



Report 2022

CWEA

The Shanwei Jiazi offshore wind farm in China. Photo Credit: CWEA

Authors Tongguang Wang, Guangping Du and Jieying He, Chinese Wind Energy Association (CWEA), China.

In 2022, China continued to have the highest wind power capacity in the world. Although the amount of newly added capacity decreased by 10% compared to the previous year, a significant 50 GW was created. Hereby, the accumulated capacity almost reached 400 GW¹.

The grid-connected capacity increased to 365 GW with the addition of nearly 38 GW in 2022. The newly added and cumulative grid-integrated wind power capacities accounted for 18.8% and 14.3% of installed power capacities nationwide in 2022.

Wind power remains China's third largest energy generation source, following thermal and hydroelectricity. The average full-load-hour of wind

power was 2,259 hours, increasing by 13 hours from 2021. Wind-generated electricity totalled 760 TWh, a considerable increase of 16.5% from the previous year. Wind-generated electricity accounted for 8.8% of the total electricity generation, an increase of 0.9 percentage points over 2021. The average wind curtailment rate was 3.2%, which remained the same level as in 2021.

¹ National capacity of in-service wind turbines (the decommissioned and early decommissioned wind turbines were eliminated, total capacity was 928 MW), not including the wind power installation capacity in Taiwan.

Table 1. Key National Statistics 2022: China

Total (net) installed wind power capacity	395.57 GW
Total offshore capacity	30.51 GW
New wind power capacity installed	49.83 GW
Decommissioned capacity (by the end of 2022)	0.93 GW
Total electrical energy output from wind	759.9 TWh
Wind-generated electricity as percent of national electricity demand	8.8%
Average national capacity factor	24.1%
Target	580GW by 2025
National wind energy R&D budget	N/A

The grid-connected capacity is 365,438 MW (37,630 MW connected in 2022).

In 2022, the Chinese government issued a series of policies and regulations to strengthen wind power development with multi-energy, implement the grid parity of both onshore and offshore wind power projects, reduce wind curtailment, promote the development of distributed wind power and push developing wind power in desert and Gobi areas. In addition, Chinese companies made progress in R&D, including wind energy developments in desert and Gobi areas and offshore wind energy generation.

Highlight(s)

- Total wind capacity surpassed 350 GW to reach nearly 400 GW.
- Total offshore capacity exceeded 30 GW, nearly 8% of total wind capacity.
- Record high wind generation of 760 TWh, a 16% increase from 2021.
- The largest onshore and offshore wind turbines installed were 8 MW and 11 MW, respectively.

Market Development

Targets and Policy

Under the requirements and guidance of the “carbon peak and carbon neutrality” goals and the 14th Five-Year Plan, the 14th Five-Year Plan for the Development of Renewable Energy was released in June 2022. The main targets aim for renewable energy to account for more than 50% of the increase in primary energy consumption, the increase in electricity generated from renewable energy to account for more than 50% of the total increase in electricity consumption, and the electricity generation from wind and solar energy to double. By 2025, the total national renewable energy consumption distribution should equal about 33%, and non-hydropower consumption weight should consist of about 18%.

The measures planned to achieve these goals include vigorously promoting the base development of wind power and photovoltaic power generation, including the development of wind and solar power projects in the desert and Gobi areas. Additionally, by promoting the

construction of offshore wind power bases in an orderly manner, focusing on building five offshore wind power bases in the Shandong Peninsula, Yangtze River Delta, southern Fujian, eastern Guangdong, and Beibu Gulf. Moreover, actively promoting the distribution and nearby development of wind power, including constructing wind power in industrial parks, development zones, mines, and rural areas.

To follow the national plan, 25 provincial plans on wind developments were released, with more than 300 GW of wind power to be constructed in the 14th Five-Year Plan period.

