

Bulgaria energy storage for demand response

Bulgaria's energy sector is at a critical juncture, with two main objectives shaping its direction: decarbonization and reducing reliance on Russian energy. Over the past year, Bulgaria has made considerable progress in expanding its renewable energy capacity, particularly in solar power. Solar energy production has surged from one gigawatt (GWh) in 2019 to more than three GWh today,[1] with solar accounting for nearly half of the country's electric capacity from renewables.[2]

Bulgaria is also making strides in other renewable energy sources (RES), including wind, hydro, and bioenergy, while nuclear energy remains a significant part of the mix. In 2023, 66% of the country's electricity came from non-fossil fuel sources, a figure expected to rise due to continued solar growth.[3] However, the decarbonization process, particularly in heavy industry, faces challenges. Industrial sectors still rely heavily on natural gas, and transitioning to electricity will require substantial investment.[4]

Moreover, nuclear energy continues to be a key part of Bulgaria's energy landscape, contributing 23% of the country's electricity production in 2023.[5] Plans from October 2023 to add two new reactors at the Kozloduy nuclear power plant (NPP) signal that nuclear will remain an essential energy source in the long term.[6] However, these new reactors won't be operational for another decade at least, leaving Bulgaria with a pressing need to accelerate its decarbonization efforts with other sources.

Bulgaria is also playing a role in supporting Ukraine during its ongoing conflict with Russia. The country has been exporting electricity and fuel to Ukraine, and there are opportunities for deeper cooperation in the future, particularly in nuclear energy and renewables.[7] Negotiations are underway for Ukraine to purchase two Russian-made reactors from Bulgaria,[8] and post-war collaboration in offshore wind and solar energy in the Black Sea could further strengthen ties between the two nations.

With regards to renewables, in 2007, Bulgaria's green energy sector seemed full of potential as the country joined the European Union. Incentivized by EU directives and a favourable investment climate, the Bulgarian government introduced legislation offering generous subsidies, including preferential pricing and long-term contracts for renewable energy. Despite the lack of a clear strategy at the central level, the sector experienced a fast-paced development, especially for wind farms and solar energy (and, to a lesser extent, for new hydroelectric power plants).

By 2012, Bulgaria had reached significant milestones, becoming a regional leader in SEE for renewables, with installed capacity exceeding 2.2 GWh.[14] Over 4 billion Euros were invested from 2009 to 2012; with over 1,900 active companies, with at least 10,000 employees. The boom in renewable sources allowed Bulgaria to reach the share of green energy on the total consumed, fixed by the EU at 16% by 2020, eight years in advance.

In 2022, Bulgaria produced 36 million tons of coal, with 98% being lignite. The Maritsa Iztok mines alone accounted for 98.6% of the lignite extracted. About 97% of the coal produced is used for electricity and thermal power generation, while 2% is used to produce briquettes.[22] The production of electricity through coal is the country's heaviest polluter.

Despite its reliance on coal, Bulgaria has committed to gradually phasing out coal production, aiming to reduce its use by 2030 and fully discontinue coal as an energy source by 2038.[23] To support this transition, the European Union has allocated EUR1.2 billion to help Bulgaria achieve a just transition. This funding is intended to mitigate the socioeconomic impacts of the coal phase-out, particularly in coal-dependent regions such as Stara Zagora, where the Maritsa Iztok complex is located.

In addition to lignite, Bulgaria has smaller reserves of sub-bituminous coal and a large, but currently unexploited, basin of bituminous coal in Southern Dobruja. The bituminous coal reserves in Dobruja are estimated to exceed 1 billion tons, but the significant depth at which they are located, between 1,370 and 1,950 meters, makes commercial extraction challenging.[24]

As shown in the chart below, the capacity utilisation of the NPP is at 94%. To increase the overall potential of the plant, the government planned in 2023 to add two more reactors utilizing Westinghouse AP1000 technology (units 7 and 8).[26]

The two new Westinghouse AP1000 reactors planned for the Kozloduy NPP are expected to significantly boost the country's energy production, aiming for a combined capacity of 2300 MWe. This will surpass the 1760 MWe capacity of the previously closed Kozloduy units 1-4. The target for the first unit's completion is 2033, with the second unit to follow within two to three years.

The AP1000 technology, known for its advanced safety and modular construction, is part of Bulgaria's middle-term and long-term strategy to diversify its energy mix and move away from dependence on older VVER-440 models.

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