19 January 2017

Mr John Pierce
Chairman
Australian Energy Market Commission
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Dear Mr Pierce

RE: AEMC Approach Paper – Distribution Market Model (Ref SEA0004)

Ausgrid is pleased to provide comments in relation to the AEMC's Distribution Market Model Approach Paper.

Ausgrid strongly supports the policy intent for undertaking this project. Technology innovation and the falling price of rooftop solar photovoltaic systems, battery storage, electric vehicles and other technologies is dramatically changing how consumers are supplied with and use electricity.

The advent of these technologies has significant implications for distribution network service providers (DNSPs), as the integration of these technologies introduces two-way electricity flows onto distribution systems traditionally built, designed and operated based on the model of one-way electricity flows.

The uptake and proliferation of these technologies, commonly referred to as distributed energy resources (DER), is driving a fundamental change in how DNSPs operate, manage and plan their network by requiring networks to accommodate increasing levels of two-way electricity flows.

Ausgrid shares the AEMC's concern that operating and maintaining the distribution network is likely to become more challenging unless appropriate changes are made to the regulatory framework, and perhaps more broadly to distribution system operation and market design, to facilitate the efficient transition to a distribution market model characterised by dynamic two-way electricity flows.

While the regulatory framework has been sufficiently flexible to accommodate DER, it has done so in a largely reactionary basis via stakeholder initiated rule change requests. As both the demand for and levels of DER rise, and new products and services emerge, there is an increasing need for a more holistic and strategic approach towards identifying the changes required to support the efficient uptake of DER and evolution of the distribution market model.

Consequently, Ausgrid supports both the timing and objective of this project. We broadly agree with the AEMC that the scope of the project should be focussed on examining:

- the technical opportunities and challenges presented by distributed energy resources (DER) and what changes to regulatory arrangements or market design might be necessary to facilitate and support efficient integration and uptake of DER;

- whether new roles, price signals and market platforms are required to optimise the development, deployment and use of DER;
- how the role of DNSPs may need to adapt to facilitate a transition to a more decentralised market for electricity services; and
- whether the existing regulatory framework impedes or encourages innovation and adaption by DNSPs to support the efficient uptake of DER.

Our attached submission provides responses to the Approach Paper questions. While our feedback is largely consistent with the key themes and positions outlined by Energy Networks Australia (ENA) our response seeks to:

- highlight issues associated with the AEMC's proposed definition for DER and the need for greater consistency in the use of terminology across policy makers, stakeholders and market bodies;
- provide further details on future challenges associated with integrating higher levels of DER and the characteristics required to optimise the benefits that such technology can provide;
- highlight issues overlooked by the AEMC in its Approach Paper which we consider to be pertinent and warrant further investigation;
- outlines the essential features and characteristics that the distribution system must be capable of achieving in order to promote the efficient operation of the network and optimisation of DER opportunities; and
- propose changes to the scope of technical impacts to be assessed as part of this project, and highlight additional technical impacts not discussed in the Approach Paper.

If you have any queries or wish to discuss this matter in further detail please contact Murray Chandler on (02) 9269 7210 or via email murray.chandler@ausgrid.com.au.

Yours sincerely

RICHARD GROSS
Chief Executive Officer

Ausgrid's submission

Question 1

Do stakeholders agree with these definitions, or have any views on the project scope as a result of these definitions?

Ausgrid considers it important that consistent terminology and definitions are used when discussing issues and impacts associated with emerging technologies. In our view, the lack of consistency and consensus in terminology to date has created confusion and has made it difficult for policy makers and stakeholders alike to identify the opportunity for use of DER and ascertain the actual challenges or gaps in the current regulatory framework which is causing concern.

Ausgrid notes that the scope of the AEMC's project can vary significantly depending on the definition that is adopted for distributed energy resources (DER). For example, the definition of distributed energy resources may include only energy equipment capable of exporting or producing energy (e.g. generation or storage equipment) or it may include other demand side measures such as demand response of appliances, energy management systems and load-control equipment. Another key distinction is whether the definition includes all distributed generation sources regardless of whether they are controllable (dispatch-able) or uncontrollable (non-dispatch-able).

