7 July 2017

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

Dear Mr Pierce

Draft Report: Distribution Market Model Project

Energy Queensland Limited (Energy Queensland) appreciates the opportunity to provide a submission to the Australian Energy Market Commission (AEMC) on its *Draft Report: Distribution Market Model Project* (draft report). The draft report describes the characteristics of a potential evolution of distribution system operation that enables future investment in and operation of distributed energy resources to be optimised.

Energy Queensland's comments with respect to the specific questions raised by the AEMC are provided in the attached submission. Comments have also been provided on conclusions outlined in the draft report relating to the indicative evolutionary pathway for distribution system operation and the future optimisation and coordination of investment in and operation of distributed energy resources. Specifically, Energy Queensland considers that further clarity is required on these key features in the AEMC's final report.

Energy Queensland has also contributed to and supports Energy Networks Australia's submission on the draft report and strongly recommends that the AEMC has regard to the *Electricity Network Transformation Roadmap* developed by the CSIRO and Energy Networks Australia in undertaking the Distribution Market Model Project.

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

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Energy Queensland

Submission to the Australian Energy Market Commission

Distribution Market Model Project - Draft Report

Energy Queensland Limited

7 July 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 km^2 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

In December 2016, the Australian Energy Market Commission (AEMC) initiated the Distribution Market Model project to examine how the operation and regulation of electricity distribution networks may need to change to accommodate a higher penetration of distributed energy resources, such as solar photovoltaic (PV) systems, battery storage, electric vehicles and other new technologies. Following feedback received from stakeholders on its approach paper, the AEMC has now published its *Draft Report: Distribution Market Model* (draft report). Energy Queensland welcomes the opportunity to participate in the consultation process and provides comment on the conclusions and issues raised in the draft report in this submission.

In its draft report, the AEMC outlines "the need for a way to buy and sell energy and related services at the distribution level in a dynamic way, in response to price signals"[1] and has set out an indicative, three-stage evolutionary path that describes the characteristics of an anticipated future state of distribution system operation as well as identifying the principal market and technical enablers of such an evolution. As part of stakeholder engagement, the AEMC has sought feedback on specific issues relating to the following enablers:

- cost-reflective network tariffs;
- network access;
- connection charges; and
- Australian Standards and technical requirements for connection.

The AEMC has requested that interested parties should make submissions on the draft report by 4 July 2017. Energy Queensland's comments are provided in Sections 2, 3 and 4 of this submission.

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

[1] AEMC, *Draft Report: Distribution Market Model*, 6 June 2017, p. 18-19.

2 General comments

Energy Queensland is fully supportive of the Distribution Market Model project. It is clear that declining costs, continuous technological development and changing consumer attitudes make it likely that the uptake of distributed energy resources will continue to grow and drive an evolution in distribution networks to accommodate two-way power flow and enable customers to optimise the value of their investment in these new technologies and distribution network access. As volumes increase, the integration of distributed energy resources will become more challenging, with distribution systems needing to adapt from traditional, uni-directional systems to platforms that enable bi-directional flows and more dynamic energy markets. Innovation in distribution system operation to ensure this level of integration of distributed energy resources will therefore be critical.

As distributed energy resource technology develops, it is influencing the way our customers use our networks and source electricity. For instance:

- We have already seen Queensland integrate the highest penetration of residential solar PV in Australia, with South-East Queensland having one of the highest penetrations in the world. Currently, there are just over half a million stand-alone houses with solar PV in Queensland which, at 1.65 GW, makes it the equal largest collective generation source in the State. We expect continued growth in solar PV, both in residential and other customer classes, and have recently seen a significant increase in applications to connect large-scale solar, particularly in our rural areas. Currently, Ergon Energy has 172 active export generation projects in progress, mostly for solar farms, while in the South-East, Energex has 23 projects for PV inverter systems over 1MW.

