Summary of statistic data in China energy and power sectors in 2021

March 2022

Note: All figures are based on coal substitution method

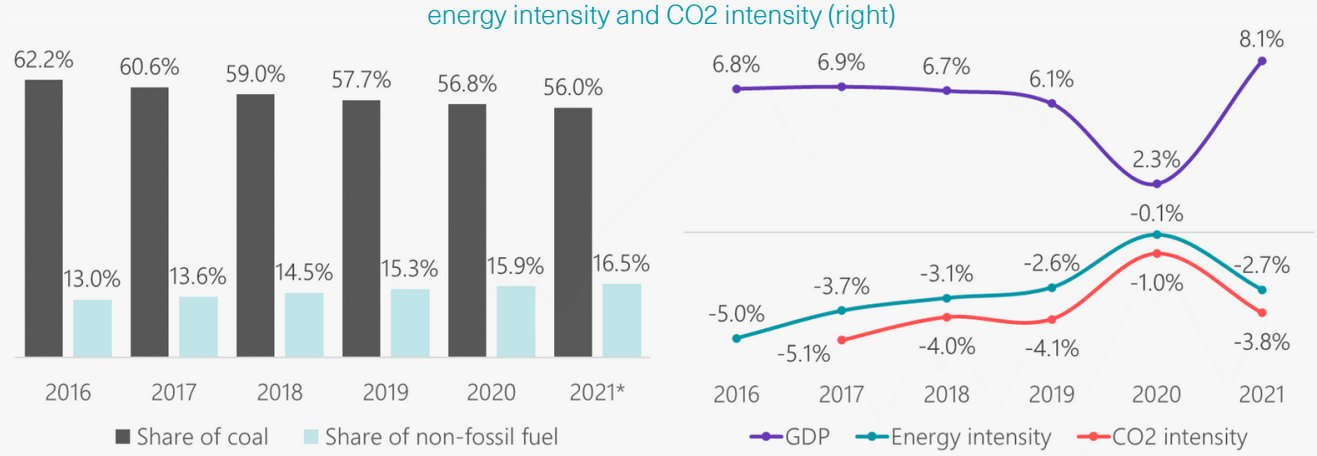
Energy consumption and economic development continue to be decoupled

In 2021, China's GDP growth rate reached 8.1%, a year-on-year increase of 5.8 percentage points, and the average growth rate in the past two years was 5.1%. The economic recovery has directly driven the growth rate of the added value of the three major industries to increase by 5 to 6 percentage points, of which the tertiary industry still accounted for the largest proportion (53.3%), followed by the secondary industry (39.4%) and the primary industry (7.3%). [1]

> *Non-fossil fuel accounted for about **16.5%** of total primary energy consumption in 2021, a year-on-year increase of 0.6 percentage points.*

The total energy consumption was 5.24 billion tons of coal equivalent (tce), a year-on-year increase of 5.2%, an increase of 3 percentage points over 2020, yet still significantly lower than the GDP growth rate. The growth rates of coal, natural gas and crude oil consumption have all increased, reaching 4.6%, 12.5% and 4.1% respectively. Nevertheless, the proportion of coal further decreased to 56.0%. In addition, energy consumption intensity and CO2 emission intensity are also decreasing, with a decline of 2.7% and 3.8% respectively, which is basically the same as that in 2019. Energy consumption and economic development continue to be decoupled. [1]

2016-2021 Total primary energy consumption by fuel (left); 2016-2021 Annual growth rates of GDP, energy intensity and CO2 intensity (right)



