

10 August 2017



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

Dear Mr Pierce

Draft Rule Determination: National Electricity Amendment (Managing power system fault levels) Rule 2017

Energy Queensland Limited (Energy Queensland) appreciates the opportunity to provide a submission to the Australian Energy Market Commission (AEMC) on its *Draft Rule Determination: National Electricity Amendment (Managing Power system fault levels) Rule 2017* (draft rule determination) in response to a rule change request from the South Australian Minister for Mineral Resources and Energy. The draft rule determination proposes to amend the National Electricity Rules (the Rules) to allocate responsibility for managing power system fault levels (or system strength) in the National Electricity Market (NEM).

Energy Queensland is pleased that the AEMC's draft rule determination has recognised that reducing system strength as a result of the greater number of non-synchronous generators connecting to the network is an issue that will need to be addressed not only for transmission networks but also for some distribution networks. However, while we are supportive of the rule change's overall objective of maintaining power system strength for existing generating facilities while facilitating the transition to greater levels of non-synchronous generation technologies in the NEM, we have some concerns in relation to specific aspects of the draft rule determination. Energy Queensland's concerns are discussed in detail in the attached submission.

Should you require additional information or wish to discuss any aspect of Energy Queensland's submission, please do not hesitate to contact either myself on (07) 3851 6416 or Trudy Fraser on (07) 3851 6787.

Yours Sincerely

A handwritten signature in black ink, appearing to read "Jenny Doyle", is written over a faint, circular stamp or watermark.

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Energy Queensland

**Submission to the Australian Energy
Market Commission**

**Managing Power System Fault
Levels - Draft Rule Determination**

ERC0211

Energy Queensland Limited

10 August 2017



About Energy Queensland

Energy Queensland Limited (Energy Queensland) is a Queensland Government Owned Corporation that operates a group of businesses providing energy services across Queensland, including:

- Distribution Network Service Providers, Energex Limited (Energex) and Ergon Energy Corporation Limited (Ergon Energy);
- a regional service delivery retailer, Ergon Energy Queensland Pty Ltd (Ergon Energy Retail); and
- affiliated contestable businesses, Metering Dynamics, Energy Impact and Ergon Energy Telecommunications.

Energy Queensland's purpose is to 'safely deliver secure, affordable and sustainable energy solutions with our communities and customers and is focussed on working across its portfolio of activities to deliver customers lower, more predictable power bills while maintaining a safe and reliable supply and a great customer service experience.

Our distribution businesses, Energex and Ergon Energy, cover 1.7 million km² and supply 37,208 GWh of energy to 2.1 million homes and businesses. Ergon Energy Retail sells electricity to 740,000 customers.

The Energy Queensland Group also includes new energy services businesses which will provide customers with greater choice and control over their energy needs and access to the next wave of innovative technologies and renewables. The energy services businesses are key to ensuring that Energy Queensland is able to meet and adapt to changes and developments in the rapidly evolving energy market.

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1 Introduction

On 27 June 2017, the Australian Energy Market Commission (AEMC) published the *Draft Rule Determination: National Electricity Amendment (Managing power system fault levels) Rule 2017* (draft rule determination) in response to a rule change request from the South Australian Minister for Mineral Resources and Energy. The draft rule determination proposes to amend the National Electricity Rules (the Rules) to allocate responsibility for managing power system fault levels (or system strength) in the National Electricity Market. Energy Queensland welcomes the opportunity to participate in the consultation process and provides comment on the conclusions and issues raised in the draft rule determination in this submission.

The draft rule determination:

- requires network service providers to maintain system strength at generating system connection points above agreed minimum levels under a defined range of conditions;
- introduces a requirement for the network service provider, generator (or market network service provider) and the Australian Energy Market Operator (AEMO) to agree and register a minimum short circuit ratio as part of the connection process;
- places an obligation on all new connecting generators to 'do no harm' to the minimum level of system strength being provided to existing generators at the time of the connection to enable those generators to continue to meet their performance standards; and
- provides transitional arrangements for existing generators, the relevant network service provider and AEMO to agree and register the level of system strength of existing generating systems that the network service provider will need to maintain on an ongoing basis.¹

The AEMC has requested that interested parties should make submissions on the draft rule determination by 8 August 2017. Energy Queensland's comments are provided in Section 2 of this submission.

¹ AEMC, *Draft Rule Determination: National Electricity Amendment (Managing power system fault levels) Rule 2017*, 27 June 2017, p. i.

