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China's '1+N' Policy Framework across Provincial Governments

Implementation, Progress and Challenges

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This study discusses China's '1+N' Policy Framework and examines how provincial governments are executing it. The paper begins with an overview of the '1+N' Policy Framework, an examination of Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality and a detailed analysis of the Action Plan for Carbon Dioxide Peaking Before 2030. Subsequently, it evaluates China's progress in meeting the targets outlined in the Action Plan while examining the country's overall investments and achievements in different renewable energy sectors.

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Executive Summary

This study discusses China's '1+N' Policy Framework and examines how provincial governments are executing it. The paper begins with an overview of the '1+N' Policy Framework, an examination of Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality and a detailed analysis of the Action Plan for Carbon Dioxide Peaking Before 2030. Subsequently, it evaluates China's progress in meeting the targets outlined in the Action Plan while examining the country's overall investments and achievements in different renewable energy sectors.

An analysis of 14 provinces' carbon neutrality action plans alongside an assessment of nationwide progress in decarbonisation efforts, reveals major challenges in the path to achieving carbon neutrality. Between 2020-2023, energy intensity decreased by only 2%, well below the targeted 13.5% (from 2020 levels) reduction by 2025. Carbon intensity also remains far from the 2025 goal of 18% reduction (from 2020 levels), with only a 4.6% cut achieved as of 2023. Despite the action plan calling for strict control and gradual reduction of coal consumption, coal still dominates China's energy mix at 61% (in 2021), while its share of total energy consumption was 55.3% in 2023. In fact, 114 GW of new coal capacity was approved in 2023 alone. These gaps underscore the difficulties China faces in transitioning from coal and aligning provincial actions with national carbon neutrality objectives.

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I. Introduction

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Despite being the world's largest[1] emitter of greenhouse gases, China, until mid-2007, placed minimal emphasis[2] on addressing climate change within its local governance structures. However, a shift occurred in the early 2007, with the central leadership establishing the National Leading Group on Climate Change, Energy Conservation, and Emission Reduction.[3] This development spurred provincial governments to create their own dedicated bodies to tackle climate challenges. In response, numerous provinces formulated action plans for mitigating and adapting to climate change, with some initiating and financing research programmes to better understand and address climate-related issues within their jurisdiction.

There were several factors that motivated the Chinese leadership to take more proactive action. First, there was increasing public awareness of and dissatisfaction over environmental issues like air pollution, water scarcity, and climate impacts, such as extreme weather events.[4] This created pressure for the government to take stronger action. Second, China aimed to position itself as a responsible global power and leader in tackling climate change, especially after surpassing the U.S. as the world's largest greenhouse gas emitter around 2007.[5] Third, as the country's renewable

energy sector experienced rapid growth, aligning climate action with the development of this industry presented significant economic opportunities, including the creation of green jobs and the expansion of exports.[6] Finally, climate change was mainstreamed and integrated into China's core economic development strategies, exemplified by the 12th Five-Year Plan (2011-2015), which set specific targets[7] for reducing energy intensity and increasing the use of renewable energy.[8]

Since mid-2007, the Chinese government has passed several key laws and issued a series of policies to tackle climate change.[9] However, a significant development in China's climate change agenda is its '1+N' Policy Framework[10], which consists of a Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality and an Action Plan for Carbon Dioxide Peaking before 2030.

II. Overview of China's '1+N' Policy Framework

In October 2021, the Chinese central government issued a *working guidance*[11] outlining the country's strategy to achieve its ambitious *dual carbon goals* of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060. This directive was accompanied by an *action plan*[12] aimed at peaking carbon dioxide (CO_2) emissions prior to 2030. Together, these documents established the framework for China's '1+N' Policy Framework.[13] Notably, there are three *most relevant* targets for China's dual-carbon agenda: carbon intensity, total energy consumption and energy intensity.

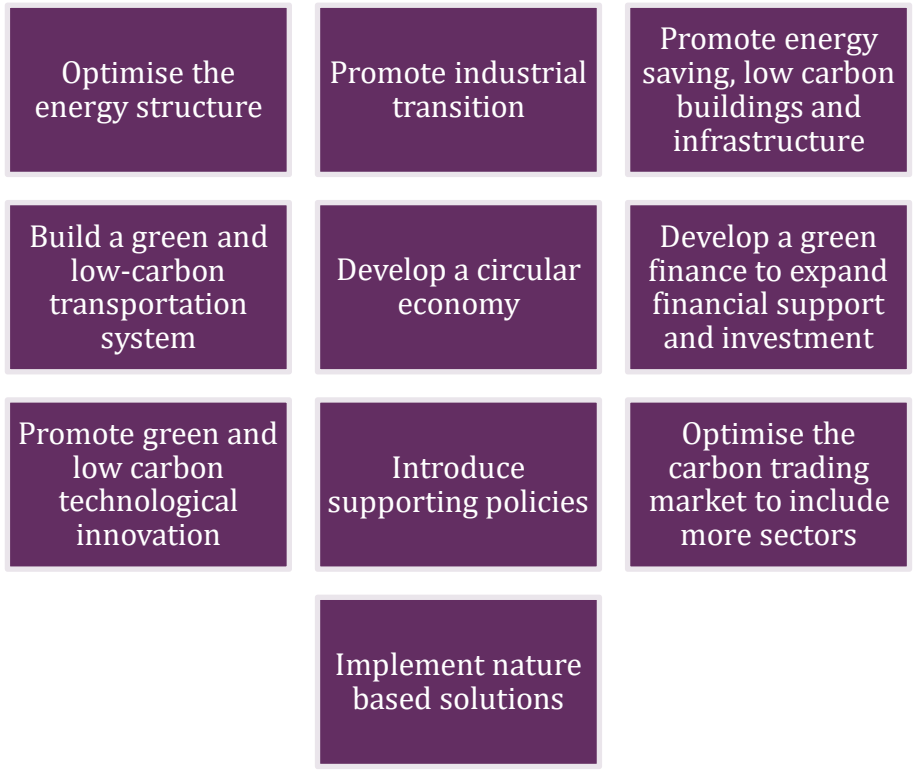
Carbon Intensity refers to the amount of carbon di-oxide (CO) emissions

