

SYSTEM TO GENERATOR OPERATIONAL INTERTRIPPING SCHEMES GENERATING UNIT REQUIREMENTS

Introduction

At the GCRP meeting 23rd November 2006 the paper “Guidance on System to Generator Intertrips” circulated by National Grid on the 20th October 2006 was discussed. A number of Panel members considered that, whilst the paper provided a useful start, more comprehensive guidance could be provided to both developers and Users regarding System to Generator Operational Intertripping Schemes. Following this discussion, it was agreed that generator representatives would jointly provide a revised paper for consideration by the Panel. Following further discussion at the Grid Code Review Panel on 17th May it was agreed to revise the text for the Grid Code based on any further comments from NGET and Panel members. This paper completes this action.

Background

Grid Code CC6.3.17 states: “*NGET may require that a System to Generator Operational Intertripping Scheme be installed as part of a condition of the connection of the Generator. Scheme specific details shall be included in the relevant Bilateral Agreement.*” An intertrip scheme may be mandated for a number of reasons. However, the Grid Code fails to provide any further information regarding what might comprise such scheme, the functional specification and required performance that might be included within the bilateral agreement. The CEGB standard “Design Memorandum 099/86 (1975)” covering the classes of intertrip lapsed following privatisation and no recognised industry standard or other description currently exists, leaving the User exposed to the uncertainty of what requirements may be specified in the bilateral agreement. Concern with the lack of transparency of these arrangements was also expressed by Ofgem in its decision letter to Grid Code Consultation A/05 “Grid Code changes consequential to CUSC Amendment Proposal CAP076 – Treatment of System to Generator Intertripping Schemes”.

It is important to the manufacturer, developer and generator to have a common and clear understanding of the range of likely requirements in order to assess the risk and cost associated with different types of generating plant, in the event that such a scheme is required a condition of connection.

Proposed description

It is proposed that Grid Code CC6.3.17 be substituted with the following text:

“The GBSO may require that a System to Generator Operational Intertripping Scheme be installed as part of a condition of the connection of the Generator. The System to Generator Operational Intertripping Scheme, where required, will be defined as a Category 1 Intertripping Scheme, Category 2 Intertripping Scheme, Category 3 Intertripping Scheme, or Category 4 Intertripping Scheme.

Category 1 Intertripping Scheme: The installation of a Category 1 intertrip is an option for the generator. These Intertrips are used to facilitate a Variation to Connection Design. The specific criteria applied to Connection Design are contained within the SQSS but an intertrip would only be acceptable if it did not reduce the security of the transmission system as a whole, affect any third party, or compromise the GBSO's or TO's ability to

meet other statutory or licence obligations. A Category 1 intertrip could also apply if an existing power station was seeking to expand its capacity.

Category 2 Intertripping Scheme: This category is intended to cover local issues i.e. the intertrip is required when there are outages on local circuits (as specified in the BCA) and the generator concerned is the only one that can reduce the overload if fault conditions occur. A Category 2 intertrip is only armed during periods when maintenance to specific circuits is being undertaken. As the purpose is to deal with maintenance, the inclusion of an intertrip would be consistent with the SQSS, whereas the addition of an extra line would not be.

Category 3 Intertripping Scheme: A Category 3 intertrip would only arise as a result of a generator request. It would be installed as an alternative to reinforcement of a third party system where the Scheme removes overloads on the third party system e.g. DNO System. The Scheme is installed in accordance with of the SQSS. In these instances the Generator has the choice of contracting with the third party to undertake the required reinforcement work, or to have the intertrip. The intertrip would have to satisfy the same criteria as for Category 1.

Category 4 Intertripping Scheme: The requirement for this type of intertrip arises out of the use of Delayed Auto Reclose (DAR) protection that is used as a matter of course on critical transmission circuits. The DAR cannot operate (i.e. potentially switch a circuit back in) in circumstances where a generator remains connected post-fault to the circuit (because the generator will no longer be synchronised with the main transmission system), and the intertrip is therefore required to ensure that the generator is completely disconnected as quickly as possible to safeguard the overall operation of the transmission system.

