

2.1.4 Carbon Intensity by Provincial Region in 2020

The three highest provincial carbon intensity levels are over three times of the levels of the 17 provincial regions at the low end.

FIGURE 7. Carbon intensity by provincial region (tCO_2/10,000 RMB, 2020)

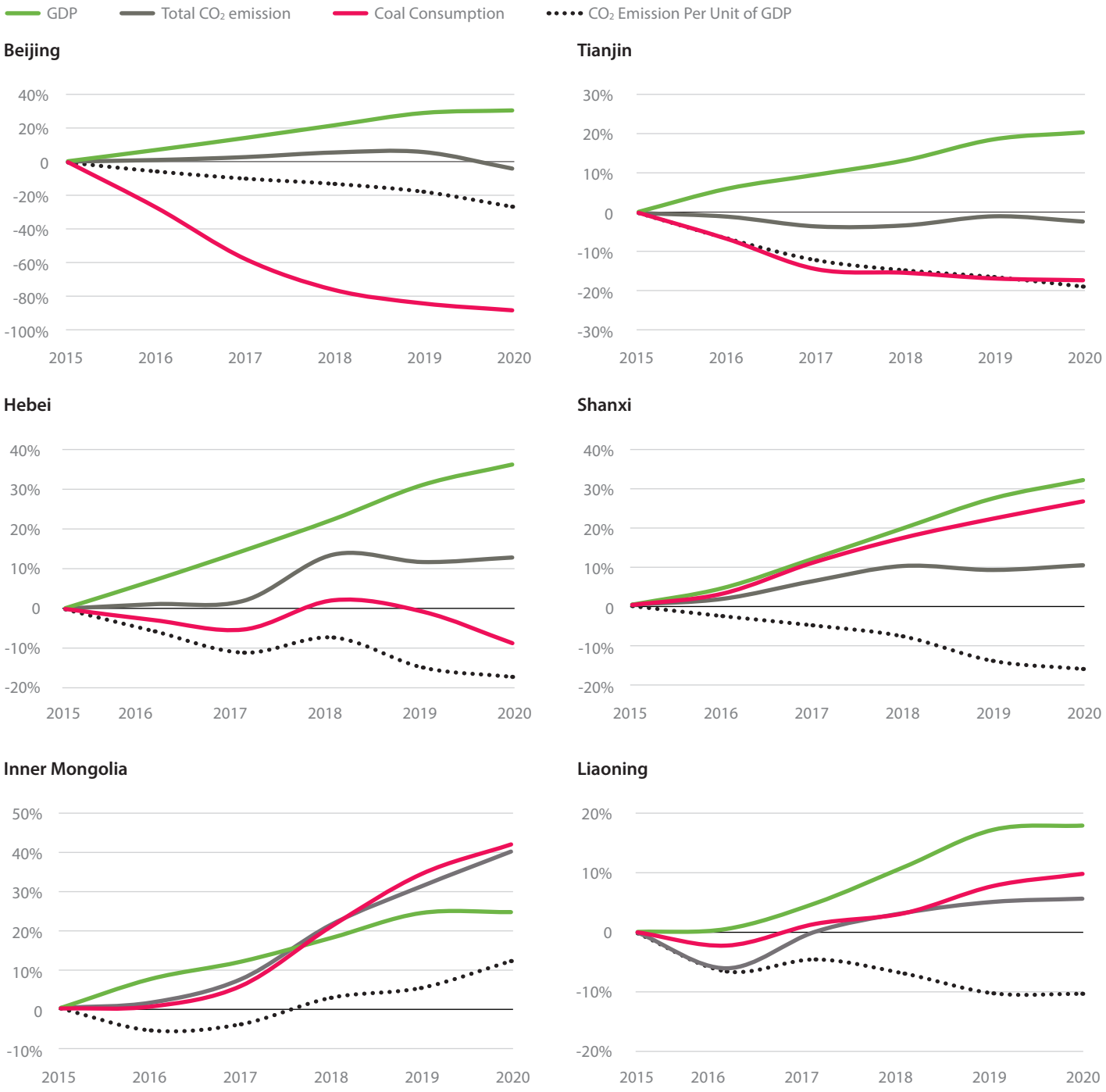


Source: Provincial regions' GDP comes from the National Bureau of Statistics. Energy-related CO_2 emissions data is calculated by iGDP based on provincial energy balance sheets from the China Energy Statistical Yearbook (electricity import and export emissions accounted for).

2.2 The Decoupling of Economic Growth from Carbon Emissions

One-thirds of China's provincial regions have seen clear decoupling of carbon emission and GDP growth, and many are on track toward a carbon emissions plateau. However, several provincial regions have shown an increase in carbon intensity[15].

FIGURE 8. The decoupling of economic growth from carbon emissions by provincial region



15. Li, Xindi., & Yang, Li. (2022). Decoupling process of economic growth from carbon emissions in China's provincial regions. Working Paper (forthcoming). Beijing. iGDP.

FIGURE 8. The decoupling of economic growth from carbon emissions by provincial region

FIGURE 8. The decoupling of economic growth from carbon emissions by provincial region

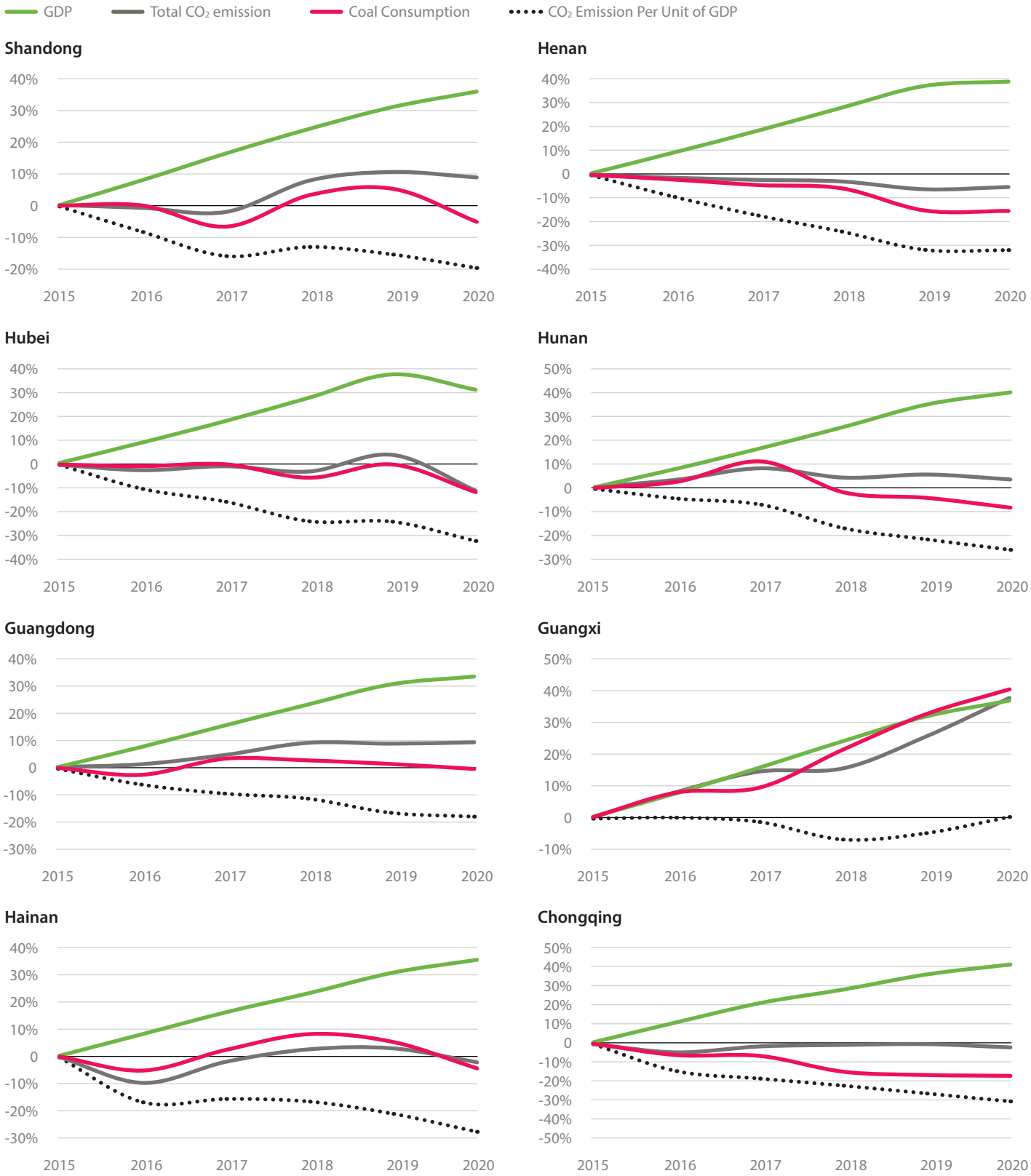
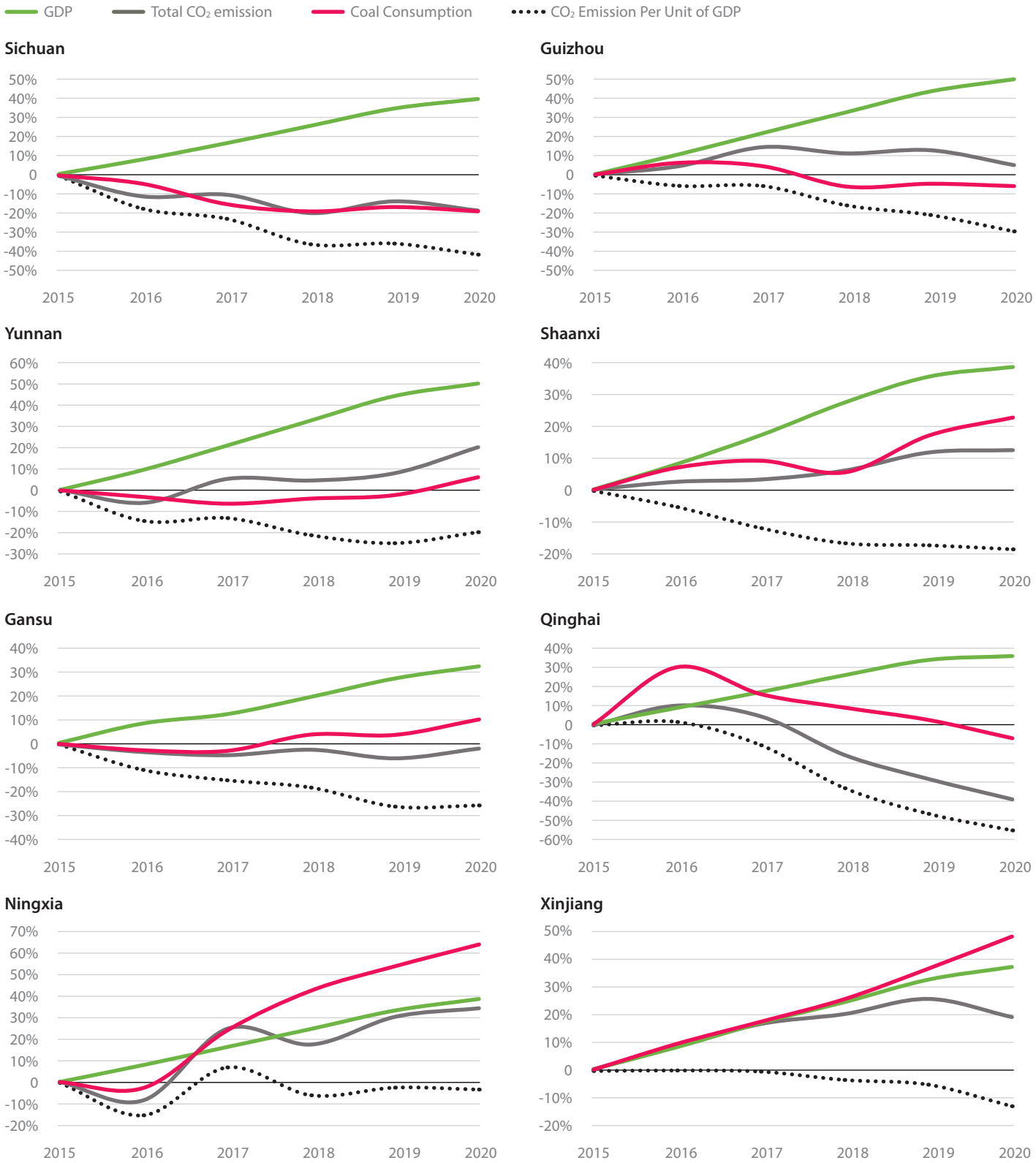


FIGURE 8. The decoupling of economic growth from carbon emissions by provincial region



Source: Provincial regions' GDP (2020 constant price) was calculated by iGDP based on data from National Bureau of Statistics. Energy-related CO2 emissions data was calculated by iGDP based on provincial energy balance sheets from China Energy Statistical Yearbook (electricity import and export emissions accounted for). Coal consumption data comes from total energy available for consumption, National Bureau of Statistics.