In order to improve the consumption of renewable power and promote the development of renewable energy, the National Development and Reform Commission, the National Bureau of Statistics and the National Energy Administration issued the notice further improving the work concerning the exclusion of newly increased renewable energy consumption from total energy consumption control on the 15th of August 2022. It is again clarified that the electricity consumption from newly increased renewable energy will not be included in the total energy consumption

control and is proposed to accurately define the scope of electricity consumption of new renewable energy sources, improve the statistical accounting system of renewable energy consumption data, and scientifically implement the responsibility evaluation and assessment of energy conservation targets.

Progress and Operational Details

By the end of 2022, China installed 49.83 GW of new wind power capacity. This accounted for 49% of global new wind capacity for the year. The accumulated wind power capacity in China reached 395.57 GW, accounting for 47% of wind power capacity worldwide, maintaining the highest wind power capacity in the world.

In 2022, a total of 11,098 new wind turbines were installed, of which 695 were offshore, and 604 wind turbines decommissioned, bringing the national total of operating turbines to 181,660. The average capacity of newly installed wind turbines was above 4.49 MW, an increase of 27.8% compared to 2021.

The top five provinces with the most new installed capacity were:

- Inner Mongolia (12.6 GW)
- Gansu (4.5 GW)
- Shandong (3.7 GW)
- Xinjiang (3.1 GW)
- Jilin (2.9 GW)

Together, these accounted for 54.1% of the new capacity nationwide. The “Three North” regions and the middle, eastern, and southern regions of China, respectively, account for 66% and 34% of new installations.

The average weighted full-load-hour of operating wind farms was 2,259 hours, an increase of 13 hours compared to 2021.

By the end of 2022, the total number of offshore turbines reached 5,932. The cumulative installation exceeded 30 GW. The new installation was about 5.2 GW, representing a 64.4% decrease from the record year of 2021. Wind turbines with a capacity of 8.0 MW to 9.0 MW (excluding 9.0 MW) accounted for 43.9% of the newly installed capacity of offshore wind turbines. In 2022, the maximum newly created capacity increased from 10 MW in

2021 to 11 MW, accounting for 7.5% of the newly installed offshore wind capacity. The new offshore installations were distributed in Shandong, Guangdong, Fujian and Zhejiang. The installation in Shandong was about 2 GW, accounting for 39.7% of the new capacity.

Matters Affecting Growth and Work to Remove Barriers

In 2022, the new installation was again record high, and the power grid is under enormous strain. NDRC and NEA issued policies and took multiple measures to ensure the grid integration of wind power and to improve renewable energy consumption.

To minimise the environmental impacts of wind power, desert and Gobi areas will be utilised, and construction in industrial parks, development zones, mines and rural areas will be promoted.

