2 February 2018

Ms Audrey Zibelman
Chief Executive Officer
Australian Energy Market Operator
GPO Box 2008
MELBOURNE VIC 3001

Dear Ms Zibelman

Integrated System Plan Consultation

Energy Queensland Limited (Energy Queensland) appreciates the opportunity to provide a submission to the Australian Energy Market Operator (AEMO) on its document entitled *Integrated System Plan Consultation* (consultation paper), the purpose of which is to provide information about a proposed Integrated System Plan (ISP) to be published in June 2018.

Energy Queensland is fully supportive of the development of a nationally integrated, long-term strategic plan for the National Electricity Market (NEM) as it is critical for the industry to have a plan that underpins the reliable and cost-effective integration of renewable energy resources. Notwithstanding our support for the development of an ISP, Energy Queensland considers that there will be scenarios where the lowest cost option for delivering continued reliability and security of the NEM while meeting emissions targets, will exist in the distribution network. Consequently, it is recommended that the ISP would benefit from including distribution networks as part of its scope.

Energy Queensland's comments on the proposed ISP and specific issues raised in the consultation paper are provided in the attached submission. Should you require additional information or wish to discuss any aspect of Energy Queensland's submission, please do not hesitate to contact either myself on (07) 3851 6416 or Trudy Fraser on (07) 3851 6787.

Yours sincerely

Jenny Doyle
General Manager Regulation and Pricing
Telephone: (07) 3851 6416 or 0427 156 897
Email: jenny.doyle@energyq.com.au

Energy Queensland

Submission to the Australian Energy Market Operator

Integrated System Plan for the National Electricity Market

Energy Queensland Limited

2 February 2018

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 business, Energy Impact Pty Ltd (trading as Yurika).

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 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 the new energy services business Yurika which will provide customers with greater choice and control over their energy needs and access to the next wave of innovative technologies and renewables.

Contact details

Energy Queensland Limited
Jenny Doyle
Phone: +61 (7) 3851 6416
Email: jenny.doyle@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

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1 Introduction

On 17 December 2017, the Australian Energy Market Operator (AEMO) published a document entitled *Integrated System Plan Consultation* (consultation paper). The purpose of the consultation paper is to provide information about a proposed Integrated System Plan (ISP) to be published in June 2018 and invite feedback from stakeholders and interested parties.

The inaugural ISP is being prepared by AEMO as a result of the *Independent Review into the Future Security of the National Electricity Market* (Finkel Review) which recommended that:

> "By mid-2018, the Australian Energy Market Operator, supported by transmission network service providers and relevant stakeholders, should develop an integrated grid plan to facilitate the efficient development and connection of renewable energy zones across the National Electricity Market."[1]

It is AEMO's intention that the ISP should be a long-term strategic infrastructure development plan that will deliver continued reliability and security of the National Electricity Market (NEM), at least long-term cost to consumers, while also meeting emissions targets.[2] In particular, it is intended that the ISP will consider:

- factors that contribute to a successful renewable energy zone (REZ) and how to develop any REZs that are identified; and
- options for transmission development.[3]

AEMO has requested that interested parties make submissions on AEMO's modelling and analysis by 2 February 2018 and on other questions and matters by 28 February 2018. Energy Queensland's comments on both AEMO's modelling and other matters raised have been provided in Sections 2 and 3 of this submission.

We look forward to engaging in further consultation on the development of the ISP and are available to discuss this submission or provide further detail regarding the issues raised.

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[1] Finkel et al., 2017. *Independent Review into the future security of the National Electricity Market: Blueprint for the Future,* June 2017, recommendation 5.1, p. 24.
[2] AEMO, *Integrated System Plan Consultation*, December 17, p. 11.
[3] Ibid, p. 3.

