

Annex 4 – GSR027 SQSS Legal Text

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5. Operation of the Onshore Transmission System

Normal Operational Criteria

- 5.1 The *onshore transmission system* shall be operated under *prevailing system conditions* so that for the *secured event* of a *fault outage* on the *onshore transmission system* of any of the following:
- 5.1.1 a single *transmission circuit*, a reactive compensator or other reactive power provider; or
 - 5.1.2 a single *generation circuit*, a single *generating unit* (or several *generating units* sharing a common circuit breaker), a single *power park module*, or a single *DC converter*; or
 - 5.1.3 the most onerous *loss of power infeed*; or
 - 5.1.4 the most onerous *loss of power outfeed*; or
 - 5.1.5 where the system is designed to be secure against a *fault outage* of a section of *busbar* or mesh corner under *planned outage* conditions, a section of *busbar* or mesh corner,
- there shall not be any of the following:
- 5.1.6 a loss of supply capacity except as specified in Table 5.1;
 - 5.1.7 unacceptable frequency conditions;
 - 5.1.8 unacceptable overloading of any primary transmission equipment;
 - 5.1.9 unacceptable voltage conditions;
 - 5.1.10 *system instability*; or
 - 5.1.11 *Unacceptable Sub-Synchronous Oscillations*.
- 5.2 For a secured event on the onshore transmission system on connections to more than one demand group the permitted loss of supply capacity for that secured event is the maximum of the permitted loss of supply capacities set out in Table 5.1 for each of these demand groups.
- 5.3 The onshore transmission system shall be operated under prevailing system conditions so that for the secured event on the onshore transmission system of a fault outage of:
- 5.3.1 a double circuit overhead line; or
 - 5.3.2 a section of busbar or mesh corner,
- there shall not be any of the following:
- 5.3.3 a loss of supply capacity greater than 1500 MW;
 - 5.3.4 unacceptable frequency conditions;
 - 5.3.5 unacceptable voltage conditions affecting one or more Grid Supply Points for which the total group demand is greater than 1500 MW;
 - 5.3.6 system instability of one or more generating units connected to the supergrid; or
 - 5.3.7 Unacceptable Sub-Synchronous Oscillations.

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Conditional Further Operational Criteria

- 5.5 If:
- 5.5.1 there are *adverse conditions* such that the likelihood of a *double circuit overhead line* fault is significantly higher than normal; or
 - 5.5.2 there is no significant economic justification for failing to secure *the onshore transmission system* to this criterion and the probability of loss of supply capacity is not increased by following this criterion,
- the *onshore transmission system* shall be operated under *prevailing system conditions* so that for the *secured event* of
- 5.5.3 a *fault outage* on the *supergrid* of a *double circuit overhead line* there shall not be:
 - 5.5.4 where possible and there is no significant economic penalty, any *loss of supply capacity* greater than 300 MW;
 - 5.5.5 *unacceptable overloading* of any *primary transmission equipment*;
 - 5.5.6 *unacceptable voltage conditions*;
 - 5.5.7 *system instability*; or
 - 5.5.8 *Unacceptable Sub-Synchronous Oscillations*.
- 5.6 During periods of *major system risk*, NGESO may implement measures to mitigate the consequences of this risk. Such measures may include: providing additional reserve; reducing system-to-generator intertrip risks, securing as far as possible appropriate two-circuit combinations, or reducing system transfers, for example *through balancing services*.
- 5.7 In the case that neither of the conditions in paragraphs 5.5.1 and 5.5.2 is met, it is acceptable to utilise short term post fault actions to avoid *unacceptable overloading* of *primary transmission equipment* which may include a requirement for demand reduction; however, this will not be used as a method of increasing reserve to cover abnormal post fault generation reduction. Where possible these post fault actions shall be notified to the appropriate *Network Operator* or *Generator*. Normally the provisions of the Grid Code, in respect of Emergency Manual Demand Disconnection and/or, for example through *balancing services*, will be applied. Additional post fault actions beyond the Grid Code provisions may be applied, but only where they have been agreed in advance with the appropriate *Network Operator* or *Generator*.
- 5.8 NGESO shall use the latest version of the *Frequency Risk and Control Report* as consulted on and approved by the Authority to determine the events for which *unacceptable frequency conditions* shall not occur. The *Frequency Risk and Control Report* assessment includes consideration of any consequential loss of distributed energy resources associated with any such event.

Post-fault Restoration of System Security

- 5.9 Following the occurrence of a *secured event* on the *onshore transmission system*, measures shall be taken to re-secure the system to the above operational criteria as soon as reasonably practicable. To this end, it is permissible to put operational measures in place pre-fault to facilitate the speedy restoration of system security.

