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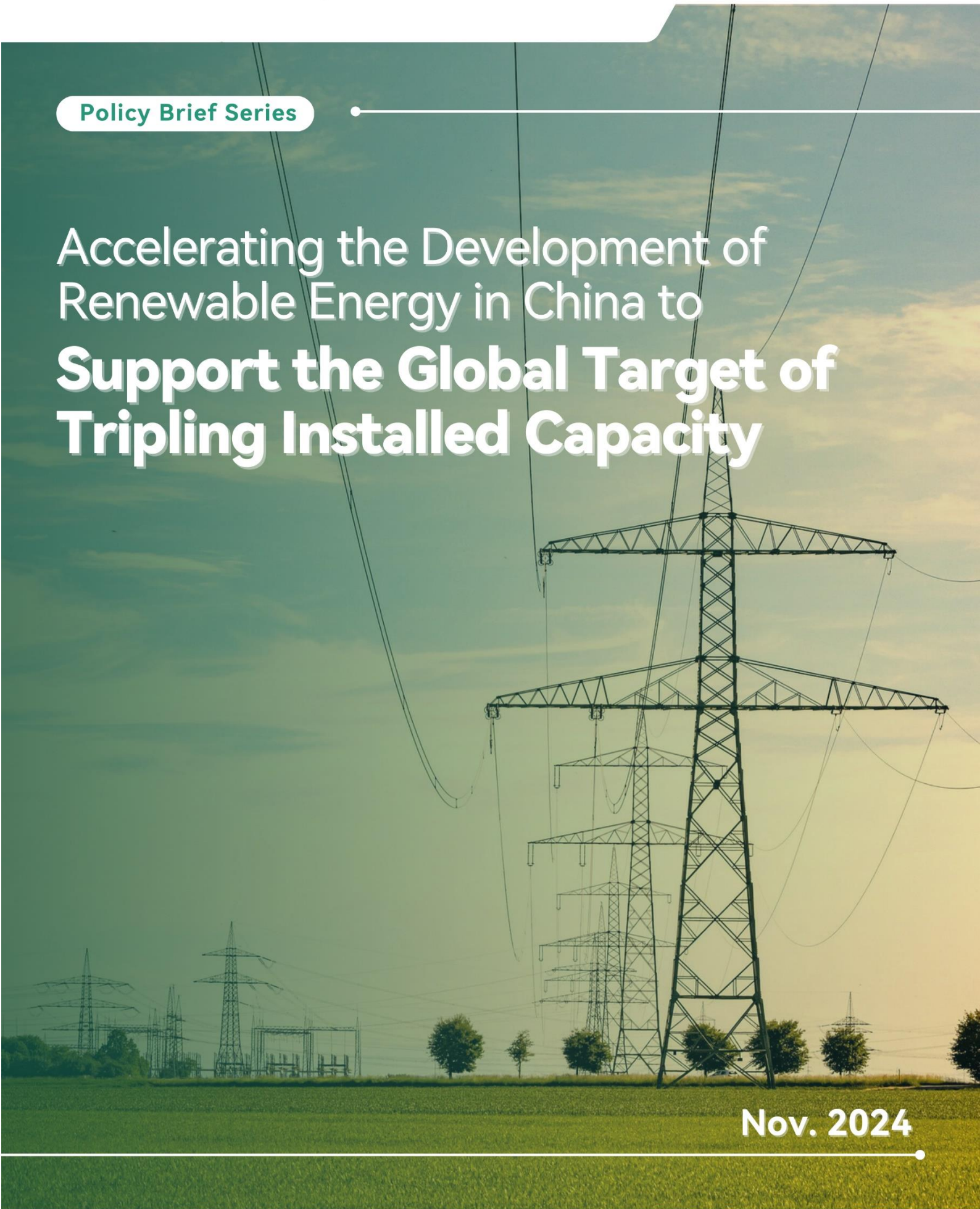
绿色创新发展研究院
Institute for Global Decarbonization Progress

Policy Brief Series

Accelerating the Development of Renewable Energy in China to **Support the Global Target of Tripling Installed Capacity**



Nov. 2024

At the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC), the UAE Consensus explicitly called for tripling the global installed capacity of renewable energy power generation by 2030 (referred to as the "the tripling target"). This goal is based on the International Renewable Energy Agency's (IRENA) World Energy Transitions Outlook 2023, which estimates that global installed renewable energy capacity (including wind, solar, hydro, biomass, geothermal, etc.) needs to exceed 11,000 gigawatts by 2030, three times the 2022 level. Furthermore, wind and solar power are expected to account for around 90% of the newly installed renewable energy capacity. (IRENA, 2023)

