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Reduction of input variability using the natural combination potential of spacious distributed offshore wind farms in the German Baltic Sea and the German Bay

Michael Splett, Jörg Bendfeld, Reinhold Lüttig
University of Paderborn, Department for Sustainable Energy Concepts, Paderborn, Germany, +49(0)5251 602306 / +49(0)5251 603235, splett@nek.upb.de

1. Introduction

The installed capacity of a single offshore wind farm is equivalent to the capacity of a conventional power plant block, therefore the short-term output fluctuations could be highly significant. Conventional power plants have to be included in the overall system in order to stabilise the frequency in the grid system. Before considering the power balance in the conventional generating system, it is necessary to analyse the possibilities of interconnected spatially distributed offshore wind farms for compensating input variability. This paper models offshore wind farms for 80 turbines each at various locations in the German Bay and the German Baltic Sea, including offshore wind farm locations each with a metmast, which is scientifically cared for by our professorship. After analysing the wind fluctuations, this paper considers the types of input variability, followed by a description of the compensation possibilities by spatial distribution of the offshore wind farms. Instead of using simulated time sequences for analysing the input variability, data obtained from actual measurements made by the German offshore wind metmasts is utilised in this paper.

2. Modus operandi

It is insufficient to consider a single wind farm for estimating the offshore influence on the power plant utilisation planning and scheduling of compensating energy. This is primarily so because of the farm groupings. A simple factor analysis of the fluctuations would give false results, because the different site conditions, such as the fetch effect, play an important role.
Therefore, because of the grouping of the wind farms, it must first of all be investigated whether an interaction exists between the individual wind farms. Two wind farms as examples, each with 400 MW installed power rating, have here been modelled at various sites in the German Bay and the German North Sea. For the three scenarios:

1. Large fluctuations
2. Small fluctuations with high average wind speed
3. Small fluctuations with small average wind speed

the percentage output powers will be shown, individually for the two single wind farms and for the interconnected one.

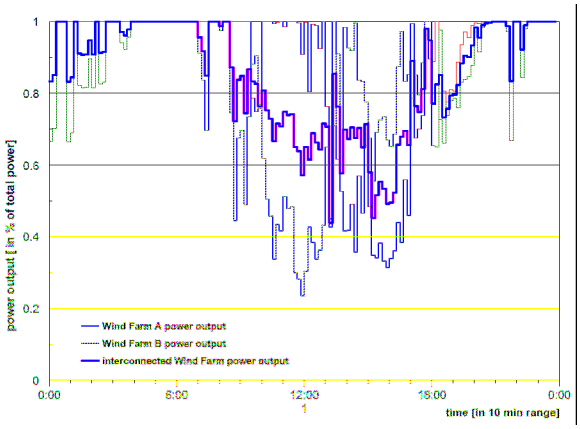

Fig. 1: One Power output scenario

3. Conclusion

The short-term power output changes can reach the order of magnitude of the power rating of a conventional power plant block. For system integration of the offshore wind power plants it is essential to first exploit the given natural compensation possibilities of the offshore wind power plants. These potentials depend not only on the respective site of the wind farm, but also on the farm geometry. They definitely exist and should therefore be integrated in the energy management concept.