Fluktuerende vedvarende energi i el- og varmeforsyningen - det mellemlange sigt - DTU Orbit (18/11/2019)

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The main objective of this methodical study is to analyse conditions for wind generated fluctuating electricity production in the context of a liberalised electricity market. Furthermore, the objective is to analyse consequences of introducing technologies, able to provide power regulation, to improve utilisation of large capacities of wind power in the Danish and North European electricity system. Main emphasis is put on the system aspects year 2005 and 2015. The Danish energy plan Energy21 forms the starting point of the analysis.

An essential part of the work has been to set up a baseline market for sale and purchase of electricity in Northern Europe year 2005. The baseline market comprises a spot and a balance market for electricity. Detailed model calculations on the North European electricity production system and data from the existing Nord Pool electricity market form the basis for this baseline market. Uncertainties due to annual precipitation variations in the Scandinavian hydropower production and consequences of CO₂-taxation are reflected in the analysis. Quantities that are not reflected in the market prices, though important for the technical functioning of the electricity system, are described.

Consequences of the prediction accuracy of the wind power production and market strategy on the market value of wind generated electricity is treated in the report. Furthermore, the economy of off shore wind farms is addressed. The relevance of using national regulation technologies to improve the integration of wind power is analysed. Decentral heat and power production systems based on natural gas fired Combined Cycle plants including heat storages and heat pumps are analysed relative to the electricity baseline market, and flexibility in such systems, as to offer power regulation capability on the electricity market, is studied. Furthermore, load management options related to electric vehicles are analysed.

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