2 General comments

The Australian electricity industry has been undergoing significant and disruptive change over recent years, impacting all levels of the supply chain. A key component of the evolving energy landscape is the increasing domination of renewable generation (primarily wind and solar photovoltaic (PV)) and a corresponding decline in traditional coal and gas-fired generation. Distribution network service providers, such as Energex and Ergon Energy, are already actively responding to the technical impacts of these changes, with one of our key forward planning strategies being to enable greater integration of new technologies into the network while ensuring the ongoing reliability and security of supply. We see positive outcomes for customers and the wider Queensland community through this approach. Energy Queensland is therefore fully supportive of the development of a nationally integrated, long-term strategic plan for the NEM. It is critical for the industry that it has a plan that underpins the reliable and cost-effective integration of renewable energy resources.

Notwithstanding our support for the development of the ISP, Energy Queensland notes from the consultation paper that AEMO, as the National Transmission Planner for the NEM, has focussed primarily on the development of the transmission network and interconnected infrastructure, including generation, gas pipelines and distributed energy resources.[4] While there is without doubt considerable benefit to be gained from a strategic approach to integrated generation and transmission network planning, Energy Queensland considers that focussing at the transmission network level is too limited for a number of reasons, including:

- 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. Regional and rural Queensland in particular have seen significant growth over the last three years in the number of large-scale generation connections, largely attributable to the State's high solar irradiance, the available and affordable land mass and Queensland's renewable energy target. Energy Queensland currently has a pipeline of more than 1.2 GW of committed renewable generators connecting to its network and renewable generator connections are expected to continue to increase, with forecasts suggesting that by 2030 there could be as much as 8.3 GW of renewables connected in Queensland to achieve the State's

[4] Ibid, p. 3.

renewable energy target. A significant proportion of those renewables will be connected to Energy Queensland's distribution networks.

- The Queensland distribution networks have already integrated the highest penetration of residential solar PV in Australia, with south-east Queensland having one of the highest penetrations of solar PV in the world. Currently, there are approximately 462,000 stand-alone houses with solar PV in Queensland, which equates to 1.95 GW of aggregate capacity. In our future, while solar PV is expected to continue to increase, batteries and electric vehicles will emerge in higher penetrations as costs continue to fall and customers are able to benefit from these technologies. Indeed, AEMO has recently forecast that uptake of rooftop solar and batteries is expected to quadruple over the next twenty years and that there will be a significant increase in the uptake of electric vehicles from 2020 onwards.[5]

- 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 AEMO and is also largely not visible to those parties in terms of planning (although the proposed distributed energy resources register will go some way to addressing this issue).

- Due to the vast geographic size of Queensland and its dispersed electricity network, it is important that any strategic planning should take into consideration the location of all new generation connecting to both the transmission network and the distribution network as well as the impacts of different weather patterns across the State on the overall system.

- Given that system limitations (i.e. capacity and voltage) will often exist at the distribution network level, there is an increasing need for orchestration of distributed energy resources within the distribution network and the "aggregator of aggregators" back to a transmission node, for example, by a Distribution System Operator.

Energy Queensland considers that these factors elevate the role of the distribution networks in system security, particularly in western Queensland where there is currently no transmission network and more than 1 GW of solar. Energy Queensland also believes

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

that there will be scenarios where the lowest cost option for delivering continued reliability and security of the NEM while meeting emissions targets, will exist in the distribution network. It is therefore suggested that the ISP would benefit from including distribution networks as part of its scope and Energy Queensland recommends that any further development of the ISP should also include input from distribution network service providers.

3 Detailed comments

Ref.	AEMO question	Energy Queensland comments
1.1	The material questions the ISP seeks to address are in Section 1.3.1. Are there any other questions the ISP should address?	Energy Queensland is generally supportive of the material questions the ISP seeks to address and the intent of each question. However, we consider that investment in or management of distributed energy resources within the distribution network or at a customer premise level may be the most efficient solution to addressing the energy trilemma. We are already seeing significant investment in these areas and believe the system should ultimately be moving towards topologies that maximise the opportunities to leverage distributed energy resources. Consequently, Energy Queensland recommends that the second question under "In pursuing this pathway: …" should be amended to include the potential for distribution network and demand-side investment, as follows: "Could large-scale renewable generation in targeted zones provide an efficient solution for future power system development, and what storage, transmission network, distribution network or demand-side investment would be needed to support such an outcome?" In addition, as the NEM is quite diverse, Energy Queensland would expect that the material questions addressed by the ISP should consider a variety of network topologies, i.e. from urban centres through to remote networks.

