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**WIND FARMS:
THE CONSISTENCY OF SUPPLY ISSUE**

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Abstract

Renewable energy is becoming increasingly attractive as an alternative source of energy on account of the relentless demand on the World's oil reserves, continuing problems over the storage of nuclear waste, and international agreements over acceptable levels of greenhouse-gas pollution from burning coal. The British Government is currently planning a massive expansion, and investment, in our wind-farm capacity. (Britain will soon be Europe's leading offshore wind-farm operator). But a potential drawback to wind energy is the 'consistency-of-supply' problem. Electricity generation is impossible during both low, and high, wind conditions.

The aim of this investigation was to analyse a set of wind data from several airports around the UK to assess the magnitude of the 'consistency-of-supply' issue. Firstly the data were adjusted to take into account differences in a) height and b) 'surface roughness' between the location at which measurements had been taken and the onshore and offshore wind farm sites being considered. Then by applying the conditions for power production from a modern wind turbine, the UK *capacity factor* could be calculated. In order to look at what effect the geographical spread of wind farms has on the consistency of electricity production (i.e. if there is no wind in southern England how likely is it that there will be no wind in Scotland also?), the UK was divided into 12 regions with each one contributing to calculations according to the *installed capacity* within it.

The capacity factor for wind power in the British Isles has risen from ~22 to 32% since the introduction of offshore wind farms and larger turbines. Strong diurnal and monthly patterns of power output from wind farms have been recognised and to a certain extent show a positive correlation with patterns of demand; on average the highest power output occurs at midday in the winter months (although the exact time of day was poorly constrained) which coincides with the greatest demand for electricity.

Although the power output from UK wind farms is variable, situations with widespread low wind conditions are rare; zero power production occurred less than 0.05% of the time according to calculations. Research has shown that the causative high pressure systems are very predictable.

The results of the investigation have shown that the target of 20% renewable electricity production by 2020 set by the UK government, is very achievable with wind being the primary contributor.