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Attn; Dominic Adams
Project Leader
AEMC
Level 6
201 Elizabeth Street
Sydney NSW 2000

Dear Sir

GENERATOR TECHNICAL PERFORMANCE STANDARDS ERC0222

Advisian is pleased to provide this Additional Submission to the AEMC regarding proposed rule changes for the Generator Technical Performance Standards ERC0222 in response to the Publication of draft determination.

Negotiating Framework

The generator performance standards must be negotiated between the project proponents and the network service providers. However, the existing and proposed rules are vague with respect to each party's obligations and responsibilities. This makes negotiations difficult and could lead to disruption of the process.

Changes in negotiating positions by NSPs over technical issues often cause frustrating delays and sometimes unacceptable project risks which project proponents have no control over.

A means of allowing independent third parties to arbitrate on technical issues would help control the current practice of NSPs of altering technical requirements with little explanation which can result in frustrating delays to the connection process.

In conclusion the current and proposed negotiating framework should be improved to give project proponents more certainty and control over their project risks. More work is required in the drafting of the rules to address these issues.

Active Power control

In order to support good control of the power system frequency, it is necessary that all large generators be able to provide stable power control in response to power system frequency changes. The FCAS market design also needs to be substantially reformed but it is understood that this is not part of the rule changes discussed in this submission.

In conclusion the proposed rules on active power control with respect to providing support to the system for frequency deviations are necessary and should be implemented in conjunction with an overhaul of the FCAS market.

Remote Monitoring and Control

The proposed rule change requires a very large number of remote monitoring and control signals to be collated at the power plant and communicated via NSP maintained communications system. In particular, power plants which have a large number of units (e.g. wind and solar) are required to provide a large number of monitoring signals covering every single unit, rather than monitoring quantities at the connection point.

There are no reliability benefits to be gained by communicating such a large number of points back to the market operator because the number of monitoring and alarm points being considered and the peripheral nature of most of the detailed power station operational points to power system dispatch would risk causing confusion for real time decision making and automated dispatch, and greatly exceed what is necessary to operate the dispatch system.

After any system event, these points are already available for analysis and generators. Therefore having them brought back in real time adding to the congestion in the communications network serves no practical purpose.

There are significant costs associated with this proposal, particularly for the NSPs as they will be required to significantly increase the capacity of their communications infrastructure. The costs to new generation proponents are also significant as they have to install additional communications equipment at their plants (which may be located in remote regions).

In conclusion the reasons for this rule change have not been shown to be of overall benefit to the market participants.

Reactive current response

The existing and the proposed rules associated with reactive power are oftentimes inappropriate for the power systems that specific projects are connected into. Specifically, if automatic access standards were to be applied for weak fault level systems, the generation system can have excessive effects on the power system voltages. The practice of applying automatic access standards to weak fault level locations reduces the reliability of the system because it enables high voltages to be created which can lead to insulation failures on the system.

Conversely on strong fault level systems, reactive power injection (whatever is provided) has minimal impact on power system voltages. In these latter cases it is preferable for reactive power to be installed closer to load centres in order to reduce thermal losses in the transmission and distribution systems. Applying too much reactive power for generation plant in this case effectively leads to economic losses and non-optimum power and reactive power flows.

In conclusion, the reactive power requirements specified in the rules should be modified so that they allow for local network conditions to be addressed, and to encourage cost effective investments which typically require reactive support to be provided close to load centres rather than at generation connection points. The proposed rule change does not address any of these desirable technical outcomes.

Continuous uninterrupted operation

The existing and the proposed rules have several clauses pertaining to continuous uninterrupted operation for generators in response to faults and power system transients. The existing rules are often arbitrary and difficult to interpret, so redrafting of this part of the rules is welcomed.

Unfortunately the proposed rule changes have increased the arbitrariness and difficulties in interpretation. In addition several sections – particularly the sections that specify the number of voltage dips a generation system must be able to ride through, cannot be demonstrated to be compliant for all possible cases. AEMO have provided a report "MULTIPLE VOLTAGE DISTURBANCE RIDE-THROUGH CAPABILITY" which attempts to clarify the proposed rule changes and purports to show compliance with this clause can be demonstrated. It is clear from even a cursory reading of this report that this is not the case because;

- the report provides no details on the specifics of what was simulated,
- and it does not consider any of the practical engineering aspects (specifically overloads of converter equipment, failure of ancillary plant or generator pole slipping which can lead to generator shaft failure) that actual generation systems must consider. These practical aspects are typically not included in computer modelling.