As a member of Energy Networks Australia (ENA), the peak national body for Australia's energy networks, Energy Queensland has also contributed to and is supportive of the issues raised in the ENA's submission

Energy Queensland is available to discuss this submission or provide further detail regarding the issues raised.

2 Key messages

Energy Queensland is supportive of the rule change's overall objective of maintaining power system strength for existing generating facilities while facilitating the transition to greater levels of non-synchronous generation technologies in the National Electricity Market. Connection of new, non-synchronous power electronic converter type generators in low system strength networks can adversely affect power system security, quality of supply and protection systems. Given the rapid growth in non-synchronous generator connections in Queensland, maintaining power system strength will be an ongoing challenge in some parts of our distribution system.

Network service providers are now receiving increasing volumes of connection enquiries and applications from multiple non-synchronous generator proponents seeking to connect to their networks. In Queensland, we are currently managing a significant number of projects which, in total, exceed 7.1 GW. South-east Queensland (Energex) consists of a strong, interconnected network with minimal large-scale generator connection opportunities, but significant levels of domestic and commercial rooftop solar systems. In contrast, regional and rural Queensland (Ergon Energy) has seen significant growth over the last two years in the number of large-scale generation connections, largely attributable to the State's high solar irradiance, coupled with available and affordable land mass.

Ergon Energy now has over 130 projects at various stages of enquiry, connection application or construction, with more expected in the future. It is anticipated that the increase in large-scale generation projects could see up to 1,650 MW of renewable non-synchronous power electronic converter type generation added to Ergon Energy's network by the final quarter of 2020. Approximately 56 per cent of those projects will have a short circuit ratio of less than 5.0 and represent 'at risk' connections where performance standard issues could be experienced. Although 44 per cent of these projects are smaller than 30 MW and contribute only 14 per cent (i.e. approximately 0.23 GW) of the entire non-synchronous generation export capacity, half will have a short circuit ratio of less than 5.0. These short circuit ratio figures exclude the effect of:

- adjacent transmission network and distribution network cluster impacts (i.e. where the weighted short circuit ratio screening metric measure will indicate a further reduction in system strength);
- retirement or displacement of existing synchronous generators; and
- contingent conditions or protected events.

These cumulative impacts will result in an even higher proportion of 'at risk' generator connections.

In addition, we are seeing an increasing number of non-synchronous generators seeking to connect to the network where their proximity to each other may have a material impact upon assessing 'first in time' connections and the new generator's performance. Consequently, the connection of both larger and smaller generators, including clusters of renewable generators, to the shared network are creating regional areas of low system strength and posing significant challenges with respect to maintaining power system security, quality of supply standards, protection system effectiveness and mitigation measures to 'do no harm'.

Energy Queensland is pleased that the AEMC's draft rule determination has recognised that reducing system strength in the distribution system is an issue that will need to be addressed as a result of the greater numbers of non-synchronous generators connecting to the network. As noted in our submission on the AEMC's System Security Market Frameworks Review Directions Paper, system strength in the distribution network is an important consideration for Energy Queensland, particularly in the extensive network which extends hundreds of kilometres west of Powerlink's east coast transmission network that, in itself, extends over 1,300 kilometres from Brisbane to Cairns in Far North Queensland. The expansion of the draft rule to include both transmission network service providers and distribution network service providers is therefore welcomed.

Notwithstanding our support for the proposed rule change, Energy Queensland has some concerns in relation to specific aspects of the draft rule determination. In particular, we consider that some elements of the proposed rule may be difficult for network service providers and other participants to implement and may not achieve efficient outcomes in line with the National Electricity Objective. In Energy Queensland's view, the approach to maintaining system strength should be well-considered, efficient and straightforward to apply. To assist in the achievement of this objective, Energy Queensland has provided specific comments for further consideration by the AEMC below. We also support and would welcome participating in further collaboration with the AEMC, AEMO, network service providers and other relevant market participants to assist the AEMC in developing its final rule determination.

