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Question 2.9 – What new or additional tools will power system operators need in order to be able to foresee, prepare and react to extreme operating conditions ?

Some New / Additional Proposed Tools/Resources to face extreme operating conditions:

- New tools to reduce the uncertainties related to wind and PV solar generation forecasting

-Reliable forecast on extreme weather, wind in particular, fires and lightning indicating in a few hours in advance, the possible risky conditions, their severity degree, and their associated consequences to some vital installations (transmission lines, inter-regional interconnections, etc.). Thus, the power system can be moved to a more secure region of operation. A warning can be sent to maintenance teams and other sectors in order to speed-up load restoration process, in case of disturbances.

-Reliable early warning system, keeping the operator aware of the operation conditions in adjacent or external interconnected systems.

-New advanced resource controls in control rooms, through artificial Intelligence (AI) techniques to improve operator's situational awareness, allowing them to make adequate operative decisions/measures.

-High performance EMS screens to man-machine interface ((MMI)

-Better TSO/DSO integration related to proceedings and data sharing

- Effective estimation of Available Transmission Capacity (ATC) under extreme operation conditions, as well as to define how to operate the power system in case of a very important installation unavailability (power plants, substations, or transmission trunks).

-Resources to achieve more observability, and controllability (SCADA/EMS, Dynamic Security Assessment – DSA, Wide Area Monitoring System – WAMS, Wide Area Control System –WACS and Wide Area Protection System – WAPS). New System Integrated Protection Schemes with faster response and more intelligence are very important to system controllability using phasor's measurements (PMU).

-Enhanced Operator Training Simulator ((OTS) focused on further development of operators' knowledge, skills, and decision-making abilities.

- Full integration of planning operation and real time operation teams in order to avoid future bottlenecks in power systems.

-Security programs with continuous monitoring of system operation performance and system equipment status with indication of asset failure risk (asset management system).

Restoration process

In the past, a blackout was considered a technical problem. This idea has changed. Nowadays, a blackout is also considered a social, economic, and political problem. Considering that blackout severity is proportional to the duration of the loss of supply, it is key to work hard towards reducing the average load restoration time. Some actions that can be taken are:

- Increase the number of power plants with black-start devices.
- Implementation of periodic tests to verify the black start devices performance.

- Keep replacement spare components, especially in areas strategically distributed along the system.
- Implement house-load operation for thermal and nuclear power plants.
- Assign or build dedicated transmission lines to ensure power supply for thermal and nuclear power plants from some specific hydro plants.
- Differentiated treatment to the substations with fundamental role to the restoration process success, in terms of maintenance, spare components and operation
- Prevention and restoration strategies may not be enough. Quick and consistent communication is emerging as crucial, and it is driven by what consumers and other external stakeholders need, not solely on what the utility thinks it is important.
- Customers have said they wanted more information on power outages, specially during storms.
- Reinforce all regarding the restoration process after large disturbances. The creation of restoration support areas with electric spare equipment, trunks, and maintenance specialists strategically located, as already adopted by PJM in the USA and CTEEP in Brazil, are mandatory.