

Joining Forces to Address the Practical Challenges of Energy Transition

CNPC Research Institute of Economics and Technology

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- According to the World Meteorological Organization, 2024 marked the warmest year on record, with temperatures 1.55° C above pre-industrial levels.
- Addressing climate change is now a global consensus. Over 140 countries have announced pledges toward "zero carbon" or "carbon neutrality" visions, collectively accounting for 88% of global carbon emissions, 90% of world GDP, and 85% of the population.

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2. The global energy development has entered a phase of strategic confrontation

- **Intensified strategic competition among major powers is pushing the global political landscape into blocs and groups.** In response, countries are localizing their energy industries to boost autonomy and control and accelerating the decoupling and disruption of industrial supply chains. **Cooperation on climate change still faces multiple challenges.**
- **Energy security has become the foremost concern for countries addressing energy issues.** Frequent outbreaks of extreme weather, geopolitical tensions, and system stability incidents have kept energy security high on governments' agendas for consecutive years.

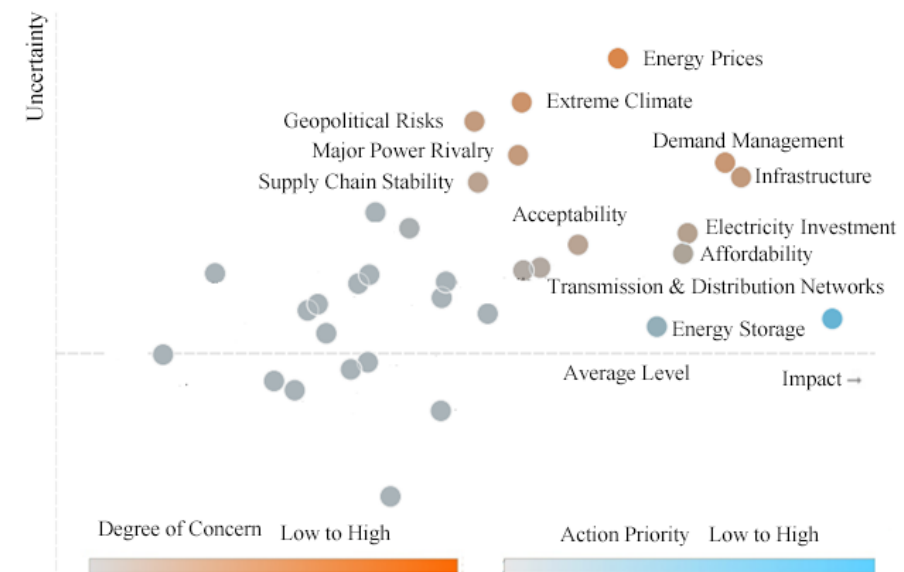
Intensified major power rivalry is reshaping the global political and economic landscape.



The United States has once again withdrawn from the *Paris Agreement*.



Security remains a key issue in global energy development.



3. ETRI has publicly issued its mid-to-long-term energy outlook



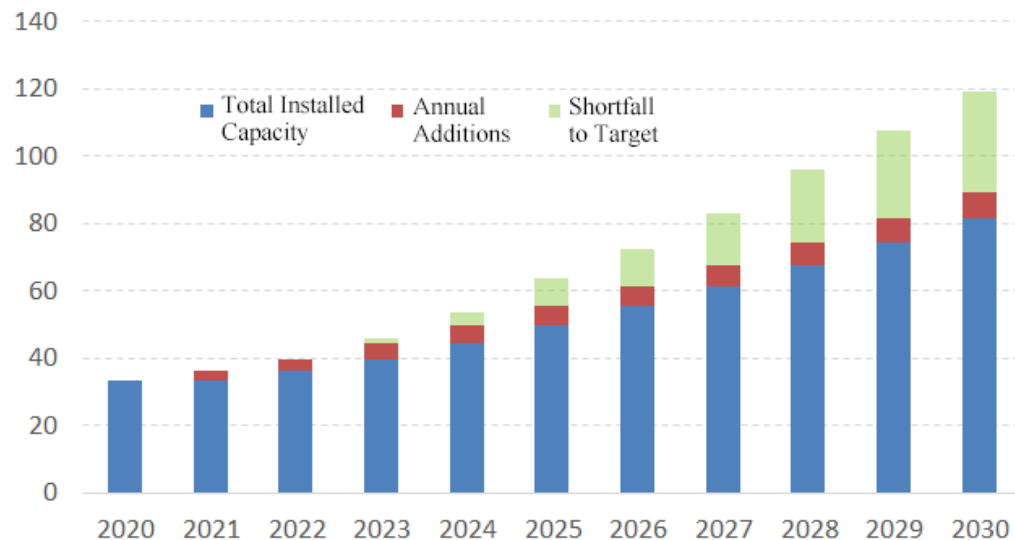
- ETRI has long been dedicated to research on energy transition and climate change. For nine consecutive years, it has released its World and China Energy Outlook report to a global audience. The report sets out insights into the mid-to-long-term energy development in China and around the world
- In the 2024 Energy Outlook, three development scenarios are defined based on varying patterns of strategic competition among major powers. With bloc confrontation intensifying among the major powers, the world is fast slipping into a strategic confrontation scenario.