In any application of the rules, questions remain as to when and where the voltage transients are to be applied, how to model so called "deep" and "shallow" voltage dips. This would be a matter of interpretation for each case and it would be very easy to choose specific scenarios which no synchronous generator would be able to ride through, and would also place extreme loading on asynchronous generation.

A key point to note is that computer modelling and simulation can only be used to investigate the dynamic behaviour of power systems, these techniques cannot be used to "prove" that any specific generation system can always ride through a large number of system transients. This is because significantly different results will be obtained if the simulation is started at a slightly different point due to the non-linear dynamics involved (this is well known in weather prediction and is due to chaos theory). This basic point which is common to all forms of non-linear computer simulations seems to be being ignored in both the drafting of the multiple ride through rules and the technical clarifications AEMO have published.

Accordingly the possibility for these rules to be misapplied (either due to technical misunderstanding or deliberate policy) in any given case is very high.

The new rules also mandate high voltage levels for significant periods of time (clause S5.2.5.4) which most existing generator or industrial installation which includes transformers, capacitor banks or motors is not able to safely achieve. Given that most of the existing fleet of generation and substation equipment cannot safely achieve the new over voltage standards, there is little or no reliability benefit to be gained by mandating these new over voltage standards for new connections. Under these rules, existing plant would be required to be decommissioned in preference to renegotiating performance standards. The costs associated with meeting the overvoltage requirements are contrary to the National Electricity Objective.

In conclusion, the proposed rules appear arbitrary, subject to technical misinterpretation and may result in disputes between AEMO, the relevant NSP and the project developer. More work is required to provide an acceptable frame work going forward which adequately addresses the needs of all participants.

System Strength

No rule changes have been proposed with regard to the system strength issues. Advisian believe this approach is appropriate at this point in time because there appears to be some technical confusion over this issue.

It is noted that AEMO have attempted to clarify some of their concerns in their supplementary report – "Maximum continuous current during faults". This document discusses the fault current contribution of some OEM's but does not provide specific examples. It does not discuss issues generally associated with the SCR (short circuit ratio) which have been the main issue of concern in industry forums.

The AEMC should be aware of the ESCRI project currently (at time of writing) being commissioned in South Australia, where these issues are being investigated in practice. The ESCRI project is a 30 MW, 8 MWh battery storage project which will be able to operated islanded from the grid in order to provide supply to the lower Yorke Peninsula. In effect it will demonstrate an inverter connected device connected to the grid with a SCR of zero. A website of the project has been set up and the behaviour of the device can be viewed at www.escri-sa.com.au .

In conclusion, Advisian agree with the draft determination which does not introduce new rules associated with this issue. Advisian is already making a practical contribution to a better understanding of this issue which will be available to all market participants under the knowledge sharing arrangements with ARENA.

Consequential amendments and Transitional arrangements

Advisian believe that because there are still significant issues with the proposed rule changes, it is pre-emptive to consider these two topics until the final rule changes are known.

The only point we wish to raise (which was already partially discussed in the AEMC workshop of 26th June 2018) is that if the final rules are significantly more onerous than the existing rules, then during and prior to the transitional period it is expected that a large number of projects will attempt to obtain connection agreements. This is likely to overload the resources of the entire industry attempting to produce technically viable projects, with the consequence that many projects will not proceed, and those that do may not provide an optimum outcome for the overall market. We are already experiencing this behaviour from many developers, and we know other consultants, AEMO and NSPs are struggling to cater to industry demand.

Conversely, after the rules come into effect – it is possible that the development pipelines will slow down significantly because developers may consider other jurisdictions around the world ahead of Australia if the rule changes create onerous financial burdens.

It is clear that the impact of these proposed rule changes – effectively over heating connection activity prior to the new GPS rule implementation followed by what could be a

collapse in investment due to capital flight to overseas markets, is not in the interests of any market participant or consumer.

We hope that the AMEC take these comments into consideration when making their final determination.

Yours sincerely,

B. J. Miller

Principal Consultant