2.1 Obligation on network service providers to maintain system strength

In its draft rule determination, the AEMC has concluded that the network service provider is the party best placed to maintain system strength to enable generators to meet their performance standards.² The AEMC has formed this conclusion on the basis that network service providers have a view of their networks at the holistic level and are therefore better able to manage the risks associated with dealing with system strength issues as well as make more efficient investment decisions to address low system strength in association with their other obligations to operate and plan their networks.³

As a consequence, the draft rule proposes that network service providers will be required to plan and operate their networks to maintain the short circuit ratio at the connection point for each generating system to a level that is above that system's minimum requirement under normal operating conditions, including following a credible contingency or protected event. The minimum short circuit ratio, which is to be registered with AEMO, is to be agreed during the connection process by the network service provider, the generator and AEMO.⁴

Energy Queensland supports the requirement for network service providers to maintain system strength at generating system connection points above an agreed minimum level. However, we believe that further consideration of the following is required:

- ***Short circuit ratio calculation***

While weighted short circuit ratio is one measure that can be used, it is, in our view, only useful as a screening metric. Similarly, other indexes, like equivalent short circuit ratio, composite short circuit ratio or short circuit ratio, are also screening metrics used to provide an indication of the network sensitivity to active / reactive power injections or absorptions (i.e. system strength) and potential adverse power system security, quality of supply and protection system effectiveness impacts when connecting non-synchronous generators on either the distribution network or adjacent transmission network. These measures provide a valuable insight into system strength but are not

² Ibid, p. ii.

³ Ibid, p. ii.

⁴ Ibid, p. iii.

considered appropriate to be registered with AEMO at conclusion of the connection process.

In order to make an accurate assessment of system strength and the impacts a new non-synchronous generator will have on power system security, quality of supply standards and protection system effectiveness, several interlinked requirements are considered essential to delivering a successful connection in Queensland, namely:

- close coordination between the distribution network service provider and the transmission network service provider due to impacts from adjacent generator clusters;
- minimum guaranteed fault levels at the connection node (both transmission and distribution networks), having regard to the:
 - normal network operation defined by AEMO, the transmission network service provider and the distribution network service provider to ensure a robust and reasonable framework to forecast displaced and retired synchronous generation units and avoid future Distribution Use of System (DUOS) charges to distribution customers;
 - contingent network operation to account for security of supply and operational response times in regional Queensland; and
 - protected events, considering the impacts of cyclones on the coastal network and storm exposure to the inland networks;
- support from robust modelling guidelines (i.e. ERC0219 Generating System Model Guidelines) and explicit requirements upon generator proponents to provide an accurate and verified electromagnetic transient (EMT)-type model (PSCAD/EMTDC) at an appropriate stage of the connection process (preferably during the application stage and no later than the offer to connect stage);
- certification from the proponent that the generating system is capable of operating correctly down to industry benchmark levels at the high voltage terminals of each item of plant, such as those provided for in the

Essential Services Commission of South Australia's (ESCOSA's) guidelines, namely:

- minimum short circuit ratio of 1.5;
 - minimum positive sequence X/R ratio of 2 (ratio of system inductive to resistive impedance); and
 - applicable safety margins; and
- 'do no harm' cost recovery mechanisms which recognise that:
- in distribution networks largely decoupled from the transmission network, associated system strength mitigation costs should be attributed to a single party (i.e. the new generator connection) to send a clear cost signal and minimise DUOS charges on future distribution customers; and
 - in distribution networks where there are system strength issues from cluster connections associated with transmission-connected generators, the 'do no harm' cost recovery mechanism should be attributed to a single party (i.e. the new generator connection) to send a clear cost signal and minimise Transmission Use of System (TUOS) and / or DUOS charges on future customers, unless it is considered that renewable generation hubs are considered a strategic network service provider objective and managed under the regulatory investment test process to fund.
- ***Generator retirements from the market***

Energy Queensland has a number of concerns with respect to retirement of generators and how this will impact on network service providers' obligations, namely:

- There is currently uncertainty over the timing of generator retirements to enable sufficient planning. To assist with future planning, the Independent Review into the Future Security of the National Electricity Market recommended that there should be a requirement for large electricity generators to notify the market three years prior to retirement

to allow adequate time for planning.⁵ However, even if this recommendation is implemented, it is possible that the notification and retirement of a large synchronous generator could occur within a single regulatory control period and the impacted network service provider would not have made allowance to address the reduction in system strength in its approved capital works program.

We therefore suggest that further consideration is given to how network service providers can effectively plan to maintain system strength where a generator unexpectedly retires during a regulatory control period and the appropriate means of cost recovery.