In November 2023, China, in its joint statement with the United States titled The Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis (referred to as the Sunnylands Statement), clearly expressed that "both countries support the G20 Leaders' Declaration, which aims to triple global renewable generation by 2030. Furthermore, both countries plan to significantly accelerate their renewable generation deployment from now until 2030, building on their 2020 levels. (MEE, 2023)

China's White Paper on China's Energy Transition states that "China's green energy development has become the engine driving the global energy transition." According to data from the National Energy Administration, China added approximately 290 gigawatts of new wind and solar capacity in 2023, (NEA, 2023) accounting for more than 50% of the world's total annual added installed capacity. (NEA, 2024b) By the end of 2023, China accounted for about 40% of the world's installed renewable energy generation capacity. (Xinhuanet, 2024)

1. Despite Rapid Growth in Global Renewable Generation, Tripling Target Remains Challenging

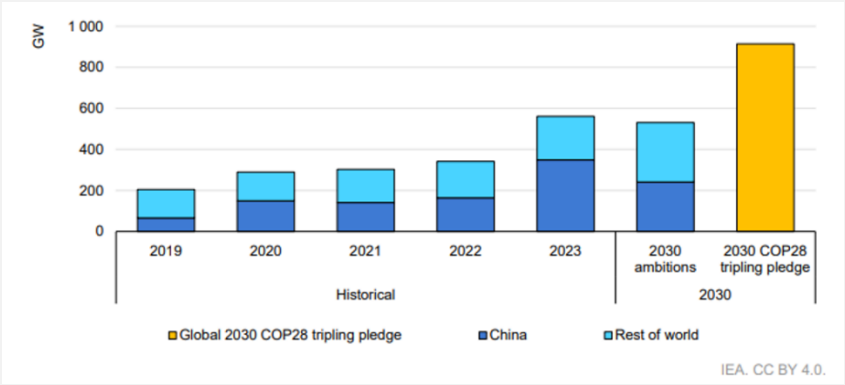
Despite the rapid growth in global renewable generation capacity over the past five years, research from organizations such as the International Energy Agency (IEA) indicates that achieving the tripling target will require more urgent and intensified efforts.

IEA's report in 2024, *COP28 Tripling Renewable Capacity Pledge* (hereinafter referred to as the IEA report)(IEA, 2024a) highlighted that Global renewable generation capacity increased by 560 gigawatts in 2023, a 64% rise compared to 2022.

However, the IEA report indicates that the total sum of existing targets for renewable generation is far below the tripling target. Based on the renewable generation targets and plans announced by various countries, it is projected that approximately 4,250 gigawatts will be added globally between 2022 and 2030, bringing the total to 7,900 gigawatts of renewable generation by 2030. Although this is higher than the sum of the Nationally Determined Contributions (NDCs) targets, it still falls significantly short of the tripling target of 11,000 gigawatts (as shown in figure 1 below).

The IEA report shows that while the actual growth rate of renewable generation capacity in recent years aligns with the existing targets of various countries, this pace must be accelerated to achieve the tripling target.

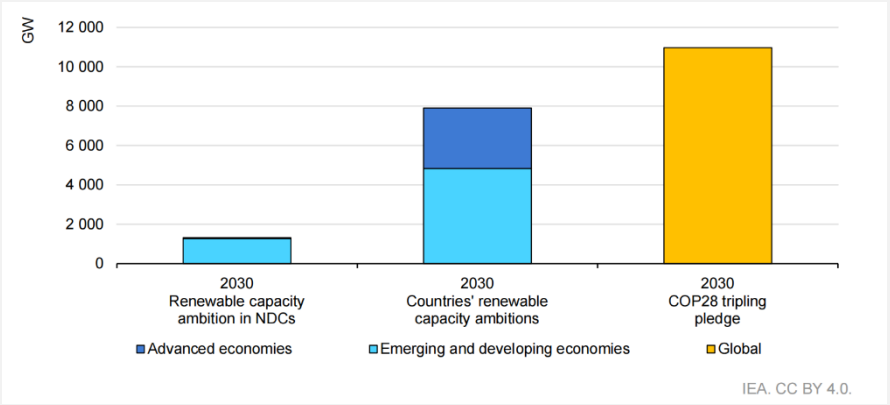
Figure 1 Global annual net capacity additions (2015-2023) vs average annual net additions needed to realize countries' ambitions for 2030 and the COP28 tripling pledge (2022-2030)