- There is significant activity around the development and deployment of complementary battery storage technology, with over 1MWh of residential energy storage installed in Queensland over the last twelve months.

- While the electric vehicle market is still in its infancy in Australia, there are now over 1,000 electric vehicles in Queensland, with a 60/40 split between plug-in hybrid and battery electric vehicles.

In future, while solar PV is expected to continue to increase, batteries and electric vehicles are also likely to emerge in higher penetrations as costs continue to fall and customers are able to benefit from these technologies. Indeed, the Australian Energy Market Operator has recently forecast that uptake of rooftop solar and batteries is expected to

quadruple over the next twenty years from less than 5 GW to almost 20 GW by 2036-37 and that there will be a significant increase in the uptake of electric vehicles from 2020 onwards[2].

In line with the prediction that customers will continue to embrace and invest in new forms of technology within their homes and businesses, Energy Queensland will continue to evolve our grids to meet these changing demands. Regardless of the type of technology, we intend to create a network that can operate as a platform and interconnector for distributed energy resources and for all of our customers. This outcome is in line with Energy Queensland's strategic objectives which are to: be community and customer focussed; operate safely as an efficient and effective organisation; strengthen and grow from our core; and create value through innovation.

Energy Queensland's distribution businesses, Energex and Ergon Energy, are already actively responding to the technical impacts of distributed energy resources, with much of our forward planning focussed on strategies to enable greater integration of these technologies into the network and support positive outcomes for customers and the wider Queensland community. For example:

- Energex has implemented a range of innovative solutions, such as direct load control of customers' hot water systems and demand response enabling device (DRED) based air-conditioning load management, to ensure the South-East Queensland network is able to cost-effectively manage the power quality and voltage management challenges of solar PV; and

- Both Energex and Ergon Energy are currently conducting trials to explore the effects of battery storage on peak demand and power quality. These trials are providing insights to help deliver solutions that offer our connected customers choice in their energy supply and minimise expenditure on the network.

Initiatives such as these not only demonstrate Energy Queensland's commitment to integrate distributed energy resources into Queensland's networks but also highlights that the evolution of distribution system operation is well under way and is already having a significant impact upon distribution network service providers' investment and network management decisions.

[2] AEMO, *Electricity Forecasting Insights for the National Electricity Market*, June 2017, p. 5.

There is no doubt that the evolutionary process driven by high levels of distributed energy resources will require significant changes to distribution system operation and Energy Queensland is supportive of the need to remove barriers and enable the development and maximisation of the value of these technologies in the various electricity markets. However, it is also essential that the primary objective of electrical power distribution systems - the safe, secure, reliable and affordable provision of electricity supply for all consumers - continues to be at the forefront of the AEMC's approach.

Energy Queensland therefore urges that care should be taken to ensure that the Distribution Market Model project takes a holistic approach to the incorporation of new technologies into the market and that the implications of any conclusions presented in the AEMC's final report are well-considered and balanced. To assist in the achievement of this objective, Energy Queensland has provided specific comments for further consideration by the AEMC in this submission on both the issues raised for consultation and the conclusions outlined in the draft report in relation to the "optimisation and coordination functions".

Energy Queensland also strongly recommends that the AEMC has regard to the *Electricity Network Transformation Roadmap* developed by the CSIRO and Energy Networks Australia. This document, which is the result of two years of extensive research, stakeholder engagement and evidence-based analysis, has been developed to help guide the transformation of Australia's transmission and distribution networks over the next decade. The comprehensive transitional pathway set out in the *Electricity Network Transformation Roadmap* is fully endorsed by Energy Queensland.

3 Comments on optimising and coordinating distributed energy resources

Energy Queensland notes that, given the increasing uptake of distributed energy resources, the AEMC has identified two key considerations relating to the future operation of the distribution system and associated regulatory arrangements, namely:

- the value from **optimising** investment in and operation of distributed energy resources; and
- the value from **coordinating** the operation of distributed energy resources with the wholesale market[3].