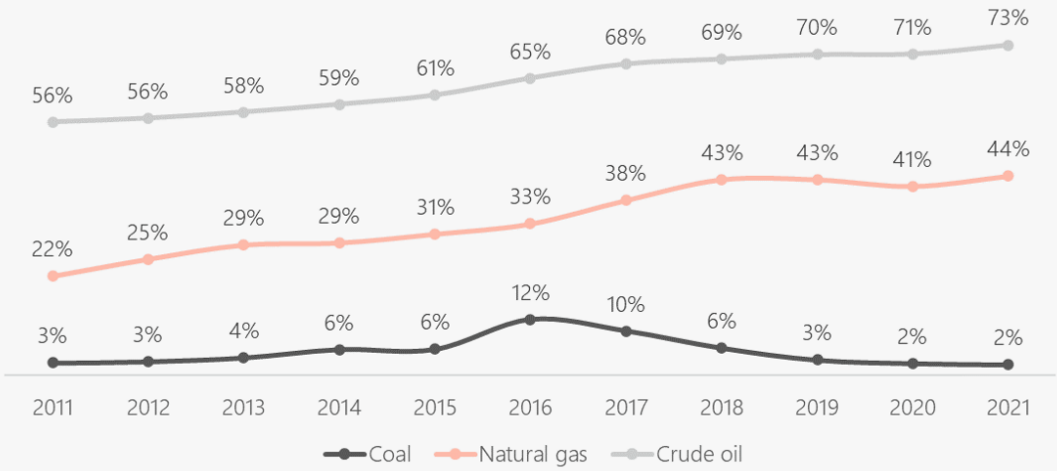
*Note: * The share of non-fossil fuel in 2021 is calculated based on the data of the National Bureau of Statistics (NBS); energy intensity refers to energy consumption per RMB 10,000 GDP; carbon intensity refers to CO2 emission per RMB 10,000 GDP.*

Source: National Bureau of Statistics (NBS), accessed in February 2022

Import dependence on fossil energy remains high

Affected by the significant increase in energy demand, the country's total primary energy production reached 4.33 billion tce in 2021, a year-on-year increase of 6.2% and an increase of 3.4 percentage points from 2020. Raw coal, as the most important energy resource, has increased its production and import growth rate, while its dependence on import remains at only about 2%. China's natural gas demand hit a record high last year. Against the backdrop of soaring global gas prices, the growth rate of natural gas imports rose sharply from 5.3% to 19.9% despite the continued increase in local production capacity. In contrast, with the increase in domestic oil reserves and production in recent years, the import of crude oil has declined for the first time since 2000, by 5.4%. On the whole, natural gas and crude oil are still dependent on imports to some extent, and the import dependence reached about 44% and 73% respectively in 2021. [1]

2011-2021 Import dependence of coal, natural gas and crude oil



Source: calculated from data of NBS, accessed in February 2022

Electricity consumption growing rapidly in all industries

Driven by the continuous recovery of the economy and the rapid growth of exports, the annual electricity consumption of China in 2021 reached 8,313 TWh, a year-on-year increase of 10.3%, and an increase of 7.2 and 5.8 percentage points compared with 2020 and 2019 respectively. [2] The two-year average growth rate was positive in the 31 provinces across the country, among which 19 provinces had a growth rate of more than 10%, and 10 provinces were between 8% and 10%. In terms of different industries, the primary industry had the fastest two-year average growth rate of electricity consumption, reaching 14.6%; followed by the tertiary industry, urban and rural residents, and the secondary industry, which were 9.5%, 7.0% and 6.4% respectively. [6]

> *The two-year average growth rate of the country's total electricity consumption reached 7.1%, 1.4 percentage pointshigher than the average annual growth rate during the 13th Five-Year Plan period.*

Primary industry - Benefited from the continuous retrofit and upgrading of rural power grids, the electricity demand in rural areas maintained double-digit growth for four consecutive quarters last year, and the electrification rate further increased.