3

MITIGATION PERFORMANCE (2015-2020)

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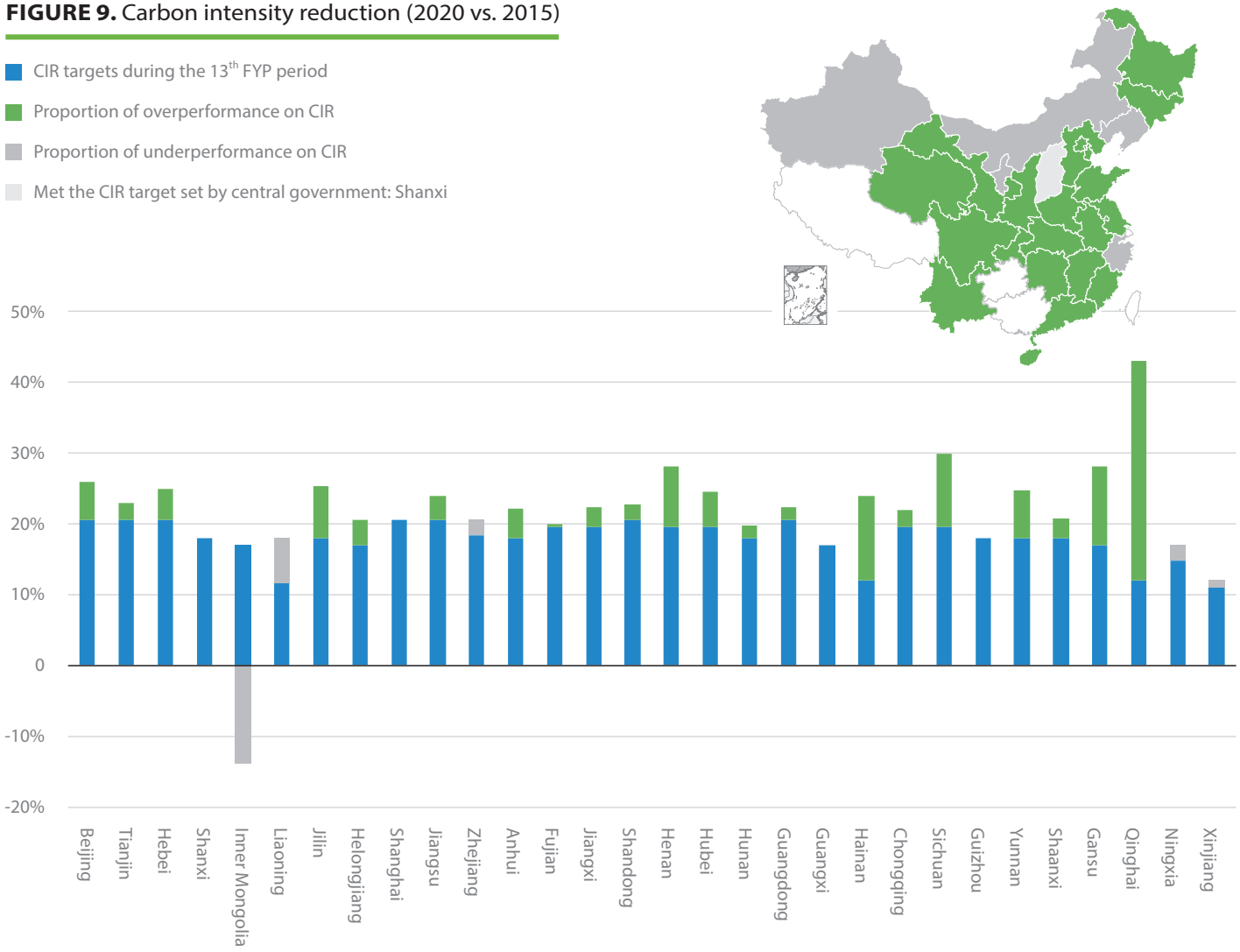
3. MITIGATION PERFORMANCE (2015-2020)

3.1 Carbon Intensity Reduction

Most provincial regions have achieved the carbon intensity reduction (CIR) targets set by the central government. Twenty-one have overperformed on CIR targets.

FIGURE 9. Carbon intensity reduction (2020 vs. 2015)



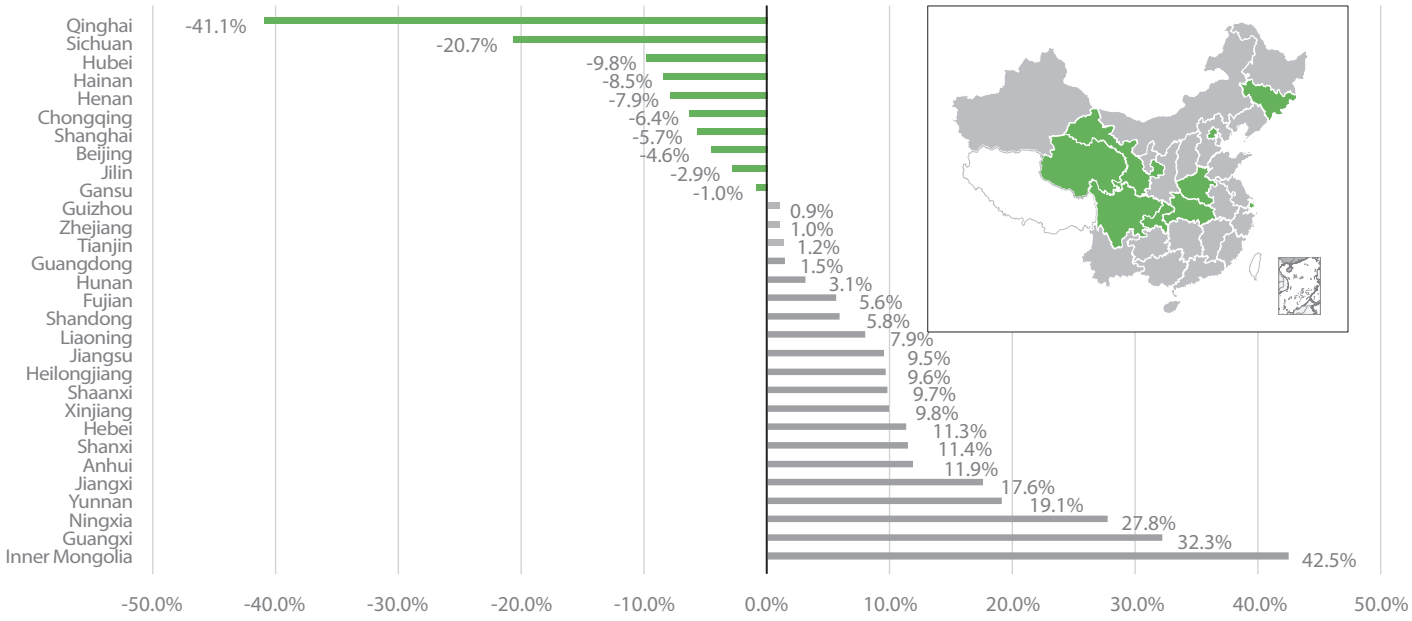
Notes: 1. Carbon intensity reduction rates for Shanghai, Guangxi and Guizhou by 2020 (during the 13th FYP period) are not publicly available.
2. Carbon intensity reduction rates for Liaoning, Jiangsu, Hainan, Zhejiang, Ningxia and Xinjiang compare 2019 and 2015 rates.

Source: Ecological and Environmental Protection Plan during the 14th FYP of each provincial region, Addressing Climate Change Plan during the 14th FYP of each provincial region

3.2 Carbon Emission per Capita

Per capita carbon emissions have increased in 20 provincial regions and decreased in 10 provincial regions.

FIGURE 10. Reduction in per capita carbon emissions (2020 vs. 2015)

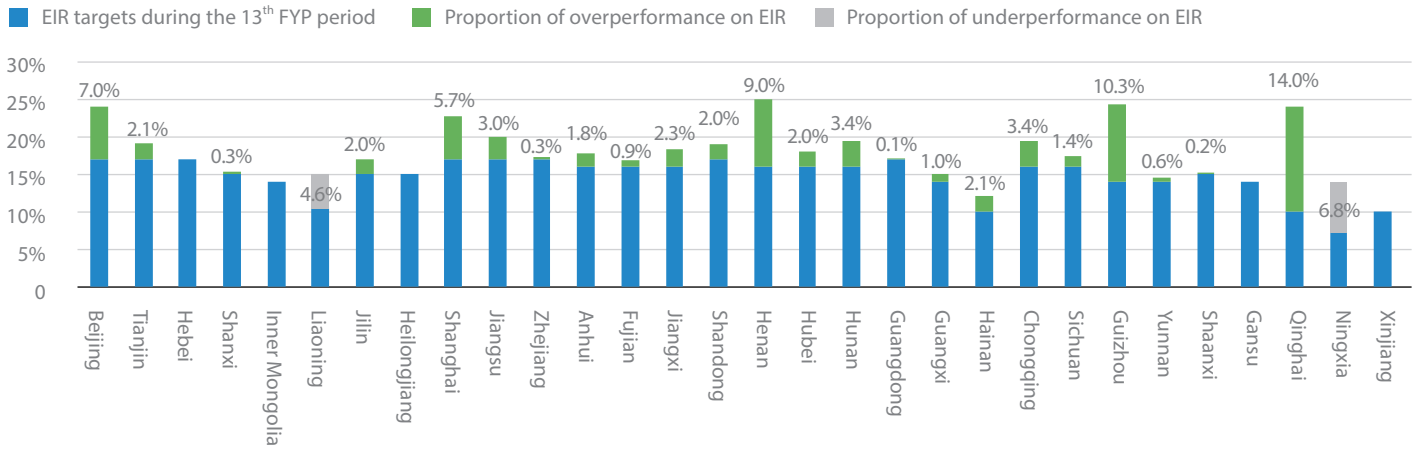


Source: Population data comes from the National Bureau of Statistics. Energy-related CO_2 emissions data is calculated by iGDP based on provincial energy balance sheets from the China Energy Statistical Yearbook (electricity import and export emissions accounted for).

3.3 Energy Intensity Reduction (2020 vs. 2015)

Twenty-three provincial regions have overperformed on energy intensity reduction targets set by the central government while two have not met their targets.

FIGURE 11. Energy intensity reduction during the 13th FYP period, targets vs. actual completion



Notes: 1. Energy intensity reduction rates for Hebei, Inner Mongolia and Heilongjiang by 2020 (during the 13th FYP period) are not publicly available while Gansu and Xinjiang met their EIR targets set by the central government.

2. Energy intensity reduction rates for Ningxia and Anhui compare 2019 and 2015 rates.

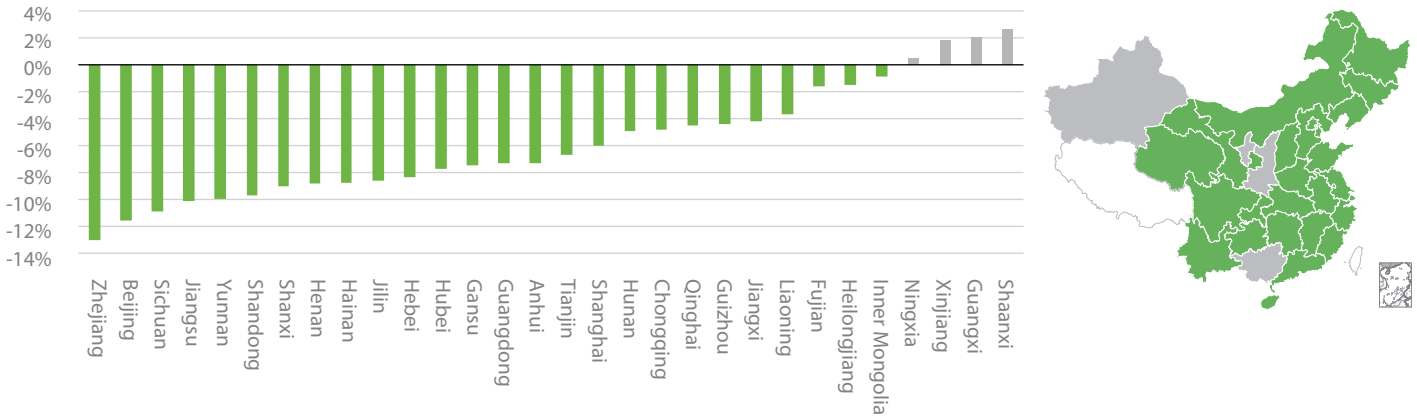
Source: Ecological and Environmental Protection Plan during the 14th FYP of each provincial region, Addressing Climate Change Plan during the 14th FYP of each provincial region

3.4 Coal Consumption

3.4.1 Coal Consumption Share (2020 vs. 2015)

Twenty-six provincial regions saw a coal consumption share reduction in the 13th FYP period.

FIGURE 12. Coal consumption share reduction during the 13th FYP period (%)



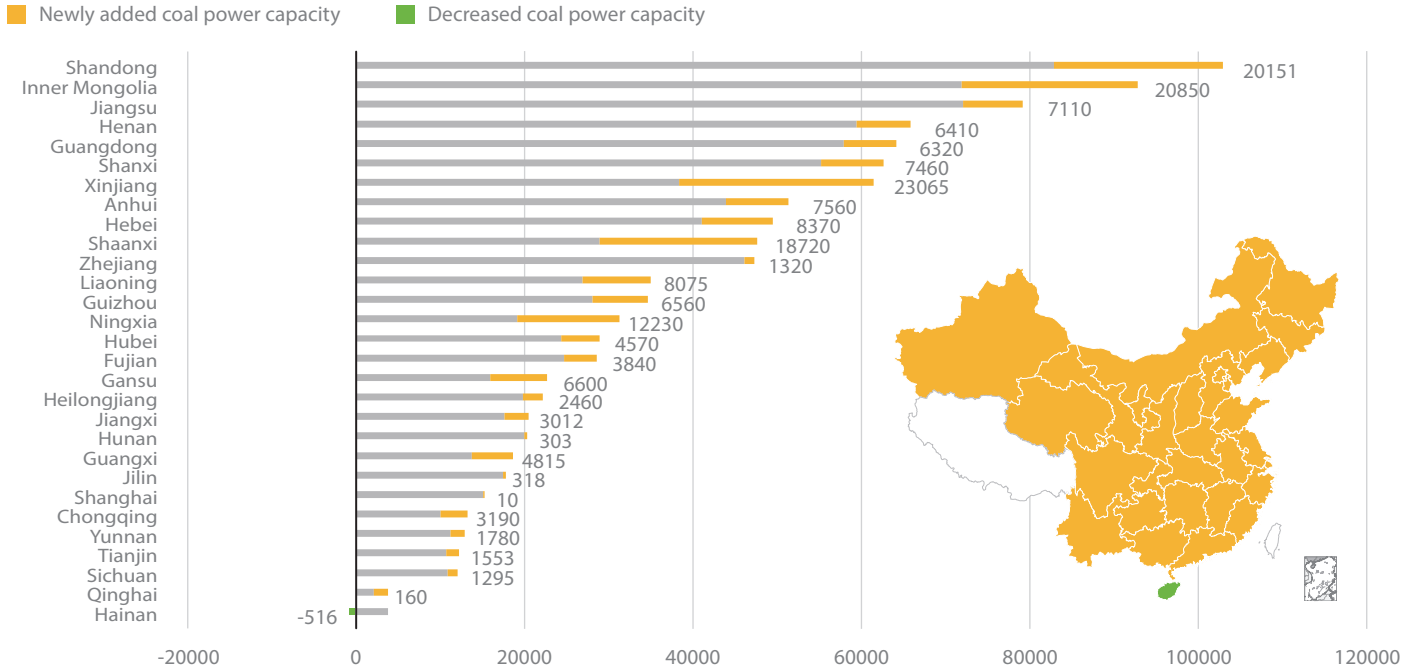
Note: Due to data availability, the proportion of coal consumption used for Shanxi province at the beginning of the 13th FYP is the proportion in 2014 rather than in 2015, while the data of Shanxi, Guizhou and Heilongjiang at the end is the proposed target by the plan rather than the actual value.

Source: Energy Development Plan during the 14th FYP and statistical yearbook of each provincial region, Shanxi Province GHG Emission Control Plan during the 13th FYP and Shanxi Province Comprehensive Energy Development Plan during the 13th FYP

3.4.2 Coal Power Capacity Addition (MW)

Twenty-eight provincial regions saw coal power capacity additions in the 13th FYP period.

FIGURE 13. Newly added coal power capacity by provincial region in the 13th FYP period (MW).



Note: Data from Beijing is not included due to data unavailability.