In the paper, we note that the AEMC uses the following definition:

> "the term **distributed energy resources (DERs)** is used in this paper to refer to an integrated system of *smart energy equipment* co-located with consumer load. By 'smart', we mean it has the ability to respond automatically to short-term (eg. within a trading period – 30 minutes, or dispatch period – 5 minutes, or an even shorter period) changes in prices or signals from wholesale markets or elsewhere in the supply chain. 'Energy equipment' could include a range of technologies, including battery storage, electric vehicles, rooftop solar photovoltaic (PV) systems, or household appliance such as refrigerators and dishwashers." [1]

Therefore, it appears from the above definition that the AEMC's intent is to apply a broader definition of the term that includes all energy equipment that is enabled to respond to short-term signals from wholesale markets or elsewhere in the supply chain. We consider this dispatch-ability to be a key characteristic of DERs in the context of potential distribution market models and that it should include generation, storage and demand response equipment as they can be used to balance electricity supply and demand or to provide other support functions in the electricity supply chain.

While we are generally supportive of the AEMC's proposed definition of DER we caution against the use of the following terms in this definition:

- 'smart'- as this can be interpreted differently and has different meanings that are still debated by various proponents;
- "co-located with consumer load" – as this implies that distributed generators connected direct to the distribution network with only auxiliary load are excluded from the definition. For example, a 500kW solar generator with battery storage, or a small hydro generator, without a consumer load would be excluded from the definition of a DER; and
- "automatically" – as this may be interpreted as only including equipment that responds automatically to various inputs such as price or voltage, and as a consequence may exclude energy equipment that is remotely controlled by an operator in response to short-term signals such as network peak demand.[2]

[1] AEMC, *Distribution Market Model, Approach Paper,* 1 December 2016, Sydney, p 2.

[2] In this case, the energy equipment responds to a command or communications signal by a third party (such as networks, retailers or aggregators) or customers.

Ausgrid seeks further clarification from the AEMC as to whether the intent is to exclude energy equipment from the scope of this project. If this is the case, direct load control of household appliances such as hot water systems or air conditioners by network operators, would be excluded from the scope of the project.

The exclusion of one of the largest types of distributed energy resources in Australia would appear to be an unintended consequence of the definition used by the AEMC. Ausgrid recommends that the definition be amended to include this equipment because the estimated combined load of domestic hot water systems on a controlled load tariff within NSW and QLD would be in the order of thousands of MWs. Ausgrid alone has about 500,000 customers with a domestic hot water storage systems on a controlled load tariff, with each system having a nominal rated capacity usually between 3.6 to 4.8kW. It would therefore be unwise to exclude such a significant, effective and wide spread source of DER from the AEMC's considerations.

Subsequently, to provide clarity on the intended scope of this project Ausgrid proposes that the AEMC adopt an alternative definition for distributed energy resources which focuses more on the dispatch-able nature of the distributed energy resources. For example:

> The term **dispatch-able distributed energy resources (dDERs)** used in the paper has the definition of referring to an integrated system of *energy equipment* co-located with consumer load that has the ability to respond to short-term signals from wholesale markets or elsewhere in the supply chain (e.g. within a trading period – 30 minutes, or dispatch period – 5 minutes, or an even shorter period).

We consider that this definition reflects the AEMC's intent that the relevant energy equipment to be considered within the distribution market model are dispatch-able DERs that can respond to short-term signals and should not include energy equipment that operates passively. However, we would note that the example used of a rooftop photovoltaic system being passive may not be the best example to use. Most existing inverters installed with rooftop PV systems currently operate passively but do have automatic safety cut-out features for over/ under voltage and over/under frequency. The latest AS/NZS 4777.2: 2015 standard now prescribes mandatory and voluntary demand response and power quality response modes on all inverters that are installed from October 2016. Due to this requirement, there is a greater potential for inverter energy systems to increasingly become DERs in the future as they will have the ability to provide demand response or power quality support if setup correctly or fitted with devices that enable these functions.

Question 2

Do stakeholders support this project scope? Is there anything that has not been flagged for consideration that should be? Is there anything that should be excluded from the project scope?

In the context of the approach paper, Ausgrid generally agrees with the AEMC's project scope of dispatch-able DERs being the most relevant energy equipment for developing a distribution market model. This is because dispatch-able DERs are able to respond to short-term signals from wholesale markets or elsewhere in the supply chain, and include both generation and load energy equipment.

