4th CIGRE SEERC Grid Resilience Workshop

“Resilience of Electrical Grids”

(NC CIGRE Kosovo)

January 23, 2025

Topics:

- The Overview of Kosovo Power System

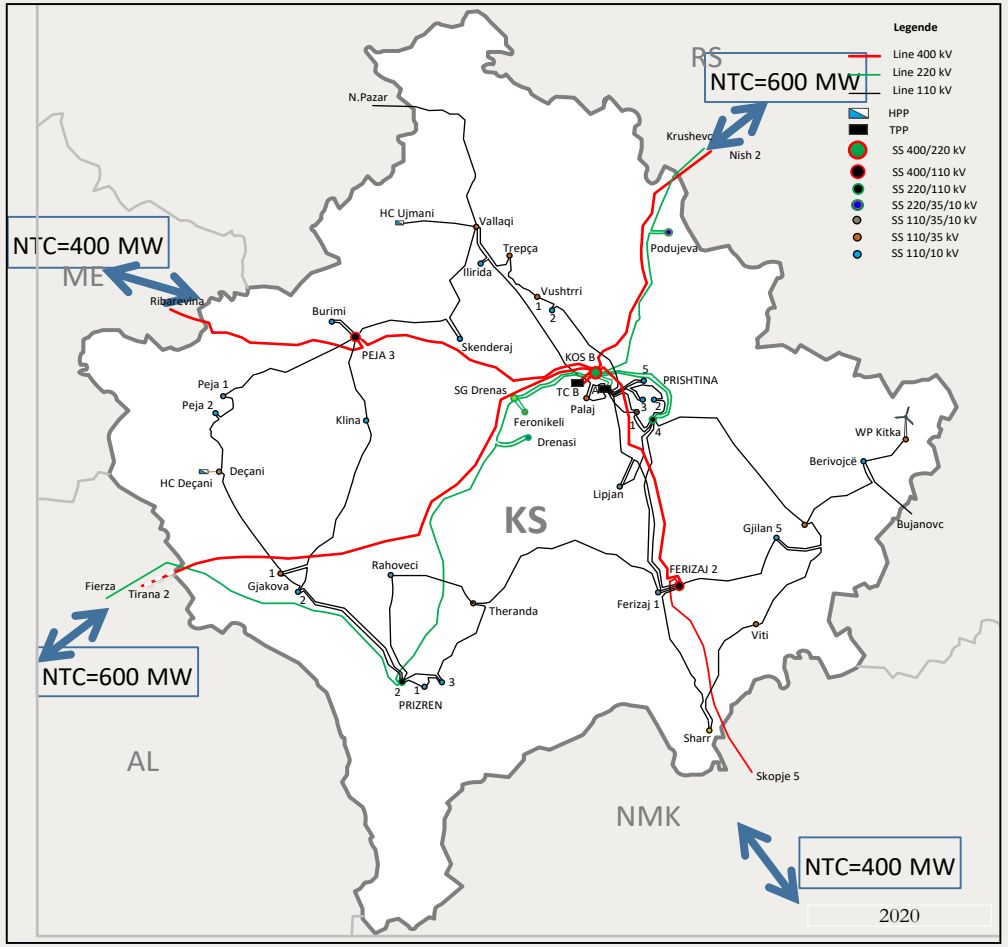
- The Importance of Grid Resilience for Kosovo Power System

