

SERVICE DE METROLOGIE NUCLEAIRE
RELIABILITY AND SAFETY OF POWER SYSTEMS

MASTER THESES

Academic year **2019-2020**

*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.***

9. Investigations into alternative uses of electricity produced by nuclear power plants (in collaboration with Westinghouse, 43, rue de l'industrie, 1400 Nivelles - possibly for 2 students)

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Nuclear power plants can operate in two modes when considering their electrical grid output:

- Operating continuously at 100% power; barring short periods of time where the reactor is taken offline for refueling and maintenance. This is referred to as base load operation.
- Operation in load-follow; following a load pattern determined to match the electrical demand expected by the grid operator.

Most nuclear power plants in the world have been designed, or modified after build, to operate most of the time in base load operation, with some limited load follow capability. This has been driven by decades of precedent; where grid operators/utilities worked to achieve the highest utilization of their nuclear units due to their low cost of operation relative to other power forms.

With a very significant increase of (often subsidized) intermittent renewable energy generation and strong competition from low priced, flexible, carbon-emitting energy, utilities operating nuclear power plants in base load are experiencing a high number of hours with very low or even negative electricity prices. Furthermore, the nature of nuclear power (i.e. high fixed cost of operation and low marginal costs) means that turning down, even if technically feasible, represents a considerable loss of profitability. Maintaining economic profitability of nuclear energy is therefore becoming a significant challenge for nuclear power plant utilities.

When electricity is not needed, the electricity production could be redirected to other, more-lucrative purposes / uses. Possibilities are energy storage or other repurposing of the plant to desalination, hydrogen generation, process heat replacement, or other applications. The purpose of this project is to investigate the technical and economic feasibility of alternative uses of the electricity produced by a nuclear power plant, integrating grid constraints as well as all

other relevant parameters. Furthermore, this work will be integrated into ongoing innovation projects within Westinghouse.

Westinghouse Electric Company provides a wide range of nuclear power plant products and services to utilities throughout the world: nuclear fuel, service and maintenance, instrumentation and control systems. Westinghouse is also leading the way with a new generation of nuclear technology, helping the world meet growing electricity demand with safe, clean, and reliable nuclear energy. <http://www.westinghousenuclear.com/>