Ausgrid supports the development of options that build upon experience and understanding of electricity markets at the transmission level, noting that one of the key differences between the distribution and transmission networks is the order of magnitude in the number of assets, connection points and distributed energy resources and the complexity of systems and management that is required to be effective.

The possibility for uncoordinated management of customer's appliances and the potential for this to create artificial peaks is a key issue not identified in the AEMC's Approach Paper, that we consider should be further investigated. The current regulatory framework creates a lack of visibility by networks of future management of customer load, which creates challenges in efficiently managing the network. The lack of visibility makes network planning more complex and problematic and is an

area of growing concern for Ausgrid. There is also a risk of network operators needing to exaggerate price signals to get appropriate market responses which has the potential to impact the balance of network pricing to particular customer types or demographics.

For example, in Ausgrid's network area there is potential for more than 2000MW of load from hot water heaters which could be operated in an uncoordinated manner by market actors leading to possible network impacts. Currently, customers on hot water load control tariffs have their water heated on a staged basis by networks to ensure that peak demand impacts are avoided.

We also consider that the AEMC should consider as part of this project the need for coordination of multiple photovoltaic (PV) generators for distributed power generation in future micro-grid scenarios. There is likely to be a growing need for coordination of active power generation and management of active power flows among distributed energy resources, while achieving supply–demand balance.

Question 3

Are there any other elements of a DNSP's role or current responsibilities that should be considered?

The Approach Paper outlines the AEMC's understanding of the challenges to existing regulatory instruments created by the increased penetration of DER. The biggest challenges identified by the AEMC appear to relate to competition concerns in respect of the broad classification of network services and the threat of foreclosure of competition without appropriate ring-fencing arrangements.

However, we consider that meeting future grid requirements of flexibility and agility involves challenges that are broader than competition concerns. Consequently, we urge the AEMC to expand its focus to include:

- The need for advanced planning and greater visibility of activities occurring at the premise that will impact the low voltage and distribution network;
- communications and data systems;
- cyber security of systems; and
- the uncoordinated operation of aggregated customer load by third parties, which can create artificial peaks.

We note that the ENA has already commenced work to identify and investigate key challenges of DER, as part of its electricity network transformation roadmap (Roadmap). The AEMC may find it useful to build upon the key findings from the ENA's Roadmap as part of its project. The Roadmap identifies that some of the key changes to market design and regulatory frameworks to support the efficient update of DER and evolution of the distribution market model as being:[3]

- the development of platforms to stimulate customised energy options in dynamic markets;
- the development of a universal authorisations and exemptions framework for the provision of new services;
- better engagement with customers, including reforms to customer protections frameworks;
- the implementation of new frameworks and services for achieving system security;[4]
- fast tracking of infrastructure to allow for more efficient pricing;
- development of new pricing arrangements to reflect new and differentiated services;
- modernising regulatory frameworks to reflect the customers new central role in the process;
- the trialling of alternative regulatory processes which are more adaptive to the transformation of the energy supply chain;

[3] Energy Networks Australia, *Electricity Network Transformation Roadmap: Key Concepts Report,* December 2016.

[4] Ibid, for further details refer to Chapter 5 and 6.

- the development of market based approaches for providing efficient capacity as well as balancing and ancillary services;
- the development of advanced protection systems to enhance system operation and security;
- the development of open standards, extended monitoring, advanced planning and feeder hosting analysis and the mapping and locational valuation of distributed energy resources[5];
- The development of basic Network Optimisation Market Functions and the piloting of more Advanced Network Optimisation Market functions with collaborative projects demonstrating the integration of both projects.[6]

Question 4

Are there any aspects of the regulatory framework that are not set out in sections 2.3 or 2.4 but which should be considered through this project?

Refer to Ausgrid's response to Question 3.

Question 5

Should the coordination of distribution systems with distributed energy resources be centralised under the direct control of one body? Or should it be devolved and performed in a tiered manner?

Ausgrid supports the adoption of a tiered approach towards the coordination of distribution systems with distributed energy resources. We consider that there is a need for centralised standards and principles, however as needs are likely to vary between networks (for example more voltage requirements are likely to be required in rural networks as opposed to those which operate in more urbanised areas), there is also a need for DNSP coordination. Further, as needs will likely be local in nature it makes sense and is also likely to be more efficient if there is some level of coordination undertaken by DNSPs.

Question 6

Do stakeholders agree with the Commission's framework and these principles of good market design? Is there anything that the Commission has missed, or is unnecessary?

