12 April 2017

Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2499
Sydney South NSW 1235

Dear Mr Pierce

"ERC0219" ***National Electricity Amendment (Generating System Model Guidelines) Rule 2017***

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex) welcome the opportunity to provide comment to the Australian Energy Market Commission (AEMC) regarding its Consultation Paper on the Generating System Model Guidelines rule change request.

This attached submission, which is available for publication, is provided by Energex and Ergon Energy as distribution network service providers (DNSPs) operating in Queensland.

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

Jenny Doyle
General Manager Regulation and Pricing
Telephone: (07) 3851 6416
Email: jenny.doyle@energyq.com.au

Encl: Ergon Energy and Energex submission

Ergon Energy and Energex

Joint submission to Australian Energy Market Commission

National Electricity Amendment (Generating System Model Guidelines) Rule 2017 – Consultation Paper

Ergon Energy Corporation Limited
Energex Limited
12 April 2017

Ergon Energy Corporation Limited ABN 50 087 646 062
Energex Limited ABN 40 078 849 055

Contact details

Jenny Doyle
Phone: +61 (7) 3851 6146
Email: jenny.doyle@energyq.com.au

1 Introduction

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex) welcome the opportunity to provide comment to the Australian Energy Market Commission on its *National Electricity Amendment (Generating System Model Guidelines) Rule* 2017 Consultation Paper (the Consultation Paper).

This submission, which is available for publication, is provided by Ergon Energy and Energex as distribution network service providers (DNSPs) operating in Queensland.

Ergon Energy and Energex are committed to providing:

- safe, reliable and affordable electricity supply;
- a great customer service experience;
- customers greater control over their energy consumption;
- efficient and sustainable energy solutions; and
- access to the next wave of energy linked innovative technologies and renewables.

Ergon Energy and Energex both support a framework that allows greater levels of renewable non-synchronous generation on the network while ensuring lowest possible costs on networks and therefore customers. Our role is to manage the networks within the regulatory framework to ensure that supply is maintained for the benefit of all customers on our network. In order to do so, system security, stability and network performance are critical. This can be achieved when network service providers (NSPs) and proponents are provided with a broader level of data and detailed EMT-type models from existing connections and applicants who have, or wish to install power electronic interfaced generator technologies.

Our key messages in relation to specific issues discussed in the Consultation Paper, and our detailed responses to the questions raised therein are included in sections 2 and 3 of this submission.

As members of the Energy Networks Australia (ENA), the peak national body for Australia's energy networks, Ergon Energy and Energex have also contributed to and are supportive of the issues raised in the ENA's submission.

Ergon Energy and Energex are available to discuss this submission or provide further detail regarding the issues raised, should the AEMC require.

2 Key messages

Ergon Energy and Energex strongly support this rule change request. The relevant issues identified in the rule change request are not unique to transmission network service providers (TNSPs); DNSPs are facing similar issues. For example, Ergon Energy has received a significant number of enquiries (approximately 114) for renewable non-synchronous power electronic interfaced generators (totalling approximately 6.14 GW) to its network. We believe that as the network transitions towards a greater penetration of renewable energies comprising non-synchronous power electronic interfaced generators (e.g. solar and wind farms), more and more DNSPs will be similarly impacted. The new technologies incorporated in non-synchronous solar and wind generation connections are based on power electronic interfaced plant which requires detailed modelling in the electromagnetic transient (EMT) time domain. To be successfully integrated in low system strength areas, EMT-type models and a broader scope of modelling data will be required for non-synchronous generator connections including NSPs and major customer impacted plant, for example, static var compensators (SVCs), static frequency converters (SFCs), Statcoms, interconnector protection systems, power transformers and large industrial variable speed drives.

Ergon Energy and Energex strongly support and recommend that the AEMC expand the rule change request to apply to generators 5MW and greater or 5 % of the system fault level whichever is the lower. In regional areas, Ergon Energy has over 100 zone substations with a fault level lower than 50 MVA.

