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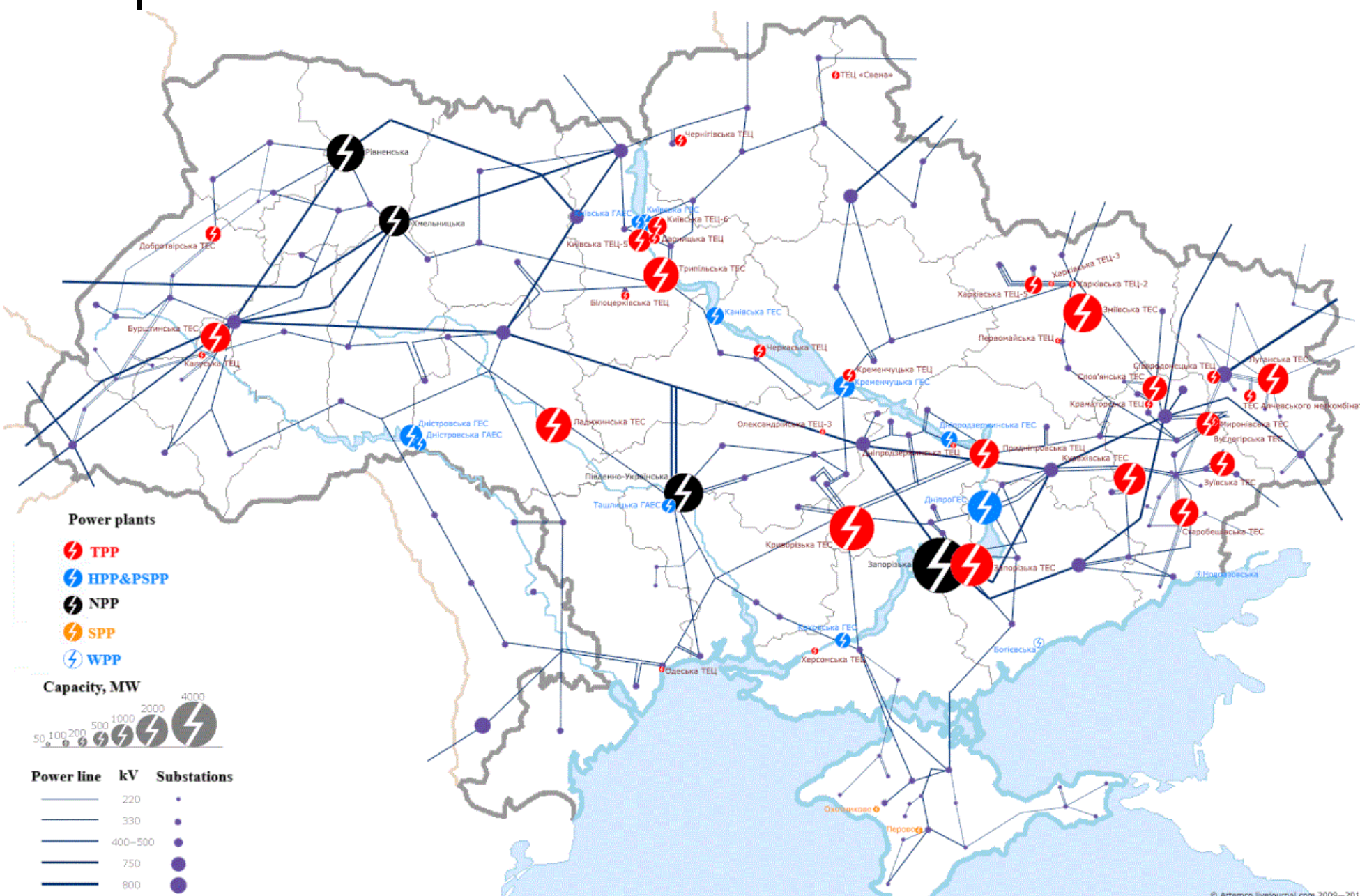
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The Ukrainian energy market operates as a complex, real-time system that remains functional despite severe wartime disruptions, due to its structured market segments and increasing integration with the European grid. Pumped storage and hydropower, operated by PJSC “Ukrhydroenergo,” play a critical role in maintaining system stability by providing flexibility, frequency regulation, and balancing services. The study highlights that further market modernization and deeper integration with ENTSO-E are essential for improving resilience, efficiency, and long-term energy security.



State of Ukrainian Generating Capacities

Ukraine uses all available electricity generation sources to ensure its energy, economic, and political independence.



Energy system in Ukraine before 2022

The Ukrainian energy system has undergone significant structural changes due to extensive wartime damage, including the loss of approximately 10 GW of generation capacity and severe destruction of thermal and hydropower infrastructure. This has resulted in a substantial electricity deficit of about 7 GW.

Despite these challenges, the system continues to operate, with an increased reliance on nuclear power and the critical contribution of hydropower and pumped storage plants in maintaining grid stability and balancing supply and demand.

Functions of PSPPs in the Energy System and Energy Market

Pumped storage power plants have evolved from traditional peak-load generators into multifunctional assets essential to modern energy systems.

They provide critical services such as real-time balancing, frequency and voltage regulation, reserve capacity, and large-scale energy storage.

Their high operational flexibility and ability to integrate variable renewable energy sources make them among the most effective and cost-efficient technologies for ensuring system stability and reliability in contemporary electricity markets.

Conclusions

The Ukrainian energy system has demonstrated strong resilience under extreme wartime conditions, maintaining stable operation despite extensive infrastructure damage.

This confirms the robustness of its design and operational principles.

Pumped storage power plants have proven increasingly critical for ensuring system stability, balancing, and frequency control.

Their expanding role, combined with effective emergency measures and strategic development, highlights their importance for strengthening the resilience and future sustainability of Ukraine’s energy sector.