Australian Energy Market Commission

Integration Of Energy Storage

Regulatory Implications

FINAL REPORT
3 December 2015

This paper examines whether changes to regulatory frameworks are required to integrate energy storage in the electricity sector.

Inquiries

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

E: aemc@aemc.gov.au
T: (02) 8296 7800
F: (02) 8296 7899

Reference: SEA0002

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About the AEMC

The AEMC reports to the Council of Australian Governments (COAG) through the COAG Energy Council. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the COAG Energy Council.

Executive Summary

Storage devices, including batteries and pumped hydro units, are not new technologies and some have been used in Australia's energy markets for decades. What is new is that technological advances, particularly in battery storage, are making the functions they perform cheaper and more accessible to a wider range of users. As a result, the potential range of storage applications is increasing. Greater penetration, including at the residential level, allows the technology to be used in a much more disaggregated fashion and under the control of consumers. This has led to questions about whether the existing regulatory frameworks are sufficiently flexible to support the integration of storage technologies.

The AEMC has undertaken analysis of storage and its uses across the sector. In October 2015 the AEMC published a discussion paper seeking stakeholder views on the ability of the existing regulatory framework to integrate storage, as well as any suggested solutions or proposed next steps. The AEMC's analysis has also been informed by collaboration with the CSIRO, who provided a technical assessment of how different storage technologies could be utilised and modelled the possible uptake rates across the NEM. With this input, the AEMC has identified several issues with the regulatory framework that may be acting as a barrier to the integration of storage. This report sets out those issues and makes a number of recommendations on what may need to change to address them. Importantly, where changes are required, the existing mechanisms for effecting regulatory change are capable of progressing the issues, either through rule changes or the work programs of the AEMC, AER or AEMO.

When considering how regulatory frameworks accommodate new technologies, it is the functions they perform that need to be the focus, not the technologies themselves. It is our view that while storage and particularly battery storage may become more pervasive, the functions it performs are not different to other types of technology and can be accommodated within the existing regulatory frameworks. For instance, many of the functions that storage devices could perform can also be performed by a generator, and so the devices in many cases can be treated as a generator of the same size in a similar commercial context. Stakeholders largely supported this conclusion in their submissions on the discussion paper.

Storage has the potential to interact with the entire electricity sector and therefore the applicable regulatory frameworks extend from rules impacting how storage is utilised on the customer side of the meter, through the economic regulation of networks, to the use of storage by a generator in the wholesale market. This has required an analysis of the National Electricity Law and the accompanying National Electricity Rules. There are aspects of the National Energy Consumer Framework – the National Energy Retail Law and the National Energy Retail Rules – that may be relevant to energy storage, particularly the consumer protection arrangements. Any consumer protection issues associated with storage penetration are best addressed by governments in the context of the current broader review of energy-specific consumer protection and the relationship with the Australian Consumer Law.

In undertaking any assessment of whether the regulatory framework remains fit for purpose in the face of dynamic market forces, it is important to understand the original purpose of that framework. An underlying principle of energy market regulation in Australia has been technology neutrality. That is, the rules are not designed to bias the deployment of storage or any other technology. Rather the rules have been designed to encourage efficient, market-based outcomes and so not act as a barrier to the use of whatever technology delivers the most cost-effective service. In sectors that are not subject to competition – network businesses – the regulatory framework has again been technology neutral, seeking to mimic to the greatest extent possible those cost-effective market outcomes.

There are many reasons to welcome the opportunities that lower cost storage technologies could bring to the electricity sector. Like other technologies, such as solar PV, advanced metering devices and home energy management systems, they have the potential to greatly expand the choices that consumers have to manage their energy needs. Networks and generators are also likely to derive value from storage solutions with storage offering an alternative to network augmentation and potentially helping to smooth the intermittent nature of renewable generation.

Utilising the competitive market frameworks currently in place will allow consumer preferences to drive how the sector develops. New business models will be tested and those that offer value to consumers will thrive while those that do not will vanish. The way consumers value storage and associated services will determine the deployment of this technology and competition between providers will keep costs low. A consumer-led deployment is not necessarily orderly – but consumers are generally in the best position to decide what works for them. We are wary of proposals that seek to impose solutions or particular technologies on consumers at the expense of competition, especially where they result in consumers bearing the risks of the technology deployment.

The AEMC is therefore of the view that for the purposes of network regulation, storage should be considered a contestable service. This conclusion is based on a number of principles that are at the foundation of energy market development in Australia. Market arrangements should promote consumer choice while providing a level playing field for market participants. Consumer choice based on clear price signals then drives innovation, with costs minimised by each service provider seeking to provide a compelling value proposition to the consumer. Finally, it is only in instances where competitive forces cannot deliver these consumer benefits that economic regulation should be contemplated.

We have already seen a number of players entering the Australian storage market and there is nothing to suggest this market is not able to deliver the sorts of products and services required by consumers, network businesses and large-scale generators. Network businesses should only be allowed to own storage behind the meter through an effectively ring-fenced affiliate that separates this activity from the provision of regulated network services. There are however a range of options available to them, through commercial arrangements with other service providers, to leverage the benefits of storage. The ring-fencing provisions that help define how regulated and

contestable services are provided by network businesses are due to be revised by the AER. These will need to be developed with very clear requirements for arms-length transactions and be accompanied by rigorous compliance and enforcement activities. This will enable networks to compete with other service providers on an equal basis.

This leads then to questions about how best to optimise the benefits of storage. Storage devices are often able to generate multiple value streams, as various generators do, and could offer network support services and ancillary services while also being able to dispatch energy into the wholesale market, or offset a residential consumer's retail load to the benefit of a consumer or its retailer. The value generated from these different services will depend to a large part on who has control of the asset – that is, whose benefit is the device seeking to maximise?

Network businesses may argue that it is inefficient having individual consumers buy storage devices when a network solution could provide benefits to all consumers at a lower cost. This, however, assumes that network optimisation is more highly valued by consumers than their individual preferences regarding the alternative uses of storage. It is also in conflict with the principles mentioned earlier that underpin the energy market frameworks, particularly the desire for consumer choices to drive energy market development. Moreover, it is important that the investment case of a consumer or retailer is not distorted by the connecting network business imposing onerous connection regimes or requiring control of the device's operation.

The current regulatory frameworks in the NEM encourage market-based solutions to these sorts of control and optimisation issues. This sort of approach may not mean a measured, controlled deployment of storage, but the regulatory frameworks are in place to reconcile the needs of networks with the desire for consumer-led decisions on technology deployment.

The AEMC's findings therefore suggest that the current regulatory frameworks and associated processes for developing them can accommodate the installation of storage across the electricity sector and are largely robust to this type of technological change. This analysis and feedback from stakeholders have indicated that there may be a range of improvements made in certain areas of the framework to make installation simpler. The AEMC's key findings and recommendations (where made) are set out in this report. A summary of the recommendations is provided in Box 1.

A work program associated with these recommendations will be developed by the AEMC and discussed with stakeholders. This work will have to be undertaken with regard to the resourcing requirements associated with rule change requests and ongoing work on other reviews.

Box 1 Summary of recommendations

1. The AEMC recommends that services provided by DNSPs behind the meter be treated as contestable services that should therefore be unclassified. Network businesses should not provide such services except through a ring-fenced business.

   Where storage behind the meter would be useful for providing network support, these services must be contracted from a third party or ring-fenced business. Storage used to provide services on the network would be subject to the AER's usual service classification.

   The AEMC recommends that the COAG Energy Council task the AEMC with reviewing the NER and identifying the necessary amendments to give effect to this recommendation. This could include:

   - clarifying the boundaries of services that can be provided by a DNSP in its capacity as a regulated entity;
   - clarifying service classification definitions; and
   - if necessary, imposing cross-ownership restrictions on network businesses.

   Consideration should also be given to how services provided by TNSPs behind generators' or transmission customers' meters are treated.

   The AEMC recommends that the COAG Energy Council task the AEMC with reviewing what cross-ownership restrictions should apply as part of the delineation of regulated and unregulated services (eg, the percentage of total revenue that can be derived from a related, unregulated activity).

2. The AEMC recommends that the AER, as part of its development of ring-fencing guidelines, consider the following factors when determining the appropriate form of ring-fencing to apply in different circumstances:

   (a) The ability of a network business to obtain access to the contestable services efficiently through alternative means, such as contracting the provision of services from third parties:

      (i) Where the network business has the ability to obtain the service effectively on a contestable basis, then this may support consideration of greater restrictions on the network business providing the service through an affiliate at all.

   (b) The extent to which an activity might generally be expected to be used to provide regulated network services compared with its use to provide contestable services.

(i) Where the primary benefits of an activity stem from its ability to support the efficient provision of regulated network services rather than from the provision of contestable services, then threats to the efficient provision of contestable services stemming from network business investment in or use of that activity may be lower, because strategic advantages in other markets are less likely to drive decision-making.

(ii) More onerous ring-fencing may be warranted where the benefits that the network business may earn through contestable services are significant, since this may strengthen incentives to exploit any advantages arising from the regulated business.

(c) The degree to which it is expected that a network business would have the ability to impact competition in the contestable market through leveraging an advantage from its regulated activities. The perceived advantages which a regulated network business may seek to leverage in providing contestable services should be clearly articulated and evaluated. This may include consideration of:

(i) The extent and nature of the advantage that is expected to result from the network business also having a regulated business, and whether this is an artificial advantage arising from its regulated status. The more significant the benefit, the more onerous ring-fencing requirements may need to be.

(ii) The nature of the other competitors in the contestable sector. Where other competitors are also regulated network businesses, it may be possible to adopt less extensive ring-fencing requirements, as all competitors would have similar advantages. The main concern in this circumstance would be to ensure that contestable activities are not subsidised by regulated activities.

(d) The extent and nature of other benefits that the network business may have in operating in the contestable market, separate from those arising from its regulated status.

(i) Where there does not appear to be substantial advantage to the network business from its regulated status, for example, but there is the risk of a distortion of competition, then ring-fencing may still be appropriate. This is because the potential costs of ring-fencing in terms of forgone benefits from additional competition are lower than in other circumstances.

(e) The ability of other elements of the regulatory framework to adequately address concerns about the interaction between regulated

and non-regulated activities.

(i) If existing elements of the regulatory framework (such as the cost allocation requirements) already provide (or can be expected to provide) a sufficient degree of protection from concerns, there may be less need for more onerous ring-fencing restrictions.

3. The AEMC recommends that the incentives on network businesses to substitute opex for capex would benefit from review. The AER is the appropriate body to do this. The review could encompass:

   - the strength of the EBSS and CESS;
   - whether expenditure on storage services through opex would qualify for the EBSS; and
   - whether further incentives are needed on network businesses to consider opportunities to substitute opex for capex, noting the ineligibility of TNSPs for the DMIA and DMIS.

4. The AEMC will review the lead times in the planning process to test whether they are appropriate in the face of changing technologies and more distributed energy resources. The review should also consider whether thresholds in the planning process (eg, for the RIT-T and RIT-D) remain appropriate in the face of changing technologies and more distributed energy resources, and whether any other information resources are necessary.

5. In order to address any perceived ambiguity regarding the use of the word 'generator' within the definition of 'generating unit' (and the related definitions that utilise 'generating unit'), the AEMC recommends that any interested party may submit a rule change request to the AEMC for consideration.

6. The AEMC recommends that AEMO conduct a review of the existing registration category of small generator aggregator to determine whether the ensuing rights and obligations are suited to parties seeking to utilise the combined capability of disaggregated storage behind the meter for participation in the NEM.

7. The AEMC recommends that AEMO conduct an assessment of whether there are any technical limitations to small generation aggregators offering FCAS, for example by aggregating the combined capability of a number of storage devices behind the meter.

8. The AEMC recommends that the AER, as part of its ongoing compliance work in this area, review existing DNSP basic connection services offerings for micro-embedded generation to ensure they clearly articulate their

applicability to the connection of a storage system intending to export electricity to the grid.

9. The AEMC will conduct a review of the technical standards contained in the NER to assess their applicability for connection of storage assets, as either a generating system or a load, by registered participants, including:

   (a) whether the performance standards/technical requirements set out in the rules are appropriate or even applicable for a storage device that is connecting as a standalone generating system or as a generating unit within a generating system;

   (b) whether the existing standards for connection of load (set out in schedules to the NER) are appropriate or even applicable to storage devices;

   (c) whether the negotiation process is suitable for determining standards as they relate to storage; and

   (d) whether the time frames allowed for in the negotiation process are sufficient for the connection of storage capability.

   The AEMC will seek advice from the Reliability Panel on items (a) and (b) where necessary.

10. The AEMC will conduct a review of the technical requirements that apply to the connection of micro-embedded generation. Such a review would assess:

    (a) the appropriateness of these technical requirements, and whether there is potential for standardisation of technical assessment across network businesses; and

    (b) how these technical requirements, including AS 4777, affect a DNSP's ability to control what is connected to its network, both in terms of

        (i) the specification of the equipment to be used and its technical performance; and

        (ii) remote control of the system.

    The AEMC will seek advice from the Reliability Panel where necessary.

Contents

1 Introduction

1.1 Purpose and scope of this report

The purpose of this report is to gain a clearer understanding of whether the existing regulatory framework is sufficiently flexible to support the integration of storage technologies, or whether regulatory change is necessary.

Energy storage technologies are available in many different forms, each of which has different ways of storing and releasing energy.[1] Examples of different methods of energy storage include mechanical energy storage, such as pumped hydro and flywheels; chemical storage, such as batteries; and thermal energy storage. Each energy storage technology has advantages and disadvantages which must be considered when determining the applicability of a particular storage technology to a specific circumstance.

Storage technologies have the potential to touch every point of the electricity sector. As such, the regulatory framework that we need to consider is broad.

By existing regulatory framework, we are referring to the National Electricity Law (NEL) and National Electricity Rules (NER). The NEL and NER establish the regulatory framework that underpins the operation of the National Electricity Market (NEM). The NEL and NER determine how companies can operate and participate in the competitive generation and retail sectors of the electricity market. They also govern the economic regulation of electricity transmission and distribution network service providers. The NEL and NER apply in all NEM jurisdictions, that is, the ACT, NSW, Queensland, South Australia, Tasmania and Victoria.

While there are aspects of the National Energy Consumer Framework - the National Energy Retail Law (NERL) and National Energy Retail Rules (NERR) - that may be relevant to energy storage, this report focuses on the regulatory framework set out by the NEL and NER.

Other issues that the AEMC has determined are out of the scope of this report include:

- Consumer protections. The COAG Energy Council and the AER are considering the impact of new electricity products and services, including storage, on consumer protections and the regulation of parties providing those products and services (see Appendix A). While we are not addressing specific consumer protection issues in this report, the AEMC does believe this is an important issue which requires thorough review.

1 CSIRO, Electrical Energy Storage: Technology Overview and Applications, July 2015, p9.

- Standards, including technical, building and safety standards for electricity storage devices and their installation. While we recognise the importance of these types of standards, their development does not fall within the AEMC's remit.[2]

- Instruments at the jurisdictional or sub-jurisdictional level. In submissions to the discussion paper, several stakeholders highlighted the relevance of these instruments to the AEMC's work, particularly those relating to technical or safety regulation. While these instruments may affect the integration of storage, their development does not fall within the AEMC's remit. Nevertheless, we acknowledge the value of alignment between these instruments and NEM-wide regulatory frameworks. Section 3 of this report recommends a review of the technical requirements that distribution network service providers (DNSPs) currently apply to the connection of micro-embedded generation in order to, among other things, determine whether there is potential for standardisation of technical assessment across network businesses.

Stakeholders expressed a number of views on the scope of the AEMC's analysis in their submissions to the discussion paper. The ERAA was of the view that the AEMC should not feel constrained in providing recommendations and views on changes that might need to occur to the NECF and jurisdictional instruments. It noted the importance of a nationally consistent approach to this emerging technology and recommended that, if there are various regulatory elements that need to be coordinated, this should be clearly identified.[3] The Clean Energy Council considered that the scope of the AEMC's work should also include aspects of the NERR as they relate to the treatment of non-exporting storage and embedded generators as retail customers.[4]

Ergon Energy noted the work being undertaken by the COAG Energy Council and the AER in this space, but considered that a review of the adequacy of consumer protections under the NECF may be required to ensure that there are no gaps in the overall framework.[5] The Clean Energy Council submitted that there may be consumer protection issues if large numbers of consumers obtain electricity through micro-grids, and therefore it may be desirable to extend the scope of the NECF beyond the "interconnected national electricity system".[6]

Networks NSW requested an indicative project timeline in the Commission's final report to understand the extent to which there will be further opportunities for consultation. It submitted that a consultative approach with other related projects will be required to ensure a clear and consistent solution is developed that achieves the

2 We note that the Clean Energy Council is undertaking a program of work on the development of standards for the storage sector, including safety, accreditation, installation, maintenance and disposal. See http://www.cleanenergycouncil.org.au/cec/policy-advocacy/storage-roadmap.

3 ERAA, submission on discussion paper, p1.

4 Clean Energy Council, submission on discussion paper, p3. This issue is discussed in section 3 of this report.

5 Ergon Energy, submission on discussion paper, p7.

6 Clean Energy Council, submission on discussion paper, p3.

strategic direction provided by the COAG and Clean Energy Council projects, and is complemented by the various AER and AEMO projects.[7]

1.2 Stakeholder consultation

The Commission held a public forum in June 2015 to provide an overview of the objectives of the AEMC's work. The CSIRO also presented its findings on electricity storage technologies and their applications across the supply chain.[8]

A discussion paper was released in October 2015 seeking stakeholder views on the ability of the existing regulatory framework to integrate storage. The paper set out the components of the existing regulatory framework that may relate to the following three possible applications of storage:

1. storage integration at the wholesale market level;
2. network businesses, both transmission and distribution, using storage on their network; and
3. end users using storage behind the meter, and aggregators combining this capability.[9]

The paper highlighted the key issues that may need to be considered in each application and set out the AEMC's preliminary findings. Views presented by stakeholders on each issue are summarised in the relevant sections of this report, and set out in more detail in Appendix B.

1.3 Related work

This report is intended to complement the range of work being undertaken by other parties in the area of electricity storage and its regulatory implications (see Appendix A). Of particular relevance are:

- The AER's review of ring-fencing guidelines, which aims to harmonise various state-based ring-fencing guidelines into a single, national guideline.
- AEMO's work to incorporate storage into its normal forecasting and planning activities, through the National Electricity Forecasting Report and National Transmission Network Development Plan.
- AEMO's examination of the regulatory arrangements applicable to the registration of a storage device under the NER.

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7 Networks NSW, submission on discussion paper, p2.

8 Materials from the forum are available on the AEMC website. See http://www.aemc.gov.au/Major-Pages/Technology-impacts.

9 The discussion paper is available on the AEMC website. See http://www.aemc.gov.au/Major-Pages/Integration-of-storage/Documents/Integration-of-Storage-Discussion-Paper.aspx.

2 Regulation and competitive neutrality

This chapter sets out the measures we recommend to encourage the efficient use of storage by network businesses. In summary, the regulatory frameworks will need to clearly delineate between regulated and non-regulated parts of the energy market to support competitive neutrality and create confidence in the market.

There are a number of reasons why a transmission network service provider (TNSP) or distribution network service provider (DNSP) might seek to utilise the services from storage capability on its network, including for network support (as an alternative to network augmentation) and to assist with quality and reliability of supply. Some of these functions may be best provided by grid-scale storage devices, which may be owned and operated by the network or by procurement of services, whereas others could be provided by storage devices behind the meter at customers' premises through a commercial arrangement with the customer or a retailer, for example.

The discussion paper set out how the economic regulation of network businesses would apply to energy storage. In particular:

- How the frameworks for the classification of transmission and distribution services would treat the services provided by storage assets:
  - whether as a regulated service, and therefore subject to economic regulation; or
  - as a contestable service, and therefore subject to ring-fencing (including legal separation).
- How regulated services provided by storage assets would be treated under the current NER provisions, including:
  - expenditure forecasts;
  - incentive mechanisms in the NER; and
  - investment test (RIT-T and RIT-D) requirements.
- How unregulated services provided by storage assets would be treated under the current NER provisions and, in particular, the applicability of the current provisions regarding:
  - ring-fencing;
  - cost allocation; and
  - shared asset provisions.

2.1 Preliminary findings

We found in the discussion paper that the current regulatory framework appears to allow network businesses to own and control energy storage, subject to some clarification of how the services provided by the storage devices would be classified.