Energy Intensity is the energy used per unit of GDP

Dual carbon goals aims to peak carbon dioxide emissions by 2030 and achieving carbon neutrality before 2060

Xie Zhenhua, China's former climate envoy, explains[14] that the '1' refers to the 'guiding opinions' that set out the overarching principles of all forthcoming policies that aim to facilitate China's peaking and neutrality goals. The 'N' includes a 'carbon peaking action plan' — a 10-point plan that sets out Beijing's expectations on the actions that key sectors are required to take to peak emissions. It covers actions from all major emitting sectors (energy, industry, infrastructure, and transport) and other key policy areas

for climate-related action (circular economy, technology, finance, economic policies, carbon trading, and nature-based solutions).[15]



10-point carbon peaking action plan

The next section examines the specifics of the 'Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality, ' a key document that represents the '1' in the '1+N' framework.

a. Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality

The working guidance[16] highlights the importance of optimising regional development, promoting green production and consumption, and restructuring industries towards cleaner and more sustainable practices. Key sectors, such as energy, steel, petrochemicals, and transportation, are targeted for clean energy adoption and innovation in low-carbon processes. The strategy also focuses on developing a clean, efficient energy system, with strict controls on fossil fuel consumption and an emphasis on renewable energy sources. The document also sets out clear objectives for the years 2025, 2030, and 2060, as summarised in the table below.

Year	Targets
2025	• Cut energy consumption per unit of GDP by 13.5%from the 2020 level • Reduce carbon dioxide (CO_2) emissions per unit of GDP by 18% • Increase the proportion of non-fossil energy consumption to around 20% • Achieve a forest coverage rate of 24.1% • Expand forest stock volume to 18 billion cubic meters
2030	• Slash CO_2 emissions per unit of GDP by over 65% compared to 2005 levels • Raise the share of non-fossil energy consumption to approximately 25% • Install more than 1200 gigawatts of wind and solar power capacity

2060	• Over 80% of energy consumption from non-fossil sources • Achieve carbon neutrality • Make significant progress in ecological civilisation

Additionally, the working guidance calls to construct a low-carbon transportation system, enhance green urban and rural development, and strengthen research in green technologies. Efforts to improve carbon sink capacity, promote green international trade, and refine laws, regulations, and policy mechanisms are also detailed. Centralised leadership and effective coordination are underscored as crucial for the successful implementation of these initiatives, aiming for significant reductions in CO_2 emissions and energy consumption, while advancing towards carbon neutrality and ecological sustainability. To complement the overarching working guidance, the central government also released a more targeted policy document, the Action Plan for Carbon Dioxide Peaking Before 2030, which outlines specific measures and goals to enable the country to reach its carbon emissions peak by 2030.

b. The Action Plan

The action plan[17] outlines two main objectives for China's transition towards a low-carbon economy:

1. "Over the 14th Five-Year Plan period, notable progress will be made in adjustment and optimization of the industrial structure and the energy mix. Energy efficiency will be largely improved in key industries, strict controls will be placed upon coal consumption growth, construction of new electric power systems based upon new energy resources will speed up, new progress will be made in the R&D and broad application of green and low-carbon technologies, environment-friendly production modes and living patterns will become widespread, and further improvement will be made in the policy framework for green, low-carbon and circular development. By 2025, the share of non-fossil fuels in total energy consumption will reach around 20%, while energy consumption and carbon dioxide emissions per unit of GDP will drop by 13.5% and 18%, respectively, compared with 2020 levels, laying a solid foundation for carbon dioxide peaking".
2. "During the 15th Five-Year Plan period, major progress will be made in adjustment of the industrial structure, a clean, safe, efficient and low-carbon energy system will be preliminary established, low-

carbon development models will have largely taken shape in key fields, energy efficiency among China's key energy consumption industries will reach advanced international standards, non-fossil fuels will account for a larger share of energy consumption, coal consumption will gradually fall, crucial breakthroughs will be made in green and low-carbon technology, the public will opt for environment-friendly living patterns, and formulation of the policy framework for green, low-carbon and circular development will be mostly complete. By 2030, the share of non-fossil energy consumption will reach around 25%, and carbon dioxide emissions per unit of GDP will have dropped by more than 65% compared with the 2005 level, successfully achieving carbon dioxide peaking before 2030".

According to the Action Plan, the following are the key targets for the years 2025, 2030, and 2060:

Year	Targets
By 2025	• Energy consumption per unit of GDP will be lowered by 13.5% from the 2020 level • CO_2 emissions per unit of GDP will be lowered by 18% from the 2020 level • The share of non-fossil energy consumption will reach around 20% • The forest coverage rate will reach 24.1% • The forest stock volume will rise to 18 billion cubic meters
By 2030	• CO_2 emissions per unit of GDP will drop by more than 65% compared with the 2005 level • The share of non-fossil energy consumption will reach around 25% • 'China's total installed capacity of wind power and solar power will reach over 1,200 gigawatts • The forest coverage rate will reach about 25% • The forest stock volume will reach 19 billion cubic meters

By 2060	• China aims to have fully established a clean, low-carbon, safe and efficient energy system. • Energy efficiency will reach an advanced international level.

The action plan also outlines a strategy to achieve carbon neutrality through a series of targeted actions. These include transitioning to green and low-carbon energy sources, enhancing energy efficiency and reducing carbon emissions across various sectors, and specifically aiming for carbon dioxide emission peaks in the industrial sector and within urban-rural development areas. The plan also promotes green and low-carbon transportation methods, the adoption of circular economy practices to mitigate carbon emissions, and the advancement of green and low-carbon technological innovations. Additionally, it focuses on consolidating and enhancing carbon sinks, fostering a green and low-carbon society, and encouraging all regions to achieve carbon dioxide emission peaks in a hierarchical and orderly manner. The next section evaluates the country's progress towards these goals and compares the actual achievements against the initial targets.