Scenario Name	Key Features of Each Scenario
Strategic Confrontation Scenario	<ul style="list-style-type: none">• Global political competition is leading to blocs and groups, with confrontations intensifying in geopolitical conflicts, technological competition, and trade barriers;• The decoupling of the global energy industry chain and the disruption of the supply chain, coupled with energy security challenges, are impeding the transition process;
Baseline Scenario	<ul style="list-style-type: none">• Major power rivalry persists but stops short of outright breakdown, with countries maintaining a bottom-line balance of competition and cooperation;• Countries coordinate energy transition with security concerns, tailor their energy transition to local conditions, and strive to meet their self-determined emission reduction targets;
Cooperation Scenario	<ul style="list-style-type: none">• The world is swiftly reshaping a cooperative, win-win development pattern and accelerating efforts to build a community with a shared future for humanity;• Countries have reached a consensus on tackling climate change, with investment, technology, and policy working in harmony to drive the energy transition;

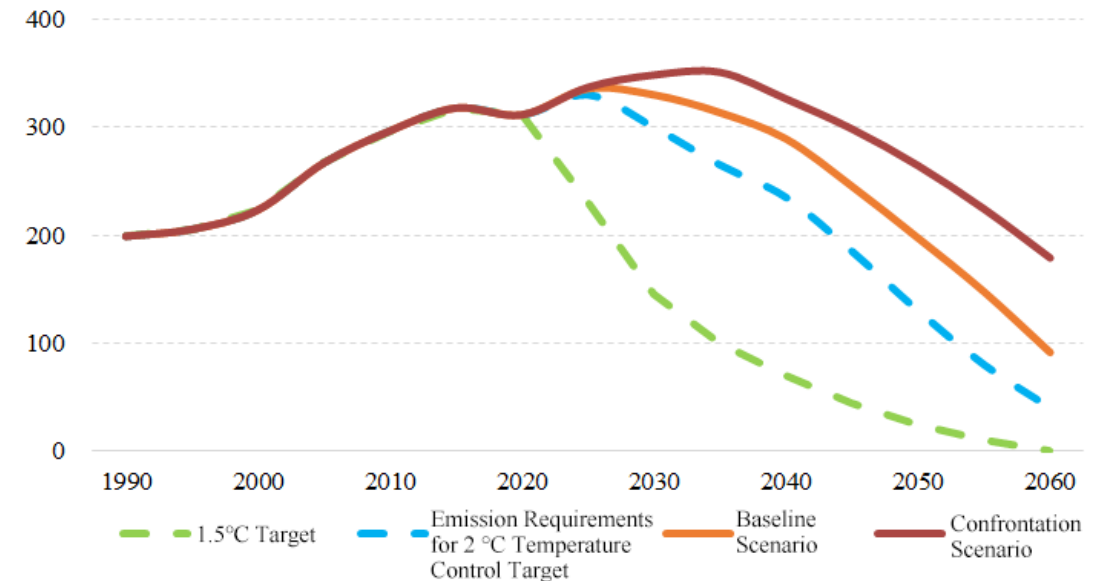
4. Under the strategic confrontation scenario, the global window for meeting the 1.5° C temperature control target has essentially closed

- Under the strategic confrontation scenario, international cooperation on clean energy wanes and its growth slows, which seriously impedes the energy transition process. At COP29, countries committed a mere USD300 billion annually to tackling climate change, far below the USD1.3 trillion needed. This highlights the steep hurdles in combating climate change.
- Investment in the energy transition remains inadequate, and the pace of technology diffusion and new energy development is slowing. As a result, CO₂ emissions will still hit 17.9 billion tons by 2060, and the global average temperature is expected to climb by about 2.5° C by 2060, exposing humanity to far more severe climate catastrophes.

Shortfall in Renewable Energy Growth vs. COP28 Targets



Energy-Related CO₂ Emissions under Different Scenarios, Measured in 100 Million Tons

