



The relationship between wind power, electricity demand and winter weather patterns in Great Britain

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Wind power generation in Great Britain has increased markedly in recent years. However due to its intermittency its ability to provide power during periods of high electricity demand has been questioned. Here we characterise the winter relationship between electricity demand and the availability of wind power in Great Britain. The relationship is analysed over a 34 year period using observed electricity demand and an idealised wind power model.

We find that although a wide range of wind power capacity factors is seen for a given demand, the average capacity factor reduces by a third between low and high demand. However contrary to what is often believed, during the highest demand average wind power starts to recover.

The nature of the weather patterns affecting Great Britain is responsible for this relationship. The change from predominantly strong, warm westerly winds, to colder, calmer easterly winds explains the reduction in wind power supply as demand increases. During highest demand, the modest recovery in wind power is associated with the building of pressure to the north of Britain, giving strengthening easterly winds.

During high electricity demand, a range of high pressure weather types generate similarly cold conditions over Britain, but varying wind power supply. Offshore wind power is sustained at higher levels and offers a more secure supply compared to that onshore. However, during high demand periods in Great Britain neighbouring countries may struggle to provide additional capacity due to concurrent low temperatures and low wind power availability.