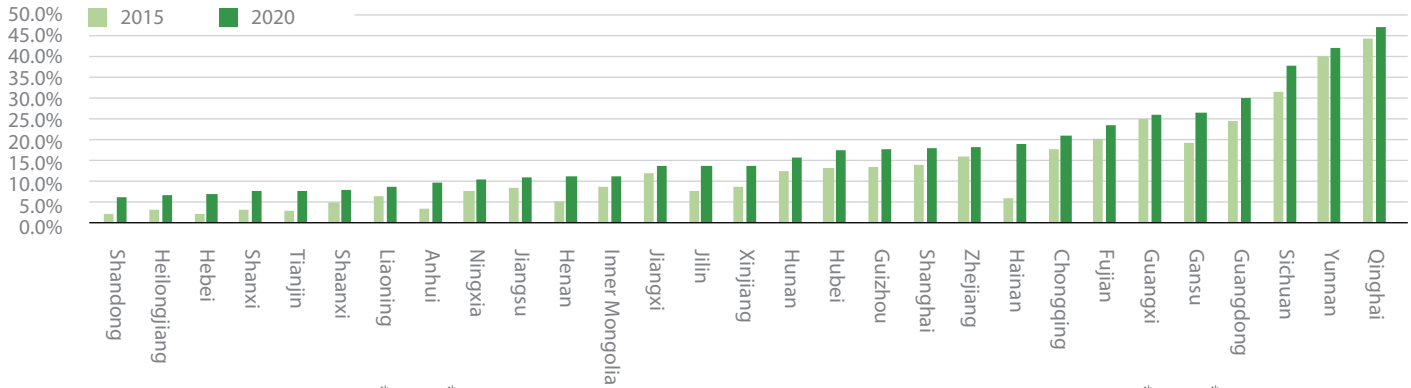
Source: Energy Development Plan during the 13th and 14th FYP of each provincial region

3.5 Renewables

3.5.1 Non-fossil Fuel Consumption Share Increase

Non-fossil fuel share increased at the subnational level in the 13th FYP period.

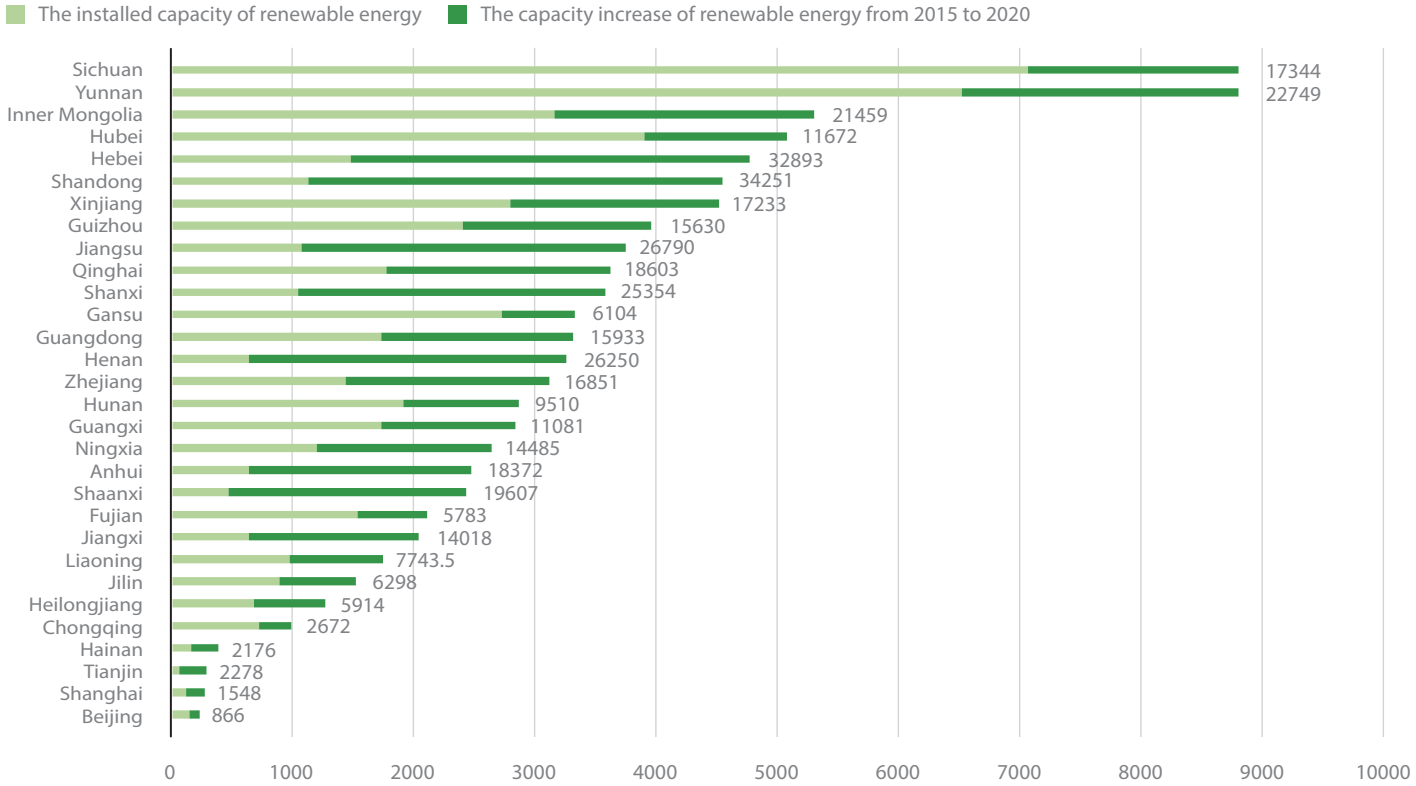
FIGURE 14. Non-fossil fuel share (%, 2020 vs. 2015)



Source: Energy Development Plan during the 13th and 14th FYP of each provincial region, Ecological and Environment Protection Plan during the 13th and 14th FYP of each provincial region and statistical yearbook of each provincial region. The 2020 non-fossil fuel share of Heilongjiang is the proposed target by its FYP rather than actual value.

3.5.2 Renewable Growth (MW)

FIGURE 15. Renewables additions during the 13th FYP period (MW)

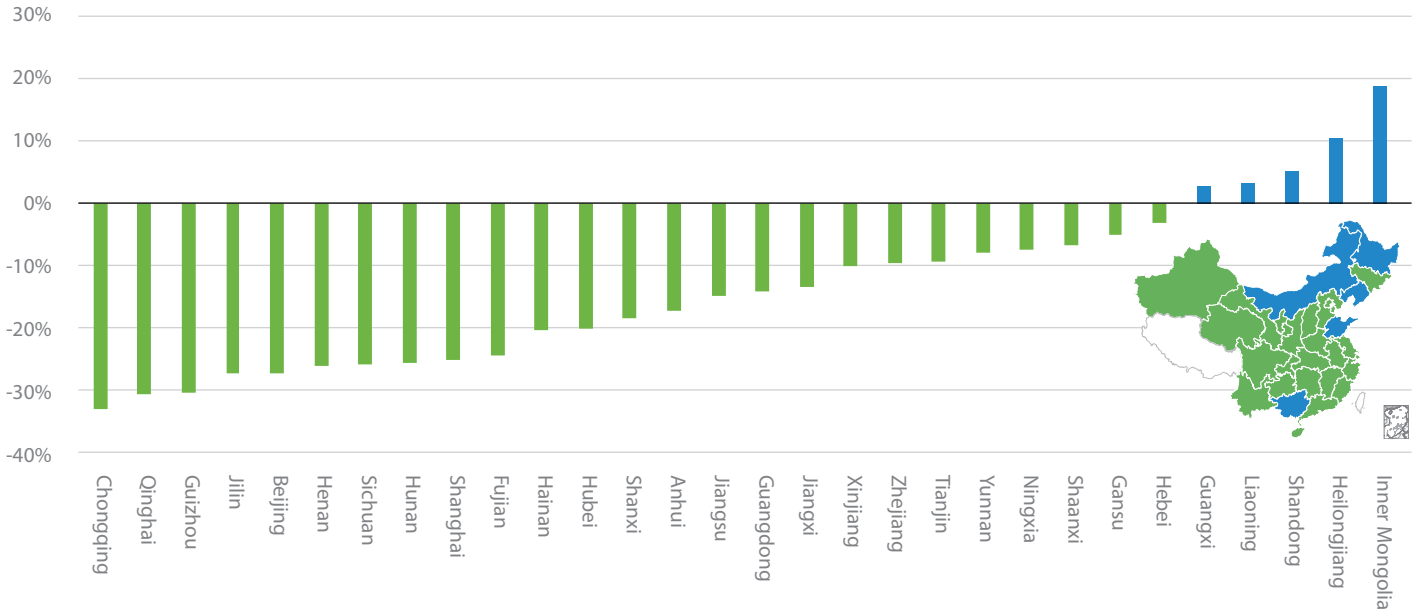


Note: Renewables here include wind, solar, hydropower and biomass.
Source: Renewable Energy Development Plan during the 13th and 14th FYP of each provincial region, Energy Development Plan during the 13th and 14th FYP of each provincial region

3.6 Energy Consumption in Industrial Value Added

Twenty-five provincial regions saw a steady reduction in energy consumption in industrial value added.

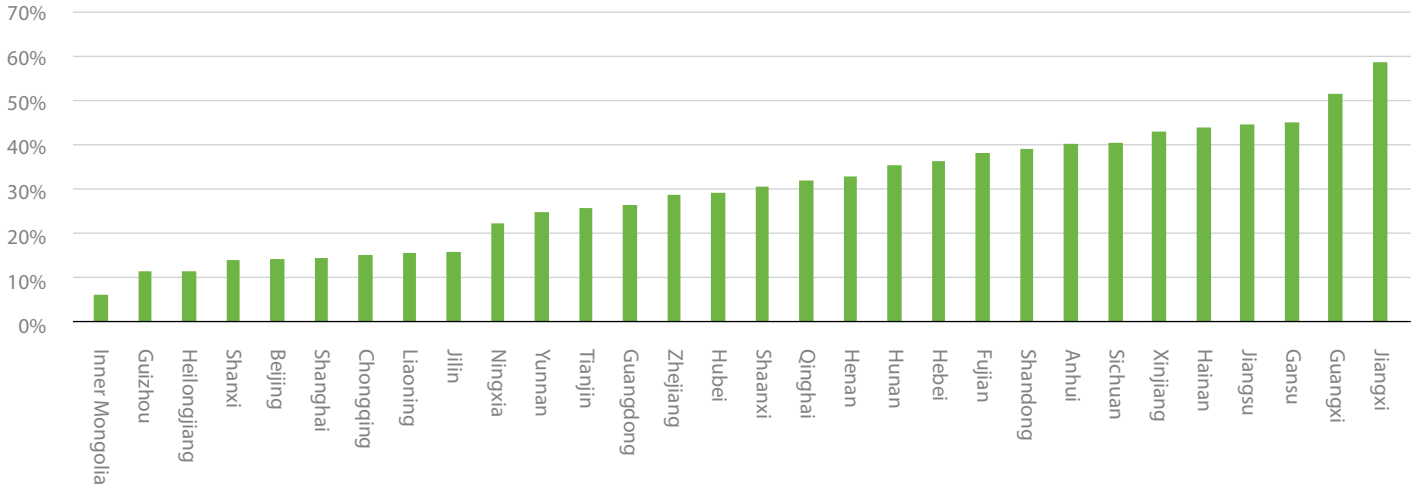
FIGURE 16. Change in per unit of industrial value added energy consumption (%, 2020 vs. 2015)



Source: Industrial added value comes from the Secondary Industry added value from National Bureau of Statistics. Provincial level industrial energy consumption is calculated by iGDP based on based on Total Energy Consumption – Industry Sector from provincial energy balance sheets of China Energy Statistical Yearbook.

3.7 Building Energy Consumption per Capita

FIGURE 17. Per capita building energy consumption change (%, 2020 vs. 2015)



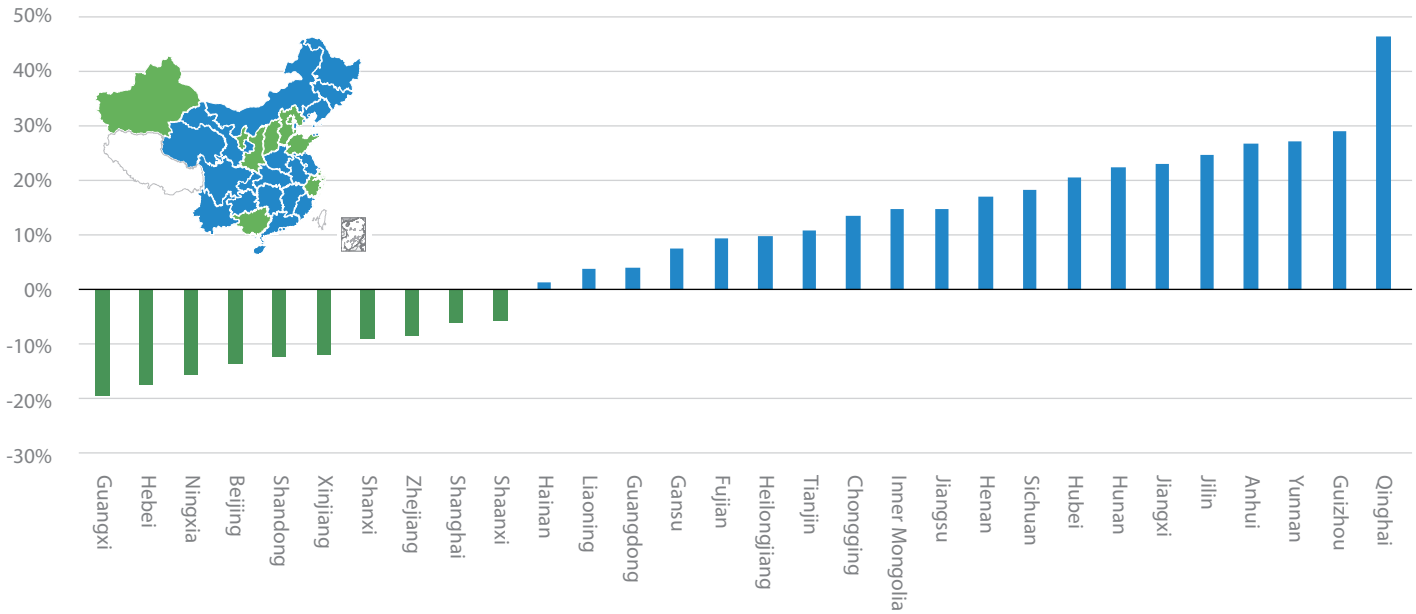
Source: Provincial level building energy consumption (operation phase) is calculated by iGDP based on based on Total Energy Consumption – Wholesale and Retail Trades, Hotels and Catering Services and Residential from provincial energy balance sheets of China Energy Statistical Yearbook. For a detailed methodology please see the working paper below.[16]

16. Yang, Li., & Li, Xindi. (2022). Research on statistical indicators and data of energy consumption and carbon emissions in China. Working Paper. Beijing. iGDP.

