

## CHINESE ELECTRICITY MARKET AS THE PERSPECTIVE DIRECTION FOR RUSSIAN INVESTMENTS

**Abstract:** The article is devoted to the evaluation of China's electric power market and its investment attractiveness for Russian investors. The author analyzes the dynamics and forecasts of power consumption and generation, the installed capacity of power plants, the structure of power sources. Both traditional sources of energy and RES are considered. Particular attention is paid to gas generation. The forecasts of the electric power market development are considered in accordance with the Plan of China's social and economic development.

**Key words:** Chinese electricity market, investments, Russian-Chinese cooperation.

### INTRODUCTION

China is the leader in primary energy consumption since 2009 with the figure of 3053 mln tons of oil equivalent [6], which is representing 23% of global consumption.

China accounts for more than 50% of global coal consumption. The volume of coal consumption in 2016 amounted to 1187,6 million tons of oil equivalent, which is almost 3 times more than in 2000 [6].

China takes the second place after the USA on oil consumption volume. The oil consumption volume in China in 2016 was 578,7 mln tons of oil equivalent [6] that is 2,7% or 16,8 mln tons of oil equivalent more, than in 2015.

Gas consumption in 2016 has grown by 7,7% or 15,04 billion cubic meters [6] in comparison with 2015. Since 2000 gas consumption has increased more, than by 8 times, - to 203,31 billion cubic meters.

In 2016 the GDP of China was 11,2 trillion US dollar [9] that is 0,14 trillion US dollar more, than in 2015. On GDP volume China takes the second place in the world after the USA.

The analysis of Chinese economy growth dynamics specifies on existence of a tendency to decrease in growth rates of GDP since 2010 (Figure 1.) The average growth rate since 2010 according to the World Bank is 8,11%. The peak of growth of Chinese economy was observed in 2007 – 14,2%. High growth rates of economy were provided at the expense of a gain of investments. The current basic indicators show slowdown of economic development of China.

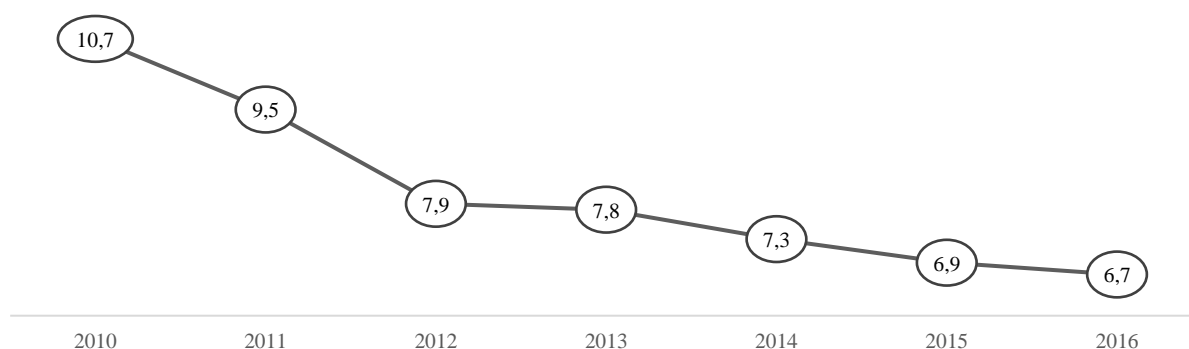


Figure 1. Dynamics of GDP growth of China for 2010-2016, %

Data source: [9]

The slowdown in the growth rate of Chinese economy is demonstrated by the dynamics of foreign direct investment (Figure 2). Since 2013, there has been a downward trend in investment in the Chinese economy. At the end of 2016 the inflow of foreign direct investment decreased by 29,7% [9].

