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Impact of Low Water Levels in the Danube on Electricity Generation in Europe

At the end of July 2026, record-low water levels in the Danube, combined with heatwaves and drought, constrained the operation of power plants in Central and South-Eastern Europe. The crisis demonstrated that even stable energy sources, including nuclear power plants, are vulnerable to the effects of extreme weather events and limited availability of water used for cooling. Within a short period, hydrological problems translated into a decline in available generation capacity, increased pressure on imports, and rising electricity prices across the region.

Energy Situation in Hungary. As a result of the heatwave in Central Europe, electricity generation at Hungary's Paks Nuclear Power Plant was reduced by 1 GW, while in Romania both units of the Cernavodă Nuclear Power Plant, with a combined capacity of 1.3 GW, were shut down. As a result, the region lost a significant share of its stable, low-emission generating capacity within a short period, increasing its dependence on imports and other balancing sources. The most visible example of the impact of low Danube water levels on Hungary's power sector is the situation at the Paks Nuclear Power Plant, whose total capacity is approximately 2 GW. The plant uses water from the Danube for cooling, while environmental regulations require electricity generation to be curtailed when the river water temperature exceeds 30°C. At the end of July 2026, the Danube reached a record-low level of 124 cm, while under the applicable procedures the plant would have to be shut down entirely if the level fell below 134 cm. Forecasts indicated the possibility of a further decline in the river level, which meant the risk of a full shutdown of the installation on 4–5 August 2026.

Under these conditions, the operator, MVM Paksi Atomerőmű Zrt., began gradually reducing the output of the units from 27 July 2026, with the total capacity reduction reaching 1 GW, or half of the plant's overall capacity. This marked an escalation of earlier restrictions and increased the likelihood of a complete shutdown of the installation if the Danube water level continued to fall. Hungarian authorities also reported that additional cooling pumps had been delivered to the plant and remained on standby to ensure reactor cooling in the event of a shutdown. From the perspective of Hungary's power system, this loss was particularly severe because it affected a stable and predictable generation source, making it difficult to replace quickly during periods of peak system demand.

Hungarian authorities emphasised that the restrictions were implemented in line with pre-defined safety procedures and were not the result of a sudden failure. Nevertheless, weekly electricity contract prices rose sharply, by approximately 46%. This shows that even controlled and predictable reductions in electricity generation at a nuclear power plant can quickly translate into higher power prices when regional market flexibility is limited, as the available dispatchable capacity becomes more valuable. Importantly, the Paks Nuclear Power Plant is one of the key sources of stable electricity in Hungary's power system, which means that curtailing its operation increased Hungary's need for imports. The authorities assessed that, in the short term, import capacity should be sufficient to cover the production shortfall, while at the same time calling on industry and households to voluntarily reduce electricity consumption. In a regional market with limited flexibility, this meant stronger competition for electricity available through cross-border interconnections. The low level of the Danube, therefore, acted as the trigger for restricting electricity generation, but it was the decline in available capacity at the Paks plant that directly increased balancing costs and price risk.

Another factor exacerbating tensions within Hungary's power system was the outage at the Dunamenti gas-fired power plant, which resulted in the loss of a further 400 MW of dispatchable capacity. As a result, the restrictions at Paks coincided with problems in the gas-fired generation segment, further narrowing the available security margin during a period of high demand. Hungarian Prime Minister Péter Magyar warned that, in the coming days and weeks, Hungary could face one of the most difficult energy situations in its history. In response, he called on large industrial facilities as well as households to voluntarily reduce or shift their electricity consumption, particularly during periods of peak system load.

Power Generation Problems in Romania. In Romania, the effects of the hydrological crisis were even more direct, leading to the shutdown of both reactors at the Cernavodă Nuclear Power Plant. Units 1 and 2, with a combined capacity of 1.3 GW, were taken offline between 27 and 30 July 2026 following a decline in Danube flow rates. The plant normally accounts for approximately 25% of Romania's domestic electricity generation, meaning that its complete shutdown represented not only the loss of a significant volume of capacity but also a weakening of one of the pillars of stability in the country's energy balance.

The decision to carry out a controlled shutdown of the units was preventive in nature and was linked to the protection of cooling infrastructure. According to Romania's Ministry of Energy, the flow rate in the Danube at Cernavodă had fallen to a level that threatened the proper operation of three cooling pumps. A failure of one of these pumps could require complex repairs lasting from several months to as long as a year. In this sense, a short-term reduction in electricity generation was considered less risky than potential equipment damage that could permanently limit the availability of nuclear capacity.

Tensions in Romania's energy system were particularly visible during periods of peak electricity demand. The curtailment of operations at the Cernavodă plant meant that Romania had to rely more heavily on imports and other available generation sources. The government called for increased electricity generation from gas-fired power plants, renewable energy sources and energy storage facilities, while also encouraging households and large industrial consumers to reduce consumption during peak hours.

In Romania, supply-side pressure was also reflected in prices; during periods of peak demand, prices at times increased by approximately 73%. Thus, the reduced availability of stable energy sources quickly translated into higher electricity prices, as dispatchable capacity, that is, the available ability of generation sources to deliver electricity rapidly and reliably during periods of high demand, became more valuable. Forecasts indicate that the Cernavodă reactors could remain offline for one to two weeks if drought conditions and low water levels in the lower Danube basin persist.

Conclusions

- The cases of Hungary and Romania show that system resilience depends not only on the amount of installed capacity but also on its actual dispatchability and the condition of auxiliary infrastructure. In Hungary, the simultaneous curtailment of nuclear power generation and the outage at a gas-fired power plant quickly narrowed the system's security margin, while in Romania the controlled shutdown of nuclear units was part of risk management aimed at preventing damage to cooling systems.
- The crisis on the Danube demonstrated that the region's energy security depends not only on the availability of fuels, generation capacity, and cross-border interconnections but also on environmental factors. This also applies to nuclear power, which remains a stable source of energy but is not fully immune to the effects of drought, high temperatures, and cooling constraints. As weather extremes intensify, water availability is, therefore, becoming one of the key parameters for the secure operation of the power system.
- Restrictions on the operation of power plants dependent on Danube water triggered a domino effect. The loss of stable electricity generation in one country quickly increases demand for imports, intensifies competition for available electricity volumes, and transmits price pressures into neighbouring markets. This is particularly important in Central and South-Eastern Europe, where power systems are increasingly interconnected, but their ability to support one another during periods of simultaneous weather-related stress remains limited.