- Factors Impacting Grid Resilience in Kosovo Power System

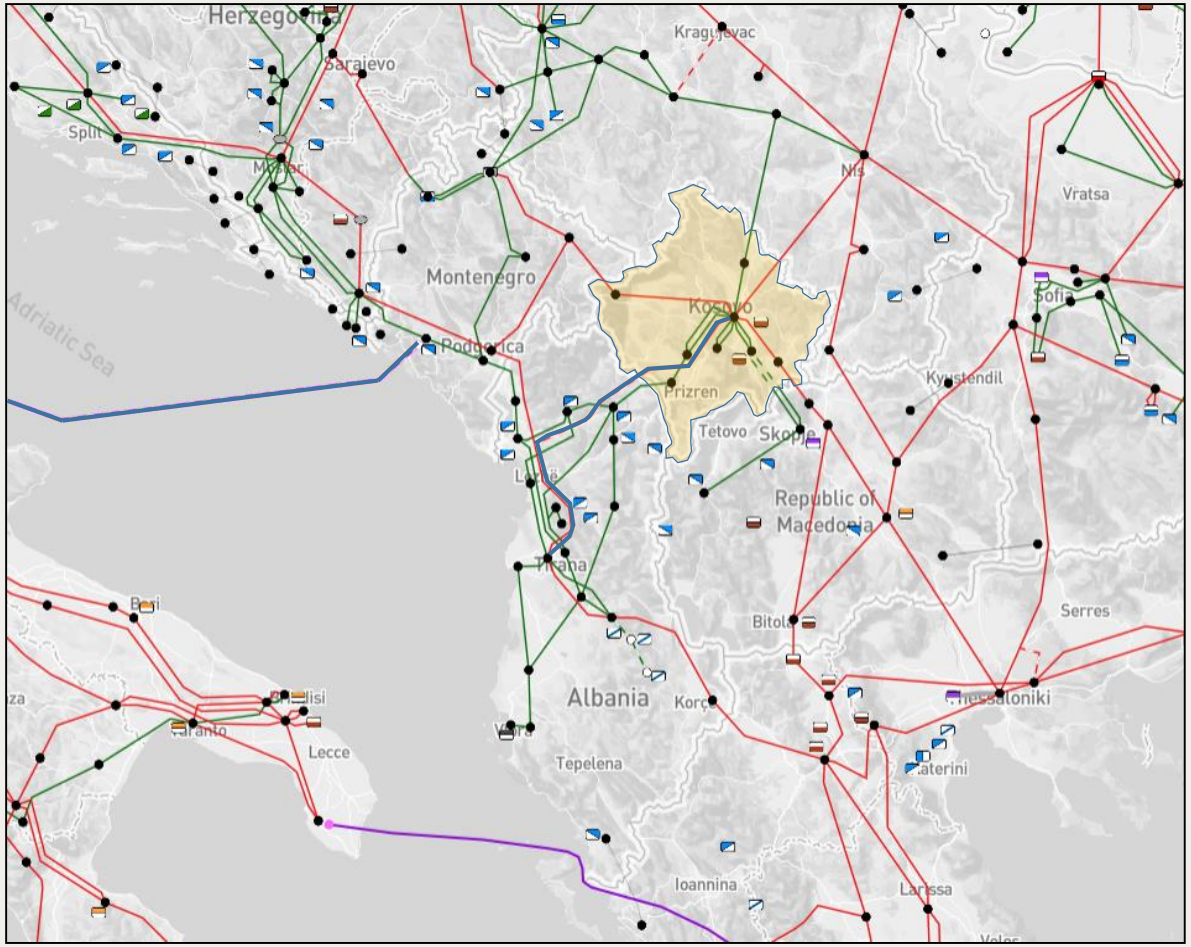
- *Extreme Weather Events*
- *Aging Infrastructure*
- *Energy Demand Fluctuations*
- *Integration of Renewable Energy*
- *Cybersecurity Threats*
- *Regulatory and Policy Frameworks*

The Overview of Kosovo Power System

Generation: TPP 920 MW, Wind 137 MW, Solar 30 MW, HPP 132 MW, BIOMASS 1.2 MW
Peak Load 1490 MW, Energy Demand 6.9 TWh
88% of Energy is produced by Lignite TPP, 12 % by RES



Kosovo Power System connection with SEE network



The Importance of Grid Resilience for Kosovo Power System

South East European Regional Council

Why Grid Resilience Matters:

- National Security: A resilient grid can withstand and recover from disruptions, whether natural or man-made, ensuring the stability of a nation's energy infrastructure.
- Essential for modern society: Powering homes, businesses, and critical infrastructure.
- Economic and social consequences of outages: Costly disruptions, and public safety risks.
- Economic Stability: Minimizing power outages and disruptions helps maintain economic activities and prevents high financial losses.
- Climate Change Adaptation: As extreme weather events become more frequent worldwide due to climate change, a resilient grid can better handle these challenges and ensure continuous power supply.
- Cybersecurity: Protecting the grid, which is becoming more digital, from cyberattacks is essential to preventing large-scale power outages and maintaining national security.
- Implementing a robust and resilient grid will require significant investments, but it is essential for ensuring national security, economic stability, and community well-being.