III. Evaluating the progress of targets in the Action Plan

As of 2024, progress[18] towards these targets has been mixed.[19] Energy intensity reduction and the control of total energy consumption have proven to be challenging, with China needing to significantly cut energy intensity in the following years to meet its 2021-2025 target. However, there has been notable growth in renewable energy installations, particularly in solar PV capacity, which aligns with the plan's objectives.[20]

The table below provides an assessment comparing the targets set in the Action Plan and the progress made as per the latest available data:

Target Category	**Specific Targets (by 2030 unless specified)**	**Progress**
Energy Intensity	Reduce energy intensity by	During 2020-2023, energy intensity declined[22] by 2%

	• 13.5% in 2025 (from the 2020 level) • 2.5% in 2024[21]	Energy intensity decreased[23] by 26.4 % from 2013-2023
Carbon Intensity	Reduce carbon intensity by • 18% in 2025 (from the 2020 level) • 65% in 2030 (from the 2005 level) • 3.9% in 2024[24]	During 2020-2023, carbon intensity fell[25] by 4.6% But carbon intensity decreased[26] by more than 51% (from 2005 levels)
Non-Fossil Fuel Energy	The share of non-fossil energy consumption will reach around 25%	By 2022, the share of non-fossil energy in China's total energy consumption reached[27] 17.5 per cent The target for 2023 was 18.3%

Share of energy consumption growth met by renewables	Above 50% (by 2025)	30% (in 2020-23), down[28] from 42% (in 2016-20)
Wind and Solar Power	Over 1200 gigawatts total installed capacity for wind and solar power	By 2023, China's installed[29] solar and wind power capacity reached 609 GW and 441 GW, respectively
Coal Consumption	Strict controls on the growth of coal consumption	China consumed approximately 3.16 billion metric tons of coal in 2023 Coal's share[30] of total energy consumption was 55.3% in 2023 China approved 114 gigawatts (GW) of coal power in 2023, up from 104 GW in 2022

Forest Coverage and Stock Volume	The forest coverage rate will reach about 25% The forest stock volume is expected to reach 19 billion cubic meters.	As of 2023, China's forest coverage rate[31] is approximately 24.02% The forest stock volume[32] has surpassed 17.5 billion cubic meters.

IV. Analysing Provincial Plans

While the provincial action plans align with national carbon peaking and neutrality goals, they adopt differentiated strategies tailored to local economic structures, resource endowments, and emission profiles. For example, Shanxi Province, a major coal producer, emphasises reducing energy consumption in the coal industry and increasing the utilisation of coal mine gas. On the other hand, Jiangsu Province, a manufacturing hub, focuses on establishing a carbon footprint management system for products, aiming to complete carbon footprinting for 400 products by 2025 and 1,000 products by 2030. This differentiated approach allows provinces to prioritise the most impactful measures based on their local context.

Most provincial plans emphasise production-side measures, such as improving industrial energy efficiency, phasing out outdated production capacity, upgrading to cleaner production processes, and shifting the energy mix from coal to non-fossil sources. However, there is comparatively less focus on curbing consumption-based emissions through lifestyle changes, demand-side management, and circular economy initiatives. But on the whole, provincial plans are light on policies to encourage sustainable consumption, reduce waste, promote a sharing economy, and shift consumer behaviours in a low-carbon direction.

Technological innovation is a key theme across many provincial action plans. Shandong Province aims to cultivate 1,000 high-tech enterprises in the green and low-carbon field by 2025, creating five to eight green technology industry clusters. Similarly, Liaoning Province targets breaking through 100 green and low-carbon core technologies in key industries by 2025, completing ten major scientific demonstration projects, and constructing 20 key laboratories and innovation centres.

The action plans recognise the importance of policy instruments, financial incentives, and market-based approaches in facilitating the low-carbon transition. For example, Ningxia Hui Autonomous 'Region's plan specifies the overall requirements for financial support to back the work of carbon peaking and carbon neutrality, the key directions and areas of support, financial policy measures, and organisational safeguards. Zhejiang 'Province's plan for the building materials industry emphasises the importance of policy coordination, financial support, public opinion guidance, and enforcement mechanisms to ensure effective implementation.

Finally, some plans, such as those from the Ningxia Autonomous Region and Jiangxi Province, emphasise the need for regional cooperation and the establishment of low-carbon pilot projects. These pilots can serve as testing

grounds for innovative approaches and help identify best practices that can be scaled up nationwide. They focus on selecting representative cities, parks, villages, communities, public institutions, and enterprises within the regions for green and low-carbon development, resource conservation, and carbon sink consolidation.

V. Challenges in China's Journey to Carbon Neutrality

In China, the contribution of investment and net exports, which are both more energy-intensive compared to household consumption, to GDP growth increased from just over 40% during the period of 2015-2019 to 45% in the period of 2019-2023.[33] Ongoing investments in infrastructure, manufacturing capacity, and real estate have been key drivers of growth, thereby increasing energy intensity. In 2023, China's CO_2 emissions increased by 565 million tonnes (year-on-year), reaching 12.6 billion tonnes. However, clean energy growth was insufficient to keep pace with surging energy demand, which increased by around 6.1% — a percentage point more than GDP. Since the pandemic, China's GDP growth has been predominantly driven by energy-intensive sectors: from 2015 to 2019, services contributed two-thirds of GDP growth, but this share dropped to about half from 2019 to 2023. In addition to these structural factors, cyclical elements also contributed to the rise in emissions. Following the lifting of COVID-19 lockdowns, highway passenger kilometres increased by nearly 50%, and aviation passenger kilometres surged by over 160% in 2023, although both remained below 2019 levels. This cyclical recovery added approximately 100 million tonnes to China's emissions. Additionally, a

shortfall in hydropower generation further increased emissions by 115 million tonnes.

