

SOLAR ENERGY IN BELARUS: OPPORTUNITIES AND CHALLENGES

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Solar energy in Belarus has exhibited consistent development over recent decades, despite the country's temperate climate and limited number of sunny days (approximately 140-160 annually). This progression is driven by the global shift toward renewable energy sources (RES) and domestic factors, such as the pursuit of energy autonomy and compliance with international environmental commitments. Given the absence of substantial hydrocarbon reserves, Belarus is actively exploring strategies to diversify its energy mix, with solar energy emerging as a significant component.

The economic viability of solar power plants varies by region. In Southern Europe, the payback period ranges from 1.5 to 2 years, in Central Europe from 2.5 to 3.5 years, and in Russia from 2 to 5 years. Technological advancements are expected to enhance the efficiency of photovoltaic modules and reduce costs, shortening the payback period for solar energy systems [1].

The Sun supplies the planet with radiation exceeding current global energy consumption by a factor of 7,000. In Belarus, the total solar energy potential is estimated at 2.7×10^6 tons of conventional fuel (t.c.f.) per year, with a technically feasible potential of 0.6×10^6 t.c.f. annually. The conversion efficiency reaches 12%. Across the republic's territory, up to 1.2 MWh of energy is radiated per square meter annually, equivalent to 60 liters of oil.

Belarus's geographical position, spanning the 56th to 51st degrees of northern latitude, governs the parameters of solar radiation, including the angle of incidence, daylight duration, and light intensity. These factors influence the total energy received. Over the course of a year, the angle of solar incidence at noon varies by 47 degrees, and daylight duration fluctuates by more than 10 hours. Annual solar radiation increases from

north to south, ranging from 3500 to 4050 MJ/m² (84-97 kcal/cm²). The number of cloudy days per year ranges from 175 (northwest) to 135 (southeast), while clear days vary from 30-35 (northwest) to 40-42 (southeast) [1].

A prominent trend is the expansion of solar power plant capacity. Between 2013 and 2016, solar energy production in Belarus surged from 0.4 million kWh to 28 million kWh, a 70-fold increase in three years. By 2023, the cumulative capacity of photovoltaic installations surpassed 124 MW, facilitated by investment initiatives and partnerships with international entities, including Ireland and the European Union. For instance, in the Gomel Region, Belorusneft launched a solar-powered gas station in 2011, while plants with a capacity of 28 MW were constructed in the Bragin and Yelsk districts. These developments reflect a shift from pilot projects to broader implementations [2].

State policy significantly shapes the sector's advancement. The 2010 Law on Renewable Energy Sources and the 2015 Energy Security Concept established targets to elevate the RES share in the energy mix to 6% by 2020 and 9% by 2035. To attract private investment, incentivizing tariffs were introduced: for the first 10 years of operation, electricity is purchased at triple the standard rate, followed by a coefficient of 0.85 for the subsequent decade. This framework has enabled the establishment of private facilities, such as the Taikun LLC plant in the Mogilev Region (400 kW) and the first private installation in the Myadel District (6 kW). Technological advancements drive growth. A 1,000-fold global cost decline in photovoltaic modules over 50 years boosts competitiveness. Belarus researches thin-film technologies and solar heating, though high initial costs and lack of domestic production limit scalability [2].

The future of solar energy in Belarus depends on cost reductions, infrastructure, and RES integration. Comparison with Germany suggests a 17-20% efficiency increase is possible, highlighting potential. Technological progress and state support could make solar energy sustainable and viable.

References

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