Ref.	AEMO question	Energy Queensland comments
1.2	The scenarios the modelling will use to inform the ISP are outlined in Section 1.4. Recognising the time limitations to produce the first ISP in mid-2018, are these suitable scenarios to address at a high level? Should these be expanded in more detailed analysis following the first high level ISP?	Energy Queensland considers that the proposed scenario design outlined in Section 1.4 is relevant for a first pass (draft) ISP. However, it is expected that the detail within each scenario will be available for further review and refinement at a later stage in the consultation process. We also strongly recommend the use of the scenarios developed by Energy Networks Australia and CSIRO for the *Electricity Network Transformation Roadmap* as the ideal reference scenarios. Energy Queensland also provides the following comments with respect to AEMO's scenario analysis: • A critical component for consideration in developing the scenarios is the forecast uptake of rooftop solar PV and other distributed energy resource technologies (such as battery energy storage systems and electric vehicles). This issue has already been confronted by Energy Queensland when managing distributed energy resources connecting to the Energex and Ergon Energy networks, particularly in rural areas. • With a proposed future uptake of at least 50 per cent of renewable generation in Queensland by 2030 and, given that a significant proportion of this generation will exist at the distribution network level (including the low voltage networks), advanced generation and demand management systems will be essential to the overall efficiency and operation of the market. • Demand-side solutions, including energy efficiency and the subsequent demand reduction benefits, may present a complementary and efficient option to reduce the need for additional infrastructure. While this factor is captured in Section 1.4, Energy Queensland considers that it should be captured in more detail to ensure that it is adequately modelled.

Ref.	AEMO question	Energy Queensland comments
		• With regard to the second sensitivity outlined in Section 1.4.1, Energy Queensland considers that where this distributed energy resource exists in the distribution network (i.e. downstream of a transmission node) then the orchestration may be performed by an entity other than AEMO (such as a Distribution System Operator – noting the work currently underway between Energy Networks Australia and AEMO on drafting a framework). Therefore, it is recommended that AEMO should consider variations of the level of orchestration possible in order to evaluate the benefit of distribution orchestration of distributed energy resources to support AEMO, particularly given the lack of visibility of local network constraints and topology available to AEMO. • It is recommended that the scenario assumptions in Table 1 be tightened to align with the Queensland renewable energy targets to 2020 and 2030 and related initiatives outlined in the Queensland Government's *Powering Queensland Plan*, published in June 2017. • Further consideration should be given to the impact that market rules and specific conditions have on the behaviours of proponents when connecting to the system, for example, differences between the classification (and therefore controllability and varying obligations) of generators. These differences can emerge within a single sub-transmission (distribution) network simultaneously, resulting in the need for varying levels of network reinforcement depending on the way in which they are orchestrated (if at all). • Energy Queensland has had preliminary discussions with proponents regarding pumped storage options across the NEM in a more distributed manner, for example, the Kidston project in North Queensland. While the Snowy 2.0 project is large-scale and the transmission infrastructure is largely already in existence for this project, other projects

Ref.	AEMO question	Energy Queensland comments
		may be in ideal locations from a Distribution Loss Factor (DLF) or Marginal Loss Factor (MLF) perspective but may not have the existing electrical infrastructure to facilitate their development. Therefore, inclusion of integration for distributed low-cost storage opportunities (for example, pumped hydro or thermal energy storage) across the NEM into the modelling would also be beneficial.
2.1	What are the key factors which can enable generation and transmission development to be more coordinated in future?	The articulation and visibility of system strength is a fundamental technical constraint for the interoperability of generation plant. There are several key components to this issue that are being considered by various rules changes and industry working groups. The core issues include: • Providing for earlier availability and ease of sharing of dynamic and electromagnetic transient models to assist proponents in assessing the technical and economic feasibility of sites at an earlier stage. • Increasing visibility of the changing system strength or expected changes to system strength for all key nodes in the NEM. • Protecting the NEM from poorly designed generating systems that put significant negative pressure on system strength. • Developing clearer national guidelines and standards relating to original equipment manufacturer requirements to prove operability and interoperability, particularly in low system strength regions. • Reviewing the interaction and compatibility of market classifications of generating units (i.e. exempt, non-scheduled, semi-scheduled, scheduled) where they exist within common network elements.