China faces significant challenges in its journey toward achieving carbon neutrality by 2060, a goal that requires a drastic reduction in carbon emissions within a relatively short time frame.[34] Unlike the European Union and the United States, which peaked in their carbon emissions in 2006 and 2007, respectively, China has yet to reach its emissions peak. This delay presents a unique challenge for China, as it compresses the timeline for the transition to carbon neutrality into just 30 years, compared to the 40-60 years available to the EU and the US, respectively. With a population of over 1.4 billion people, China also has to achieve carbon neutrality on a much larger scale than the EU or US.

Meeting the massive energy demands of such a large population while transitioning away from fossil fuels is an immense undertaking. In November 2014, the approval authority for coal-fired power plants in China was decentralised from the central government to provincial governments, simplifying the approval process and shortening the approval time.[35] This devolution of authority increased the risk of overinvestment, as local officials, who have historically been evaluated based on regional economic growth, could realise short-term political benefits by approving coal projects, even if they led to an oversupply of coal-fired electricity. By the time the oversupply became apparent, the approving official might have

been promoted or transferred to another province. This created a bias towards approval, even when the approved plants were likely to crowd out green energy and reduce the utilisation of existing coal plants.

Even today, transitioning away from coal remains a significant challenge in China for several reasons. Firstly, China's heavy industrial sectors, such as steel, cement, and chemicals production, are deeply reliant on coal for energy and as a key input. They also wield substantial political influence and are major employers in China, making it difficult for the government to push for a rapid transition without causing economic disruption and potential social unrest. China's coal and electricity industries are intrinsically linked, with coal comprising more than 60% of China's electricity generation by source, and excessive government interventions have made it difficult for the two industries to form a stable, reasonable, and transaction cost-saving relationship.[36] For instance, the 2021 electricity crisis highlighted the vulnerabilities in China's energy system when it experienced a severe electricity supply crisis that affected 20 provinces, leading to curtailed industrial activity and prolonged outages for households.[37]

Second, the production of clean energy technologies, such as solar panels, wind turbines, and electric vehicles, requires significant amounts of steel and aluminium, which are currently produced using coal-intensive processes.[38] This creates a complex interdependence between China's clean energy sectors and its coal-reliant heavy industries. Chinese EV

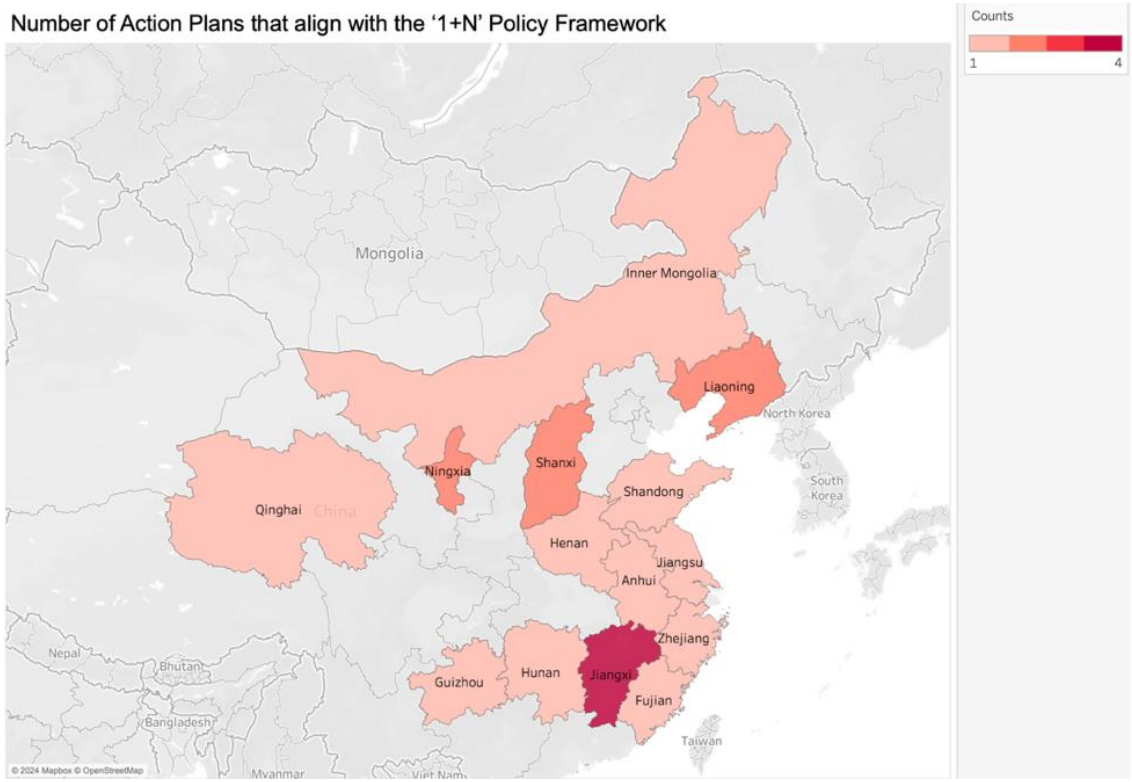
makers benefit from access to the country's vast aluminium industry, which accounts for more than half of global production. This helps lower material costs, a significant factor in keeping overall costs low. Additionally, Chinese EV manufacturers have the advantage of working directly with producers of aluminium and aluminium products to develop specialised alloys and ensure stable supplies. According to an analysis by BloombergNEF, solar energy requires around 33 tons of steel and 15 tons of aluminium for every megawatt of output. Similarly, wind farms use steel for ""the structural tower itself, the house of the turbine, the turbine blades, plus electrical steels for electricity generation"." Offshore wind farms require even more steel (90% of total materials) for foundations that reach down to the ocean floor.[39]

Lastly, there is also a fear that China's transition to a low-carbon economy could also negatively impact many other assets closely tied to the coal industry.[40] This includes physical assets (e.g. infrastructure, coal processing technologies, and coal mines), natural assets (e.g. water reserves), financial assets (e.g. equities, debt, and derivatives), human assets (e.g. knowledge, management practices, and labour), and social assets (e.g. community networks).

