

MSc Thesis Project Proposal – DNV-GL Energy

Value of Energy Storage in Future Power Systems

Field of study

Power systems, control theory, stochastic processes, mathematical modeling

Background

In an effort to curb climate change, our society is transitioning from an energy sector with high fossil fuel dependency to a more electrified energy sector where a substantial amount of our energy will be provided by wind and solar plants. One of the main obstacles to this energy transition is the weather-dependent variability and uncertainty in wind and solar power. Since the inherent ability of the power system to store energy is very small, generation (including wind and solar) must match demand at all times.

Scope and objective

The objective of this project is to provide insight into the most cost-effective way to integrate variable generation into the power system. This is important from a societal perspective in order to design proper incentives for the energy market, e.g. in the form of subsidies. A key question is: is it more effective to invest in energy storage units or is it more advantageous to redirect those funds towards building additional renewable generation plants? While an energy storage unit can absorb variations in net demand, additional generation units help balance the system by ensuring that more power is produced at all times, including times of high demand.

A suggested (but not required) approach for investigating this question is to

- develop a simple stochastic model of variations in net demand in a power system.
- model and investigate the effect of storage on net demand variations. This step requires developing a control strategy for charging/discharging the storage unit.
- investigate the generation increase needed to match the performance of the storage unit
- compare the economic viability of the two alternatives based on present costs

The final report should be submitted as a written report, and presented orally at both DNV-GL and the Department of Automatic Control.

Prerequisites

An deep interest in power systems and mathematical modeling. Knowledge of stochastic processes and control theory.

Other

The project is supervised jointly between DNV-GL Energy Sweden and the Department of Automatic Control. DNV-GL will provide desk-space at our facilities in Malmö and a lap-top.

Contact

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