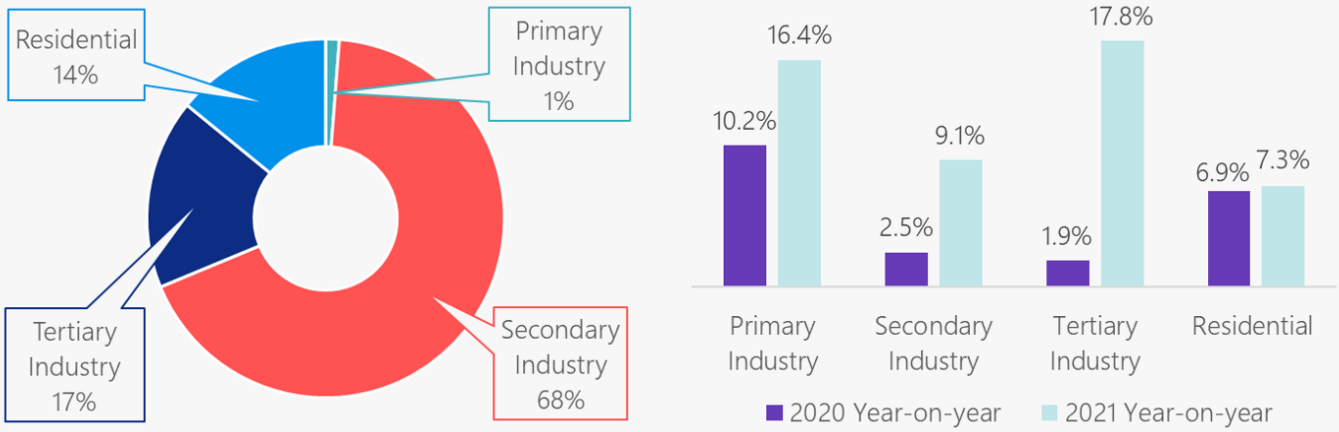
Secondary industry - Although the year-on-year growth rate of electricity consumption has been dropping quarter by quarter, the transition of the manufacturing industry showed an upward trend. The year-on-year growth rate of electricity consumption in the four major energy-intensive industries, including steel, non-ferrous metals, building materials and chemicals, turned from positive to negative, and has fallen to -1.9% in the fourth quarter of 2021.

While the proportion of electricity consumption in the high-tech and equipment manufacturing industry in the whole manufacturing industry increased by 1.1 percentage points last year, with a growth rate of 15.7%. Among which, the equipment manufacturing of solar PV, new energy vehicles and wind energy saw the most significant year-on-year growth, reaching 91.3%, 46.8% and 25.4%, respectively.

Tertiary industry - The electricity consumption of the service industry has basically recovered to what before the epidemic, but the electricity consumption structure has undergone significant changes. The rapid development of the EV industry has driven the demand for electricity in the charging service industry, with an average two-year growth rate of 79.0%. In the service industries including transport, storage and post industry, and hotels and catering industry, which require direct contact, the growth rate of electricity consumption has declined due to the impact of the epidemic.

Residential - Residents' domestic electricity consumption has basically maintained a normal growth level after the epidemic.