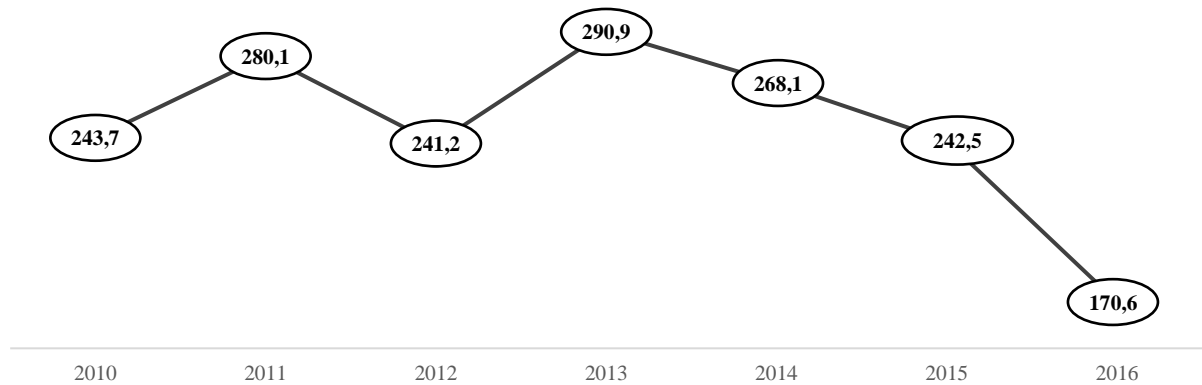


Figure 2. Inflows of foreign direct investments (at the current rate) for 2010-2016, USD billion  
Data source: [9]

According to forecasts of the analytical companies IHS and Wood Mackenzie, slowdown of growth rates of the Chinese economy is expected to continue. IHS forecasts that growth rates will decrease to 2035. Experts of Wood Mackenzie do more optimistical forecast: since 2030 small increase in growth rates (Figure 3) is expected. Nevertheless, according to the Plan of social and economic development of China for the 13th five-years period (2016-2020), till 2020 the average rate of a GDP gain at least has to be 6,5%.

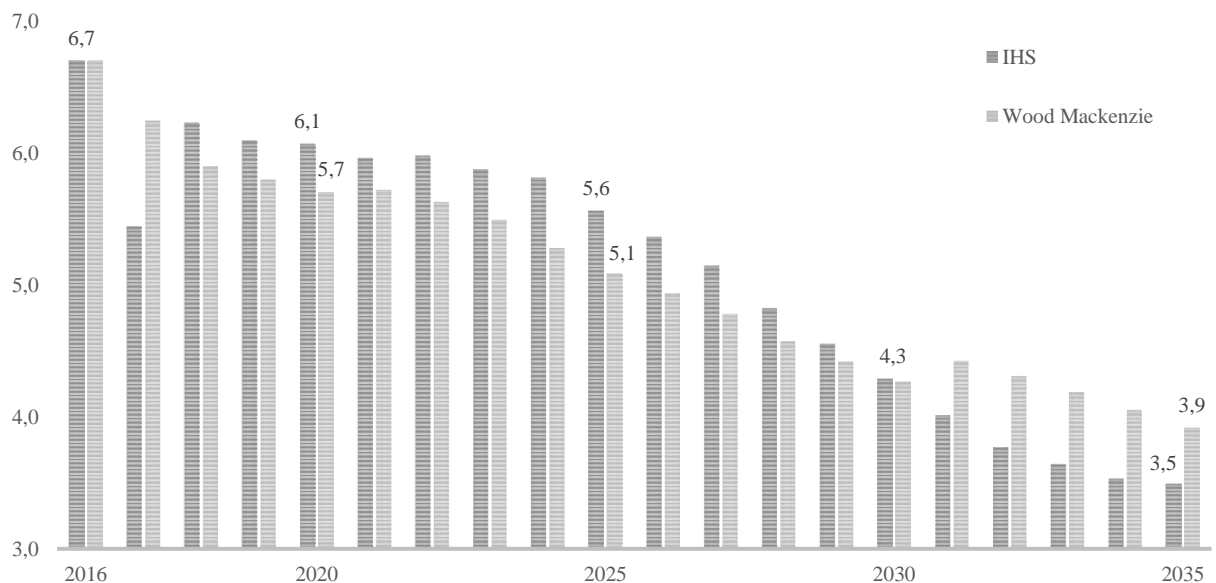


Figure 3. The GDP growth forecast for China, %  
Data source: [5], [8]

But it should be noted, that China and Russia are political partners, so Russian companies reduces political risks to minimum, and it helps to develop cooperation. Energy sphere is a likely to be the most important in the relation between Russia and China and PJSC “Gazprom” is searching the opportunities for the implementation of joint projects with Chinese companies in electric energy industry.

Therefore, the hypothesis is that Chinese electricity market is the promising direction for Russian investments.

