Part of Energy Queensland

23 June 2022

Ms Anna Collyer
Chair
Australian Energy Market Commission
GPO Box 2603
Sydney NSW 2000

Dear Ms Collyer

ERC0272 Efficient reactive current access standards for inverter-based resources

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex), operating as distribution network service providers in Queensland, welcome the opportunity to provide comments to the Australian Energy Market Commission (AEMC) on the *Better reactive current access standards for inverter-based resources – Consultation Paper* (Consultation Paper).

Ergon Energy and Energex continue to accommodate large numbers of registered generators. We have a total of 27 large-scale inverter-based generators currently committed and connected with a capacity of 1.5GW and more than 600MW of further projects going through the application process. This has given Ergon Energy and Energex significant insight into and experience with renewable technologies' performance and compliance with the generator performance standards. In that context, Ergon Energy and Energex have provided responses to the questions raised in the Consultation Paper in the attached submission.

Should the AEMC require additional information or wish to discuss any aspect of this submission, please contact either myself, on 0438 021 254 or Barbara Neil on 0429 782 860.

Yours sincerely

Charmain Martin
Acting Manager Regulation

Telephone: 0438 021 254
Email: charmain.martin@energyq.com.au

Better reactive current access standards for inverter-based resources

Joint response to the AEMC

23 June 2022

Part of Energy Queensland

Better reactive current access standards for inverter-based resources

ABOUT ERGON ENERGY

Ergon Energy Corporation Limited (Ergon Energy) is part of Energy Queensland and manages an electricity distribution network which supplies electricity to more than 740,000 customers. Our vast operating area covers over one million square kilometres – around 97% of the state of Queensland – from the expanding coastal and rural population centres to the remote communities of outback Queensland and the Torres Strait.

Our electricity network consists of approximately 160,000 kilometres of powerlines and one million power poles, along with associated infrastructure such as major substations and power transformers.

We also own and operate 33 stand-alone power stations that provide supply to isolated communities across Queensland which are not connected to the main electricity grid.

ABOUT ENERGEX

Energex Limited (Energex) is part of Energy Queensland and manages an electricity distribution network delivering world-class energy products and services to one of Australia's fastest growing communities – the South-East Queensland region.

We have been supplying electricity to Queenslanders for more than 100 years and today provide distribution services to almost 1.4 million domestic and business connections, delivering electricity to a population base of around 3.4 million people via 52,000km of overhead and underground network.

Contact details

Energy Queensland Limited
Charmain Martin
Phone: 0438 021 254
Email: charmain.martin@energyq.com.au

PO Box 1090, Townsville QLD 4810
Level 6, 420 Flinders Street, Townsville QLD 4810
www.energyq.com.au

Energy Queensland Limited ABN 96 612 535 583

Ergon Energy Corporation Limited ABN 50 087 646 062 | Energy Queensland Limited ABN 96 612 535 583 | Energex Limited ABN 40 078 849 055

CONTENTS

Better reactive current access standards for inverter-based resources

1 INTRODUCTION

Ergon Energy Corporation Limited (Ergon Energy) and Energex Limited (Energex), operating as distribution network service providers (DNSPs) in Queensland, welcome the opportunity to provide comments to the Australian Energy Market Commission (AEMC) on their consultation on the *Better reactive current access standards for inverter-based resources – Consultation Paper* (Consultation Paper).

Ergon Energy and Energex continue to accommodate large numbers of registered generators. We have a total of 27 large-scale inverter-based generators currently committed and connected with a capacity of 1.5GW and more than 600MW of further projects going through the application process. This has given us significant insight and experience with renewable technologies' performance and compliance with respect to the generator performance standards. In that context, Ergon Energy and Energex have provided responses to the questions raised in the Consultation Paper in the following section.

