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Incorporating system resilience to extreme weather events in system planning

ENTSO-E/RGI: Expert workshop on Climate adaptation and resilience measures in the ENTSO-E TYNDP CBA framework

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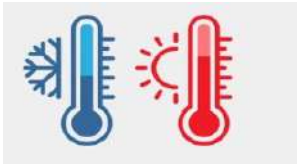
Impact of climate change on the energy system

The climate change is manifested by an increase of frequency of occurrence and severeness of extreme weather events: prolonged heat waves, droughts, wildfires, cold spells, extreme rainfalls/snowfalls causing floods/avalanches, extreme winds, etc.

- The impact of extreme weather conditions on the energy system is bifold:



System characteristics:
- demand is increased
- generation is reduced

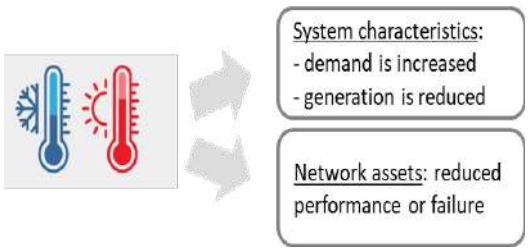
Network assets:
reduced performance
or failure

- Persistent, expected phenomena linked to climate change (e.g. average temperature rise) should be included in the scenarios (incl. the central one).

- **The focus here is on "extreme" weather events:** events with a low probability of occurrence over the study period, but with a high impact on security of supply, as they may lead to long disruptions and/or on wide geographical areas, including the transmission and distribution networks.

Extreme events and system planning

- The impact of extreme weather events is currently only partially considered in the ENTSO-E CBA analysis - such consideration would enable the assessment of infrastructure projects' contribution to energy system resilience



- The impact on the system characteristics could be taken into account by simulating extreme weather conditions into new scenarios. However, this is mainly an adequacy issue and in practice does not have a significant impact on the networks. Also, building new scenarios would be copious and would require significant extra resources.
- The impact of extreme events on transmission asset performance/ outages should be in the focus and is further analysed in this presentation.

Necessary steps

1. Identification of critical events and of the affected equipment

2. Assessment of projects' impact to transmission system resilience in terms of reduction of expected energy not supplied

3. Evaluation of the value of lost load to be used

1. Identification of critical events and of the affected equipment

Topics to be addressed	Who does what
a) Which are the critical events that must be considered and their geographical impact area?	Appropriate knowledge should be sought at appropriate (national) weather and climate change research institutions (*) (*) the possibility of available projections with regional granularity at European level could be also considered, e.g. IPCC climate system scenarios
b) What are the consequences of these events in terms of asset performance/ outages?	TSOs (maybe with some coordination by ENTSO-E on the methodology), after receiving input from the weather organisations, should determine the impact of these events in terms of asset outages in the impact area

Note: *The same critical events should be used for both sectors, electricity and H2*

2. Assessment of projects' impact to transmission system resilience

Topics to be addressed

The assessment can be performed in terms of calculation of reduction of the expected energy not supplied (EENS): Calculation of Δ(EENS) between the case with the project under assessment and the reference case (without the project) on all the relevant nodes of the grid

- What is the granularity of the grid to be used?

- Which projects shall be assessed?

- Who performs the assessment? ENTSO-E at pan-EU level (common methodology, consistency, comparability) or TSOs (local knowledge, local resources)?

3. Valuation of lost load

Topics to be addressed

- The VoLL to be considered for the evaluation of the projects' resilience benefit cannot be the same value considered for the typical monetisation of the adequacy benefit, due to the longer expected outage duration e.g. more than 1 day compared to the classical VOLL analyses.

- A VoLL without prenotification should be considered. The ERAA surveys can be used, extending the questionnaire to cover longer interruption durations.

- What value to use for countries where no VoLL calculation takes place?

Thank you!

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