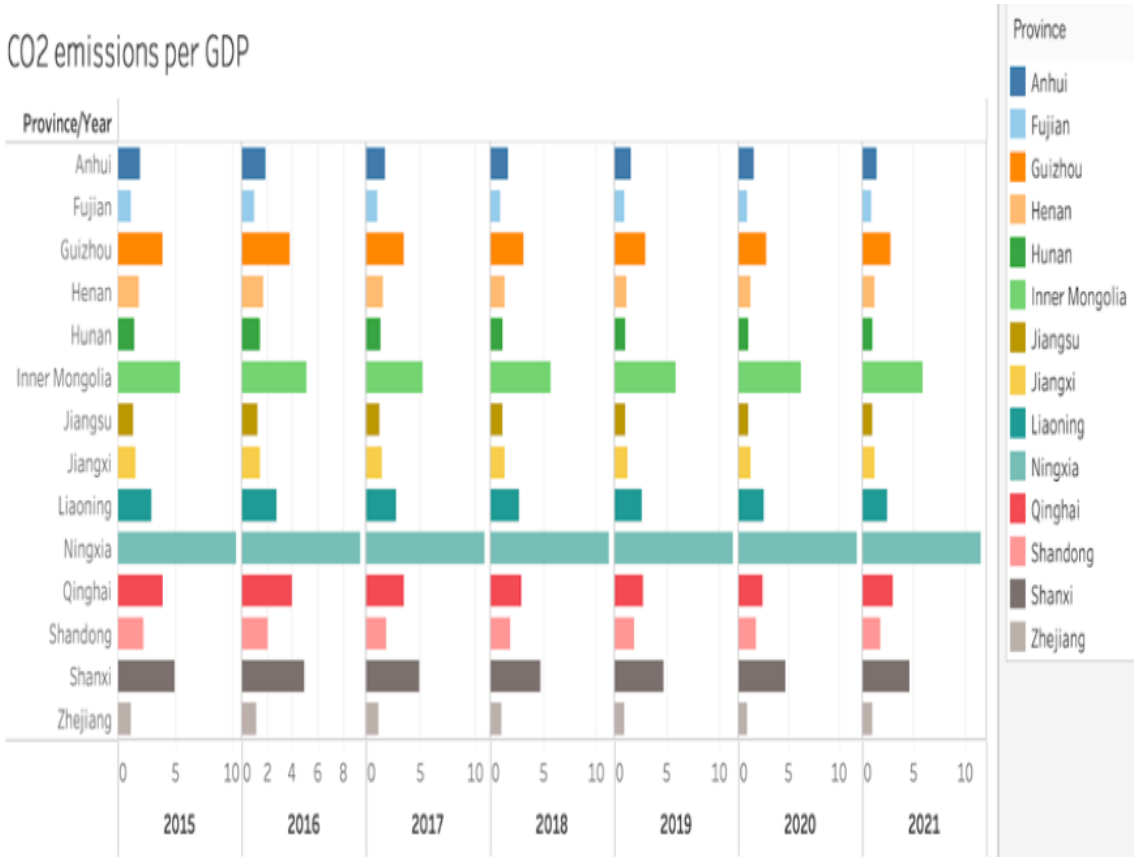
VI. Conclusion

While China has made significant strides in renewable energy installations, particularly in solar PV capacity, it has faced challenges in reducing energy intensity and controlling total energy consumption. The country needs to make substantial cuts in energy intensity in the coming years to meet its 2025 target. Similarly, the reduction in carbon dioxide emissions per unit of GDP has been slower than anticipated. Despite efforts to control coal consumption, China has continued to approve new coal power projects, indicating the difficulties in reducing coal dependency. This reliance on coal poses a significant hurdle in achieving the plan's objectives and may require more stringent measures and an accelerated transition towards cleaner energy sources. On a positive note, China has made progress in increasing its forest coverage rate and forest stock volume, although further efforts are needed to reach the 2030 targets. The country has also demonstrated a strong commitment to renewable energy deployment, with installed renewable energy capacity accounting for over half of its total installed power generation capacity in 2023.

VII. Annexe



The number of carbon neutrality action plans that align with the '1+N' Policy Framework. (Chart by Author)



Carbon dioxide emissions per GDP across the provinces analysed in the study. Data Source: IPE (Chart by author)

Changes in the output of major energy products and growth rates.

Product	Unit	Output (2023)	Increase over 2022 (%)
Coal	100 million tons	47.1	3.4
Crude Petroleum Oil	10000 tons	20902.6	2.1
Natural Gas	100 million cubic meters	2324.3	5.6
Thermal Power	100 million kilowatt hours	62657.4	6.4
Hydropower	100 million kilowatt hours	12858.5	- 4.9
Nuclear Power	100 million kilowatt hours	4347.2	4.1
Wind Power	100 million kilowatt hours	8858.7	16.2
Solar Power	100 million kilowatt hours	5841.5	36.7

Source - National Bureau of Statistics of China.