Factors Impacting Grid Resilience in Kosovo Power System

- **Extreme Weather Events**: Natural disasters like hurricanes, wildfires, and ice storms can cause significant damage to the grid.
- **Aging Infrastructure:** Older grid components are more prone to failures and less capable of handling modern energy demands.
- **Energy Demand Fluctuations**: Sudden changes in energy demand, such as during heatwaves or cold snaps, can strain the grid. Future Electric Vehicles will affect the distribution grid due to intense demand on specific parts of the DSO grid due to fast charging stations needed for EVs.
- **Integration of Renewable Energy**: While beneficial, integrating renewable energy sources like solar and wind can introduce variability and complexity to grid management.
- **Cybersecurity Threats**: Cyberattacks can disrupt grid operations and compromise the security of the energy supply.
- **Regulatory and Policy Frameworks**: Effective regulations and policies are essential for promoting investments in grid resilience and ensuring coordinated responses to disruptions

Weather events caused significant risk to the security of supply

(June 21, 2024)

- On June 21, 2024, a significant power blackout occurred in Southeast Europe, affecting Albania, Montenegro, Bosnia and Herzegovina, and parts of Croatia. The incident was triggered by a major grid failure, leading to a voltage collapse and subsequent blackout in the region. Kosovo Power System was not effected, only the 220 kV interconnection line with Albania was disconnected.

- The affected areas experienced a rapid decrease in voltage and frequency, causing several lines to disconnect and resulting in a total blackout

- The blackout in Southeast Europe on June 21, 2024, was significantly influenced by extreme weather events, which were exacerbated by climate change.

- The region experienced unusually high temperatures and severe storms, leading to increased demand for electricity and stress on the grid. These conditions contributed to the grid failure and subsequent blackout.

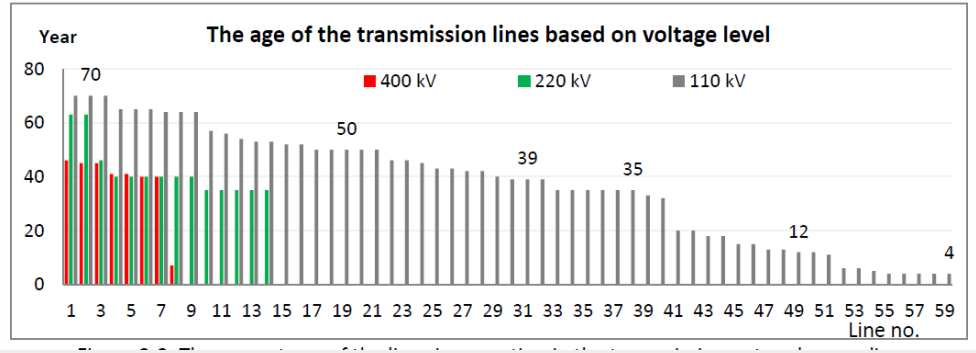
Average Temperature in Kosovo

Year	Average Temperature (°C)
2020	12.1
2021	12.3
2022	12.5
2023	12.7
2024	12.9

Aging Infrastructure

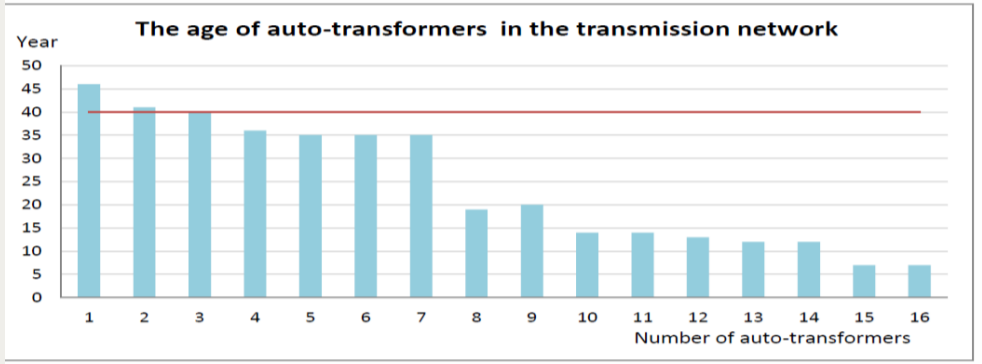
KOSTT Overhead lines:
Live cycle =50-80 years depending on tower type and climate condition.

- 400 kV and 220 kV lines in the average age of 40 years
- 110 kV lines, more than 23 lines reached 50 years.
- Those lines will be refurbished with new lines or underground cables, as per TNDP 2024-2033.