Source: IEA, 2024a

The installed capacity targets proposed by countries and regions in their NDCs account for only about 12% of the tripling target (as shown in figure 2 below). As of September 2023, among the 194 countries that submitted NDCs, only 93 included quantifiable targets related to renewable energy, and merely 14 NDCs specified absolute capacity targets for 2030. Notably, the capacity target outlined in China's NDC accounts for 90% of the total targets set across all NDCs. (IEA, 2024a)

Figure 2 Gap between 2030 renewable capacity ambitions and the tripling target (IEA, 2024a)



Source: IEA, 2024a

2. China Leads the World in Renewable Generation Capacity

As of June 30, 2024, renewable generation accounted for over 50% of China's total installed power capacity, of which wind and solar made up nearly 40%. Renewable sources represented about 35% of the total electricity generation, while wind and solar contributed approximately 20%.(NEA, 2024e)

Based on publicly available data, from 2019 to 2023, China's installed capacity for wind and solar power cumulative grew at an impressive rate of about 153%. The cumulative increase across various provincial regions ranged from about 79% to 477%. Public records indicate that China achieved its 2030 wind and solar capacity targets, as committed in its NDC, ahead of schedule by July 2024.(NDRC, 2024)

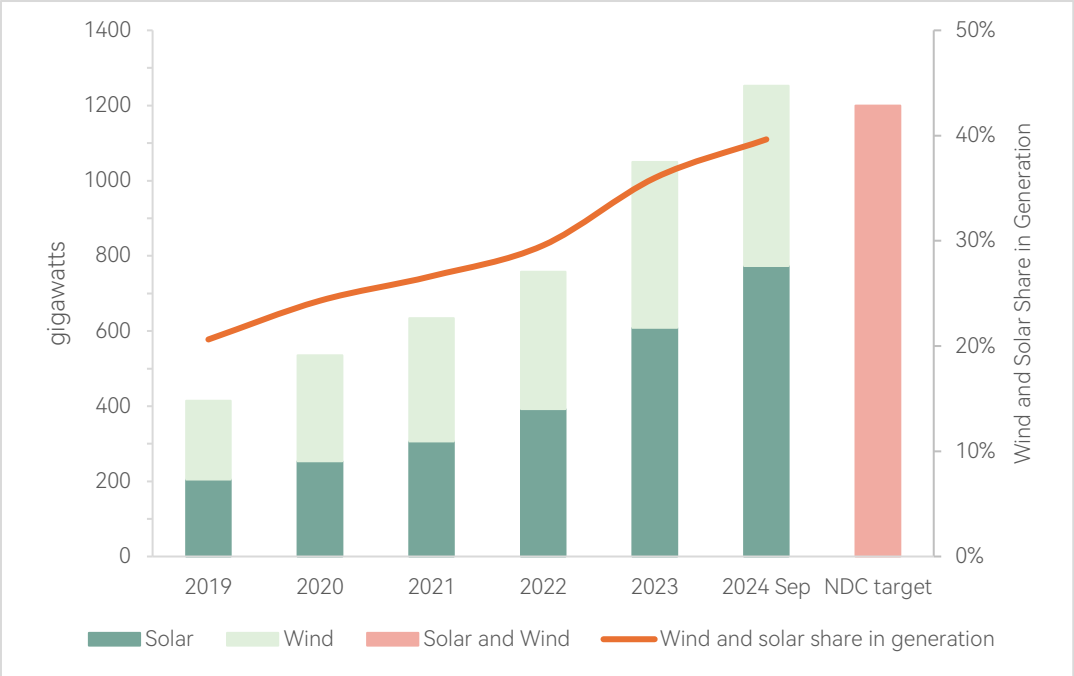
2.1 China Has Achieved Its NDC Wind and Solar Capacity Targets Six Years Ahead of Schedule

In October 2021, China submitted to UNFCCC *China's Achievements, New Goals and New Measures for Nationally Determined Contributions*, which stated that by 2030, the share of non-fossil energy in primary energy consumption would reach around 25%, and the total installed capacity of wind and solar power would exceed 1,200 gigawatts.