The incentive-based regulatory framework treats storage like any other technology. Network businesses could leverage storage – if it is cost effective to do so. There are a range of incentives and innovation tools available to network businesses and the AER that would accommodate storage – if it is prudent to do so, and subject to any competition concerns being allayed. Where storage devices provide a mixture of regulated activities (substituting for traditional network services) and competitive energy services, then ring-fencing, cost allocation and shared asset guidelines would apply.

The AER will soon assess the ring-fencing guidelines. The AER's and AEMC's consideration of the appropriate regulatory arrangements for network businesses owning and operating generation assets may serve as a starting point in determining whether a network business should be allowed to own energy storage assets, the extent to which the business may provide services from energy storage, and the appropriate ring-fence settings to maximise benefit from energy storage while minimising undue advantage in supplying contestable services.

We put forward the following preliminary findings in the discussion paper:

1. **Market-led installation.** Storage is a contestable service and participation of network businesses in this market must be done on a level playing field with other market participants. The market-led installation of storage is most likely to lead to efficient outcomes. The Commission would not recommend any policy decisions to actively encourage the deployment of storage by networks in contravention of a framework that assumes that competitive energy activities should be market-led.

2. **Service classification.** There is scope for the AER to classify storage for use by network businesses under existing service classifications. However, the service classification framework in relation to energy storage would benefit from clarification. The provision of storage behind the meter is a contestable service and should therefore be unclassified. Networks should not be able to install storage behind the meter unless they do so through a ring-fenced business. Where storage behind the meter would be useful for providing network support, these services must be contracted from a third party or ring-fenced business. Storage used to provide services on the network would be subject to the AER's usual service classification.

3. **Cost recovery.** Once service classification is determined, the efficiency sharing incentives should lead network businesses to seek the most efficient trade-off between storage and traditional network assets, and between owning storage assets and procuring their services under contract. We do not recommend any

blanket prohibitions on network businesses owning storage on their network or requirements that they only competitively tender for storage services on their networks. It is unlikely that networks purchasing storage for their network will prevent the development of a competitive market for storage devices – given the amount of activity by retailers and direct sellers.

4. **Ring-fencing.** It will be important to monitor the impact of ring-fencing requirements to ensure the vertical disaggregation of the electricity supply chain between regulated monopoly and competitive activities is maintained. In relation to energy storage, we take this to mean:

   (a) Network businesses should use energy storage where it substitutes for traditional network (not behind the meter), where it is efficient to do so, so long as it does not significantly displace competitive energy services. It is appropriate for the storage to be financed from regulated expenditure to the extent that it is providing network services.

   (b) If a network business installs storage on its network to provide network services, then its use for energy trading (or other competitive energy services) should be strongly separated from the regulated network business. The auctioning of energy trading rights from network-connected storage that has been proposed by Oncor, or the transfer of those benefits to a retailer in the ElectraNet trial, are attractive models.

   (c) It is not appropriate for network businesses to own or directly control storage behind the meter except through a ring-fenced entity. If storage behind the meter is of value to network businesses, then they should contract with consumers, retailers or third parties to gain services, or create price signals or offer rebates that would reward consumers for operating storage in the desired way.

   It will be very important that strict ring-fencing provisions are in place for network businesses looking to set up separate entities to install storage behind the meter. These provisions must prevent any ability of the network to favour affiliated businesses or provide advantage to the affiliate in areas like connection processes. Strong enforcement and compliance obligations will also be required to give the market confidence that a level playing field is being maintained. This is also applicable to transmission businesses looking to enter contestable markets.

5. **Annual planning process.** The existing network planning requirements and investment tests should lead network businesses to consider storage as an alternative to traditional network solution, as they do with generation and network support agreements. The option value element of the investment test should also lead them to value the potentially incremental nature of a storage solution (as opposed to a "lumpy" network investment.)

2.2 Stakeholder views

2.2.1 Market-led installation

Most stakeholders supported a market-led approach to the installation of energy storage. Many took this to mean that storage should be treated as a contestable service for the purposes of network regulation.[10] Network businesses, on the other hand, argued that the deployment of storage devices – either behind the meter or on their networks – is unlikely to prevent the development of a competitive market in storage, given that energy retail firms and others have already entered the storage and related markets.[11]

2.2.2 Service classification

Most stakeholders agreed that the current service classification framework was capable of accommodating energy storage, because it is the services provided by a storage asset that would form the basis of the assessment, and those services are already classified. However, significant differences of opinion were expressed in relation to whether services provided by storage – both behind the meter and on the network – should be classified as a distribution service or left unregulated in order for competition to develop.

Many stakeholders also called for the AEMC and the AER to resolve the apparent inconsistency of positions with regard to storage behind the meter. To this end, Origin Energy suggested that a clear definition be made of where the distribution system ends in order for services provided by storage to be classified differently according to whether the storage device is behind the meter or in the distribution network.[12]

2.2.3 Revenue regulation and incentives

A dichotomy of views was presented regarding revenue regulation. Many network businesses argued that a technology neutral approach means they should place storage in the regulatory asset base if that is the most efficient means of providing network services.[13] The ENA supported the overall conclusion that existing efficiency sharing incentives and normal commercial cost minimisation incentives should drive trade-offs between storage and traditional network asset choices in the delivery of regulated services.[14] AEMO shared a similar view, submitting that measures to support competition should be complemented by measures to ensure network businesses adopt

10 See submissions on discussion paper from Clean Energy Council,p4; Snowy Hydro, p1; PIAC, p2; Simply Energy, pp2, 9; AGL pp1, 14, 17; AEMO, p6.

11 ENA, submission on discussion paper, p14; Ergon Energy, submission on discussion paper, p15.

12 Origin Energy, submission on discussion paper, pp1, 4.

13 CitiPower and Powercor, submission on discussion paper, pp2-3.

14 ENA, submission on discussion paper, p4.

storage-based solutions where this is the most efficient option.[15] By contrast, AGL, PIAC and Simply Energy suggested that it would be more efficient if network businesses were prevented from being able to own storage and place it in the regulatory asset base. Instead, they should tender for storage services as part of their opex – both within the distribution network and behind the meter.[16]

Network businesses called for stronger incentives for them to undertake storage trials and for clarification of the relationship between the DMIA and DMIS with the STPIS.[17] TransGrid submitted that the incentives for TNSPs to defer network augmentation would benefit from greater clarity, challenging the AEMC's findings that the Efficiency Benefit Sharing Scheme (EBSS) and the Capital Expenditure Sharing Scheme (CESS) provide incentives to pursue energy storage options where it is cost effective, resulting in deferral of capex or avoidance of opex. TransGrid stated that it is unclear whether these payments would provide sufficient return to balance the certainty of return provided by a network option in the regulatory asset base. TNSPs are excluded from the DMIS which is intended to address potential DNSP bias against non-network options.[18] ElectraNet noted that the EBSS would usually not apply to expenditure on storage services procured from another party. Where a network support service is procured by a TNSP as opex, it is typically treated as a network support pass-through with no materiality threshold. This expenditure would normally be excluded from the EBSS as non-controllable expenditure, as the extent to which the service is required each year is driven by external factors.[19]

The ENA identified some further potential issues with how network incentives would apply to storage. There is the potential for a regulatory asymmetry to arise where a network may be liable for STPIS penalties arising from an inability to control or effectively risk-share with a distributed energy resource, even in circumstances where such a resource is the least cost technology to deliver, for example, network support services. Transmission network businesses have also reported that some aspects of the revised STPIS arrangement – in particular, the way 'network capability' is defined for the purpose of assessing market benefits – may create unintentional barriers to storage deployment.[20]

The Customer Advocate was concerned that there is little commercial incentive for network businesses to be involved in storage or to incentivise customers to participate in time shifting of demand, other than when it results in an expansion to the regulatory asset base. Network businesses should face incentives to address falling load factors on their networks in order to improve the returns on increasingly under-utilised assets, because the costs of underutilisation are passed onto consumers. Rather than utilising

15 AEMO, submission on discussion paper, p6.

16 AGL, submission on discussion paper, p12; PIAC, submission on discussion paper, pp1, 3; Simply Energy, submission on discussion paper, p8.

17 Networks NSW, submission on discussion paper, p20; TransGrid, submission on discussion paper, pp2-3.

18 TransGrid, submission on discussion paper, pp2-3.

19 ElectraNet, submission on discussion paper, p2.

20 ENA, submission on discussion paper, p12.

grid-level storage, a better solution would be to encourage customer load management through efficient tariffs that reward use of energy at times when the network is 'idle'.[21]

2.2.4 Network planning processes and investment tests

Several stakeholders commented that the regulatory investment tests and network planning processes would benefit from review. EnergyAustralia submitted that there would be merit in reviewing elements of the RIT-D to determine whether it remains valid as the cost of alterative technology is falling, including the $5m materiality threshold.[22] The ENA and Ergon Energy submitted that the regulatory investment test may require review in the future to provide a sound platform for truly technology agnostic assessments of network and distributed energy resource alternatives.[23] Simply Energy submitted that the distribution annual planning process should evolve to ensure that competitive providers of solutions to address network constraints have sufficient lead time to develop and deploy solutions.[24] AEMO expressed support for the AEMC's recommendation in the Optional Firm Access final report to extend the RIT-T to apply to replacement expenditure, noting that changing market conditions mean that replacing ageing assets is now the primary driver of network investment.[25]

EnergyAustralia also called for network businesses to publish regular information on network constraints and network planning strategies to enable third parties to consider non-network solutions, and provided the Australian Renewable Energy Mapping Infrastructure project as a an example of a useful tool in this regard.[26] The Customer Advocate called for a review of network voltage standards by distributors to consider the impact of changes in demand and customer load profile on network voltage planning, resulting in a more informed view of the impact of battery charging and generation.[27]

Networks NSW submitted that consultation periods for non-network alternatives in the RIT-D are still relatively untested and should not be altered until there is evidence that they are insufficient. While the incremental introduction of small scale storage in a particular network area might be found to be the least cost solution, this is no different to similar non-network alternatives such as small scale embedded generation, load control (air conditioner, hot water etc.) or energy efficiency. Extending lead times would impose planning schedules on networks that might be inefficient.[28]

AEMO supported reforms to the requirements that annual planning reports should meet, arguing that proponents of non-network services should be able to obtain a

21 The Customer Advocate, submission on discussion paper, pp7-8.

22 EnergyAustralia, submission on discussion paper, p5.

23 ENA, submission on discussion paper, p11; Ergon Energy, submission on discussion paper, p12.

24 Simply Energy, submission on discussion paper, p8.

25 AEMO, submission on discussion paper, p6.

26 EnergyAustralia, submission on discussion paper, p5.

27 The Customer Advocate, submission on discussion paper, p15.

28 Networks NSW, submission on discussion paper, p20.

comprehensive understanding of upcoming network investment opportunities in a timeframe that allows them to submit alternative solutions.[29]

2.2.5 Separation of regulated and unregulated services

A large amount of commentary was received on ring-fencing issues, representing a range of responses. Some stakeholders agreed with the AEMC's preliminary findings.[30] Others disagreed because they thought ring-fencing would not be strong enough, preferring cross-ownership prohibitions,[31] while others thought ring-fencing was inappropriate in the absence of evidence of harm to competitive activities.[32]

Network businesses highlighted the existing tools, such as the Cost Allocation Mechanism, which prevent cross-subsidisation between activities[33] and argued that preventing network businesses from operating storage behind the meter may harm consumers, particularly in remote and rural areas that may be uneconomic for private sector storage providers.[34] Energex and the ENA similarly argued that network businesses should not be constrained from using energy storage as a potential non-network alternative as it is increasingly likely that energy storage will become a cost-effective and efficient solution to address network constraints, improve power quality and reliability.[35]

Several submissions agreed that the ESCRI-SA trial and Oncor model are positive avenues for the separation of market-facing activities from network owned storage that may be workable in an Australian context, but that the energy trading arrangements would need careful consideration to avoid distortions to competition.[36]

Several stakeholders also welcomed the AER's forthcoming review of the ring-fencing guidelines and suggested that there would be value in the AEMC and AER jointly approaching the development of national guidelines, to ensure consistency with policy objectives.[37]

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29 AEMO, submission on discussion paper, p6.

30 ERAA, submission on discussion paper, p2; EnergyAustralia, submission on discussion paper, p6.

31 Lumo Energy, submission on discussion paper, p3; PIAC, submission on discussion paper, pp1, 3; ERAA, submission on discussion paper, p2; AGL, submission on discussion paper, pp14-15.

32 Ergon Energy, submission on discussion paper, pp1, 3, 4, 15; ENA, submission on discussion paper, p4; Energex, submission on discussion paper, pp8-9; SA Power Networks, submission on discussion paper, p9; United Energy, submission on discussion paper, p1; CitiPower and Powercor, submission on discussion paper, p2; SA Power Networks, submission on discussion paper, p8.

33 CitiPower and Powercor, submission on discussion paper, p2.

34 Ergon Energy, submission on discussion paper, pp3-4.

35 Energex, submission on discussion paper, p5; ENA, submission on discussion paper, p6.

36 ElectraNet, submission on discussion paper, p2; ENA, submission on discussion paper, p6; SA Power Networks. submission on discussion paper, p9; Simply Energy, submission on discussion paper, p4.

37 ENA, submission on discussion paper, p4; Energex, submission on discussion paper, p9; Origin Energy, submission on discussion paper, p6.

A number of stakeholders were concerned that ring-fencing obligations would not be strong enough, or would be too difficult and expensive to enforce, and preferred tighter regulation of network business ownership of storage assets.[38] Lumo Energy, Snowy Hydro and Stanwell questioned whether the ownership threshold for transmission businesses carrying out related activities should be lowered from five per cent of total revenues.[39] Stanwell and Simply Energy suggested that a similar threshold should apply to distribution businesses, but with a limit appropriate to them.[40] The Clean Energy Council was concerned that connection processes and technical standards give DNSPs too much power to favour a ring-fenced affiliate, even if it were legally separate, and favoured transferring connection approval powers to an independent organisation like AEMO.[41]

2.3 Commission's analysis

2.3.1 Separation of regulated and unregulated services

In the discussion paper, we identified three sets of behaviours (in general, not just in relation to energy storage) that have the potential to weaken competition to the detriment of consumers. Some form of ring-fencing should then apply where:

1. The network business is able to cross-subsidise a competitive service from its regulated activities. A cross-subsidy may impede competition in the competitive market.

2. In the course of performing its regulated activities, the network business acquires commercially sensitive information that may provide it with an advantage in a competitive market. Metering data or load profile data are examples.

3. The network business is able to restrict competition in a competitive market by restricting access to infrastructure or providing access on less favourable terms than to its affiliate.

The AEMC is broadly confident in the ability of ring-fencing to address the first and second of these situations. The AER has discretion as to the type and strength of separation it would require between the regulated and non-regulated activities.

The third situation is more problematic and ring-fencing must be sufficiently strong in the case that the business (or an affiliate) seeks to carry out a competitive energy service that could gain advantage through the way the business operates its network. There is a clear parallel here in the structural separation that has operated since the

38 Lumo Energy, submission on discussion paper, p3; PIAC, submission on discussion paper, pp1, 3.

39 Lumo Energy, submission on discussion paper, p3; Snowy Hydro, submission on discussion paper, p1; Stanwell, submission on discussion paper, p3.

40 Stanwell, submission on discussion paper, p3; Simply Energy, submission on discussion paper, p4.

41 Clean Energy Council, submission on discussion paper, p8.

electricity industry was deregulated – with the generation and retail sectors subject to competition and structurally separated from monopoly networks.

The underlying logic that applied during deregulation still applies today. For this reason, we recommended in the Transmission Frameworks Review[42] that transmission businesses should not control generation assets (and generators should not control shared transmission assets) – because the TNSP would have the ability (and incentive) to control the network in such a way that discriminates in favour of its downstream generation business and/or against its generation business's competitors. That is, we would not rely on a ring fence alone, but rather prohibit network businesses from carrying out activities in very closely related competitive energy services that are dependent on the way the network carries out its regulated activities.

This same logic appears to be relevant to energy storage, particularly if storage-related activities have the potential to become a significant part of a network business's revenue, or that of a ring-fenced affiliate. The network business may then use its network to advantage its storage assets (over other forms of distributed energy owned by rivals, or over conventional generation) when competing in the wholesale or retail market. It could use the connections process to make it difficult for rivals to install storage behind the meter, if the business or an affiliate were competing in that space. The network business could use information it gains in the course of its regulated activities that is not available to other competitors to provide an advantage to its storage-related activities – for instance, information regarding local network issues and customer demand profiles. The network business could leverage its regulated interactions with customers to also offer non-regulated services, in a manner which results in an advantage for its non-regulated activities and does not make clear to customers that they could choose an alternative supplier for these activities.

It will therefore be very important in the context of storage, but indeed other potential technologies such as smart meters, home energy management systems, 'smart homes' and electric vehicles, that the line between regulated and non-regulated services is clear, and that the ring-fencing guidelines are robust and strongly enforced. Any lack of confidence in the practical reality of separating multiple revenue streams from a single asset, and only financing the regulated services from regulated revenue, will be damaging to the market and could potentially deter investment by non-network participants.

Under the AEMC's 2015 rule on Expanding Competition in Metering and Related Services, if a DNSP wants to provide advanced metering services to a competitive segment of the market, the service will be non-regulated and the DNSP will not be able to place metering assets in its regulatory asset base. The DNSP will also need to comply with ring-fencing guidelines developed by the AER – which may prevent a DNSP from owning metering assets as part of its regulated business. If a DNSP does not take on the role of providing metering services itself, it may be able to enter into contracts to obtain services from the metering assets to provide regulated services (eg, network

42 AEMC, Transmission Frameworks Review, Final Report, April 2013, pp.184-186.

management), where those assets are owned by a third party or a ring-fenced subsidiary of the DNSP.[43]

We maintain that a similar policy should exist to any energy services behind the customer's meter. By 'behind the meter' we mean the provision of energy services from an asset, or data acquired from an asset, on site provided as part of a direct relationship with the consumer located at that site. That is a competitive segment of the market whose development should be led by customer choices among offers from retailers and other non-monopoly energy service providers.

The means of giving effect to this policy position will need careful consideration. The current definitions of the transmission and distribution networks and of network services do not lend themselves to a spatial or asset-based restriction on network businesses from providing services behind the meter.[44]

Distribution services are currently very broadly defined as a service provided by means of, or in connection with, a distribution system.[45] The words 'in connection with' appear to imply that the service does not itself need to utilise assets that fall within the scope of the 'distribution system' (defined as a distribution network and related connection assets), but can be provided by any assets or other means provided that the service is being provided 'in connection with' a distribution system. This potentially allows for services provided behind the meter to be defined as a distribution service.

The NER do not appear to allow the AER to impose a restriction on a network business owning a particular type of asset in order to provide services which form part of its regulated business, as part of its ring-fencing guideline. The ring-fencing guideline can only impose restrictions relating to the regulated business conducting a non-regulated business (as part of the same legal entity), or on the manner in which its regulated activities interact with its non-regulated activities. However, a storage device on the network or behind the meter could conceivably provide the same set of functions (network support, power quality and reliability), so a functional restriction is also not straightforward.

Some of the relevant definitions that may need to change are in the NEL, so beyond the AEMC's rule making powers – for example, direct control network service, distribution system and electricity system.

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43 AEMC, Final Rule Determination, National Electricity Amendment (Expanding competition in metering and related services) Rule 2015, 26 November 2015, Appendix D3.

44 See for example, *network service* which is defined as '*transmission service* or a *distribution service* associated with the conveyance, and controlling the conveyance, of electricity through the network' and the definition of *network* itself: ' the apparatus, equipment , plant and buildings used to convey, and control the conveyance of, electricity to customers (whether wholesale or retail) excluding any connection assets. In relation to a *Network Service Provider*, a network owned operated or controlled by that *Network Service Provider*.

45 Chapter 10 of the NER under 'distribution service'.

For this reason, we recommend further work be done on determining the solution that will achieve competitive neutrality with the minimum of disruption to the regulatory frameworks. It is likely to be a combination of changes to service definitions, clarifying the boundaries of the services that can be provided by a DNSP in its capacity as a regulated entity and, if necessary, cross-ownership restrictions. The solution should also be flexible enough to apply to the emergence of new technologies and services behind the meter generally, which network businesses should also be restricted from including in their regulated asset base.