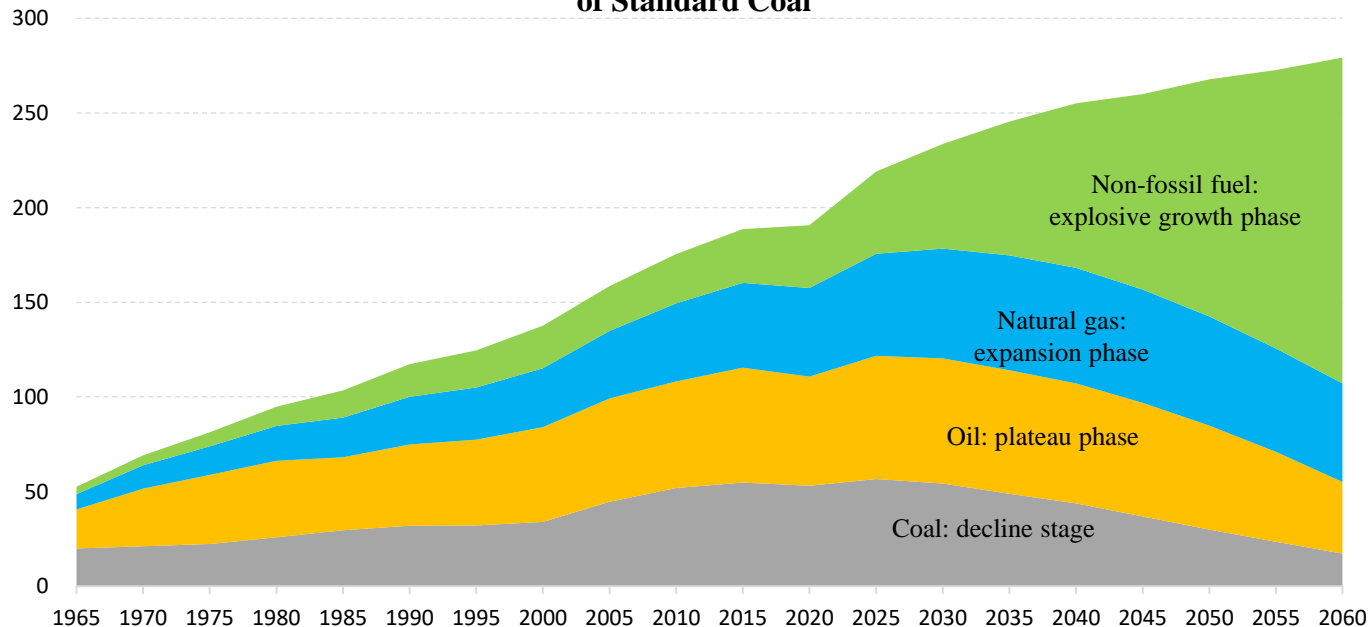


Data sources: The Sixth Assessment Report by IPCC, CNPC Research Institute of Economics and Technology.

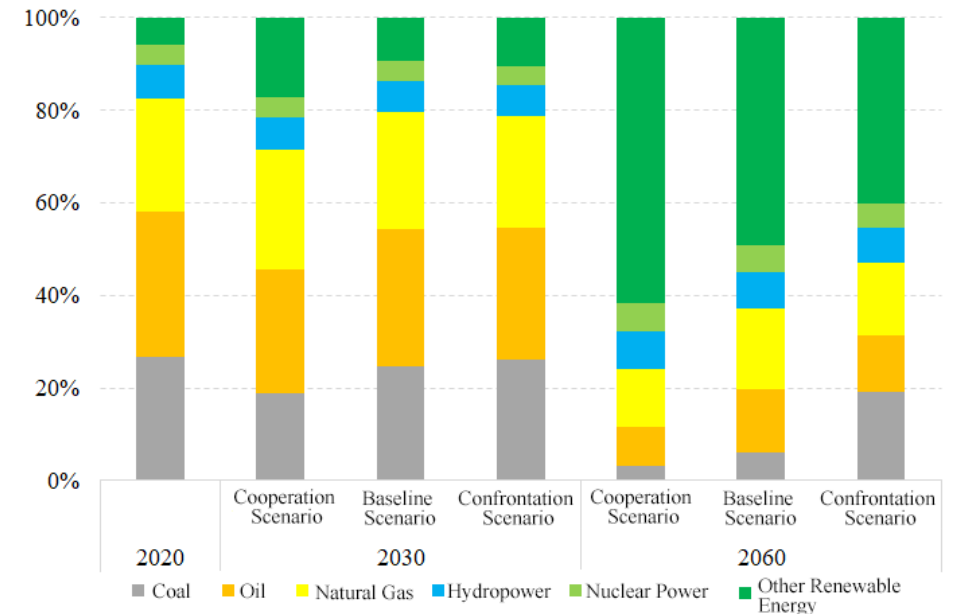
5. Under the strategic confrontation scenario, the transition to clean, low-carbon energy slows down dramatically

- The global energy landscape is undergoing its third structural transformation from oil & gas toward new energy. **Coal is now in its decline phase, oil has plateaued, natural gas is in an expansion phase, and non-fossil fuels are experiencing explosive growth.**
- Under the strategic confrontation scenario, countries place greater emphasis on securing energy supplies and scale back the application of advanced clean energy technologies. As a result, non-fossil fuel consumption shrinks markedly and its share is projected to reach just 53% by 2060, which is 10 percentage points lower than in the baseline scenario.