3.1 Optimising investment in and operation of distributed energy resources

In its draft report, the AEMC has put forward the view that an effective market-based approach to the provision of optimisation services will develop where there is a level playing field and, further, that the party who provides the optimisation function must be **independent** and **exposed to financial incentives**[4]. Given the independence criterion, the AEMC has formed the view that it would not be appropriate for a distribution network service provider (and potentially an affiliated entity) to perform the optimisation function. However, in Energy Queensland's view, the conclusions presented in the draft report do not appear to be supported by a comprehensive analysis and evaluation of alternative market design options.

Energy Queensland therefore recommends that before any attempt is made to definitively determine which party should or should not be responsible for performing a function which has the potential to impact upon distribution system operations, further detailed analysis of market design options, including associated strengths and limitations, gaps between the future state and current state and the potential benefits and associated cost components is required.

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[3] AEMC, *Draft Report: Distribution Market Model*, p. 18.
[4] Ibid, p. 34.

In response to the conclusions outlined in the AEMC's draft report, Energy Queensland provides the following comments:

- ***The "independence" criterion and its application to distribution network service providers and affiliated entities.***

  The AEMC has stated that:

  > "If the optimising function is taken on by a party who has a particular financial or regulatory interest in the provision of a particular service (i.e. where the provision of that service has a higher value to the party who takes on the optimisation function than to what the customer's preference would be), then that party is acting in accordance with its own interests and is unlikely to make decisions that result in the full value of that asset being maximised"[5].

  Based on this logic, the AEMC has determined that distribution network service providers should be excluded from performing the optimisation function as they have greater financial and regulatory incentives to favour network services over customer or wholesale services. The draft report further suggests that an affiliated entity of a distribution network service provider should also potentially be excluded from performing the optimisation function on the basis that distribution ring-fencing arrangements "may not be able to successfully address these risks"[6]. However, Energy Queensland is of the view that:

  - it could be argued that other parties, such as retailers and the market operator, do not meet the independence criterion either as they also have greater incentive to focus on specific interests and are likely to value customer services and wholesale market services over network services;

  - in order for an independent, third party to provide the optimisation function, they would need real-time visibility of network constraints which are (by orders of magnitude) far more complex than at the national transmission market level and would essentially be a duplication of the distribution network service provider's role;

[5] Ibid, p. 34.
[6] Ibid, p. 37.

- the scenario where a workable market is slow to develop and there are insufficient financial incentives to attract an independent third party to provide optimisation services (such as in less populated regional areas) has not been considered; and

- the current ring-fencing legal separation obligations represent a targeted, proportionate and effective regulatory response to counter any concerns regarding perceived biases with respect to affiliated entities.

Consequently, Energy Queensland questions the AEMC's current application of the independence criterion to single out distribution network service providers and potentially affiliated entities for exclusion from performing the optimisation function. Conversely, Energy Queensland considers that distribution network service providers, supported by appropriate network infrastructure, system automation and technical and communications protocols, are well placed to not only:

- address the technical integration challenges of distributed energy resources, including managing technical issues relating to: voltage stability; frequency stability; harmonics; flicker; power factor; supply/demand management; thermal loading; islanding and reclosing; and protection (which have the potential to affect the reliability or quality of electricity supply or impact the safety of the network); but also

- optimise and coordinate those technologies for the benefit of all parties

in line with their obligation to provide a safe, secure, reliable and affordable electricity supply for all electricity consumers.

While decisions relating to policy are beyond our control, Energy Queensland strongly recommends that a participant neutral approach should be adopted by the AEMC.

- ***The ability for distribution networks to meet their obligation to ensure a safe, secure, reliable and affordable electricity supply for all electricity consumers.***

  As distribution network asset owners and operators, distribution network service providers are responsible for ensuring the safety, security and reliability of electricity supply for all electricity consumers, at least cost. In order to do

so, distribution networks must have the ability to operate the distribution system in a manner that will efficiently address the technical impacts of distributed energy resources on their networks, defer investment in network assets and maximise customer and community outcomes.