Ergon Energy Corporation Limited ABN 50 087 646 062 | Energy Queensland Limited ABN 96 612 535 583 | Energex Limited ABN 40 078 849 055

2 TABLE OF DETAILED COMMENTS

Consultation Paper Feedback Question	Ergon Energy and Energex response
Issue 1 – Assessment framework	
Do stakeholders agree with the proposed assessment framework? Alternatively, are there additional principles that the Commission should take into account or are there principles included here that are not relevant?	Ergon Energy and Energex are supportive of the proposed framework.
Issue 2 – Has the Commission characterised the problems created by existing arrangements for security and reliability correctly?	
Are the current standards efficient? If current standards are too onerous, what impacts are the reactive current capability standards having on the viability of new resources connecting to the system? Can these impacts be quantified?	While Ergon Energy and Energex acknowledge that it is challenging for (in particular) some renewable energy technologies to achieve automatic access for S5.2.5.5, ensuring a robust and well-considered design to achieve as much reactive current injection as possible is in the long-term interests of the secure operation of the power system and thus each participant contributing to the achievement of the National Electricity Objective (NEO).
Can the impacts of reactive current standards on system security by quantified? If not, under what specific circumstances do the coordination challenges presented by too much reactive current capacity create system security risks?	The cases where too much reactive current injection can lead to instability are in very weak grid scenarios. In these scenarios, there can be a trade-off between system strength requirements and the minimum Short Circuit Ratio (SCR) capability of the plant. That said, there should be no such issues with an inverter based renewable generator meeting the existing reactive current standards alongside the proposed minimum SCR Access Standard of 3.
What implications might emerging technologies have for existing reactive current capability	Ergon Energy and Energex note the comment regarding electrolyser loads and the capability that they would already possess to deliver reactive current support. We agree there should be performance standards for inverter-connected loads which deliver the capabilities of this equipment to the power

Consultation Paper Feedback Question	Ergon Energy and Energex response
standards? What are the cost and regulatory complexity implications of emerging technologies providing reactive current to support voltage stability?	system, noting that these performance requirements would need to align with other requirements under the National Electricity Rules (NER) for load connections. Reactive current injection is just one of these capabilities. As per the previous questions, all participants contributing to the achievement of the NEO is an important design criterion and, in that context, loads contributing fairly would be an efficient approach as it would continue to simply be accessing existing capability. However, this should not be seen as 'instead of' but 'as well as' other participants contributing reactive current.
Issue 3 – Has the commission correctly characterised the problems that current arrangements may be presenting for the efficient allocation of risks?	
Is the current allocation of responsibilities between NSPs and generators for providing voltage support services maximising system security benefits across the power system?	DNSPs such as Ergon Energy and Energex are not System Strength Service Providers (SSSPs) so the scenarios mentioned in the Consultation Paper do not apply to distribution networks. Further, in many cases the TNSP network is too distant from the location where these large distributed generators are connecting for any proposed system strength services to have any impact.
If the current allocation is inefficient, what impacts or costs are current arrangements placing on generators' or network businesses' abilities to ensure a secure system at least cost?	In our experience, the cost impacts on generators have only been very minor improvements to the reticulation network design. However, it is important that proponents consider this from the start of the project, as undertaking this part way through the project lifecycle may have time/cost implications greater than the cost to do the quality reticulation design from the start.
Can competition drive meaningful innovation that will reduce the cost of delivering voltage support services over time?	Competition can be an important driver for innovation. However, although innovation may achieve reduction in costs to delivering voltage support services, so too can quality design from the beginning of a project.
Issue 4 – More transparent and simpler grid approvals	
What problems are the existing minimum standards on reactive current presenting for more transparent and simple grid approvals?	We believe the existing rule is clear, and the current Minimum Access Standard is not impacting transparency or simplicity of grid approvals. The issues highlighted in the Consultation Paper are related to coordination and tuning of control systems and addressing potential interactions with nearby generators. This is not an issue with the current Minimum Access Standard.
Can the cost of these problems be quantified	Ergon Energy and Energex believe the Rules are already simple. In our experience, once proponents consider their reticulation network design, they