Global Energy Demand by Category, Measured in 100 Million Tons of Standard Coal



Primary Energy Mix under Different Scenarios



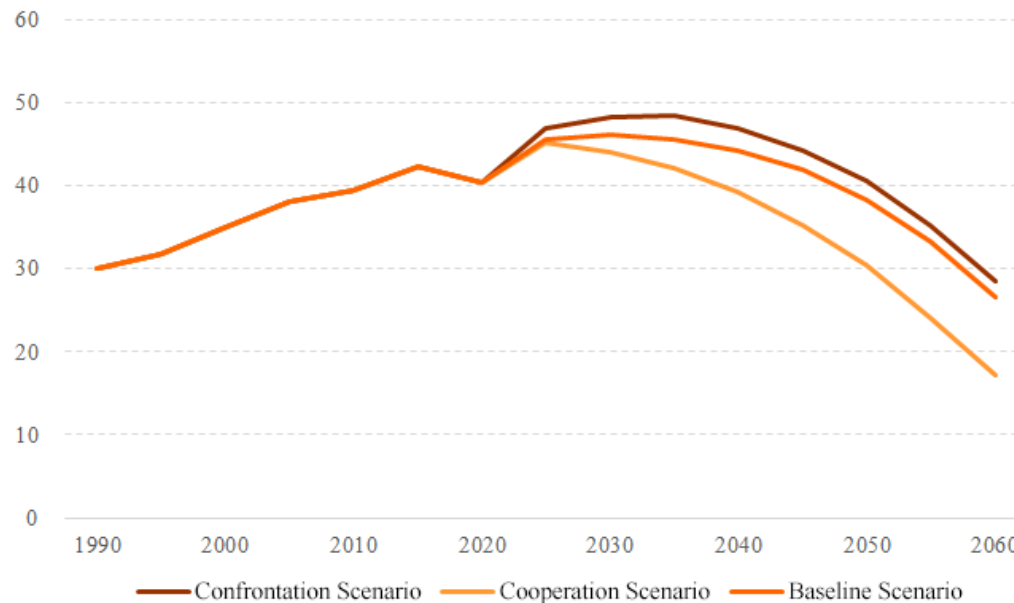
6. Under the strategic confrontation scenario, the transition pathway in the oil & gas sector is fundamentally altered



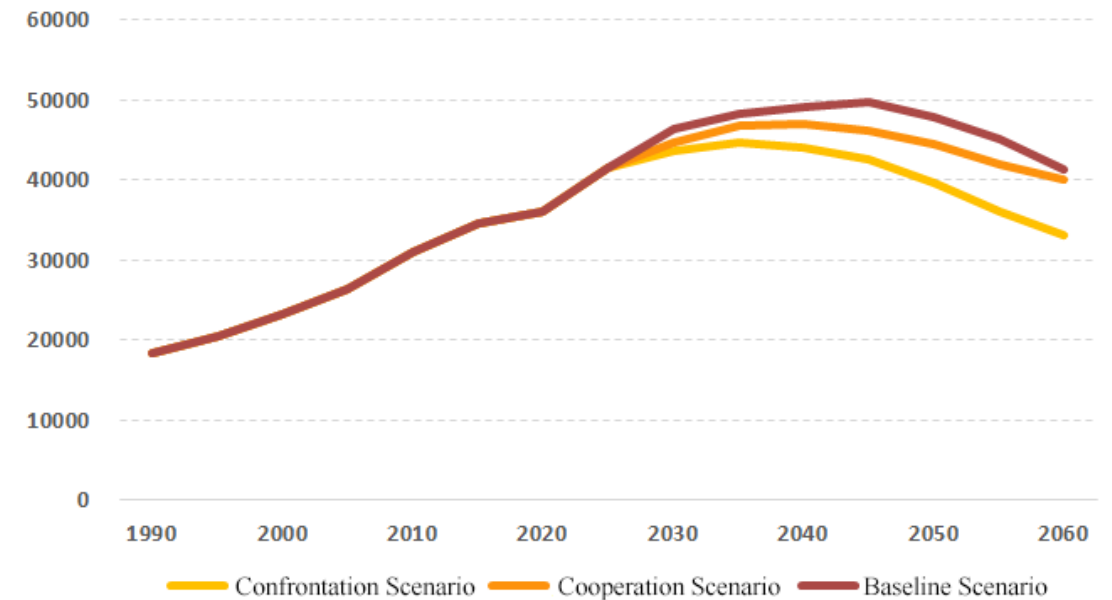
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- Despite a speeding global transition to clean, low-carbon energy, oil & gas demand will remain high over the long haul. Through 2045, it is expected to hold steady on a peak plateau at above 11.5 billion tons of standard coal (8 billion tons of standard oil), cementing its role as the primary energy source.
- Under the strategic confrontation scenario, **trade barriers and technological competition** push the oil demand to a peak of 4.85 billion tons in 2035, which is five years later than in the baseline scenario and raises the peak level by 4.9%. Meanwhile, **global natural gas demand peaks earlier and at a lower level**. It will peak at roughly 4.4 trillion cubic meters in 2035, which is five years ahead of the baseline scenario and 6.1% lower.

Oil Demand under Different Scenarios, Measured in 100 Million Tons



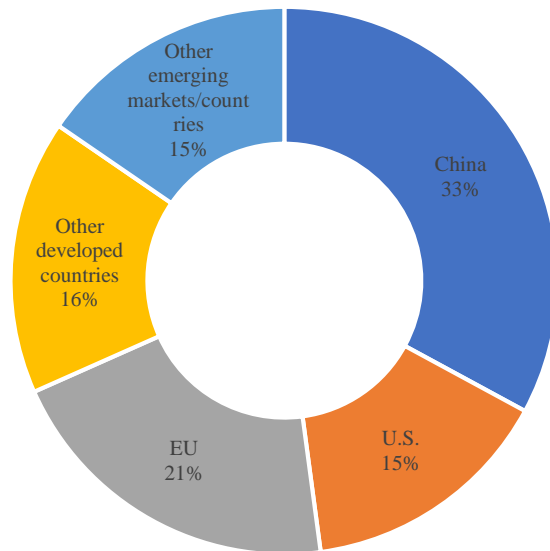
Natural Gas Demand under Different Scenarios, Measured in 100 Million Cubic Meters