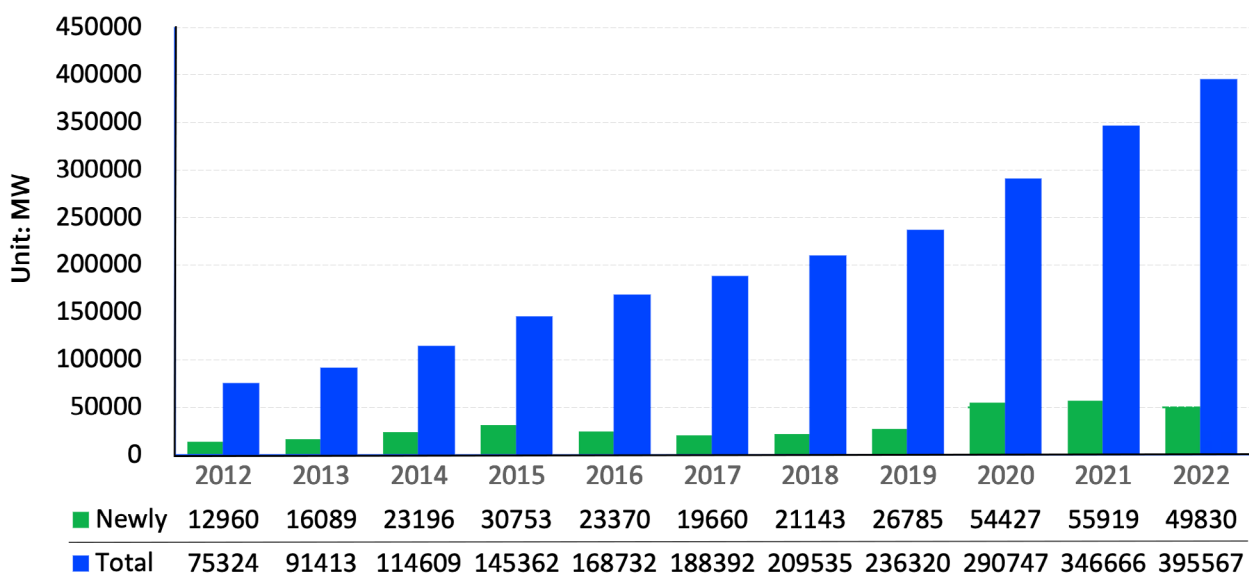


Figure 1. The new installations and cumulative installations from 2011 to 2022. Data Source: CWEA.

RD&D Activities

National RD&D Priorities and Budget

In 2022, the national RD&D focused on building the multi-energy complementary clean energy bases, including the integration development of wind, solar, hydro, ocean energy, clean coal-fired plants, grid, load and energy storage projects, desert and Gobi wind power, deep-sea offshore wind power and several transmission channels, new types of wind turbines and their key components, and medium voltage, direct current, low-frequency technologies, etc.

2022 is the second year of the “14th Five-Year Plan” development. The relevant RD&D actions made achievements which were invested mainly by the developers, manufacturers and research bodies.

National Research Initiatives and Results

The research and manufacturing of super-large wind turbines and their main components have made remarkable achievements. The 6.2 MW whole floating wind turbine was installed in seawater at 65m depth in July 2022. The “CNOOC Guanlan” floating platform for a 7.25 MW floating wind turbine was finished at the end of 2022. The first 16 MW and 18 MW offshore wind turbines finished assembly in workshops in November and December 2022, respectively. The 8-11 MW onshore wind turbines started design and prototype manufacturing. The 20 MW offshore middle-speed PMSG generator was announced in WindEnergy Hamburg 2022. Meanwhile, the 15 MW floating wind turbine and 20 MW offshore wind turbine have been under research and development.

Yangzhou University, NUAU, Gold Wind, MYwind, Chinawind, Shanghai Electric and CGC jointly take part in the research on low noise wind turbine technology, including improvement of the wind turbine aerodynamic noise source model, development of PE noise propagation models in complex terrain, research of coupling methods of PE models and CFD in complex terrain, among others. The project has finished all seven research tasks and applied for nine patents, licensed four software systems, and published 11 academic papers.

In the meantime, IEA Wind Tasks’ participants from China actively joined collaborative research, combined with their company’s needs, on Task 30 OC6, Task 31 Wakebench, Task 32 Wind Lidar, Task 41 Distributed Wind, Task 42 Wind Turbine Lifetime Extension, among others, and achieved some progress, winning industry praise.



Figure 2. The 6.25 MW floating wind turbine.

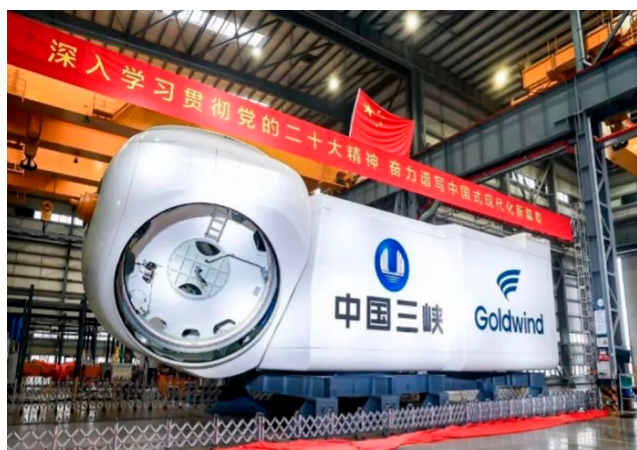


Figure 3. The 16 MW offshore wind turbine off the production line.

