Change proposal:	**Grid Code G/09: Grid Code Short Circuit requirement in respect of very Large Synchronous Generating Units**		
Decision:	The Authority[1] directs that the proposed change to the Grid Code[2] be made		
Target audience:	National Grid Electricity Transmission PLC (NGET), Grid Code users and other interested parties		
Date of publication:	23 August 2010	Implementation Date:	6 September 2010

Background to the change proposal

The Grid Code specifies limits for certain parameters relating to the capabilities of synchronous generating units connected to the National Electricity Transmission System (NETS). One such parameter is the Short Circuit Ratio (SCR) requirement. The SCR of a synchronous generator is defined in international standard IEC34-4 as "The ratio of the field current for rated armature voltage on open-circuit to the field current for rated armature current on sustained symmetrical short circuit, both with the machine running at rated speed".

According to section 6.3.2 of the Grid Code's Connection Code (CC), the SCR of synchronous generating units connected to the NETS is required to be not less than 0.5. The SCR requirement of a synchronous generator affects the stability performance of the generators and the overall transmission system.

The largest single synchronous generating unit currently connected to the NETS is in the order of 776MVA. New nuclear generation stations that are currently contracted to be connected to the NETS may encompass single synchronous generating units with a rated output of up to 2000MVA.

NGET reports that it has received information from manufacturers indicating that the size of generating units with a high output rating and an SCR of 0.5 or above presents manufacturing and transport issues (for example, due to limitations on road bridge loadings). Reducing the minimum SCR requirement of a generating unit reduces the size of the field winding required and can therefore reduce the size of a compliant unit.

The change proposal

The G/09 change proposal was raised in response to the concerns of a number of generators hoping to utilise new technology (in particular new nuclear) for which generating units with rated output of up to 2000MVA have been proposed. These generating units are not available with an SCR of 0.5 or above.

NGET propose that the Grid Code is amended to specify that the SCR must not be less than 0.4 for units with apparent power output of 1600MVA or greater. For units with apparent power output of less than 1600MVA the SCR must not be less than 0.5 (as is currently required).

[1] The terms 'the Authority', 'Ofgem' and 'we' are used interchangeably in this document. Ofgem is the Office of the Gas and Electricity Markets Authority.
[2]This document is notice of the reasons for this decision as required by section 49A of the Electricity Act 1989.

NGET considers that G/09 will better meet the objectives of The Grid Code[3] by:

- facilitating competition in the generation and supply of electricity by allowing generation developers to procure larger generation units from a wider range of suppliers without the need for enhanced excitation systems; and
- promoting the security and efficiency of the electricity generation, transmission and distribution system in Great Britain by not detrimentally affecting unit stability and therefore the security of the NETS.

NGET consulted on the Grid Code change proposals and received responses from three Authorised Electricity Operators (AEOs). All three respondents supported the proposed relaxation of the SCR obligations although one respondent believed it should be applied to all generation. NGET submitted on 19 May 2010 their Report[4] to the Authority recommending that the change proposals be adopted. Following discussion with Ofgem, NGET agreed to provide further information within the report and consulted the members of the GCRP on a revised version of the above report. Two responses to this consultation were received. One was an expansion of the response from the AEO which considered that the change should be applied to all generation, the other was fully supportive.

NGET's recommendation

NGET submitted a final report to the Authority recommending that change proposal G/09 is implemented.

The Authority's decision

The Authority has considered the issues raised by the change proposal and in the final report dated 5 August 2010. The Authority has considered and taken into account the responses to NGET's consultation on the change proposal which are included in the final Report[5]. The Authority has concluded that:

1. **implementation of the change proposal will better facilitate the achievement of the objectives of the Grid Code; and**
2. **approving the change is consistent with the Authority's principal objective and statutory duties[6].**

Reasons for the Authority's decision

In reaching our decision we have considered how the change proposal better meets the objectives of the Grid Code as set out in Standard Licence Condition C14 (1) (b). These are considered below.

[3] As set out in Standard Condition C14(1)(b) of NGET's Transmission Licence, see: http://epr.ofgem.gov.uk/document_fetch.php?documentid=14343
[4] Grid Code proposals, final reports and representations can be viewed on NGET's website at: http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/
[5] ditto
[6] The Authority's statutory duties are wider than matters which NGET must take into consideration and are detailed mainly in the Electricity Act 1989.

(i) To permit the development, maintenance and operation of an efficient, co-ordinated and economical system for the transmission of electricity

We consider that the proposal will have no adverse impact on the development, maintenance and operation of an efficient and economical electricity transmission system. All generating units, including those with a lower SCR, will have a continued requirement to comply with the Grid Code and the specific conditions relating to reactive power capability (CC6.3.2) and stability (CC6.3.8 dealing with excitation performance requirements and CC6.3.15 dealing with fault ride through capability). The generators will continue to be monitored for compliance with the Grid Code through:

- assessing individual generator connection applications and modelling their effect on the electricity transmission system and other users;
- setting out excitation performance requirements as outlined in CC6.3.8 and Appendix 6 of the Grid Code Connection Conditions; and
- witnessing commissioning tests at site to ensure the models and data received from the developer are a true and accurate reflection of the plant as built.

