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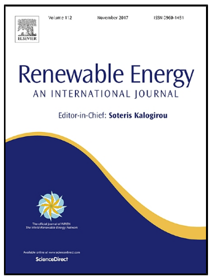

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The importance of forecasting regional wind power ramping: A case study for the UK

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Abstract

In recent years there has been a significant change in the distribution of wind farms in Great Britain, with a trend towards very large offshore farms clustered together in zones. However, there are concerns these clusters could produce large ramping events on time scales of less than 6 hours as local meteorological phenomena simultaneously impact the production of several farms. This paper presents generation data from the wind farms in the Thames Estuary (the largest cluster in the world) for 2014 and quantifies the high frequency power ramps. Based on a case study of a ramping event which occurred on 3rd November 2014, we show that due to the large capacity of the cluster, a localised ramp can have a significant impact on the cost of balancing the power system on a national level if it is not captured by the forecast of the system operator. The planned construction of larger offshore wind zones will exacerbate this problem. Consequently, there is a need for accurate regional wind power forecasts to minimise the costs of managing the system. This study shows that state-of-the-art high resolution forecast models have capacity to provide valuable information to mitigate this impact.

Keywords: Wind; energy; ramping; predictability; offshore

1.0 Introduction

In recent years there has been a significant growth in wind power in the UK. Between 2008 and 2014, the installed capacity of wind turbines increased from 2.9 GW to 12.4 GW and the proportion of electricity provided by wind power increased from 1.5% to 9.3% [1]. Much of this growth is the result of the development of offshore wind. Following the construction of the offshore wind farms in the second round of developments (started by the Crown Estate in 2003); the offshore capacity has risen to approximately 5 GW (40 % of total wind capacity). Much of this new capacity has been installed in a small number of very large wind farms which are located in clusters. For example, in the Thames Estuary alone there is approximately 1.7 GW of capacity [2]. This trend looks set to continue as the third round of offshore wind development in the UK, launched in 2009, identified 9 zones within which a number of individual wind farms could be located. Consequently, following the construction of the round 3 wind farms the majority of GB wind capacity would be located offshore in clusters of very large wind farms [3, 4].

Concentrating large amounts of capacity in a small number of wind farms in close proximity can lead to large regional ramps in generation on time scales of minutes to hours as the impact of local meteorological phenomena could simultaneously impact production in several sites. Drew et al [5] showed that on time scales of less than 6 hours, the ramps in generation of the cluster of wind farms in the Thames Estuary were larger than those of the more spatially dispersed onshore wind farms. Large fluctuations in power on short time scales have also been observed at the Horns Rev wind farm [6, 7].