Cross-ownership restrictions may also need to be considered more generally as part of the separation of regulated and unregulated activities. Historically, cross-ownership restrictions have been imposed as part of jurisdictional distribution ring-fencing requirements. For example, some of the current jurisdictional distribution ring-fencing guidelines place restrictions on the regulated network business also engaging in 'related activities' as part of the same legal entity, with 'related activities' then being separately defined (at present, variously, as 'generation, distribution, retailing' (transmission), 'producing, purchasing or selling electricity' (ACT and Queensland), or 'any business in the electricity supply industry or other business that provides electrical services' (Tasmania)).

In addition, restrictions have previously been placed on the ability of a regulated network business to carry out specific non-regulated activities, either via explicit cross-ownership restrictions or by placing a limit on the extent to which the regulated business is able to engage in those activities. These include the current restriction on TNSPs from undertaking 'related activities' that result in revenues exceeding 5% of their regulated revenue,[46] or on DNSPs in South Australia on owning generation, unless used solely for network support.[47]

It is the AEMC's view that such limits are appropriately a policy decision that are part of drawing a clear line between regulated and unregulated activities. We therefore recommend that the AEMC should further consider what cross-ownership restrictions are appropriate. However, this review should take place independently of the AER's development of ring-fencing guidelines. To the extent that any changes to cross-ownership are recommended, the recommendations will also consider what regulatory instrument they most appropriately located in. The ring-fencing guidelines will continue to apply to the relationship of regulated and non-regulated activities.

Recommendation 1

The AEMC recommends that services provided by DNSPs behind the meter be treated as contestable services that should therefore be unclassified. Network businesses should not provide such services except through a ring-fenced business.

46 ACCC, Transmission Ring-Fencing Guidelines, August 2002, clause 7.1.

47 ESCOSA, Electricity Industry Guideline No. 9: Operational Ring-Fencing Requirements for the SA Electricity Supply Industry, June 2003, clause 3.1.

Where storage behind the meter would be useful for providing network support, these services must be contracted from a third party or ring-fenced business. Storage used to provide services on the network would be subject to the AER's usual service classification.

The AEMC recommends that the COAG Energy Council task the AEMC with reviewing the NER and identifying the necessary amendments to give effect to this recommendation. This could include:

(a) clarifying the boundaries of services that can be provided by a DNSP in its capacity as a regulated entity;

(b) clarifying service classification definitions; and

(c) if necessary, imposing cross-ownership restrictions on network businesses.

Consideration should also be given to how services provided by TNSPs behind generators' or transmission customers' meters are treated.

The AEMC recommends that the COAG Energy Council task the AEMC with reviewing with what cross-ownership restrictions should apply as part of the delineation of regulated and unregulated services (eg, the percentage of total revenue that can be derived from a related, unregulated activity).

2.3.2 Ring-fencing

The form of ring-fencing applied to network businesses looking to establish separate entities to install storage in competitive sectors of the market will be a necessary complement to the clarification of network versus contestable services. Once it is clear where regulated network services end, provisions must prevent any ability of the network business to favour affiliated businesses or provide advantage to the affiliate in areas like connection processes. Strong enforcement and compliance obligations will also be required to give the market confidence that a level playing field is being maintained. This is equally applicable to transmission businesses looking to enter contestable markets, for instance where storage devices on the network are used for providing FCAS or for trading on the wholesale market.

The NER currently allow the AER to develop ring-fencing guidelines for distribution and transmission network businesses. Specifically, the AER can develop guidelines for the 'accounting and functional separation' of the provision of direct control services (in the case of DNSPs) or prescribed services (in the case of TNSPs) from the provision of other services.

The NER sets out a non-exhaustive list of what the AER's ring-fencing guidelines may cover:

1. provisions defining the need for and extent of:

(i) legal separation of the entity through which a Distribution Network Service Provider provides network services from any other entity through which it conducts business; and

(ii) the establishment and maintenance of consolidated and separate accounts for standard control services, alternative control services and other services provided by the Distribution Network Service Provider; and

(iii) allocation of costs between standard control services, alternative control services and other services provided by the Distribution Network Service Provider; and

(iv) limitations on the flow of information between the Distribution Network Service Provider and any other person; and

(v) limitations on the flow of information where there is the potential for a competitive disadvantage between those parts of the Distribution Network Service Provider's business which provide direct control services and parts of the provider's business which provide any other services;[48]

There is no further guidance in the NER in relation to principles or considerations that the AER should have regard to in determining the appropriate form of ring-fencing regulated services from non-regulated services.

The AER is also able to impose particular restrictions on the extent to which the regulated NSP is able to use its regulated resources (assets, staff, IT systems etc) to also provide non-regulated services, and the manner in which its regulated functions may interact with its non-regulated functions. For example, the current transmission and distribution ring-fencing guidelines variously impose a range of restrictions, including:

- requiring the regulated business to provide separate accounts;
- requiring the regulated network business to locate staff providing regulated services separately from staff providing non-regulated services;
- not allowing a regulated network business to use its marketing staff for its regulated business to also market its non-regulated activities;
- requiring a network business to report to the AER where it uses the same staff, consultants or contractors that are used to provide regulated services to also provide non-regulated services;
- requiring IT access controls to be placed between the network business's information systems for its regulated activities and its non-regulated activities;
- not permitting the regulated network business to provide certain information to any affiliate businesses providing non-regulated activities;

48 The above list relates to the ring-fencing guidelines for regulated distribution services, with an equivalent list applying for regulated transmission services.

- requiring the regulated network business, where it provides information to any affiliate providing non-regulated activities, to also make that information available to competing businesses;

- requiring the regulated network business either not to include links to its non-regulated activities on its website, or to provide them on a separate page, together with links to businesses competing with its affiliate, in a non-discriminatory manner; and

- not allowing the regulated network business to earn revenue from a specified related activity.[49]

The NER do not appear to allow the AER to impose a restriction on an NSP owning a particular type of asset in order to provide services which form part of its regulated business, as part of its ring-fencing guideline. The ring-fencing guideline can only impose restrictions relating to the regulated business conducting a non-regulated business (as part of the same legal entity), or on the manner in which its regulated activities interact with its non-regulated activities.

Recommendation 2

The AEMC recommends that the AER, as part of its development of ring-fencing guidelines, consider the following factors when determining the appropriate form of ring-fencing to apply in different circumstances:

(a) The ability of a network business to obtain access to the contestable services efficiently through alternative means, such as contracting the provision of services from third parties:

(i) Where the network business has the ability to obtain the service effectively on a contestable basis, then this may support consideration of greater restrictions on the network business providing the service through an affiliate at all.

(b) The extent to which an activity might generally be expected to be used to provide regulated network services compared with its use to provide contestable services.

(i) Where the primary benefits of an activity stem from its ability to support the efficient provision of regulated network services rather than from the provision of contestable services, then threats to the efficient provision of contestable services stemming from network business investment in or use of that activity may be lower, because strategic advantages in other markets are less likely to drive decision-making.

49 SAPN in South Australia is allowed to own generation as part of its regulated activities in order to provide network support, but not to earn revenue by selling output from that generation to the wholesale market.

(ii) More onerous ring-fencing may be warranted where the benefits that the network business may earn through contestable services are significant, since this may strengthen incentives to exploit any advantages arising from the regulated business.

(c) The degree to which it is expected that a network business would have the ability to impact competition in the contestable market through leveraging an advantage from its regulated activities. The perceived advantages which a regulated network business may seek to leverage in providing contestable services should be clearly articulated and evaluated. This may include consideration of:

(i) The extent and nature of the advantage that is expected to result from the network business also having a regulated business, and whether this is an artificial advantage arising from its regulated status. The more significant the benefit, the more onerous ring-fencing requirements may need to be.

(ii) The nature of the other competitors in the contestable sector. Where other competitors are also regulated network businesses, it may be possible to adopt less extensive ring-fencing requirements, as all competitors would have similar advantages. The main concern in this circumstance would be to ensure that contestable activities are not subsidised by regulated activities.

(d) The extent and nature of other benefits that the network business may have in operating in the contestable market, separate from those arising from its regulated status.

(i) Where there does not appear to be substantial advantage to the network business from its regulated status, for example, but there is the risk of a distortion of competition, then ring-fencing may still be appropriate. This is because the potential costs of ring-fencing in terms of forgone benefits from additional competition are lower than in other circumstances.

(e) The ability of other elements of the regulatory framework to adequately address concerns about the interaction between regulated and non-regulated activities.

(i) If existing elements of the regulatory framework (such as the cost allocation requirements) already provide (or can be expected to provide) a sufficient degree of protection from concerns, there may be less need for more onerous ring-fencing restrictions.

2.3.3 Network business incentives

A number of stakeholders – both network businesses and other parties – identified that the incentives to substitute opex for capex may not be strong, leading to network

businesses building assets and placing them in the regulatory asset base, rather than seeking opportunities to contract for services through opex. It will be important if in the future more of the energy market, including network services, is supplied by distributed energy resources, that network businesses seek opportunities to contract with the owners of those resources where that is the most efficient solution.

Recommendation 3

The AEMC recommends that the incentives on network businesses to substitute opex for capex would benefit from review. The AER is the appropriate body to do this. The review could encompass:

(a) the strength of the EBSS and CESS;

(b) whether expenditure on storage services through opex would qualify for the EBSS; and

(c) whether further incentives are needed on network businesses to consider opportunities to substitute opex for capex, noting the ineligibility of TNSPs for the DMIA and DMIS.

2.3.4 Network planning processes and investment tests

A number of stakeholders queried whether the investment test thresholds and planning lead times remain appropriate in the light of alternative technologies with falling costs. There were also suggestions of additional information resources that could be published to make it easier for non-network solutions to be offered to address areas of emerging network needs.

Recommendation 4

The AEMC will review the lead times in the planning process to test whether they are appropriate in the face of changing technologies and more distributed energy resources. The review should also consider whether thresholds in the planning process (eg, for the RIT-T and RIT-D) remain appropriate in the face of changing technologies and more distributed energy resources, and whether any other information resources are necessary.

3 The participation of storage in competitive markets

A major theme that emerged from the analysis in the discussion paper is the ability of storage technology to perform a number of functions and therefore create multiple value streams. This feature of storage technology can create opportunities for parties to participate in the NEM using storage capability, but also presents challenges in terms of the ability of the regulatory framework to accommodate the installation and operation of storage.

Parties could use storage capability, either individually or in aggregate, to participate in competitive markets in a number of ways, including by buying and selling electricity on the wholesale market or by providing ancillary services or demand management services.

Participation in the wholesale market by a storage facility can be motivated in numerous ways, including:

- time shifting to arbitrage prices or to manage the differences between available generation and demand over the course of a day;
- managing the intermittency of renewable generation; or
- providing ancillary services.

The small generation aggregator business model is attractive because it attempts to capture the value of multiple value streams that can be provided by an electricity storage system. The discussion paper includes a case study on Reposit Power, which illustrates how a small generation aggregator could employ storage in different ways in order to benefit from multiple available value streams.[50] Reposit's GridCredits platform is designed to capture the value of residential solar PV and storage systems on the customer's behalf by maximising the customer's self-sufficiency and trading additional capacity in to the market as an added value stream.

The discussion paper outlined in detail the current registration framework and participant categories and associated requirements (for both generators and small generation aggregators) and the system operations implications associated with storage.[51]

The AEMC's analysis, informed by stakeholders, has identified a number of issues with the ability of the existing regulatory framework to support participation in the NEM using storage capability, either individually or in aggregate. These are set out below.

50 Reposit Power case study, see Box 2.1 of the discussion paper.

51 See sections 2.4, 2.4, 4.1, 5.1 and 5.4 of the discussion paper.

3.1 Registration

In order to participate in the NEM, a person must become registered in relation to the activity they wish to pursue in the market.[52]

Registration applies to the person, not the technology itself. However, the technology to be used is relevant to registration because it will affect what activities a participant intends to undertake and therefore the category of participant it will be required to register in. Registration requirements are in place in order to maintain the integrity and security of the electricity market and the power system. In order to be granted registration, AEMO must be satisfied that a potential market participant will, among other things, be able to respond to dispatch instructions, settle its financial obligations in the market and meet relevant performance standards.

Registration affects the benefits that can be realised by a storage facility. Whether and how the person is registered is likely to depend on the technical specifications and the intended primary functions of the device.

The AEMC is of the view that a new category of registered participant does not need to be introduced for persons seeking to participate in the NEM using a storage device. This is because the existing categories are sufficiently flexible to incorporate the use of storage. Further, there are no specific rights or obligations that are particular to storage which would necessitate the creation of a new participant category.

A person seeking to participate in the NEM using a storage device should be registered according to the value stream from the storage device in relation to which that person intends to participate in the NEM. In the Commission's view, any system that exports electricity to the grid is a generating system, and the owner/operator of that system is a generator. A system that only ever draws electricity from the grid is a load, and the owner/operator of that system is a customer. A system that imports and exports electricity is therefore both a load and a generating system, and the owner/operator of that system is both a customer and a generator.

These views were supported by many stakeholders in their submissions to the discussion paper.

AEMO submitted that registering the operator of a storage device as both a generator and a customer is feasible, but noted that a number of practical issues would need to be clarified. For example, how the device operates in the market, what information AEMO needs to manage the dispatch process, and the network charging arrangements that would apply.[53]

52 See section 4.1 of the discussion paper.

53 AEMO, submission on discussion paper, p4.

3.1.1 The definition of generation

There is debate about whether the current NER definitions of 'generating system' and 'generating unit' capture energy storage and hence whether the generation registration category would apply to persons seeking to use storage capability for participation in the NEM.[54] A number of stakeholders have suggested that energy storage be explicitly defined in the rules, particularly by defining 'generator' given that the dictionary meaning of 'generator' is somewhat technologically specific. However, the AEMC is of the view that the accepted usage of 'generating unit' would include a variety of generating units and systems, such as solar PV systems, and so avoids the need to refer to the dictionary definition.

A number of submissions on the discussion paper commented on this lack of clarity regarding the definition of generation. Ergon Energy noted that the classification of storage as generation is not appropriate because storage is capable of performing multiple functions. It submitted that generation technology is characterised by single functionality - the production of energy, and given this difference and the fact that storage is distinguishable from generation it is inappropriate for the same NER definition to apply to two different technologies.[55] AGL was of the view that a clearer definition of generator was required because the current definitions may lead to confusion regarding the application of associated terminology such as 'generating units', 'aggregation of generating units' and 'dispatchable units'.[56]

AEMO submitted that the current definition creates legal uncertainty and expressed support for clarifying the NER to allow the definition of 'generating unit' to remove any ambiguity in what can be classified as a generating unit. It stated that it is considering submitting a rule change request to alter the definition of 'generating unit' so that it is both technology and process neutral.[57]

As noted above, the Commission is of the view that any system that exports electricity to the grid is a generating system. A storage device that intends to export electricity to the grid should therefore be registered and treated as a generator.

The Commission considers that the accepted usage of the term 'generating unit', both within and outside of the NER, is understood without reference to the dictionary meaning of 'generator'. However, to the extent that there is any perceived ambiguity in the use of this word within the definition of 'generating unit', and therefore its applicability to a storage device, a rule change request could be submitted to the AEMC.

54 See section 5.1.2 and Appendix K.1 of the discussion paper for further discussion on this issue.

55 Ergon Energy, submission on discussion paper, pp1-3.

56 AGL, submission on discussion paper, p17.

57 AEMO, submission on discussion paper, p2.

Recommendation 5

In order to address any perceived ambiguity regarding the use of the word 'generator' within the definition of 'generating unit' (and the related definitions that utilise 'generating unit'), the AEMC recommends that any interested party may submit a rule change request to the AEMC for consideration.

3.1.2 Registration of small generation aggregators

The discussion paper outlined the registration process for small generation aggregators, with particular regard to how this might apply to storage.[58]

The installation of storage devices at end users' premises provides an opportunity for parties to aggregate the combined capacity of distributed storage across the network.[59] A party who wishes to employ storage in this way would be required to register in that capacity. It is our expectation that parties that aggregate small distributed energy storage systems would register as small generation aggregators.[60]

The Commission and a number of stakeholders support the ability for parties to aggregate the combined capability of a number of storage devices behind the meter, including selling electricity into the wholesale market, providing ancillary services, offering demand response or providing network support. However it is unclear whether the rights and obligations of the existing registration category of small generation aggregator are suited to the aggregation of storage behind the meter. AEMO also noted that the uncertainty around the ability to register storage systems as a generator within the NER also extends to the ability to register small generation as aggregators.[61]

In order to address this issue, the Commission recommends that AEMO conduct an assessment of the existing registration category of small generation aggregator. The purpose of the review would be to assess whether the existing registration category is suited to parties seeking to utilise the combined capability of disaggregated storage for participation in the NEM.

The assessment should consider:

- thresholds on what can be offered into competitive markets; and
- the scheduling requirements that would apply.

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58 See section 2.3.2 of the discussion paper.

59 This may be technically difficult as it would require two connection points, one for load and one to sell generation to the aggregator.

60 See Appendix K.2 of the discussion paper for more detail on registration as a small generation aggregator.

61 AEMO, submission on discussion paper, p3.

The outcomes of this work will be important to the AEMC's future work program. The AEMC will therefore work with closely with AEMO throughout the review process to help identify any issues and determine appropriate solutions.

Recommendation 6

The AEMC recommends that AEMO conduct a review of the existing registration category of small generation aggregator to determine whether the ensuing rights and obligations are suited to parties seeking to utilise the combined capability of disaggregated storage behind the meter for participation in the NEM.

3.1.3 The ability of small generation aggregators to provide FCAS

The aggregated capability of a number of storage devices may be able to participate in competitive markets through the provision of FCAS. It may be more complex for an aggregator to demonstrate its ability to provide ancillary services than for market generators, however it is technically feasible and in some cases it may be commercially advantageous.

Under the current rules, a small generation aggregator is not able to provide market ancillary services. We are of the view that this restriction should be lifted, however, further consideration should be given to potential technical limitations and changes to market arrangements to facilitate the participation of small generation aggregators in FCAS markets.

The Commission is of the view that small generation aggregators should be permitted to offer FCAS. This would increase competition in FCAS markets, diversify the sources of FCAS supply and support the reliability of the electricity system. The majority of submissions that commented on this issue supported this view.[62] The arguments in favour of this view include:

- the restriction is inconsistent with the market-based principles applied in the NEM;
- overall costs to customers will be reduced by allowing new technology and aggregators to enter FCAS markets;
- additional potential sources of FCAS will benefit consumers, especially as the need for FCAS is expected to increase as the share of energy generated by intermittent renewable energy sources increases; and
- small generation aggregators are already liable for ancillary services charges and should therefore be able to provide the service.

62 AEMO, submission on discussion paper, p3; AGL, submission on discussion paper, p11; Clean Energy Council, submission on discussion paper, p9; Ergon Energy, submission on discussion paper, Attachment 1, p5; SA Power Networks, submission on discussion paper, pp6-7.

AEMO agreed that there is no reason why small generation aggregators should be precluded from offering FCAS if they meet the technical specifications required by the NER and AEMO. It noted that the NER sets out the requirements for market ancillary services, including that bids be specified in whole MW. This places a threshold of 1MW on the minimum quantity of FCAS that can be offered, which may pose a barrier for some small generation aggregators.[63]

Intelligent Energy Systems provided detail on how storage devices could participate in FCAS markets.[64] It suggested that a four-second FCAS market should be established. In determining the providers of power variations that cause frequency deviations AEMO use four-second SCADA measurements of actual generation and load. A four-second FCAS market would be an extension of the current causer-pays logic and could be an overlay on the current arrangements and does not require the making of offers. In order to establish this market, suitable rules and certification procedures would be required and studies would be needed to ensure the arrangements were stable in a system control sense. This market would not only allow storage to participate in the provision of FCAS but would also avoid causing additional instabilities through the simultaneous switching of storage devices.[65]

As part of the Demand Response Mechanism (DRM) and Ancillary Services Unbundling rule change request, the COAG Energy Council proposed to unbundle the provision of ancillary services from the purchase and sale of electricity in the wholesale market to increase competition in the FCAS markets. This proposal was not specifically seeking to address any implicit limitation that may exist on small generation aggregators offering FCAS, however some of the issues being considered as part of that request may be relevant to this issue. This rule change request is still in the early stages of consultation.[66]

It is the Commission's view that it is important to determine whether there are any technical or other limitations to small generation aggregators offering FCAS. We recommend that AEMO conduct an assessment of what, if any, technical limitations exist to small generation aggregators offering FCAS, for example by utilising the aggregated capability of numerous storage devices behind the meter. The outcomes of this work will be important to the AEMC's future work program. The AEMC will therefore work with closely with AEMO throughout the review process to help identify any issues and determine appropriate solutions.