Consultation Paper Feedback Question	Ergon Energy and Energex response
in terms of the typical amount of time it currently takes for grid approvals and how much faster it could be if the Rules were simpler?	can significantly improve reactive current injection at the connection point and meeting both negotiating framework principles and the objectives of the NSP and AEMO. The issues highlighted in the Consultation Paper are related to coordination and tuning of control systems and addressing potential interactions with nearby generators. This is not an issue with the current Minimum Access Standard.
Issue 5 – Evidence to support changing the point of compliance from the connection point to generator unit terminals	
What factors should guide the Commission's assessment of how to determine the reactive current capability standard that should apply to inverter-based generation?	The connection point should apply as the assessment point for all generating systems, regardless of technology type. Ergon Energy and Energex note that generators connecting to our networks have been able to define and improve performance at the connection point, to meet either the automatic, or close to the automatic limit, by improving plant design (for example, improved reticulation system design) and without necessitating the installation of additional reactive plant. We believe this is efficient and meets the NEO.
What are the implications of limiting the minimum reactive current response capability that inverter-based generators have to provide, to the relationship proposed by RER in Table 1?	Ergon Energy and Energex have experience with a network which typically has low X/R ratios. Together, Ergon Energy and Energex have 27 large-scale inverter-based generators currently committed and connected with a capacity of 1.5GW and have not yet seen a need in any case to limit the maximum reactive current injection. In cases where generator proponents have pushed to reduce the maximum reactive current injection the issue has been resolved through better control system tuning. It is also noted that the X/R ratio may change over the lifetime of a project. In that context, it could mean that future network security is compromised by allowing ineffectively designed plant to be installed. This approach seems counter to the NEO and will only serve to cost consumers in the long term.
Issue 6 – What should the minimum reactive current capability be?	
If the point of compliance remains at the connection point, at what level should the minimum reactive current capability that generators have to install be set?	Ergon Energy and Energex have not yet come across a proposed generating system which has not been capable of achieving 2% at the connection point. The cases where this has been a challenge have been resolved with minor changes to generator reticulation system design. Similarly, Ergon Energy and Energex have not seen any cases where a Statcom or Syncon has been required to achieve the minimum reactive power standard. This is in the context of Ergon Energy and Energex having a total of 27 large-scale inverter-based generators currently committed and connected with a capacity of 1.5GW and more than 600MW of further projects going through the application process.
What potential risks to system security are there from lowering the minimum reactive	If the inverter based renewable generators do not provide the voltage support during faults, there is a credible not-too-distant future state where there will be insufficient reactive current to support system voltage during a fault as a critical mass of synchronous generators retire. Based on the ISP step change

Consultation Paper Feedback Question	Ergon Energy and Energex response
current capability to this level?	scenario and the early retirement announcements, this is a threat that will materialise.
What are the potential benefits for reliability and efficient investment in generation from lowering the reactive current capability?	Ergon Energy and Energex suggest that reducing the current capability of generators would not be consistent with the NEO.
Issue 7 – What are the benefits of aligning reactive current capability to locational system strength needs?	
To reduce the risk of investment duplication, should the minimum level of reactive current capability take into account the available / forecast level of dynamic voltage support from System Strength Service Providers?	It should be noted that Generators are also present in the distribution network, and may be remote from a SSSP, and as such, the presence of voltage support from the SSSP may not be relied upon, especially considering the needs of the local network.
What are the potential implications for the future development of grid forming inverters from lowering the minimum reactive current capability that inverter-based generators have to provide?	Grid forming inverters will likely be capable of delivering more reactive current capability than the existing grid following inverters. Lowering the standard may lead to this capability not being taken advantage of.
Issue 8 – Evidence to support changing the point of compliance from the connection point to the generator unit terminals	
What are the distinctions between steady-state compliance and dynamic response that the Commission needs to consider in assessing whether to change the point of compliance assessment from the connection point to the generator unit terminals?	Ergon Energy and Energex do not support a proposal to move the assessment point to the generator unit terminals. Depending on the generator design, this could mean that during a fault, the reactive current is negative at the connection point, and therefore the generator is exacerbating the fault condition. This is turn increases the demand on other services to maintain system security. It is unclear what is meant by steady state compliance in this context, and we suggest the Draft Determination provides this clarification. In either case, we believe dynamic modelling is the only way to demonstrate compliance prior to connection.

