SERVICE DE METROLOGIE NUCLEAIRE
RELIABILITY AND SAFETY OF POWER SYSTEMS

MASTER THESES

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Estimation of the risk linked to outage planning under uncertainty in a transmission system with an increasing share of renewables (in collaboration with Elia)

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For master thesis and internship

Context & objectives

Elia is the operator of the Belgian high-voltage grid from 380 kV to 30 kV with the mission to lead the way in the energy transition by developing diversified, sustainable and reliable on- and offshore electricity systems that open up new possibilities.

We develop, build and maintain our transmission grid according to long-term needs. We heavily invest in the integration of renewable energy, the development of an on- and offshore high-voltage grid and the construction of interconnectors to facilitate the integration of the European energy market. By doing so, Elia Group drives the transition to tomorrow's energy system.

In a context of a growing share of renewables, the planning of outages for maintenance of the high-voltage grid elements becomes a challenge for Elia. For some grid elements, it is impossible to define maintenance periods when it can be sure that the grid will be safe without redispatching needs due to the variable nature of Renewable Energy Sources (RES).

This issue raises many questions, a.o.:

- If an outage can be planned in an "optimal way"/in a statistically most favorable period, what are the expected risk and operational cost considering imperfect information on the load, wind and other forecast and associated error patterns?
- What are other indicators next to the expected values that can support decision making and budgeting?
- How to quantify the incremental risk to plan the outage in less optimal periods due to organizational constraints/challenges?
- What are the effect/benefits that could be expected if the outage and the work could be organized in a more flexible way? For example, daily vs. continuous outages, works outside business hours in specific situations…?
- Can we define criteria to decide when the risk becomes too high? To be able to decide whether it is necessary to adapt the planning or even the grid structure because there are not sufficient acceptable outage windows?

Work description

- Gain knowledge of the current method for maintainability assessment and outage planning within Elia
- Screen the literature concerning risk management under uncertainty to assess which concepts can be applied to this particular issues
- Apply the concepts on provided datasets to answer (at least) the first question stated above
- Develop (or define requirements for) scripts that will allow Elia to assess systematically all its maintenance and outage needs

The student will be able to develop knowledge and competences regarding the grid development and operational planning of the electrical network as well as in the fields of system reliability and data handling which are useful in many industries.