The low fault levels of Ergon Energy's network and the single or aggregated impact of generator systems on the grid will mean that system strength should be analysed using EMT-type modelling data provided by generators.

In its rule change request, the Australian Energy Market Operator (AEMO) sought a broader scope of data and EMT-type models be provided to them. Ergon Energy and Energex would support that disclosure of data and EMT-type models also being provided to NSPs and other proponents while respecting intellectual property (IP) and commercial-in-confidence matters.

It is critical that a broader scope of modelling data and EMT-type models is accessible, validated, provided and shared to ensure accurate modelling by proponents for the purposes of power system security, quality and reliability of supply and efficient network planning. This data will enable multiple generators to connect, add more value to network planning and ensure optimal network utilisation and investment.

Ergon Energy and Energex support the current rule change request going further by:

- requiring the disclosure of EMT-type models to TNSP's and DNSP's;

- applying it to all generation at 5MWs or 5 % of the system fault level whichever is the lower;
- allowing third parties to access the modelling information; and
- applying the information obligations (EMT-type models) retrospectively to all connected generators where they meet the above threshold of 5MW or 5% of the system fault level, whichever is the lower.

3 Table of detailed comments

Consultation Paper Feedback Question	Energex and Ergon Energy response
Issue 1 - materiality of the issue	
1. Are changing power system conditions impacting on the ability of AEMO, and other parties, to accurately model the power system?	Yes. We consider that with more non-synchronous generators connecting to networks, a broader scope of data and detailed EMT-type modelling will be required. There are a significant number of connections where RMS-type models are not fit for purpose for network studies to fully demonstrate generator performance standard (GPS) compliance. Connection of power electronic interfaced generators in low system strength networks can adversely affect power system quality and reliability of supply, protection systems and supply security. There is no industry consensus on how to measure system strength when there are multiple non-synchronous generators connecting to the network. However, a common analytical indicator is the use of the short circuit ratio (SCR). The SCR, the ratio of the short circuit power to the rating of the generator at a given location, is a metric used for quantifying system strength. This conventional measure is used when there is a single non-synchronous generator connecting to the network. However, with the fast growth of renewable generation in the market, and in our experience, network operators are no longer seeing a “single” non-synchronous generator connecting to the network. Instead we have multiple non-synchronous generators connecting to the network in adjacent areas. When multiple generators connect, a weighted short circuit ratio (WSCR), equivalent short circuit ratio (EQSCR) or composite short circuit ratio (CSCR) are more appropriate indicators used to measure system strength. In our experience and understanding of literature, a SCR less than 5 is a screening metric which identifies the need for more detailed studies using EMT-type modelling. Although a combination of indicators should be used to screen multiple connecting generator impacts, the use of the WSCR as an initial metric to assess the multiple generators proposing to connect to the DNSP network is considered necessary. The below table represents a cross section of proposed non-synchronous generation (both solar and wind – 16 in total) connections from the Ergon Energy, Energex and Powerlink areas to underscore the immediate and critical inter-planning TNSP, DNSP and SCR relationships. Of the 16 projects selected in the 5 different areas of Queensland, 9 projects are committed, representing approximately 43% (358 MW) of committed export capacity. The 16 projects comprise a combined export capacity of approx. 832 MW of non-synchronous generation including the TNSP generators.

