

Rebuilding Energy in Ukraine

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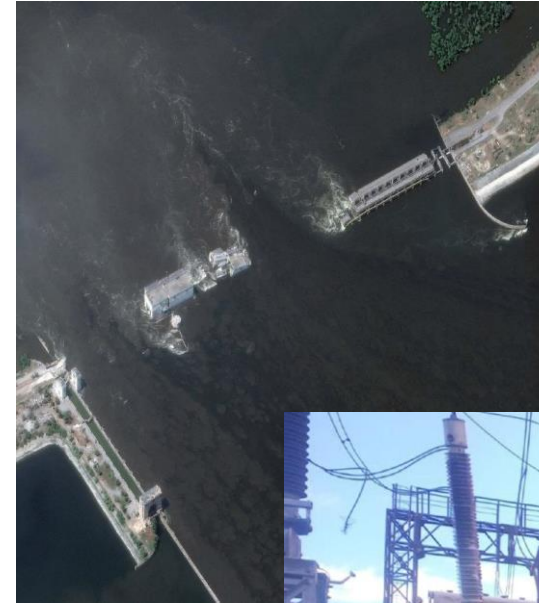
World Bank

Europe and Central Asia Energy Unit

KGID
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More than half of energy facilities in Ukraine damaged, with largest share in power sector

- As of February 24, 2023, the cumulative damage to power, gas, heating infrastructure, and coal mining has now exceeded US\$10 billion.
- Among these sectors, the power sector has borne the brunt of the damage, accounting for nearly US\$6.5 billion damages.
- Ukrenergo's substations targeted, particularly transformers, causing extensive electricity disruptions downstream.
- Damages on Ukrhydroenergo's Rakhovka HPP dam caused serious economic and environment impacts.



World Bank Group has mobilized \$38 billion to support Ukraine, with \$29 billion disbursed

- Most of the financial support has been provided for public expenditures through the PEACE project*.
- The multi-donor trust fund, URTF**, has been supporting Ukraine's recovery and reconstruction and reform particularly in the energy sector among others (transport, health, housing and agriculture).
- WB also support the government's reforms through the Ukraine Relief and Recovery DPL***.

* Public Expenditures for Administrative Capacity Endurance project

** Ukraine Relief, Recovery, Reconstruction and Reform Trust Fund

*** Development Policy Loan

Ukraine needs large amount of energy storage

Energy storage systems



↑ **+38** GW of new capacities

💰 **\$25** bn investment



Construction new **38 GW** of energy storage plants of various capacities

Increase of capacity for frequency **maintenance reserve** and automatic **frequency recovery reserve**

A large number of **energy storage systems** is due to a **considerable number of solar power plants**

Technical Assistance Program funded by KGGTF has supported energy storage market development



Analysis on battery storage use case for grid stability



Industrial tours to dialogue with Korean partners on energy storage and substation equipment to help Ukraine's restoration and reconstruction



Assessment of suitable business models to increase private sector participation in battery storage projects



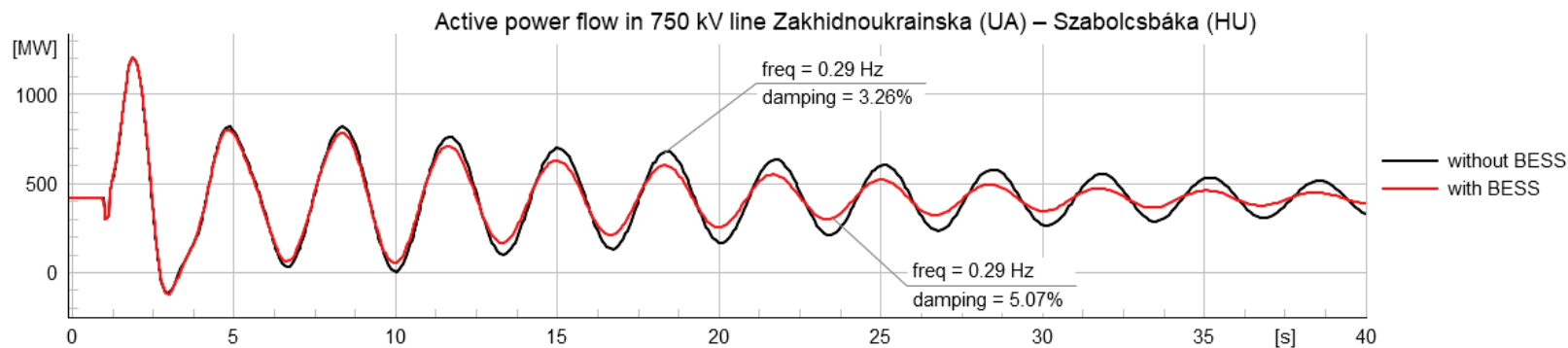
Capacity building activities on energy storage regulations and business models



Preparation of sustainable heating roadmap for Ukraine

Grid stability analysis confirmed battery can support further increase in export capacity

- Battery devices with Power Oscillation Damper function can provide improvement in damping of inter-area modes.
- The analysis result was presented by UE to ENTSO-E.
- Together with other countermeasures on generators, it can ensure power export up to around 1.5 GW under light load conditions without compromising inter-area oscillation stability.