To check the hypothesis the author analyzes the power sector of China through statistics, articles and analytical reviews, defines the future demand and the most perspective directions for investment.

### CHINESE ELECTRICITY MARKET

China is a world leader in electricity consumption and generation, as well as in the total installed capacity of power plants. Measures of the Chinese Government reducing coal generation have a stimulating effect on the using of renewable energy and gas generation.

#### Power consumption

Despite the slowdown in the Chinese economy, the country remains the world leader in terms of electricity consumption. Electricity consumption in China in 2016 amounted to 5920 TWh, which is 40% or 1720 TWh more than last year [2]. Consumption growth was observed in all sectors, but the manufacturing industry (secondary sector) clearly dominates (Figure 4): demand growth compared to 2010 amounted to 1066 TWh (more than 33%).

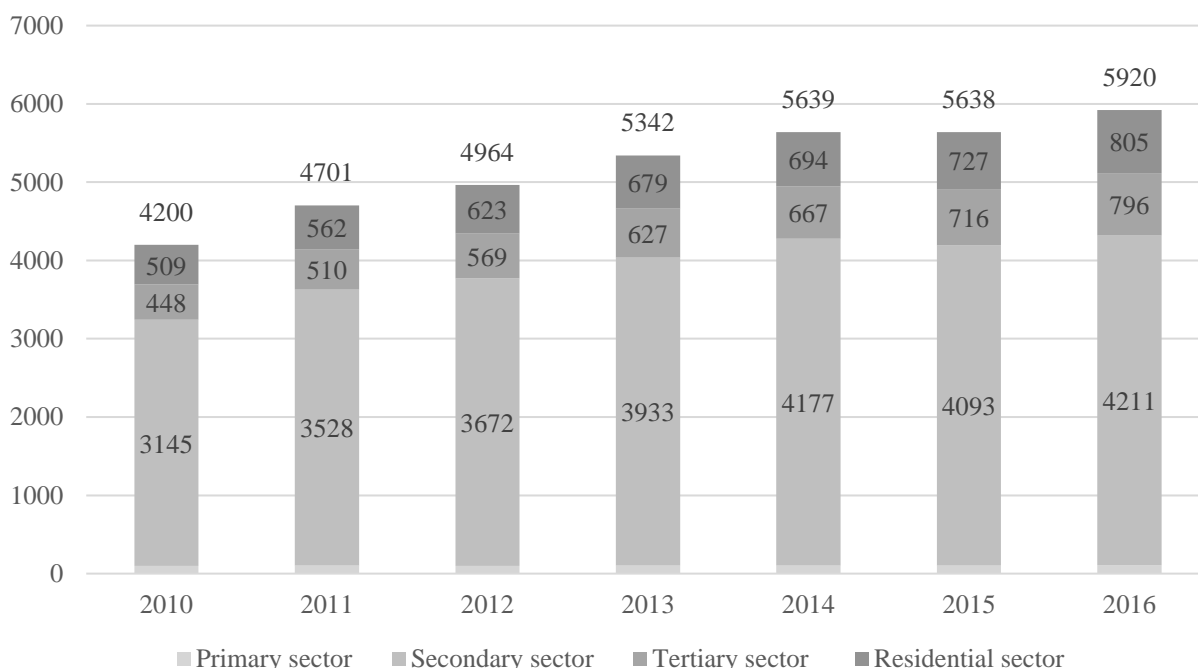


Figure 4. Electricity consumption by sector in 2010-2016, TWh  
Data source: [2]

The link between economic growth and energy consumption in China is beginning to weaken. The introduction of energy-efficient technologies, especially in energy-intensive industries, and the growth of the service sector in China reduces the energy intensity of GDP (Figure 5).