- Energy Queensland envisages that a regulatory investment test process will be required where the cost of the most expensive option to address a network need is above the regulatory investment test cost threshold. As the regulatory investment test process can take from between six to eighteen months to complete, there may be significant delays in undertaking remediation works to address low system strength on the network, which may be an issue where short notice of a generator retirement is provided.

Consequently, Energy Queensland recommends that further consideration of how the regulatory investment test process can be amended to ensure system strength remediation works can be undertaken in a timely manner is required. For example, the process could be streamlined by applying the same approach to system strength as currently applies to urgent and unforeseen network issues that put the reliability of the distribution network at risk.

- Energy Queensland believes that where a retiring synchronous generator is either transmission-connected or distribution-connected and has a significant impact on the fault levels at the transmission connection point, the transmission network service provider should be responsible for maintaining system fault levels in both the transmission and distribution networks. We would therefore appreciate further

⁵ Dr Alan Finkel et al, *Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future*, June 2017, p. 6.

clarification in the final rule determination to ensure that the obligation to maintain system strength in this situation is the responsibility of the relevant transmission network service provider.

- Generators are commercial entities and so are likely to experience long-term shutdown events which can also have a significant impact upon system strength. These long-term shut down events can be driven by commercial reasons (such as 'mothballing'), suspended fuel supply contracts (either commercially driven or due to supply chain failures), or plant failure with a long repair time. Energy Queensland therefore considers that further clarity is required as to what is meant by 'retirement' of a generator for the purposes of this rule change (i.e. whether it includes long-term shutdown events) as well as which party will be responsible for funding any necessary remediation to address the impact on the registered short circuit ratios of other generators.
- ***Appropriate governance, regulatory and competitive protections under the Rules***

The proposed rule change will place new obligations on network service providers with respect to maintaining system strength and, as highlighted by the ENA in its submission, it is important to ensure that appropriate governance, regulatory and competitive arrangements are in place for network service providers under the Rules. Consequently, Energy Queensland would appreciate if the AEMC would extend its consideration of these issues to include distribution network service providers, particularly with respect to any protections, limitations or immunities from liability that may be appropriate as a result of the provision of system strength services.

2.2 Obligation on new connecting generators to 'do no harm'

The draft rule determination places an obligation on new generators to 'do no harm' to the minimum level of system strength that is currently being provided by the network service provider to existing generators connected to its network. Consequently, as part of the connection process, the new generator, the network service provider and AEMO will need to not only agree and register the minimum short circuit ratio to be provided by the network service provider but also determine the extent to which the new connecting generator will impact upon the minimum short circuit ratios currently being

provided to existing generators. The new connecting generator will be required to fund any remediation works required to be undertaken by the network service provider to address system strength issues.⁶

Energy Queensland supports the proposed requirement for new connecting generators to 'do no harm' to the minimum level of system strength being provided to existing generators. We welcome an arrangement that will assist in incentivising a new generator to either connect in a part of the network where there is sufficient system strength or fund the costs associated with addressing system strength issues to accommodate their connection. However, we believe that the following issues require further consideration in the AEMC's final rule determination:

- ***Assessing 'do no harm'***

While Energy Queensland considers that a weighted short circuit ratio calculation would provide an indication of system strength, our view is that it is only valuable as a screening metric, i.e. to determine whether there is a reasonable expectation that a new generator connection will impact upon the minimum short circuit ratios being provided to existing generators. In order to assess harm, a more detailed assessment of all factors, such as those defined in section 2.1 above, will be required. To undertake a detailed assessment, it will be essential for EMT-type modelling data to be provided by generator proponents. However, experience has shown that the ability of proponents to provide accurate and timely technical information is often an issue.

As it will be necessary for generator proponents to provide network service providers with accurate and timely models and information to determine whether remedial actions will be required to maintain system strength, it should be made explicit in the final rule that generator proponents have an obligation to provide this information during the application to connect stage and finalised before the offer to connect stage of the connection process.

