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Implications of the North Atlantic Oscillation for a UK-Norway Renewable Power System

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Wind power capacity in the UK is increasing, and new transmission links are proposed with Norway where electricity is primarily produced through hydroelectric generation. The impact of climate variability on such an interconnected power system incorporating different renewable sources therefore merits investigation. This study examines the effect of the North Atlantic Oscillation (NAO), the dominant large-scale pattern of atmospheric variability affecting northern Europe, on an integrated UK-Norway power system with growing reliance on wind power.

Wind and temperature data from the NCEP/NCAR reanalysis (1948-2010) are used to model demand and wind power using simple models. 'Demand net wind' (DNW) is estimated for positive, neutral, and negative NAO, focusing on March when Norwegian hydropower reserves approach their minimum and the combined system might be most susceptible to meteorological variations. It is found that the cold and still conditions associated with the NAO negative state (compared to NAO positive or neutral) result in greater demand and decreased wind production. The resulting increase in DNW in NAO negative relative to NAO neutral, under a 2020 power system scenario, would be equivalent to an approximately 25% increase in the present-day rate of Norwegian hydropower usage during March. This represents a marked increase in the magnitude of the power system's sensitivity to NAO variability.