Recommendation 7

The AEMC recommends that AEMO conduct an assessment of whether there are any technical limitations to small generation aggregators offering FCAS,

63 AEMO, submission on discussion paper, p4.

64 Intelligent Energy Systems, submission on discussion paper, p2.

65 Ibid.

66 A consultation paper on this rule change request was published on 5 November 2015. See http://www.aemc.gov.au/Rule-Changes/Demand-Response-Mechanism.

for example by aggregating the combined capability of a number of storage devices behind the meter.

3.2 Market developments

A key theme that emerged through the submissions to the consultation process is that the electricity market is changing and that the regulatory framework must continue to be fit-for purpose in the face of market developments. As previously discussed, storage technology, and distributed energy resources in general, present a challenge to the regulatory framework which was designed under the paradigm of large-scale, centralised generation, transmission and distribution assets connected to loads at the fringes of the system.

This section identifies two areas where the current framework may need to be reviewed given the increased proliferation of distributed energy resources, including energy storage, participating in competitive markets.

3.2.1 Review of registration process and associated requirements

As discussed in section 3.1, we do not find that a new category of registered participant is necessary for persons using storage capability to participate in the NEM.

However, the category in which a party registers to participate in the NEM has flow-on effects with regard to the payment of registration costs, participant fees, ancillary service payments, TUOS/DUOS and prudential requirements. It is not yet clear whether the current obligations and requirements of each category of registered participant under the NER are appropriate for the operation of a storage device.

There was general agreement in submissions on the discussion paper that the applicable registered participant categories should reflect the changing nature of the market. The possibility for changes to the registration process or the creation of new categories should be considered, if they are found to be necessary. Several stakeholders were of the view that AEMO was the body most suited to carry out this work.[67]

AEMO agreed that there may be value in reconsidering the exemption threshold for registration given the growth in embedded generation and storage, noting that units that fall below the threshold can, in aggregate, have an even greater impact on the power system.[68]

As discussed in section 3.1.2, the Commission recommends that a review of the current registration category for small generation aggregator be undertaken to determine whether the ensuing rights and obligations are suited to parties seeking to utilise the

67 EnergyAustralia, submission on discussion paper, p7; Networks NSW, submission on discussion paper, p1; Clean Energy Council, submission on discussion paper, p9.

68 AEMO, submission on discussion paper, p5.

combined capability of disaggregated storage behind the meter for participation in the NEM (Recommendation 6).

3.2.2 Effects of distributed energy resources on system operations

An increased penetration of distributed energy resources has the potential to create system operation issues. Storage devices acting in aggregate (either in response to a price signal or because they are aggregated) could have the potential to cause system issues, such as through effects on frequency, which can affect the entire power system.

Stakeholders generally agreed that widespread use of storage could have system operation effects. There was agreement that, in order to maintain system security, the effects of increased distributed energy resources, including energy storage, should be monitored. Stanwell was of the view that, in order to maintain oversight of system security, AEMO should be provided with the location and specification of batteries on installation.[69] SA Power Networks noted that the proliferation of embedded generation, solar PV in particular, has changed the nature of network power flows and creates new challenges. It submitted that storage has the potential to ameliorate some of the network issues associated with high levels of distributed generation, but controls are needed to ensure that storage does not exacerbate network issues.[70]

AEMO noted the power system security issues that may arise should there be a mass uptake of distribution connected storage systems. It was of the view that a number of issues would need to be investigated, including rapid changes of state of the systems in aggregate and the displacement of scheduled generation, which leads to difficulties controlling the transmission network flows within limits. AEMO noted that it is in the process of establishing a Power Systems Issues Technical Advisory Group, which will identify challenges in relation to emerging technologies in general.[71]

AEMO submitted that, to fulfil its network functions, it will need detailed information about storage systems connected to distribution networks, including the size, location and operation of each installation. It was of the view that such information could be provided as part of the connection process, but noted that the obligation to provide such information would need to be carefully targeted and proportionate to the potential benefits so as not to stifle competition.[72]

The Commission agrees that the effects of an increased penetration of distributed energy resources are potentially significant and should be investigated. The AEMC is supportive of the work proposed by AEMO through the Power Systems Issues Technical Advisory Group and will continue to participate in the Group to determine appropriate solutions to any identified issues.

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69 Stanwell, submission on the discussion paper, p2.

70 SA Power Networks, submission on the discussion paper, pp1-2.

71 AEMO, submission on discussion paper, p5.

72 Ibid., pp7-8.

4 Connection and control of storage capability

As noted in section 2, the Commission is of the view that storage is a contestable service. The installation, connection, optimisation and control of storage devices should therefore, except for system security and safety reasons, be determined through market-based signals. This approach will most likely to lead to efficient outcomes because it promotes consumer choice while providing a level playing field for market participants.

The AEMC's analysis, informed by stakeholders, has identified a number of issues with the ability of the existing regulatory framework to support the development of a competitive market for the installation and operation of storage assets both behind the meter at customers' premises and at a large-scale by registered participants. These are set out below.

4.1 The connection process

To charge a storage device using electricity from the grid, or export electricity from a storage device to the grid, it must be connected to the electricity network.

In the Commission's view, any system that exports electricity to the grid is a generating system. A system that only ever draws electricity from the grid is a load. A system that imports and exports electricity is therefore both a load and a generating system, and the person operating it is both a customer and a generator.

The connection arrangements set out in the NER establish the obligations and processes by which generating systems and loads connect to a transmission or distribution system.

4.1.1 Small loads and generating systems

The falling cost of energy storage technologies is increasing the economic viability of residential and other small electricity end users installing battery capability 'behind the meter' for energy management purposes.

The regulatory framework for smaller loads and generating systems connecting to a distribution network is set out in Chapter 5A of the NER.[73] These rules apply (among others) to:

- retail customers;
- micro-embedded generators (eg, retail customers with solar PV systems); and
- non-registered embedded generators (connecting a system of less than 5 MW but larger than a micro-embedded generator).

73 Chapter 5A connection processes are summarised in Appendix B of the discussion paper.

A retail customer seeking to connect storage capability at their premises to the distribution system with the intention of exporting electricity to the grid – whether in conjunction with a solar PV system, for example, or as a standalone device – would be captured by the existing definition of 'micro-embedded generator', as long as the connection is of the kind contemplated by Australian Standard 4777 (Grid connection of energy systems via inverters).[74]

The existing connection process under the NER for a micro-embedded generator therefore accommodates a retail customer seeking to install storage behind the meter for the purposes of exporting electricity to the grid. Stakeholders largely supported this conclusion in their submissions on the discussion paper. Networks NSW explained that applications to connect battery systems using existing connection processes are already being received and accepted without any negative feedback or customer issues arising to date.[75] While several stakeholders submitted that the connection process for micro-embedded generators was not as simple or transparent as it could be, most agreed that it was not necessary to require DNSPs to have a connection offering that separately addresses the connection of storage capability.[76]

The AEMC therefore does not recommend that the NER be amended to require DNSPs to have a basic connection offering that separately addresses the connection of storage capability by a retail customer. The Commission expects that, in most cases, retail customers will seek to couple storage capability with another form of generation, for example a solar PV system, and AS 4777 will be relevant to the connection. Requiring DNSPs to develop a separate storage offering would be duplicative.

However, feedback from stakeholders suggests that the applicability of storage is not well documented in the connection process.[77] The Commission therefore sees value in DNSPs reviewing their connection offerings and processes to remove ambiguity and more clearly articulate their applicability to the connection of storage capability.

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74 'Micro-embedded generator' is defined in clause 5A.A.1 of the NER as "a retail customer who operates, or proposes to operate, an embedded generating unit for which a micro EG connection is appropriate". A micro EG connection means "a connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters)". Australian Standard 4777 is an industry standard for grid-connected inverter systems. An inverter is the means by which micro-embedded generating systems, like solar PV, are connected to the network. AS 4777 is described in more detail in Chapter 2 of the discussion paper.

75 Networks NSW, submission on discussion paper, p3.

76 AGL, submission on discussion paper, p6; Clean Energy Council, submission on discussion paper, p4; Energex, submission on discussion paper, p6; Ergon Energy, submission on discussion paper, Attachment 1, p3; Networks NSW, submission on discussion paper, pp1,3,17; SA Power Networks, submission on discussion paper, p7.

77 Ergon Energy, submission on discussion paper, Attachment 1, p3; Networks NSW, submission on discussion paper, p3; SA Power Networks, submission on discussion paper, p5.

Recommendation 8

The AEMC recommends that the AER, as part of its ongoing compliance work in this area, review existing DNSP basic connection services offerings for micro embedded generation to ensure they clearly articulate their applicability to the connection of a storage system intending to export electricity to the grid.

Several stakeholders sought clarity on whether non-exporting systems (ie, storage systems that do not export electricity to the grid) should be treated as micro-embedded generators or retail customers under the NER.

As explained in the discussion paper and set out above, it is the Commission's view that a system that exports electricity to the grid is a generating system, and a system that only ever draws electricity (either from the grid or a solar PV system) is a load. Requiring a retail customer to comply with the connection process for a micro-embedded generator to connect a storage system that is not intended to 'generate' - ie, export electricity to the grid - would introduce unnecessary costs for the customer and additional administrative burden for the connecting DNSP.

Retrofitting an existing connection with a storage system, as a load only or as a generating system, would require a connection alteration. The deemed standard connection contract requires a retail customer to apply to the DNSP for a connection alteration if it wants to connect a small generator (eg, a solar panel) "for the purposes of exporting energy".[78] Connection of load or micro-embedded generation will then be subject to separate contractual arrangements. The Commission is of the view that these arrangements are sufficiently clear. That is, if the system is a non-exporting load, it will be captured by the parameters of the basic or standard connection offerings. If the system is intended to export electricity to the grid, it should be considered a micro-embedded generator and will therefore be caught by the requirements of a micro-embedded generation connection.

4.1.2 Large loads and generating systems

The regulatory framework for registered participants connecting larger-scale generation, embedded generation and load is set out in Chapter 5 of the NER.[79]

The Commission is of the view that the existing connection process in the NER supports, or is sufficiently flexible to accommodate, the connection of energy storage – as generation, load or both – by registered participants. Stakeholders largely supported this view.

78 See clause 6.6(a) of the model terms and conditions for deemed standard connection contracts.

79 See Appendix L of the discussion paper for further information about the connection requirements for generating systems and loads connecting to a transmission network and for generating systems larger than 5MW connecting to a distribution network.

However, the Commission acknowledges that the process of connecting large generation or load to the network is not always straightforward. AGL submitted that the current connection process is based on connecting large generation units or large customers, and should therefore be simplified so smaller facilities are not discouraged from connecting.[80]

In July 2015 the COAG Energy Council submitted a rule change request proposing amendments to arrangements for transmission planning and connections. Consultation on this rule change request commenced on 26 November 2015.[81] The rule change request is based on recommendations made by the AEMC in 2013 in the Transmission Frameworks Review, in which the AEMC concluded that the process for connecting new generation to a transmission network can be costly, complex and time consuming.[82] The amendments seek to, among other things, promote the delivery of efficient connection services to those parties seeking to connect to the transmission network. The Commission does not recommend any additional review of the connection process for large generating systems at this time.

Stakeholders did not raise any specific issues with the connection process as it would apply to storage as a load.

4.2 Technical requirements for connection

The technical requirements applicable to the connection of a storage device may depend on a number of factors, including whether the storage device:

- constitutes an alteration to an existing connection or a new connection;
- is connected to a transmission or distribution network;
- will be used to export electricity to the network; and/or
- constitutes part of an existing generating system (eg, at a wind farm or combined with rooftop solar PV).

4.2.1 Small loads and generating systems

In addition to the requirements set out in the rules, distribution connection applicants may have specific processes or technical requirements placed on them by their connecting DNSP before they can connect a storage device to the network. For example, a connecting DNSP might undertake a technical assessment of the size and intended operation of the system to determine whether the local network is able to accommodate it. As such, connection arrangements are likely to differ between DNSPs

80 AGL, submission on discussion paper, pp18-19.

81 See http://www.aemc.gov.au/Rule-Changes/Transmission-Connection-and-Planning-Arrangements#.

82 See http://www.aemc.gov.au/Markets-Reviews-Advice/Transmission-Frameworks-Review#.

and areas within a network. A number of submissions from stakeholders on the discussion paper suggested that this is the case.

A lack of consistent technical requirements across and within network areas, or a lack of transparency regarding the reasons why different technical requirements are being imposed, can increase the transaction costs of connecting a generating system or load, including storage, to the distribution network. Overly onerous requirements for relatively straightforward connections may also act as a barrier to the connection of storage capability.

Retail customers and micro-embedded generators

A number of stakeholders, including some DNSPs, expressed support for the development of a standardised approach to the technical assessment of micro-embedded generation.[83] These stakeholders were of the view that standardisation would:

- simplify the connection process for parties operating within or across distribution areas (for example, retailers or storage system installers);
- reduce administrative burden on DNSPs;
- provide transparency in the connection process; and
- support a level playing field for the provision of storage and the services it enables.

AEMO noted the potential system impacts of an increased penetration of distributed systems, and suggested it might be appropriate to consider whether there are practical means of regulating the technical characteristics of facilities in aggregate rather than focusing on a facility's local interaction with the network as standalone.[84]

Concerned about competitive neutrality where DNSPs are operating in contestable markets, such as the provision of storage services, both AGL and the Clean Energy Council proposed that an independent gate keeper, such as AEMO or the AER, be appointed to administer and approve all connection applications to ensure a fair, streamlined process for the connection of embedded generation.[85]

While we recognise that electricity networks vary greatly in their nature and configuration, the Commission is of the view that greater transparency in the technical

83 AGL, submission on discussion paper, p6; Clean Energy Council, submission on discussion paper, p5; ERAA, submission on discussion paper, p1; ENA, submission on discussion paper, p3; Lumo Energy, submission on discussion paper, pp3-4; Networks NSW, submission on discussion paper, p5; Origin Energy, submission on discussion paper, p3; The Customer Advocate, submission on discussion paper, pp14-15; Simply Energy, submission on discussion paper, p7.

84 AEMO, submission on discussion paper, p5.

85 AGL, submission on discussion paper, pp6, 16; Clean Energy Council, submission on discussion paper, p8.

assessment of micro-embedded generation, and standardisation of such an assessment where appropriate, will reduce transaction costs for both consumers and connecting DNSPs and enable a more consistent and predictable approach to the connection of storage capability. The Commission therefore intends to conduct a review of the technical requirements that DNSPs currently apply to the connection of micro-embedded generation. This recommendation is further set out in section 4.3.

Non-registered embedded generators

The Commission notes that AECOM was engaged by the Commonwealth Department of Resources, Energy and Tourism (now the Department of Industry, Innovation and Science) in 2012 to conduct a feasibility study on the development of a grid connection technical standard for embedded generation. The study focused on mid-scale embedded generators that are not covered by the requirements of AS 4777, are exempt from registration in the NEM (generally 30 kW to 5 MW) and are connected to a distribution network. The study found that there are a range of technical specifications and performance outcomes that could be standardised in embedded generation connections, and that there is strong stakeholder support for the development of connection standards. It concluded that an Australian Standard is the most suitable option for developing consistent standards.[86]

The Commission also notes that the Clean Energy Council is managing the development of a scope of work to design and implement a standard for the connection of commercial-scale embedded generation (between 30 kW and 5 MW).[87] The Commission is supportive of this work and therefore makes no recommendations regarding technical requirements for the connection of embedded generators that fall within this range.

4.2.2 Large loads and generating systems

It is not yet clear to the Commission whether the technical standards set out in the NER are appropriate or even applicable for the connection of storage, as either a load or a generating system, by registered participants. A number of stakeholders expressed support for a review of technical requirements for the connection of generation and load by registered participants to ensure that storage technology can participate in the NEM.[88]

AEMO was of the view that the processes and requirements set out in Chapter 5 of the NER are suitable for the connection of storage systems at the transmission level, but noted that it has not yet assessed whether the current access standards will be adequate

86 COAG Energy Council, Embedded generation, August 2013, https://scer.govspace.gov.au/workstreams/energy-market-reform/demand-side-participation/embedded-generation/, accessed 16 November 2015.

87 See http://www.cleanenergycouncil.org.au/fpdi/reports/grid-connection-standards-scoping-study.html.

88 AGL, submission on discussion paper, pp18-19; Networks NSW, submission on discussion paper, p1; Simply Energy, submission on discussion paper, p9.

for the mass uptake of utility scale storage systems, or where particular challenges may arise.[89] It recommended that, subject to the analysis to be undertaken by its Power Systems Issues Technical Advisory Group, the current technical requirements for connection be left in place and monitored to determine whether they become barriers to the connection of storage or any other technology.[90]

Recommendation 9

The AEMC will conduct a review of the technical standards contained in the NER to assess their applicability for connection of storage assets, as either a generating system or a load, by registered participants, including:

- **whether the performance standards/technical requirements set out in the rules are appropriate or even applicable for a storage device that is connecting as a standalone generating system or as a generating unit within a generating system;**
- **whether the existing standards for connection of load (set out in schedules to the NER) are appropriate or even applicable to storage devices;**
- **whether the negotiation process is suitable for determining standards as they relate to storage; and**
- **whether the time frames allowed for in the negotiation process are sufficient for the connection of storage capability.[91]**

The AEMC will seek advice from the Reliability Panel on items (a) and (b) where necessary.

4.3 Control of storage capability through connection requirements

A storage device can provide a range of benefits to the consumer, retailer, network business and wholesale market participants. The most successful business models will be those that are best able to capture all of these benefits or, at least, the most material ones. However, there will be limits on the ability of some models to capture all benefits.

The primary purpose of a network business controlling a storage device would presumably be to maximise network benefits, for example to avoid network augmentation by discharging storage devices during times of critical network peaks, or

89 AEMO, submission on discussion paper, p5.

90 Ibid., p6.

91 We note that some of these issues will be considered as part of the transmission connection and planning arrangements rule change in considering the efficient delivery connections services to those parties seeking to connect to the transmission network. This rule change request is currently being considered by the AEMC. See http://www.aemc.gov.au/Rule-Changes/Transmission-Connection-and-Planning-Arrangements#.

to avoid the failure of reliability standards in areas that are prone to outages. This model is therefore likely to negate many benefits to the retailer, and potentially to the individual customer because it assumes that network optimisation is more highly valued by consumers than their individual preferences regarding the alternative uses of the device.

Network-controlled storage also has the potential to act as a barrier to a retailer-controlled or consumer-controlled storage model. Network businesses have a legitimate interest in ensuring that nothing is connected that affects the safety, security and reliability of their network, but they may make the connection process onerous and costly if they have a competing business interest in pursuing network-controlled storage. Network businesses might also require some ongoing degree of control through those agreements and standards that affects the customer or retailer's original business case for investing.

In submissions on the discussion paper, a number of stakeholders expressed support for the Commission's view that control of storage devices should, in all but a narrow band of circumstances related to system security and safety, be based on market signals.[92] However, feedback from stakeholders suggests that the role of standards and other technical requirements in the connection of load and generation is unclear. Several stakeholders were of the view that there was a risk that network businesses would impose too much control over what is connected to their network, particularly if the business also plans to compete in contestable markets.

4.3.1 Small loads and generating systems

A number of stakeholders have raised concern about the technical requirements of AS 4777.[93] This standard is referred to in the NER in the context of the connection of micro-embedded generation. 'Micro-embedded generator' is defined as "a retail customer who operates, or proposes to operate, an embedded generating unit for which a micro EG connection is appropriate". Micro EG connection means "a connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters)".[94] A retail customer who installs storage capability behind the meter at their premises with the intention of exporting electricity to the grid would therefore be captured by the definition of micro-embedded generator if its connection is of the kind contemplated by AS 4777.

The Commission supports the development of standards that define minimum safety and technical requirements for the operation of micro-embedded generators and their connection to the electricity network. The revised AS 4777 has been developed by

92 Lumo Energy, submission on discussion paper, p2; Energy Australia, submission on discussion paper, p4; Simply Energy, submission on discussion paper, p2.

93 See Appendix B.2.4 for a summary of stakeholder comments on this issue.

94 See clause 5A.A.1 of the NER.

Standards Australia through an open and consultative process to set safety and technical standards for grid-connected inverters.[95]

However, the revised version of AS 4777 may give DNSPs the ability to control the operation of inverters that connect storage systems to the distribution network. While there are valid safety, security and reliability reasons for a DNSP to want to control these devices, such control may present a barrier to the development of business models that also rely on a degree of control over the operation of the storage device. We note that this issue is not unique to storage capability – any energy system connected via a grid-connected inverter may need to be compliant with the revised AS 4777 and may therefore be subject to a level of control via the inverter by the DNSP.