A System to Generator Operational Intertripping Scheme would comprise a system which, when armed, and following a fault on the transmission system, would disconnect the selected Generating Units or CCGT Modules or Power Park Modules at a Power Station from the transmission system by opening the User's circuit breakers within a specified period of the trip signal being received. The trip signal would be provided by NGET normally at its substation adjacent to the Power Station. (Please note System to Generator intertrips apply to the automatic opening of the generator breakers; opening the DNO or TO breaker would cause the generator to trip on over-speed.)

A System to Generator Operational Intertripping Scheme will be armed in response to an Ancillary Service instruction given by NGET to the Generator in accordance with BC2.8 during the planned outage of a specified transmission circuit.

The trip signal would be initiated in the event of a fault outage occurring on a specified transmission circuit. The System operator will strive to avoid tripping a User and under some system conditions it may be more economic and efficient to secure the system using post-fault actions other than generator intertripping. Examples of such post fault actions would be utilisation of DAR. However, because there is an inter-trip installed this is an indication in itself that the scope for other post-fault actions by the SO is normally very limited.

At some locations depending on prevailing system conditions, it may be possible to utilise delayed auto re-close (DAR) (See Category 4 Intertripping Scheme above) to avoid tripping the generation where the fault is transitory and post-fault overload is below a critical value. The sending of the trip signal to the generating unit breakers will be delayed until the DAR has attempted to return the faulted circuits to service (a delay typically around 20 seconds). If this is successful then the trip signal will not be sent. NGET will determine whether the trip signal can be delayed based on the system conditions existing at the time of the event.

In order to protect an otherwise overloaded transmission or distribution circuit or to preserve the stability the generator will be expected to be disconnected from the system within a very short period of time following the receipt of the signal from the transmission system. Generally this will be of the order of 80ms i.e. 30 ms for the trip relay to operate and 50 ms for the generator breaker to open. In some locations where post fault loads are low enough to avoid instability and provide sufficient time before the circuit trips, it may be possible for the trip signal from the system to automatically initiate a reduction in the output of the generator prior to the tripping of the generator breaker through low forward power. If the faulted circuits are restored through DAR then the trip signal from the system will be inhibited. The time between receipt of the signal and the breaker opening would be no more than 10 seconds.

The requirement for a System to Generator Operational Intertripping Scheme will be specified in the relevant Bilateral Agreement and will also include the Category of the scheme, the number of the generating units(s) that may be instructed to be armed, and the time within which the load reduction should be achieved where applicable and the circuit breaker(s) should be opened. The relevant Bilateral Agreement will also specify the planned circuit outage(s), the corresponding fault outage and either the overloaded circuit(s) or will identify the system as being required for transmission stability reasons."

Timing of Intertrips

In the earlier draft of this text Generator representatives drew attention to typical times for trips of 6 to 15 seconds. NGET representatives are concerned about inclusion of such timings is inappropriate, referencing as they do an obsolete standard. The above revised text now contains references to typical approximate timings. **I believe this issue is now resolved.**

Additionally, the reference to timings in CC.6.2.2.2 is hardly clear to me.

*'The times specified in accordance with the **Bilateral Agreement** shall not be faster than:*

(i) 80mS at 400kV

(ii) 100mS at 275kV

(iii) 120mS at 132kV and below

*but this shall not prevent a **User** or **NGET** having faster fault clearance times. Slower fault clearance times may be specified in accordance with the **Bilateral Agreement** for faults on the **GB Transmission System**.'*

This issue is now to be added to the Grid Code Issues List for further consideration.

CUSC Facsimile

It is noted that the facsimile forms to be used in the event that NGET wishes to instruct the arming or de-arming of an Intertripping scheme are provided as CUSC Section 4 Schedule 3. It appears inconsistent to the generator representatives for a facsimile associated with an Ancillary Service instruction to be given in accordance with the Grid Code to be contained within the CUSC. NGET representatives are of the view that the facsimile forms part of a commercial agreement and should therefore remain within the CUSC. However NGET representatives have suggested that the Grid Code could include a reference to the relevant section in the CUSC. **I suggest this reference is included.**

Recommendation

The Grid Code Review Panel is invited to:

- Recognise the Grid Code deficiencies regarding intertripping schemes;
- Review the proposed description to be included within the Grid Code
- Consider the section on timings in CC.6.2.2.2.2 and the provision of specific up-to-date indicative timings and agree changes and additions as appropriate