In Energy Queensland's view, any proposed optimisation function should be focussed on achieving more efficient investment in, and operation of, **both** distributed energy resources and distribution network assets. It is therefore clear that for full value to be achieved in accordance with the overarching requirement to ensure a safe, secure, reliable and affordable electricity supply for the entire customer base, the optimisation function cannot be performed in isolation from distribution system operation and full visibility of real-time network constraints.

It is our expectation that in order for an independent party to perform the optimisation function, constraint equations or limits would be needed across the entire distribution network. However, the level of information that would be required for the distribution network would be far more complex than that currently used by the market operator for the transmission network (and some parts of the distribution network to manage embedded generation greater than 30 MW). Managing the optimisation function for all distribution networks across the National Electricity Market is not a simple expansion of the market operator's current capability, but would require a significant investment given the increased complexity of individual distribution networks (by orders of magnitude) compared to the transmission network. To achieve Stage 3 of the distribution system operation evolution, models of the entire distribution network, including controllable devices with real-time or near real-time data (potentially including some level of state estimation to reduce costs and complexity, i.e. incomplete metering) will be required to be held by the party performing the optimisation function. These key elements do not currently exist and will therefore need to be created before the optimisation function can occur.

As noted earlier, in Energy Queensland's view, the potential for distribution network service providers (supported by appropriate network infrastructure, system automation and market protocols) to be best placed to effectively and efficiently manage both the distribution system operation and optimisation of distributed energy resource functions in the best interests of electricity consumers should not be overlooked.

- ***Transition to an optimised end-state***

  The AEMC's draft report describes a possible evolution over time and through three distinct stages to a future where investment in and operation of distributed energy resources is optimised[7]. Energy Queensland considers there is considerable work required to achieve the AEMC's future state. At present, the operation of and investment in distributed energy resources is not optimised, there is limited transparency of the costs of supply to customers and cross-subsidies are occurring as a result of distortion of price signals in a fragmented distributed energy market.

  In Energy Queensland's view the draft report does not give sufficient consideration to the impacts that the rapidly increasing penetration of distributed energy resources will have upon distribution network service providers and other market participants throughout the transition phase, particularly market operations during the initial stages of evolution where distributed energy resource optimisation and coordination capability has not yet reached full maturity. As noted earlier in this submission, the continued growth in distributed energy resources is already impacting upon distribution network service providers' obligations and decision-making with respect to distribution system operation and investment.

- ***Costs and benefits of creating an additional role in the market.***

  The creation of an additional, independent third party role with the necessary technical and systems capability to perform the optimisation function is likely to involve significant expense and result in increased costs for customers. There is also considerable potential that the need for such a role may be mitigated by technology and smart grids, as suggested by the staged evolution towards smart grids outlined in the *Electricity Network Transformation Roadmap*. Consequently, the costs of creating an additional optimisation role may be unnecessary in the long-term and have the potential to outweigh the benefits to electricity consumers.

[7] Ibid, p. 29.

3.2 Coordinating the operation of distributed energy resources with the wholesale market

Energy Queensland notes the AEMC's conclusion that:

> "In order for a market-based approach to optimisation to be effective, and for the full wholesale benefits of distributed energy resources to be realised, the operation of distributed energy resources would benefit from being coordinated with the wholesale market, and vice versa."[8]

However, in order to coordinate the operation of distributed energy resources within the wholesale market, the multitude of current price signals (including marginal loss factors, distribution loss factors, zonal pricing, the National Electricity Market despatch engine constraint equation, transmission use of system charges, distribution use of system charges and, in the future, peer-to-peer trading) will need extensive consideration.