As such, it is possible that the use of AS 4777, particularly its control functionality, may dictate outcomes that stray into regulatory policy and distort competitive outcomes. For example, there is a risk that a DNSP would only permit the connection of micro-embedded generation, including storage, to its network if the customer gives the DNSP control over the device's operation via the AS 4777 compliant inverter. The parameters of the DNSP's control are unclear, as is how those parameters would interact with any arrangements the customer has entered into, for example with an energy services company, regarding the operation of the system. Control of a storage system by the DNSP alone in response to network operational signals may shut off some of the potential benefit streams that can be captured by other parties and passed on to the customer.

The Commission is therefore of the view that it is not appropriate for network businesses to directly control storage systems behind the meter, except for system security and safety reasons, unless it is doing so through a ring-fenced entity that is subject to strict compliance requirements and robust enforcement. If storage behind the meter is of value to network businesses, then they should contract with customers, retailers or third parties to gain access to the services enabled by the device's functionality, or create price signals or offer rebates that would reward consumers for operating storage in the desired way.

Any standard that precludes the appropriate valuation of the multiple value streams that storage can provide will affect the development of a competitive market for storage. The AEMC therefore sees value in assessing the appropriateness of the technical requirements that apply to the connection of micro-embedded generation.

Recommendation 10

The AEMC will conduct a review of the technical requirements that apply to the connection of micro-embedded generation. Such a review would assess:

1. **the appropriateness of these technical requirements, and whether there is potential for standardisation of technical assessment across network**

95 Part 2 of AS 4777, *Inverter requirements*, was published in October 2015. Part 1 of the standard, *Installation requirements*, is due to be published in 2016.

businesses; and

2. **how these technical requirements, including AS 4777, affect a DNSP's ability to control what is connected to its network, both in terms of:**

    the specification of the equipment to be used and its technical performance; and

    remote control of the system.

The AEMC will seek advice from the Reliability Panel where necessary.

Similarly, the Commission is of the view that the standards development process should not be a proxy for understanding how network businesses meet the reliability standards that are set by jurisdictions. In the future, the network may become more of a dynamic two-way platform. The AEMC intends to look at this concept in future work, which will include consideration of a charging regime where network augmentation and reliability standards are in part determined by customers' appetite for exporting their excess generation.

The Commission is of the view that a review of technical requirements, and possibly standardisation, in conjunction with appropriate ring-fencing of DNSPs operating in the contestable storage space will provide an appropriate pathway to address concerns raised by AGL and the Clean Energy Council that DNSPs are able to exert market power and favour a ring-fenced affiliate by virtue of them being the connecting DNSP.

The AEMC also plans to engage directly with Standards Australia to better understand the standards-setting process and develop a more proactive dialogue so that the interaction between standards and the NER are well understood.

A Related work

This report is intended to complement the range of work being undertaken by other organisations in this area. Some of these projects are set out in the table below.

Table A.1 List of projects relevant to this report

Project proponent	Project title	Description of project
COAG Energy Council - DSP Working Group	New products and services in the electricity market	The purpose of this work is to determine whether the existing regulatory framework is appropriate in the context of new products and services being offered to small customers, including embedded generation and storage. A consultation paper was published in December 2014. A paper was submitted to the COAG Energy Council for its consideration in July 2015, after which COAG officials were tasked with further work to: • investigate whether the scope of existing energy consumer protections require change in light of consumers having an increasing range of electricity supply options; and • identify options to manage any risks to power system operations where aggregators are controlling large amounts of load.[96]
COAG Energy Council - Network Strategy Working Group	Strategic assessment of network regulation	The purpose of this work is to assess the adequacy of the current network regulation framework to accommodate future market and technological changes under four possible scenarios. A paper was submitted to the COAG Energy Council for its consideration in July 2015, after which COAG officials were tasked with further work to explore the implications of the issues that emerged from the stress-testing exercise, including: • network asset under-utilisation;

96 COAG Energy Council, Meeting communique, 23 July 2015, p4.

Project proponent	Project title	Description of project
		• network incentives to invest and innovate; and • the frameworks needed to support competitive markets in alternative services.[97]
AER	Regulating innovative energy selling business models under the NERL	The AER is looking at the business models of alternative energy sellers, specifically those brought about by technological innovation, and the impacts that these may have on how energy is retailed to customers. It is also assessing the policy implications for the AER's regulation of this segment of the market and options for future regulation. The AER plans to finalise the outcomes of this work in 2015.[98]
AER	Ring-fencing guideline	In 2012 the AER signalled its intention to review ring-fencing arrangements for DNSPs and harmonise the various state-based ring-fencing guidelines into a single, national guideline.[99] The final rule for the competition in metering and related services rule change, published on 26 November 2015, requires the AER to develop ring-fencing guidelines for the separation of a DNSP's provision of direct control services from the provision of other services.[100]
Clean Energy Council	Australian energy storage roadmap	The roadmap, published April 2015, outlines a program of initiatives to better define and address the safety, environmental, technical, commercial and informational barriers to the deployment of energy storage technologies - large and small scale.[101]

97 COAG Energy Council, Meeting communique, 23 July 2015, p4.

98 See https://www.aer.gov.au/retail-markets/retail-guidelines/regulating-innovative-energy-selling-business-models-under-the-national-energy-retail-law.

99 See https://www.aer.gov.au/node/12493.

100 See http://www.aemc.gov.au/Rule-Changes/Expanding-competition-in-metering-and-related-serv.

101 See http://www.cleanenergycouncil.org.au/cec/policy-advocacy/storage-roadmap.

Project proponent	Project title	Description of project
Clean Energy Council	Embedded generation grid-connection standards scoping study	The Clean Energy Council is managing the development of a scope of work to design and implement a standard for the connection of commercial-scale embedded generation (between 30 kW and 5 MW).[102]
AEMO	Emerging technologies information paper	AEMO is now taking initial steps to incorporate storage facilities into its normal business processes. In June 2015, AEMO published this paper as a companion to the National Electricity Forecasting Report (NEFR). The report estimates the uptake of battery storage systems by residential consumers to determine the impact on 2015 NEFR maximum demand forecasts.[103]
AEMO	National Transmission Network Development Plan	AEMO used two scenarios to examine the efficient development of the national transmission grid for its 2015 National Transmission Network Development Plan, published November 2015.[104] One of these scenarios includes high penetrations of distributed generation and residential storage.
AEMO	Registration requirements	AEMO is examining the regulatory arrangements applicable to participant registration under the NER using a storage device.

102 See http://www.cleanenergycouncil.org.au/fpdi/reports/grid-connection-standards-scoping-study.html.

103 See http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report/NEFR-Supplementary-Information.

104 See http://www.aemo.com.au/Electricity/Planning/National-Transmission-Network-Development-Plan.

B Summary of stakeholder comments

This appendix provides a summary of the comments received from stakeholders in their submissions to the discussion paper. The comments refer to questions asked in the discussion paper but may also refer to issues for which no specific question was asked. The summaries provided in this appendix are organised with reference to the structure of the discussion paper. Please refer to the sections of the discussion paper referenced throughout this appendix for more information on the issue raised and/or questions asked.

B.1 Chapter 1: Introduction

B.1.1 Purpose and scope of the AEMC's work (section 1.1)

The AEMC asked the following questions in its discussion paper:

- Do stakeholders agree that the appropriate scope for the AEMC's work is the NEL and the NER as they relate to the integration of energy storage?
- Are there elements of the current consumer protection framework that need to be reviewed in relation to the penetration of energy storage?
- Are there jurisdictional and sub-jurisdictional instruments relevant to energy storage that the AEMC should also consider?

SA Power Networks agreed that the AEMC's scope includes the NEL and the NER. It recommended that, in proposing policy positions, the AEMC be cognisant of relevant jurisdictional arrangements for licensing electricity entities both on and off-grid and jurisdictional arrangements for technical and safety regulation.[105] Ergon Energy expressed a similar view, noting the requirements of jurisdictional instruments such as the Queensland's Electricity Safety Act and Electrical Safety Regulations.[106]

The ERAA submitted that the AEMC should not feel constrained in providing recommendations and views on changes that might need to occur to the NECF and jurisdictional instruments. It noted the importance of a nationally consistent approach to this emerging technology and recommended that, if there are various regulatory elements that need to be coordinated, this should be clearly identified.[107] Ergon Energy recognised the need for adequate consumer protections to protect consumers of energy storage products. It noted the work being undertaken by the COAG Energy Council and AER in this space, but considered that a review of the adequacy of consumer protections under the NECF may be required to ensure that there are no

105 SA Power Networks, submission on discussion paper, p5.

106 Ergon Energy, submission on discussion paper, p7.

107 ERAA, submission on discussion paper, p1.

gaps in the overall framework.[108] The Clean Energy Council submitted that there may be consumer protection issues if large numbers of consumers obtain electricity through micro-grids, and therefore it may be desirable to extend the scope of the NECF beyond the "interconnected national electricity system".[109]

A number of stakeholders supported the AEMC's proactive approach to looking at the regulatory implications of emergent technologies.

Vector was of the view that the discussion paper provided a good starting point for thinking about how, and the extent to which, energy storage should be regulated. It also welcomed the AEMC's observation that developments and innovations in energy storage are challenging traditional boundaries in the electricity supply chain.[110] The Customer Advocate was of the view that unintended external factors and political influence tend to drive energy storage policy, and that a number of the case studies in the discussion paper did not acknowledge the externalities that have influenced these examples.[111]

SA Power Networks was strongly of the view that battery storage should be treated no differently to other technologies, and that it should, as far as practical, be accommodated within existing frameworks. It argued that affording storage technologies different treatment could lead to unintended consequences and otherwise disadvantage other technologies and/or distort the wholesale market.[112] Ergon Energy also supported the AEMC's technology neutral approach.[113] The Customer Advocate was also of the view that the regulatory framework to adopt storage is largely in place, but noted that it is how the regulatory framework is interpreted and applied that will have the biggest bearing on how storage is adopted. It also highlighted the relevance of energy tariffs in the speed and scale of storage uptake by electricity consumers.[114]

A number of DNSPs expressed concern that the analysis and findings set out in the AEMC's discussion paper pre-empted regulation, and submitted that the AEMC should promote the National Electricity Objective, not regulation.[115] Energex considered that the regulatory regime should not favour any particular outcome and that the market should be allowed to determine where the largest benefit sits without the regulatory regime distorting the market outcome.[116] The ENA was of the view that rigorous assessment of the costs and benefits of regulation should take place, and that

108 Ergon Energy, submission on discussion paper, p7.

109 Clean Energy Council, submission on discussion paper, p3.

110 Vector, submission on discussion paper, p2.

111 The Customer Advocate, submission on discussion paper, p2.

112 SA Power Networks, submission on discussion paper, p8.

113 Ergon Energy, submission on discussion paper, p4.

114 The Customer Advocate, submission on discussion paper, pp2-4.

115 CitiPower and Powercor, submission on discussion paper, p2; ENA, submission on discussion paper, p1; SA Power Networks, submission on discussion paper, p3.

116 Energex, submission on discussion paper, p4.

the AEMC should consider the potential loss of integration efficiencies and increased transaction costs if ring-fencing requirements are imposed on DNSPs. It submitted that the overall regulatory approach on storage will be a "joint product" between AEMC rules and AER guidelines and approaches.[117] United Energy expressed concern that a number of the conclusions set out in the discussion paper would result in increased regulation and barriers to market-based deployment of technology, but are not supported by appropriate evidence of robust cost benefit analyses. It was of the view that many of the recommendations are inconsistent with regulatory best practice and are proposed to be enduring, not reviewed as markets develop.[118]

SA Power Networks was of the view that imposing additional regulation, particularly on already heavily regulated DNSPs, risks inhibiting innovation and stifling competition in the storage market by:

- reducing incentives for DNSPs to seek out opportunities to implement innovative network solutions using storage devices;
- establishing a barrier to entry for DNSPs to compete to offer storage solutions for customers, potentially lessening competition in that market;
- preventing integration and efficiency across the energy supply chain; and
- introducing new and inefficient ring-fencing costs such as increased transactional costs and new costs associated with reporting and compliance.[119]

Simply Energy expressed concern that the existing regulatory framework would allow an increase in the scope of regulated monopoly activities into an area that does not exhibit natural monopoly characteristics. It argued that this is inconsistent with the framework of energy regulation in Australia, which is built on the understanding that competitive markets give the best customer outcomes, and that regulation is second-best. It asked that the AEMC look instead at maximising the scope of competitive energy markets, and restrict the activity of regulated monopoly businesses to natural monopolies.[120] PIAC expressed a view that keeping monopoly power in check is an almost impossible task and leaves consumers bearing unacceptable risks. It submitted that the emergence of storage technology offers the chance for the risks associated with monopoly market power to be more effectively managed, and for a new, dynamic and innovated sector of energy market services to be fostered.[121]

Energy Australia supported the guiding principle of competitive neutrality across the energy sector. It submitted that regulation should avoid conferring an advantage on a particular technology, and was of the view that this would encourage consumption and investment that reflects the true cost of generation and transportation, and support

117 ENA, submission on discussion paper, pp1-3.

118 United Energy, submission on discussion paper, pp1,4.

119 SA Power Networks, submission on discussion paper, p3.

120 Simply Energy, submission on discussion paper, p1.

121 PIAC, submission on discussion paper, p2.

the realisation of the full range of benefits that storage technology offers. Its submission also noted that regulation has the potential to create differences in cost structures across market participants and argued that the regulatory framework should not disadvantage incumbents relative to new entrants.[122]

The Customer Advocate submitted that the strongest case for energy storage will be when the customer/investor benefits from the largest 'value stack' - ie, an aggregation of the benefits that storage offers through:

- the ability to make the best use of the 'cheapest' energy where a price differential exists;
- a component of the retail benefits through their retail contract; and
- a component of the network benefits from better utilisation of the network.

It was of the view that any regulatory framework needs to support the ability for the amalgamation of the value stack and pass much of that value back to the customer.[123]

The Clean Energy Council considered that the scope of the AEMC's work also included aspects of the NERR as they relate to the treatment of the non-exporting storage and embedded generators as retail customers.[124]

Ergon Energy submitted that electric vehicles can reasonably be considered as energy storage devices, comparable to non-export and export embedded generation, and should therefore be included in the scope of the AEMC's review.[125]

Networks NSW requested an indicative project timeline in the Commission's final report to understand the extent to which there will be further opportunities for consultation. It submitted that a consultative approach with other related projects will be required to ensure a clear and consistent solution is developed that achieves the strategic direction provided by the COAG and Clean Energy Council projects, and is complemented by the various AER and AEMO projects.[126]

B.2 Chapter 2: End users and aggregators

B.2.1 Connection processes (sections 2.1 and 2.1.1)

The AEMC asked the following questions in its discussion paper:

- Connection processes are new and still being implemented. Do you anticipate any issues with the connection process associated with storage?

122 Energy Australia, submission on discussion paper, p1-3.

123 The Customer Advocate, submission on discussion paper, p6.

124 Clean Energy Council, submission on discussion paper, p3.

125 Ergon Energy, submission on discussion paper, Attachment 1, p5.

126 Networks NSW, submission on discussion paper, p2.

- Do connection processes represent a barrier to storage? If so, what specifically is the issue?

- Should DNSPs be required to have a connection offering that separately addresses the connection of micro storage capability?

Most stakeholders that presented a view on the issue agreed that the existing connection process under the NER for micro-embedded generation was adequate for storage, and therefore considered that it was not necessary to require DNSPs to have a separate storage connection offering.[127] Ergon Energy submitted that such a requirement would represent unnecessary duplication and result in unnecessary costs to both industry and consumers because, in most cases, energy storage will be coupled with generation (either via the same inverter or in parallel to a generator), and will therefore:

- share the same connection assets, control mechanisms and protection; and

- feed into the same circuits.[128]

Networks NSW noted that there are existing rules, standards, guidelines and processes for connecting both load and micro-embedded generation, and that both should be followed for the connection of storage capability. It explained that applications for battery systems using the existing connection processes are already being received and accepted without any negative feedback or customer issues arising to date.[129]

Some DNSPs were of the view that existing connection offerings could be reviewed to more clearly articulate their applicability to the connection of storage devices.[130] Networks NSW noted that Ausgrid is already updating its connection application forms to add an extra category for battery storage as a type of generating system. Ergon Energy supported the utilisation of existing connection processes for the connection of battery storage systems because they are based on AS 4777,[131] which is also the basis for the connection of energy storage devices. However, it noted that these processes, and AS 4777, will likely require updating to accommodate energy storage, and suggested that any such review could integrate a new definition of energy storage that takes into account its multi-functional capabilities.[132]

The Customer Advocate was of the view that the connection arrangements in Chapter 5A of the NER already present challenges for the connection of embedded generation,

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127 AGL, submission on discussion paper, p6; Clean Energy Council, submission on discussion paper, p4; Energex, submission on discussion paper, p6; Ergon Energy, submission on discussion paper, Attachment 1, p3; Networks NSW, submission on discussion paper, pp1,3,17; SA Power Networks, submission on discussion paper, p7.

128 Ergon Energy, submission on discussion paper, Attachment 1, p3.

129 Networks NSW, submission on discussion paper, p3.

130 Networks NSW, submission on discussion paper, p3; SA Power Networks, submission on discussion paper, p5.

131 Australian Standard 4777 is discussed further in Chapter 2 of the discussion paper.

132 Ergon Energy, submission on discussion paper, Attachment 1, p3.

stating that almost all solar PV connections are considered 'negotiated' with commensurate fees, variable outcomes and extended response times. It argued that this disincentivises consumers to take up new technologies and that the increased uptake of storage will only heighten the costs and frustration. The Customer Advocate proposed that consideration be given to how small energy storage behind the meter could be a basic connection to create surety and transparency for customers and remove low priority workload from DNSPs.[133] It also recommended that the AEMC consider mechanisms to incentivise DNSPs to negotiate effective connection contracts with customers that reflect the benefit of the customer's investment in demand management, storage and embedded generation where the connection provides a benefit to the network.[134]

Simply Energy saw value in requiring DNSPs to have a basic storage connection offer to make it as easy as possible for potential connection applicants to understand the requirements when they are developing projects.[135] AGL was of the view that DNSPs should be required to have a new basic connection offering, approved by the AER, that involves automatic approval for storage systems below a certain size threshold that do not require network upgrade or augmentation works. It recommended that this threshold for retail customers be set at 5kW, and applied to all systems that meet the requirements of AS 4777.[136]

The Clean Energy Council asked the AEMC to clarify the extent of DNSPs' "quasi-regulatory powers" in relation to the connection approval of non-exporting storage or micro-embedded generation systems. Specifically, it asked that the AEMC:

- clarify that non-exporting systems are to be treated as retail customers under both the NER and NERR, not embedded generators;
- clarify the NER to ensure that any non-exporting system is subject to a model standing offer for customers who are not embedded generators under the NER; and
- incorporate the appropriate technical requirements for non-exporting systems in the NER as part of the development of connection standards for embedded generators.[137]

Ergon Energy was of the view that the connection process should be viewed as a necessity, rather than a barrier to storage because of storage's potential to disrupt the operation of the network through capacity, voltage or frequency disturbances and network outages. It noted that the connections framework under the NER provides for simplified connection processes where the level of risk associated with a particular

133 The Customer Advocate, submission on discussion paper, pp13-14.

134 Ibid., p7.

135 Simply Energy, submission on discussion paper, p7.

136 AGL, submission on discussion paper, pp11,17.

137 Clean Energy Council, submission on discussion paper, p8.

connection type is low.[138] Ergon Energy recommended that consideration be given to extending the scope of when an energy storage device is considered a generator and as such cannot be connected to a DNSP's network without its consent. It explained that even non-exporting systems have the potential to disrupt the operation of electricity networks because the systems cannot always respond in sufficient time to prevent the export of small amounts of electricity to the grid. It also noted that network disruption may be caused as a consequence of variations in load profiles due to storage capability.[139]

The NSW DNSPs submitted that there is no evidence to suggest that they impose anti-competitive or onerous connection requirements that would present a barrier to the development of the storage market. They argued that DNSP connection requirements and agreements are subject to consultation and AER approval through the regulatory determination process, which ensures an effective, cost reflective and safe market is established.[140] Energex explained that it has already successfully connected approximately 60 storage devices and has one of the highest penetrations of solar PV in the world. It therefore did not consider that current connection processes or requirements are a barrier to customers seeking to connect energy storage to the distribution network.[141]

AGL submitted that connection processes used by DNSPs are not as efficient and transparent as they should be following changes to Chapter 5 and 5A. It raised a number of specific concerns, including that:

- there is information asymmetry and there are minimal incentives on DNSPs to negotiate fair and equitable connection terms, particularly for negotiated agreements;
- there are minimal compliance and enforcement management provisions in the NER with respect to the grid connection process;
- DNSPs apply the same connection process and regulatory arrangements to all retail customers, irrespective of whether the customer is seeking to install an export or non-export system, which introduces unfair costs, risks and installation delays;
- DNSPs may have a tendency to treat AC-coupled storage as an additional inverter and apply a greater stringency in the connection requirements for it if the DNSP can argue that the effect of the customer using storage would put a strain on network assets during peak events; and

138 Ergon Energy, submission on discussion paper, Attachment 1, p2.

139 Ibid.

140 Networks NSW, submission on discussion paper, pp1-2.

141 Energex, submission on discussion paper, p6.

- DNSPs playing 'gate keeper' for grid connections is inefficient and unfair, especially given some have acknowledged their interest in competing in contestable markets.[142]

AGL was of the view that the NER should consider storage as a distributed energy resource tool that contributes to network stability. It asked that the AEMC acknowledge that a customer with storage capability only has the incentive to export when being paid for the service, and that network businesses will be the primary beneficiary of retail customers exporting. AGL therefore considered that DNSPs should be more flexible with their connection requirements and provide a support provision within their connection agreement, eg, a market based feed-in tariff.[143]

Concerned about competitive neutrality where DNSPs are operating in contestable markets, such as the provision of storage services, both AGL and the Clean Energy Council proposed that an independent gate keeper, such as AEMO or the AER, be appointed to administer and approve all applications to ensure a fair, streamlined process for the connection of embedded generation.[144]

B.2.2 Costs of connection (section 2.1.2)

The AEMC asked the following question in its discussion paper:

- Do connection costs represent a significant barrier to storage? If so, what specifically is the issue?

