

The National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS) sets out a coordinated set of criteria and methodologies that Transmission Licensees use in planning and operating the National Electricity Transmission System (NETS) of Great Britain and Offshore. These criteria provide a baseline for the investment in transmission assets and support secure operation of the GB transmission system.

The occurrence of switch faults on the transmission network, represent credible conditions that can have significant repercussions on the security and reliability of the transmission system. As such, the risks associated with switch faults have been required to be considered in the ongoing design and operation of the transmissions system in the limitation of infrequent infeed loss within chapter 2 and chapter 7 of the NETSQSS. The NETSQSS addresses switch faults in the following respects-

- “2.6 Generation connections shall be planned that, starting with an *intact system*, the consequences of *secured events* on the *onshore transmission system* shall be as follows:-
- 2.6.4 following the concurrent *fault outage* of any two *transmission circuits* or any two *Generation circuits* on the same double circuit overhead line, or the *the fault outage* of **any single busbar coupler circuit breaker** or mesh circuit breaker, the *loss of power infeed* shall not exceed the infrequent infeed loss risk;
  - 2.6.6 Following the *fault outage* of any single *busbar* coupler circuit breaker or busbar section circuit breaker or mesh circuit breaker, during the planned outage of any single section of busbar or mesh corner, the *loss of power infeed* shall not exceed the *infrequent infeed loss risk*.”

And:-

#### 7.8.3 Busbars and Switchgear on an offshore platform

- 7.8.3.3 Following a *fault outage* of any single *busbar* coupler circuit breaker or *busbar* section circuit breaker or mesh circuit breaker, the *loss of power infeed* shall not exceed the *infrequent infeed loss risk*;
- 7.8.3.4 Following a *fault outage* of any single section of *busbar* or mesh corner, during a planned outage of any other single section of *busbar* or mesh corner, the loss of power infeed shall not exceed the *infrequent infeed loss risk*;
- 7.8.3.5 Following a *fault outage* of any single busbar coupler circuit breaker or busbar section breaker, during a planned outage of any single section of *busbar* or mesh corner, the *loss of power infeed* shall not exceed the infrequent infeed loss risk;

#### 7.13.3 Busbars and Switchgear

- 7.13.3.3 Following a *fault outage* of any single *busbar* coupler circuit breaker or *busbar* section circuit breaker or mesh circuit breaker, the *loss of power infeed* shall not exceed the *infrequent infeed loss risk*;
- 7.13.3.4 Following a *fault outage* of any single section of *busbar* or mesh corner, during a planned outage of any other single section of *busbar* or mesh corner, the loss of power infeed shall not exceed the *infrequent infeed loss risk*;
- 7.13.3.5 Following a *fault outage* of any single busbar coupler circuit breaker or busbar section breaker, during a planned outage of any single section of *busbar* or mesh corner, the *loss of power infeed* shall not exceed the infrequent infeed loss risk;

Switch faults, depending on the location of the substation in which they occur, the generation/demand background and range of operator actions and responses available can potentially cause wider system issues such as frequency or angular instability, cascade tripping and voltage collapse. There is however no explicit reference to these scenarios within either chapters 4 or 5 of the NETSQSS, given that these risks can arise from a wide variety of conditions and can frequently be addressed in operational timeframes via various measures, for example network reconfiguration and post fault action to ensure the prospect of such instabilities are suitably contained in practice. As such, the impact of Switch fault risks as they occur in planning or operational contexts are currently managed under case by case risk assessment and Cost Benefit analysis approaches as appropriate by the GBSO.

Under the NETSSQSS Working Group modification GSR017, a working group was formed to consider whether it was appropriate to introduce new planning clarity into the existing SQSS. Whilst the working group confirmed that the probability and potential impact of switch fault risk remained material, it recognised that against the range of circumstances by which such events could emerge and the array of operational and investment approaches to mitigation it would not be in the interests of the end consumer to further define the management of such risk given that those approaches would risk driving inefficient operational and/or investment decisions in practice. It was finally noted that to support effective planning and where appropriate investment decisions further guidance surrounding the management of switch faults would be welcomed.

A number of points may be noted surrounding switch fault security requirements already in place:-

- a) *The loss of power infeed* is a defined term and relates to generating units, collections of generation output and import from external systems (HVDC interconnector output onto the GB system) less demand disconnected from the network as a consequence of the *secured event*. The consideration of switch fault as such references both the design of physical point of connection and that of the wider system which could be subject to disconnection in this scenario.
- b) The infrequent infeed loss risk is a defined term and presently relates to a total consequence of loss no larger than 1800MW
- c) The consideration of switch fault risk pertains both to year-round intact system conditions and to certain outage conditions. These reflect a mixture of defined and undefined terms within the standard which relate differently to differing typical network designs as discussed further below.
- d) In the consideration of year round scenarios and in the consideration of generation groups certain considerations surrounding the assumptions of generation and demand impacted and the allocation of system access are required and are covered further in the worked examples discussed below.
- e) The requirements of chapter 2 and chapter 7 in respect of switch fault management relate most clearly to the consequences of network disconnection events. Where the consequence of disconnection is a scenario that could lead to broader consequences of unacceptable overloading of equipment, unacceptable voltages or insufficient voltage performance margins or system instability ahead of cascade disconnection, there would clearly be a requirement for a further planning action, and further clarification surrounding how this is addressed is discussed below in areas of broader consideration.

The GSR0017 work group has found there is no requirement for explicit SQSS guidance beyond that already provided explicitly within chapter 2 of the SQSS at present. Operational switch fault actions rather relate to risk management activities surrounding: the impact of alternative running arrangements on this and other operational planning considerations, the expected duration of the risk, what would be the consequence of the risk occurring (would other measures present at the time contain the risk), what would be its probability and what would the costs be in avoiding the risk. It has rather concluded that the appropriate approach should be additional guidance surrounding under what circumstances it is appropriate to review the design that gives rise to that switch fault risk and what factors such consideration should then include in the analysis surrounding the switch-fault risk identified

Ultimately, where a switch fault risk is identified within the framework of this guidance the guidance is intended to form a framework for discussions across Transmission Licensees Distribution Network Operators and the GB System Operator in agreeing the appropriate response to that risk, in those situations where liaison between these parties in the management of such switch fault risk is appropriate. It remains the decision of each party whether to initiate such discussions or address appropriately without recourse to the process where it is within the capability of that party to do so.

**Recommendation- withdraw GSR017 modification**