3.8 Transportation Energy Consumption per Capita

Twenty provincial regions saw a rise in transportation energy consumption per capita during the 13th FYP period.

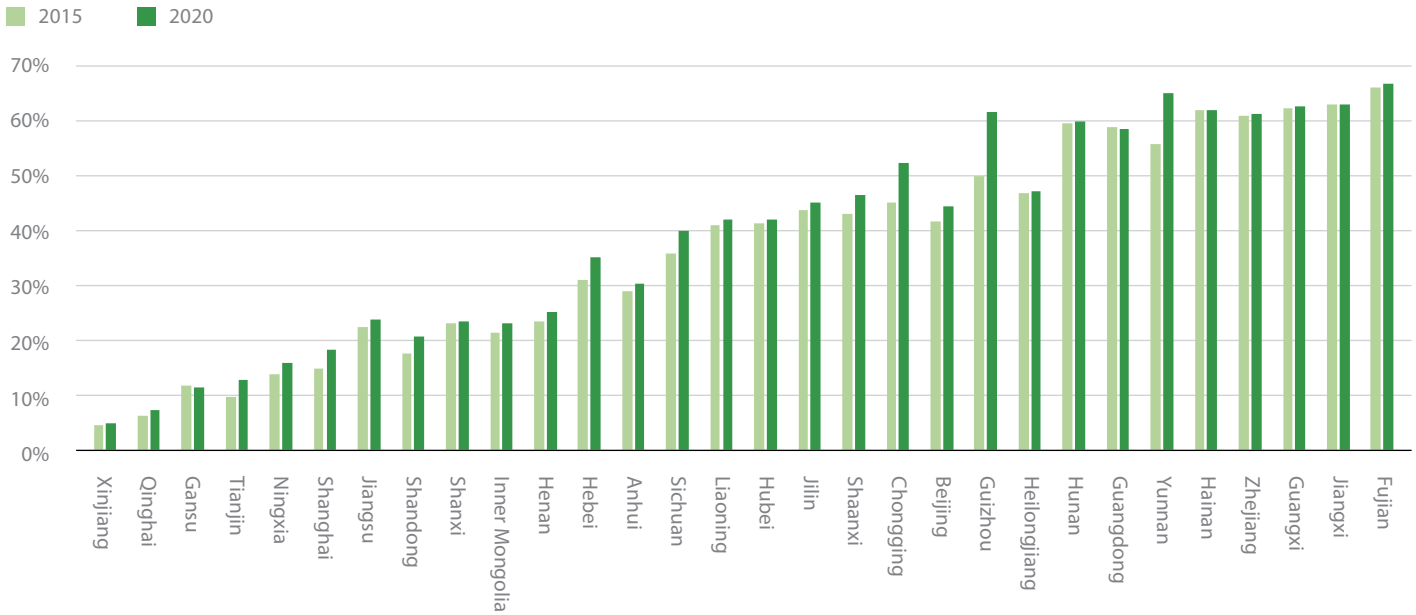
FIGURE 18. Per capita transportation energy consumption change (%, 2020 vs. 2015)



Source: Provincial level transportation energy consumption is calculated by iGDP based on based on Total Energy Consumption – Transport, Storage and Post from provincial energy balance sheets of China Energy Statistical Yearbook.

3.9 Forest Coverage

FIGURE 19. Forest coverage (%, 2020 vs. 2015)

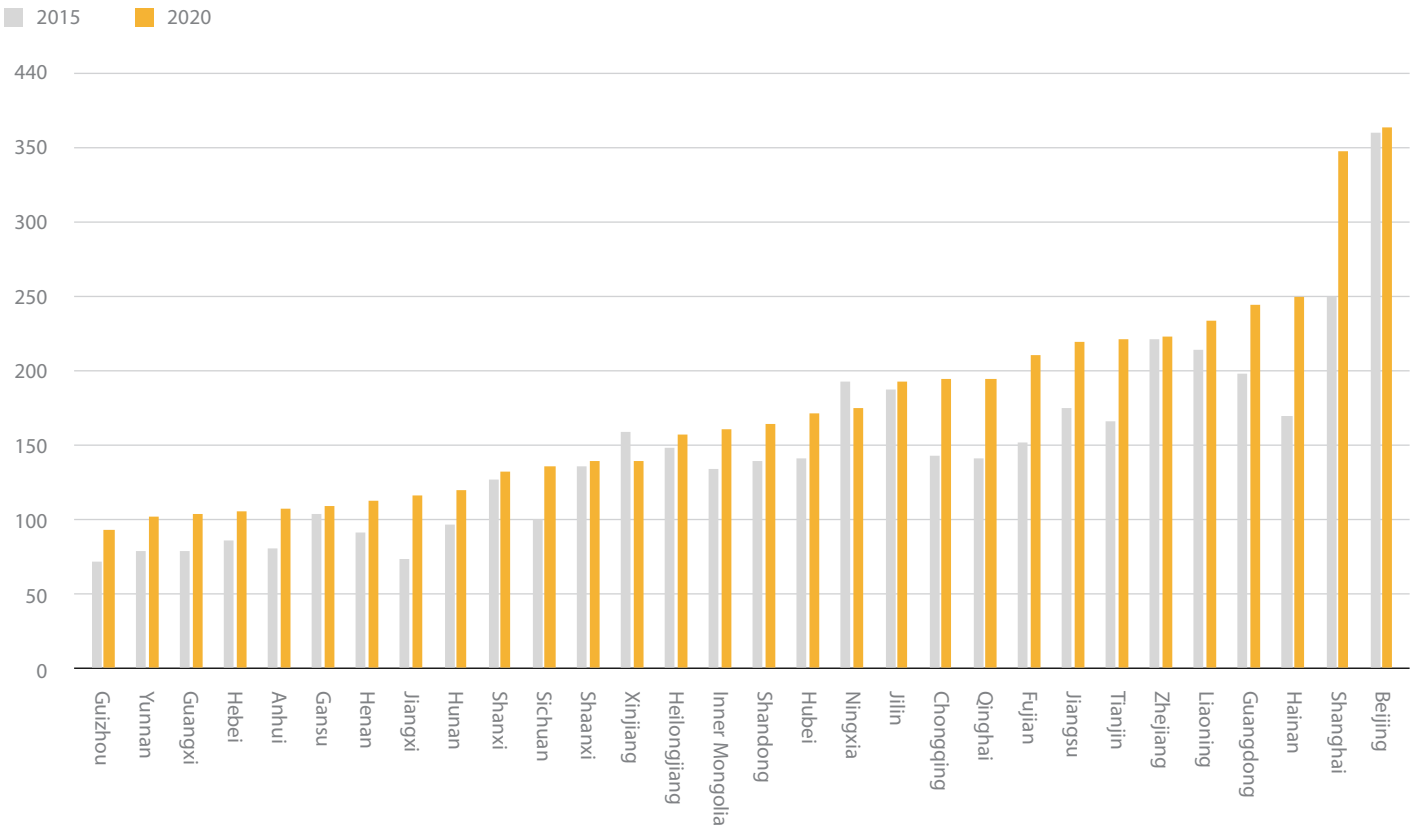


Source: Ecological and Environment Protection Plan during the 13th FYP and 14th FYP of each provincial region, Annual Statistical Bulletin of each province

3.10 Municipal Solid Waste Generation per Capita

Municipal solid waste generation continued to grow during the 13th FYP period. Waste-related methane emissions calls for attention.

FIGURE 20. Municipal solid waste generation per capita (kg/cap/year)



Source: Waste data comes from the Statistical Yearbook and the Urban and Rural Development Yearbook of each provincial region. Population data comes from the National Bureau of Statistics.

4

CLIMATE ACTIONS TOWARDS 2025

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4. CLIMATE ACTIONS TOWARDS 2025

This section provides an overview of provincial climate actions towards 2025.

TABLE 4. A brief overview of subnational climate actions for carbon peaking and carbon neutrality

PROVINCIAL REGION	DUAL-CARBON GOALS STATEMENT
Beijing	• By 2025, the proportion of energy consumption from renewable sources will reach 14.4% or more. Energy consumption per unit of GDP will drop 14% compared to 2020, and CO_2 emissions per unit of GDP will drop to achieve the national target. By 2030, the proportion of energy consumption from renewables will reach about 25%, and CO_2 emissions per unit of GDP will hit the national target, ensuring that carbon emissions will peak by 2025.
Tianjin	• By 2025, energy consumption and CO_2 emissions per unit of GDP will hit national targets. The proportion of energy consumption from non-fossil sources will reach 11.7% or more, laying a solid foundation for carbon peaking. By 2030, energy consumption per unit of GDP will drop significantly, and CO_2 emissions per unit of GDP will drop by more than 65% compared with 2005; the proportion of energy consumption from non-fossil sources will reach more than 16%, to achieve peak carbon emissions by 2030.
Hebei	• By 2025, a low-carbon economic system based on the circular economy concept will have been established. Provincial energy consumption and CO_2 emissions per unit of GDP will hit the national target, laying a solid foundation for a carbon peak by 2030. By 2030, the energy efficiency of key energy-consuming industries will be at an internationally advanced level, ensuring carbon peaking before 2030. By 2060, energy consumption from non-fossil sources will have increased significantly, a green circular economy will be established and the goal of carbon neutrality will be met.
Shanxi	• Implement the task of carbon peak carbon neutrality in Shanxi, jointly promote pollution reduction and carbon reduction, enhance the ability to deal with climate change, and control and reduce greenhouse gas emissions. Carry out carbon peaking actions in depth, and support qualified regions, key industries, and key enterprises to take the lead in carbon peaking.
Inner Mongolia	• By 2025, a green and low-carbon economic system based on the circular economy concept will be established. The energy efficiency of key industries will be enhanced, laying the foundation for a carbon peak and carbon neutrality. By 2030, CO_2 emissions will peak and begin to decline. By 2060, energy efficiency will reach an internationally advanced level and carbon neutrality will be achieved.
Liaoning	• By 2025, the proportion of energy consumption from non-fossil fuel sources will reach about 13.7%. Energy consumption per unit of GDP will drop by 14.5% compared with 2020 and total energy consumption will be reasonably controlled. The national target for reduction of CO_2 emissions per unit of GDP will be met. Incremental CO_2 emissions in key industries will be gradually brought under control to pave the way for emissions peaking. By 2030, energy consumption from non-fossil sources will reach about 20%, and CO_2 emissions per unit of GDP compared to 2005 levels will hit the national target. Carbon peaking will thereby be achieved.
Jilin	• By 2025, the proportion of energy consumption from non-fossil fuel sources will reach 17.7%, while energy consumption and CO_2 emissions per unit of GDP will hit national targets. This will lay a solid foundation for carbon emissions to peak by 2030. By 2030, the proportion of energy consumption from non-fossil sources will reach about 20%, and CO_2 emissions per unit of GDP will drop by more than 65% compared with 2005, ensuring peak carbon emissions by 2030.
Heilongjiang	• By 2025, the proportion of non-fossil energy consumption will increase to about 15%, and the energy consumption per unit of GDP and carbon emissions will be reduced to ensure the completion of the national target and lay a solid foundation for the realization of carbon peaking. By 2030, energy consumption per unit of GDP and carbon emissions per unit of GDP will drop significantly, and the goal of carbon peaking before 2030 will be successfully achieved.
Shanghai	• By 2025, energy consumption per unit of GDP will drop 14% compared with 2020. The proportion of energy consumption from non-fossil fuel sources will reach 20%, and CO_2 emissions per unit of GDP will hit national targets. By 2030, non-fossil energy as a proportion of total energy consumption will be 25%, and CO_2 per unit of GDP will drop by 70% compared to 2005, leading to a carbon peak by 2030.
Jiangsu	• By 2025, a green and low-carbon economic system based on the circular economy concept will be established. The energy efficiency of key industries will reach an internationally advanced level, laying the foundation for a carbon peak and carbon neutrality, and the beautiful Jiangsu project will be near completion. By 2030, CO_2 emissions will peak and begin to decline. By 2060, energy efficiency carbon neutrality will be achieved.
Zhejiang	• By 2025, a green and low-carbon economic system based on the circular economy concept will be established. The energy efficiency of key industries will be significantly improved, paving the way for carbon neutrality. By 2030, the green transition will bear fruit, the energy efficiency of key industries will reach an internationally advanced level and emissions control systems will be in place. By 2060, a green and low-carbon system will be in place. Energy efficiency will be at world-leading levels, and carbon neutrality will be achieved.
Anhui	• By 2030, greenhouse gas emissions will be controlled in a scientific manner, mitigation measures and technologies will be promoted, and peak carbon emissions will be achieved. By 2035, carbon emissions will remain stable and decline after peaking, and the goal of building a beautiful Anhui where people live in harmony with nature will be achieved.
Fujian	• By 2025, the foundations will be laid to achieve carbon peaking and neutrality. After 2030, CO_2 emissions will remain stable and decline after peaking. By 2060, carbon neutrality will be achieved.
Jiangxi	• After 2030, CO_2 emissions will remain stable and decline after peaking, in line with national targets. By 2035, CO_2 emissions will be in decline.