Test Facilities and Demonstration Projects

The National Offshore Wind Power Equipment Quality Inspection and Testing Centre, with investment from CGC in Yangjiang, have finished the static test of the longest blade spanning 126m, made by Shuangrui. Tests are now being prepared for the new longest blades, up to 150m. The full-scale test benchmarks for blades more than 150m long and whole nacelles of 15+ MW have been planned and started construction by industry players.

Collaborative Research

By the end of 2022, the CWEA had arranged for 28 domestic wind power companies, research institutes, and universities to attend IEA Wind TCP Tasks:

- **Task 11** Base Technology Information Exchange.
- **Task 19** Wind Energy in Cold Climates.
- **Task 25** Design and Operation of Power Systems with Large Amounts of Wind Power.
- **Task 27** Small Wind Turbines.
- **Task 29** Mexnext: Analysis of Wind Tunnel Measurements and Improvement of Aerodynamic Models.
- **Task 30** Offshore Code Comparison, Collaboration, Continued, with Correlation, unCertainty (OC3-OC6).
- **Task 31** Benchmarking of Wind Farm Flow Models.
- **Task 32** Lidar Systems for Wind Energy Deployment.
- **Task 33** Reliability Data: Standardizing data Collection for Wind Turbines.
- **Task 35** Full-Size Ground Testing

for Wind Turbines and Their Components.

- **Task 36** Forecasting for Wind Energy.
- **Task 37** Systems Engineering.
- **Task 39** Quiet Wind Turbine Technologies.
- **Task 41** Enabling Wind to Contribute to a Distributed Energy Future.
- **Task 42** Wind Turbine Lifetime Extension Assessment.
- **Task 49** Integrated Design of Floating Wind Arrays (IDEA).
- **Task 52** Large-Scale Deployment of Wind Lidar.

Impact of Wind Energy

Environmental Impact

In 2022, wind-generated electricity totalled 759.9 TWh, which saved about 243.18 million tons of standard coal per year and reduced 637.1 million tons of carbon dioxide. It plays an important role in reducing air pollution and controlling greenhouse gas emissions. Furthermore, to realise the “30-60” targets of carbon peak and carbon neutrality in China.

Developing a total of 450 GW in two hatches of wind and solar power plants in the desert and Gobi areas will help improve the ecological environment. Developing wind power in line with local cultural and environmental requirements, restoration of greenery, soil and water conservation, and roads is the cardinal principle to maintaining the ecological environment.

Economic Benefits and Industry Development

In 2022, the new installation capacity reached about 49.8 GW, which included more than 5.2 GW of new offshore wind power capacity. With a

land-based wind power investment of 6,500 CNY/kW (877.5 EUR/kW; 942.5 USD/kW) and offshore wind power investment of 16,000 CNY/kW (2,160 EUR/kW; 2,320 USD/kW), the total investment in wind energy in 2022 reached more than 373.1 billion CNY (50.37 billion EUR; 54.10 billion USD).

The development of the wind energy industry will markedly enhance the development of related industries and increase employment. In 2022, about 15 jobs will be produced for every 1 MW of installed wind power capacity, and it is estimated that more than 750,000 people were employed in the wind power industry through 2022.

Next Term

Wind power development has become an essential part of China’s green transition. The domestic wind power industry has made significant achievements in onshore and offshore wind developments. It is expected that during the 14th Five-Year Plan period, desert and Gobi wind power, distributed wind power, and offshore wind power will be the three main forces of wind power development and construction. Coastal areas will promote local electricity consumption, and the imbalance of integrated energy between east and west regions will be reduced. As subsidies recede, the end market demand will grow substantially. CWEA will continue to do its best to organise national research efforts and related activities of IEA wind.

References

- [1] Xinhua (2022) The 14th Five-Year Plan for the Development of Renewable Energy.
- [2] CWEA (2023) China Wind Power Industry Mapping 2022
- [3] GWEC (2023) Global Wind Report 2023..