Ref.	AEMO question	Energy Queensland comments
		• Providing for centralised distributed energy resource orchestration beyond transmission nodes (including “aggregator of aggregators”) to more effectively enable optimisation of the interaction between transmission proponents and assets (controlled and visible by AEMO) and distribution proponents and assets (generally not controlled and visible by AEMO). (In this regard, it is important to note that while the study is focussed on increased interconnection within the transmission networks, the level of interconnection (meshing) is unlikely to increase within distribution networks and that this will need to be considered.) • Investigating the removal of key barriers to efficient development of renewable projects, including removing the confidentiality restrictions placed on network service providers. These restrictions have the potential to result in circumstances where multiple proponents are undertaking a connection application process concurrently in areas of the network where system strength will not facilitate multiple connections. This process has the potential to involve significant time and costs for proponents and there is a risk that those costs may not be recovered if they are not the first proponent to commit and their project is no longer technically or economically viable. • Facilitating regular working groups between network service providers on electrical infrastructure development at a strategic level to ensure these and other emerging issues are addressed to enable generation and network development to be more effectively coordinated in the future.

Ref.	AEMO question	Energy Queensland comments
3.1	Does this analysis capture the full range of potential REZs in eastern Australia?	While the analysis captures the major REZ opportunities in Queensland, Energy Queensland considers that there are also other, albeit smaller, REZ opportunities that should be included, such as in the Wide Bay region, North West Minerals Province and the North Maranoa region and other potential locations for pumped and thermal storage.
3.2	What other factors should be considered in determining how to narrow down the range of potential REZs to those which should be prioritised for development?	Energy Queensland agrees that the quality of resources (i.e. wind or sun), which has been identified as a driver for efficient siting of REZs, is a critical factor. However, we consider that the following factors should also be considered: • The combination of different size, technology type and operating capability of generating units, taking into consideration the interaction and compatibility of market classifications where they could exist within a single REZ. • The potential for other renewable generation sources, such as geo-thermal energy, which may assist in influencing the optimal location of transmission infrastructure in western Queensland (where the geo-thermal resource is prevalent). • Given the predominance of solar in the NEM, irradiance levels and the timing of irradiance with regard to peak loads in different parts of the NEM. As there is significant variation in daylight hours across the NEM, it is possible that a greater interconnected network could harness sunlight in remote locations to more effectively correspond to peak load times. • The potential for REZs to be co-located with existing or future major industry or emerging economic opportunities (for example, energy intensive operations such as mining, minerals processing or manufacturing), so that the infrastructure can promote economic

Ref.	AEMO question	Energy Queensland comments
		development and deliver community benefits in regional areas. For example, in western Queensland there are many mining and gas facilities that are not grid connected, but which have a potentially significant contribution to greenhouse gas emissions and duplication of generation infrastructure, that could provide economic and technical benefits and reduce emissions. • The opportunity to distribute smaller, diverse REZs adjacent to load centres through multi-technology adoption at the sub-transmission level. For example, Energy Queensland operates 132kV, 110kV and 66kV assets across the State that would effectively facilitate “mini-REZs" that would support load centres, reduce losses and improve reliability. • Network resilience and micro-grid opportunities as part of the value proposition for REZs, particularly in Queensland with the impact of natural disasters (cyclones). • Expected growth rates in renewable generation in each region, particularly given jurisdictional influences. For example, the growth in renewable generation in Queensland over the forward period to achieve the 30 per cent and 50 per cent renewable generation targets.
3.3	What are the potential barriers to developing REZs, and how should these be addressed?	In addition to the potential barriers identified in the consultation paper, Energy Queensland highlights the following potential challenges for consideration: • In some instances asset replacements may not be viable at current levels of redundancy on load alone due to changes in security criteria or if the distribution network service provider looked to micro-grid communities. Consequently, the establishment of REZs