Networks NSW was of the view that connection costs do not present a barrier to the uptake of storage, and stressed the importance of understanding the distinction between cost reflective price signals and cost barriers. It submitted that the cost of the capital equipment borne by the customer may be high for legitimate reasons and that DNSPs incur costs to assess voltage levels for larger micro-embedded generator units, which are passed on to customers through regulated connection charges.[145] Ergon Energy supported this view, noting that connection costs are approved and regulated by the AER, meaning protections are already in place to ensure customers are paying a fair and reasonable price for connection to the grid.[146]

AGL was also of the view that connection costs do not present a barrier to storage, but only where they are applied efficiently. It noted that there are other costs that affect the installation of storage, including costs to comply with the requirements of AS 4777.[147]

142 AGL, submission on discussion paper, p7.

143 Ibid.

144 AGL, submission on discussion paper, pp6,16; Clean Energy Council, submission on discussion paper, p8.

145 Networks NSW, submission on discussion paper, p18.

146 Ergon Energy, submission on discussion paper, Attachment 1, p3.

147 AGL, submission on discussion paper, p8.

The Customer Advocate submitted that the current structure of energy tariffs and capital contributions is not conducive to the uptake of storage. Specifically, it was the of the view that the pricing practice of raising fixed charges reduces the incentive to invest in energy storage. It argued that if the fixed charge is too high, customers have an incentive to leave the grid, and if it's a large component of the bill, customers are dis-empowered and have reduced inventive to be aware of how much they use and when.[148]

B.2.3 Additional requirements, including technical requirements (section 2.1.3)

The AEMC asked the following question in its discussion paper:

- Would a separate industry standard for the connection of small or micro storage assets to a distribution network be appropriate? If so, what should be included?

The Customer Advocate was of the view that an energy industry standard for the connection of small storage was definitely not necessary because it is technically the same as connecting a small embedded generator, which is already addressed.[149]

A number of stakeholders submitted that each jurisdiction, and sometimes each DNSP, has separate technical requirements to connect to the network, which are often applied inconsistently. These stakeholders therefore saw value in standardising technical requirements and approval processes so that the connection of embedded generation is consistent, transparent and efficient NEM-wide.[150] AGL recommended that the NER set out the requirements for a separate connection standard for storage in the NEM to address the complexities of storage, including different technical and safety requirements, which are more apparent than other forms of embedded generation. It proposed that this connection standard be linked to a purpose-designed Australian Standard (once developed) which sets out minimum installation guidelines, safety and technical requirements, grid protection requirements and supports a broad range of storage architectures.[151]

The ERAA was of the view that there may be competing interests from market participants as to how energy storage is deployed and operated across the supply chain. For this reason, it supported the development of a nationally consistent industry standard covering connection assessments and approval processes, with an independent appeal mechanism, to provide clarity and transparency.[152] Origin Energy supported this view.[153] Simply Energy also supported the development of standard technical requirements for connection across networks. It considered that technical

148 The Customer Advocate, submission on discussion paper, pp6-7.

149 The Customer Advocate, submission on discussion paper, p15.

150 AGL, submission on discussion paper, p6; Clean Energy Council, submission on discussion paper, p5; Lumo Energy, submission on discussion paper, pp3-4; Origin Energy, submission on discussion paper, p3; The Customer Advocate, submission on discussion paper, pp14-15.

151 AGL, submission on discussion paper, pp7-8.

152 ERAA, submission on discussion paper, p1.

153 Origin Energy, submission on discussion paper, p3.

requirements should be focused on safety and compatibility only, with the financial impact on the network signalled through tariffs and connection charges.[154]

Energex considered that, while having standard connection requirements is attractive in theory, DNSPs vary greatly in their nature and configuration, from high-density urban networks to remote rural networks. It was of the view that connection requirements should be flexible enough to allow transparent decision-making by the DNSP to manage the network risks arising from localised and large-scale energy storage in the same way that a large-scale generator would be required to satisfy connection requirements.[155] Networks NSW supported a review of technical requirements for connection across networks, but considered that any concerns arising from such a review should be addressed through Standards Australia rather than through amendments to the NER or the creation of duplicative guidelines.[156] SA Power Networks was of the view that existing connection arrangements, with the revised AS 4777, are appropriate.[157]

Ergon Energy was of the view that a separate industry standard for the connection of micro storage assets would result in the removal of technology neutrality and may result in a slow and complex connection process, which could present a barrier to storage uptake. It submitted that an energy storage device would connect to the network via an AS 4777 inverter, so can be managed under existing processes. It recommended that the combined micro-embedded generation standard be updated if and as required to include clauses relevant to storage capability, and noted that the joint Ergon Energy / Energex connection standard is currently under review.[158]

The ENA supported a review of technical requirements applying to the connection of storage behind the meter to assess the appropriateness and consistency of existing arrangements. It noted that such a review could consider the underlying reasons for different requirements and the costs and benefits of harmonisation, but give due regard to the safety and system security reasons for technical specifications and control requirements.[159]

AEMO noted the potential system impacts of an increased penetration of distributed systems, and suggested it might be appropriate to consider whether there are practical means of regulating the technical characteristics of facilities in aggregate rather than focusing on a facility's local interaction with the network as standalone.[160]

154 Simply Energy, submission on discussion paper, p7.

155 Energex, submission on discussion paper, p7.

156 Networks NSW, submission on discussion paper, p5.

157 SA Power Networks, submission on discussion paper, p5.

158 Ergon Energy, submission on discussion paper, Attachment 1, p3.

159 ENA, submission on discussion paper, p3.

160 AEMO, submission on discussion paper, p5.

B.2.4 Standards for the installation, connection and operation of storage devices (sections 2.2, 2.2.1 and 2.2.2)

The AEMC asked the following question in its discussion paper:

- Does standard AS 4777 represent a potential barrier to the deployment of storage by providers other than networks? What elements of the standard are problematic?

Most DNSPs did not consider that AS 4777 gave DNSPs too much control over distribution-connected storage. Energex submitted that AS 4777 does not provide control to any one party and that its purpose is to ensure the overall safety, reliability and performance of the inverter when connected to the electricity distribution system.[161] Networks NSW also made this point, and noted that use of the standard control functionality would require the agreement of the customer or owner of the equipment.[162] SA Power Networks was of the view that an ability for DNSPs to limit or increase inverter output at certain times is a key requirement to maintaining a safe and reliable network, and that the absence of these protections may have adverse consequences for customers, the operation of the network and the safety of powerline workers.[163]

Networks NSW submitted that DNSPs need to exercise a degree of control over certain devices to manage network risks and satisfy their regulatory and license obligations. It argued that requirements such as AS 4777 are prudent measures to ensure the safe and reliable operation of the network and promote customer choice without compromising safety. It noted that majority of the demand response and power quality support control functions of AS 4777 are optional, and that flexibility is provided to utilise this functionality via an external device or integrated into the inverter. Networks NSW also stated that DNSPs' connection requirements mainly refer to these standards and typically do not impose any additional restrictions unless specific network circumstances warrant. It was of the view that an absence of appropriate technical requirements would preclude an accurate valuation of the potential revenue streams from deploying battery storage devices and may result in other customers cross-subsidising the network costs created by the inefficient operation of the market.[164]

Energex noted that AS 4777 was developed in consultation with a wide range of industry and technical experts and is only just being finalised. It was of the view that a review of technical requirements covered by AS 4777 is neither necessary nor appropriate, and that Standards Australia is responsible for coordination of those reviews on an 'as needs' basis.[165]

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161 Energex, submission on discussion paper, p6.

162 Networks NSW, submission on discussion paper, p19.

163 SA Power Networks, submission on discussion paper, pp2,5.

164 Networks NSW, submission on discussion paper, pp1,4-5,19.

165 Energex, submission on discussion paper, p6.

Lumo Energy believed that the amendments to demand management in proposed AS 4777 will allow for higher saturation of solar PV and storage without effects on system security or stability. It submitted that it is imperative the standard is not used by networks to the detriment of consumers.[166]

AGL expressed concern that AS 4777 has the ability to mandate the voluntary AS 4755 standard, which would allow DNSPs to control the demand response of inverter systems that are connected to their network. It was strongly of the view that DNSPs should not have the ability to control a customer's storage system via the inverter, and that AS 4777 should only set out the technical and safety specifications of inverter systems for grid connection purposes.[167]

The Customer Advocate was of the view that AS 4777 is appropriate for a grid-connected inverter for a battery storage system, but submitted that it was unclear who, why, when and who gets paid for inverters to enter the control mode for power output. It argued that customers expect commercial returns from their systems, and that the implications of the control modes must exist in tariffs, subsidies or other compensation to the customer.[168]

The Clean Energy Council was of the view that DNSP control of inverters under AS 4777 would expose a gap in consumer protections. It proposed two regulatory solutions:

1. allow DNSPs to control an AS 4777 inverter when there is a demand management contract in place; or

2. introduce a mechanism in the NER to require DNSPs to return revenues collected from micro-embedded generation and storage customers when it has activated the inverter's demand response mode.[169]

AGL also recommended a regulatory response to DNSP control of inverter systems. It proposed that the NER be amended to require DNSPs to notify a customer where a network load issue has been identified, and provide suitable financial compensation for the customer's lost value stream. If this cannot be introduced, AGL recommended that the NER specifically override the network control provisions in AS 4777.[170]

B.2.5 Retailer authorisation and aggregator registration (sections 2.3.1 and 2.3.2)

The AEMC asked the following questions in its discussion paper:

166 Lumo, submission on discussion paper, pp3-4.

167 AGL, submission on discussion paper, p10.

168 The Customer Advocate, submission on discussion paper, p16.

169 Clean Energy Council, submission on discussion paper, p6.

170 AGL, submission on discussion paper, p11.

- Do storage systems have characteristics, either individually or in aggregate, that mean regulation through the retail exemptions framework set out above is inappropriate for the relevant value stream? For example, there is no limit on the number or size of generating units a small generation aggregator can aggregate and so sell into the wholesale market. Does this present a concern?

- Aggregating parties would be required to register with AEMO if they intend to participate in the NEM. Will this provide any kind of barrier?

AGL was of the view that exemption, rather than retail authorisation, is the most appropriate means of regulation because authorisation does not offer the required flexibility for regulating non-traditional business models. It expressed support for the approach set out in the AER's guideline, and described its views on the principles that should underpin the development of a regulatory framework applying to storage businesses selling energy.[171] Origin agreed that the provision of a service using storage technology should be exempt from retail authorisation because the service will largely be used by the customer for self consumption. However, it considered that aggregating parties should be required to be authorised because the service is clearly a departure from the customer using it for their own use, and is more a retail activity.[172]

AGL was not concerned that there is no limit on the number of size of generating units a small generation aggregator can aggregate and sell into the wholesale market because it is the aggregator's choice to obtain registration and pay the associated market fees.[173] The Customer Advocate expressed doubt about the economics of the aggregator business model under current market conditions, and submitted that the overhead of registration and administration of aggregation with AEMO remains as much an issue for solar PV as it will for storage. It was of the view that the AEMC would soon need to consider the aggregation of community-based generation where an aggregation of energy infeed from solar PV is 'retailed' to the local shareholders, and that the same issues will apply to distributed storage.[174]

Ergon Energy was of the view that regulation through the retail exemptions framework is inappropriate because aggregators will have the ability to control considerable amounts of energy for release into the grid, which could cause challenges for AEMO and/or network businesses if the stored energy is within a single network zone (such as a distribution feeder).[175]

SA Power Networks acknowledged that there are likely to be a range of ways that the functions enabled by storage would be provided, including operating models whereby customers with energy management systems trade excess energy to neighbours using the distribution network using 'virtual net metering' and 'point-to-point wheeling charges'. However, it submitted that it is difficult to see how such models can be

171 AGL, submission on discussion paper, p9.

172 Origin Energy, submission on discussion paper, pp3-4.

173 AGL, submission on discussion paper, p10.

174 The Customer Advocate, submission on discussion paper, p16.

175 Ergon Energy, submission on discussion paper, Attachment 1, p4.

integrated into the NEM under current registration, metering and network charging arrangements.[176]

Ergon Energy did not perceive that the requirement for aggregating parties to register with AEMO would create a barrier to participation in the NEM. It considered registration to be vital to manage the potential for energy storage devices to cause disruptions on the network, and to ensure a level playing field for all market participants.[177] AEMO noted that the uncertainty around the ability to register storage systems as a generator within the NER also extends to the ability to register small generation as aggregators.[178] Ergon Energy also submitted that DNSPs should be provided visibility of aggregated loads and locations, potentially by the development of a national guideline stipulating load management standards (such as visibility, capacity and ramp up limitations). It was of the view that such a guideline could be separately classed across central business district, urban, rural and isolated regions to enable market benefits as determined by capacity in various regions.[179] Networks NSW was of the view that this visibility could be created by requiring AEMO or the aggregating parties themselves to notify DNSPs of their registration.[180]

Several stakeholders supported the AEMC's recommendation that the existing registration requirements for a small generation aggregator be investigated to assess whether the ensuing rights and obligations are suited to the aggregation of behind-the-meter storage assets. SA Power Networks was of the view that this review be completed as a matter of priority and no later than June 2016.[181] Simply Energy proposed that the investigation ensure that cross subsidies from customers without storage to customers with storage are not introduced.[182] The Customer Advocate recommended that the AEMC consider mechanisms to influence the ability for aggregators to identify and draw out the maximum value of disaggregated storage assets on behalf of consumers.[183]

Stanwell suggested that consideration be given to the impact of charging and discharging aggregated storage capability on market transparency, including whether aggregators with large portfolios should be required to bid and offer into the central dispatch in the same manner as registered generators and market customers. It was of the view that, without a requirement for these parties to provide AEMO with offer prices and capacity information, AEMO would be unable to accurately forecast pre-dispatch information. Stanwell also submitted that when the battery portfolios are charging, they will be responding to a price in the same manner as a market customer. It was of the view that, without a "small market customer aggregator" registration

176 SA Power Networks, submission on discussion paper, p3.

177 Ergon Energy, submission on discussion paper, Attachment 1, p4.

178 AEMO, submission on discussion paper, p3.

179 Ibid., p6.

180 Networks NSW, submission on discussion paper, p3.

181 SA Power Networks, submission on discussion paper, p7.

182 Simply Energy, submission on discussion paper, p7.

183 The Customer Advocate, submission on discussion paper, p7.

category, these portfolios will be unable to access the wholesale market price and will instead be responding to retail tariffs. Alternatively, if the aggregators are registered as retailers, the aggregator may manage charging with consideration for wholesale prices. Stanwell concluded that, given there is no requirement for the aggregator to provide AEMO with bid price and capacity information, AEMO would be unable to accurately forecast pre-dispatch.[184]

B.2.6 Ability to provide ancillary services (section 2.4.1)

The AEMC asked the following questions in its discussion paper:

- Should aggregators be able to offer FCAS? If no, why not?
- What are the technical or data requirements that would need to be addressed?

A number of stakeholders agreed with the Commission's view that the restriction on small generation aggregators offering FCAS should be lifted.[185] Some of the arguments put forward by stakeholders to support this view include that:

- the restriction is inconsistent with the market-based principles applied in the NEM;
- overall costs to customers will be reduced by allowing new technology and aggregators to enter FCAS markets;
- additional potential sources of FCAS will benefit consumers, especially as the need for FCAS is expected to increase as the share of energy generated by intermittent renewable energy sources increases; and
- small generation aggregators are already liable for ancillary services charges and should therefore be able to provide the service.

AEMO suggested that there is no reason why small generation aggregators should be precluded from offering FCAS if they meet the technical specifications required by the NER and AEMO. It noted that the NER sets out the requirements for market ancillary services, including that bids be specified in whole MW. This places a threshold of 1MW on the minimum quantity of FCAS that can be offered, which may pose a barrier for some small generation aggregators.[186]

SA Power Networks supported the participation of small generation aggregators in FCAS markets provided that appropriate technical and data requirements are addressed, but did not specify what these requirements might be.[187] Ergon Energy

184 Stanwell, submission on discussion paper, pp2-3.

185 AEMO, submission on discussion paper, p3; AGL, submission on discussion paper, p11; Clean Energy Council, submission on discussion paper, p9; Ergon Energy, submission on discussion paper, Attachment 1, p5; SA Power Networks, submission on discussion paper, pp6-7.

186 AEMO, submission on discussion paper, p4.

187 SA Power Networks, submission on discussion paper, Attachment 1, p3.

noted the importance of small generation aggregators providing audit services that accurately show the value of the ancillary service at any point in time to ensure they correctly charge for the services provided.[188]

Simply Energy stated its support for the development of competitive markets wherever possible, but submitted that different types of FCAS need to be correctly valued to ensure that incentives for lower quality FCAS are not inadvertently created. It noted that only scheduled market generators can offer market ancillary services and was of the view that this requirement needed to be maintained, otherwise the market ancillary services market will be distorted by the operation of non-dispatched services.[189]

The Customer Advocate submitted that storage could offer more to network security than just FCAS. It was of the view that the ability for distributed generation and storage to have adequate coordinator and control capability for FCAS response is unlikely to be economic.[190]

B.3 Chapter 3: Network businesses integrating storage

B.3.1 The regulation of services provided by storage facilities (sections 3.1.1, 3.1.2 and 3.1.3)

The AEMC asked the following questions in its discussion paper:

- Do stakeholders agree that there may be tensions and ambiguities within the distribution service classification framework that would benefit from clarification?
- Do these issues relate in particular to the potential for development of competition in the provision of energy services from storage?
- How should network business-controlled storage on the network be regulated – as standard or alternative control, or other?

Most stakeholders that presented a view on the issue agreed that the current service classification framework was capable of accommodating energy storage, that it is the services provided by a storage asset that would form the basis of the assessment, and those services are already classified. However, significant differences of opinion were expressed in relation to whether services provided by storage – both behind the meter and on the network – *should* be classified as a distribution service or left unregulated in order for competition to develop. Many stakeholders also called for the AEMC and the AER to resolve the apparent inconsistency in their positions with regard to storage behind the meter.