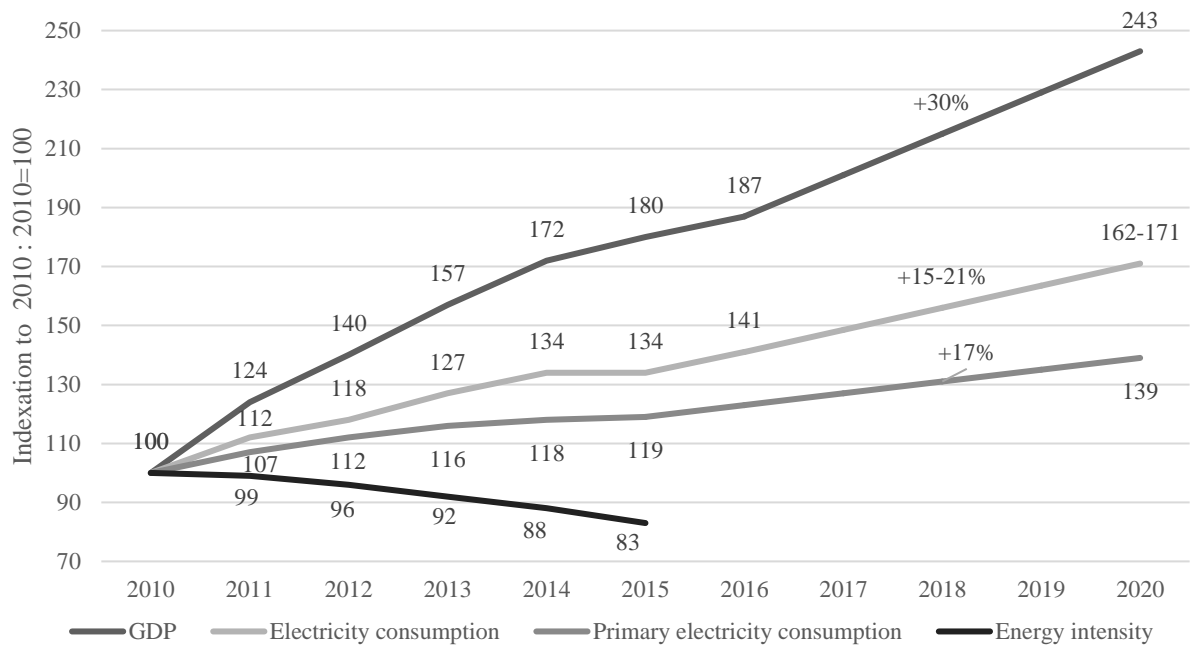


Figure 5. GDP, primary energy consumption, electricity consumption, energy intensity of GDP (at constant PPP) for 2010-2016 and forecast until 2020  
 The dotted lines are the linear predictions based on the targets of 2020. Percentages - GDP growth and energy consumption from 2016 to 2020. Data about the energy intensity of GDP are available only up to 2015.  
 Data source: [2]

According to the plan of socio-economic development for the 13th five-year plan (2016-2020), GDP growth from 2016 to 2020 will be about 30%. At the same time, the growth of electricity consumption for the same period is expected only at the level of 15-21%. The growth of primary electricity consumption will be 17%. These data indicate a gradual disconnect between electricity consumption and economic growth.

It is assumed that 80% of energy consumption will be provided by its own generation. By 2020, electricity consumption is expected to grow by 3,6-4,8% per year to 6800-7200 TWh.

### Power generation

In 2016 electricity production has increased by more than 5% (or 296 TWh) compared to 2015, reaching 5990 TWh [4] (for comparison, the same indicator of EU is equal to 3211 TWh, of Russia – 1071,8 TWh [1]). Most of the electricity was produced mainly at coal-fired power plants. Their share in 2016 amounted to 65% (or 3906 TWh) of all produced electricity (Figure 6).

Compared to 2010, electricity generation increased by nearly 40% (or 1,761 TWh). Coal-fired power plants still have the largest share of the growth in electricity generation – 40% or 680 TWh.

Since 2010 the generation of electricity from gas-fired power plants has more than doubled: from 78 TWh to 188 TWh [2]. Share of gas generation has increased by 1% since 2010 and amounted to 3% of the total output in 2016. Basically, gas generation in China is used to cover peak loads.

At the end of 2016, the share of hydro power plants and renewable energy sources in electricity generation was 24,8% (or 1488 TWh) [2]. For comparison, in Europe this figure was 29,6%, and if we exclude biomass, only 23,8%.

