ROSA & ROUBINI
ASSOCIATES

MACRO PICTURE

China's Energy Pivot: Building Self-Sufficiency

By

Nato Balavadze

22 May 2025

Nato Balavadze

China's Energy Pivot: Building Self-Sufficiency

22 May 2025

Table of Contents

Rosa & Roubini Associates Ltd is a private limited company registered in England and Wales (Registration number: 10975116) with registered office at 118 Pall Mall, St. James's, London SW1Y 5ED, United Kingdom.

For information about Rosa&Roubini Associates, please send an email to info@rosa-roubini-associates.com or call +44 (0)20 7101 0718.

***Analyst Certification**: I, Nato Balavadze, hereby certify that all the views expressed in this report reflect my personal opinion, which has not been influenced by considerations of Rosa & Roubini Associates' business, nor by personal or client relationships. I also certify that no part of my compensation was, is or will be, directly or indirectly, related to the views expressed in this report.*

***Disclaimer**: All material presented in this report is provided by Rosa & Roubini Associates-Limited for informational purposes only and is not to be used or considered as an offer or a solicitation to sell or to buy, or subscribe for securities, investment products or other financial instruments. Rosa & Roubini Associates Limited does not conduct "investment research" as defined in the FCA Conduct of Business Sourcebook (COBS) section 12 nor does it provide "advice about securities" as defined in the Regulation of Investment Advisors by the US SEC. Rosa & Roubini Associates Limited is not regulated by the FCA, SEC or by any other regulatory body. Nothing in this report shall be deemed to constitute financial or other professional advice in any way, and under no circumstances shall we be liable for any direct or indirect losses, costs or expenses nor for any loss of profit that results from the content of this report or any material in it or website links or references embedded within it. The price and value of financial instruments, securities and investment products referred to in this research and the income from them may fluctuate. Past performance and forecasts should not be treated as a reliable guide of future performance or results; future returns are not guaranteed; and a loss of original capital may occur. This research is based on current public information that Rosa & Roubini Associates considers reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. Rosa & Roubini Associates, its contributors, partners and employees make no representation about the completeness or accuracy of the data, calculations, information or opinions contained in this report. Rosa & Roubini Associates has an internal policy designed to minimize the risk of receiving or misusing confidential or potentially material non-public information. We seek to update our research as appropriate, but the large majority of reports are published at irregular intervals as appropriate in the author's judgment. The information, opinions, estimates and forecasts contained herein are as of the date hereof and may be changed without prior notification. This research is for our clients only and is disseminated and available to all clients simultaneously through electronic publication. Rosa & Roubini Associates is not responsible for the redistribution of our research by third party aggregators. This report is not directed to you if Rosa & Roubini Associates is barred from doing so in your jurisdiction. This report and its content cannot be copied, redistributed or reproduced in part or whole without Rosa & Roubini Associates' written permission.*

Nato Balavadze

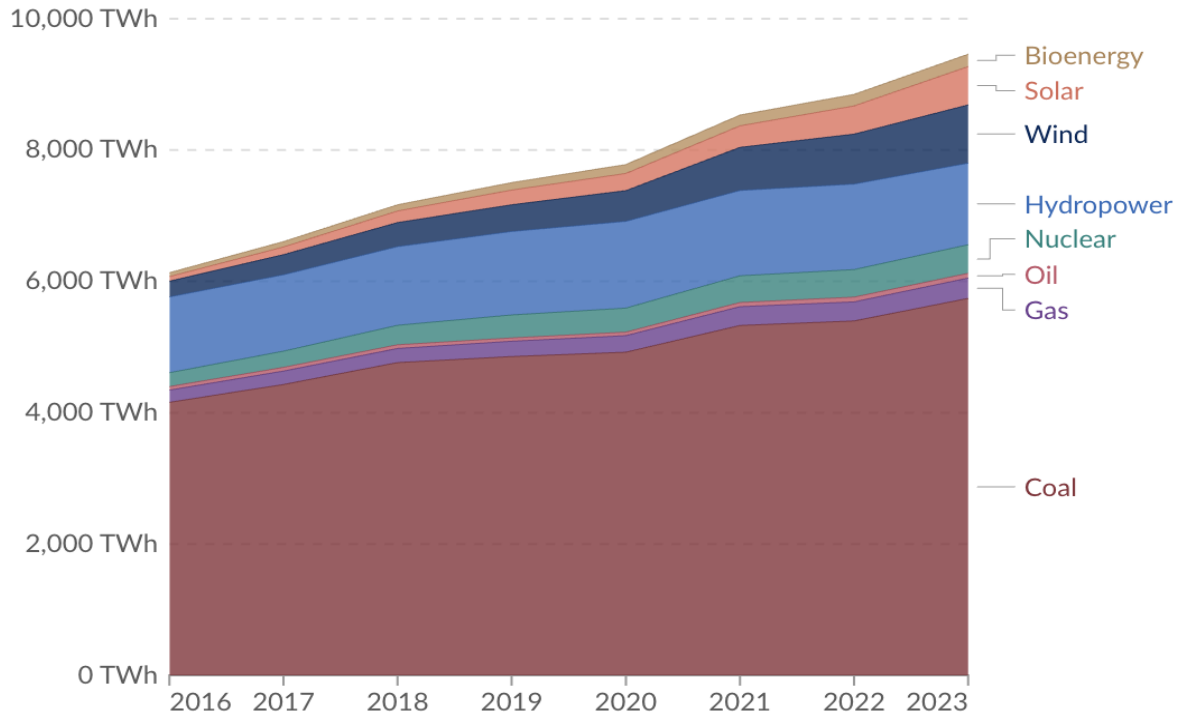
China's Energy Pivot: Building Self-Sufficiency

