Hydro Tasmania
The power of natural thinking

19 October 2016

John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

By online submission

Emergency Control Schemes (ERC0212)

Dear Mr Pierce,

Summary

- Tasmania has developed effective operational emergency under and over frequency schemes to manage non-credible events and several System Protection Schemes (SPS) to manage credible events like the instantaneous loss of Basslink. Basslink could be transferring over 50% of energy supply in the region at the same time as significant non-synchronous generation of up to 80% is operating ;and
- Event based schemes can be useful in managing emergency or non-credible events as alternatives or enhancements to traditional 'relay based' schemes and the rest of the NEM could benefit from the approach used in Tasmania.

Current Tasmanian Schemes

Based on the experience in Tasmania, solutions implemented need to consider high Rate of Change of Frequency (ROCOF), low inertia and low fault levels scenarios as these emerge. Therefore, traditional methods of protective relays offering purely frequency based triggers will become insufficient to manage non-credible events. In Tasmania, the Under Frequency Load Shedding (UFLS) and Over Frequency Generation Shedding (OFGS) schemes have proven to manage non-credible events using both frequency and rate of change of frequency triggers. These schemes are coordinated with a system limit/constraint to ensure that ROCOF does not exceed a level at which the scheme would not operate effectively, currently 3Hz/s.

Protected Events

Hydro Tasmania acknowledges there needs to be more scrutiny on particular non-credible events which would have significant impact on the power system; these events have caused the initiation of the concept of 'protected events'. This could include the loss of an interconnector under high loading or multiple generating units/systems. The Transmission Network Service Provider (TNSP) and the Australian Energy Market Operator (AEMO) (or possibly an independent party) should identify possible high impact non-credible events (or 'protected' events) including the loss of interconnectors and develop solutions accordingly. It is Hydro Tasmania's view that there should be some guidelines around establishing these 'protected' events such that only high risk events (considering likelihood

and consequence) have specific schemes designed around them to ensure costs to consumers are minimised.

System Protection Schemes

Hydro Tasmania notes that there are two different types of protection schemes (which can both provide backup for each other):

- Event based – based on triggers such as circuit breaker status and inter-tripping; and
- Response based – based on measurements and thresholds, for example frequency level and RoCoF.

System Protection Schemes (SPS) such as those operated in Tasmania are event based and have been proven successful in running the system well in excess of 'firm' rating and support the running of high amounts of non-synchronous generation. Some examples in Tasmania are the Frequency Control System Protection Scheme (FCSPS) and Network Control System Protection Scheme (NCSPS).

- FCSPS – While the maximum credible contingency size is limited in Tasmania to well below the interconnector capacity, the Basslink HVDC interconnector is able to operate up to 630 MW (exporting to Victoria) by arming generators and tripping them to balance system frequency if the interconnector trips. Similarly on import, load blocks are armed to cater for the tripping of the interconnector; and
- NCSPS - parallel transmission lines can run at 90% of their combined thermal rating. The loss of one of two parallel lines and potential overloading on the remaining line is managed with direct generator tripping behind the transmission line to reduce load immediately after the event occurs.

While both FCSPS and NCSPS mentioned above are designed for credible contingency events, schemes such as these are very effective options for emergency control schemes for non-credible or 'protected' events. SPS like arrangements are more effective and far less expensive than 'relays' as described in the National Electricity Rules (NER) and can simply use the live status (e.g. circuit breakers) and power flows to determine real time arrangements and possible events.

An NCSPS scheme could have been used to protect the SA system against high interconnector flow exceeding firm ratings of the transmission. In the case of events on 28/09/2016 additional pre-selected loads could have been tripped to avoid excessive import and the interconnector trip.

Reduction in Contingency Size

As a similar concept to the FCSPS mentioned above, reduction in contingency size is also a very effective way of managing credible and non-credible events to reduce the impact on system frequency. For example, a 208 MW generating unit in Tasmania has a direct load inter-tripping arrangement to effectively reduce the contingency size in a Generator Contingency Scheme (GCS). While this again is used for credible events to reduce FCAS requirements in Tasmania, this mechanism is a valid solution for non-credible events.

Changes and Enhancements

One potential improvement to the NER could be to clarify that the TNSP's are required to own/operate 'effective' schemes to include both over-frequency and under-frequency schemes for non-credible events and sometimes credible events where such schemes are more efficient by reducing Frequency Control Ancillary Services requirements. It should also clarify that if a scheme becomes insufficient due to a change in power system conditions, the TNSP is responsible for changing, enhancing and/or redeveloping the scheme(s). It could be clarified that AEMO should

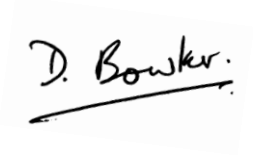
approve the design of TNSP's UFLS/OFGS schemes to manage system security. Another enhancement to the NER is that the TNSP's should have the right to dictate settings to new connections (including generators) provided it does not prescribe the connected party to conditions which could materially impact plant, safety or the environment. Non-synchronous generation/load should be preferentially targeted for participation in schemes due to the lack of contribution to inertia and system strength (fault level) currently offered by these technologies.

However, Hydro Tasmania's view is that there are risks in making the Rules too prescriptive around emergency over and under frequency protection schemes. These include (but are not limited to):

- Preventing innovative and cost effective solutions to manage non-credible events; and
- New Rules may preclude existing arrangements which are operating effectively.

If you have any questions or require further information in relation to this submission, please contact Cameron McCulloch on 03-62305291.

Yours sincerely



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