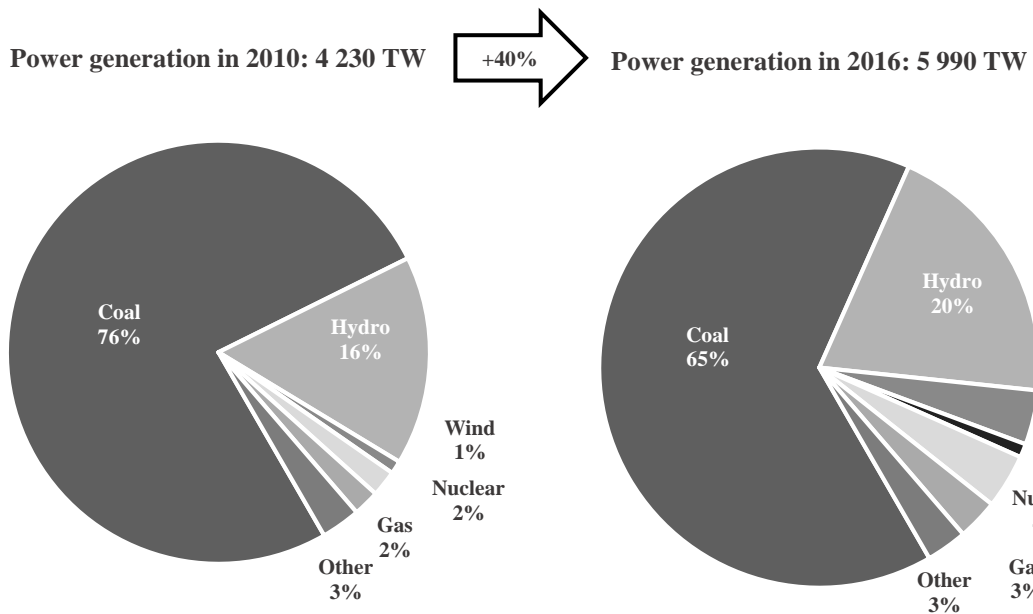


Figure 6. Structure of electricity generation in China in 2010 and 2016  
Source: [2]

### Power installed capacity

China is the first among all countries in the world in terms of the total installed capacity of power plants. According to data for 2016, the total installed capacity is 1645,75 GW, which is 139,02 kW (9,2%) more than in 2015. The average growth rate of installed capacity since 2010 is 9,3% [4].

In 2016 the installed capacity of thermal power plants and nuclear power plants was about 1046 GW or almost 64% of the total installed capacity. Over the past 7 years this figure has increased by more than 40% (300 GW). The main role continues to be played by coal-fired power plants, the capacity of which according to the data for 2016 is 943 GW, which is 45% (291 GW) more than in 2010 [4]. Such dynamics indicates low efficiency and insufficient measures of the Chinese government to reduce coal generation.

The widespread using of coal for power generation has led to China's leading position in terms of greenhouse gas emissions. The share of China in the global indicator of greenhouse gas emissions at the end of 2016 was 27,3%. Due to the deterioration of the environmental situation in the country, China joined the race for the transition to alternative energy using renewable energy and gas generation. During the period from 2010 to 2016 the installed capacity of gas generation increased more than 7 times: from 9 GW to 70 GW. The dynamics of capacity commissioning for the period under review, as well as the goals of the socio-economic development plan for the 13th five-year plan are shown in Figure 7. It is expected that by 2020 the installed capacity of gas generation will be 110 GW or 8,7% of the total capacity, which is 57% (40 GW) more than in 2016.

