

VÆR MED TIL AT LAVE SPÆNDENDE PROJEKTER MED ENERGINET



Grid Former technology and replacement of a large synchronous generator

SEMESTER:

MSc Thesis

KEYWORDS:

Grid Former, Control, Technical Specification, Power Transmission System, Synchronous Generator Replacement

BACKGROUND:

The Grid Former is a relatively new power-electronics converter technology and control for the transmission power systems. The Grid Former converters are pronounced to define the voltage and frequency of the grids and work as Virtual Synchronous Machines (VSM), which is in contrast to the present and well-known Grid Follower technology and control of the inverter-interfaced units relying on the voltage and frequency of the grids.

As the amount of the inverter-interfaced production increases rapidly and mainly in the distribution power systems, the share of conventional large synchronous generators in the transmission power system and their provision of ancillary services reduces. When the inverter-interfaced units will dominate the power production, their ability to provide ancillary services to the transmission power grid becomes essential for stability and reliability of the electric energy supply.

PROBLEM-STATEMENT:

Conduct a study on the Grid Former technology and application in the transmission power grids as replacement of conventional large synchronous generators. Evaluate which control principle as well as which power (MW) and energy (MWh) capacity of the Grid Former are needed to match the main ancillary services such as the short-circuit contribution, the inertia, and the black-start capability, in comparison to a given large synchronous generator.

DESCRIPTION:

- From literature identify the state-of-the-art of the Grid Former technology and utilization in transmission power grids with focus on provision of ancillary services: the short-circuit contribution, the inertia and the black-start capability.
- Identify utilization of the energy generation, such as PV and wind, and energy storages, for delivering of the above given ancillary services to the grids.
- Identify control principles for delivering of the above given ancillary services to the grid.
- Conduct a desktop design study and prepare a technical specification of a Grid Former unit, including all relevant electrical data, to replace a large synchronous generator in the Danish transmission grid. For the desktop design study, Energinet will provide relevant parameters of a corresponding synchronous generator and a black-start sequence.

Mandatory prerequisites: successfully conducted university-level courses on Control and Electrical Energy Systems. Knowledge of simulation programs such as DiGSILENT PowerFactory or Matlab/Simulink is beneficial.

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CONFIDENTIALITY:

Confidentiality on the data and models from Energinet.

LANGUAGE:

Danish or English

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