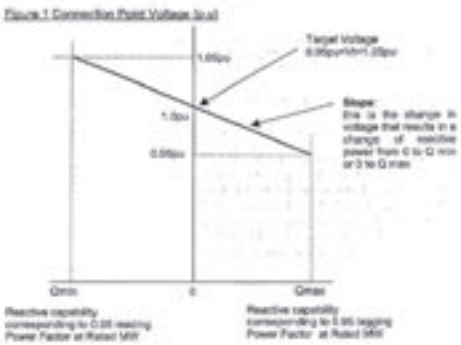
Grid Code Compliance - Voltage Aspects

by Paul Glendinning and Mark Halliday, Econnect Group Ltd

Changes to both the Irish and GB Grid Code in 2005 have brought about additional technical requirements for wind parks, which include reactive power and voltage control. These particular requirements have brought about a fair amount of concern and frustration to wind farm developers.

We in the Econnect Group have been following these changes and working closely with both manufacturers and grid operators to clarify the technical requirements and to assist wind farm developers by providing cost-effective solutions. Our strategy has been aimed specifically to ensure that developers can connect the maximum amount of wind generation to the electrical networks of Great Britain and Ireland.

The voltage control requirement is made up of two main aspects, that of steady state performance and transient voltage control. With respect to the steady state performance requirements (section 6.2.2.1 of a Bilateral Agreement) for voltage control the wind farm is required to provide continuous steady state voltage control of the voltage at the User System Entry Point with a 4% voltage slope characteristic to a target voltage of between 0.95pu to 1.05pu.



Source of illustration: National Grid

For the transient voltage control requirements (section 6.2.2.2 of the Bilateral Agreement) of the Grid Code the wind farm voltage control system is required to be capable of achieving 90% of the steady state change in reactive power, in a time not exceeding 1 second.

This is an onerous requirement for most wind turbines and we have found that, even if the wind turbine as an individual unit can get close to the requirement, the wind park as a whole requires co-ordination and further compensation. This is due to the electrical impedances in the network between the connection of the project at the 'User system entry point' and the LV connection of the prime movers. The technical data submitted from wind turbine manufacturers to developers mostly encompasses information given at the LV terminals of the converter / machine, however, this then needs to be modified further to include for transformers and reticulation system losses.

Many technical solutions proposed require a DVAr unit and/or other compensation requirements to be installed at the wind farm substation, which forms the controlling point for the grid operator. This substation equipment is surprisingly large and wind developers will be required to apply for planning permission for the space in the substation. Econnect has found that the space required is more than double that of a 'normal' substation.

Econnect Construction Ltd, part of the Econnect Group, has the capability to design and build the 'Grid Code Equipment' necessary to meet the requirements for voltage control and reactive power capability. Econnect Construction is currently involved in the first project of this type, the 37.5MW Earlsburn project located in Scotland, where the turbine supplier is Nordex and the distribution network operator is Scottish Power.

Figure 1 shows a graph from a study that was performed at Econnect Construction, with the assistance of Durham University, to illustrate the voltage recovery of Econnect Construction's proposed step change design using a 'Hybrid' solution. This hybrid solution does not use a fully rated DVAr unit, but it is ably assisted by the use of capacitors and reactors, which allow for both reactive power and voltage control operation in either direction (leading or lagging) from unity.

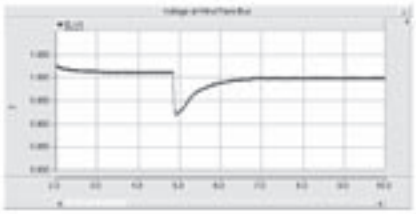


Figure 1 – Voltage Recovery Graph

The technical requirements for voltage control, and subsequently the solutions, are becoming clearer as time moves on. The key aspects for any wind developer are to ensure that they allow sufficient substation space for the required electrical equipment and to budget for the costs of Grid Code compliance into the project finance. The Grid Code compliance testing required at the commissioning stage of a wind park is three to four times that previously carried out on typical wind farms, therefore developers should also allow for this in terms of cost and project programme. □

Real Power is published by BWEA, the professional association championing the UK wind and marine renewables industry, representing over 320 companies active in the sector.
Contact BWEA Renewable Energy House, 1 Aztec Row, Berners Road, London, N1 0PW
t 020 7689 1960 • f 020 7689 1969 • info@bwea.com • www.bwea.com
Editorial 020 7689 1935 / mari@bwea.com E&OE
Printed by Kent Art Printers Printed on Revive Uncoated: minimum 80% de-inked post consumer waste and 20% mill broke