2021 Power consumption by sector (left); 2020 and 2021 year-on-year growth rate of power consumption by sector (right)



Source: China Electricity Council (CEC), January 2022

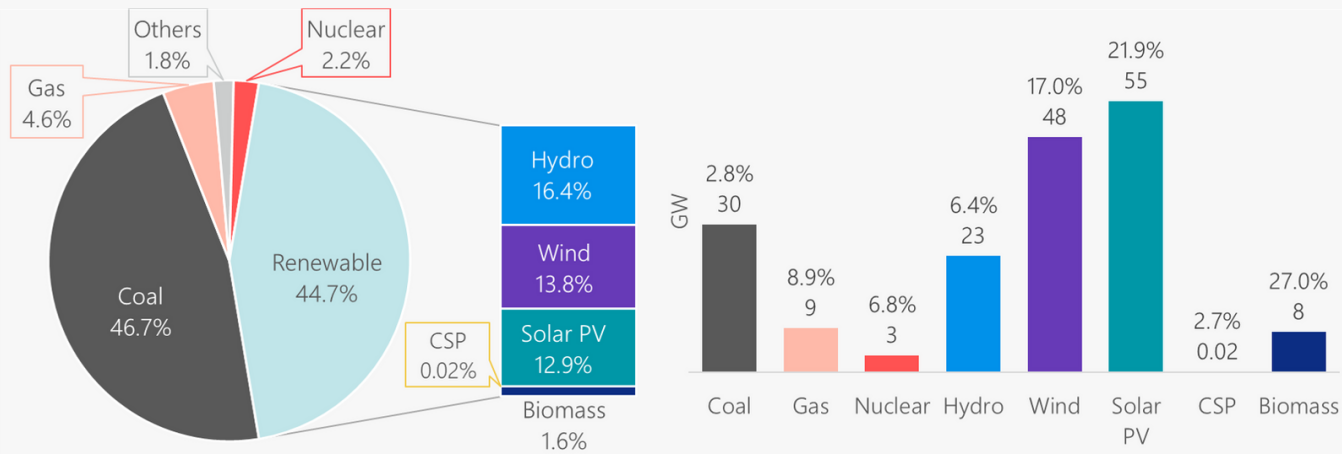
Power source structure further goes clean

The total installed power generation capacity in China reached 2,377 GW by the end of 2021, a year-on-year increase of 7.9%. Although the growth rate has dropped by 1.6 percentage points compared with 2020, non-fossil fuel accounted for 78.3% of newly installed capacity, and the share of annual investment increased to 88.6%. [6] The total installed capacity of renewable power sources exceeded 1,000 GW for the first time, of which non-hydro renewable accounted for 28.3%, a year-on-year increase of 2.7 percentage points. [4] The installed capacity of coal power increased by 30 GW, yet its proportion in total installed capacity further dropped to 46.7%. [2]

> *The total installed capacity of non-fossil fuel power generation surpassed coal power for the first time, accounting for 47.0%.*

Since the 13th Five-Year Plan period (2015-2020), the year 2021 has seen the largest number of hydropower projects put into operation, with the total installed capacity reaching 391 GW, of which pumped storage accounted for 9.2%. As the most important non-hydro renewable power sources, 48 GW of new wind power projects and 55 GW of new solar PV projects were connected to the grid in 2021, building up the cumulative installed capacity to 328 GW and 306 GW respectively. [4] The cumulative installed capacity of concentrated solar power (CSP) has exceeded 500 MW in 2021. [5] The newly installed biomass power capacity continued to hit a record high, with the cumulative installed capacity reaching 38 GW, a year-on-year increase of 27.0% and an increase of 4.5 percentage points from last year. [4]

2021 Total installed power generation capacity by fuel and share (left); 2021 Incremental installed power generation capacity and year-on-year growth rate (right)