In addition, the capability of distributed energy resources to provide wholesale market services will depend on a number of complex interactions, including:

- the physics of electrical energy flows from and within the low voltage through to transmission level electrical networks;
- the location and availability at any point in time of a service provider's distributed energy resources;
- the number of service providers operating at a local level and across the wholesale market;
- the terms and conditions of a service provider's agreements with consumers which may affect the availability of distributed energy resources in the distribution and transmission services markets; and
- standardisation of communications platforms.

Energy Queensland therefore recommends that the AEMC gives further consideration in its final report as to how these challenges can be addressed to allow the efficient coordination of the operation of distributed energy resources. Energy Queensland also considers that further detailed analysis of market design options as well as the potential benefits and associated cost components (and how they will be apportioned to the various parties involved) is required.

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[8] Ibid, p. 24.

4 Responses to specific issues raised

Consultation Paper Feedback Question	Energy Queensland Comment
Issue 1: Network Tariffs	
Question 1 Do stakeholders consider that there are any other barriers to the development and implementation of cost-reflective network tariffs? How material are these barriers? Are there other means for them to be addressed?	Truly cost-reflective tariffs need to recognise that the cost of supplying customers changes frequently because of variations in load and network asset usage throughout each day of the year, as well as individual customers' usage of distributed energy resources. For the tariff structures to enable the Distribution Market Model to work effectively there needs to be a sufficient level of transparency to allow customers to understand both the costs associated with electricity supply and the price signals being sent through network tariffs. However, in achieving the alignment between cost of supply and price signals, recognition must be given to cost-reflectivity, with administrative simplicity and customer impact management. The tariff structure statement framework provides a barrier to the **development** of cost-reflective network tariffs. While the market and technology competing with traditional networks is developing rapidly, the five year duration of the tariff structure statement does not provide the flexibility for cost-reflective network tariffs to keep pace with market and technology developments. In addition, in the case of granular locational prices, the tariff structure statement does not allow for tariff response to changes in actual network load outcomes and revised optimal network needs through updating of the efficient locational tariff structures and signals.

Consultation Paper Feedback Question	Energy Queensland Comment
	The three significant barriers for **implementation** of cost-reflective network tariffs include: • ***The availability of advanced metering***. The vast majority of cost-reflective network tariffs require interval data for billing purposes. However, advanced metering is unlikely to achieve mass adoption, outside of Victoria, for at least 10-15 years. • ***The cost and lack of incentives for retailers.*** Retailer billing system changes and B2B processes associated with the implementation of cost-reflective network tariffs are expensive and this expense is compounded where tariff structures vary across the National Electricity Market. Given the lack of incentive and limited ability for retailers to manage the risks cost-reflective network pricing imposes, the opt-in nature of most tariff structure statements and the costs of tariff implementation, very few customer-facing tariffs are underpinned by cost-reflective network tariffs. • ***The limited energy literacy of energy consumers and lack of capability to respond.*** The limited energy literacy of consumers means that they are ill-equipped to understand the signals embedded in cost-reflective network tariffs, even if they were to be made available by retailers. Similarly, customers will require the technology to respond to cost-reflective pricing. While that technology is available, it is almost entirely absent from residential and small business premises currently and therefore a capital investment will be required by those customers in order to respond to price signals. These barriers present a high risk of the price signals presented to customers not being aligned with network tariff signals. Locational network tariffs aligned with the granularity required to efficiently signal distributed energy resource opportunity and value are anticipated to see a significant proliferation of

