

The power sector of Mongolia: Current status and future opportunities



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ABSTRACT

Mongolia is located between Russia and China in Central Asia. In coal-rich corners, both the energy and energy sectors of our country prevail. Mongolia has vast resources of renewable energy and limited hydropower plants, such as wind and solar. In their first iNDC (intended Nationally Determined Contributions) submitted in 2015, Mongolia has pledged to increase the share of renewables capacity to 20% by 2020, and 30% by 2030 while reducing their energy related GHG emissions.

Keywords: Power sector, Renewable energy, Solar PV, Mongolia

Introduction

Mongolia covers 1,564,116 square kilometers and is the 18th-largest and most sparsely populated sovereign state in the world with a population of about three million people. Mongolia is landlocked. The country has very few arable lands, since most of its territory is covered by grassy steppes, with mountains in the north and west and the Gobi desert in the south. Ulaanbaatar, the capital and largest city, is home to about 45% of the country's population. Ulaanbaatar also shares the title of the coldest capital of the world. Mongolia is divided into 21 provinces and subdivided into 329 districts (sums).^[9]

Overview and issues of electric power system in Mongolia:

The Mongolian power system consists of five detached segments. Central Energy System (CES),

Western Energy System (WES), Altai– Uliastai Energy System (AUES), Eastern Energy System (EES), South Gobi Region, comprising 7 combined heat and power plants, 2 hydropower plants, coal–fired power plant, wind park, off–grid renewable energy systems, regional diesel generators, and nine distribution systems.^[1] Figure 1 shows the power system of Mongolia.

In 2017, Mongolia generated 6,089,1 million kWh of electricity, of the total electricity, was generated 95.6% by thermal power plants, 1.4% by hydroelectric power plants, 2.9% by solar and wind power stations and 0.1% at diesel stations. In 2017, heat energy was generated at 8,933,4 thousand Gcal. This year, 1,522,5 million kWh were imported electricity.^[1] Table 1 and Figure 2 shows the production and import of electricity in Mongolia 2017.

Lack of flexibility in the power system: Mongolia's energy systems in general and Central Energy System, in particular, is historically dominated by coal–fired CHP plants. The CHPs, transmission and

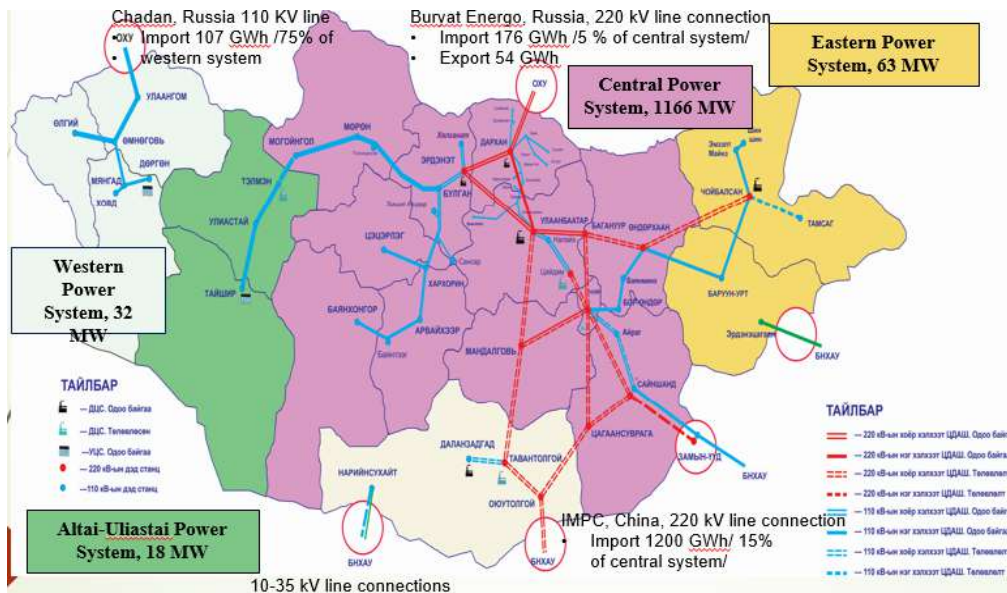


Figure 1. The power system of Mongolia

Source: Ministry of Energy Mongolia 2017.