The formal definition of the process by which NGET and generators demonstrate compliance with the Grid Code is currently the subject of Grid Code change proposal A/10.[7] NGET advise that, if implemented, the proposed changes will not have a detrimental impact on the above compliance monitoring.

(ii) To facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the GB transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity)

We consider that the proposal will contribute to competition in the generation and supply of electricity by increasing the choice of generating unit available to users for connection to the NETS.

NGET currently have ten signed Connection Agreements in which generators have committed to using single synchronous generating units with rated apparent power output of 1600MVA or greater. NGET considers that the different SCR requirement for these projects is necessary because machines rated at 1600MVA or above with an SCR of 0.5 are not available on the market.

NGET has also considered undertaking a wider review to assess the merits of introducing a uniform change to the SCR for all generation plants. NGET considers that such a review would take a minimum of a year. NGET considers that a delay to introducing different SCR requirements for projects rated at 1600MVA and above would result in considerable impact on costs, uncertainty and delays to those projects.

NGETs consider that by undertaking detailed studies at the design stage and managing these projects through the compliance process, together with ongoing liaison with manufacturers, the effect of reducing SCR for the 10 generator applications already received can be managed without causing a negative impact to either the design and operation of the transmission system or to current users of the transmission system.

[7] Grid Code proposals, final reports and representations can be viewed on NGET's website at: http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/

They also consider that the process is robust going forward should further applications be received.

One respondent to NGET's consultation considered that the change proposal could be considered discriminatory in relation to generating units rated below 1600MVA. We note that, depending on the circumstances, each generator has to satisfy different plant parameters including the SCR. We also note that a deterministic value set in Grid Code for some of these parameters may be appropriate and efficient and that NGET's analysis indicates that 0.4 is a more efficient minimum SCR level for individual generator above 1600MVA as well as the system as a whole. We further note the following:

- It will avoid delays to the development of projects using new technologies such as the EPR design nuclear power plant with generating units rated above 1600MVA and widens the options for new generation.
- Generators who install plant of below 1600MVA will not be adversely affected in terms of system security or costs by the interim measure of lowering the minimum SCR requirement for synchronous generating units of greater than or equal to 1600MVA.

We therefore consider that, based on the evidence presented to us, there are objective reasons for the proposed different treatment of the larger generators as an interim measure. However, we consider a full and thorough review of SCR should be undertaken through the Grid Code Review Panel (GCRP) by an Industry Working Group. This review should also be considered in the context of EU activity[8] focussed on drafting harmonised European requirements for generators. The review should be undertaken in a timely manner. If it brings forward evidence which suggests that it is necessary to revise the SCR requirements, any resulting Grid Code changes should be developed and implemented without undue delay. NGET should update the Authority on the progress of the review by 30th April 2011.

(iii) Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in Great Britain taken as a whole

We consider that the proposal has potential to widen the options available for new generation and therefore reduce the risk of power supply shortage, particularly given the potential need to complement increased volumes of intermittent generation, thereby better facilitating objective (iii). We note that NGET does not consider the proposal will have adverse effect on the stability of the transmission system. All generating units, including those with a lower SCR, will have a continued requirement to comply with the Grid Code and NGET will continue to monitor compliance (as discussed above).

The G/09 change proposal is limited to those synchronous generating units with rated apparent power output of 1600MVA or greater. A more comprehensive review of the effects of changing the Grid Code's SCR requirements will be carried out before considering extending the proposed change to synchronous generating units of all outputs. This will ensure that system security is not compromised.

We consider that the proposal will contribute to the efficiency of the electricity generation, transmission and distribution systems in Great Britain taken as a whole by

[8] Further information can be obtained from the website of the European Regulators' Group for Electricity and Gas (ERGEG): http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT

allowing connection of larger single synchronous generating units which are more efficient and could potentially lead to lower costs for consumers. Allowing new technologies to participate in the market increases competition and has potential to benefit customers.

Consideration of overall facilitation of Grid Code objectives and alignment with Ofgem's statutory duties

Overall, we consider that change proposal G/09 better facilitates the Grid Code objectives by better facilitating competition in generation of electricity while not adversely affecting the security and efficiency of the electricity generation, transmission and distribution systems in Great Britain.

We consider the interim measure of allowing different SCR requirements based on machine apparent power output to be appropriate because of the urgency of specifying new nuclear power station requirements. We expect that a wider review of SCR will be undertaken for all generators as soon as possible with consideration of the harmonised European requirements for generators currently being drafted by ENTSO-E. We do not consider that the proposed change will have any direct impact on existing users of the transmission system.

We consider that the change proposal is consistent with our principal objective of protecting the interests of consumers, existing and future, wherever appropriate by promoting effective competition. It is also consistent with our wider statutory duties including securing that all reasonable demands for electricity are met.

Decision notice

In accordance with Standard Condition C14 of NGET's Transmission Licence, the Authority, hereby directs that change proposal Grid Code G/09: Grid Code Short Circuit Requirements in Respect of Very Large Synchronous Generating Units be made.

Stuart Cook
Senior Partner – Smarter Grids & Governance

Signed on behalf of the Authority and authorised for that purpose.