China's Achievements and Investments Across Renewable Sectors

Sector	Summary
Solar Power	The solar sector alone grew by 63% to reach 2.5 trillion yuan (approximately $350 billion) in 2023.[41] During 2023, China added substantial capacity in solar manufacturing, including 340 gigawatts (GW) of polysilicon production and 300GW of wafer, cell, and module production.[42] The country exported 56GW of solar wafers, 32GW of cells, and 178GW of modules in the first 10 months of 2023. Most of the exports went to Southeast Asian countries[43] and African countries.[44] In 2021, the value of China's solar PV exports was over $30 billion, representing almost 7% of China's trade surplus over the last five years.[45] China dominates the solar panel supply chain from end to end, holding over 80% of the manufacturing capacity at every stage of production.[46]

	China can produce 1000 GW of solar modules annually, which is more than twice the global demand.[47] China employs approximately 2.7 million people in the solar energy sector, which constitutes more than half of the world's total solar jobs.[48] Investment in PV cells in 2023 was estimated at $300 billion, as reported by eight leading PV companies.[49] Major government initiatives like ""whole-county distributed solar"" and ""clean energy base"" programmes fuelled solar industry growth. Policies encouraged solar projects on unused lands, with 15 provinces prioritising solar industry development.
Wind Power	Investment in wind power in 2023 was estimated at $74.2 billion[50] For wind turbines, China controls more than 80% of the global supply of refined rare earth metals and manganese, which are essential for manufacturing wind turbines[51]

	Wind power capacity grew significantly in China in 2023, with 41 GW of new capacity installed, an 84% increase year-on-year[52] Offshore wind capacity increased by 6GW across the whole of 2023 Onshore wind growth is driven by "clean energy bases" and the repowering of older wind farms. Offshore wind faced challenges but rebounded in the fourth quarter, with expectations for significant growth in 2024 New wind projects no longer receive central government subsidies since 2021. Investments in wind power is lower relative to solar due to lower profit margins.[53]
Nuclear Power	China approved the construction of 10 new nuclear power units in 2023.[54] China has 77 nuclear power units operating or under construction, making it the second-largest nuclear power market globally.[55]

	Total investment in nuclear power in 2023 was estimated at 87 billion yuan ($11.98 billion).[56] Nuclear power projects are concentrated in coastal provinces (e.g. Guangdong, Fujian and Zhejiang) with heavy industry, contributing to emission reduction efforts. These provinces get 20% of their electricity from nuclear power. [57] Development of inland nuclear power projects remains stalled[58]
Electric Vehicles (EVs)	China accounted for nearly 60% of global EV sales, significantly outpacing other countries China's EV market continued to expand rapidly, with EV sales expected to be more than 30% higher than in 2022, reaching around 8 million units China's EV production surged by 36% in 2023, reaching 9.6 million units, accounting for 32% of all vehicles produced in the country.[59] Despite the phase-out of national purchase subsidy for EVs, domestic sales of EVs continued to grow strongly, indicating a shift towards market-driven demand.[60]

	Sales of EVs made in China reached 9.5m units (out of which 1.3m units were exported) in 2023, a 38% year-on-year increase The Chinese EV market is highly competitive, with over 94 brands offering more than 300 models, and domestic brands dominating 81% of the market. Major investments in manufacturing capacity totalled 1.2 trillion yuan in 2023.[61] The expansion of EV charging infrastructure included 3 million new charging points installed, bringing the total to 8.6 million by November 2023.[62] Investment in EV charging infrastructure in 2023 was estimated at 0.1 trillion yuan. [63]
Electricity storage and hydrogen	China is rapidly expanding its electricity storage capacity to reduce reliance on coal- and gas-fired power plants during peak demand and integrate variable renewable energy into the grid.

	Construction of pumped hydro storage capacity saw a remarkable increase, with 167GW under construction in 2023, up from 120GW the previous year. An additional 250GW in the pre-construction stages indicates the potential for the current surge in capacity to continue.[64] Investments in new battery manufacturing capacities are estimated at 0.3 trillion yuan each in 2023. [65] China also targets raising inter-provincial power transmission capacity to 300GW by 2025 and 370GW by 2030, from 230GW in 2021.[66] Investment in electrolysers for green hydrogen production nearly doubled, reaching around 90 billion yuan in 2023. [67] China Electricity Council reported investments in electricity transmission at 0.5tn yuan in 2023. [68]

A Brief Analysis of the Carbon Neutrality Action Plans released by the Provinces

Year	Action Plan	Region	Brief
2024	Notice on the Issuance of the Implementation Opinions on the Construction of Carbon Footprint Management System for Products in Jiangsu Province.[69]	Jiangsu	The Plan aims to establish a carbon footprint management system for products at the provincial level in Jiangsu Province and help realise the goal of carbon peaking and carbon neutrality. It is proposed that by 2025, a number of key product carbon footprint accounting rules and standards will be introduced, striving to complete the carbon footprinting of 400 products, and releasing carbon footprinting rules and standards for key products such as batteries, photovoltaic, iron and steel. By 2030, the province's product carbon footprint management standard

			system will be basically perfected, the product carbon footprint accounting rules and standards system to support the province's key advantageous industrial chain will be basically built, and the carbon footprint accounting work for about 1,000 products will be completed.
2024	Ningxia Carbon Peak Pilot Construction Program.[70]	Ningxia	The Plan reflects the region's commitment to aligning with national directives on carbon peaking and carbon neutrality. It aims to select representative cities, parks, villages, communities, public institutions, and enterprises within the region for pilot construction, focusing on green and low-carbon development, resource conservation, and carbon sink consolidation. Guided by Xi Jinping Thought on Socialism with Chinese Characteristics

			for a New Era, the plan emphasises the exploration of diverse paths to carbon peaking, offering replicable solutions for green and low-carbon transformations. Key principles include positivity and prudence, adaptation to local conditions, reform, innovation, and safe carbon reduction. By 2025, significant progress is expected in pilot construction, with clear paths to carbon peaking for different regions. By 2030, the plan aims to establish fully-fledged policy mechanisms conducive to green and low-carbon development, laying a solid foundation for carbon neutrality. The plan encompasses six main pilot types—urban, park, rural, community, public institution, and enterprise—each