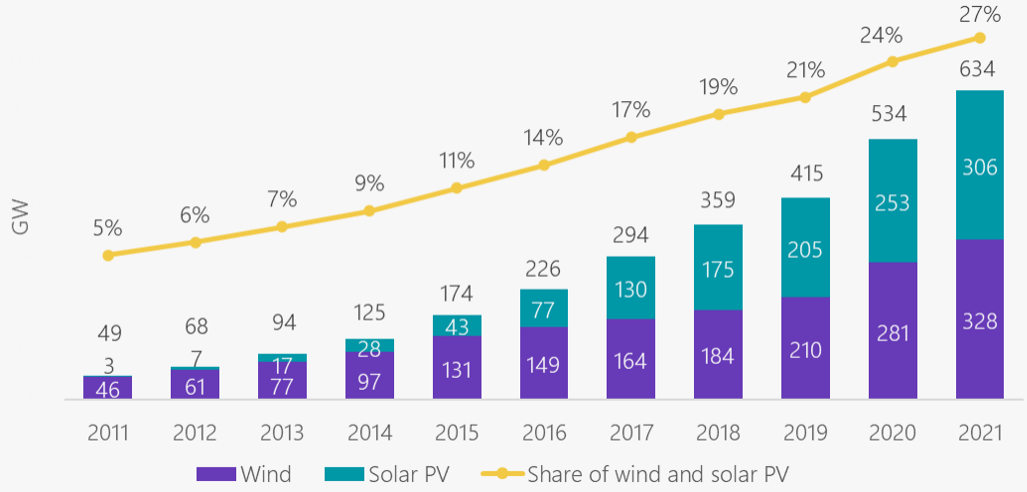


Source: data of coal, gas and nuclear from CEC, January 2021; data of hydro, wind, solar PV and biomass from the National Energy Administration (NEA), January 2021; CSP and others are calculated based on CEC and NEA's data

Wind power - Among the 48 GW of newly added capacity, the Three Norths region accounted for 39%, and the central, eastern and southern regions accounted for 61%, further optimizing the layout of wind power nationwide. **As 2021 was the last year for the central government to subsidize new grid-connected offshore wind power projects, offshore wind power accounted for 35.5% of the newly installed capacity.**

Solar PV - Among the record high of 55 GW of newly added capacity, North China accounted for 39% and central and eastern China for 34%. **Household solar PV capacity doubled in 2021, which pushed the development of distributed solar PV to accelerate significantly, to account for 53.3% of newly installed solar PV, surpassing centralized solar PV for the first time.**

2011-2021 Cumulative installed capacity of wind power and solar PV and share in total installed capacity



Source: NEA and Energy Research Institute of the National Development and Reform Commission (ERI of NDRC), accessed in February 2022

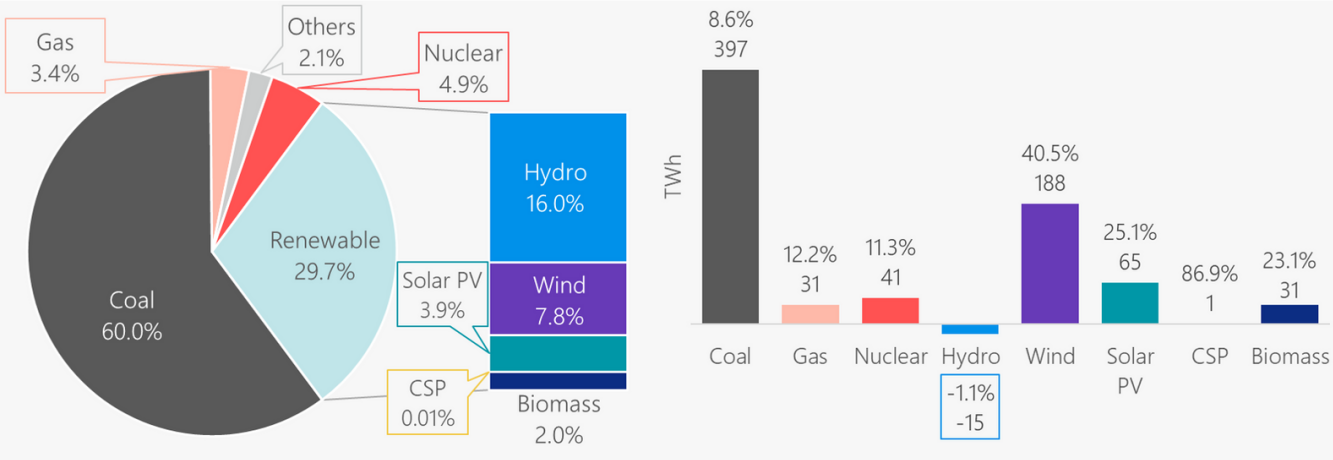
Power generation from non-hydro RE sources increased significantly

Affected by the rapid recovery of power consumption, China's total power generation in 2021 reached 8,377 TWh, a year-on-year increase of 9.8%, an increase of 5.8 and 4 percentage points compared with 2020 and 2019 respectively. [2] The proportion of non-fossil fuel power generation reached 34.5%, an increase of 0.6 percentage points year-on-year. [2][3][4]