22 May 2025

Executive Summary

- Energy self-sufficiency is now a top strategic priority for China**,** driven by geopolitical instability, energy insecurity, and climate goals. Xi Jinping's push to overcome "technological backwardness" began in 2014, with a focus on building new systems before phasing out fossil fuels.
- China's energy self-sufficiency rate has exceeded 80% and is projected to reach 95% by 2060, supported by domestic oil and gas production, clean energy expansion, and resource exploration breakthroughs like the 10,000-meter Shendi ultra-deep well in Xinjiang.
- Clean energy is advancing at record pace: By 2024, China had already surpassed its 2030 goal of 1,200 GW of wind and solar capacity. Renewables now make up 16% of primary energy use, with projections reaching 60% by 2050.
- Electrification is accelerating across transport and industry, supported by a $800 billion investment in ultra-high voltage (UHV) grid infrastructure. China's electrification rate (30%) already surpasses that of the EU and US (22%).
- Despite clean energy growth, oil and gas remain crucial**,** especially for petrochemicals and industrial needs. Transportation fuel demand peaked in 2023 due to EV adoption, but feedstock use will dominate oil demand by 2060.
- China leads the world in clean tech manufacturing, producing over 70% of global EV batteries and 45% of global solar additions. Domestic EV sales are set to reach 12.5 million in 2024, with EVs outselling ICE vehicles for the first time.

Key Picture: Electricity Production by Source



Source: Our World in Data

Strategic Imperatives Behind China's Energy Shift

In an era of rising geopolitical tensions, volatile energy markets, and escalating climate pressures, few goals have become as central to China's national strategy as energy self-sufficiency. The world's largest energy consumer and emitter, China faces a challenge: how to simultaneously ensure secure, affordable energy supplies while advancing toward carbon neutrality. Beijing's response has been a sweeping transformation of its energy system—anchored in self-reliance, diversification, and technological leadership.

China's pursuit of energy self-sufficiency is not new. For decades, policymakers have been acutely aware of the country's vulnerability to external energy shocks, particularly its dependence on imported oil and gas. Xi Jinping's first direct call to "revolutionize" China's energy system came in 2014, two years into his presidency. At a key party economic meeting, he criticized the system's "technological backwardness" and emphasized the need to strengthen energy security. In his 2022 speech at the 20th Party Congress, Xi Jinping emphasized a phased and pragmatic approach to China's climate goals. He underscored the principle of "building the new before discarding the old," signaling that China will prioritize developing reliable alternatives—like renewables and nuclear—before scaling back fossil fuel reliance.

As China seeks to reduce its reliance on imported fossil fuels, an affordable renewable energy system—supported by robust energy storage and smart grid infrastructure—is increasingly seen as the country's long-term pathway to energy self-sufficiency.