			tailored to local characteristics to promote effective implementation. The organisation and implementation focus on meticulous planning, strengthening scientific and technological support, policy mechanism improvement, nationwide action, and rigorous evaluation to ensure the success and scalability of pilot initiatives, with an emphasis on sharing valuable experiences for broader dissemination and adoption within the region and beyond.
2024	Action Plan for Carbon Peaking in the Building Materials Industry in Zhejiang Province.[71]	Zhejiang	The plan aims to tackle carbon emissions within the building materials sector effectively and facilitate its transition towards high-quality development in Zhejiang Province. Drawing inspiration from national directives such as the "Action Plan for Carbon Peaking before 2030,"" this

			strategy focuses on optimising energy consumption structures, accelerating energy-saving transformations, and promoting the development and application of low-carbon technologies. With a set of overarching goals and key tasks, including industrial structural adjustments, promotion of cleaner production, and enhancing the utilisation of alternative fuels, the plan delineates a path towards achieving carbon peak targets by 2030. Moreover, it emphasises the importance of policy coordination, financial support, public opinion guidance, and enforcement mechanisms to ensure effective implementation, with the plan slated for execution starting March 1, 2024.

2023	Circular on the Issuance of the Work Program on Shifting from Dual Control of Energy Consumption to Dual Control of Carbon Emissions in the Autonomous Region for Early and Pilot Implementation and the Key Points of Work for 2024.[72]	Inner Mongolia	The Plan aims to lead the way in promoting the transition from energy consumption control to carbon emission control and promote green and low-carbon development of the economy and society in Inner Mongolia Autonomous Region. This plan is the first provincial-level transition plan formally issued. It proposes that during the ““14th Five-Year Plan” period, a management mechanism mainly based on the constraint of carbon emission intensity, supplemented by the elastic management of carbon emission total quantity, and coordinated advancement of energy consumption control and carbon emission control will be initially formed to ensure the completion of the national energy-saving and carbon reduction targets

			during the "14th Five-Year Plan" period. During the "15th Five-Year Plan" period, a dual-control system for carbon emissions and intensity will be fully implemented in accordance with national arrangements, providing institutional guarantees for achieving the carbon peak by 2030.
2023	Liaoning Province Pollution Reduction, Carbon Reduction and Synergies Implementation Program.[73]	Liaoning	The Plan aims to synergistically promote Liaoning Province's efforts to reduce pollution and carbon emissions. By 2025, the province's energy consumption per unit of GDP will decrease by 14.5% compared to 2020, and its carbon dioxide emissions per unit of GDP will decrease by 18%. Incremental carbon emissions from key sectors and industries will be gradually controlled.

			The total installed capacity of wind power and solar power will exceed 37 million kilowatts. The proportion of clean energy installed capacity in the province will reach 55%, with its electricity generation accounting for over 48% of the total. The forest coverage rate will increase by 0.5% from the 2020 baseline. By 2030, the total emissions of major pollutants and the carbon dioxide emissions per unit of GDP will continue to decrease, significantly improving the ecological environment and helping achieve the carbon peak target.
2023	Implementation Program for Pollution Reduction, Carbon	Guizhou	The Plan aims to comprehensively advance pollution reduction and carbon reduction in a coordinated

	Reduction and Synergistic Efficiency in Guizhou Province.[74]		manner under the framework of high-quality development. It proposes that by 2025, the pollution reduction and carbon emission control targets issued by the state will be fully completed, and the reduction of nitrogen oxides, volatile organic compounds, chemical oxygen demand, and ammonia nitrogen in key projects will reach 12,000 tons, 4,600 tons, 31,400 tons, and 3,300 tons respectively. The carbon dioxide emissions per unit of GDP will be reduced by 18% compared to 2020. By 2030, significant achievements will be made in pollution reduction and carbon reduction in key areas and industries, with significantly improved coordination capabilities and orderly completion of the carbon peak target.

2023	Carbon Peak Implementation Program for the Unconventional Natural Gas Sector in Shanxi Province.[75]	Shanxi	The Plan aims to promote the high-quality development of the unconventional natural gas industry in Shanxi Province and support the realisation of the provincial carbon peaking target. It proposes that by 2025, unconventional natural gas production will strive to reach 20 billion cubic meters, the provincial natural gas pipeline network transmission capacity will exceed 40 billion cubic meters/year, and the storage and peaking capacity will reach 481 million cubic meters. During the 15th FYP, the scale and production of unconventional natural gas development remain stable. The provincial gas transmission and storage and peaking capacity will be improved.

			The energy-saving and carbon reduction effects in the industrial chain will be significant, and the proportion of natural gas in primary energy consumption will continue to increase.
2023	Carbon Peak Implementation Program for the Coal Industry in Shanxi Province.[76]	Shanxi	The Plan aims to promote the green and low-carbon transformation and development of the coal industry. It proposes that by 2025, the comprehensive energy consumption of tons of raw coal production in mines will drop by more than 10% compared with 2020, and the utilisation rate of coal mine gas extraction will strive to reach 50%. By 2030, the comprehensive energy consumption of tons of raw coal production in mines will continue to decline based on 2025, and the utilisation rate of coal mine gas extraction will strive to reach 60%.

2023	Jiangxi Provincial Low Carbon Zero Carbon Negative Carbon Demonstration Project Implementation Program.[77]	Jiangxi	The Plan aims to carry out the creation of low-carbon, zero-carbon and carbon-negative demonstration projects to accelerate the creation of a green and low-carbon development model. It proposes that by 2025, approximately 60 low-carbon, zero-carbon, carbon-negative demonstration projects will be established. Several demonstration projects will be implemented, and a number of advanced and applicable green technology results will be transformed and applied. By 2030, the total energy consumption and carbon dioxide emissions of demonstration projects in the category of application scenarios will decrease.
2023	Implementation Program for the Establishment of	Hunan	The Plan aims to advance further the construction of carbon peaking and

	a Sound Carbon Peak Carbon Neutral Standard Measurement System in Hunan Province.[78]		carbon neutrality standards and measurement systems. It proposes that by 2025, no fewer than 30 scientific and technological studies on the measurement will be conducted, no fewer than 20 standards of measurement will be newly devised or modified, no fewer than 30 technical specifications for measurement will be completed and revised, no fewer than 50 local standards will be completed and revised, and no fewer than ten relevant national or industrial standards will be revised and formulated. By 2030, the verification of carbon accounting in major industries will realise full coverage of standards. By 2060, a standard measurement system for carbon neutrality will be established.