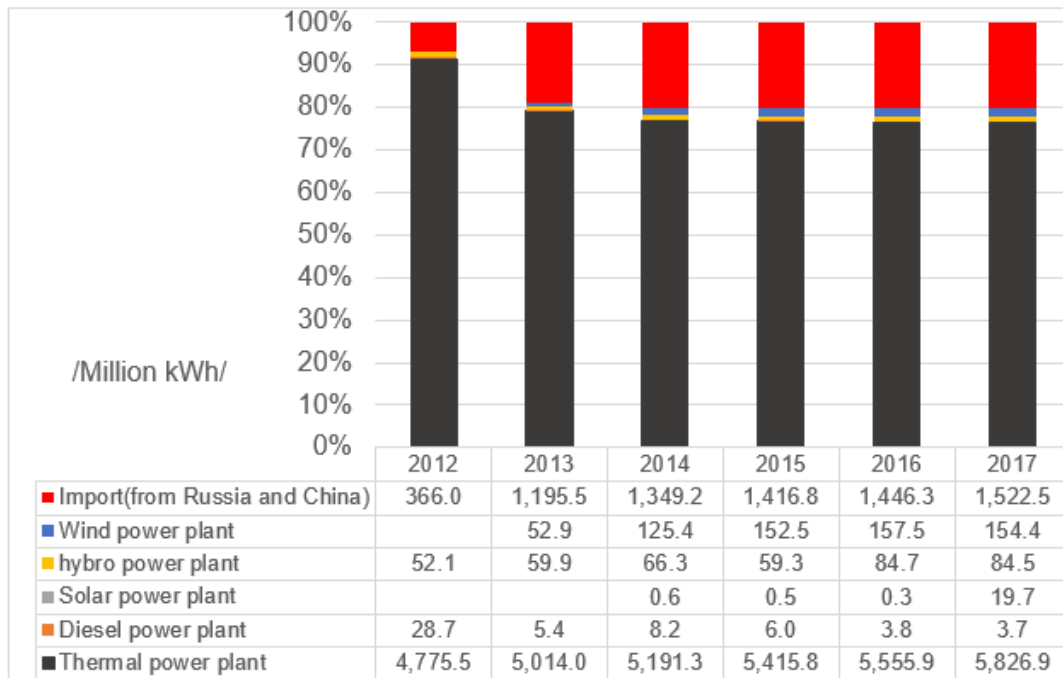


Table 1 and Figure 2. The production and import of electricity in Mongolia from 2012 to 2017

Source: Energy Regulatory Commission of Mongolia

distribution networks in urban agglomerations like Ulaanbaatar, Darkhan, Erdenet, and Dornod started their operation in the 1960s and 1980s. Therefore, these systems are outdated and lack flexibility. During the winter peak load, there are high fluctuations in power supply due to low transmission capacity for electricity imports, limited own electricity generation capacity and fluctuation in the generation of variable renewables. Moreover, the overall efficiency of CHP plants decreases in summer as the heat generated is wasted or of no use in summer. Mongolia continues to import electricity from China and Russia.^[4]

Limitation on the integration of variable renewables:

According to the Ministry of Energy, the central grid currently has the maximum capacity of integrating all already connected. At present, the National Dispatch Center (NDC) operating as the grid operator has

capacity constraints to engage in power regulation from the control room due to the constraints that some power plants/CHPs have in adjusting their production level to load variations. Therefore, the dispatch center is giving priority to electricity generated by thermal power plants and put curtailment on wind due to the technical and economic constraints that coal-fired steam generators in the thermal power plants might encounter. Mongolia's unified energy system has limited technical capabilities to absorb more than 30% of renewable energy.^[4]

Limited human capacity: Since the renewable energy sector is relatively new in Mongolia, there is a lack of skilled manpower in the sector and lack of government institutions, regulating bodies, and research organizations.^[4]