Ref.	AEMO question	Energy Queensland comments
		may require upgrading or replacement of assets that otherwise would be retired and consideration is therefore required as to how works to enable generation will be funded. • The building of major new infrastructure has the potential to significantly impact DLFs and MLFs for existing generators. These impacts will need to be managed appropriately. • The alignment of load and generation is critical to the development of REZs. It will therefore be necessary for any national electrical infrastructure plan to take a holistic view of how the population and load centres will look in 2040 and beyond. For instance, a greater concentration of population (for example, in Brisbane) has a different transmission configuration to a more distributed population (for example, in regional Queensland) which may be better able to utilise generation closer to the source and improve local resilience.
4.1	Have the right transmission options been identified for consideration in the ISP?	Energy Queensland owns and operates a significant amount of 132kV and 110kV assets across Queensland and believes there are also distribution options that could potentially resolve constraints and provide for greater diversified renewable generation opportunities, particularly in areas of the distribution network that are already energised at 110kV or 132kV. Energy Queensland also considers that: • The reinforced Queensland transmission backbone is likely to have an impact on fault levels in some areas of the regional network which may affect plant ratings. Although detailed investigation will be required, that impact should be incorporated to some extent in the economics of the project feasibility plan. • Any development of reinforced Queensland infrastructure should take into account historical weather events, particularly cyclones and flooding events to improve and increase system resilience.

Ref.	AEMO question	Energy Queensland comments
		• Regulatory, commercial and economic options may need to consider regulated and unregulated assets to minimise duplication of assets and open up a wider region for generation capability. • Connection further west of the proposed Queensland backbone route may allow further large loads to be connected into the transmission infrastructure, such as major mining operations through Central Queensland and the Galilea Basin (perhaps running from Wandoan South through to Carmichael Mine and then connecting into the southern side of the *Powering North Queensland Plan* ring). This would still allow the west to east connection line but broaden the region and open up greater irradiance zones and access to hydro, wind and geothermal resources.
4.2	How can the coordination of regional transmission planning be improved to implement a strategic long-term outcome?	Energy Queensland recommends that, as the National Transmission Planner for the NEM, it would be appropriate for AEMO to facilitate: • Regular working groups between network service providers on electrical infrastructure development at a strategic level. These working groups, which should include representatives from the strategic planning areas of each transmission network service provider and distribution network service provider across the NEM, would: – assist in ensuring there is greater harmony and cohesiveness between transmission networks, distribution networks and AEMO; and – facilitate a consistent best practice approach to joint planning across NEM regions.

Ref.	AEMO question	Energy Queensland comments
		• Short- to medium-term planning working groups to moderate and evaluate distribution network service provider and transmission network service provider plans (as defined in annual planning reports, regulatory investment tests and joint workings) to ensure that those plans are meeting the strategic objectives of the ISP.
4.3	What are the biggest challenges to justifying augmentations which align to an over-arching long-term plan? How can these challenges be met?	Energy Queensland considers the greatest challenge to justifying augmentations will be the significant cost of these projects and the impact of cost recovery on the affordability of energy to customers in the short-term. The funding model (including regulatory reform or review) for this type of large-scale strategic investment requires greater definition, particularly around the proponent collaboration model and the framework to facilitate cost recovery of REZs.
4.4	Is the existing regulatory framework suitable for implementing the ISP?	More detail with respect to the funding model and delivery approach are required before comment can be made on the suitability of the regulatory framework for large-scale strategic infrastructure investment. Given the scale of the investment, these projects fall into a program of national significance and should have the appropriate levels of governance and support allocated to ensure their efficient delivery.