188 Ergon Energy, submission on discussion paper, Attachment 1, p5.

189 Simply Energy, submission on discussion paper, p7.

190 The Customer Advocate, submission on discussion paper, p17.

Network businesses generally submitted that the services provided by storage are capable of being classified under existing service definitions,[191] that the service classification should be determined based on the service provided and the beneficiary of the service, rather than the underlying technology or the location of the asset[192] and that storage that provides network support and quality and reliability of supply services should be treated as providing standard control services.[193] By contrast, SA Power Networks submitted that the provision of storage services to customers by DNSPs are contestable, unregulated services: that is, they are not subject to service classification under the NER.[194] Similarly, CitiPower and Powercor submitted that the meter is the point of demarcation between the distributor's network and that of the customer, so equipment behind the meter is contestable.[195] Networks NSW argued that network support and quality and reliability of supply services are not contestable, so the AEMC's concerns about the potential to damage the development of competitive markets are not relevant.[196] However, while the existing service classification process may be workable with minor adaptions to accommodate an increased uptake of storage, the ENA agreed with the AEMC that there may be tensions and ambiguities within the current framework and considered that there is a case for looking more strategically at 'fit-for-purpose' service classification processes, form of regulation tests and institutional arrangements for the increasingly competitive environment around new and existing network service delivery.[197]

ElectraNet submitted that storage could be provided by a TNSP as part of the transmission connection service to generators and transmission customers. This would potentially see the storage device located behind the customer or generator meter, with the market facing component of the device resting with the connecting party, but the TNSP owning and maintaining the device. Because the service would be provided on a contestable, non-regulated basis it would reasonably be considered a transmission service not subject to the ring-fencing guidelines.[198]

United Energy disagreed with the AEMC's preliminary finding that DNSPs should be prohibited from investing directly in storage behind the meter. United Energy argued that the use of load control behind the meter for network support provides an historic counter-example.[199] The most efficient means of addressing local network issues may be for network businesses to own batteries behind the meter with a contribution from

191 Networks NSW, submission on discussion paper, pp1, 8; SA Power Networks, submission on discussion paper, p3.

192 Networks NSW, submission on discussion paper, pp1, 8; Ergon Energy, submission on discussion paper, pp12, 14.

193 Networks NSW, submission on discussion paper, pp1, 9; SA Power Networks, submission on discussion paper, p7.

194 SA Power Networks, submission on discussion paper, p3.

195 CitiPower and Powercor, submission on discussion paper, p2.

196 Networks NSW, submission on discussion paper, pp1, 9;

197 ENA, submission on discussion paper, pp3, 10.

198 ElectraNet, submission on discussion paper, p2.

199 United Energy, submission on discussion paper, p3.

the customer for the benefit that the customer receives through the use of the battery when it is not required for network support.[200] The regulatory framework must allow for the cost of procuring services from storage to be treated as standard control to enable network businesses to contract with customers with storage for network support.[201] By contrast, Simply Energy and The Customer Advocate agreed with the AEMC's preliminary finding that networks should not invest in storage behind the meter using regulated revenue.[202]

Stakeholders commented on the lack of consistency between the AER's interpretation that services provided from storage behind the meter would fall within the definition of a distribution service and the AEMC's preliminary finding that such services should be unregulated.[203] A lack of certainty over the treatment of service classification issues by the AER is likely to contribute to the deferral of otherwise efficient investment by all parties.[204] The ENA proposed that the AEMC and the AER jointly undertake future service classification processes on an integrated national basis. Ergon Energy agreed with this proposal.[205] Networks NSW also called for a collaborative approach between the AEMC and the AER and noted the need for certainty.[206]

EnergyAustralia called for the AER to develop and adhere to a definitive guideline for service classification that does not distort outcomes in favour of network solutions.[207] Origin Energy called for clear definition of where the distribution system ends in order for services provided by storage to be classified differently according to whether the storage device is behind the meter or in the distribution network.[208] Storage within the distribution system providing regulated network services could be a standard control service, so long as it did not compromise the integrity of the competitive retail market.[209] Storage behind the meter should not be a standard control service; it does not form part of the shared network.[210] Simply Energy called for the COAG Energy Council or the AEMC to provide clear direction to the AER as to the boundaries of the distribution system; this is a policy question that should not be decided by the AER on an ad hoc basis.[211]

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200 Ibid.

201 Ibid., p2.

202 Simply Energy, submission on discussion paper, p8; The Customer Advocate, submission on discussion paper, p18.

203 SA Power Networks, submission on discussion paper, p3.

204 Ergon Energy, submission on discussion paper, pp12, 14.

205 ENA, submission on discussion paper, pp3-4; Ergon Energy, submission on discussion paper, pp12, 14.

206 Networks NSW, submission on discussion paper, pp1, 8; SA Power Networks, submission on discussion paper, pp1, 8.

207 EnergyAustralia, submission on discussion paper, pp4-5.

208 Origin Energy, submission on discussion paper, pp1,4.

209 Ibid., pp4-6.

210 Ibid., pp1,4.

211 Simply Energy, submission on discussion paper, p5.

AGL agreed with how the AEMC has assessed the distribution service classification framework and on the likely classification of different storage functions under the AER's regulation. This will make service classification a critical issue - allowing network businesses to invest directly in energy storage, despite there being a competitive market for storage services - and requiring the AER to assess the efficiency of a network business's storage investments. The issue would be a secondary one, and the assessment of costs less controversial, if network businesses were required to access storage services through competitive markets.[212]

B.3.2 Network revenue regulation and energy storage (sections 3.2 and 3.2.1-3.2.7)

The AEMC asked the following questions in its discussion paper:

- Do stakeholders agree that the current rules applicable to networks are capable of integrating storage?
- Is the incentive framework for distribution and transmission businesses creating any barrier to the deployment of storage where it is cost effective to do so?
- Given the relatively unproven nature of battery storage should it be treated differently to other assets?
- Are any of the timelines associated with regulatory processes likely to be problematic?
    - For instance are the lead times in the planning process sufficiently long to capture the value of an incremental storage solution as a substitute for traditional network investment?

A dichotomy of views was presented regarding cost recovery.

Network businesses argued that a technology neutral approach means they should place storage in the regulatory asset base if that is the most efficient means of providing network services.[213] SA Power Networks submitted that services procured from customers will likely be an operating cost negotiated with the customers. Storage devices installed by SA Power Networks for network purposes are likely to be a capital investment, eligible for inclusion in the regulatory asset base, subject (where appropriate) to RIT-D public consultation processes being completed.[214] The ENA supported the overall conclusion that existing efficiency sharing incentives and normal commercial cost minimisation incentives should drive trade-offs between storage and traditional network asset choices in the delivery of regulated services.[215] Ergon Energy agreed that the current rules applicable to networks appear capable of integrating

212 AGL, submission on discussion paper, p12.

213 CitiPower and Powercor, submission on discussion paper, pp2-3.

214 SA Power Networks, submission on discussion paper, p7.

215 ENA, submission on discussion paper, p4.

storage.[216] ElectraNet noted that while the AER has made observations about proposed uses of energy storage in regulatory determinations, the AER only approves the allowance, not individual projects. A network business would not be precluded from choosing to procure a service provided by a storage device, subject to the efficiency and prudency of the decision in accordance with the rules.[217]

By contrast, AGL, PIAC and Simply Energy suggested that it would be more efficient if network businesses were prevented from being able to own storage and place it in the regulatory asset base. Instead, they should tender for storage services – both within the distribution network and behind the meter.[218] AGL argued that the AEMC's proposed approach of using the current rules frameworks will fail to realise cost effective delivery of energy storage to provide regulated services. Instead, the AEMC should be examining this issue in the light of three objectives: (1) incentivising the use of innovative non-network options; (2) ensuring the services are delivered efficiently; and (3) developing a competitive market.[219] AGL argued that network businesses will not price non-network options efficiently, because they do so on the basis of the options that are directly available to them, and also because they may not be aware of or able to capture benefits to parties other than the distribution network. Therefore network businesses should not be able to utilise their regulated funding for technologies and offers to customers for non-network solutions.[220]

The ENA submitted that an issue that would benefit from explicit focus is the treatment of standalone power solutions that feature a significant storage component. Separate to questions of cost recovery for storage as part of the shared network is the need for cost recovery arrangements to be flexible enough to accommodate innovative standalone power solutions being trialed and explored by ENA members that can substantially reduce total end costs to consumers (ie by allowing for the decommissioning of single or low use customer lines) at a distribution and transmission level.[221] Ergon Energy supported this view.[222]

Network businesses also argued that storage shouldn't be treated any differently to other assets, even given its relatively unproven nature.[223] Networks NSW identified that the DMIA provides the appropriate funding path for the testing and trial of innovative non-network solutions such as battery storage.[224] The ENA submitted that no special powers are needed for the AER to exclude non-proven technologies from the

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216 Ergon Energy, submission on discussion paper, p12.

217 ElectraNet, submission on discussion paper, p2.

218 AGL, submission on discussion paper, p12; PIAC, submission on discussion paper, pp1, 3; Simply Energy, submission on discussion paper, p8.

219 AGL, submission on discussion paper, p13.

220 AGL, submission on discussion paper, p14.

221 ENA, submission on discussion paper, p4.

222 Ergon Energy, submission on discussion paper, p15.

223 Networks NSW, submission on discussion paper, p20; Ergon Energy, submission on discussion paper, p13.

224 Networks NSW, submission on discussion paper, p20.

RAB; the introduction of these would contradict the principle that regulation should be technology agnostic. There is a need to encourage innovation through incentives rather than exclude cost recovery of unproven technologies.[225] Ergon Energy agreed with the ENA and highlighted the importance of trials in order to evaluate the reliability and performance of energy storage systems, prior to their widespread integration, in order to address the risk that a storage device runs out of capacity prior to addressing the constraint it was installed for.[226]

Network businesses called for stronger incentives for them to undertake storage trials and for clarification of the relationship between the DMIA and DMIS with the STPIS.[227] SA Power Networks noted that the DMIS and DMIA provide relatively weak incentives, generally limited to being useful only to undertake small-scale trials rather than promote any significant uptake of storage technology by network businesses (noting the approved AER allowance for SA Power Networks is $600,000 per annum).[228] TransGrid submitted that there is insufficient evidence to support the AEMC's conclusion that the network capability component of the STPIS provides an incentive for TNSPs to pursue innovative storage projects. TransGrid noted that TNSPs are not able to access the DMIA and submitted that TNSPs will need to undertake pilots that are unable to deliver market benefits before they can use storage as a cost-effective network solution.[229]

TransGrid also submitted that the incentives for TNSPs to defer network augmentation would benefit from greater clarity, challenging the AEMC's findings that the CESS and EBSS provide incentives to pursue energy storage options where it is cost effective, resulting in deferral of capex or avoidance of opex. TransGrid stated that it is unclear whether these payments would provide sufficient return to balance the certainty of return provided by a network option in the regulatory assets base. TNSPs are excluded from the DMIS, which is intended to address potential DNSP bias against non-network options.[230] ElectraNet noted that the EBSS would usually not apply to expenditure on storage services procured from another party. Where a network support service is procured by a TNSP as opex, it is typically treated as a network support pass-through with no materiality threshold. This expenditure would normally be excluded from the EBSS as non-controllable expenditure, as the extent to which the service is required each year is driven by external factors.[231]

The ENA identified some other potential issues with how network incentives would apply to storage. There is the potential for a regulatory asymmetry to arise where a network may be liable for STPIS penalties arising from an inability to control or

225 ENA, submission on discussion paper, p4.

226 Ergon Energy, submission on discussion paper, pp12-13, 15.

227 Networks NSW, submission on discussion paper, p20; TransGrid, submission on discussion paper, pp2-3.

228 SA Power Networks, submission on discussion paper, p8.

229 TransGrid, submission on discussion paper, pp2-3.

230 Ibid., pp2-3.

231 ElectraNet, submission on discussion paper, p2.

effectively risk-share with a distributed energy resource, even in circumstances where such a resource is the least cost technology to deliver, for example, network support services. Transmission network businesses have also reported that some aspects of the revised STPIS arrangement – in particular, the way 'network capability' is defined for the purpose of assessing market benefits – may create unintentional barriers to storage deployment.[232]

The Customer Advocate submitted that network businesses need further incentives to permit customers to use storage. It expressed concern that there is little commercial incentive for network businesses to be involved in storage or to incentivise customers to participate in time shifting of demand, other than when it results in an expansion to the regulatory asset base. Network businesses should face incentives to address falling load factors on their networks in order to improve the returns on increasingly under-utilised assets, because the costs of underutilisation are passed onto consumers.[233] And rather than utilising grid-level storage, a better solution would be to encourage customer load management through efficient tariffs that reward use of energy at times when the network is 'idle'.[234]

AGL noted that the DMIS will provide some incentives for networks to use non-network options. However, AGL queried whether networks are well placed to provide non-network solutions, and considered that if storage is procured 'in house' the options will be largely generic and lacking in innovation.[235]

EnergyAustralia submitted that there would be merit in reviewing elements of the regulatory investment test for distribution to determine whether it remains valid as the cost of alterative technology is falling, including the $5m materiality threshold.[236] The ENA submitted that the regulatory investment test may require review in the future to provide a sound platform for truly technology agnostic assessments of network and distributed energy resource alternatives.[237] Ergon Energy agreed with this assessment.[238] Simply Energy submitted that the distribution annual planning process should evolve to ensure that competitive providers of solutions to address network constraints have sufficient lead time to develop and deploy solutions.[239] AEMO expressed support for the AEMC's recommendation in the Optional Firm Access final report to extend the RIT-T to apply to replacement expenditure, noting that changing market conditions mean that replacing ageing assets is now the primary driver of network investment.[240]

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232 ENA, submission on discussion paper, p12.

233 The Customer Advocate, submission on discussion paper, pp7-8.

234 Ibid., p8.

235 AGL, submission on discussion paper, p14.

236 EnergyAustralia, submission on discussion paper, p5.

237 ENA, submission on discussion paper, p11.

238 Ergon Energy, submission on discussion paper, p12.

239 Simply Energy, submission on discussion paper, p8.

240 AEMO, submission on discussion paper, p6.

EnergyAustralia also called for network businesses to publish regular information on network constraints and network planning strategies to enable third parties to consider non-network solutions, and provided the Australian Renewable Energy mapping Infrastructure project as a an example of a useful tool in this regard.[241] The Customer Advocate called for a review of network voltage standards by distributors to consider the impact of changes in demand and customer load profile on network voltage planning, resulting in a more informed view of the impact of battery charging and generation.[242]

Networks NSW submitted that consultation periods for non-network alternatives in the RIT-D are still relatively untested and should not be altered until there is evidence that they are insufficient. While the incremental introduction of small scale storage in a particular network area might be found to be the least cost solution, this is no different to similar non-network alternatives such as small scale embedded generation, load control (air conditioner, hot water etc.) or energy efficiency. Extending lead times would impose planning schedules on networks that might be inefficient.[243] Ergon Energy noted that if ring-fencing requirements required networks businesses to seek a waiver before deploying storage, this would a burden to the planning process.[244] AEMO supported reforms to the requirements that annual planning reports should meet, arguing that proponents of non-network services should be able to obtain a comprehensive understanding of upcoming network investment opportunities in a timeframe that allows them to submit alternative solutions.[245]

B.3.3 Separation of regulated and non-regulated services (sections 3.3 and 3.3.1)

The AEMC asked the following questions in its discussion paper:

- Would current ring-fencing guidelines address any concerns about a TNSP being able to impact the wholesale market or does storage raise unique issues? If changes are required, what are they?
- What will be required in the distribution ring-fencing guidelines to maximise the benefit of network use of storage?
- What will be required in the distribution ring-fencing guidelines to minimise a network business's ability to unduly impact a contestable market?

A large amount of commentary was received on ring-fencing issues, representing a range of responses. Some stakeholders agreed with the AEMC's preliminary findings. Others disagreed – some because they thought ring-fencing would not be strong enough, preferring cross-ownership prohibitions – others because they thought

241 EnergyAustralia, submission on discussion paper, p5.

242 The Customer Advocate, submission on discussion paper, p15.

243 Networks NSW, submission on discussion paper, p20.

244 Ergon Energy, submission on discussion paper, p13.

245 AEMO, submission on discussion paper, p6.

ring-fencing was inappropriate in the absence of evidence of harm to competitive activities.

The ERAA agreed with the AEMC on the need for ring-fencing if a network business wishes to operate in the competitive market for the provision and use of storage devices.[246] PIAC agreed with the AEMC that networks should only be able to sell/lease batteries behind the meter through ring-fenced affiliates and also agreed that if networks own large-scale batteries, even through ring-fenced affiliates, these businesses should not be able to arbitrage the wholesale energy market.[247] EnergyAustralia expressed concerns with respect to competitive neutrality, and welcomed the AER's review of ring-fencing arrangements, suggesting that the rules should be clear, the penalties should be adequate and the obligations should be effectively monitored and enforced. Guidelines should consider explicit prohibitions on networks providing contestable services, obligations to provide unambiguous legal undertakings or guarantees of equivalence and obligations to consider non-network solutions for new investment proposals.[248] Origin Energy called for restrictions on network businesses and related parties engaging in storage behind the meter until there is clear evidence of an established market.[249]

The ERAA viewed network-scale storage as analogous to generation, and that network businesses should not be able to own these assets. Ring-fenced entities could provide the services, but to ensure that third parties are not disadvantaged, network businesses should procure storage services competitively, using an open and transparent process.[250] In a similar vein, Simply Energy argued that ring-fencing guidelines will need to be supplemented with open and transparent arrangements to enable regulators and consumers to identify that network businesses are treating related entities on equal terms to third parties. This will also help to assign value to the multiple value streams that storage can provide, which will otherwise be hard to value.[251] Simply Energy also suggested:

- Ring-fencing will need accounting standards, which require that corporate accounts reflect financial substance rather than legal form.
- Ring-fencing cannot rely on legal separation, but must ensure the 'financial substance' that regulated businesses do not privilege their related parties over unrelated parties.
- Given the potential gains to be made from related-party transactions, ring-fencing requirements are likely to be severely tested. While related party transaction risk and ring-fencing are not new issues in themselves, the characteristics of battery-based storage mean that their importance has greatly

246 ERAA, submission on discussion paper, p2.

247 PIAC, submission on discussion paper, p1.

248 EnergyAustralia, submission on discussion paper, p6.

249 Origin Energy, submission on discussion paper, p5.

250 ERAA, submission on discussion paper, p2.

251 Simply Energy, submission on discussion paper, p3.

increased. The AER will need to have a qualified and experienced team that monitors network businesses' transactions. If not, then a rule change will be needed to realign the rules with the long term interests of consumers.[252]

A number of network businesses submitted that it would be inappropriate to impose ring-fencing requirements on their involvement in the provision of energy storage in the absence of evidence that competition was being damaged.[253] United Energy submitted that using storage as an alternative to traditional augmentation, on current price projections, would not have a material impact on the competitive market for storage in its network.[254] Ring-fencing obligations should be proportionate and supported by cost/benefit analysis.[255] CitiPower and Powercor submitted that the imposition of ring-fencing guidelines is not justified because:

- customers have a choice of the most suitable product in a competitive market;
- the Cost Allocation Method does not permit cross-subsidisation;
- retailers are able to obtain customer information under Chapter 7 of the NER;
- only registered electrical contractors can work behind the meter, which limits the DNSP's ability to do so;
- there is no first mover advantage as the market for storage behind the meter already exists;
- ring-fencing is costly to implement, which may discourage investment and innovation.[256]

Ergon Energy disagreed with the AEMC that the use of energy storage by DNSPs should be subject to strict ring-fencing, arguing that the requirement would be a barrier to the efficient usage of storage in lieu of traditional network augmentation and would add costs. The use of generation or storage to provide network support and quality and reliability of supply services should be distinguished from other forms of generation that are entered into solely for commercial gain. There should be no requirement under the ring-fencing guidelines for DNSPs to apply for a waiver to own and/or operate a generator or storage for genuine network support and related purposes such as voltage stabilisation.[257] Ergon noted that it should not be assumed that DNSP access to household storage could be contracted from customers via an efficient price signal, citing low take-up rates of air-conditioning demand response programs, and also cited preliminary analysis showing that market load profiles can be

252 Ibid., p4.

253 Ergon Energy, submission on discussion paper, pp4,15; ENA, submission on discussion paper, p4; Energex, submission on discussion paper, pp8-9; SA Power Networks, submission on discussion paper, p9.

