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Clean Energy Council

Level 15 222 Exhibition Street

Melbourne 3000

Power System Model Guidelines Issues - Submission

Pacific Hydro, as one of Australia's leading clean energy companies, is committed to maximising Australia's renewable energy opportunities while supporting regional growth and the reduction of Australia's greenhouse gas emissions. To date, Pacific Hydro has invested around $650 million in the Australian renewable energy market, $560 million of this in wind farm developments and now multiple solar farm developments.

Being an owner of distribution and transmission connected wind farms and now developing solar farms, Pacific Hydro has significant experience in the development, operation and management of wind farms and maintains strong working relationships with the NSPs, to whom the renewable energy projects are connected. Each connection brings different challenges and frequently requires careful consideration of local network issues.

As a company which recognises Australia's incredible wind and solar resources and the opportunity they create for our energy future, Pacific Hydro welcomes the opportunity to comment on the Power System Model Guidelines.

Requirement for existing plant to provide PSCAD models

The rule changes regarding system strength impact and the new system model guidelines have imposed on generators an obligation that was not required at the time of connection. It anticipates that participants can produce highly detailed models regardless of whether the participants have the data and control information that would underpin such models. It is unlikely that participants can produce the detail required of these guidelines as the data is not available to them and is unlikely to be held even by the OEMs of the older plant. As such, the rule change providing AEMO with the right to request such models will need to consider the application of such rules changes in circumstances where EMT models do not exist due to the age of existing plant.

The conclusion 4.1.3 that AEMO does not propose to make any changes to the Guidelines to address the issue of cost versus benefits illustrates that it is highly problematic to really identify the benefits of moving to excessively detailed EMT models for the entire network. The following issues highlight the scope and scale of cost increases that result from this move:

- The considerable costs involved in building EMT models for older plant;
- The considerable costs and difficulty to validate detailed models;
- The resources and technical expertise required to get such models to integrate is prohibitive;
- The removal of transparency as participants will not be able to work on the PSCAD network model due to confidentiality requirements;

- The time and cost to connecting parties to include studies that cover the combinations or multiple fault ride through obligations while also dealing with changing SCR figures would be considerable;
- Inverter Based Generation (IBG) can provide higher fault current, but only at additional cost, making the equipment more expensive.

Without an appropriate overarching investigation into the cost benefit which contemplates the pros and cons of different solutions and methods, the outcome appears to be adding costs and therefore reducing efficiency in numerous areas of the entire market.

While AEMO wishes to ensure that it has covered the stability issues associated with IBG controls in low or weak networks, Pacific Hydro urges AEMO to consider alternative, more practical and cost-effective approaches, such as using hybrid modelling methods.

Pre-emptive Requirements

These guidelines also pre-empt the AEMC's determination on multiple fault ride through as the guidelines build in the obligation despite the technical rule not being in place. It is clear that AEMO is taking the outcome of the AEMC's determination as given. This limits the opportunity to look for collaborative solutions to the complex issues that exist in the power system. It tells participants that AEMO has a preferred method regardless of whether it is economic, sensible and reflects international practise or not. It is leading to the NEM being expensive, complex to connect to, and carries a high level of risk if generators no longer have grand-fathered rights.

These guidelines illustrate a belief that modelling can represent everything. The expectation that auxiliary equipment should be included into the control modelling for large units greatly complicates the mathematical model, increasing the risk of error. The requirement to validate and verify the model assumes that auxiliaries will also have high speed monitoring on them suitable to provide measurements into an EMT model.

Pacific Hydro is concerned that in highlighting this point, a potential outcome may include a requirement on generators to measure their auxiliaries with high speed meters. This is in part due to the fact that the guideline includes obligations that cover the objections which industry raised against the multiple fault ride through, whether it is practicable to model or not or whether it is normal control practise or not.

Further consideration of the potential costs of such outcomes is recommended as there does not appear to be any justification for the dramatic change in control philosophy and no nett benefit test for these modelling changes. Similarly, there is no practical engineering limitation placed on the modelling requests nor any acknowledgement that detailed control data may not exist.

Quest for Accuracy

The quest for accuracy is not entirely clear. For example, further clarification is required to understand what is meant by "more relaxed and flexible accuracy requirements", when the detail required in the model appears to be excessive and, as such, may make it extremely difficult to get repeatable results with any degree of confidence.

The only benefit for using a PSCAD model for IBG is to improve the understanding of single point control such as that required at the point of connection or at the terminals of an inverter. Investigating a single point in detail is a matter for the participant to prove regarding connection and control; it is not well suited to understanding the overarching control of the power system.

The Guidelines call for a level of detail and accuracy that is impractical and driven by what would appear to an excessive faith in modelling, placing it over and above any practical understanding of the approximate manner that is used to capture data and study the power system. The time and costs of meeting this set of guidelines may not have been thoroughly understood. Such detailed models are usually built by the specialist engineers who want to understand a particular detailed problem. But such EMT models are rarely required for the entire system, and it is recommended to consider hybrid modelling using PSS/E or RMS style modelling for the systems integrated with PSCAD for the detail of a particular generating system. This type of modelling was undertaken for Basslink, for example.

Multiple fault ride through

It is recommended that the Guidelines, as they pertain to multiple fault ride-through, require further examination to ensure their practicality and logical application. To expect multiple faults not resulting in multiple losses of network elements, is not necessarily practical, considering the potential implications to equipment.

Further clarification is required to understand how the Guidelines are interpreted to study in the same network model, applying a different set of rules for synchronous machines (e.g. minimum standard expectations) while insisting on “automatic standards” for inverter based generators (IBG). If network protection is to be modelled, then network elements will trip in the model and as such the results will show whether the system would survive a significant combination of faults. It is recommended to have a requirement for a benchmark assessment of the software and equipment limits for IBG rather than an expectation to run the enormously complicated studies in a highly detailed complex model that these Guidelines require.

Focus on detail undermining Control

There is evidence that the overarching control of the power system is poor. The attention paid to new technologies has removed focus from the broader obligations to ensure that the power system itself is efficiently controlled. It is suggested that a better alternative would be to restore appropriate tight controls on the speed regulation of the synchronous fleet guaranteeing the synchronising and damping torque of the system, than to focus on the micro second switching of inverters.

Lumped EMT models for wind farms are unlikely to represent the actual high frequency switching resonances and produce worst case results. This is because the lumped model would present synchronised switching in simulations. In reality no individual wind turbine switching pattern is synchronised within the farm and as such there is a natural offset. Without assuming an offset, the EMT models give inaccurate results. Harmonic measurements are averaged over several minutes and vary with wind conditions. There is, therefore, is no way that an EMT model could be validated. The lack of validation possibilities for Harmonic models or EMT models for power system studies in transient area is a concern. It is questionable whether the release of the EMT PSCAD model for this purpose will address these inaccuracies.

PSCAD modelling on a wide scale across the NEM is likely to produce misleading results in resonance studies and in harmonic studies if those using the models do not have detailed knowledge of the IBG technology along with practical understanding of the actual operational results. Incorrect assumptions along with excessive detail without applying natural offsets would lead to worst case outcomes and drive poor control decisions with increased, unnecessary costs applied to projects.

For further information or clarification of any of the points raised above, please don't hesitate to contact us.

Yours sincerely,

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