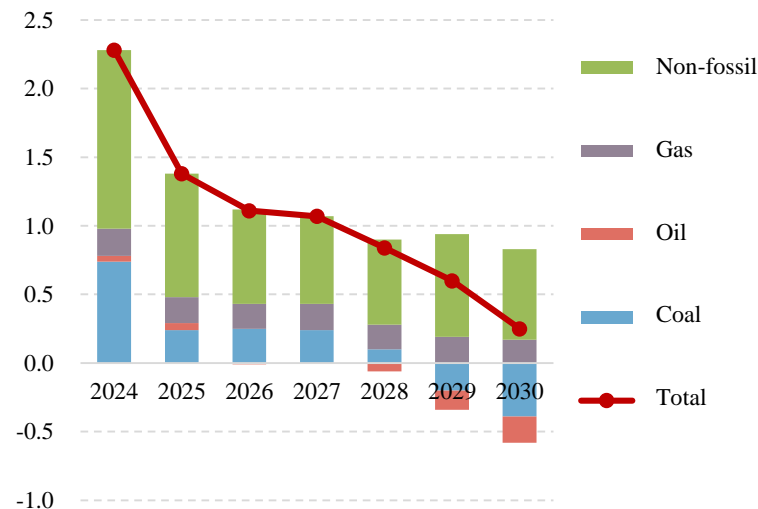
7. China continued to lead the world in green and low-carbon transition

- By 2024, China's clean energy investment will account for one-third of the world's share, with new wind and solar energy installations reaching 260GW, and it has become a leader in the global energy transition.
- The energy structure is transitioning toward cleaner sources, characterized by declining coal, stable oil and gas, and rising new energy. with the proportion of non-fossil energy sources rising to more than 25 per cent by 2030.

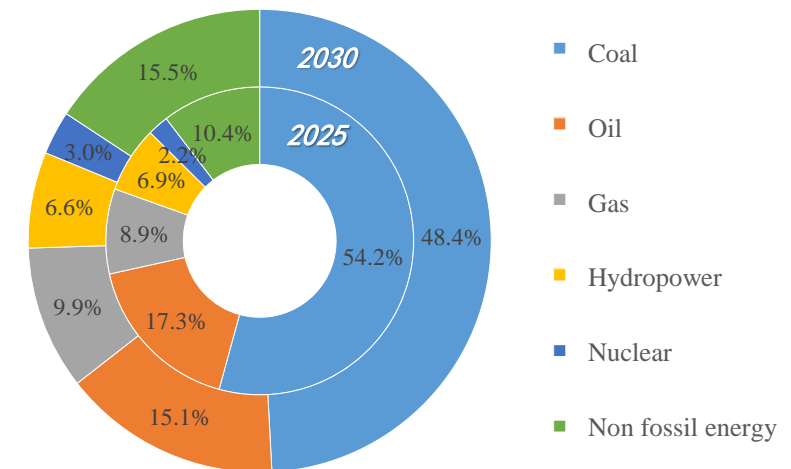
Global Investments in Clean Energy in 2024



Change in energy demand (100 Mtoe)