Energy Self-Sufficiency: A Growing Reality

Despite mounting global uncertainties and ongoing disruptions to supply chains, China has made notable progress in strengthening its domestic energy security. According to a January report by the China National Petroleum Corporation's Economics and Technology Research Institute, the country's energy self-sufficiency rate has now surpassed 80 percent—reflecting a broader trend of steadily expanding domestic energy output. China's energy self-sufficiency rate is projected to rise further, reaching 95% by 2060—driven by rapid advances in resource exploration technologies and the continued expansion of renewable energy systems.

This progress has been underpinned by rising production of oil and natural gas, with China's combined oil and gas output exceeding 400 million metric tons of oil equivalent in 2023. Meanwhile, total electricity generation crossed the 10 trillion kilowatt-hour mark, representing a 5.7 percent increase year-on-year. Total energy output exceeded 5 billion metric tons of standard coal equivalent in 2024, with forecasts suggesting it will grow to 6 billion tons by 2060. This trajectory reflects China's dual strategy: maintaining a reliable fossil fuel base while steadily elevating renewables as a central pillar of its energy mix.

Clean Tech Leadership and Electrification of Demand

As mentioned, becoming energy self-sufficient by 2060 is mostly credited to China's massive investment in clean energy. China has invested over five times more in clean tech than the US and 15 times more than Japan. This investment has supercharged domestic champions like CATL, BYD, and Ming Yang Wind Power, making China a global leader in solar, wind, and battery manufacturing. Electric vehicles have become the most visible manifestation of this transition. In 2024, EV sales are expected to hit 12.5 million—more than doubling 2022's figures—making China the first major market where EVs outsell internal combustion vehicles. New energy vehicles (NEVs) surpassed 31 million in use by the end of the year, and this number is projected to top 40 million in 2025.

Today, China controls approximately 90% of the global market for upstream solar components—such as polysilicon, wafers, and cells—cementing its leadership in solar manufacturing. In the wind sector, Chinese companies now produce roughly 30% of the world's wind turbines, benefiting from economies of scale, competitive pricing, and robust state support.

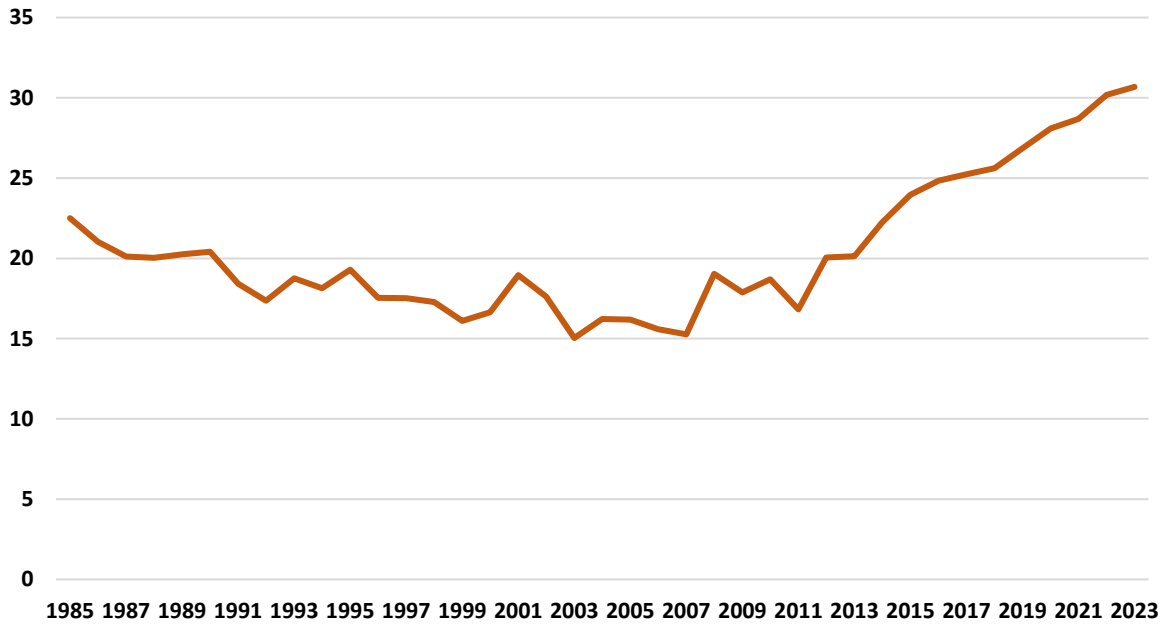
Goldman Sachs estimates that China's advances in renewables and clean hydrogen could reduce energy imports by 10% by 2030—and by up to 50% by the early 2040s if installations accelerate as expected. These innovations, alongside lower coal prices, are likely to bring down consumer energy costs. However, achieving this transition will require major investment—around $2.26 trillion in renewables and grid storage by 2040.