The development of renewable energy in China continues to accelerate, expediting the low-carbon transition in the power sector. According to data released by the National Energy Administration (NEA), the combined installed capacity of wind and solar power grew by approximately 130 gigawatts in the first half of 2024, marking a year-on-year increase of 24%. During the same period, the total renewable electricity generation increased by 22% compared to the previous year, accounting for about 35.1% of the total electricity generated. Notably, wind and solar power alone represented approximately 20% of the total generation, surpassing the electricity consumption of the tertiary sector as well as that of urban and rural households. (NEA, 2024d)

According to data from the National Development and Reform Commission (NDRC), as of the end of July 2024, the cumulative installed capacity of wind and solar power in China has reached 1,206 gigawatts. **This milestone indicates that China has achieved its wind and solar capacity targets outlined in its NDC six years ahead of schedule.** (NDRC, 2024)

Figure 3 China's wind and solar photovoltaic generation capacity growth



Data source: NEA

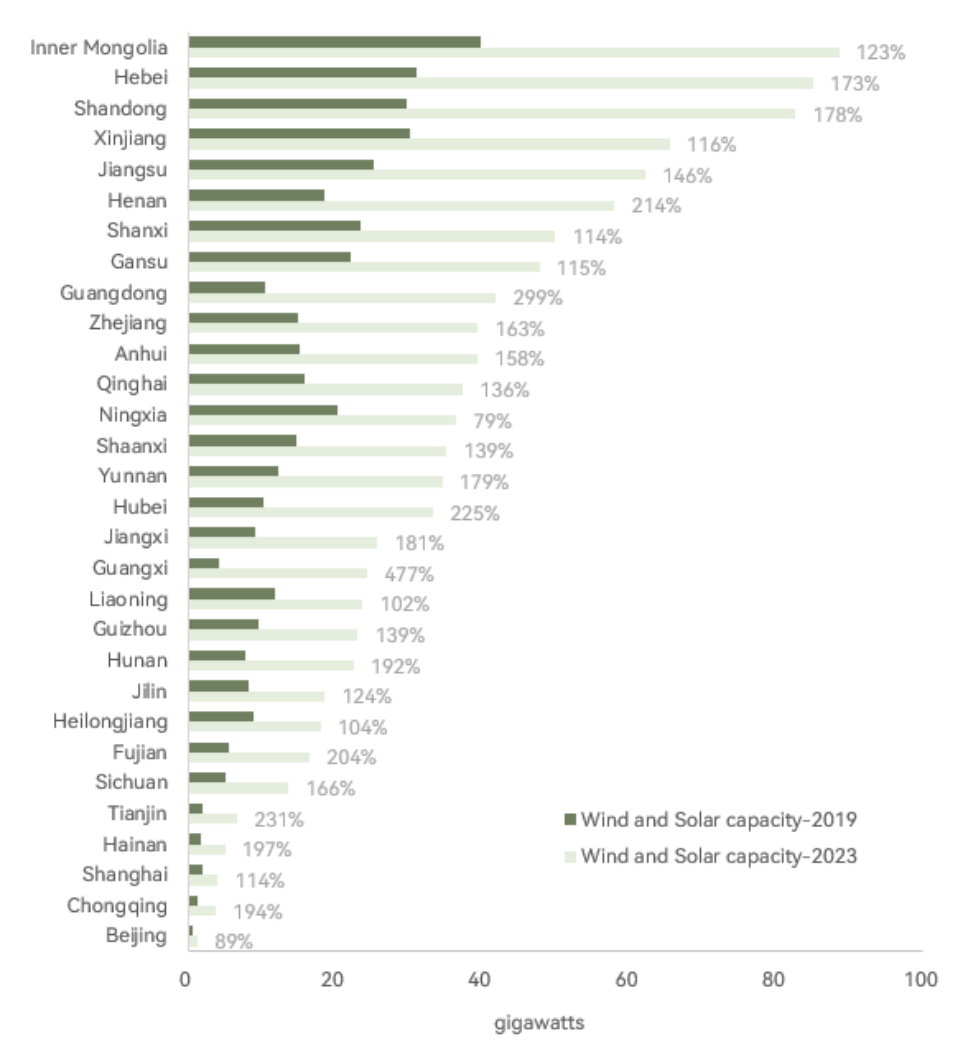
3. Provincial Strategies to Support Large-Scale Growth in China's Renewable Sector

Provinces and regions in China are actively proposing strategies to develop renewable energy, supporting the country's large-scale growth in this sector. These regional initiatives align with national objectives to enhance renewable energy capacity and promote sustainable development.

As of the end of 2023, publicly available data shows that the top five provinces in China with the highest cumulative installed capacity of wind and solar power are Inner Mongolia, Hebei, Shandong, Xinjiang, and Jiangsu.

Between 2019 and 2023, the increase in installed capacity for wind and solar power across provinces ranged from 79% to 477%. Notably, Guangxi, Guangdong, Tianjin, Hubei, Henan, and Fujian exhibited the highest average growth rates.