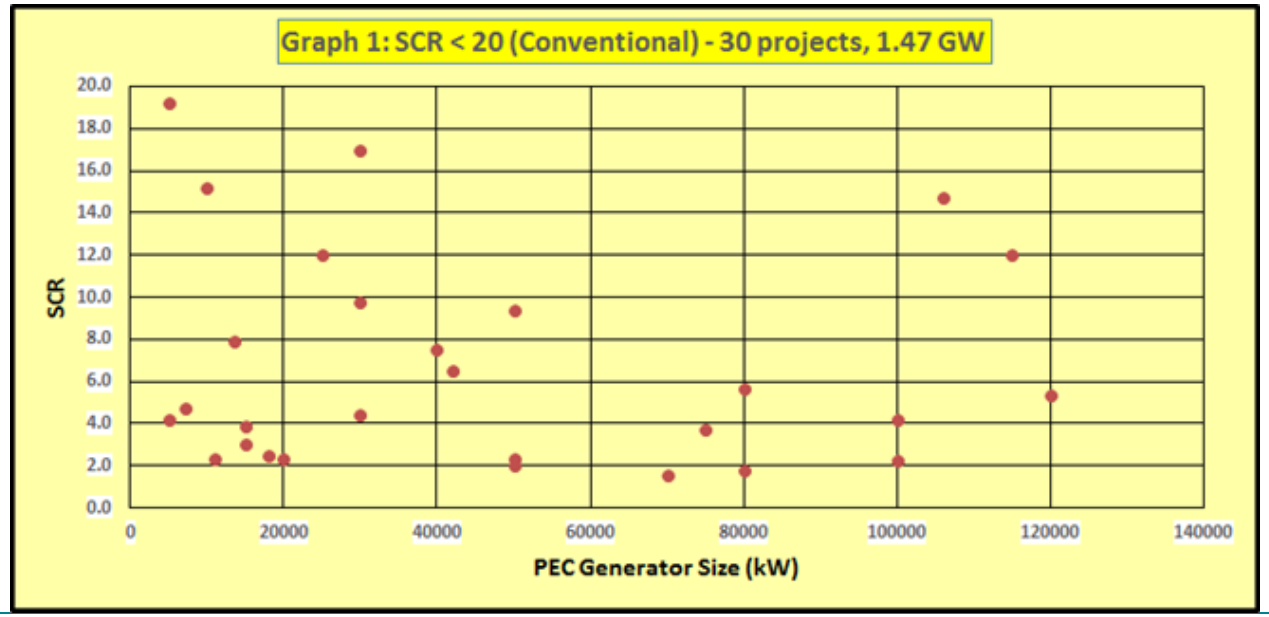
Consultation Paper Feedback Question	Energex and Ergon Energy response

NSP	QLD Area	Total Power Electronic Interfaced Generator capacity (Nameplate- MW)	Conventional SCR	WSCR	Committed Power Electronic Interfaced Generator Capacity (Nameplate- MW)	Wind	Solar
DNSP	A	128	1.5 - 4.7	0.9	53	✓	✓
DNSP	B	204	1.3 - 8.0	0.7	14	✓	✓
DNSP	C	65	2.0 - 3.0	1.3	15	✓	✓
DNSP/TNSP	D	393	6.5 - 22.9	2.9	249	X	✓
DNSP	E	42.2	2.4 - 4.7	1.0	27.2	X	✓

The above table highlights the conventional SCR range when each generator is assessed as a single connection as compared to an area based assessment of a number of non-synchronous generators connecting to the network (TNSP and DNSP) using the WSCR metric to measure overall system strength.

As demonstrated by the table, for all projects in the impacted areas, the WSCR is less than 5. Ensuring that we have access to the right type of modelling data from both committed and proposed TNSP and DNSP generator connections will enable appropriate power system modelling (i.e. EMT-type models) across the interconnected networks.

The following graph also highlights power electronic interfaced based generation sites within Ergon Energy's area by size and conventional SCR that are in advanced phases from 'Application to Connect' through to 'Connection Establishment'. Of the 30 solar and wind farm projects assessed in Ergon Energy's area that are at various stages of advanced development (i.e. detailed engineering planning, application, offer acceptance and connection establishment), there are 15, or 50%, of projects connecting into areas with a short circuit ratio of 5 or less. In total, these projects represent 1.47 GW (30 projects) and 0.65 GW (15 projects) of generation export capability respectively.