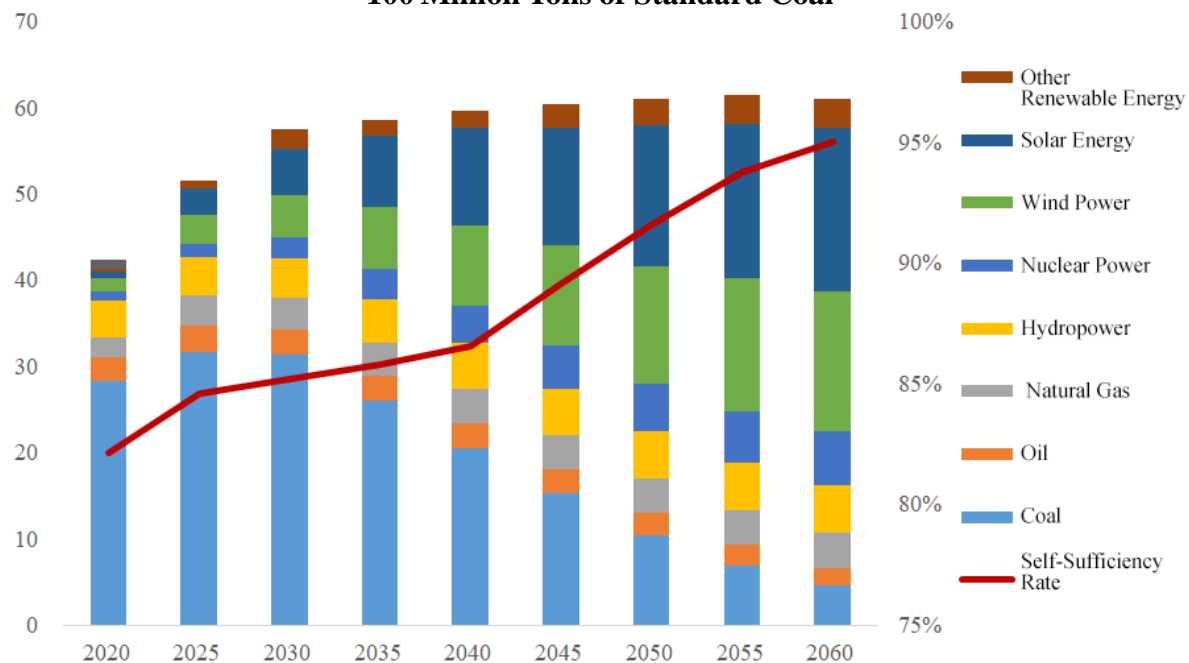
China's primary energy mix



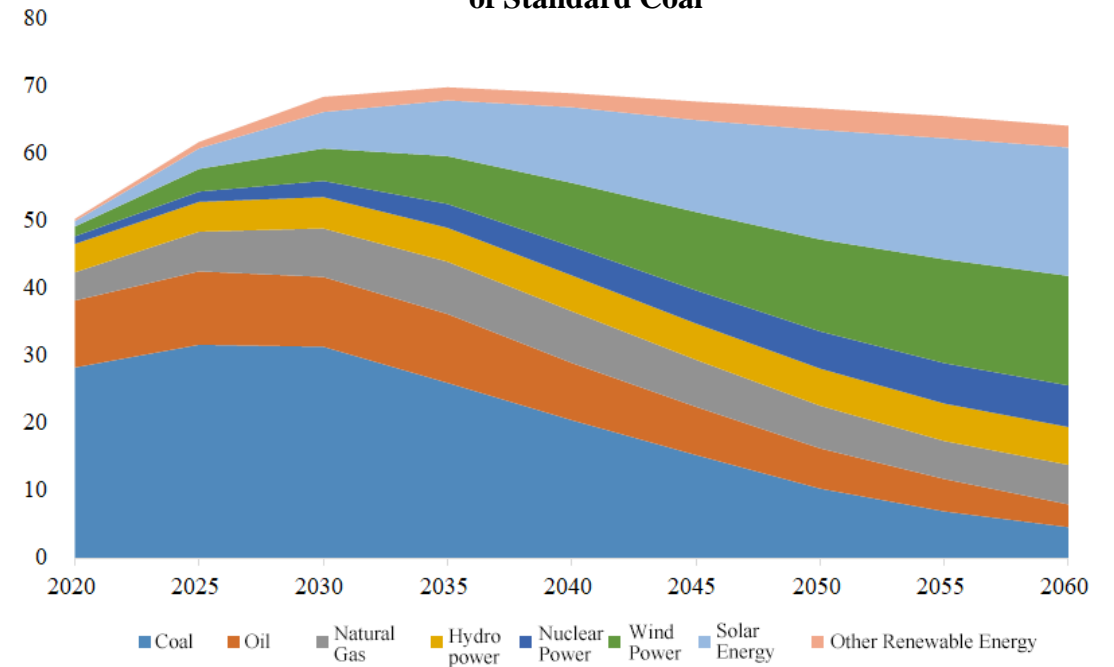
8. China is speeding up the development of a new energy system to drive an accelerated energy transition

- The capacity to secure energy supply keeps elevating.
- China's primary energy demand is projected to peak at 7 billion tons of standard coal in 2035.

China's Energy Output and Self-Sufficiency Rate, Measured in 100 Million Tons of Standard Coal



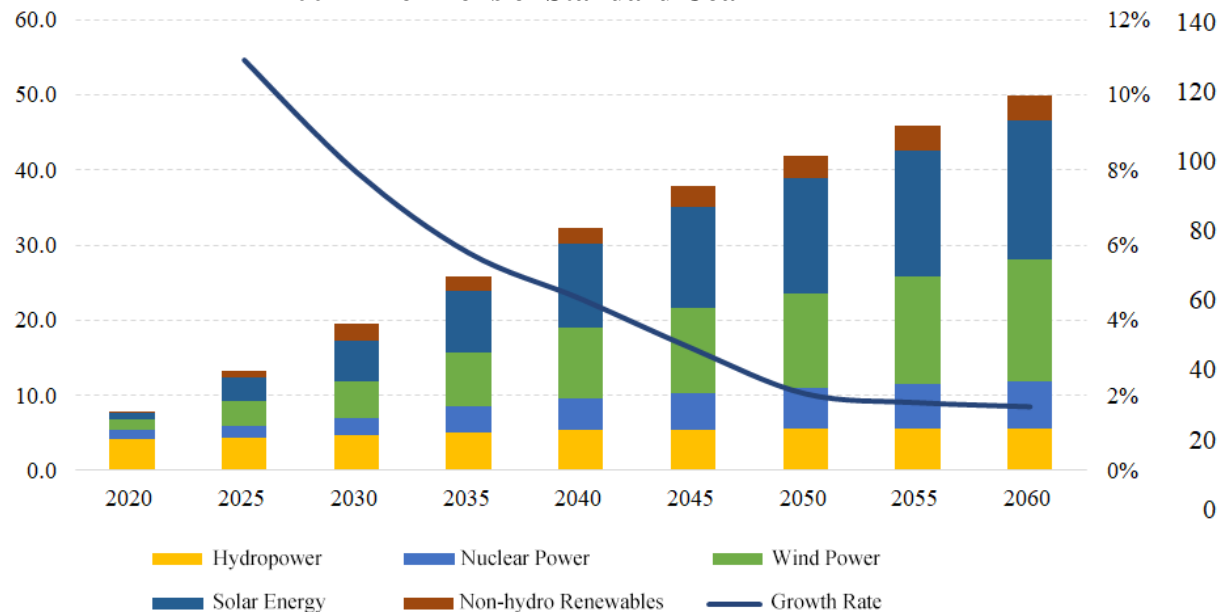
China's Primary Energy Demand, Measured in 100 Million Tons of Standard Coal