TABLE 4. A brief overview of subnational climate actions for carbon peaking and carbon neutrality

PROVINCIAL REGION	DUAL-CARBON GOALS STATEMENT
Shandong	• By 2025, the proportion of non-fossil energy consumption will increase to about 13%, and energy consumption per unit of GDP and carbon emissions per unit of GDP will decrease by 14.5% and 20.5% respectively compared with 2020, laying a solid foundation for the province to achieve carbon peaking as scheduled. By 2030, the proportion of non-fossil energy consumption will reach about 20%, and carbon emissions per unit of GDP will be reduced by more than 68% compared with 2005, ensuring that the goal of carbon peaking before 2030 will be achieved as scheduled.
Henan	• After 2030, CO_2 emissions will remain stable and decline after peaking. • By 2035, CO_2 emissions will be in decline.
Hubei	• By 2030 local cities will demonstrate that they have achieved peak emissions, and policy will be designed to ensure that this happens in an orderly manner. • By 2035, CO_2 emissions will be in decline.
Hunan	• By 2025, the foundations will be laid to achieve carbon peaking and neutrality. The Chang-Zhu-Tan city cluster and other promising areas will take the lead in hitting peak emissions. After 2030, CO_2 emissions will remain stable and decline after peaking. By 2060, a green and low-carbon economic system based on the circular economy concept will be established, and carbon neutrality will be achieved.
Guangdong	• By 2025, the foundations will be laid to achieve carbon peaking and neutrality. After 2030, CO_2 emissions will remain stable and decline after peaking. By 2060, carbon neutrality will be achieved.
Guangxi	• By 2030, a green economy will be established and the energy efficiency of key industries will hit an internationally advanced level, paving the way for carbon neutrality. By 2060, carbon neutrality will be achieved.
Hainan	• By 2025, the foundations will be laid to achieve carbon peaking and neutrality. After 2030, CO_2 emissions will remain stable and decline after peaking.
Chongqing	• By 2030, society and the economy will be undergoing a green transition, and the energy efficiency of key industries will reach an internationally advanced level, and emissions control systems will be in place. After 2030, CO_2 emissions will remain stable and decline after peaking. By 2060, a green and low-carbon system will be in place, energy efficiency will be at world-leading levels, and carbon neutrality will be achieved.
Sichuan	• By 2025, a green and low-carbon economic system will be established and the energy efficiency of key industries will be significantly improved, paving the way for carbon neutrality. By 2030, society and the economy will be undergoing a green transition, the energy efficiency of key industries will reach an internationally advanced level, and emissions control systems will be in place. By 2060, a green and low-carbon system will be in place, energy efficiency will be at world-leading levels, and carbon neutrality will be achieved.
Guizhou	• The energy efficiency targets of the 14th Five-Year Plan will be met. After 2030, CO_2 emissions will remain stable and decline after peaking.
Yunnan	• By 2025, the total installed capacity of wind power and solar power will be greatly increased, the proportion of non-fossil energy consumption will continue to increase, and the energy consumption per unit of GDP and carbon emissions will be reduced to meet the national targets and create favorable conditions for achieving carbon peaking. By 2030, the energy consumption per unit of GDP and carbon emissions will continue to decline, and strive to achieve carbon peak simultaneously with the whole country.
Shaanxi	• By 2025, a green and low-carbon economic system based on the circular economy concept will be established and the energy efficiency of key industries will be significantly improved, paving the way for carbon neutrality. By 2030, society and the economy will be undergoing a green transition, the energy efficiency of key industries will reach an internationally advanced level, and emissions control systems will be in place. By 2060 energy efficiency will be at world-leading levels, and carbon neutrality will be achieved.
Gansu	• By 2035, CO_2 emissions will be in decline and the goal of creating a beautiful Gansu with a well protected ecology will be accomplished.
Qinghai	• By 2025, a green and low-carbon economic system based on the circular economy concept will be established, and the energy efficiency of key industries will be significantly improved, paving the way for carbon neutrality. By 2030, society and the economy will be undergoing a green transition, a green industrial, technological and governance system will be built, the energy efficiency of key industries will reach an internationally advanced level, and emissions control systems will be in place. By 2060, a green and low-carbon system will be in place and carbon neutrality will be achieved.
Ningxia	• By 2025, energy consumption and CO_2 emissions per unit of GDP will meet the national target. By 2030, a clean and efficient energy system will be developed and green development models will be ready for key areas. By 2035, CO_2 emissions will be in decline. Installed renewable energy capacity will continue to rise, and a green society and economy will be in place.
Xinjiang	• An action plan to achieve carbon peaking will be developed and greenhouse gas emissions will be more strictly controlled.

Source: CCNT

4.1 Carbon Intensity Reduction Targets

TABLE 5. Carbon intensity reduction targets by provincial region in the 14th FYP period

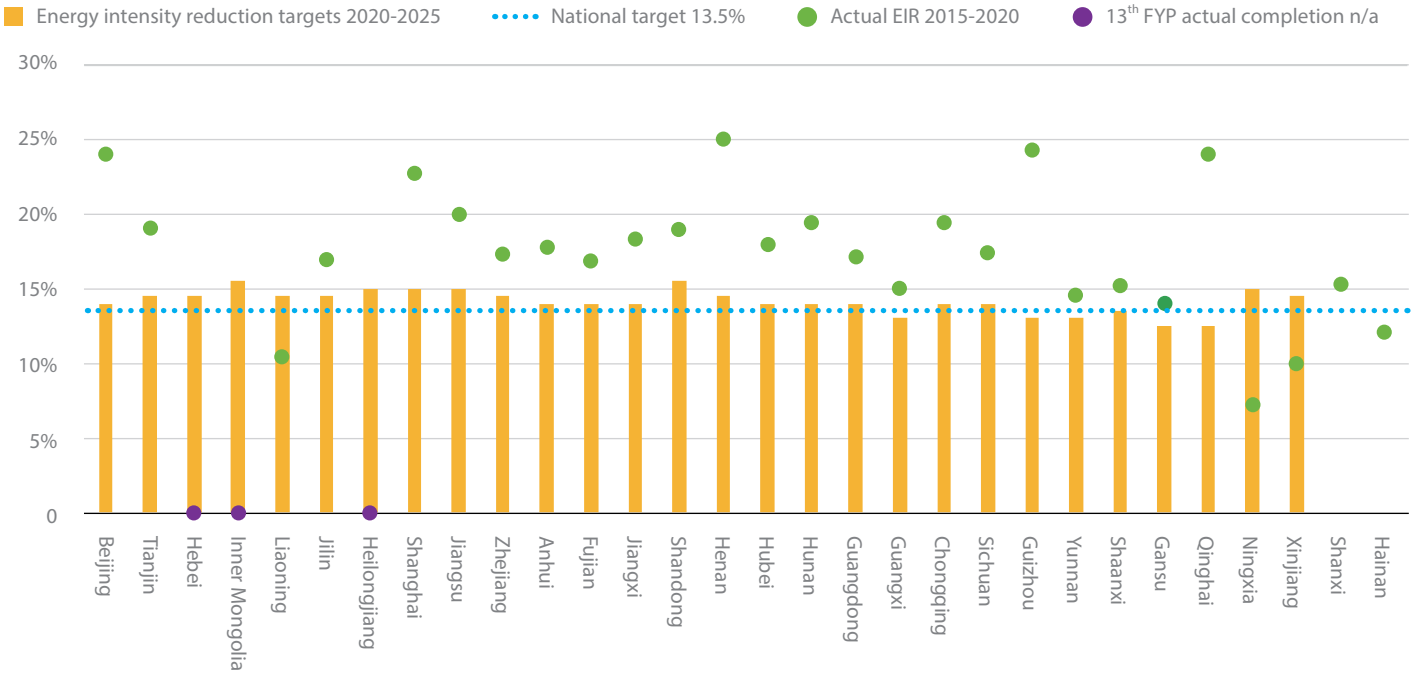
PROVINCIAL REGION	CARBON INTENSITY REDUCTION TARGETS BY 2025 (%, COMPARED TO 2020)
Shandong, Guangdong	20.5%
Henan, Jiangxi	19.5%
Hebei	19%
Guizhou, Shaanixi	18%
Heilongjiang, Ningxia	16%
Qinghai	12%
Other provincial regions	Follow central government requirements

Source: CCNT

4.2 Energy

4.2.1 Energy Intensity Reduction Targets

FIGURE 21. Energy intensity reduction targets by provincial region in the 14th FYP period

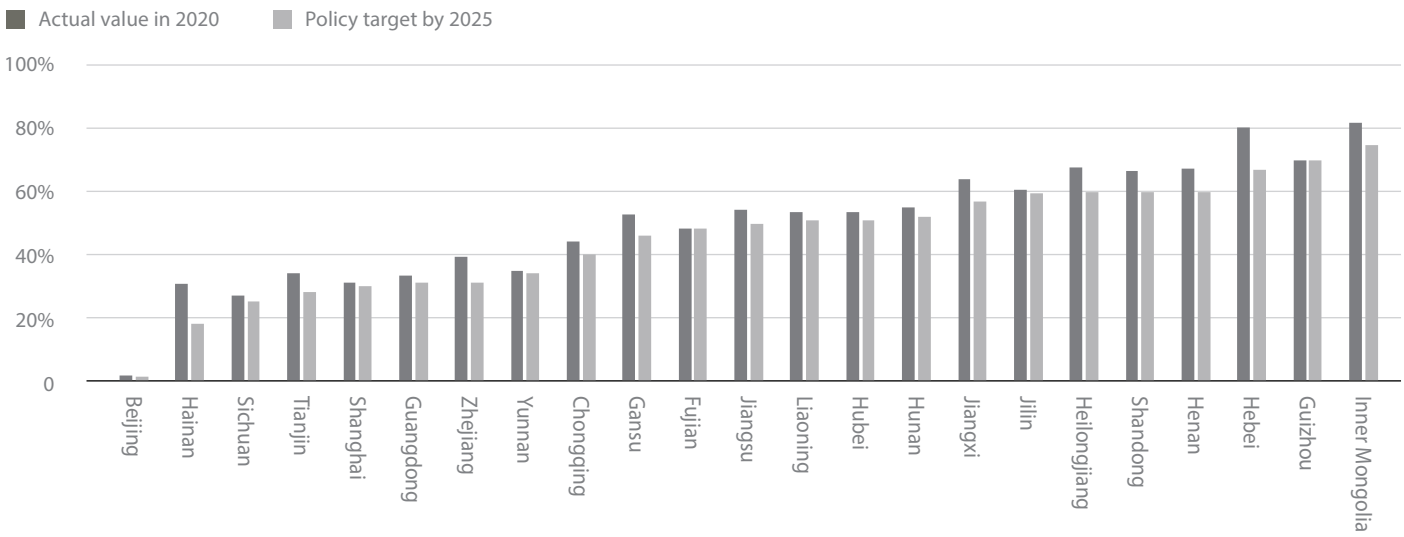


Notes: 1. Shanxi and Hainan announced that they would only "meet the national targets" regarding energy intensity reduction for 2025, so do not appear in the figure.
2. Energy intensity reduction completion data for Hebei, Inner Mongolia and Heilongjiang by 2020 (during the 13th FYP period) is not publicly available.
3. The 13th FYP completion rate for Anhui and Ningxia compare energy intensity reduction rates in 2019 and 2015.

Source: CCNT

4.2.2 Coal Consumption Reduction Targets

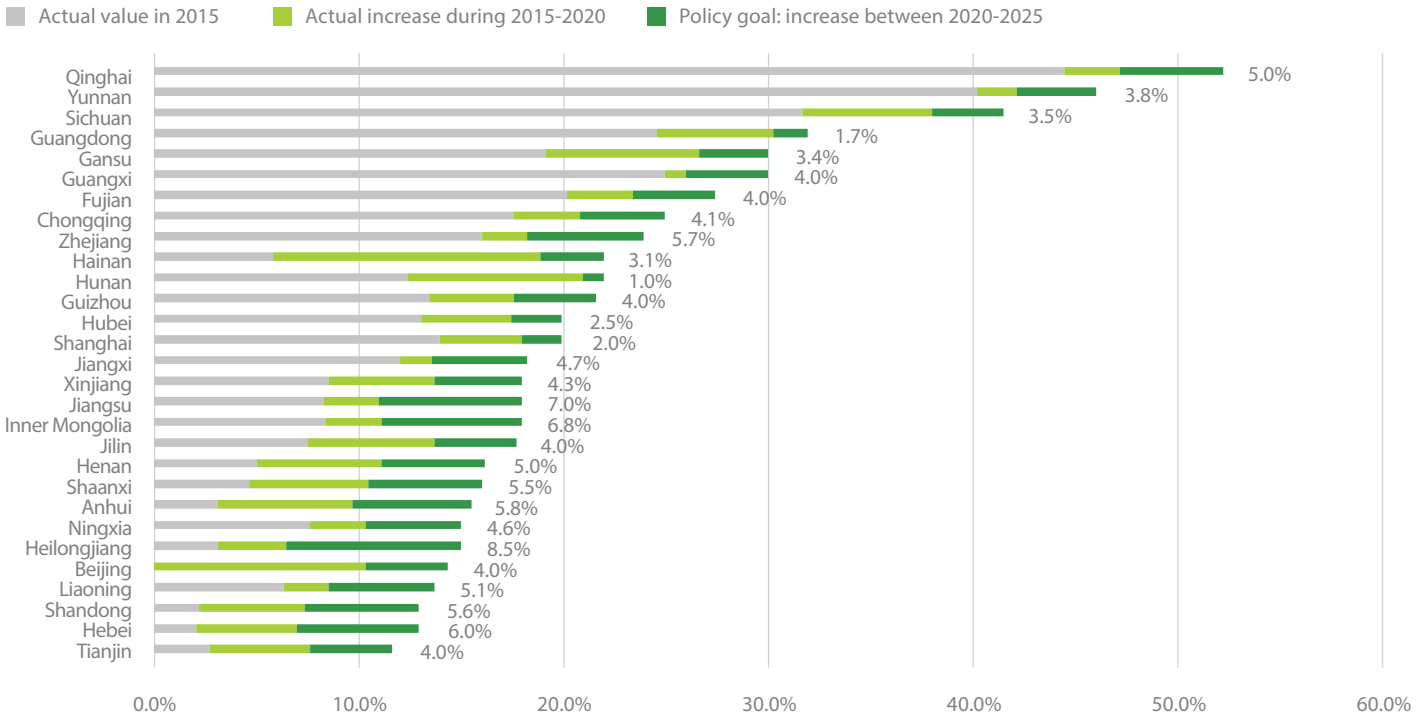
FIGURE 22. Coal consumption share of total energy consumption (2025 policy target vs. 2020 status)



Notes: Due to data availability, the proportion of coal consumption of Guizhou and Heilongjiang in 2020 is the proposed target by relevant FYPs rather than the actual value.
Source: The Energy Development Plan during the 14th FYP of each provincial region, the Ecological and Environment Protection Plan during the 14th FYP of each provincial region and the Implementation Plan for Energy Conservation and Emission Reduction during the 14th FYP of each provincial region.