Consultation Paper Feedback Question	Energex and Ergon Energy response
	It is important to note that this high-level approach to analysing SCR only considers the individual generator at the time of connection, and therefore the following impacts are not considered which will impact on the SCR over the life of the generator: • WSCR due to adjacent renewable non-synchronous generation sites; • Adjacent NSP or customer dynamic plant; • Future retirement of NSP plant; • Contingent system operating states; and • Future retirement of synchronous generators. As such, there is a material impact on the DNSP to manage generator connections when considering both the adjacent TNSP generator connections and generators within the DNSP area. 

Consultation Paper Feedback Question	Energex and Ergon Energy response
2. Given any such impacts, do existing NER requirements for the provision of model data remain sufficient for parties to undertake effective power system studies?	No. We consider that the existing NER requirements are written with RMS-type models in mind and this is considered present industry practice by proponents who are required to demonstrate GPS compliance and network performance capability. Further, we agree with the AEMC that the NER does not specify which type of models must be provided. We also note that we are now requesting generators to provide additional data and EMT-type models from an early preliminary enquiry stage through to the GPS stage and in the connection contracts. However, there is no regulatory obligation requiring proponents to provide this data. Additionally, there is no ability to share this with other proponents who are in the pre-feasibility or detailed stages of a generator connection project. As previous stated in this submission, we strongly support an amendment to the NER to ensure that AEMO can obtain additional data and EMT-type modelling data. However, we also consider that NSPs should also be entitled to receive this data and where necessary, disclose this modelling data to proponents to undertake studies when their proposed project connects into an adjacent area. As stated above, proponents and the NSP require EMT-type modelling to undertake power system simulations to ensure that we understand how the network system performs in low system strength areas under various system operating conditions. RMS-type models are inadequate to model fast acting power electronic interfaced plant of solar and wind farms, associated NSP or pre-existing customer dynamic plant like SVCs, SFCs, Statcoms or large variable speed drives. This lack of data also affects the development of detailed constraint equations and augmentation proposals like synchronous condensers to resolve performance issues.
3. Is it necessary to amend the NER to place more explicitly defined obligations on participants to provide specific modelling data to AEMO?	Yes. Ergon Energy and Energex consider it would be prudent to amend the NER and place defined, explicit obligations in respect of a broader scope of data and detailed EMT-type models on proponents. This would provide greater clarify on what type of information and network models are required to be developed and provided. Similar to what we have stated above, we suggest the NER amendment extends to require EMT-type modelling data be provided to NSPs for all generator connections above a certain size. We suggest that the modelling data is extended to all generators with a nameplate rating of greater than 5 MW or 5 % of the system fault level whichever is the lower to cater for scenarios where there are single or multiple generators connecting to the network.

Consultation Paper Feedback Question	Energex and Ergon Energy response
	In regional areas, Ergon Energy has over 100 zone substations with a fault level lower than 50 MVA. Of the 114 connection enquiries, 42 projects (i.e. 37 %) are smaller than 30 MW in size: • *11 projects are sized >1 MW - ≤5 MW;* • *12 projects are sized in the range of >5.0 – ≤15.0; and* • *19 projects are sized in the range of >15.0 – <30.0 MW.* Of the thirty projects assessed from the 42 projects smaller than 30 MW, 40 % have an SCR <5 and this excludes the WSCR metric analysis. The AEMO 'Data_and_Model_Requirements_Generating_Systems_less_30_MW' preferred approach published in 2013 will require updating to reflect the requirement for data and detailed model requirements to enable EMT-type modelling in the DNSP network for generators <30 MW including the provision of data sheets (S, D, R1 and R2) and associated testing in order to manage non-synchronous generators connecting to the network. As previously stated, we consider access to this data is critical and we therefore recommend the AEMC consider applying this rule on a retrospective basis to existing generators.
Issue 2 – information gathering	
4. Does AEMO have scope to gather sufficient information under existing NEL/NER provisions?	While AEMO may have the authority to request additional information under existing provisions, Ergon Energy and Energex consider it necessary that the NER be amended to place defined and explicit obligations on proponents and registered participants in respect of the type of modelling data each party is required to provide. Additionally, there may be value in amending the Power System Model Guidelines to capture the types of modelling data that AEMO may require of specific generators and existing customer load dynamic plant and under what circumstances.
5. Is the solution proposed appropriate?	As stated above, Ergon Energy and Energex support this rule change request. However, we would strongly support the AEMC giving consideration to expand the focus to not just TNSPs but also DNSPs given the significant impacts Ergon Energy is seeing on their network from the large amount of non-synchronous generation coming on the network. In addition, we support an extension of the rule change request to systems smaller than 30 MWs.