Figure 4 Provincial wind and solar photovoltaic installed capacity



Data source: [1]

[1] CWEA & GWEC, 2024; National Energy Administration, 2024a; Compilation of Statistical Data on Electric Power Industry, 2022)

4. China's Increasingly Robust Policy Framework Supported the Rapid Development of Renewable Energy Generation

In the past two decades, China's installed capacity and generation of wind and solar power have soared from almost zero to rapid growth, positioning them the primary sources of renewable energy expansion. This achievement is underpinned by the gradual establishment and refinement of China's renewable energy policy framework, which has adeptly navigated numerous challenges that emerged in the development process.

In February 2005, the National People's Congress passed *the Renewable Energy Law of the People's Republic of China*, which laid the foundation for the development of China's renewable energy policy system. This law requires that the priority purchase of renewable energy and "guaranteeing the purchasing of electricity generated by using renewable energy resources in full amount", thereby ensuring the viability of renewable development.

Since then, China has introduced over a hundred policies covering various aspects, including: financial support, renewable energy quota system, Green Electricity Certificates, tax incentives for research and development (R&D), etc. These policies cater to the diverse development needs of renewable energy, promoting rapid industry growth and technological advancement. The continuous evolution of this policy landscape has been crucial in positioning China as a global leader in renewable energy. (Tu et al., 2020)

Figure 5 China's renewable generation support policies

In the early stages of renewable energy development in China, funding support primarily came from the Renewable Development Fund and a benchmark feed-in tariff system. These measures ensured the profitability of power generation companies, driving the rapid growth of renewable energy and leading to a significant decrease in technology costs.

However, the swift expansion of renewable energy has also given rise to the issue of curtailment, where excess wind and solar power generation goes unused. To address this challenge, more reasonable long-term planning—both overall and regionally—is required to ensure that the increasing scale of renewables is matched by improvements in their utilization rates. (Ren, 2019) Since 2019, China has gradually shifted towards a renewable consumption responsibility quota system, progressively refining its development targets and assessment framework based on renewable energy consumption responsibilities.

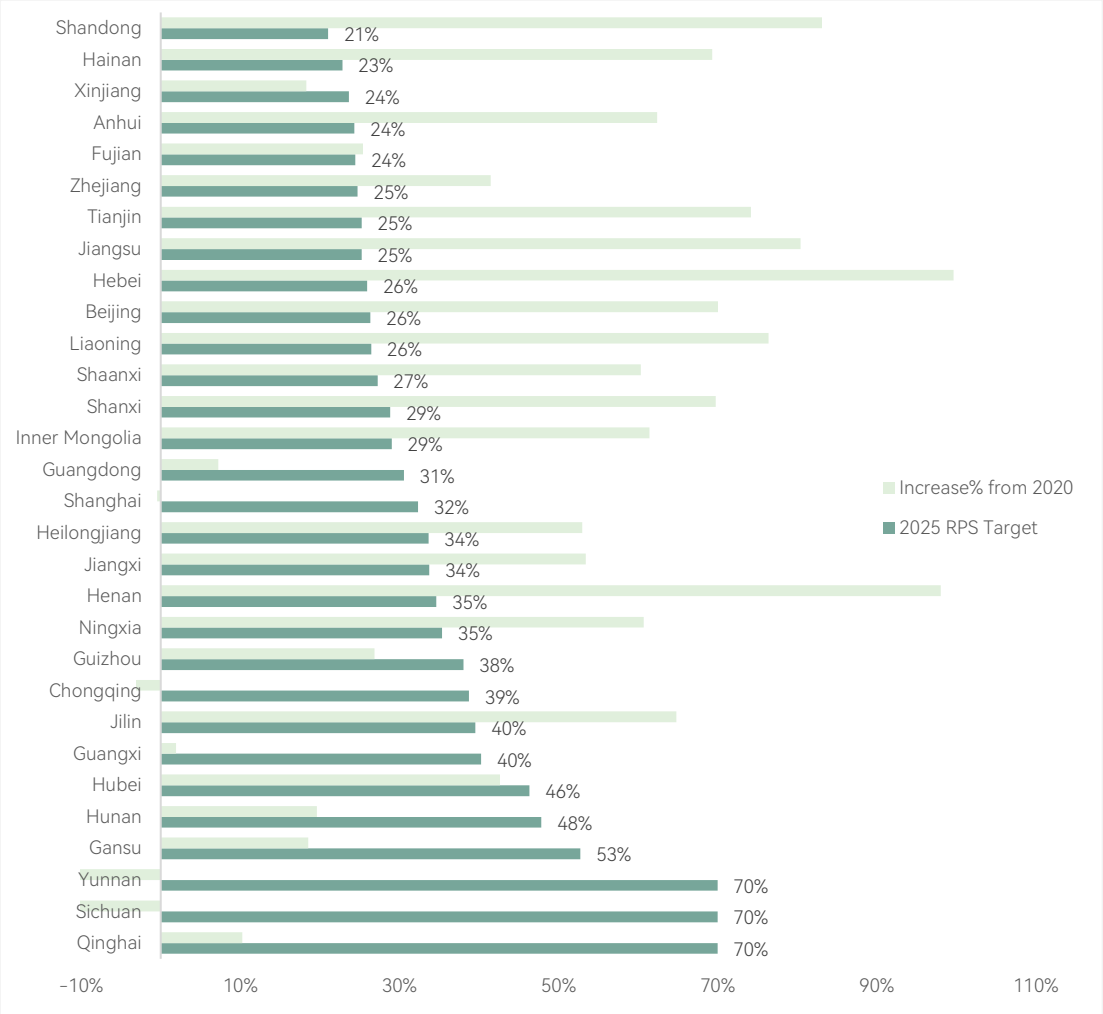
Since 2020, aiming to gradually increase the national non-fossil energy share targets, the National Energy Administration (NEA) has annually published the renewable energy and non-hydro renewable energy consumption responsibility quota for each provincial region, similar to the Renewable Portfolio Standard (RPS) (referred to as China RPS). This indicates the respective target proportion of renewable energy and non-hydro renewable