Consultation Paper Feedback Question	Energy Queensland Comment
	tariffs resulting in additional complexity (for networks, retailers and customers) as well as driving tariff temporal instability issues, widespread tariff geographic boundary issues and market confusion. An alternative to locational prices in tariffs is to directly address the network constraint value to the market through the dynamic layer as described in Ergon Energy's Supporting Information - Revised Tariff Structure Statement 2017 to 2020, October 2016. This approach provides a mechanism to bypass any distortion that is occurring in the retail layer, aligns with simpler and stable tariff structure statement network tariffs, allows rapid response to changing network opportunities and opens up the potential to respond to locational price signals to the broader market (i.e. the opportunity is not just mediated through the retail tariff). Essentially, there is an opportunity for a mechanism, such as Ergon Energy's Optimal Incremental Pricing method, to work alongside cost-reflective tariffs to provide locational value in the medium term (i.e. not long run, but beyond the current regulatory period) on a dynamic basis.
Question 2 Do stakeholders consider that there are any 'missing markets' or 'missing prices' beyond those that will be implemented through cost-reflective network tariffs? If so, what are these?	There are currently multiple markets in which the efficient adoption and coordination of distributed energy resources is encouraged. This is not limited to network tariffs but is also found in demand management programs and, at a larger scale, in network investment decisions. It is therefore prudent that the AEMC considers the full breadth of market impacts of distributed energy resource coordination and optimisation as part of this project. In addition to gaps between the approved network tariffs and retail customer prices, network tariffs are not anticipated to be able to offer the granularity needed to provide precise temporal and locational prices. Smaller areas may experience network issues that are not

Consultation Paper Feedback Question	Energy Queensland Comment
	sufficiently addressed by even the most nuanced cost-reflective network tariffs. This implies that demand management programs will be necessary and will need to work in conjunction with signals in cost-reflective network tariffs. An additional consideration is that power quality management and voltage management costs (which are even more locational in nature than demand/capacity driven investment) are forecast to increase for network businesses, and these costs have not yet been signalled through cost-reflective network tariffs.
Issue 2: Network Access	
Question 3 Do stakeholders consider that an open access regime will continue to be appropriate in an environment of increasing uptake of distributed energy resources and more constraints on distribution networks? If not, what principles or considerations should be taken into account in determining whether a different access regime is more appropriate?	While networks currently operate under an open access regime there are constraints that determine how much energy can be imported or exported in any given sub-segment of the network and the connections to that segment. Consequently, customers either operate within those constraints or the constraints must be removed at the time of connection. Energex and Ergon Energy are not permitted to refuse connection of distributed energy resources in areas of the network that are constrained. Instead, the customer is offered alternative options for connection when a constraint is found to exist as part of a technical assessment, for example: partial or full export limitation; spreading connections evenly across three phases; leveraging reactive power control functionality in inverters; or performing connection augmentation. Where augmentation of the shared distribution network is necessary, the customer may be required to pay a capital contribution towards those costs (in line with the Australian Energy Regulator's (AER's) connection charge guidelines and distributor connection policies). However, as small customers with less than or equal to 100 amps per phase in Energex's distribution area and 80 amps per phase or 10 kVA on Single Wire Earth Return (SWER) lines in Ergon Energy's distribution area are

Consultation Paper Feedback Question	Energy Queensland Comment
	exempt from the requirement to pay a capital contribution towards shared network augmentation, almost no residential customers are required to contribute to shared asset augmentation triggered by the installation of a distributed energy resource. The uptake of large scale embedded generation on distribution networks is, in many cases (but most particularly in Queensland), continuing at a rate and volume greater than that experienced by the corresponding transmission network service provider. The shift to a greater volume of generation existing as market exempt (i.e. generating systems with a nameplate rating of less than 5MW) and non-scheduled, in conjunction with the collective mass of household solar PV systems and battery storage, is not visible in real time to either the transmission network service provider or the market operator and is also largely invisible to those parties in terms of planning. This situation therefore elevates the role of the distribution network service provider in system security, particularly in western Queensland where there is no transmission network. In Energy Queensland's view, as South Australia has become an indicator for the future of transmission networks, Queensland is likely to be the indicator for the future of distribution networks with mass distributed energy resources. Further consideration as to the impacts of non-synchronous generation systems on distribution networks and their impact on the market is therefore necessary. With the emergence of distributed energy resources, distribution networks have increasingly been required to deal with a reduced level of export diversity compared to load diversity, i.e. much (if not all) of the distributed energy resources that export energy are automatically dispatched when fuel (sun or wind) is available and occur with little diversity at a local level where they can have significant impacts on the local demand and voltage. One approach to the lack of diversity in generation from distributed energy resources is to use local load and energy storage under control to follow the local generation patterns.