Consultation Paper Feedback Question Issue 3 – Costs of compliance	Energex and Ergon Energy response
6. What are the likely costs for participants of providing a broader scope of modelling data, or more detailed EMT-type models, to AEMO?	From a network perspective, EMT-type model development for 3 static var compensators (SVCs) on Ergon Energy's network adjacent to proposed non-synchronous generator sites required significant resources to: • Re-establish engineering knowledge and datasets for plant that is over 20 years old and originally developed using outdated or proprietary EMT modelling software; • Establish engineering contracts, obligations and limits of liability with the original equipment manufacturer (OEM) or successor engineering company or consultancy firm; • Undertake site testing to validate the EMT-type models produced; and • Upskill and train staff using EMT-type models. This process took approximately 6 months at a cost of $126,000. However, despite the costs, Ergon Energy considered it a prudent investment in the context of the following: • Actively enabling the integration of renewable non-synchronous generation connecting to our network; • Managing the uncertainty of successfully integrating adjacent power electronic converter equipment in low system strength areas; • Ensuring critical plant as SVCs remain connected to the network during fault conditions; and • Reducing the risk of plant damage where spares are limited or no longer manufactured. Finally, to the extent additional costs are incurred through validation on our assets, we consider such costs should be also recoverable.
7. Is there a difference in costs if an EMT-type model is requested before connection, or required retrospectively after the connection is completed?	In Ergon Energy and Energex's experience, the earlier that data and modelling is provided, the easier it is for proponents to finalise their generator design. We consider that this will result in a more effective use of design resources, increases the prospective generator's capacity to export to the maximum system level available, and will reduce the time in both the construction and commissioning phases. As such, Ergon Energy and Energex suggest that there are significant cost advantages to a proponent to undertake and provide the NSP with data and modelling early in the process. Ergon Energy and Energex consider that that there may be several issues involved in retrospectively providing EMT-type model data, including but not limited to: • The cost of re-establishing the engineering knowledge base of the project. That is, it is no longer a marginal cost to the existing engineering contract or OEM service as part of the plant supply contract;

Consultation Paper Feedback Question	Energex and Ergon Energy response
	• The cost of undertaking on-site generator testing – typically either or both the proponents' engineers and OEM are on site during initial commissioning, particularly in low system strength connections; and • Delay costs to any new proponents relying on timely delivery of existing plant models. However notwithstanding these issues, as stated above, we support retrospective application of the proposed rule on the basis that the benefits of having access to such data and modelling outweigh the impacts of issues such as those described above.
8. What data provision requirements should apply to a generator that is halfway through the connection process, when new data provision requirements are introduced?	Considering our support for retrospective application of the proposed rule, Ergon Energy and Energex also support the immediate application of any new data provision requirements that are introduced during an existing connection process.
9. Could the cost of any new data provision requirements form a barrier to entry for new participants?	No. While AEMO has suggested the data provision requirements would cost around $75,000, Ergon Energy and Energex do not consider this would form a barrier to entry. In addition, we consider that the costs to develop, test and validate new EMT-type modelling data would not be significant in comparison to the overall investment required for network stability studies and connection of generating equipment. Once expectations are set and proponents recognise the potential impacts of delays through the generator performance standard (GPS) compliance process and plant commissioning phase through the use of RMS-type models that are not fit for purpose, the cost of providing EMT-type models as part of the entry requirement for new proponents will be seen as cost beneficial. Furthermore, as the OEM market is represented across the industry and proponents typically use recognised OEM suppliers, any future connection proponents should be able to mitigate their expenses where EMT-type models have already been developed during previous projects and work by the OEMs.