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Authorised Variations from the Operational Criteria

- 5.10 Provided it is in accordance with the appropriate requirements of the demand connection criteria in Section 3, there may be associated *loss of supply capacity* due to a *secured event*, for example by virtue of the design of the generation connections and/or the designed switching arrangements at the substations concerned.
- 5.11 Exceptions to the criteria in paragraphs 5.1 to 5.87 and 5.9 may be required:
- 5.11.1 where variations to the connection designs as per paragraphs 3.12 to 3.15 have been agreed; or
 - 5.11.2 in relation to 5.1.7 and 5.3.4 only, based on the outcome of an assessment conducted in accordance with the *Frequency Risk and Control Report*.
- 5.12 The principles of these operational criteria shall be applied at all times except in special circumstances where *NGESO*, following consultation with the appropriate *Network Operator*, *Generator* or *Non-Embedded Customer*, may need to give instructions to the contrary to preserve overall system integrity.

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9. Operation of an Offshore Transmission System

Normal Operational Criteria

9.1 An offshore transmission system shall be operated under prevailing system conditions so that for the secured event on the offshore transmission system of a fault outage of any of the following:

- 9.1.1 a single transmission circuit, a reactive compensator or other reactive power provider; or
- 9.1.2 a single generation circuit, a *single generating unit* (or several *generating units* sharing a common circuit breaker), a single *power park module*, or a *single DC converter*, or
- 9.1.3 the most onerous *loss of power infeed*; or
- 9.1.4 the most onerous *loss of power outfeed*; or
- 9.1.5 a section of *busbar* or mesh corner, or
- 9.1.6 a *double circuit overhead line*.

there shall not be any of the following:

- 9.1.7 a loss of supply capacity except as specified in Table 9.1;
- 9.1.8 unacceptable frequency conditions;
- 9.1.9 unacceptable overloading of any primary transmission equipment;
- 9.1.10 unacceptable voltage conditions;
- 9.1.11 system instability; or
- 9.1.12 Unacceptable Sub-Synchronous Oscillations.

Table 9.1 Maximum permitted *loss of supply capacity* following *secured events*

Group Demand	Initial system conditions	
	<i>Prevailing system conditions with no local system outage</i>	<i>Prevailing system conditions with a local system outage</i>
over 1 MW to 12 MW	Whole group up to <i>Group Demand</i> for up to the operational specified time to restore supply capacity	Whole group up to <i>Group Demand</i>
up to 1 MW	Whole group up to <i>Group Demand</i> for up to the operational specified time to restore supply capacity	Whole group up to <i>Group Demand</i>

Notes

1. The time to restore any lost supply capacity shall be as short as practicable. If any part of any lost supply capacity can be restored in less than the specified maximum time to restore all of it, it shall be restored.

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Conditional Further Operational Criteria

- 9.2 NGESO shall use the latest version of the *Frequency Risk and Control Report* as consulted on and approved by the Authority to determine the events for which *unacceptable frequency conditions* shall not occur. The *Frequency Risk and Control Report* assessment includes consideration of any consequential loss of distributed energy resources associated with any such event.

Post-fault Restoration of System Security

- 9.3 Following the occurrence of a secured event, measures shall be taken to re-secure an offshore transmission system to the above operational criteria as soon as reasonably practicable. To this end, it is permissible to put operational measures in place pre-fault to facilitate the speedy restoration of system security.

Authorised Variations from the Operational Criteria

- 9.4 Exceptions to the criteria in paragraphs 9.1 and 9.23 may be required:
- 9.4.1 where variations to the connection designs as per paragraphs 7.21 to 7.24 and paragraphs 8.12 to 8.15 have been agreed; or
 - 9.4.2 in relation to 9.1.8 only, based on the outcome of an assessment conducted in accordance with the *Frequency Risk and Control Report*.
- 9.5 The principles of these operational criteria shall be applied at all times except in special circumstances where NGESO, following consultation with the appropriate Generator, may need to give instructions to the contrary to preserve overall system integrity

Definitions section:

Frequency Risk and Control
Report Methodology

The methodology by which a *Frequency Risk Control Report* will be developed, consulted on and approved by the Authority, and as set out in the SQSS Appendix H.

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Frequency Risk and Control Report

The periodic report setting out the results of an assessment of the operational frequency risks on the system produced by NGESO and approved by the Authority and as set out in the SQSS Appendix H, and prepared in accordance with the *Frequency Risk and Control Report Methodology* as also prepared and approved as set out in the SQSS Appendix H. The report shall include an assessment of the magnitude, duration and likelihood of transient frequency deviations, forecast impact and the cost of securing the system and confirm which risks will or will not be secured operationally by NGESO in accordance with paragraphs 5.8, 5.11.2, 9.2 and 9.4.2.