Consultation Paper Feedback Question	Energy Queensland Comment
	The Distribution Market Model needs to encourage the efficient mix of distributed energy resources and their control to allow all parties connected to the network to have access to the network. Where an individual customer's appliance operation affects the quality of other customers' supply, then remedies can be applied. Currently, under the *Electricity Regulations 2006* (Qld) a customer causing interference to another by the operation of equipment in their installation can be required to remedy the interference. More recent experience with solar PV generation is that the disconnection occurs automatically within the inverter energy system. There is, however, no industry accepted position on how often the distributed energy resource must operate. In Ergon Energy's distribution determination for the 2015-2020 regulatory control period, the AER included the position that if a customer's inverter is set correctly to 255V it will trip off when it exceeds that level, thereby avoiding a network overvoltage issue. However, the customer's system is unable to operate and generate electricity until the voltage drops and the inverter can reconnect. This impacts the customer's financial return from their investment in a micro-embedded generator, as they are unable to supply internal loads or export and also has impacts on the inverter itself from the increased switching. While it is understood that distributors are obliged to facilitate the connection of micro-embedded generators to allow at least some export, there is no minimum percentage that must be allowed for. The AER did not address any customer impacts of reduced micro-embedded generation availability in Ergon Energy's final determination. To further facilitate open access for the connection of distributed energy resources certain standard requirements must be met with respect to power quality, including voltage management and ramp-back capabilities. Currently, Energex and Ergon Energy require reactive power control as a mandatory requirement for all micro-embedded generators

Consultation Paper Feedback Question	Energy Queensland Comment
	greater than 2 kVA (Ergon Energy) and greater than 3 kVA (Energex) on the main grid to support greater uptake and recently altered our standards to also allow Q(V) (also known as volt var mode) to allow reactive power to be used as a function of local voltage. A more desirable outcome would be the combination of volt-watt and volt-var, thereby leveraging the four quadrants of the inverter capability, and ensuring the inverter ramps back based on local conditions. However, current inverter technology lacks the capability to combine these modes. Because of the nature of distribution and the connection of a range of distributed energy resources, standards and automated operating protocols will be critical. Energy Queensland therefore considers a national approach to standards and automated operating protocols for access to the distribution system should be a priority.
Issue 3: Connection Charges	
Question 4 Is there support for the Commission's proposal that the deletion of clause 6.1.4 of the NER be explored?	Energy Queensland supports deletion of clause 6.1.4 of the National Electricity Rules to allow for distribution use of system charges to be incurred for the export of electricity generated by a user into the distribution network. The continued growth in solar PV embedded generation is continuing to present network-related challenges. These challenges include maintaining electricity supply quality for customers and managing the effects of reverse power flows, both of which increase the costs of providing distribution network services. In its final distribution determinations for Energex and Ergon Energy, the AER allocated Energex $24 million and Ergon Energy $26 million in capital expenditure to manage power quality issues caused by solar PV on Queensland's networks during the 2015-2020 regulatory control period. However, we have estimated that the actual costs are likely to be closer to $59 million for Energex and