Consultation Paper Feedback Question	Energex and Ergon Energy response
Issue 4 – Possibility of compliance	
10. Are there any restrictions associated with providing data of the type contemplated in the rule change request?	There may be restrictions in terms of intellectual property (IP) or confidential agreements over these models. However, we suggest that the NER could be amended to require EMT-type models be provided while allowing OEMs to retain commercial IP rights. We do not support a framework that inhibits proponents connecting to the network thereby compromising NSP strategic planning and placing system security at risk or by affecting performance of the network.
Issue 5 – existing generators	
11. Should AEMO be able to request additional modelling data from existing generators who are already registered and have executed connection agreements?	Ergon Energy and Energex in principle support this notion especially in circumstances where the stability of the network is/may be compromised, and suggest it be extended to dynamic plant from both generators and load customers sites. However, there needs to be some guidance and examples as to how AEMO would administer this prospective expanded range of 'discretionary' information requests. The guidelines should also outline generator type (rotating or power electronic connected) and the size of the generator to which it applies.
12. Does the rule change request and the proposed rule provide sufficient guidance or clarity regarding what circumstances AEMO may require additional model data from existing participants?	The rule change request does not cater for generators less than 30 MWs, nor does it specify what type of generation it applies to. In addition, it does not require load customers with dynamic plant that have a material impact on the network to supply EMT-type modelling. Ergon Energy and Energex strongly recommend that the AEMC consider expanding the application of the proposed rule to include • Power electronic interface non-synchronous generators greater that 5 MWs or 5 % of the fault level, whichever is the lowest; and Customer load sites that have dynamic plant (SVCs, SFCs, major transformers, Statcoms, variable speed drives, etc.).
Issue 6 – data disclosure	
13. Should third parties have access to EMT-type models?	Yes. EMT-type models that are encrypted should be available to any participant/NSP/party required to provide network transient/dynamic stability studies. This is critical as it will enable consultants to undertake optimal generator sizing and capital budgeting of the proposed impacts prior to entering detailed planning and due diligence required by the NSP and AEMO. These pre-feasibility studies can amount to significant savings for the proponent and increase the certainty surrounding the application. It can also provide a level of risk assessment where multiple proponents are applying for connection in the same area.

Consultation Paper Feedback Question	Energex and Ergon Energy response
14. What information should be made available to third parties? Would encryption of this data provide sufficient protection to address issues related to commercial sensitivity of the data?	We consider that encrypted EMT-type models would be sufficiently secure provided they have been validated to accurately model generator performance standards.
15. Should EMT-type model data be provided only to AEMO, or should NSPs also have access?	NSPs will be required to assess the system strength impacts under the following scenarios: • Replacement or retirement of aged assets; • Optimal network configurations when new proponents connect; • Constraint equations as multiple proponents seek to connect in an area; • Retirement of synchronous generators; • To enable Queensland NSPs to manage the transition from an aging synchronous generator fleet to a synchronous and non-synchronous generator mix that operates significant distances and at reduced fault levels across the state; and • Strategic studies and regional development plans to produce long term network augmentation budget forecasts based on system strength limitations and inter-regional transfer capabilities. Without adequate models, such as EMT-type models, these considerations will result in conservative planning and inefficient investment. They will also result in sub-optimal proponent connections including limitations on developing constraint equations. Security and performance risk and uncertainty will result in increased costs of augmentation, which are ultimately borne by customers. In addition to our support for NSPs having access, we consider that other proponents should also have access so they can properly account for existing generators when preparing their own models.
16. Should information provided by NSPs be made available to third parties?	Yes. Similar to sentiments expressed throughout this submission, subject to appropriate confidentiality considerations, it is essential that this information is shared in order to undertake accurate modelling to ensure network performance outcomes.