2023	Implementation Program for the Establishment of a Sound Carbon Peak Carbon Neutral Standard Measurement System in Jiangxi Province.[79]	Jiangxi	The Plan aims to promote the construction of a standardised measurement system for carbon peaking and carbon neutrality in Jiangxi Province. It proposes that by 2025, the standard measurement system of carbon peaking and carbon neutrality will be established. This includes the construction or update of 30 measurement standards, the formulation or revision of at least ten measurement technical specifications, and efforts to establish the National Carbon Measurement Center (Jiangxi). Three provincial industry measurement and testing centres will also be established, and at least ten standard materials/samples will be developed.

			As part of the efforts, no fewer than five international, national, and industry standards will be revised or established, no fewer than ten provincial and local standards will be developed, and no fewer than 50 group standards, including the Jiangxi Green Ecological certification and evaluation, will be issued.
2023	Liaoning Provincial Science and Technology Supporting Carbon Peak Carbon Neutral Implementation Program (2023-2030).[80]	Liaoning	The Plan aims to promote the supporting and leading role of technology and innovation and accelerate the green and low-carbon transformation and development of the new Liaoning, a modernised Chinese-style city. It proposes that by 2025, 100 green and low-carbon key core technologies will be broken through in key industries, ten major scientific demonstration projects will be completed, 20 key laboratories and

			green technology innovation centres will be constructed in the carbon and related fields, and 100 new high-tech enterprises will be established in the field of green and low-carbon. By 2030, more than 20 low-carbon and zero-carbon technology solutions and comprehensive demonstration projects with significant influence will be established, and more than two national-level green and low-carbon innovation platforms will be established.
2023	Shandong Province Science and Technology Supporting Carbon Peak Work Program.[81]	Shandong	The Plan aims to support the work of carbon peaking and carbon neutrality in a strong, orderly and effective manner in Shandong Province. It proposes that by 2025, Shandong will cultivate and strengthen about 1000 high-tech enterprises in the field of green and low-carbon, creating 5-8

			green technology industry clusters with large industrial scale, strong innovation ability and a complete industrial chain. Shandong will introduce 3-5 national-level innovative experts and teams and train 8-10 expert teams on core technologies.
2022	Implementation Program on Financial Support for Good Carbon Peak and Carbon Neutral Work.[82]	Ningxia	The Plan aims to accelerate the construction of financial and tax support policies that are conducive to the efficient utilisation of resources and green and low-carbon development and to support the realisation of the goal of carbon peaking and carbon neutrality as scheduled. It specifies the overall requirements for financial support of the Ningxia Autonomous Region to support the work of carbon peaking and carbon neutrality, the key directions and areas

			of support, financial policy measures, and organisational safeguards.
2022	Jiangxi Provincial Carbon Peak Carbon Neutral Work Leading Group Office on the First Batch of Carbon Peak Pilot List in Jiangxi Province Public Notice.[83]	Jiangxi	The notice announced the initiation of the first batch of carbon peak pilot projects in Jiangxi Province, in alignment with the provincial Carbon Peak Implementation Plan and Carbon Peak Carbon Neutral Work Points for 2022. Following application recommendations and organisational reviews from each districted city, 11 cities and nine parks are slated to be designated as carbon peak pilot areas. The announcement invites public feedback on the pilot list from November 2 to November 8, 2022. This initiative aims to actively and steadily advance the province's carbon peak and carbon neutrality efforts,

			fostering ecological civilisation and sustainable development.
2022	Anhui Province Science and Technology Support Carbon Peak Carbon Neutral Implementation Program (2022-2030).[84]	Anhui	The plan outlines a comprehensive strategy to achieve carbon peak and carbon neutrality goals from 2022 to 2030. Grounded in Xi Jinping Thoughts on Socialism with Chinese Characteristics for a New Era, the plan emphasises scientific and technological innovation as pivotal for success. Key objectives include enhancing original innovation capabilities, promoting green and 2022 low-carbon technology breakthroughs, and establishing innovation platforms and talent teams. Measures encompass various sectors, from basic research to energy systems,

			industrial processes, transportation, and ecological carbon sinks. The plan prioritises carbon capture, ecological carbon sink development, monitoring of carbon source emissions, collaborative innovation, and resource allocation. Safeguard measures, such as organisational leadership strengthening and innovative management mechanisms, to ensure effective implementation. Ultimately, the plan aims to leverage scientific and technological advancements to transition Anhui Province towards a carbon-neutral future while contributing to broader national goals.
2022	Fujian Province Implements the Requirements of	Fujian	The plan aims to advance Fujian Province's pursuit of carbon peak and carbon neutrality goals while propelling

	Peak Carbon and Carbon Neutral Targets to Promote Green and High-Quality Development of Data Centers, 5G and Other New Infrastructures Implementation Plan.[85]		the green and high-quality development of new infrastructure such as data centres and 5G Technology. With a comprehensive approach, the plan underscores the province's commitment to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, focusing on digital empowerment and ecological civilisation principles. It outlines specific objectives, including establishing a robust data centre and 5G network infrastructure by 2025, emphasising energy efficiency, green technologies, and collaborative development. The plan's main tasks encompass promoting 5G network construction, optimising data centre layout, advancing edge computing capabilities,

			enhancing computing power, integrating data and networks, and facilitating the transformation and upgrading of existing data centres. Key safeguard measures include overall planning, increased support mechanisms, demonstration and promotion efforts, strengthened energy management, and improved working mechanisms to ensure effective implementation and monitoring of the plan's objectives.

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