KOSTT Main Autotransformers 400/220/110 kV:
Live cycle =40 years

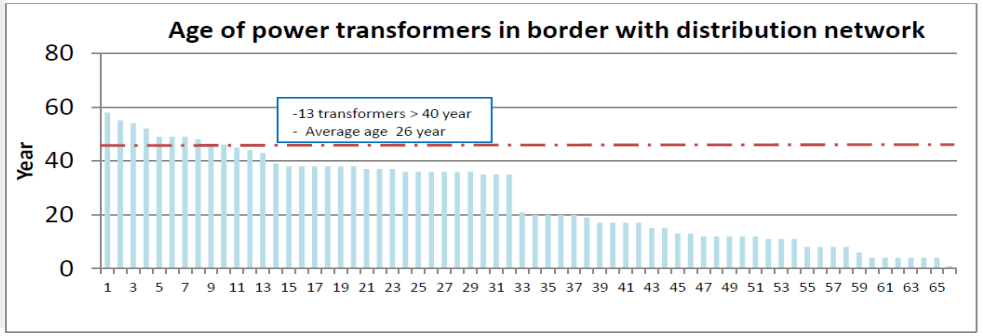
- Three autotransformers above 40 Year.



KOSTT Power Transformers in boundary with DSO:

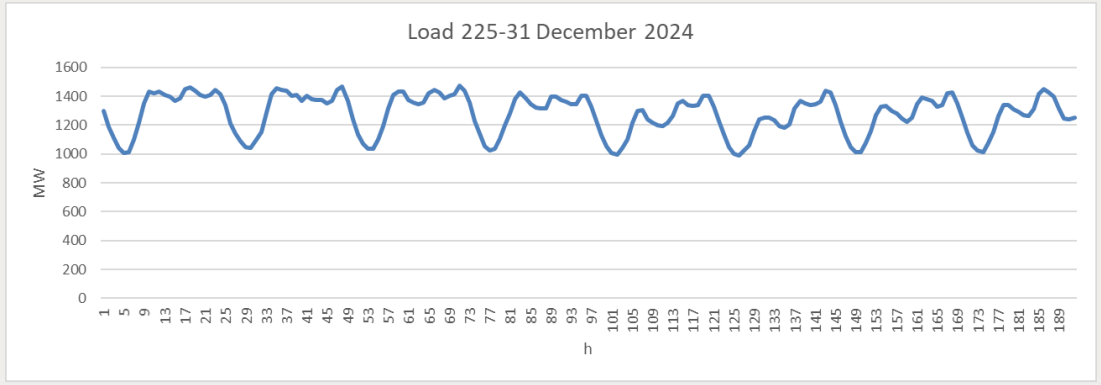
220/110/35/20/10 kV kV: Live cycle =40 years

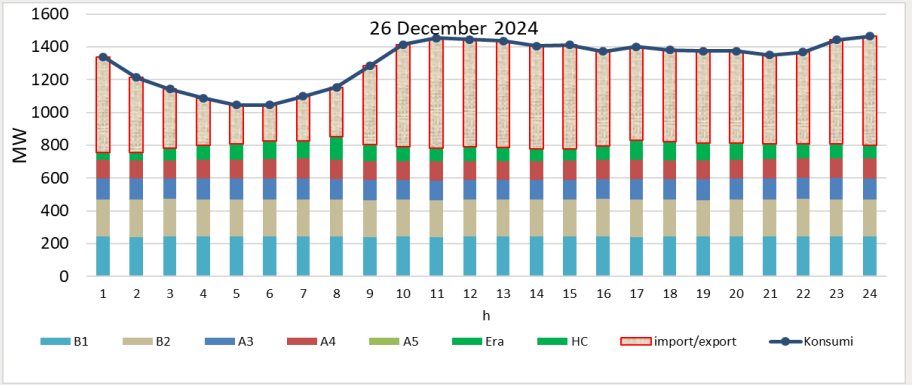
- Based on TNDP systematically those power transformers will be replaced with a new one with 40 MVA-63 MVA ratings.



Energy Demand Fluctuations:

- Electricity demand fluctuations can significantly impact the resilience of the power grid. These fluctuations can be caused by a variety of factors, including weather temperature, and seasonal events.
- In Kosovo, where there is no gas infrastructure, electricity demand is particularly sensitive to weather temperature, as electricity is the primary source of heating.
- Additionally, Kosovo experiences a surge in electricity demand during the New Year holiday, as many emigrants return home. This influx of people puts additional stress on the grid, which can lead to power outages.
- Furthermore more lot of consumers installed heating pumps (replacing heating from pellets and wood with electricity).
- Activities to solve the problems:
  - Additional investments in the DSO grid, and power transformers in boundary TSO-DSO
  - Increased measures on efficiency for energy use and installing small-scale distributed RES





