



## **Current energy usage and sustainable energy in Kazakhstan: A review**

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Kazakhstan has abundant natural resources. The country has enough coal to supply its energy needs for the next 150 years, and has the world's largest deposits of uranium, substantial quantities of natural gas and petroleum deposits. However, despite such energy riches, due to the size of the territory, its geography, and the country's economic structure, distribution of electricity in Kazakhstan is not uniform. As a result, Kazakhstani rural and remote areas suffer from serious electricity deficits. According to the latest estimates from the Ministry of Industry and New Technologies, about 25-30% of the Kazakhstani population lives in rural communities, where access to affordable energy (for heating, cooling, cooking, refrigeration, lighting, household as well as IT use) is limited. Furthermore, with the main electricity production infrastructure concentrated in the main urban areas, a high amount of electricity is therefore lost during transmission. Moreover, the consumption of poor quality coal as the main source of power generation creates a significant amount of environmental pollution. To illustrate this development, fuel combustion from coal has produced around 75% of carbon dioxide emissions in Kazakhstan. Thus, in order to address the country's electricity and environmental challenges, the Kazakhstani government is taking initiatives to promote renewable energy resources. However, so far, the outcome of these initiatives remains negligible. The current contribution of renewable energy to the total energy consumption is less than 1% (with 90% provided by hydropower) despite the significant potential for renewable energy in the country. As yet, no comprehensive study has been published on the energy scenario and on the potential for renewable energy resources in Kazakhstan. This comprehensive review aims to present an overview of the country's energy resources, supply and demand as the current energy scenario, while discussing the potential for renewable energy resources such as wind, solar, small hydro and biomass as alternative energy supplies in this country. Our analysis shows that wind and solar energy can become major contributors towards renewable energy in Kazakhstan. The biomass of agricultural residues, municipal solid waste and wood residues could be used for energy purposes too. Therefore, Kazakhstan should optimize energy consumption and take active and effective measures to increase the contribution of renewables in energy supply to make the country's energy mix environmentally sustainable.