4.2.3 Renewables share targets

FIGURE 23. Announced new targets for non-fossil fuel share increase (%, new addition) in the 14th FYP period

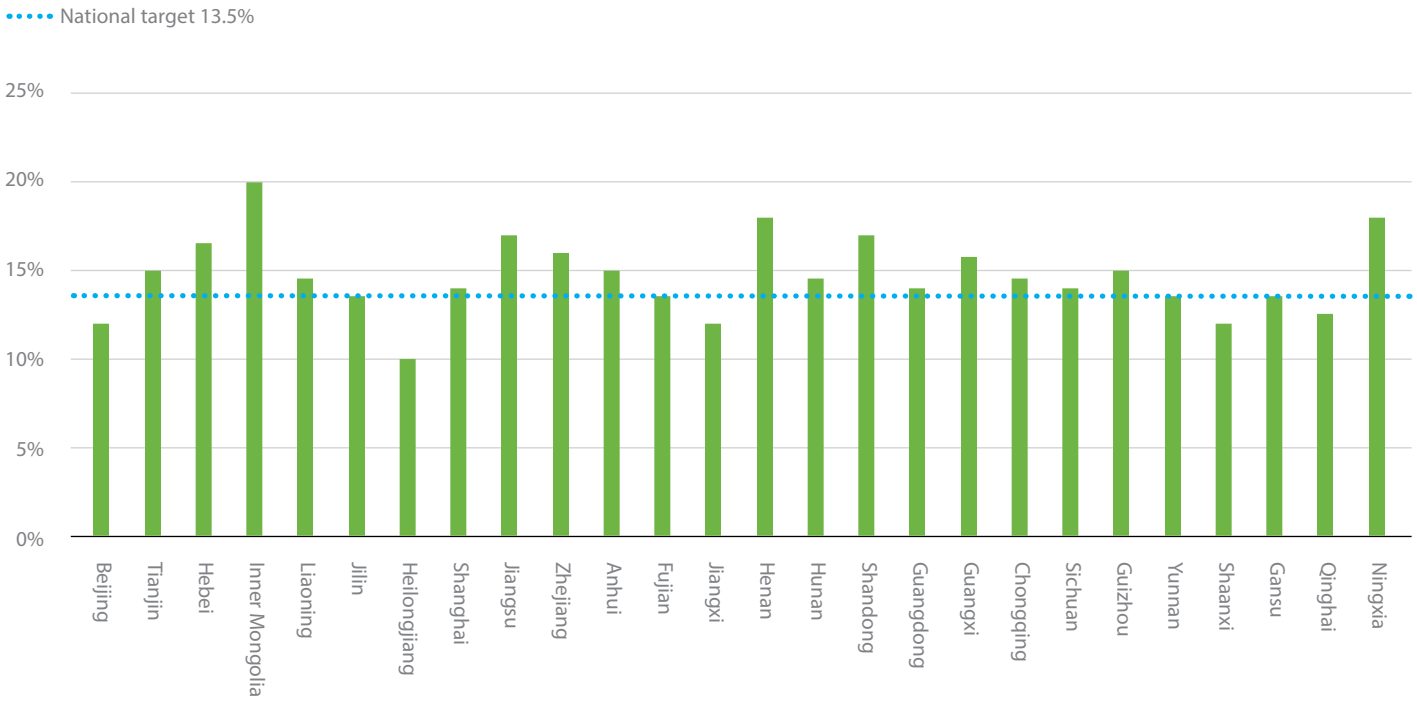


Source: The Energy Development Plan during the 13th and 14th FYP of each provincial region, The Ecological and Environment Protection Plan during the 13th and 14th FYP of each provincial region and the Implementation Plan for Energy Conservation and Emission Reduction during the 13th and 14th FYP of each provincial region.

4.3 Energy Intensity Reduction Targets for Industry Value Added

Seventeen provincial regions set higher targets than the national target.

FIGURE 24. Announced energy intensity reduction per unit of value added in industrial enterprises above a designated size (compared to 2020).



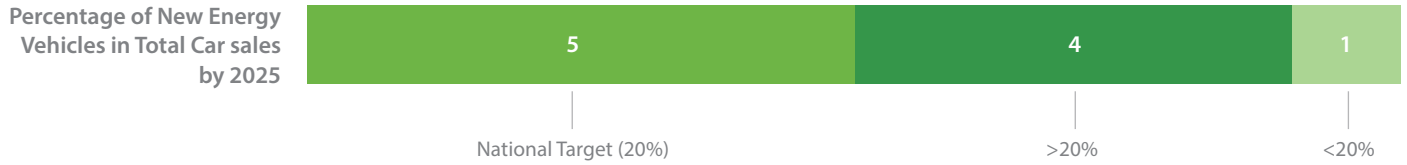
Source: CCNT

4.4 Transport

4.4.1 Percentage of New Energy Vehicle Sale Target in Total Car Sales

Ten provincial regions have already set targets for % of new energy vehicle sales in total car sales by 2025.

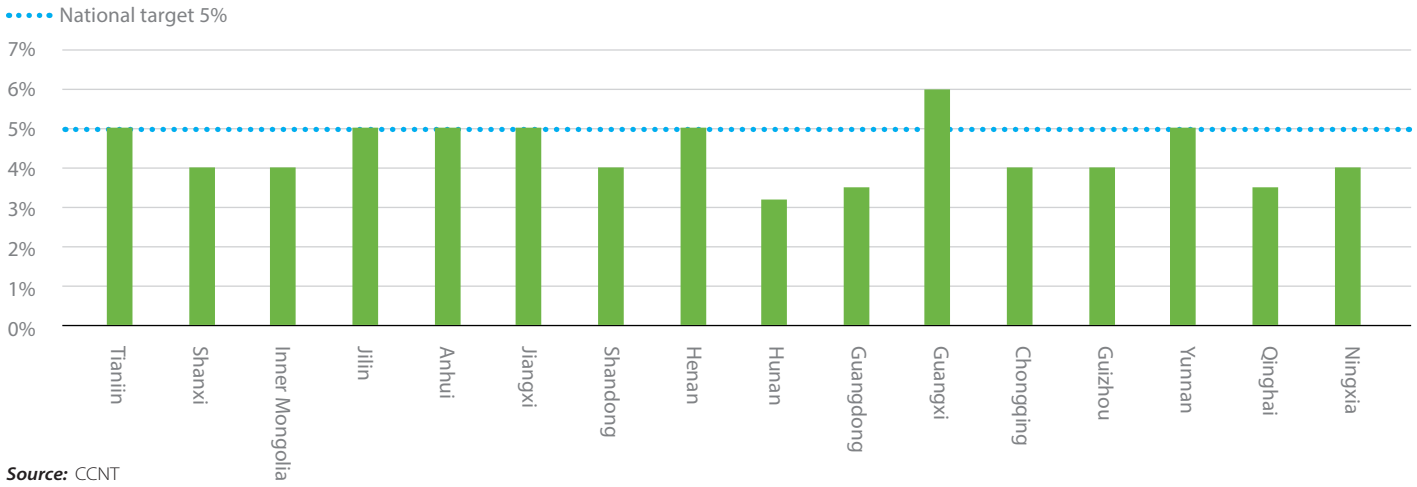
FIGURE 25. Percentage of new energy vehicles in total car sales by 2025



Source: CCNT

4.4.2 Carbon Emissions Reduction Targets in per Unit Transportation Turnover of Operating Vehicles[17]

FIGURE 26. Carbon emissions reduction targets in per unit transportation turnover of operating vehicles by 2025 compared with the 2020 level



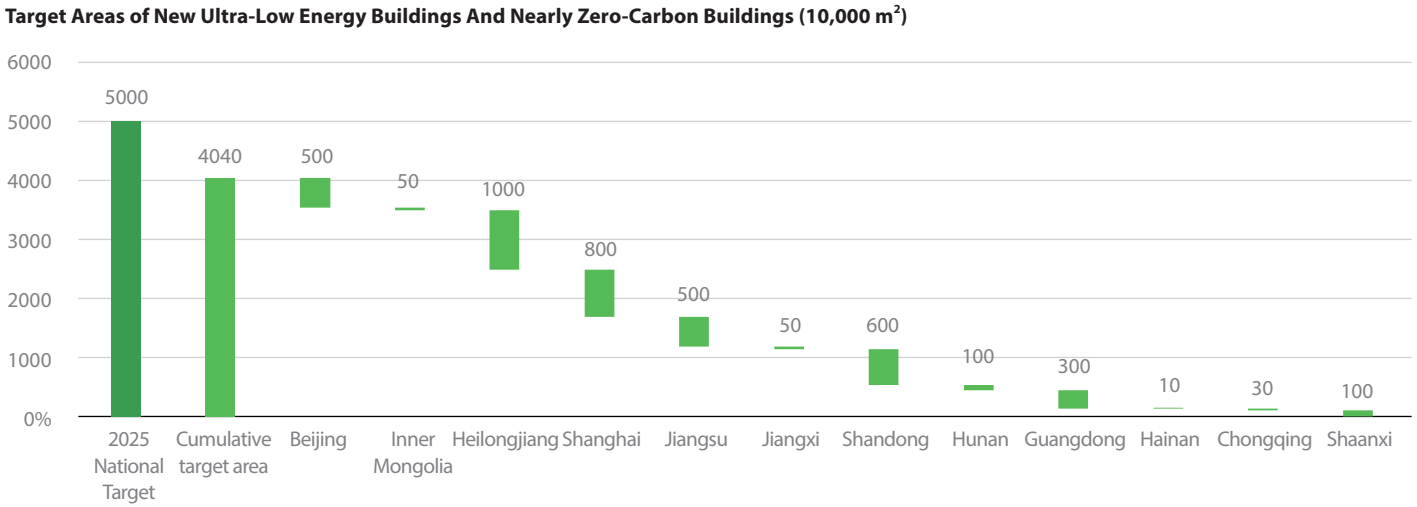
Source: CCNT

4.5 Buildings

4.5.1 Targets for Ultra-low Energy or Nearly Zero Buildings

As of October 2022, 12 provincial regions have proposed targets of newly added building areas for ultra-low energy buildings and nearly-zero energy buildings during the 14th Five-Year Plan period, and the cumulative target area has reached 40.4 million square meters, close to the national target of 50 million square meters by 2025.

FIGURE 27. Announced newly added building areas for ultra-low energy buildings or nearly zero energy buildings (10,000 m^2)



Source: CCNT

17. Han Di. (2022). Subnational progress on decarbonization in transportation. Working paper. Beijing: iGDP.

4.5.2 Building Codes for Ultra-low Energy or Near-zero Buildings

Sixteen provincial regions are developing or have implemented building codes for ultra-low energy buildings and near-zero energy buildings.

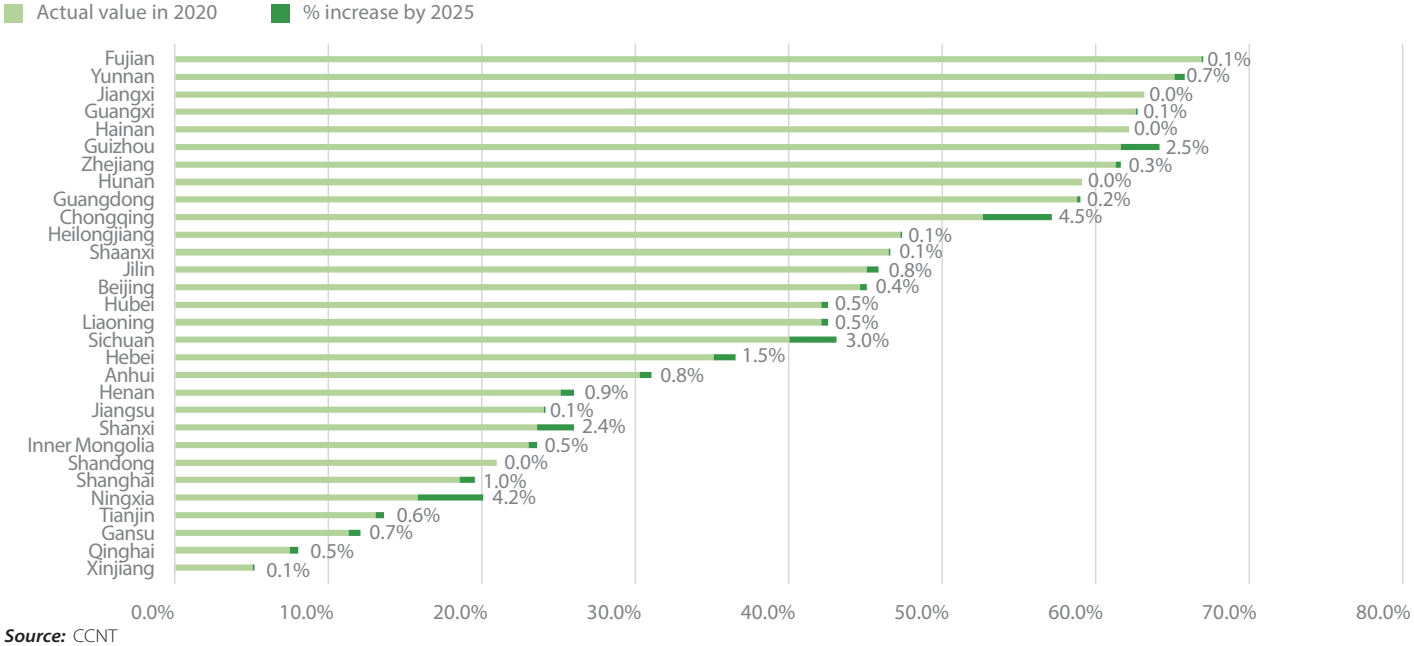
TABLE 6. Building codes for ultra-low energy buildings or near-zero energy buildings by provincial region

PROVINCIAL REGION	SUB-NATIONAL ULTRA-LOW-ENERGY BUILDING CODE IMPLEMENTED	SUB-NATIONAL NEARLY ZERO-ENERGY BUILDING CODE IMPLEMENTED	SUBNATIONAL BUILDING CODES
Beijing	√		Architectural Design Standards for Ultra-Low Energy Residential Buildings
Hebei	√		Evaluation Standards for Passive Ultra-Low Energy Buildings
Liaoning	√		Energy Conservation Design Standards for Ultra-Low Energy Residential Buildings
Heilongjiang	√		Energy Conservation Design Standards for Ultra-Low Energy Residential Buildings in Heilongjiang Province Energy Conservation Design Standards for Ultra-Low Energy Public Buildings in Heilongjiang Province
Shanghai	√		Technical Guidelines for Ultra-Low Energy Buildings in Shanghai (for Trial Implementation)
Jiangsu	√	√	Technical Guidelines for Ultra-Low Energy Residential Buildings in Jiangsu Province (for Trial Implementation) Technical Standards for Nearly Zero-Energy Building Inspection
Anhui	√	√	Energy Conservation Technical Standards for Passive Ultra-Low Energy Civil Buildings Technical Standards for Nearly Zero-Energy Buildings
Fujian	√		Technical Guidelines for Ultra-Low Energy Buildings in Fujian Province (Draft for Comments)
Shandong	√		Energy Conservation Design Standards for Passive Ultra-Low Energy Residential Buildings
Henan	√		Energy Conservation Design Standards for Ultra-Low Energy Public Buildings in Henan Province
Hubei	√		Energy Conservation Design Code for Passive Ultra-Low Energy Residential Buildings
Hunan	√		Energy Conservation Design Standards for Ultra-Low Energy Residential Buildings in Hunan Province
Guangdong	√		Technical Guide for Ultra-low Energy Buildings with Lingnan Characteristics
Sichuan	√		Technical Guide for the Application of Ultra-low Energy Buildings in Sichuan Province (Draft for Comments)
Shaanxi	√		Energy Conservation Design Standards for Ultra-Low Energy Residential Buildings
Xinjiang	√	√	Application Guidelines for Applicable Technologies for Ultra-Low Energy Buildings and Nearly Zero-Energy Buildings in Urumqi

Source: CCNT

4.6 Environment: Forest Coverage

FIGURE 28. Forest coverage (%, increase by 2025)