energy consumption in total electricity consumption in each provincial region. The completion status of these targets is then disclosed the following year.

According to the *14th Five-Year Plan for Renewable Energy Development*, the target for the China RPS is set to reach approximately 33% by 2025, with non-hydro renewable energy accounting for 18% of total consumption. Additionally, the NEA's document titled *Letter Soliciting Suggestions on the Renewable Energy Power Consumption Responsibility Quota for 2021 and Expected Targets for 2022-2030 proposes that by 2030*, the unified target for China RPS across the country should be 40%. In October 2024, the National Development and Reform Commission (NDRC) issued the "*Guiding Opinions on Vigorously Implementing Renewable Energy Substitution Actions*", which proposed that "the national renewable energy consumption will reach more than 1.5 billion tons of standard coal in 2030", which further set a target for the total amount of renewable energy consumption.

In the process of gradually increasing the consumption quota, provinces such as Hebei, Henan, Shandong, Jiangsu, and Liaoning have experienced the fastest growth rates. From 2020 to 2025, the increases for these provinces are projected to reach 100%, 98%, 83%, 80%, and 74%, respectively (as shown in figure below). Currently, **nearly one-third of the provinces have already met or exceeded the unified target of 40% renewable energy consumption by 2030**.

Figure 6 Provincial Consumption Responsibility Weight in 2025 and growth from 2020



Data source: NEA

Over the past decade, subsidies for renewable energy sources have been gradually phased out. Since 2017, the government has established the Green Electricity Certificates (GECs) trading system, implementing a market mechanism for renewable electricity transactions. This system ensures the profitability of renewable power generation and thus provides new pathways to support renewable energy. Together with the China RPS, these initiatives promote the long-term, high-quality development of renewable energy in China.

The coverage and trading scale of GECs has expanded over the years. Initially, GECs issuance was limited to onshore wind and centralized solar photovoltaic (PV) power generation. In recent years, the scope has

broadened to include offshore wind, distributed solar PV, biomass power generation, and various other renewable energy sources. With ongoing policy adjustments and improvements, the scale of GECs trading has also seen rapid annual growth.

Since 2018, the Beijing-Tianjin-Hebei region, as well as several provincial areas such as Zhejiang, Yunnan, and Guangdong, have begun exploring local green electricity trading. In September 2021, China's green electricity trading pilot officially launched, marking a significant step in facilitating market-oriented renewable energy transactions. (Wu, 2024) Since then, the volume of green electricity trading across the country has rapidly increased, reaching 69.7 terawatt-hours in 2023. (Liao, 2024) A nationwide unified standard for green electricity transactions has been established in August 2024, as the *Basic Rules for Medium- and Long-term Power Trading – Special Chapter on Green Electricity Trading* was released, which further encourages market participants to engage in green electricity trading.

In response to the challenges posed by large-scale integration of renewable energy into the power grid, China proposed the construction of the new type of power system in 2021. The core objective of this new-type power system is to achieve a clean and low-carbon energy landscape while ensuring the safe and stable operation of the grid. According to the pathways outlined in the *Blue Book on the Development of New Type Power System* released in 2023, the new system will be formed by 2045 and consolidated through 2060.