Consultation Paper Feedback Question	Energy Queensland Comment
	$50 million for Ergon Energy. These estimates include expected capital expenditure on augmenting the network, changing operating practices, managing customer voltage complaints and installing equipment to monitor and manage power quality issues. In light of the expected continued growth of distributed generation, Energex and Ergon Energy consider that the ability to charge network users distribution use of system charges for electricity export would: • ensure that the costs incurred by networks in facilitating the export of electricity to the grid are aligned with the source; and • assist in ensuring that customers who do not adopt distributed energy resources or do not use distributed energy resources for purposes other than to offset their own energy consumption are not disadvantaged. A similar approach exists in many modern platform business models (for example, Airbnb) and works equally as well with smart and passive distributed energy resources.
Issue 4: Australian Standards	
Question 5 Are there any other aspects of the development of Australian standards that are relevant and should be considered?	Energy Queensland supports ensuring that Australian Standards for distributed energy resources and related technologies should be fit-for-purpose and forward looking. Because of the nature of the distribution system it is anticipated that the future operation of networks will need to be automated and that standards will be required to not only deal with technical aspects but also the protocols for communications and operating procedures. An important consideration with respect to the development of Australian Standards is that each standard takes significant time to develop and implement. For example, the review of AS/NZS 4777 (Grid connection of energy systems via inverters), which had not been revised

Consultation Paper Feedback Question	Energy Queensland Comment
	since 2005, took approximately three years from publication of a first draft in 2013 to finalisation in 2016. This lengthy timeframe can in large part be attributed to the fact that standards are developed by volunteers who receive no financial reward and almost always require the support of their organisation to accommodate the significant time commitments involved. However, given the rapid pace of technological change, it will become increasingly important for standards to be reviewed regularly to remain relevant and this will therefore be a significant challenge for the market. A further issue for consideration is that jurisdictional requirements, such as the *Professional Engineers Act 2002 (*Qld), make it necessary for any work that falls outside a prescriptive standard or is subject to extensive engineering judgement to be performed by or under the direct supervision of a registered professional engineer. While the installation and operation of small-scale distributed generation (systems up to 30 kVA) has been enabled almost entirely through standardised designs to date, the complexity that will be introduced as a result of the increased uptake of energy storage, energy control systems, and protection will be well outside the scope of existing "prescriptive standards", resulting in potentially serious safety concerns and many professionals who may be exposed to legal prosecution. Consequently, there is an opportunity for prescriptive standards to be developed for a wide-range of distributed energy resources to ensure the safety of consumers and the wider public as well as minimise costs.
Issue 5: Technical Requirements and Connection Arrangements	
Question 6 Do stakeholders see value in the AEMC (or other party) reviewing the technical requirements that DNSPs apply to the connection of distributed energy	Energy Queensland supports a move towards greater consistency in technical standards for connection of distributed energy resources to distribution networks and also considers there may be value in greater alignment of communication and procedural protocols across network businesses. Many of the challenges resulting from the increased uptake of

Consultation Paper Feedback Question	Energy Queensland Comment
resources?	distributed energy resources will be common to all network service providers, with jurisdictional requirements being the key points of difference. However, Energy Queensland does not support a third party review of technical connection standards. As demonstrated by the work recently undertaken by Energex and Ergon Energy in developing and implementing joint standards (described below), we consider that national consistency can best be achieved through effective collaboration by distribution network service providers in consultation with industry and customer stakeholder groups. Energex and Ergon Energy have already worked together to develop and implement a Queensland-wide connection standard for micro-embedded generating units up to 30 kVA. In developing this joint standard, Energex and Ergon Energy undertook full industry consultation, including stakeholder workshops with customer and industry groups such as the Clean Energy Council and Customer Advocate, and published draft standards for stakeholder feedback. The final document, which is straightforward and effective, has been well supported by stakeholders and is considered to have set a benchmark for other network service providers. Energex and Ergon Energy are now also currently developing a joint standard for connection of embedded generating systems (greater than 30 kW to 1,500 kW) to a distributor's LV network, with a draft standard for connection of embedded generating systems (greater than 30 kW to 5 MW) to a distributor's HV network due to be released for public consultation in coming months. We also note that the New South Wales government has recently contracted CutlerMerz to undertake a review of the embedded generator standards within that State to establish alignment. Energex and Ergon Energy have offered to assist in this project and have already provided early input and shared insights from our own joint workings.