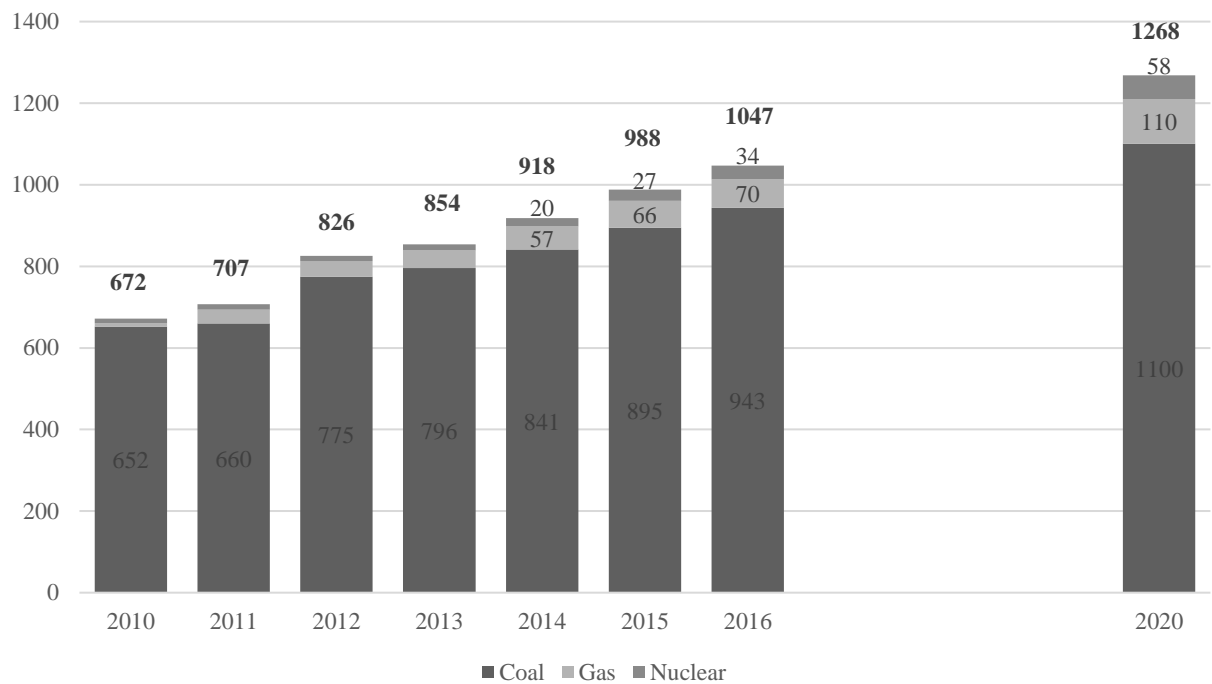


Figure 7. Installed capacity dynamics of power plants operating on traditional energy sources, GW  
 The target value for 2020 is specified according to the plan of social and economic development of China for the 13th five-year plan.  
 Source: [4]

In 2016, the installed capacity of renewable energy source, including hydro power plants, has amounted 558 GW, which is 34% of the total installed capacity. During the period from 2010 to 2016 the renewable energy sources installed capacities increased more than 2 times.

The construction of new solar power plants and the increase in installed capacity from 43 GW to 77 KW (+34 KW) in 2016 allowed China to set a new world record (Figure 8).

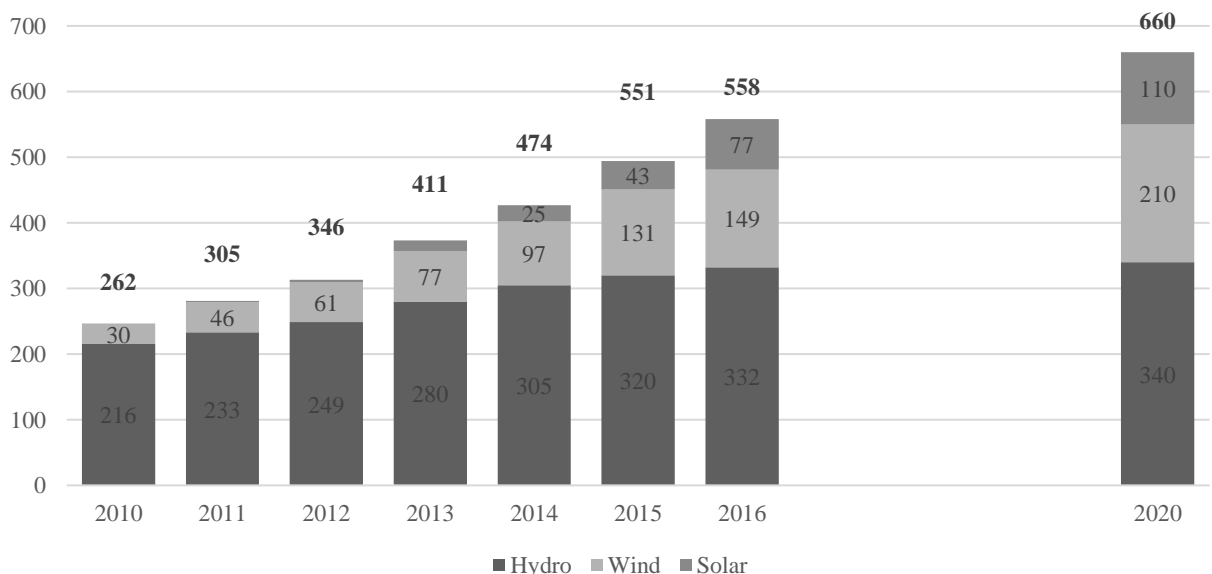


Figure 8. Installed capacity dynamics of power plants operating on renewable energy sources, GW  
 The target value for 2020 is specified according to the plan of social and economic development of China for the 13th five-year plan.  
 Source: [4]