Fault Outage

An outage of one or more items of *primary transmission* ~~apparatus-equipment~~, and/or ~~generation plant~~ user equipment, which may or may not result in a loss of power infeed or loss of power outfeed, initiated by automatic action unplanned at that time, ~~and~~ which may or may not involve the passage of fault current.

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Unacceptable Frequency Conditions

These are conditions where:

- i) the steady state frequency falls outside the statutory limits of 49.5Hz to 50.5Hz; or
- ii) a transient frequency deviation on the MITS ~~persists outside the above statutory limits and does not recover to within 49.5Hz to 50.5Hz within 60 seconds.~~ does not meet the criteria below.

Transient frequency deviations outside the limits of 49.5Hz and 50.5Hz shall:

- only occur at intervals which ought to reasonably be considered as infrequent;
- only persist for a duration which ought to reasonably be considered as tolerable; and
- only deviate by a magnitude which ought to reasonably be considered as tolerable.

The Frequency Risk and Control Report will define what is considered reasonable, infrequent and tolerable for each of these criteria for transient frequency deviations.

~~In order to avoid the occurrence of Unacceptable Frequency Conditions:~~

- ~~a) The minimum level of loss of power infeed risk which is covered over long periods operationally by frequency response to avoid frequency deviations below 49.5Hz or above 50.5Hz will be the actual loss of power infeed risk present at connections planned in accordance with the normal infeed loss risk criteria;~~
- ~~b) The minimum level of loss of power infeed which is covered over long periods operationally by frequency response to avoid frequency deviations below 49.5Hz or above 50.5Hz for more than 60 seconds will be the actual loss of power infeed risk present at connections planned in accordance with the infrequent infeed loss risk criteria.~~

It is not possible to be prescriptive with regard to the type of secured event which could lead to transient frequency deviations since this will depend on the extant frequency response characteristics of the system which NGESO adjust from time to time to meet the security and quality requirements of this Standard.

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Loss of Power Infeed

The output of a *generating unit* or a group of *generating units* or the import from *external systems* disconnected from the *national electricity transmission system* by a *secured event*, less the demand disconnected from the *national electricity transmission system* by the same *secured event*.

For the avoidance of doubt if, following such a secured event, demand associated with the normal operation of the affected *generating unit* or *generating units* is automatically transferred to a supply point which is not disconnected from the system, e.g. the station board, then this shall not be deducted from the total *loss of power infeed* to the system.

For the purpose of the operational criteria:

- i) the *loss of power infeed* includes the output of a single generating unit, CCGT Module, boiler, nuclear reactor, or *import from an external system via a HVDC Link* ~~lost as a result of an event~~.
- ii) In the case of an offshore generating unit or group of offshore generating units, the *loss of power infeed* is measured at the *interface point*, or *user system interface point*, as appropriate.
- iii) In the case of an *offshore generating unit* or group of *offshore generating units* for which infeed will be automatically re-distributed to one or more *interface points* or *user system interface points* through one or more interlinks, the re-distribution should be taken into account in determining the total generation capacity that is disconnected. However, in assessing this re-distribution, consequential losses of infeed that might occur in the re-distribution timescales due to wider generation instability or tripping, including losses at distribution voltage levels, should be taken into account.

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Loss of Power Outfeed

The load taken by storage units, *non-embedded customers, grid supply points, or the export to external systems* disconnected from the *national electricity transmission system* by a *secured event*, less the generation disconnected from the *national electricity transmission system* by the same *secured event*.

For the avoidance of doubt if, following such a secured event, demand associated with the normal operation of the affected outfeed is automatically transferred to a *grid supply point* which is not disconnected from the *national electricity transmission system*, then this shall not be added to the total *loss of power outfeed* to the system.

For the purpose of the operational criteria:

- i) the *loss of power outfeed* includes demand from pump storage, battery storage and other storage, *non-embedded customers*, and export to *external systems* via a HVDC Link.
- ii) In the case of an *offshore transmission system*, the *loss of power outfeed* is measured at the *interface point*, or *user system interface point*, as appropriate.

NB Note that some minor numbering changes may also be required to subsequent sections and to be reflected in references.

The changes set out here are designed to only impact the way in which the system is operated with sufficient allowances for response, reserve and inertia holding to maintain security of supply through stabilising system frequency and limiting disturbances. Other operational criteria (voltage, overloading of equipment etc) are unchanged as they have more to do with the design of the system and potential reinforcement.

This modification does not intend to alter any of the following criteria:

- *operational criteria beyond the criteria related to frequency control;*
- *design criteria in general;*
- *design criteria related to loss of infeed risk in particular.*