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Large-scale integration of wind power into different energy systems

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Abstract

The paper presents the ability of different energy systems and regulation strategies to integrate wind power. The ability is expressed by the following three factors: the degree of electricity excess production caused by fluctuations in wind and Combined Heat and Power (CHP) heat demands, the ability to utilise wind power to reduce CO₂ emission in the system, and the ability to benefit from exchange of electricity on the market. Energy systems and regulation strategies are analysed in the range of a wind power input from 0 to 100% of the electricity demand. Based on the Danish energy system, in which 50% of the electricity demand is produced in CHP, a number of future energy systems with CO₂ reduction potentials are analysed, i.e. systems with more CHP, systems using electricity for transportation (battery or hydrogen vehicles) and systems with fuel-cell technologies. For the present and such potential future energy systems different regulation strategies have been analysed, i.e. the inclusion of small CHP plants into the

regulation task of electricity balancing and ancillary grid stability services and investments in electric heating, heat pumps and heat storage capacity. The results of the analyses make it possible to compare short-term and long-term potentials of different strategies of large-scale integration of wind power.



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