## Electricity price

For more than 10 years, the Chinese government has been reforming the electric power industry, the ultimate goal of which is to create a market mechanism for electricity pricing, but this process is slow, and tariffs are still set by the state.

The wholesale electricity tariff for gas power plants is determined by the regional authorities and approved by the State committee for development and reformation of the China.

Tariffs are divided into "single-rate" (year-round) and "double-rate" (including an increased rate for peak demand periods). In most regions, a "single-rate" tariff is applied for gas stations, a "two-rate" tariff is applied, for example, in Shanghai, where companies whose annual number of capacity use hours use is less than 2500 hours are paid a compensation of 0,22 yuan per kWh for electricity generation during the peak demand period (Figure 9).

In a number of provinces in China there is no special tariff for gas-fired power plants, so gas has to compete with coal on a "market" basis, and decisions on subsidies or special tariffs are made by local authorities on an "individual" basis.

Some regions (Zhejiang, Hubei, Shanghai) have introduced separate tariffs for different types of stations. In other regions (Hainan, Hainan, Tianjin, Beijing) there are regulations on a special price for the purchase of electricity from gas stations, regardless of their type.

Jiangsu is considered to be the province with the most developed pricing mechanism for electricity from gas-fired power plants. Jiangsu is the only region in China where the tariff for electricity from gas stations is directly linked to gas prices at the entrance to the regional gas distribution network.

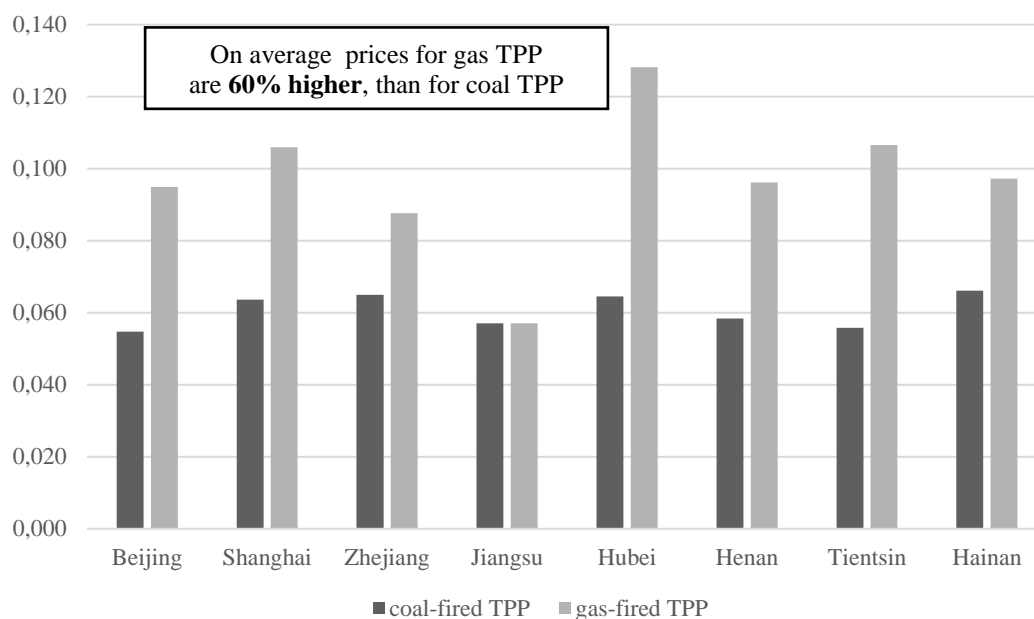


Figure 9. Electricity prices in China in 2016, USD/ kWh  
 The average annual exchange rate CNY/USD for conversion is equal to 6,644.  
 Source: [3], [9]

Wind and solar energy in China is supported in the form of "green tariffs", which are differentiated according to the geographical type of resources or categories. "Green tariff" (connection tariff) is an economic and political mechanism designed to attract investment in renewable energy technologies. Depending on the intensity of solar radiation or wind speed, tariffs are adjusted to create the same economic conditions throughout the country. Solar power plants are provided with a "green tariff" for 20 years. For wind turbines green tariffs are approved through tender procedures.

