SERVICE DE METROLOGIE NUCLEAIRE
RELIABILITY AND SAFETY OF POWER SYSTEMS

MASTER THESES

Academic year **2020-2021**

The topics listed below correspond more to ***themes*** *in which master theses can be realized, than to a detailed description of topics. Depending on the interest of the students, more theoretical or instead industry-related topics will be developed. Some of the proposed themes are more convenient for an* ***internship****, to be made before the master thesis.*
The themes proposed are preferably ***accessible mainly to students in engineering physics and in electromechanical engineering****.*

Probabilistic adequacy assessment of decarbonized power systems

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The adequacy of a power system is its ability to satisfy the consumer demand at any time, considering the possible outages of components and the variability of renewable energy sources. In order to consider the stochastic nature of generation availability, the adequacy of a power system is characterized by probabilistic metrics such as the Loss Of Load Expectation (LOLE), which is the average number of hours per year with a lack of power supply for one or several customers (loads), or the Expected Energy Not Served (EENS) which is the average energy per year that the system is unable to supply (but should supply). In Belgium, by law, the LOLE must be below 3 hours/year. It is the case also in neighboring countries. The most common way to evaluate the adequacy of a power system is to use a sequential Monte Carlo simulation. However, a main drawback of this technique is the long computation times needed to reach a satisfying statistical accuracy. Furthermore, this technique relies often on an implicit assumption of perfect foresight over a specific timeframe: it considers implicitly that future weather conditions are perfectly known. These two drawbacks are expected to become limiting factors for the probabilistic adequacy assessment of decarbonized power systems. Indeed, they will integrate massively storage and it would be overoptimistic to dispatch that storage assuming a perfect forecast of future weather conditions. Moreover, the possible occurrence of extreme weather events (e.g. cold spell, *dunkelflaute*, dry year) might lead to higher computation times in decarbonized power systems. In that context, the purpose of this MSc thesis will be twofold: (i) the development of variance reduction techniques to improve computation times while considering extreme weather events, and (ii) the study of the impact of the perfect foresight assumption on the adequacy assessment. For that purpose, a dedicated tool will be developed and applied to a decarbonized power system.