China's Energy Transition

China's energy transition is unfolding at a scale and speed unmatched globally. By 2024, China had already surpassed its 2030 target of 1,200 GW of combined wind and solar capacity, putting it ahead of schedule in achieving peak emissions set under 14th FYP (2021-2025). Clean energy accounted for 40% of China's GDP growth in 2023, with solar photovoltaic (PV) additions alone making up 45% of global new capacity in 2022. In terms of electric mobility, more than half of the world's electric vehicles were on Chinese roads by 2023, and the country accounted for 60% of global EV sales that year. Over 70% of all EV batteries ever produced were made in China, where battery prices are significantly lower—over 30% cheaper than in Europe and 20% cheaper than in North America. These cost advantages have made EVs more affordable than internal combustion engine (ICE) vehicles in many Chinese cities.

As of now, the share of renewables in primary energy consumption is around 16% (**Figure 1**). The studies project that by 2050, renewables could supply 60% of total energy consumption and up to 90% of power generation, with the overall electrification rate nearing 60%.

Figure 1: Share of Electricity Production from Renewables



Source: Our World in Data

As renewable energy production scales up, economies of scale are driving down manufacturing costs. Falling solar and wind prices—coupled with technological advancements and manufacturing surpluses—will make 24/7 solar-plus-storage projects increasingly viable. While the current internal rate of return for such projects is negative, ongoing innovations are expected to boost efficiency and raise returns to nearly 10% by 2030.

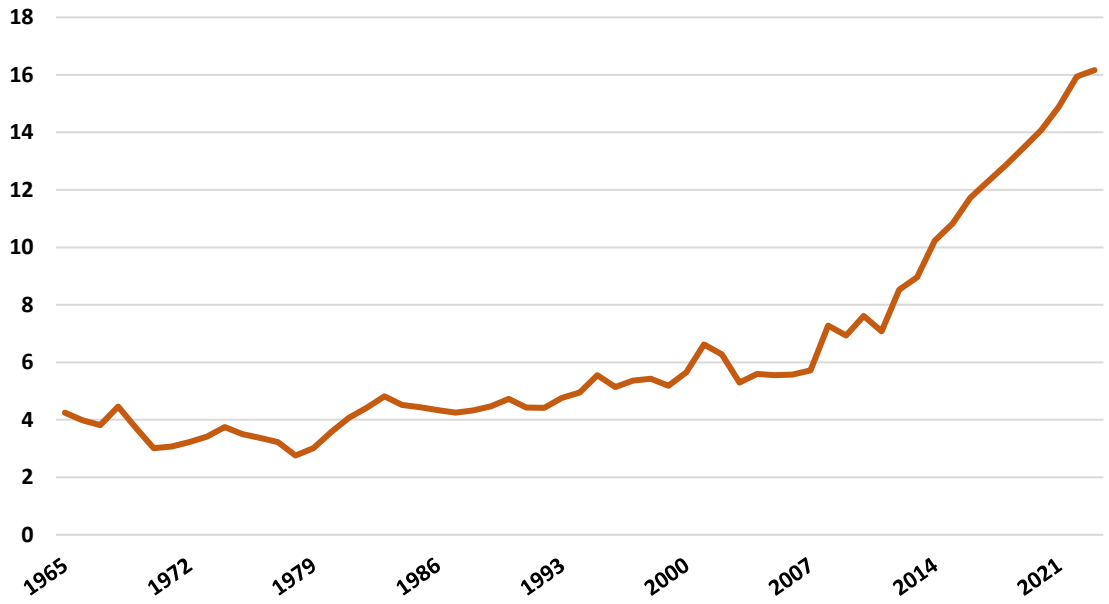
Electricity and Grid: Backbone of the Green Transition

Electrification is where China's transformation is most visible. Its electrification rate now exceeds 30%, compared to 22% in Europe and the US Rail networks, vehicles, and even industrial processes are shifting rapidly to electric power.

Coal, solar, wind, and hydropower account for the bulk of China's installed power capacity, which expanded by 15% to over 3,300 GW in 2024. These sources are strategically deployed across the country based on geographic resource availability and local energy demand.