- ***Multiple generator connections***

The proposed process for allocating the level of harm that a new connecting generator will cause to the minimum system strength being provided to existing generating systems will only be effective where there is one generator seeking to connect at any one time. In the situation where there are multiple generators

⁶ AEMC, *Draft Rule Determination: Managing power system fault levels*, p. iii.

seeking to connect in the same area of the network (both transmission and distribution networks) within a similar timeframe, there will be added complexity in assessing and allocating responsibility for system strength mitigation, determining the most practical and economic solution to address system strength issues and apportioning the allocation of costs associated with the provision of any required remedial work. This is primarily due to the following issues:

- the 'first in time' approach is not appropriate or equitable where there are multiple connection projects being assessed concurrently, particularly as there is uncertainty as to which of the generator proponents will proceed to the connection application and offer stages;
- there is no mechanism for network service providers to obtain accurate, detailed modelling information at an appropriate stage in the connection process to adequately assess the impact of a generator on the network and ability to meet generator and system performance standards;
- there is a general unwillingness for generator proponents to share information due to commercial reasons;
- generic models are not considered an acceptable compromise when assessing low system strength generator connections; and
- even if detailed EMT-type modelling is provided, there is no ability for network service providers to share information concerning other proposed connections with generator proponents to assist in reaching agreement on mutually beneficial and cost-effective solutions.

Consequently, in addition to a requirement for generator proponents to provide accurate and timely models, Energy Queensland believes further consideration is required in the final rule determination as to how the 'do no harm' requirement is to be managed where there are multiple proponents as well as the circumstances under which information can be shared to enable efficient decision-making, particularly with respect to identifying the most cost-effective solution to address system strength issues on the network.

- ***Regulatory Investment Test***

As noted in section 2.1, it may be necessary to undertake a regulatory investment test for remediation works and this process can take from six to eighteen months to complete. Consequently, there may be significant delays in undertaking 'do no harm' remediation works to address system strength issues

on the network where a regulatory investment test is required. As recommended in section 2.1, Energy Queensland would appreciate further consideration of how the regulatory investment test process can be streamlined to ensure system strength remediation works can be undertaken in a timely manner.

2.3 New responsibilities for AEMO

Under the proposed rule, AEMO will be required to:

- monitor system security and identify locations in the network where system strength has fallen below, or is likely to fall below, the registered minimum short circuit ratio and take any necessary actions to ensure a secure operating state;
- publish a register of short circuit ratios; and
- develop short circuit ratio calculation guidelines which network service providers will be required to follow in fulfilling their obligations.⁷

Energy Queensland supports AEMO having responsibility for forecasting when fault levels may be too low and to take any necessary actions to ensure system stability. We also support the publication of a short circuit ratios register and development of short circuit ratio calculation guidelines by AEMO to ensure a consistent methodology is used by network service providers.

However, as noted in section 2.1 above, in our experience, the calculation of a short circuit ratio is only useful as a screening metric to identify whether there is a need for more detailed studies using EMT-type modelling. Therefore, it should be made clear in the final rule determination and in the guidelines that the short circuit ratio calculation should only to be considered as fulfilling this purpose and that in order to make an accurate assessment of the system strength and the impacts a non-synchronous generator will have on power system security, quality of supply standards and protection system effectiveness, several interlinked requirements are considered essential to delivering a successful connection.

Given the complexity of the issues raised during this consultation process, Energy Queensland considers that there may be value in allowing for flexibility in the new framework so that the guidelines can evolve over time. This could be achieved by

⁷ Ibid, p. iii-iv.

making less prescriptive amendments to the Rules and providing high-level principles to guide the development of the guidelines. Effectively separating the guidelines from the Rules would enable the considered development of fit-for-purpose arrangements and allow for more timely modification of the guidelines as required.

2.4 Transitional arrangements

The draft rule contains two transitional arrangements as follows:

- establishment of a process for existing generators, relevant network service providers and AEMO to negotiate and agree the existing generating system's minimum short circuit requirements and to register these with AEMO by 1 July 2018; and
- interim short circuit ratio calculation guidelines to apply until AEMO exercises its power to develop the short circuit ratio calculation guidelines.⁸

Energy Queensland is of the view that the proposed transitional timeframe within which to agree minimum short circuit ratios for existing generating systems will be onerous and difficult to achieve. As noted earlier in this submission, the calculation of minimum short circuit ratios will require provision of detailed data and information to enable a robust assessment and we have concerns that obtaining accurate, detailed information in a timely manner to enable negotiation and agreement may be difficult.

Overall, Energy Queensland has significant concerns as to whether the intended implementation timeframe is achievable, particularly given the uncertainty surrounding the proposed new framework and the complexity of the issues raised during the consultation process. Before the AEMC makes a final determination on this rule change, we strongly urge that further consultation is undertaken with industry participants and AEMO to determine the best way forward, including the potential to implement interim measures to address the immediate problem and allow additional time to develop a more permanent, well-considered solution.

⁸ Ibid, p. iv.