Renewable energy application in Mongolia

Solar energy

Based on satellite estimation, solar irradiation in Mongolia is abundant throughout the country as shown in Figure 3 below. On average 270 to 300 days are estimated as sunny in a year and average daylight time is estimated as 2250–3300 hours. The yearly radiation is estimates 1200–1600 kWh/m² and its intensity is estimates more than 4.3–4.7 kWh/h.^[4]

Wind energy

According to the Joint Wind resources assessment made by NREL (USA) and National Renewable Energy Center of Mongolia in 2001, 10% of the total territory (160,000 km²) of the country is suitable for wind energy application. It is estimated that 13 provinces have more than 20,000 MW of wind potential and 9 provinces have more than 50,000 MW of wind potential

and Omnogobi province alone has wind energy potential of over 300,000 MW. Figure 4 shows the wind resources of Mongolia.

Hydro energy

There are 3800 small and big streams and rivers in the country, which have the potential of 6417.7 megawatts of power and deliver 56.2 billion kWh of electric energy in a year.^[4] Figure 5 presents the wind resources of Mongolia.

Geothermal energy

There are over 43 geothermal reservoirs on the territory of Mongolia and in some locations such as Tsenkher, Khujirt and Shargaljuut in Khangai region geothermal power plant can be built. In Shargaljuut spring the temperature reaches 51–90°C and the nearby hot-spring sanatorium uses it as heating in cold seasons without any additional equipment.^[3]

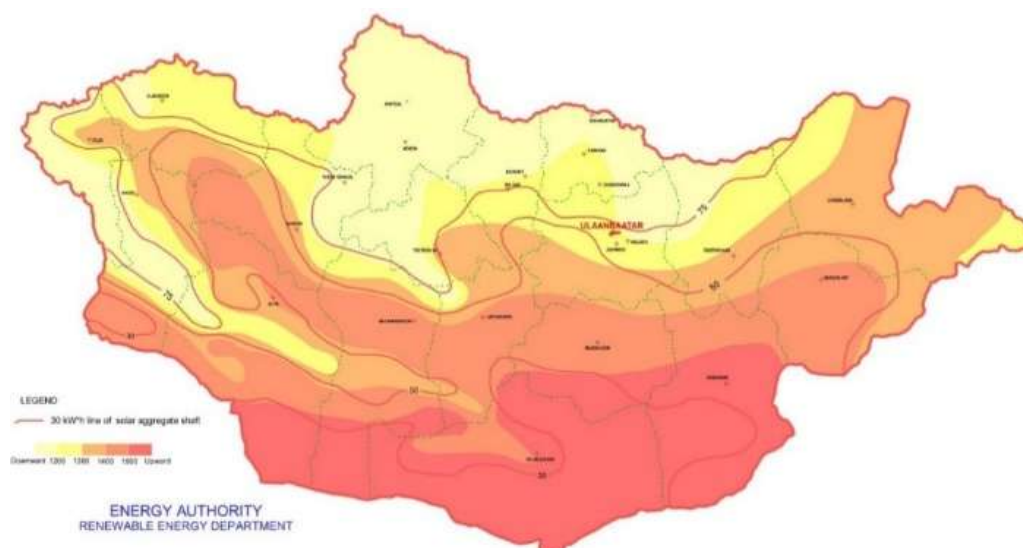


Figure 3. Mongolian solar radiation with year basis, kWh/m²/year (EA, 2009)