Ergon Energy Corporation Limited ABN 50 087 646 062 | Energy Queensland Limited ABN 96 612 535 583 | Energex Limited ABN 40 078 849 055

Better reactive current access standards for inverter-based resources

Consultation Paper Feedback Question	Ergon Energy and Energex response
What specific implications does this have for the connections assessment process and does this outweigh the cost of high-speed monitoring that is needed at each unit terminal to assess compliance?	Ergon Energy and Energex have no further comments.
Issue 9 – What challenges does the current voltage trigger range present for inverter-based generators in meeting the existing reactive current capability minimum access standard?	
What are the implications for generator connection applicants of maintaining the rule that the response be triggered at a range of connection point voltages?	The implication for Connection Applicants is that they will still need to carry out a robust reticulation system design and coordination of connection point voltages and fault ride through triggers at the inverter.
What other implications might lowering the minimum reactive current capability that generators are required to provide have for the voltage level or range that triggers a generator's reactive current response?	This could lead to highly variable trigger points for reactive current injection at the connection point which are poorly correlated to the needs of the power system.
Issue 10 – What are the key issues with the rise and settling time standards?	
What stakeholder experiences over the past three years support a Commission decision to revise the current rise and settling time access standards?	Projects using inverter-based technology are struggling to meet this requirement. The discussion becomes a negotiation around how best to confirm compliance given inherent delays in reactive current measurement methodologies.
What should the rise and settling time be revised to if the point of compliance assessment is maintained at the	Ergon Energy and Energex suggest the existing requirement be maintained for the Automatic Access Standard, but a lesser requirement could be included in the Minimum Access Standard. Then the negotiation framework can be used to achieve the best possible performance for the plant and location.

Consultation Paper Feedback Question	Ergon Energy and Energex response
connection point instead of the generator unit terminals?	
How should the rise and settling time standards change with the minimum reactive current response capability, if at all?	We believe these are two separate issues and can be appropriately treated separately.
Issue 11 – How should the minimum access standards that apply to reactive power recovery be clarified?	
Is there a conflict between the obligations for active power recovery after fault clearance to ensure stable frequency levels and the obligations in S5.2.5.5 for active power to recover to 95% of pre-fault levels after a fault occurs?	Ergon Energy and Energex believe there is no conflict between the obligations for active power recovery after fault clearance to ensure stable frequency levels and the obligations in S5.2.5.5 for active power to recover to 95% of pre-fault levels after a fault.
How should this conflict be clarified to ensure clarity on generators' obligations to return to continuous uninterrupted operation in a timely manner?	Ergon Energy and Energex have no further comments.
Issue 12 – Implementation considerations that the Commission should take into account	
How quickly should any new access standards come into effect?	Given there are some potential overlaps with the system strength rule change as mentioned in the Consultation Paper, any access standard changes should only be considered after those changes come into effect.
What are the potential unintended consequences of bringing these into effect immediately (e.g. for new connection applications)?	Consideration should be given to the impacts on the established connection and access framework under the NER, specifically Rule 5.3A and the impact on customers for longer negotiation periods associated with negotiated access standards, generator performance standards and the potentially increased fees from Generator Performance Modelling studies. As the Consultation Paper proposed a lessening of the minimum requirements, there may be no detrimental impact to projects in the existing connection process. Existing committed (or registered generators) should already be achieving performance in line with the current rule. It is possible that they could

Consultation Paper Feedback Question	Ergon Energy and Energex response
	seek to withdraw and resubmit to a lesser standard. However, it would be very difficult for those generators to demonstrate that they are applying the Negotiation Framework when negotiating performance below the Automatic Access Standard.
What are the implications of providing project proponents the option to connect under the existing or the new standard (e.g. for advanced projects that have already been approved or close to securing grid approvals)?	If a project has committed or registered (assuming this is what is meant by approved), the Generator Performance Standard has already been agreed (through a clause 5.3.4A / 5.3.4B process) and a Connection Agreement has been executed. Therefore, it is important that those projects can continue to registration or commissioning according to the executed connection agreement within the appropriate timeframe. Further clarity may be required by AEMO on the implications of clause 5.3.9 proposals after or during commissioning.