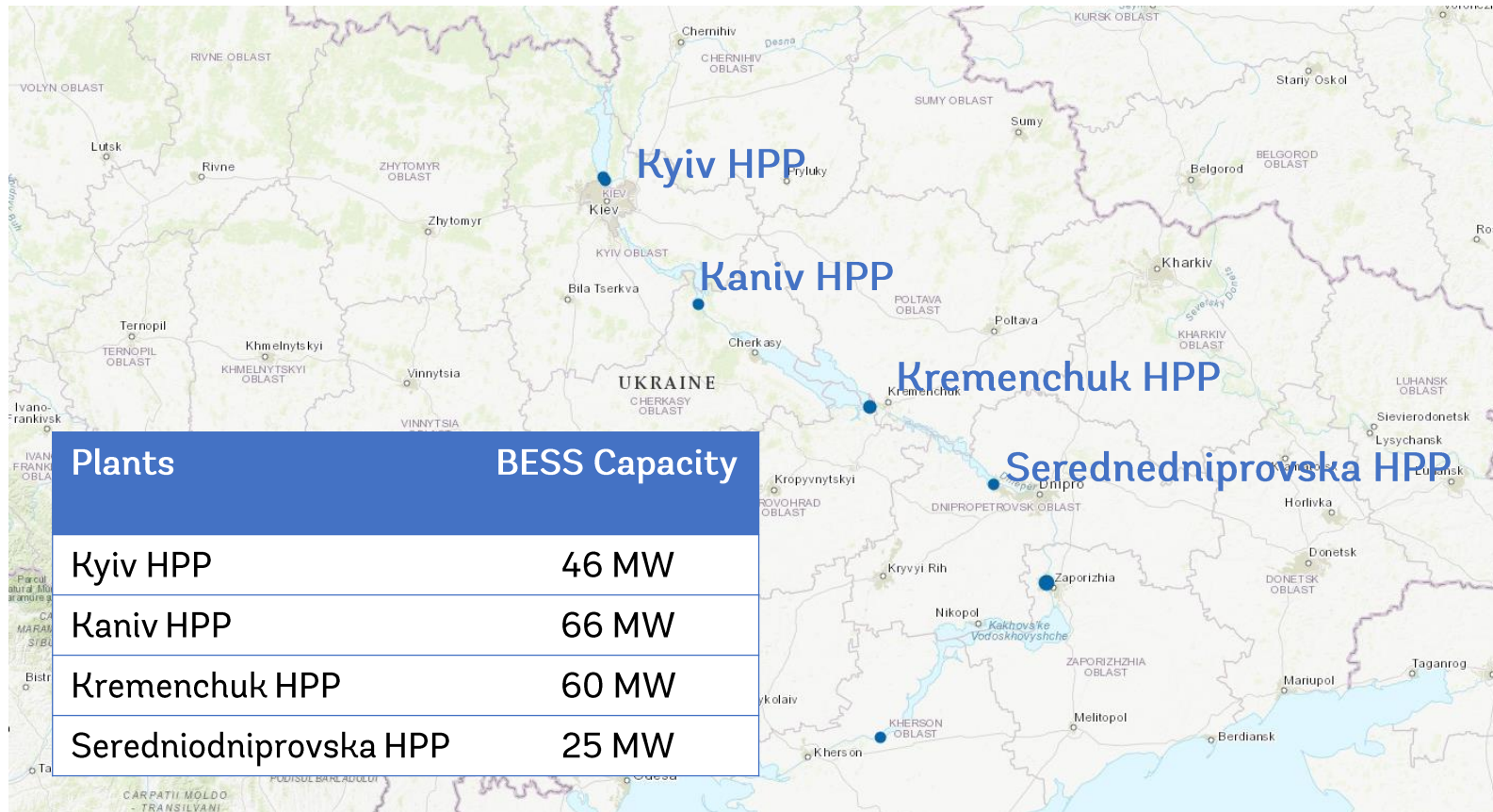
Study Trip to Korea conducted in July 2023

The study trip was instrumental for Ukrainian delegation for learning and strengthened cooperation. Particularly the following topics were discussed.

- Technical specifications for procurement and supply chain considerations
- Korean experience with storage and incentives and performance of battery storage
- Opportunities to support Ukraine energy sector during reconstruction phase



WB finances 200MW utility scale battery storage for frequency regulation services for Ukrhydroenergo



Future Collaboration

- Continuous financial and technical support from Korean Government and KEPCO for energy companies in Ukraine
- EPC and manufacturing opportunities on energy equipment including transformers for Ukrenergo and battery storage for Ukrhydroenergo
- Investment opportunities for Korean investors in various developments including energy storage and renewable energy in the reconstruction phase
- Capacity building and training by Korean partners on energy storage, digitalization, renewable, electricity market etc

Conclusion

- Ukraine needs continuous financial and technical support to restore and rebuild the energy infrastructure in view of building back better and green growth.
- Large amounts of renewable energy and energy storage need to be deployed for energy sector decarbonization.
- Many opportunities for Korean partners through technical assistance and financing.



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