Instytut Europy Środkowej

IEŚ Commentaries

Editorial Team: Grzegorz Gil (Director of ICE), Anton Saifullayeu (Deputy Director of ICE), Agnieszka Zajdel (Editorial Assistant), Spasimir Domaradzki, Bartłomiej Krzysztan, Damian Szacawa, Agata Tatarenko

No. 1605 (110/2026) | 01.05.2026

ISSN 2657-6996

Michał Paszkowski

Ukraine's Nuclear Sector 40 Years After the Chernobyl Disaster

Four decades after the Chernobyl disaster, it is evident that Ukraine's nuclear sector has undergone a lasting shift toward risk management; rather than expansion, the priorities have become safety, reliability, and system resilience. The ongoing war has further tested this model, exposing the critical dependence of stable electricity generation on the power grid, as well as the operational risks associated with attacks on infrastructure and threats to the physical security of facilities. Nuclear power now serves as a reliable source of electricity, helping to limit supply fluctuations under conditions of wartime destruction.

Ukraine's Nuclear Sector Over the Past 40 Years. While the Chernobyl disaster did not bring nuclear power in Ukraine to a halt ("IEŚ Commentaries", No. 382), it fundamentally changed its logic from expansion to risk management and reliability. A moratorium on new investments was introduced between 1990 and 1993, and the process of decommissioning Chernobyl (i.e., the cessation of electricity generation) was completed in 2000. Over time, sectoral policy shifted toward safety upgrades and the lifetime extension of units originally designed for approximately 30 years of operation. At the same time, the importance of the largest facilities increased, and in particular, the Zaporizhzhia Nuclear Power Plant (6 reactors, approx. 6 GW of capacity), which before 2022 was not only a key component of the national power balance but also the largest nuclear power plant in Europe.

After 1991, the sector developed under conditions of global economic transformation and declining electricity demand, which limited the scope for new investments and shifted attention from expansion to maintaining the operability of existing capacity. The decisive institutional turning point was the suspension of new projects in the early 1990s, followed by the shutdown of the Chernobyl plant, all of which reordered safety priorities and changed the way technological risk was understood. In subsequent years, the state and the operator focused on enhancing safety and extending the operation of existing units. At the same time, organisational and market frameworks were strengthened (including the consolidation of management within Energoatom), which was intended to facilitate the planning of replacement investments and the standardisation of operating practices. A persistent constraint remained the dependence on external nuclear fuel cycle services and the need to diversify supplies, which – under conditions of geopolitical tension – acquired strategic significance comparable to technical issues.

It is worth emphasising that the "lifetime extension" of reactor units is not merely a technical decision about refurbishment, but a policy model. It makes it possible to maintain generating capacity at relatively lower cost than building new units, but it shifts the burden onto regulatory institutions, safety culture, and the stable financing of modernisation. Under conditions of limited capital and high uncertainty – initially transitional, later wartime – extending the operation of existing units became a way to reduce the risk of capacity shortages. At the same time, this process exposed weaknesses in the supply chain, such as limited access to parts, engineering services, fuel, and supporting infrastructure. Since the diversification of nuclear fuel supplies is not a new challenge (in Ukraine, this process has been underway for a number of years), what has become equally important today is maintaining service capabilities and operational capacity under wartime conditions. Amid continuous Russian attacks on infrastructure, it is the ability to safely maintain and restore reactor operations that determines the fleet's real long-term availability, rather than merely its formal authorisation for operation.

The Importance of Nuclear Power Plants Under Wartime Conditions. After 2022, the role of nuclear energy became even more important as the war primarily struck thermal generation and grid infrastructure, thereby constraining the system's balancing capabilities. As a result, security of supply depends not only on the availability of generating capacity, but also on the ability to evacuate that power and maintain functioning

systems under conditions of damage and operational constraints. Consequently, the three nuclear power plants remaining under Ukrainian control (with a total of 9 reactors) have become the principal stabilisers of electricity supply, although their role is increasingly dependent on the condition of the grid and the availability of flexible resources capable of compensating for fluctuations resulting from both from the destruction of infrastructure and from the growing share of variable generation. A key risk factor is the loss of the Zaporizhzhia Nuclear Power Plant, the largest in the country, whose occupation by Russia deprived the system of a significant share of baseload capacity and reduced its security "buffer," increasing vulnerability to outages and transmission constraints. From a system perspective, synchronisation with the European ENTSO-E system (16 March 2022) was also important, as it opened up the possibility of supporting balancing through cross-border exchanges as well as strengthening the framework for operational stability. In the context of the country's economic reconstruction once the war ends, nuclear energy would perform a dual function: first, it would provide relatively low-cost and low-carbon baseload electricity and, second, it would create a durable foundation for the reconstruction of industry and critical services. At the same time, its strong baseload character means that the success of its reconstruction will depend on parallel investments in the grid, balancing capacity (flexible resources such as hydropower, gas-fired, or coal-fired plants), as well as demand-side flexibility and storage, so that stable generation can be used effectively despite the infrastructure constraints and security risks.

Conclusions

- The memory of Chernobyl did not push the nuclear sector into the margins; rather, it permanently shifted the sector toward a regime centred on safety and reliability. With a fleet of 15 VVER reactors, nuclear power supplied approximately 50–55% of electricity generation for many years, which means that its role cannot be rapidly replaced without substantial costs and risks for the energy balance.
- The sustainability of the sector depends less on declarations and more on underlying conditions: financing for modernisation, the quality of regulatory oversight, and regulatory stability. Since many of the units were originally designed for approximately 30 years of operation, their long-term use requires consistent investment in safety and in mitigating fuel-cycle risks (diversification of supplies and the safeguarding of logistics), which directly affect the fleet's availability.
- The country's post-war economic reconstruction will require a systemic perspective: nuclear energy stabilises the balance; however, its effective use depends on the grid and on flexibility. The loss of the Zaporizhzhia Nuclear Power Plant increased the system's vulnerability, and synchronisation with ENTSO-E in 2022 improved balancing capabilities, but it cannot be a substitute for the modernisation of transmission infrastructure, reserve capacity, and storage.