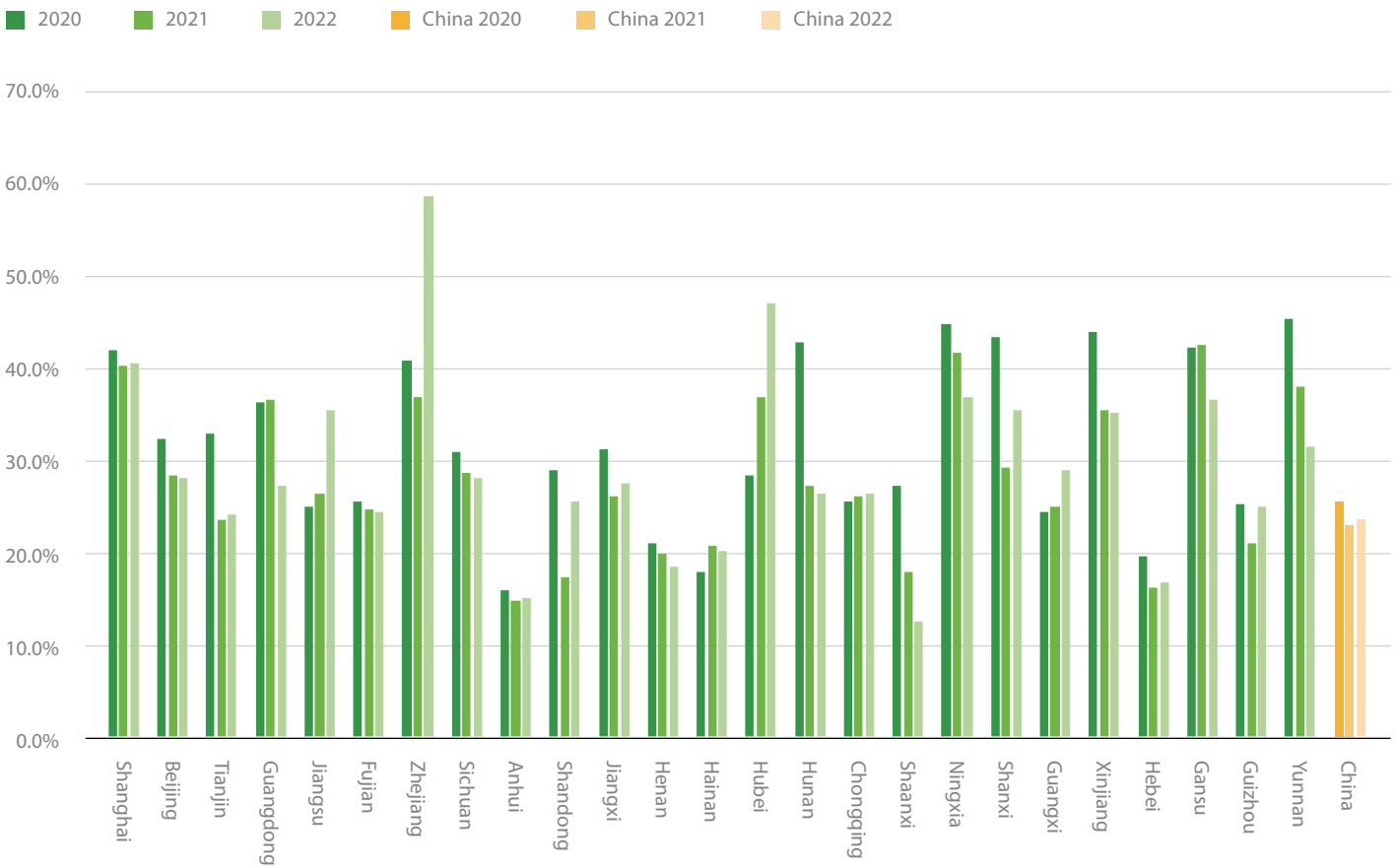


Source: CCNT

4.7 Public Investment

iGDP analysis of the project numbers listed in *Key Construction Projects*[18] or public finance in the past three years (2020-2022)[19] indicates that carbon mitigation projects[20] are still a comparatively small portion of all key projects.

FIGURE 29. Carbon mitigation projects share in key construction projects by provincial region



Source: iGDP calculations.

18. "Key Construction Projects" are projects that are considered main infrastructure development projects, high-tech and key innovation projects, cross-region projects and other projects that have significant social and economic development impacts. These projects are normally the priorities of public investment. http://www.gov.cn/zhengce/2020-12/26/content_5574782.htm

19. Liu Xueye. (2022). "Public Investment Progress Towards Dual-Carbon Goal: A Review of Key Investment Projects of China" draft report, iGDP, 2022

20. Carbon Mitigation Projects here refers to projects that fall under the standards set by the "Common Ground Taxonomy: Climate Change Mitigation", https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/211104-ipsf-common-ground-taxonomy-instruction-report-2021_en.pdf

4.8 Assessing Climate Ambition

TABLE 7. Subnational climate ambitions

● Below national target ● Above national target ● Equal to national target /: N/A

	RATIO OF 14TH FYP TARGETS TO 13TH FYP ACTUAL		COMPARED WITH NATIONAL REQUIREMENT			
	COAL CONSUMPTION SHARE REDUCTION RATE	NON-FOSSIL FUEL SHARE INCREASE RATE	ENERGY INTENSITY REDUCTION RATE	INDUSTRIAL ENERGY INTENSITY REDUCTION RATE	CARBON EMISSION PER UNIT TRANSPORTATION TURNOVER REDUCTION RATE	BUILDING CODES IMPLEMENTED
Beijing	19%	/	●	●	/	●
Tianjin	109%	28%	●	●	●	/
Hebei	180%	35%	●	●	/	●
Shanxi	/	/	/	/	●	/
Inner Mongolia	786%	191%	●	●	●	/
Liaoning	78%	173%	●	●	/	●
Jilin	13%	36%	●	●	●	/
Heilongjiang	532%	119%	●	●	/	●
Shanghai	20%	39%	●	●	/	●
Jiangsu	52%	196%	●	●	/	●
Zhejiang	83%	217%	●	●	/	/
Anhui	/	29%	●	●	●	●
Fujian	6%	108%	●	●	/	●
Jiangxi	178%	259%	●	●	●	/
Shandong	81%	32%	●	●	●	●
Henan	98%	37%	●	●	●	●
Hubei	37%	43%	●	/	/	●
Hunan	98%	7%	●	●	●	●
Guangdong	40%	24%	●	●	●	●
Guangxi	/	385%	●	●	●	/
Hainan	189%	7%	/	/	/	/
Chongqing	99%	105%	●	●	●	/
Sichuan	26%	46%	●	●	/	●
Guizhou	0%	75%	●	●	●	/
Yunnan	11%	181%	●	●	●	/
Shaanxi	/	43%	●	●	/	●
Gansu	101%	32%	●	●	/	/
Qinghai	/	175%	●	●	●	/
Ningxia	/	126%	●	●	●	/
Xinjiang	/	53%	●	/	/	●

5

GAP TOWARDS CARBON NEUTRALITY

Photo by Zoya Loonohod on Unsplash

5. GAP TOWARDS CARBON NEUTRALITY

Questions remain about whether current climate actions can lead provincial regions to peak carbon emissions and reach carbon neutrality, thereby contributing to China's national pledge. iGDP has used the Energy Policy Simulator (EPS) to create models and scenario analyses for China's national-level policies as well as many provincial actions. This report describes EPS models of two provincial regions and a national model to illustrate policy action gaps.

In both the national model and the provincial models, scenarios are based on three sets of policy approaches:

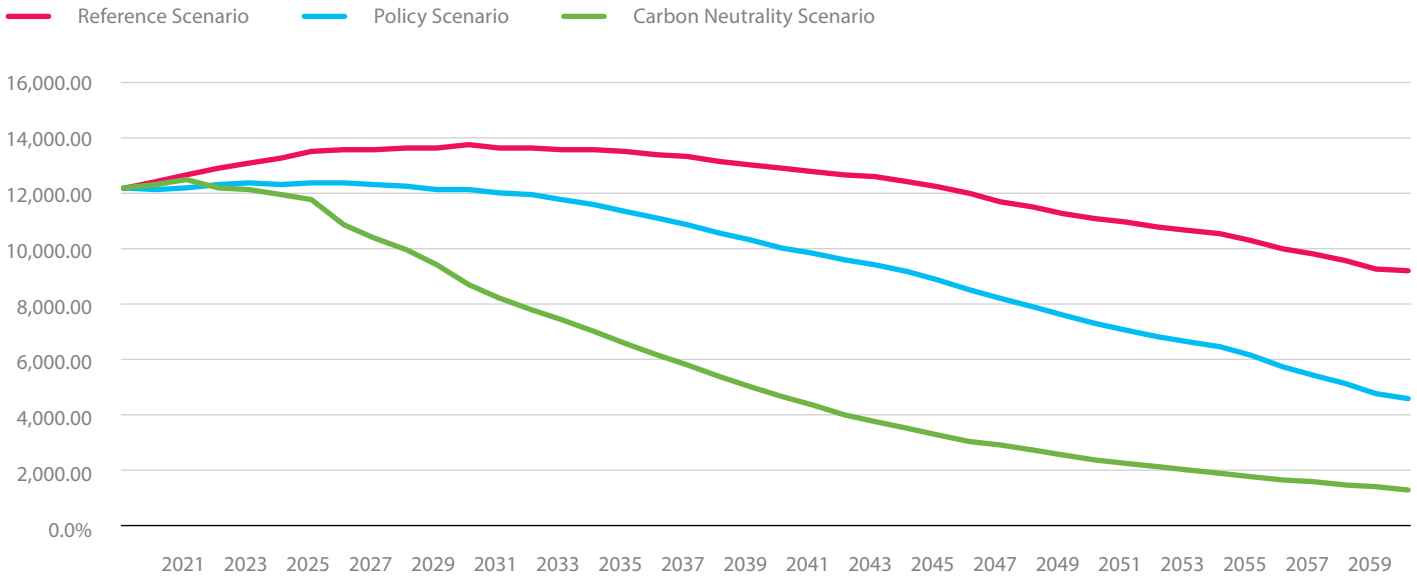
TABLE 4. A brief overview of subnational climate actions for carbon peaking and carbon neutrality

Reference Scenario (Business as Usual)	Assuming all policies until the end of 2020 continue with no enhancement
Policy Scenario (14th FYP Scenario)	All policies and actions proposed for "1+N" system and the 14th FYPs are well-implemented
Carbon Neutrality Scenario	New policies and actions, including best practices from China, the EU Green New Deal, and the US state of California, are added to reach carbon neutrality goals

5.1 National

China would be able to peak in the early part of the 15th FYP period under the 14th FYP Scenario, but a gap would be still be left in meeting the 2060 carbon neutrality goal.

FIGURE 30. CO_2 emissions under different scenarios (no LULUCF, MMT)



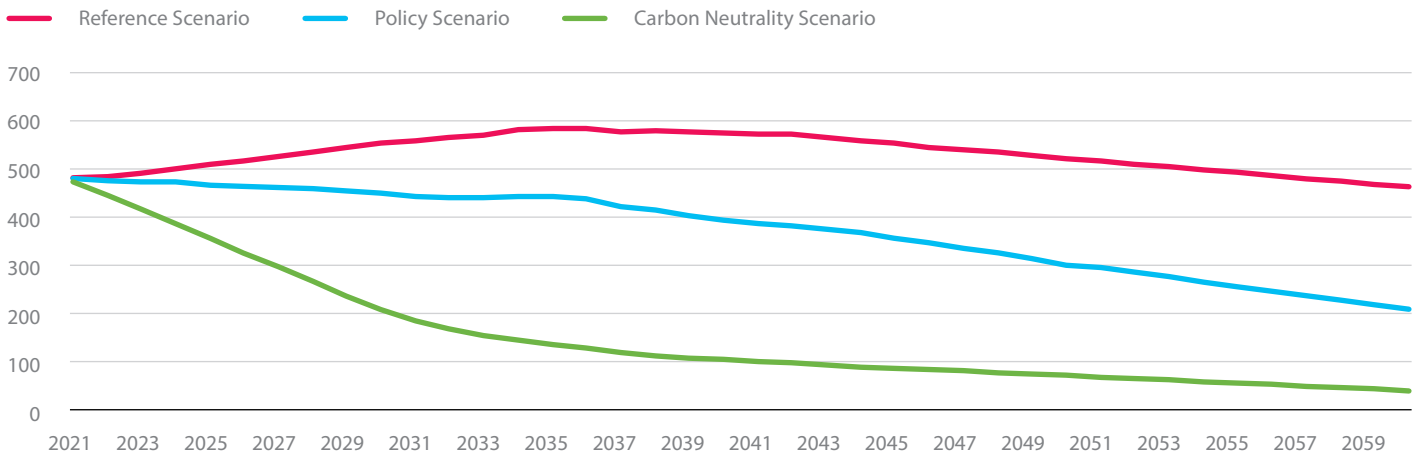
Source: iGDP calculations[21].

21. "EPS-based Research on China's National Dual-Carbon Goal and Pathways", iGDP, April 2022

5.2 Guangdong

Guangdong would be able to peak before 2025 under the 14th FYP scenario and carbon emissions would drop quickly after 2035. However, a gap toward net zero emission in 2060 would still remain.

FIGURE 31. CO_2 emissions in Guangdong Province under different scenarios (MMT)

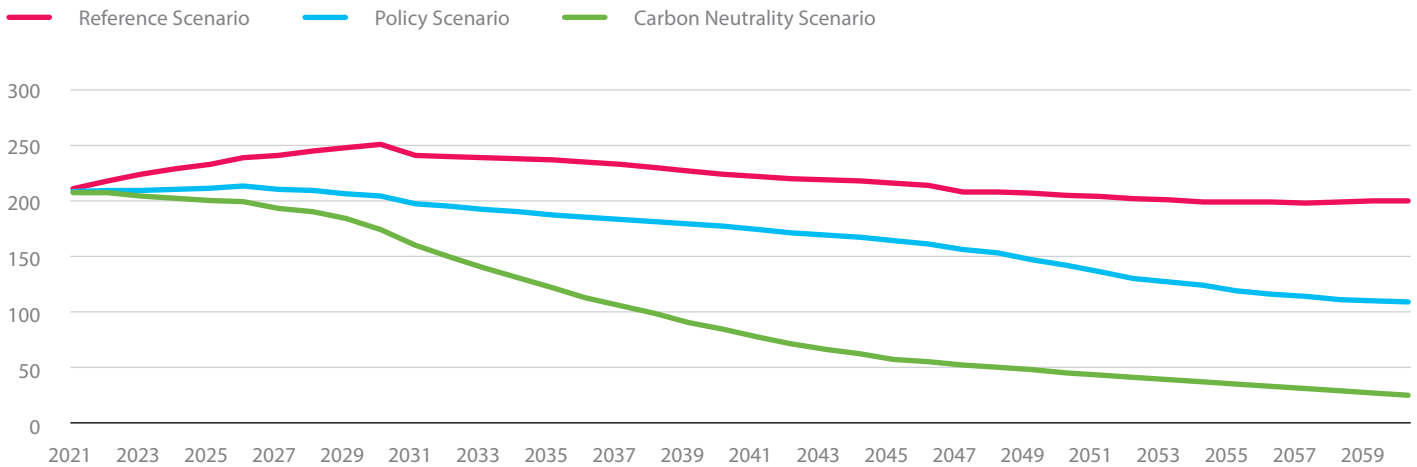


Source: iGDP calculations[22].

