Adaptation of the French Transmission Network to Climate Change – The case of underground lines resilience to extreme heat

Laurent Dubus[1, 2], Catherine Lelong[1], Jean Thorey[1], Sergeï Agapoff[1]

1. RTE, Paris, France

2. WEMC, Norwich, UK

RTE is the operator of the French electricity transmission network. As a public service company, RTE is responsible for the operation, maintenance and development of the high and very high voltage network and guarantees the proper functioning and safety of the power system.

This is dependent on meteorological conditions at all time scales. Air, river and sea temperature, precipitation, wind speed, solar radiation… have indeed impacts on both the consumption of electricity and its generation, but also on the operation of the network itself, and on the components of the network. Climate change will substantially alter these dependencies, and it is crucial to anticipate the impacts to 1/ identify potential weaknesses of the existing assets and 2/ design the network of the future so that it is resilient to a changing climate.

Over the last three years, the RESILIENCE project has focused on the impacts of flooding on the one side, and heat waves & droughts on the other side, on the different components of the network: overhead and underground lines, pylons and power stations. The analysis were based on RTE's current reference climate database, which consists in three simulated datasets of 200 years, respectively for the years 2000s and the years 2050s, with RCP4.5 and RCP8.5. Considering the long lifetime of some network elements, additional datasets, mainly based on EURO-CORDEX, were used to better quantify the temporal evolution of the relevant climate events over the whole century, and also to compare different models' projections.

This presentation will introduce the overall project and make a focus on extreme heat for underground lines. We compared different datasets to estimate the soil temperature at different depths, including direct model outputs and an empirical engineering model that uses air temperature to determine soil temperature. Results show significant differences among the datasets and raise questions about the validity of the models. They also show some needs to better assess the effects of soil humidity and characteristics on the heat dissipation capacity of the lines, as well as the quality of the corresponding datasets from climate models.