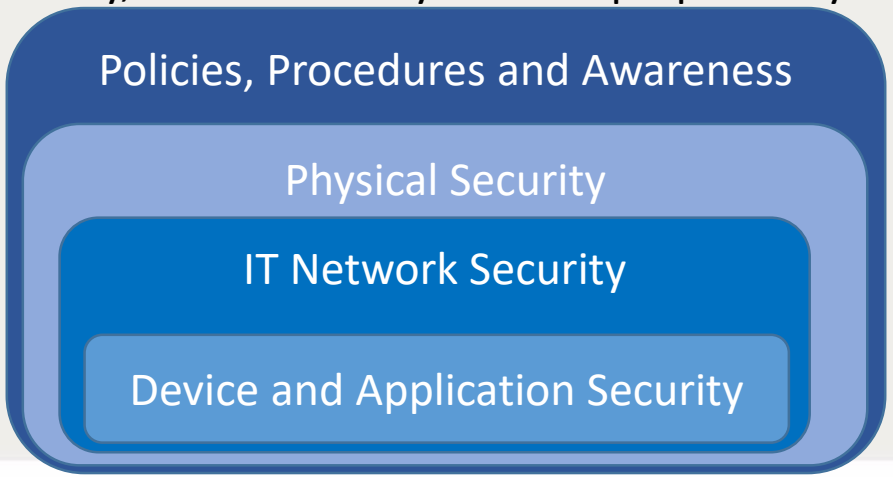
Integration of Renewable Energy

- Renewable energy sources like solar and wind are variable and intermittent, which can lead to fluctuations in power supply. Better forecasting tools are crucial to maintain the power balance in the Control Area.
- The existing grid infrastructure mainly 110 kV grid may not be equipped to handle the integration of large-scale RES, requiring upgrades and modernization.
- The availability and efficiency of energy storage systems are crucial for balancing supply and demand when RES are integrated.
- Effective regulations and policies are essential to support the integration of RES and ensure grid resilience. Some % of capacity for each RES (Wind or Solar) should be associated with Energy Storage Systems.
- Innovations in grid management, smart grid technologies, and energy storage can enhance grid resilience with RES integration.
- Based on Energy Strategy of Kosovo 2022-2031 till 2031, 2000 MW new RES should be installed, mainly Solar and Wind

- Activities to solve the problems:
  - 170 MW BESS will be installed in the transmission grid to support RES integration
  - Integration in regional and Pan-European market
  - Participation in European Platforms such a PICASSO and MARI

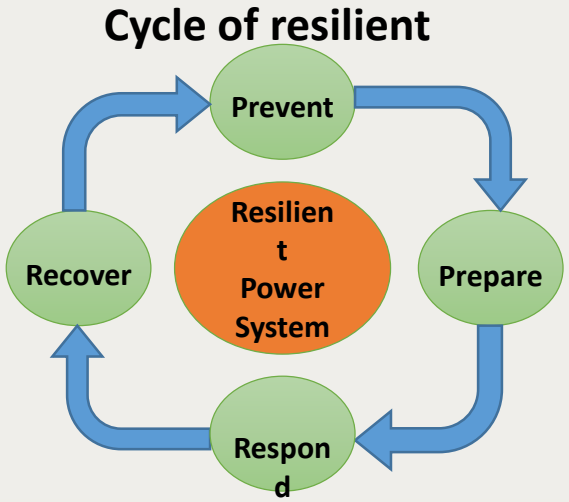
Cybersecurity Threats:

- As more National Power Systems utilize smart grids technologies, solar photovoltaics, battery storage devices, and other distributed energy resources, and with so many of these resources connecting to the power grid, there is a growing concern among utility companies about potential cyberattacks, especially when considering that power grids are an essential part of critical infrastructure.
- Digitalisation creates significant risks as an increased exposure to cyberattacks and cybersecurity incidents potentially jeopardises the security of energy supply and the privacy of consumer data.
- The main protective measures:
  - ***Device and application Security*** (such as PLCs, protection and measurement systems)
  - ***IT network security*** (network separation, intrusion detection systems-IDS)
  - **Physical security** (at critical infrastructure: substations, generation etc.)
  - ***Policies, procedures, and awareness*** (implementation of ISO/IEC 27001 certification and future task implementation of Network Code for Cyber Security, which will very soon be prepared by the European Commission).



Regulatory and Policy Frameworks

- Energy Strategy of the Republic of Kosovo 2022-2031
- LAW FOR PROTECTION AGAINST NATURAL AND OTHER DISASTERS
- The energy and electricity Law
- Grid Code (TSO &DSO)
- ENTSO-E Codes (Planning, Emergency, restoration, Cybersecurity Code)
- SECURITY POLICIES FOR INFORMATION AND COMMUNICATION TECHNOLOGY (KOSTT)
- The Law on the Promotion of the Use of Renewable Energy Sources in Kosovo



Thank you for your attention!

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