Source: Former Energy Authority of Mongolia, 2009

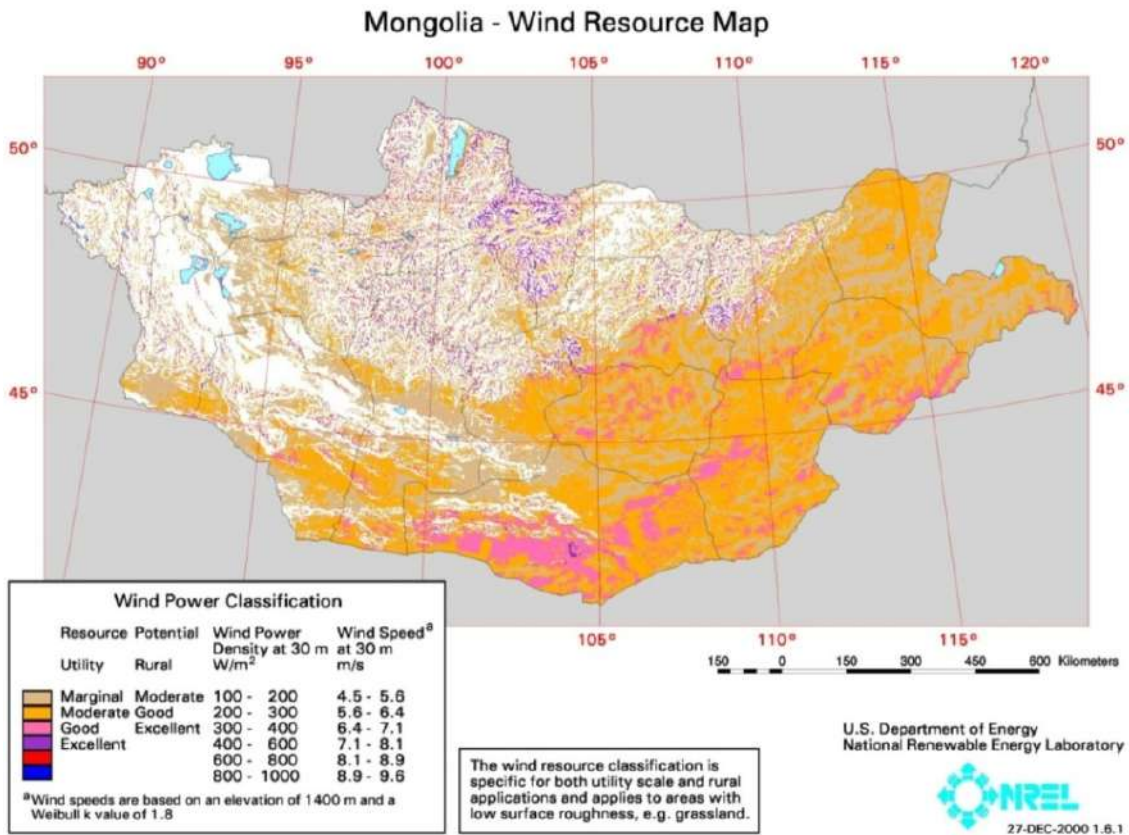


Figure 4. Wind resources map of Mongolia
Source: Former Energy authority

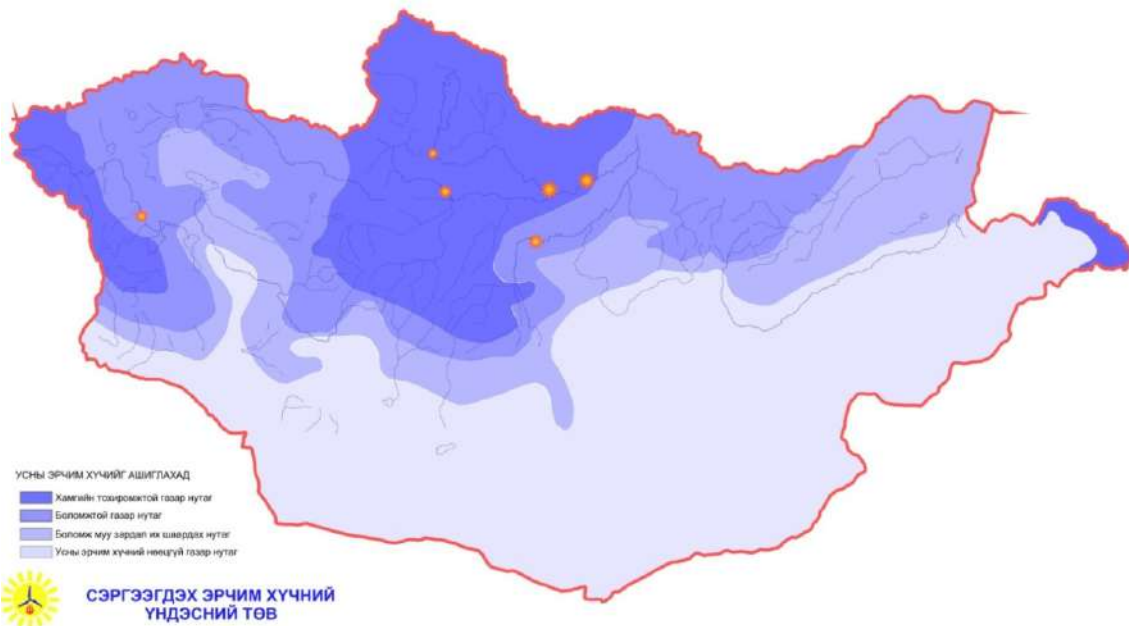


Figure 5. Mongolia's hydro power potentials
Source: Former Energy authority

Current installed solar energy capacity

Estimated potential of solar electricity generation of 4.3–4.7 kWh/m²/day, in the area of 5542 km², calculations rank the Gobi Desert as the third place in on the list of the world's deserts with high solar electricity generation potential, as shown in Figure 3. The Gobi Desert where shares a border with China is also the site between solar energy resources and good wind resource and this area is concerned for the exportation of renewable electricity.^[1]

Policies and Regulations

Renewable energy is one of the top priorities in the energy sector where indicated in government policy documents such as the Government Action Program, the Regional Development Concept and the Sustainable Development Strategy. According to these documents, the Parliament approved the “Renewable Energy Law” on 11th January 2007. The Renewable Energy Act was amended by the State Great Khural on June 19, 2015, on the year and June 6, 2019. Also the Parliament approved the Government Energy Policy Document in 2015 by Resolution No 63. According to the Paragraph 3.2.6.2, it is indicated that the renewable energy production share shall be 20% by 2023 and 30% by 2030. The government of Mongolia approved a medium-term national policy program for the implementation of state energy policy in 2018. On December 18th, 2015 Mongolian Parliament made amendment to Customs tariff, Customs tax law, Value added tax law and renewable energy equipment were exempted from tax. Also in 2016 Mongolian Government approved the list of 100 types

of solar, wind, hydro, bio, and geothermal energy equipments for tax exemption (Government resolution No.198).^[5]