> ***Coal power** is still the most important power source in China, but the share of coal power generation continued to decrease in 2021.*

Due to the low precipitation, the growth rate of coal power and non-hydro renewable power generation both increased, while the growth rate of coal power was 8.6%, which was lower than that of the total power generation (9.8%) and total electricity consumption (10.3%), and the proportion of coal power generation decreased from 60.8% to 60.0% [3]; the growth rate of wind power, solar PV and biomass power generation reached 40.5%, 25.1% and 23.1% respectively, which were significantly higher than that of the total power generation and total electricity consumption. The share of renewable energy in total electricity consumption reached 29.8%. [4]

2021 Total power generation by fuel and share (left); 2021 Incremental power generation and year-on-year growth rate by fuel (right)

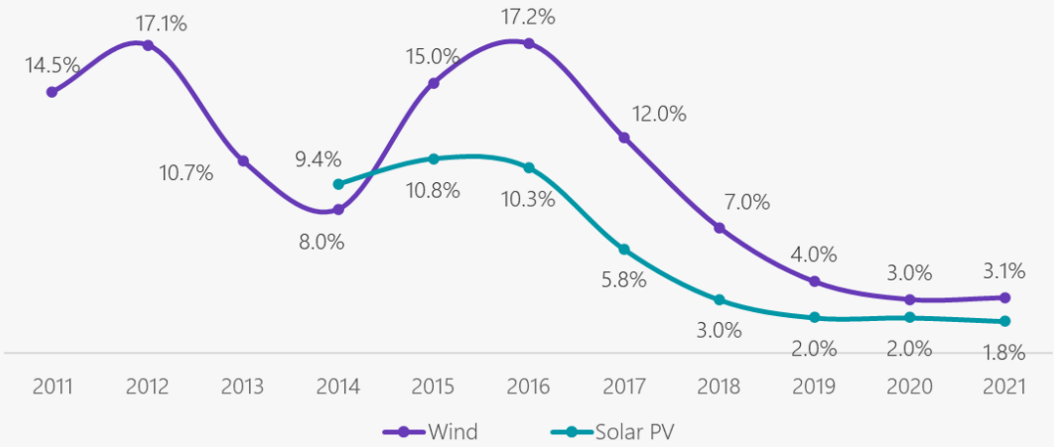


Source: data of coal, gas and nuclear from CEC, January 2021; data of hydro, wind, solar PV and biomass from NEA, January 2021; CSP and others are calculated based on CEC and NEA's data

The overall operating efficiency of power units across the country has been improved, with the average annual utilization hours increasing by 60 hours to 3,817 hours. In addition to the year-on-year decrease of 203 hours in utilization hours of hydropower, the annual utilization hours of thermal power (mainly refers to coal and gas power), nuclear power and wind power increased by between 170 and 230 hours, and the utilization hours of solar PV remained stable. [4][6]

The average utilization rates of hydropower, wind power and solar PV power reached 97.9%, 96.9% and 98.0% respectively, all higher than the national target of 95%, and the utilization rates in key regions such as Xinjiang and Gansu have increased significantly. [4] According to these data, the estimated curtailment rates of hydropower, wind power and solar PV were 2.1%, 3.1% and 1.8% respectively. [5]

2011-2021 Annual wind and solar curtailment rates



Source: 2011-2020 data from NEA, 2021 data from ERI of NDRC, accessed in February 2022

Assessment of power sector development with focus of wind power and solar PV policy trends in 2022

Outlook of power sector development

The power balance of China was generally tight in 2021, therefor a stable electricity supply will be the industry's top priority in 2022. According to the forecast of the China Electricity Council (CEC), considering factors such as economic development and electrification process, it is expected that the year-on-year growth of total electricity consumption will reach 5%-6% in 2022, which is the same level as that in 2019. Driven by the rapid development of new energy, the installed capacity of non-fossil fuel power is expected to account for 50% of the total installed capacity for the first time, reaching 1,300 GW. Newly installed nuclear power, hydropower, wind power, solar PV and biomass power are expected to reach 2 GW, 19 GW, 52 GW, 94 GW and 7 GW respectively. Newly installed coal power capacity will be around 31 GW, the same level as in 2021, with a cumulative installed capacity of 1,140 GW. [6]