5.3 Jiangxi

Under the 14th FYP scenario, Jiangxi would be able to peak around 2030, after which carbon emissions could plateau and gradually drop by around 50% through 2060.

FIGURE 32. CO_2 emissions in Jiangxi Province under different scenarios (MMT)



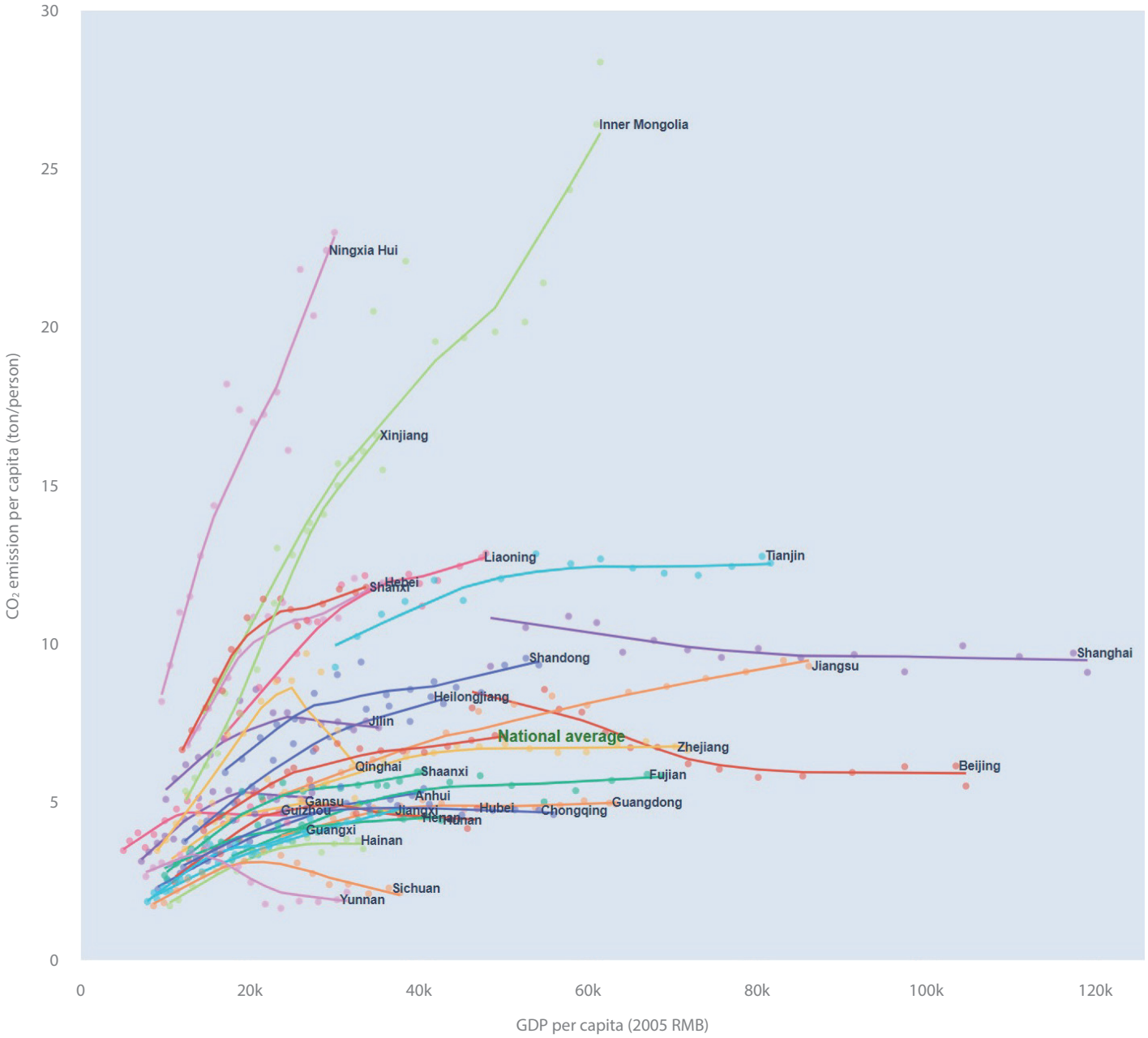
Source: iGDP calculations[23].

22. "EPS-based Research on Guangdong's Dual-Carbon Goal and Pathways", iGDP, July 2022

23. "EPS-based Research on Jiangxi's Dual-Carbon Goal and Pathways"

APPENDIX 1

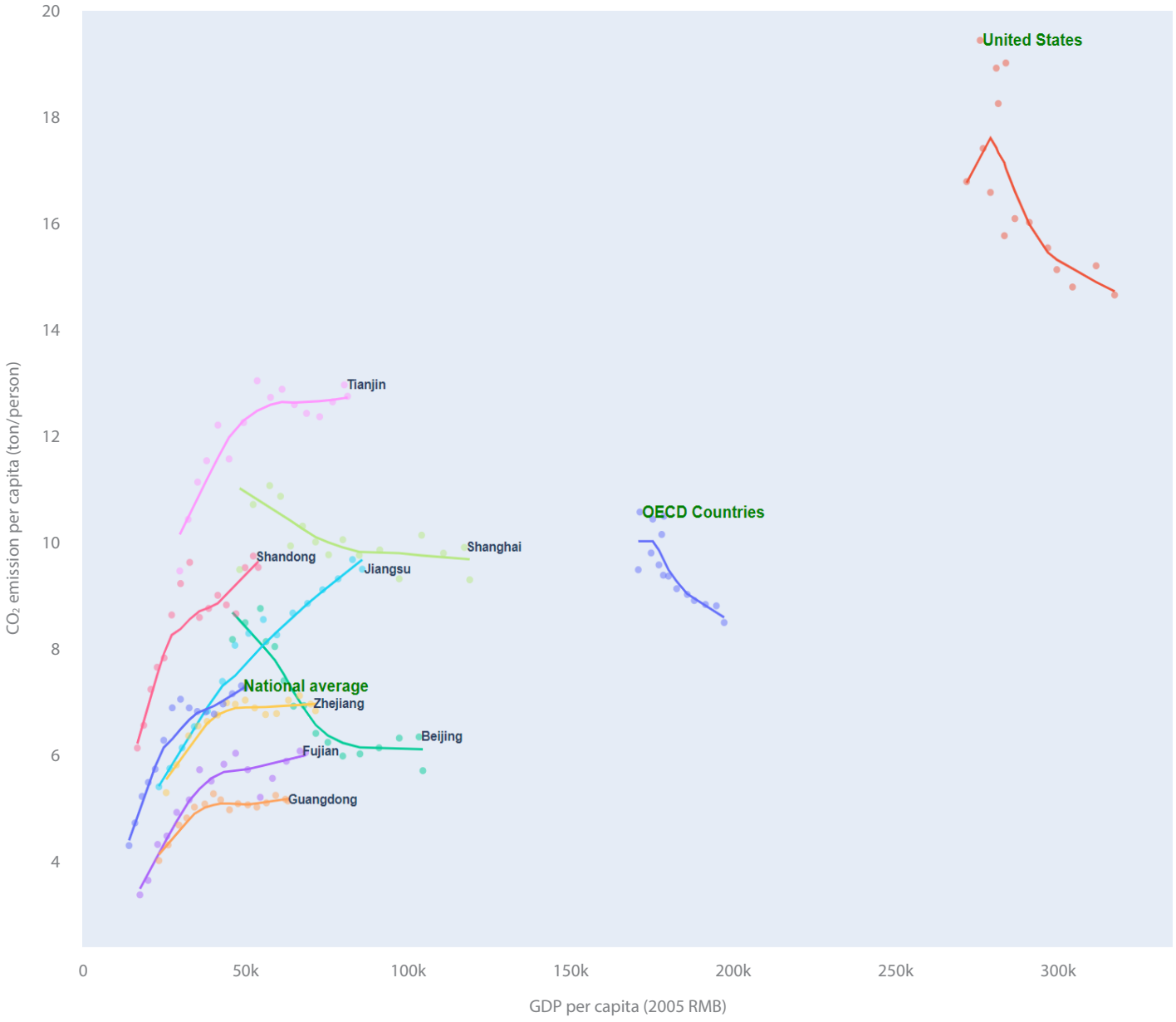
FIGURE A1. Provincial economic development and carbon emissions (2005-2020)[24]



24. Li, Xindi., & Yang, Li. (2022). Decoupling process of economic growth from carbon emissions in China's provincial regions. Working Paper (forthcoming). Beijing. iGDP.

APPENDIX 2

FIGURE A2. Economic development and carbon emissions, comparison between selected provincial regions and developed countries[25]



25. Li, Xindi., & Yang, Li. (2022). Decoupling process of economic growth from carbon emissions in China's provincial regions. Working Paper (forthcoming). Beijing. iGDP.

APPENDIX 3: GLOSSARY

1. **Building energy consumption per capita:** Annual per capita energy consumption in building operations in both residential and commercial buildings. Calculated by iGDP, based on provincial regions' population data from the statistical database of the National Bureau of Statistics. Provincial regions' energy consumption in the building operation phase is calculated based on the energy balance sheets from the *China Energy Statistical Yearbook*.

2. **Carbon intensity:** In this report, carbon intensity refers to CO2 emissions emitted per unit of GDP.

3. **Carbon neutrality scenario:** This scenario simulates a path to reach the carbon neutrality goal when new policies and actions, including best practices from China, the EU Green New Deal, and the US state of California are adopted. It also draws on studies from authoritative sources. See Figure 31, Figure 32 and Figure 33 for CO_2 emission lines in this scenario.

4. **Dual-carbon goals:** China's two climate goals - one to peak carbon emissions before 2030, and the other to become carbon neutral by 2060.

5. **Energy intensity:** Total energy consumption per unit of GDP. Energy consumption by provincial regions is calculated by iGDP based on energy balance sheets from the *China Energy Statistical Yearbook*. GDP data is drawn from the statistical database of the National Bureau of Statistics.

6. **Energy Policy Simulator (EPS):** Energy Policy Simulator (EPS) is a is free and open-source computer model developed by Energy Innovation LLC. EPS allows the user to control numerous, different policies that affect energy use and emissions in various sectors of the economy. The model includes every major sector of the economy: transportation, electricity supply, buildings, industry, agriculture, and land use.

7. **FYP (Five-Year Plan):** The comprehensive plan for social and economic development developed every five years by the Chinese government. Both central and subnational governments release FYPs.

8. **Industrial value added:** Gross output of all production activities of industrial enterprises (consisting of sales or receipts and other operating income and taxes) after deducting the value of intermediate inputs and purchased labor services consumed or transferred in the production process, during a reporting period. Industrial production activities include both industry and construction. Industry value added data is drawn from the statistical database of the National Bureau of Statistics.

9. **Key construction projects:** Projects that are considered main infrastructure development projects, high-tech and key innovation projects, cross-region projects and other projects that have significant social and economic development impacts. These projects are normally the priorities of public investment.

10. **Nationally Determined Contribution (NDC):** National climate action plans for climate change mitigation and adaptation that are submitted to the UNFCCC every five years under the Paris Agreement.

11. **Non-fossil fuel share target:** The proportion of non-fossil fuel consumption in total energy consumption in a given year. Policy targets in this report were collected from provincial climate plans under the 14FYP.

12. **Policy scenario:** Also known as 14th Five-Year Plan policy scenario. In this scenario, all policies and actions proposed under the "1+N" system and the 14th Five-Year Plan are well implemented. This scenario also draws on studies from authoritative sources related to China's low-carbon pathways. When applying the EPS model to provincial regions, if the region has not published its own sectoral FYP, iGDP sets values from national sectoral FYP documents in simulations. See Figure 31, Figure 32 and Figure 33 for CO_2 emission lines in this scenario.

13. **Provincial regions:** In this document, 'provincial regions' refers to provincial administrative regions, including China's 23 provinces, 4 municipalities, and 5 autonomous regions.

14. **Renewable energy (RE):** The RE installation data used in this report is gathered from provincial regions' *Renewable Energy Development Plan during the 13th FYP* and *Renewable Energy Development Plan during the 14th FYP.* Renewables in the figure include wind, solar, hydropower and biomass.

15. **Reference scenario:** Also known as Business As Usual (BAU). When forecasting emissions and potential reductions in the EPS model, this scenario assumes all policies till the end of 2020 continue with no enhancement. See Figure 31, Figure 32 and Figure 33 for CO_2 emission lines in this scenario.

16. **Total CO_2 emissions:** In this report, total CO_2 emissions refers to energy-related CO_2 emissions estimated based on energy balance sheets from the *China Energy Statistical Yearbook*.

17. **Total energy consumption:** In this report, the total energy consumption that is used to calculate energy intensity, building energy consumption per capita, and transportation energy consumption per capita is based on iGDP estimates. It is calculated using the coal-fired power generation method (*发电煤耗法*, electricity is converted to standard coal based on the average coal consumption of coal-fired power generation in a given year). Data is based on energy balance sheets from the *China Energy Statistical Yearbook*.

18. **Transportation energy consumption per capita:** Annual per capita energy consumption in the transportation sector, including both passenger traffic and freight traffic. Calculated by iGDP, based on provincial regions' population data from the statistical database of the National Bureau of Statistics. Provincial regions' energy consumption in the transportation sector based on energy balance sheets from the *China Energy Statistical Yearbook*.

19. **Waste generated per person:** Waste generated per person per year in kilograms. Calculated by iGDP, based on provincial regions' population data from the statistical database of the National Bureau of Statistics. Provincial regions' annual amount of waste generated is drawn from respective *Statistical Yearbooks.*

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Xi Xiping, Deputy Director of Industry Division, Jiangxi Academy of Sciences
Qin Yan, Director of the Green Low Carbon Strategy Research Center, Shanxi Coshare Innovation Institute of Energy & Environment

Carbon Neutrality Tracker

ABOUT CCNT

China Carbon Neutrality Tracker (CCNT) is an online database and interactive platform that tracks China's national and sub-national carbon neutrality actions by collecting and sorting publicly-available policy documents with an impact on GHG emissions. It offers an overview and structural classification of China's climate actions and serves as a comprehensive compendium of the specific policies and actions of various government departments and key non-state entities. CCNT includes all policies and actions with a climate impact and classifies them by region and sector. It gathers policy information primarily from authoritative government sources at national, regional, provincial and municipal levels. CCNT currently has national and provincial webpages. The database is continuously updated to include new provincial and city-level actions, and CCNT regularly issues short policy briefings.

ABOUT IGDP

innovative Green Development Program is a non-profit consultancy that focuses on green and low-carbon development. It works to strengthen China's low-carbon environmental policy design and implementation through interdisciplinary, systematic and empirical research. We work with all stakeholders to promote a zero-emissions future and tell the story of China's green and low-carbon development. iGDP's research, consulting and communications focus on the following areas:

- Energy Transition
- Sustainable Cities
- Green Economics
- Strategic Communication
- Climate Strategies

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