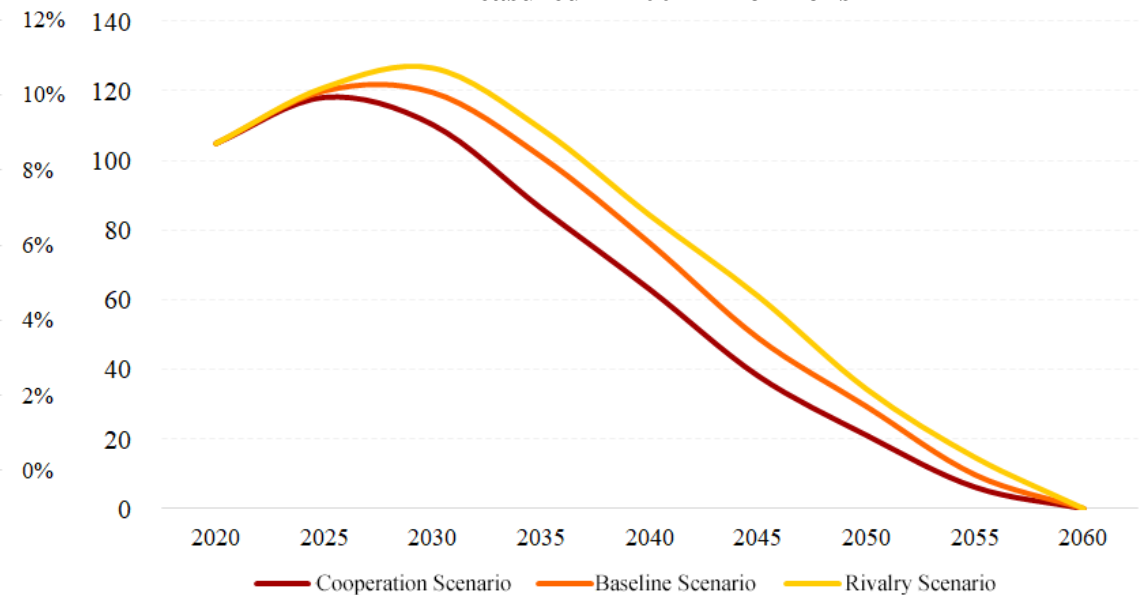
9. China is optimizing its energy mix to honor its pledged "dual carbon" goal

- Non-fossil fuels are growing at a rapid speed. By 2060, their consumption will exceed 5 billion tons of standard coal, accounting for 78% of primary energy.
- **China will honor its pledged "dual carbon" goal on schedule.**

Non-Fossil Energy Demand and Growth Rate, Measured in 100 Million Tons of Standard Coal



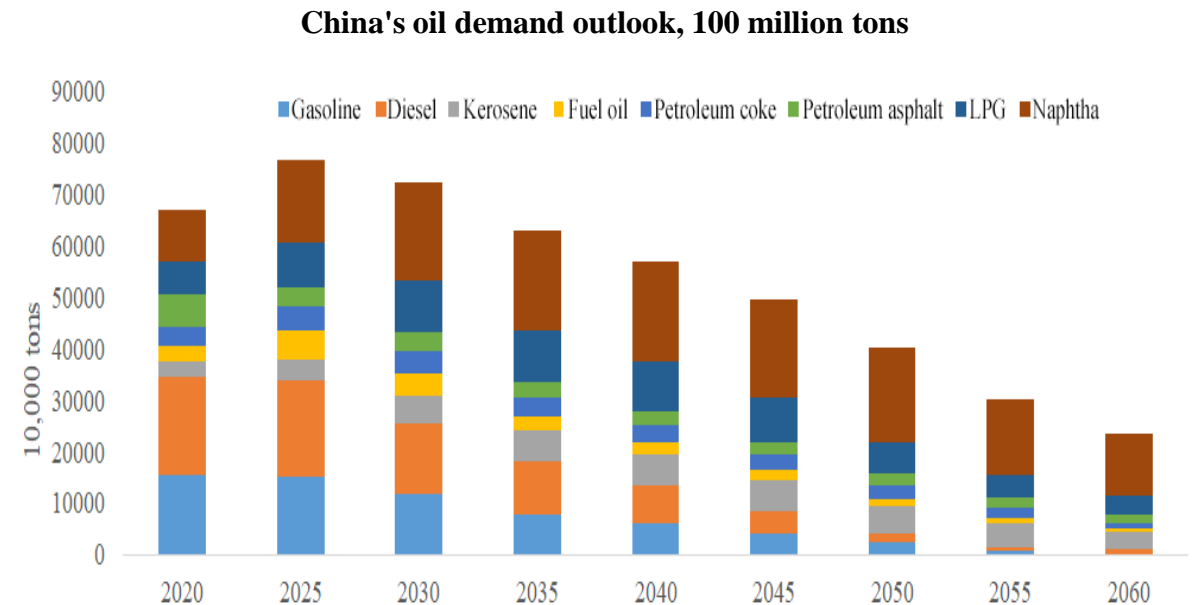
Trends in Energy-Related CO₂ Emissions under Different Scenarios, Measured in 100 Million Tons



10. Accelerated Energy Transition to Push China's Oil Consumption to Peak Early

- The oil consumption structure showed the trend of "declining in transportation oil, rising in chemical oil".
- In the Mid-term, Alternative energy will develop beyond expectations.