Wind power and solar PV policy trends

2021 is the first year of China's 14th Five-Year Plan period (2021-2025) and the first year of the implementation of the 30-60 dual carbon targets. In 2021, wind power and solar PV plants were fully unsubsidized for the first time, both the development environment and the industry have been facing great changes. To achieve the goal of reaching a total installed capacity of wind power and solar PV of more than 1,200 GW by 2030, the State Council, the National Development and Reform Commission (NDRC), and the National Energy Administration (NEA) have issued more than a dozen policies and mechanisms directly related to the development of wind power and solar PV industries. Although the 14th Five-Year Plans for energy, power and renewable energy development have not been officially issued, the short, medium and long-term policy and mechanism routes are generally clear. [5]

01 The development and consumption of renewable power such as wind power and solar PV should be promoted equally and synchronously

The promotion of integration of generation-grid-load-storage and multi-energy complementary projects, large-scale wind power and solar PV bases in desert and Gobi, and county-wide distributed rooftop PV projects, has provided hundreds of giga-watts of wind power and solar PV project layout and reserves for the 14th Five-Year Plan period. The main policies to increase the energy consumption capacity include:

- Wind power and solar PV capacity expansion will take diversified grid connection mechanisms of guaranteed grid connection and market-based grid connection (please refer to the June 2021 newsletter for policy content);
- Define the quantitative standards for the configuration of peak shaving/storage for new on-grid wind power and solar PV projects that are market-based grid connection capacity, and establish a dynamic regulating mechanism (please refer to the July 2021 newsletter for policy content);
- Build a multi-dimensional power consumption guarantee mechanism composed of power dispatch, market-oriented operation, and distributed power markets.

02 Strengthen the binding requirements for the proportion of renewable energy in electricity consumption by region, which aims for a shared responsibility

That is, the total amount of renewable power consumption that needs to be increased is relatively greater in the east and central regions (please refer to the June 2021 newsletter for the mechanism). Meanwhile, implement measures to encourage the consumption of renewable energy, such as exempt the incremental renewable energy consumption from the assessment of total energy consumption.

03 Wind power and solar PV projects will participate in the power markets on a larger scale, in a wider range, and in various ways under the trend of advancement and deepening of the construction of the power market

In 2021, China launched the green power market under the medium- to long-term contract market (please refer to the September 2021 newsletter for the trading mechanism). The green certificate mechanism is also being improved, and the environmental attributes of wind power and solar PV has been partially shown. This lays the foundation for its connection with the carbon market in the future and the gradual transition from the dual control of energy consumption to the dual control of carbon emissions.

For any questions, please contact china@ens.dk

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Appendix - 2021 China energy and power datasheet