The stage to develop energy safety resources and backup capacity, establish a foundation for the development of renewable and commence large scale power plant and DC line projects cooperating with neighboring countries. The installed power capacity will be doubled, and start using critical technology with high parameters. Hydro will be taken place at least 10% of the total installed power capacity and it will increase packup capacity to 10%, and create a fundament for the renewable sector to develop intensively.^[6]

In the 2nd stage 2024–2030: The stage to export secondary energy and develop sustainably the renewable sector. Integrated smart energy system will be created by connecting regions with high capacity transmission lines. State-owned Power companies will become a public company. Distribution and supply service will be privatized and the energy sector will be worked as a competitive marked with regulation. Secondary energy will be exported by connecting with Northeast Asian countries with high capacity DC lines. Source: (Ministry of Energy Mongolia 2017)

Future opportunities

The Gobitec concept represents the idea of producing clean energy from renewable energy sources in the Gobi Desert and to deliver the produced energy to regions with a high demand for electric energy. The delivery of the energy produced is planned to be using power corridors: the planned

Asian Super Grid (ASG), connecting Russia, Mongolia, China, South Korea, and Japan. The project is to meet domestic electricity demand and to export surplus electricity to other countries.^[7]

Conclusions

- Further implementation of the medium-term national policy program for the implementation of the state energy policy of the country, adopted by the government of Mongolia in 2018.
- In Mongolia, new energy sources must be built, since domestic energy consumption is increasing every year.
- Generating resources for stabilizing load fluctuations, thereby developing renewable energy.
- Mongolia will wish to be RE export country to supply clean electricity to neighboring countries in the future.

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