In the field of renewable energy equipment manufacturing, China has introduced a series of supportive policies. For example, in 2016, the renewable energy sector was included in the *National Key High-Tech Fields Supported by the State*, allowing eligible enterprises to benefit from tax incentives. Starting in 2019, the *Green Industry Guidance Catalogue* further directed policy and financial support towards the technology R&D and manufacturing of the renewable energy industry chain, promoting technological advancements and decline in costs.

The reform of the power market has propelled the high-quality development of renewable energy. Measures such as establishing a market-oriented

pricing mechanism to reallocate costs, constructing a unified national electricity market to break down inter-provincial trading barriers, and improving ancillary service markets, will facilitate the consumption and utilization of renewable energy. In 2023, 5.7 trillion kilowatt-hours have been traded via power market, accounting for 61% of total electricity consumption, an increase of 44 percentage points since 2016. This growing market activity continuously enhances resource allocation and optimizes the integration of renewable energy into the grid. (NEA, 2024a)

Through these supportive policies, China has not only boosted the installed capacity and technological advancements of renewable energy but has also gradually established a comprehensive industrial chain support system, spanning from equipment manufacturing to power consumption. These policies provide a solid foundation for China to achieve its Dual Carbon goals and fulfill its international commitments.

5. Outlook for China's Renewable Power Development

As the world aims to triple renewable energy capacity and China's renewable sector booms, it is important to understand the growth potential for renewable power in China by 2030. This chapter reviews domestic and international research forecasts on different scenarios for renewable capacity in China. To further expand the utilization of renewable energy, this chapter identifies opportunities and challenges based on the previous discussion on the current landscape and policy framework of renewable power development in China.

Growth Potential of Renewable Capacity in China

Various research institutions predict that China's renewable capacity will continue to grow rapidly, potentially reaching 1.7 to 3.5 times its 2020 level by 2030, equating to 1,600 to 3,300 gigawatts.[2] This indicates a big potential to achieve the tripling target by 2030, though challenges remain.

As the standard of living in China improves, industrial structure transforms, and electrification progresses, the demand for electricity will continue to surge. According to the NEA's annual statistics release, from 2019 to 2023, the average growth rate of total electricity consumption was about 6%. Multiple studies and models predict that total electricity consumption will continue to grow significantly until at least 2040. The new electricity demand gap under the dual carbon goals also creates substantial space for the development of renewable energy.

On the supply side, several factors are driving the continued expansion of renewables. Advances in technology and improvements in grid infrastructure are making renewable energy increasingly competitive with coal. Diverse business models that integrate distributed renewables with industrial parks, buildings, transportation infrastructure, and agriculture also reveal new growth opportunities. Additionally, China's long-term policy commitment to pollution reduction reinforces the need to tighten restrictions on coal and

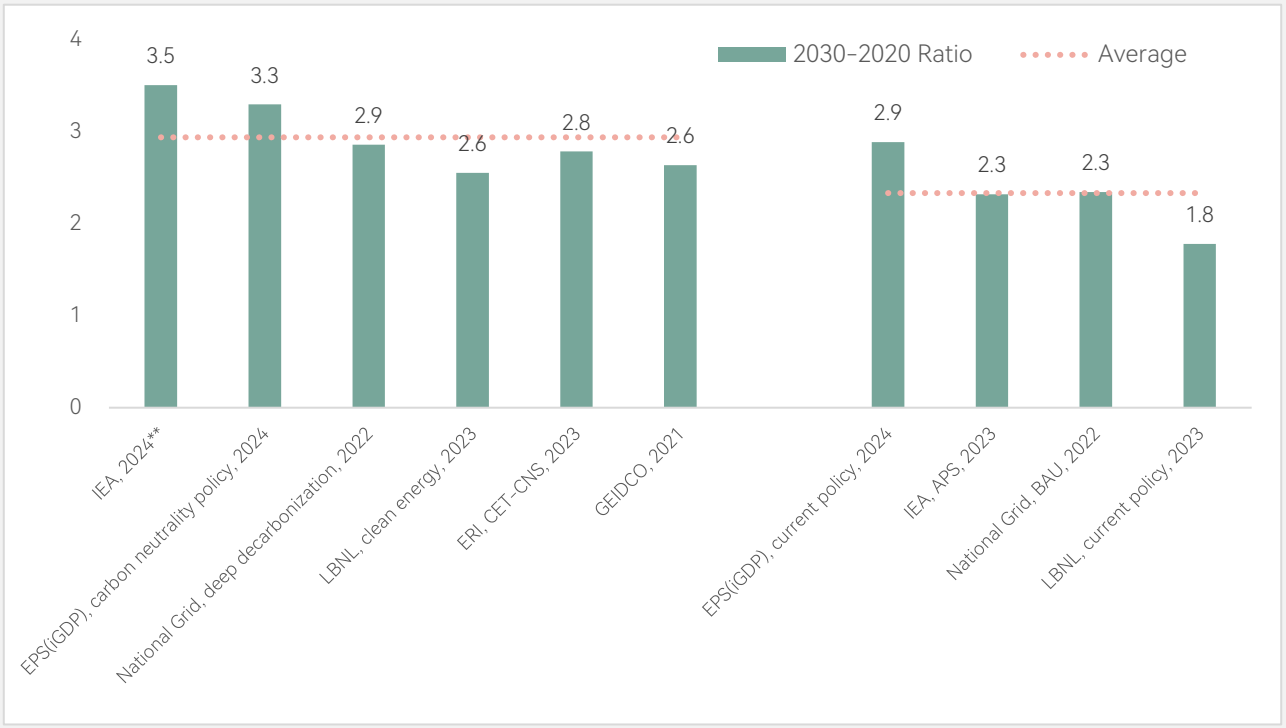
[2] These research include the following: (Abhyankar et al., 2022; IEA, 2021, 2024b; GEIDCO, 2021; National Grid, 2022; Tsinghua University, 2020; Tsinghua University, 2024; Energy Innovation & Institute for Global Decarbonization Progress, 2024)