	Amount	Year-on-year	Amount	Year-on-year
Energy consumption	Data		Reference	
Total (billion tce)	5.2	5.2%	[1]	[1]
Coal (billion tons)	4.2	4.6%	[1][10] calculated	[1]
Natural gas (billion m3)	369	12.5%	[1][10] calculated	[1]
Crude oil (million tons)	724	4.1%	[1][10] calculated	[1]
Share of coal	56.0%	-0.9 pct	[1]	[1]
Share of non-fossil fuel**	16.5%	0.6 pct	[1][10] calculated	[1][11] calculated
Energy production				
Total (billion tce)	4.3	6.2%	[1]	[1]
Raw coal (billion tons)	4.1	5.7%	[1]	[1]
Natural gas (billion m3)	208	7.8%	[1]	[1]
Crude oil (million tons)	199	2.1%	[1]	[1]
Energy import (million tons)				
Coal	323	6.6%	[1]	[1]
Natural gas	121	19.9%	[1]	[1]
Crude oil	513	-5.4%	[1]	[1]
Electricity consumption (TWh)				
Total	8313	10.3%	[2]	[2]
Primary Industry	102	16.4%	[2]	[2]
Secondary Industry	5613	9.1%	[2]	[2]
Tertiary Industry	1423	17.8%	[2]	[2]
Residential	1174	7.3%	[2]	[2]
Power installed capacity (GW)				
Total	2377	7.9%	[2]	[2]
Thermal *	1259	3.5%	[2][4] calculated	[2][4] calculated
of which coal	1109	2.8%	[3]	[3]
of which gas	109	8.9%	[3]	[3]
Nuclear	53	6.8%	[2]	[2]
Hydro	391	6.4%	[4]	[4] calculated
of which pumped storage	36	14.3%	[4]	[4][8] calculated
Wind	328	17.0%	[4]	[4] calculated
of which onshore wind	302	11.3%	[4]	[4] calculated
of which offshore wind	26	178.1%	[4]	[4] calculated
Solar PV	306	21.9%	[4]	[4] calculated
of which utility-scale solar PV	200	14.7%	[4][5] calculated	[4][5] calculated
of which distributed solar PV	107	37.5%	[4][5] calculated	[4][5] calculated
CSP	0.6	2.7%	[2][4] calculated	[2][4][5] calculated
Biomass	38	27.0%	[4]	[4] calculated
Other non-fossil fuel	0.9	127.8%	[3]	[3]
Non-fossil fuel	1118	13.4%	[2][3][4] calculated	[6]
Renewable energy	1063	14.4%	[2][4] calculated	[2][4] calculated
Share of non-fossil fuel	47.0%	2.3 pct	[2][3][4] calculated	[2][4][7][8] calculated
Share of renewable energy	44.7%	2.3 pct	[2][4] calculated	[2][4][7][8] calculated
Power generation (TWh)				
Total	8377	9.8%	[2]	[2]
Thermal *	5483	8.7%	[2][4] calculated	[2][4] calculated
of which coal	5027	8.6%	[3]	[3]
of which gas	283	12.2%	[3]	[3]
Nuclear	407	11.3%	[2]	[2]
Hydro	1340	-1.1%	[4]	[4]
of which pumped storage	39	16.4%	[3]	[3]
Wind	653	40.5%	[4]	[4]
Solar PV	326	25.1%	[4]	[4]
CSP	1.1	86.9%	[3][4] calculated	[3][4] calculated
Biomass	164	23.1%	[4]	[4][8] calculated
Other non-fossil fuel	0.2	-18.8%	[3]	[3]
Non-fossil fuel	2891	12.1%	[2][3][4] calculated	[2][3][4][8] calculated
Renewable energy	2483	12.2%	[2][4] calculated	[2][4][8] calculated
Share of non-fossil fuel	34.5%	0.6 pct	[2][3][4] calculated	[2][3][4][8] calculated
Share of renewable energy	29.6%	0.5 pct	[2][4] calculated	[2][4][8] calculated
Utilization hours (hours)				
National	3817	60	[6]	[6]
Thermal	4448	237	[6]	[6]
of which coal	4586	263	[6]	[6]
of which gas	2814	204	[6]	[6]
Nuclear	7802	352	[6]	[6]
Hydro	3622	-203	[4]	[4]
Wind	2246	149	[4]	[4][8] calculated
Solar PV	1163	3	[4]	[4]
Curtailment				
Wind	3.1%	0.1 pct	[5]	[5][8] calculated
Solar PV	1.8%	-0.2 pct	[5]	[5][8] calculated

*Notes: *The figure of thermal power is revised by CEC's thermal power - NEA's biomass power because CEC's thermal power data includes biomass; **The figure is calculated based on the data issued by the National Bureau of Statistics.*