Paris Session 2022

Validation and application of the methodology to compute resilience indicators in the Italian EHV transmission system

Study Committee C1
Preferential Subject 1
Question 1.1.1: Have others applied asset management tools and methods to set resilience measures or metrics?

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Asset Management (AM): methods and metrics for resilience (I)

- **Resilience** definition by CIGRE WG C4.47: *the ability to limit the extent, severity and duration of system degradation following an extreme event*
- **Increasing the resilience of assets** is of paramount **importance to** increase the **resilience of the system**
- **Probabilistic and risk-based methods** are of the utmost importance in AM
- Quantifying the effects of ageing and **damages caused by threats (Resilience!)**

- **Encountered barriers in applying probabilistic risk based methods** (e.g. data availability and quality, complexity of methods)… currently less limiting thanks to new data technologies

Asset Management (AM): methods and metrics for resilience (II)

- **Long term AM**: from the **frequency and the severity of extreme events** in a grid area -> **efficient prioritization** of interventions to improve the resilience of the system, **reducing** the number of **future damages** to the grid infrastructure
- **Mid term AM**: information on **seasonal trends** of specific threats can help the TSO improve the preparation phase (**efficient management of maintenance**)
- **Short term AM**: **short term forecasts of the forthcoming threats** can help the TSO **react in a proper way to the threat** (pre-allocation of emergency generators, redispatch of generators to assure minimum anti-icing currents)

- **Copying with uncertainties** over different time horizons -> this highlights the **importance of probabilistic risk based** methods

Asset Management (AM): methods and metrics for resilience (III)

- **International research**: some metrics proposed for asset resilience (e.g. the **return period for the outage of an asset**) and for PS resilience (e.g. **EENS, CVAR and VAR**) but …

  generally applied to limited portions of real-world grids and NO modeling of climate changes (which however affect both planning and AM processes)

- **Italian experience**: a **risk based resilience assessment** methodology jointly developed by RSE and TERNA (the Italian TSO).
  - Assessing the **return period of asset outages** and efficient selection of N-k contingencies to quantify the **EENS (Expected Energy Not Served) indicator**
  - **Climatological models accounted for** by updating the probability of extreme events over the time horizon of analysis
  - **Prioritization of the grid interventions** in a CBA: benefit quantified as the difference of pre-intervention and post intervention EENS indicators.
  - Supporting long term AM