expand renewables. The carbon market further enhances the cost competitiveness of renewables relative to fossil fuels.

China has gradually established a more comprehensive policy framework to support renewable energy. Under the current policy goals for renewable development, various models suggest that by 2030, China's renewable capacity could reach 1.8 to 2.9 times its 2020 level.[3] Specifically, wind and solar capacity may reach between 1,662 to 2,694 gigawatts.

Model results also indicate that to achieve carbon neutrality, China's renewable capacity would need to reach approximately 2,500 to 3,100 gigawatts by 2030, which represents 2.6 to 3.3 times its 2020 level,[4] showing a clear need for improvement compared to the existing policy path (as illustrated in figure 7 below).

Figure 7 Projected renewable capacity from various research[5]



[3] These scenarios include China EPS-iGDP Current Policy Scenario, IEA APS scenario, National Grid BAU scenario, LBNL current policy scenario etc.
[4] Multiple research institutes have projected the electricity generation capacity mix under Carbon Neutrality target, including National Grid's deep decarbonization scenario, GEIDCO, and China EPS (iGDP)'s carbon neutrality scenario.
[5] **IEA forecasts are for year 2028, projections are from reports and research including (Abhyankar et al., 2022; IEA, 2021, 2024b; GEIDCO, 2021; National Grid, 2022; Tsinghua University, 2020; Tsinghua University, 2024; Energy Innovation & Institute for Global Decarbonization Progress, 2024)

The highest forecast for China's renewable capacity comes from the International Energy Agency (IEA) in its 2024 report, which estimates that under the influence of carbon neutrality goals, a complete domestic supply chain, and ample policy incentives, China's renewable capacity could reach 3,275 gigawatts by 2028. Between 2023 and 2028, China's renewable growth rate may be nearly four times faster than that of the European Union and five times faster than that of the United States.

4.2 Key Actions

China's renewable energy evolution has unfolded across several stages, each marked by distinct challenges. As mentioned earlier, China has adjusted its systems and policies to respond to new issues and challenges. Moving forward, resolving the contradiction between the large-scale development of renewable energy and its efficient utilization will be a key focus for future policies.

At this stage, there are several key actions needed to support the high-quality development of renewable energy, including:

- Accelerate the construction of the new type power system that can better accommodate and utilize a high proportion of renewable energy, improving its utilization rate while ensuring grid safety, reliability, and flexibility.
- Further expand market participation in green electricity and GECs trading by improving the GECs-based renewable energy consumption quota system, enhancing China GEC's international recognition, to optimize the cost allocation mechanism.
- Enhance market design and pricing mechanisms by enhancing mechanisms like hourly pricing to incentivize demand-side participation, speeding up the construction of a unified national market, and promoting cross-regional electricity trading etc. to break down geographical and temporal barriers, and optimize resource allocation.

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Citation Recommendation

Li Xindi. 2024. Policy Brief Series: *Accelerating the Development of Renewable Energy in China to Support the Global Target of Tripling Installed Capacity*. Policy Brief. iGDP.

Acknowledgement

The authors of the report would like to thank Tian Zhiyu, researcher from the Energy Research Institute of the National Development and Reform Commission, for his valuable suggestions on this report, and iGDP colleague Hu Min, Yang Li and Chen Mei'an, for their support and help in the preparation of the report.

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