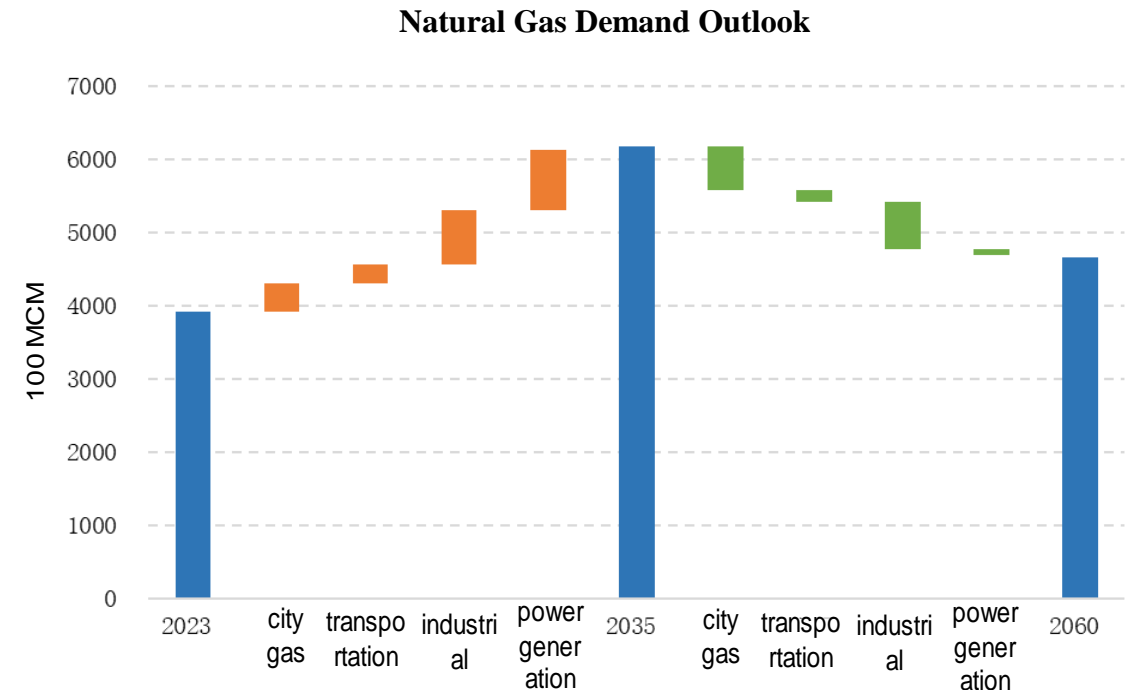
- **Plateau Phase (2021-2030):** Total consumption peak level is 770~780 million tons per year. The main consumer is the transportation sector.
- **Decline Phase (2031-2050):** Demand for oil as fuel will decline while as chemical feedstock will increase.
- **Feedstock Phase (2051-2060):** Total consumption will be around 200-250 million tons. Chemical feedstock is the main consumption.



Source: ETRI

11. Integration of natural gas and new energy drives faster consumption growth

- Natural gas is an important energy source supporting the green transition of China's economic and social development, playing a significant and positive role in the process of building China's new energy system, and it is expected that the demand for natural gas will maintain a growth trend in the long term.
- **Rapid Growth Phase (2025–2035).** Demand will rise quickly, driven by replacing high-pollution fuels and integrating with new energy.
- **Peak Plateau Phase(2035–2045).** Demand will stabilize at 600-650bcm/y, driven by integration with new energy.
- **Decline Phase(2045–2060).** Natural gas will be a key safeguard in the new energy system, mainly used in centralized decarbonization via "natural gas + CCS."



① Pragmatic Cooperation

- Enhance energy trade and technological collaboration, make full use of fossil fuel technologies and infrastructure.
- Keep energy prices fair and stable while striving for universal access to energy and the eradication of energy poverty.

③ Joint Promotion of the Transition

- Maintain confidence in the carbon neutrality goal, pursue both the decarbonization of fossil fuels and the large-scale development of renewable energy in parallel.
- Ensure steady markets for critical minerals essential to the energy transition, and work together to build a clean, beautiful world.

② Inclusive Development

- Foster inclusivity of diverse energy sources. Each country should tailor its strategy to national conditions, get the pace right, coordinate development, and build robust institutions.
- Replace traditional fossil fuels with clean, low-carbon energy in a safe pace. Robust energy system security and resilience.

④ Stabilization of Expectations

- Fossil fuels will remain the primary energy source for the long haul.
- Prevent supply-demand imbalances caused by the energy transition by maintaining steady investment .



Thank You!