The power grid is the foundation of this shift. China is investing up to $800 billion by 2030 in grid upgrades, particularly in ultra-high voltage (UHV) transmission lines that transport renewable electricity from inland deserts to coastal factories. With over 40 UHV lines already operating, the grid now supports scaled deployment of solar and wind.

Figure 2: Share of Primary Energy Consumption From Renewable Sources



Source: Our World in Data

Oil and Gas: Still Essential Amid Transition

Historically, China's rise was powered by oil and coal—it has long been the main driver of global oil demand growth. While oil demand for transportation is plateauing, oil and gas remain critical for China's industrial and chemical needs. In 2023, transportation fuel use peaked, driven by the rapid adoption of electric vehicles. However, petrochemical feedstocks—used in manufacturing—are expected to make up 60% of oil demand by 2060.

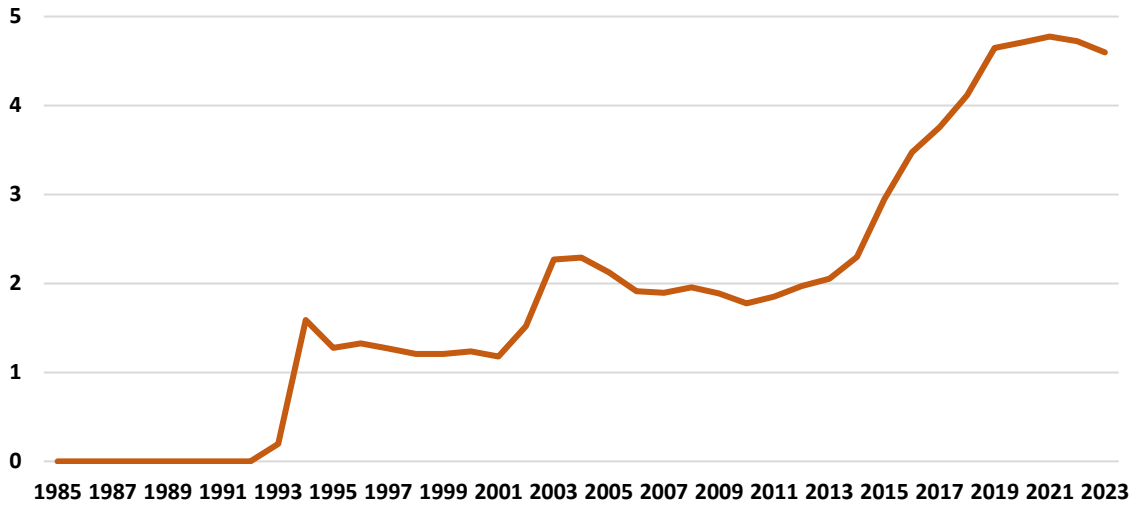
Technological breakthroughs in ultra-deep and offshore drilling have opened access to previously unreachable reserves. The Shendi Take 1 ultra-deep well in Xinjiang reached a depth of over 10,000 meters, setting a world record and showcasing China's homegrown capabilities. Onshore ultra-deep reserves now represent over a third of total oil and gas resources.

Offshore exploration is also booming. China's offshore oil discovery rate reached 30% in 2024—exceeding the global average—and new finds in the Bohai Bay and Tarim Basin are reshaping upstream output. CNPC, Sinopec, and CNOOC continue to invest heavily in unconventional resources like coalbed methane and low-maturity shale oil.

Fusion Race

China and the US are in a high-stakes race to develop grid-scale nuclear fusion—the "holy grail" of clean energy. Fusion promises vast energy output without greenhouse gases or long-term radioactive waste, generating four times more energy per kilogram than fission and millions more than coal. If commercialized, the global fusion market could exceed $1 trillion by 2050.

Figure 3: Share of Electricity Production from Nuclear



Source: Our World in Data

The US achieved the first net-energy fusion ignition at the Lawrence Livermore National Lab in 2022, fueling a surge in private investment—now over $8 billion, with 25 of the Fusion Industry Association's 40 member startups based in the US

Yet China is gaining ground quickly. Despite entering the fusion race decades later, Beijing is investing roughly $1.5 billion annually—almost twice US federal spending—and accelerating reactor construction at an unmatched pace. China also leads in new fission power projects, positioning itself as the global hub for next-generation nuclear development.

While the US dominates private fusion investment, China is scaling up larger reactor footprints, which could prove more effective in sustaining stable plasma conditions and reaching net energy production.