The Approach Paper infers that customer outcomes will be maximised through its market design principles, while acknowledging trade-offs are likely to occur between different principles. While Ausgrid broadly supports the AEMC's proposed principles we consider that these could be improved by including a principle that ensures efficient and fair outcomes for customers. This would assist in promoting customer outcomes more broadly (other than customer choice) by requiring the AEMC to consider the impact of market design options on all customers not just those that benefit from new technological developments.

Question 7

Are there any other issues the Commission should have regard to in considering possible market design options?

[5] Ibid, for further details refer to Chapter 10.
[6] Ibid, for further details refer to Chapter 11.

In considering market design options, Ausgrid considers that in addition to the market design principles it would be useful for the AEMC to consider whether the options are likely to facilitate the following outcomes:

- allow distribution systems to seamlessly enable orchestration and self-optimisation at the customer level;
- allow distribution systems to integrate distributed energy resources in a way that supports both power system reliability and economic efficiency;
- enable the distribution system to provide equivalent firmness of response to traditional network response;
- support the distribution system to be non-discriminatory;
- promote network optimisation opportunities in a transparent manner which reflects the actual distributed energy resource provided;
- promote observable and auditable outcomes; and
- allow distribution systems to be scalable, adaptable and extendable.

Question 8

Do stakeholders agree with the Commission's assessment of the technical impacts of distributed energy resources set out above in sections 4.1 to 4.8?

In light of additional penetration of DER, the aggregate technical impact needs to be considered, with the impacts more severe if the operation of distributed energy resources is not orchestrated to minimise negative outcomes.

Ausgrid notes that the description of the technical impacts listed by the Commission in section 4 appears to be more of a summary of the possible technical impacts of distributed energy resources and distributed generation rather than a detailed assessment of impacts. We broadly agree that the main technical themes are listed but would recommend more detailed studies be conducted to quantify the impacts and technical limitations.

In Ausgrid's case, for example, there have been no significant technical impacts from the increase in DERs and distributed generation to date. In areas with reasonably high levels of distributed generation we have been able to manage voltage level impacts and adjust our practices to accommodate distributed generation at the low voltage level. For example, Ausgrid's 230V migration program of adjusting transformer settings across the network allows for voltage rise headroom to better account for increased distributed generation and avoid significant network augmentation.

Below are some further comments on the list of possible technical impacts in section 4.

- Section 4.1 refers to voltage stability, however voltage range is also important as too much generation or not enough generation may mean that the network voltage operates outside of the desired range for periods of time.
- Section 4.6 refers to overloading equipment in reverse power flow. However Ausgrid's main concern is overloading of equipment due to co-incident control of distributed energy resources with power flow in either direction. There is a real likelihood that equipment ratings would be exceeded and the networks turns off to protect itself if all battery chargers, electric vehicle chargers and hot water systems in a localised area with a high penetration of these appliances, were coordinated by an electricity retailer or some other party to start charging at the same time (e.g. off peak 10pm).

We would also note that section 4 appears to refer to technical impacts from distributed generation which is largely passive (solar PV). However, the Commission's definition of distributed energy resources in section 1.3 refers to short-term response as one of the key characteristics of DERs. We

found that the usage of the term distributed energy resources in section 4 appeared to contradict the way the term was defined in section 1 as most of the commentary in section 4 appeared to refer to the technical impacts from distributed generation that is mostly passive (solar PV). This reinforces the need to be consistent with the definitions and use of certain terms in the approach paper.

Question 9

Do stakeholders agree with the Commission's preliminary assessment of these opportunities, and possible solutions to address the technical impacts of distributed energy resources?

Ausgrid agrees with the technical solutions proposed in section 4.9 but is unsure about the market based approach as it relies on customers operating their equipment as we incentivise them to do but still enables them to operate it in an unsafe / unreliable manner.

Question 10

Do stakeholders have any initial views on who should be responsible for managing these opportunities, or implementing possible solutions to the technical impacts?

Ausgrid understands that a combination of all opportunities will contribute to addressing the overall management of the increase in DER penetration. The portfolio of solutions required to adequately manage this uptake will heavily depend upon the local or jurisdictional network needs as the variety of network topologies is likely to drive a different range of solutions for that area. This requires a significant contribution from the local network manager in addition to market input to determine the appropriate approaches to be successful.