## Forecast

The 13th five-year socio-economic development plan calls for further use of innovation and seeks to find a compromise between economic growth and environmental protection. The Chinese government has set targets for the country's economic and energy sectors. By 2020, the installed capacity of power plants should be 2000 GW, which is 300 KW higher than in 2016.

The commissioning of new capacities of coal-fired power plants should be about 200 GW. At the same time, investments in renewable energy up to 2020 will amount to about 340 billion dollars. The total installed capacity for wind and solar power plants by 2020 should be 210 and 110 GW respectively. The installed capacity of gas generation by 2020 should be 110 GW, which is 57% (40 GW) higher than the current figure. Also, a slight increase in the capacity of hydro power plants and nuclear power plants is expected: by 7,9 GW and 24,4 GW, respectively. The forecast of changes in the structure of installed capacity of power plants is shown in Figure 10.

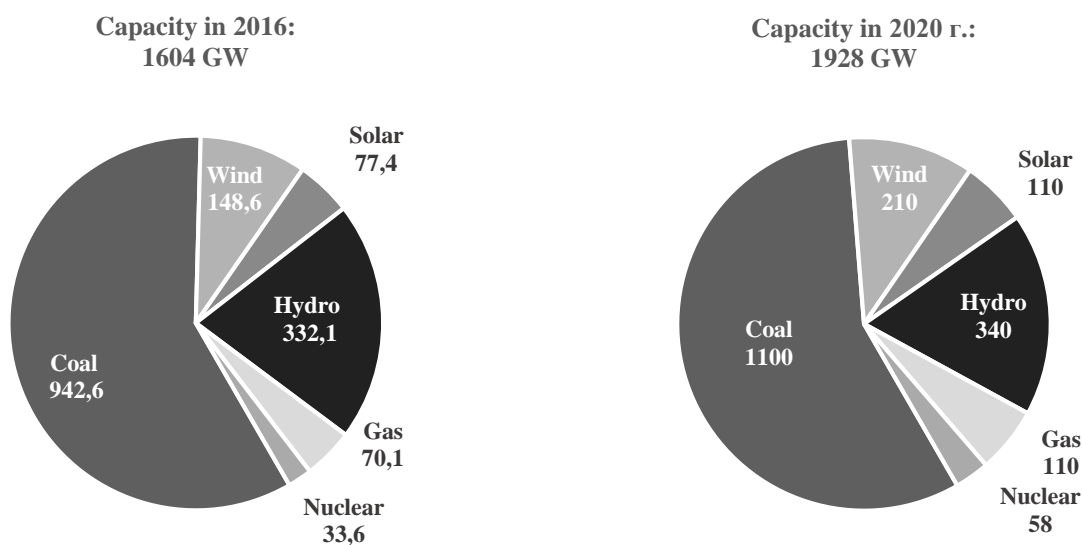


Figure 10. Installed power generation capacity in China, GW  
Source: [2], [7]

China's energy market reform, launched in 2015, has already had an impact on the country's energy sector. In the coming years, the impact of the reform will increase, especially through the introduction of electricity trade. In 2016, there was a surge in long-term electricity trade, and a pilot project on spot trading is planned to be launched this year.

## CONCLUSION

According to the plan of socio-economic development of China by 2020 the installed capacity of gas generation will reach 110 GW, for which it is necessary to introduce 40 GW of new capacities (+57% compared to 2016). The annual increase in gas generation capacity for the period 2016-2020 should be 11,9% [3].

Deliveries by gas pipeline “Power of Siberia” are planned to start in December of 2018, so China will have enough gas for generation. Nowadays PJSC "Gazprom" along with CNPC and other Chinese companies consider the possibility of constriction a thermal power plant Sunyang with 960 MW installed capacity. Moreover, there is one more perspective project – thermal power plant Langfang with total installed capacity of 800 MW.

Thus, the construction of new gas thermal power plants can be considered as a promising direction for cooperation with Chinese energy companies, given the increase in gas exports from Russia.

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