254 United Energy, submission on discussion paper, p1.

255 Ibid., p3.

256 CitiPower and Powercor, submission on discussion paper, p2.

257 Ergon Energy, submission on discussion paper, pp1,3.

smoothed and even flattened utilising relatively small two kilowatt sized batteries situated behind the meter, reducing peak demand and thus costs for all customers.[258]

Ergon further submitted that preventing DNSPs from operating behind the meter would be likely to hurt customers in its rural and remote customer base, and would likely hinder its customers from accessing the benefits of energy storage technologies, as many such regions would most likely be an uneconomic market for the private sector due to costs associated with the provision of services in these areas.[259] Energex and the ENA similarly argued that network businesses should not be constrained from using energy storage as a potential non-network alternative as it is increasingly likely that energy storage will become a cost-effective and efficient solution to address network constraints, improve power quality and reliability and, if managed effectively, allow networks to potentially increase the quantity of renewable energy available from the grid.[260]

SA Power Networks also disagreed with the AEMC's finding that DNSPs should only offer storage behind the meter through a legally separate business, arguing that this would hurt consumers by impeding innovation. Instead, ring-fencing guidelines should recognise that storage services provided to customers are contestable and storage services uses to operate the network are standard control services. The AEMC should then focus on maximising the opportunities for competition and not inhibiting DNSPs from being a valid part of that mix.[261]

Ergon Energy called for a nationally consistent ring-fencing guideline relating to the ownership and/or operation of generation or storage so as to not impede investments.[262] Energex suggested that a flexible and minimalist ring-fencing model would be sufficient to facilitate competition and support efficient deployment of energy storage currently, and noted that there are a number of existing mechanisms already in place, such as cost allocation, service classification and the shared asset guideline, which could alleviate the AEMC's concerns without the need to impose additional costs on network businesses.[263] The ENA recommended that the AEMC and AER jointly approach the development of national ring-fencing guidelines to ensure consistency with policy objectives. That process should focus on credible impacts, assessing their materiality and developing a proportionate response.[264] Energex supported this recommendation.[265] Origin Energy also called for a nationally consistent approach to ring-fencing, including the explicit recognition of ownership and operating conditions associated with storage.[266] AGL strongly supported the

258 Ibid., pp3-4.

259 Ibid.

260 Energex, submission on discussion paper, p5; ENA, submission on discussion paper, p6.

261 SA Power Networks, submission on discussion paper, p8.

262 Ergon Energy, submission on discussion paper, p13.

263 Energex, submission on discussion paper, p9.

264 ENA, submission on discussion paper, p4.

265 Energex, submission on discussion paper, p9.

266 Origin Energy, submission on discussion paper, p6.

establishment of a nationally consistent ring-fencing guideline, developed and enforced by the AER, to address the structural and financial separation of network businesses wishing to participate in contestable markets. Ring-fencing should apply to access and use of information (customer and network data) that is collected and maintained for the purposes of network operation from being used to support contestable activities by network businesses. Strong enforcement and compliance obligations and monitoring will be required to give the market confidence that a level playing field is being maintained.[267]

TransGrid supported the principle of separating regulated and competitive services to promote competition on a level playing field, but noted that: network businesses are already subject to strong ring-fencing under the NER; there is a risk scale efficiencies and integrated planning won't be achieved under the AEMC's recommendation; and it is important not to impose unnecessary enforcement and compliance burdens on businesses and the AER.[268]

A number of stakeholders were concerned that ring-fencing obligations would not be strong enough, or would be too difficult and expensive to enforce, and preferred tighter regulation of network business ownership of storage assets.[269] Lumo Energy, Snowy Hydro and Stanwell questioned whether the ownership threshold for transmission businesses carrying out related activities should be lowered from five per cent of total revenues.[270] Stanwell and Simply Energy suggested that a similar threshold should apply to distribution businesses, but with a limit appropriate to them.[271] AGL called for the AEMC's preliminary position in relation to storage behind the meter to apply at grid level also, so that network businesses would have to procure all storage services on an open competitive basis.[272] PIAC also suggested more forceful ownership prohibitions, given the risks to competitive neutrality and the possible ineffectiveness of ring-fencing. Network businesses could be required to seek tenders from third party providers to provide specific services, and fund these through opex rather than capex.[273]

B.3.4 Cost allocation methodology (Section 3.3.2)

The AEMC asked the following question in its discussion paper:

- The current cost allocation arrangements do not appear to raise any issues in relation to the use of storage assets. Do you agree?

267 AGL, submission on discussion paper, pp15-16.

268 TransGrid, submission on discussion paper, pp1-2.

269 Lumo Energy, submission on discussion paper, p3; PIAC, submission on discussion paper, pp1,3.

270 Lumo Energy, submission on discussion paper, p3; Snowy Hydro, submission on discussion paper, p1; Stanwell, submission on discussion paper, p3.

271 Stanwell, submission on discussion paper, p3; Simply Energy, submission on discussion paper, p4.

272 AGL, submission on discussion paper, pp14-15.

273 PIAC, submission on discussion paper, p3.

Stakeholders who commented on this issue agreed that the current cost allocation arrangements are suitable in relation to the use of storage assets.[274]

B.3.5 Shared asset mechanisms (Section 3.3.3)

The AEMC asked the following question in its discussion paper:

- The current shared asset arrangements do not appear to raise any issues in relation to the use of storage assets. Do you agree?

Stakeholders who commented on this issue agreed that the current shared asset arrangements are suitable in relation to the use of storage assets.[275]

B.4 Chapter 4: Ownership and control

B.4.1 Control (Sections 4.1 and 4.1.1 – 4.1.5)

The AEMC asked the following questions in its discussion paper:

- Are the connection requirements that are being imposed by different distribution businesses for consumer- or retailer-controlled storage being used as a barrier? If so, how?

- Does the ongoing degree of control that is being required by distribution businesses for consumer- or retailer-controlled storage represent a genuine safety, security or reliability need, or is it more appropriately a network interest that should be negotiated or signalled through prices?

Stakeholders expressed strong support for the Commission's preliminary view that market-based outcomes would be the most efficient and that, except for in cases related to system security, control of storage systems should be based on market-based price signals.

Lumo Energy submitted that storage has multiple potential benefits and that the type of business in control of the storage device will determine the ease with which these benefits can be realised. Retailers will have to sell the benefits to interested consumers and efficient outcomes are most likely to occur under a competitive framework.[276] EnergyAustralia stated that parties other than distributors are best placed to derive the full range of potential benefits associated with storage devices. Retailers are best placed to offer control services which complement their broader service offerings and to provide network benefits. A retailer-led model of storage control could include an

274 SA Power Networks, submission on discussion paper, p9; ENA, submission on discussion paper, p1.

275 SA Power Networks, submission on discussion paper, pp7, 9; ENA, submission on discussion paper, p1; CitiPower and Powercor, submission on discussion paper, pp2-3; Untied Energy, submission on discussion paper, p2.

276 Lumo Energy, submission on discussion paper, p2.

obligation for retailers to engage with networks as they develop storage offerings.[277] Simply Energy was of the view that regulated network businesses owning storage would be analogous to them owning generation, which is not in the interests of consumers as it represents an unnecessary transfer of investment risk from the project investor to the consumer. They also argued that network businesses investing in storage assets could crowd out any similar projects from competitive providers, because a competitive provider faces more uncertainty in terms of return on their investment. It was therefore of the view that a prohibition on regulated network ownership of storage is appropriate to allow a competitive market to evolve.[278]

TransGrid noted that given the multiple value streams available from battery storage, conflicting priorities over the operation and control of the device may occur. If a network cannot reliably call on behind-the-meter storage it may act as a barrier to the use of storage as network support. It noted that TNSPs are well placed to play a coordination role given their position between centralised generation and distribution and their role in planning.[279]

Network businesses commented extensively on this issue. They were generally of the view that the relative costs and benefits of any regulatory reforms needed to be carefully considered, and that the preliminary findings were not appropriate or justified as they may limit the ability of network businesses to use storage as an alternative to traditional network investment.

Ergon Energy considered that the term 'market-based price signals' should be broadly defined to enable innovation in the market and avoid limiting the potential uses of storage devices. Its submission also disagreed that connections standards, such as the use of AS 4777, give too much control to DNSPs.[280]

SA Power Networks was of the view that the AEMC was predisposed against DNSP ownership or control of storage behind the meter. It also disputed the finding that network businesses can gain implicit control of storage devices through onerous connection agreements. SA Power Networks concluded that insufficient consideration is given to the long-term costs to consumers if network businesses cannot rely on appropriate connection standards and capabilities to manage the impact of distributed energy resources on the distribution network. It also highlighted the importance of DNSPs maintaining control in order to maintain safety standards. It submitted that if there is any proposal to diminish a DNSP's ability to control storage devices for network safety and security purposes, then the DNSPs' liability in these matters must be reduced accordingly and re-allocated to those parties exercising control.[281]

Networks NSW stated that existing regulatory arrangements, such as the Power of Choice reforms, sufficiently accommodate the integration of storage. It cited

277 EnergyAustralia submission on discussion paper, p4.

278 Simply Energy, submission on discussion paper, 2.

279 TransGrid, submission on discussion paper, p2.

280 Ergon Energy, submission on discussion paper, pp5,11,17.

281 SA Power Networks, submission on discussion paper, p2,26,10.

international evidence that network-controlled integration of storage can enhance the value realised by customers.[282] Networks NSW did not consider that connection requirements give networks too much control, but rather benefit customers by providing certainty and allow for greater choice as they allow parties to provide services, such as load control. They also pointed out that networks do not exercise ongoing control of storage devices but rather the forms of control are negotiated and entered into with the agreement of the customer. Finally, the submission noted that network control may remove barriers that will prevent a market-based approach from achieving efficient deployment and use of storage.

B.4.2 System operations (section 4.1.6)

Stakeholders generally acknowledged that storage has the potential to affect the operation of the electricity system, and that the possible effects should be investigated. AEMO was widely suggested as the appropriate body to conduct this work. Submissions broadly agreed that such a review should consider the expected developments in the energy market including the effects of a large amount of distributed energy resources and also a scenario with low synchronous generation. Simply Energy suggested that a review was necessary to inform policy makers, and that the AEMC should consider other independent advice, as well as that provided by AEMO.[283]

AEMO noted the power system security issues that may arise should there be a mass uptake of distribution connected storage systems. It was of the view that a number of issues would need to be investigated, including rapid changes of state of the systems in aggregate and the displacement of scheduled generation, which leads to difficulties controlling the transmission network flows within limits. AEMO noted that it is in the process of establishing a Power Systems Issues Technical Advisory Group, which will identify challenges in relation to emerging technologies in general.[284]

AEMO submitted that, to fulfil its network functions, it will need detailed information about storage systems connected to distribution networks, including the size, location and operation of each installation. It was of the view that such information could be provided as part of the connection process, but noted that the obligation to provide such information would need to be carefully targeted and proportionate to the potential benefits so as not to stifle competition.[285]

Stanwell was of the view that AEMO should be provided with the location and specification of batteries on installation. It considered this was necessary to maintain oversight of system security. Storage devices will respond to price signals and have the potential to cause local voltage issues and system-wide frequency deviations, this could add to problems associated with intermittent renewable generation. Without

282 Networks NSW, submission on discussion paper, pp6,27.

283 Simply Energy, submission on discussion paper, p8.

284 AEMO, submission on discussion paper, p5.

285 AEMO, submission on discussion paper, pp7-8.

adequate information on size and location of batteries AEMO processes such as load-shedding and system restoration become more difficult and makes forecasting more difficult.[286]

Ergon Energy noted that storage, especially in aggregate, has the capability to disrupt the operation of electricity networks and cause capacity, voltage and frequency disturbances outside of normal operating ranges. A consequence of this could be the instigation of outages if storage devices are switched to charge at peak periods. This risk could be exacerbated by "gentailers" using storage load to influence spot prices. Control issues are not limited to managing any sudden export of large amounts of energy but also that this export occurs with a lack of ramp up or down, as would be the case with base load generation.[287]

Networks NSW submitted that battery storage is likely to be used to curtail consumption during peak periods and the batteries would be charged during off-peak periods. If this period where batteries are charging coincides with other services, such as the charging of electric vehicles, an artificial peak period may be created, requiring network augmentation. Networks NSW argued that this potential development means that it is critical that networks are able to effectively participate in emerging markets and to manage potential impacts.[288]

SA Power Networks stated that the discussion paper did not adequately recognise the importance of network technical standards and the fact that these standards are in place in order to protect customer and generator installations as well as the wider community. It was also of the view that the effect of recent changes and experiences was not adequately acknowledged by the Commission. The proliferation of embedded generation, especially solar PV, has led to radical changes in the nature of network power flows and created new challenges. Storage has the potential to ameliorate some of the network issues associated with high levels of distributed PV by enabling customers to store rather than export their embedded generation. However, controls are needed to ensure that storage does not exacerbate network issues.[289]

B.4.3 Competitive neutrality (section 4.2)

The Clean Energy Council, Snowy Hydro, PIAC, Simply Energy, AGL and AEMO all agreed that, for the purposes of network regulation, storage should be considered a contestable service. Networks NSW also supported competitively neutral market for storage but argued that it is important in creating a level playing field not to conflate natural cost advantages with barriers to competition.[290]

286 Stanwell, submission on discussion paper, p2.

287 Ergon Energy, submission on discussion paper, pp5-6.

288 Networks NSW, submission on discussion paper, p7.

289 SA Power Networks, submission on discussion paper, pp1-2.

290 Networks NSW, submission on discussion paper, p1.

Lumo Energy supported the use of storage as substitute for traditional network where this is efficient. Where competition exists, network service providers should contract for the services it needs from storage as part of opex.[291] United Energy was of the view that limiting the control of storage by networks has the potential to limit the ability of networks to use storage as an alternative to traditional network investment.[292] AEMO submitted that network businesses respond to the incentives in the regulatory framework, and that measures to support competition should be complemented by measures to ensure network businesses adopt storage-based solutions where this is the most efficient option.[293]

The Clean Energy Council suggested that customers who provide network services should be rewarded by networks. It recommended that the AER provide an appropriate "standing offer" for these customers providing network services.[294]

The ENA noted that the deployment of network-owned storage devices behind the meter would be unlikely to prevent the development of a competitive market in storage, given that energy retail firms and others have already entered the storage and related markets.[295] Ergon Energy agreed with this position and noted that it is unlikely that networks purchasing storage will prevent the development of a competitive market for storage devices given the amount of activity by retailers and direct sellers.[296]

The separation of market-facing activities from network owned storage was raised in several submissions. ElectraNet commented on the case ESCRI-SA case study.[297] The submission stated that the hybrid ownership and operation model abstracts the TNSP from the market-facing component of the storage device, therefore reducing the complexity of registration arrangements for a relatively small device. The ENA was of the view that both the Oncor model and the ESCRI-SA trials, described in case studies in the discussion paper, are positive avenues for exploration.[298] SA Power Networks also mentioned the Oncor model as one which could potentially be workable in a Australian context but stated that energy trading arrangements for grid-side devices requires further consideration.[299] Simply Energy considered that energy trading and other competitive rights must be offered in to the market in a transparent manner that does not reduce competitiveness.[300]

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291 Lumo Energy, submission on discussion paper, p2.

292 United Energy, submission on discussion paper, p3.

293 AEMO, submission on discussion paper, p6.

294 The Clean Energy Council, submission on discussion paper, p4.

295 ENA, submission on discussion paper, p14.

296 Ergon Energy, submission on discussion paper, p15.

297 ElectraNet, submission on discussion paper, p2.

298 ENA, submission on discussion paper, p6.

299 SA Power Networks. submission on discussion paper, p9.

300 Simply Energy, submission on discussion paper, p4.

B.5 Chapter 5: Storage at the wholesale level

B.5.1 Registration (sections 5.1.1-5.1.5)

The AEMC asked the following questions in its discussion paper:

- Is more clarity required in the definition of a 'generating unit'? If so, what changes would be necessary? How would such changes be necessary to preserve the registration requirements and eligibility criteria currently in place for generators?

- Are current registration requirements appropriate for storage that may be used both as generation and load? Should a person operating storage to both buy and sell electricity through the spot market be required to register as both a market customer and a generator?

Stakeholders generally agreed that a new category of registered participant is not necessary for persons seeking to participate in the NEM using storage capability. Stakeholders also generally agreed that persons using storage devices should be registered according to the value stream from the storage device in relation to which that person intends to participate in the NEM.

AEMO submitted that registering the operator of a storage device as both a generator and a customer is feasible, but noted that a number of practical issues would need to be clarified. For example, how the device operates in the market, what information AEMO needs to manage the dispatch process, and the network charging arrangements that would apply.[301]

Ergon Energy's submission noted that the classification of storage as generation is not appropriate because storage is capable of performing multiple functions.[302] It submitted that generation technology is characterised by single functionality - the production of energy, and given this difference and the fact that storage is distinguishable from generation it is inappropriate for the same NER definition to apply to two different technologies. AGL suggested that a clearer definition of generator is required because the current definitions may lead to confusion regarding the application of associated terminology such as 'generating units', 'aggregation of generating units' and 'dispatchable units'.[303]

AEMO submitted that the current definition creates legal uncertainty and expressed support for clarifying the NER to allow the definition of 'generating unit' to remove any ambiguity in what can be classified as a generating unit. It stated that it is

301 AEMO, submission on discussion paper, p4.

302 Ergon Energy, submission on discussion paper, pp1-3.

303 AGL, submission on discussion paper, p17.

considering submitting a rule change request to alter the definition of 'generating unit' so that it is both technology and process neutral.[304]

EnergyAustralia made the point that storage may become more valuable in the wholesale market given the displacement of thermal generation with intermittent renewable generation, and noted the importance of AEMO retaining sufficient oversight to operate the market in an orderly manner.[305] The submission noted that if storage aggregators control exports to the grid of over 30MW, this would be large enough to impact the market. It asked that AEMO review its generator classifications and thresholds to ensure that they reflect the evolution of the market, including the size and location of storage. AEMO agreed that there may be value in reconsidering the exemption threshold for registration given the growth in embedded generation and storage, noting that units that fall below the threshold can, in aggregate, have an even greater impact on the power system.[306]

AGL noted that if the aggregation is across numerous NMIs, registration may not be appropriate as aggregation is primarily for ease of settlement and the storage devices may not be used as a single dispatchable unit.[307]

AEMO submitted that a further relevant issue is the technical standards that apply to different classes of registered participant. It was of the view that the higher standard should apply if a unit is subject to more than one set of technical standards.[308]

B.5.2 Connection (sections 5.2, 5.2.1, 5.2.2)

The AEMC asked the following questions in its discussion paper:

- Do you see any issues with the current connections framework? For storage as a generator? For storage as a load?
- Do performance standards represent a barrier to storage connection? For storage as a generator? For storage as a load?

While stakeholders generally agreed that the current categories of registered participant do not prevent the operation of storage, there was also agreement that a review of requirements surrounding registration would be useful. The submissions also agreed that a review of technical standards should take place to ensure that parties can use storage technology to participate in the NEM. Given that the market is changing and it is likely that there will an increase in smaller generators seeking to register, a review of participant classifications and thresholds would ensure that these remain suitable.

304 AEMO, submission on discussion paper, p2.

305 EnergyAustralia, submission on discussion paper, p7.

306 AEMO, submission on discussion paper, p5.

307 AGL, submission on discussion paper, p18.

308 AEMO, submission on discussion paper, p5.

AEMO was of the view that the processes and requirements set out in Chapter 5 of the NER are suitable for the connection of storage systems at the transmission level, but noted that it has not yet assessed whether the current access standards will be adequate for the mass uptake of utility scale storage systems, or where particular challenges may arise.[309] It recommended that, subject to the analysis to be undertaken by its Power Systems Issues Technical Advisory Group, the current technical requirements for connection be left in place and monitored to determine whether they become barriers to the connection of storage or any other technology.[310]

TransGrid asked that communication standards be considered and the regulatory treatment of pilot programs clarified. Specifically, it noted that coordinating storage device via market-based price signals will be complex, as different (potentially conflicting) signals may exist for each value stream flowing from a signal device and thus the regulatory treatment of communications infrastructure in non-proven pilot programs will need to be clarified.[311]

B.5.3 Charges (section 5.3)

The AEMC asked the following question in its discussion paper:

- Is there anything unique about the use of storage devices that makes the existing arrangements regarding fees/charges for participation in the NEM not fit for purpose?

There was general agreement in the submissions that the applicable registered participant categories, thresholds, fees and prudential requirements should reflect the changing nature of the market, and that the possibility for changes to the registration process or the creation of new categories should be considered. The submissions identified AEMO as the body most suited to carry out this work.

The Clean Energy Council suggested that, in order to charge efficiently for registration, AEMO's arrangements should include a category that includes generation and load from the same registration.[312]

AGL suggested that registration fees should be fair and reasonable for the registration of smaller scale generation, including storage. It submitted that fees should not be excessive for smaller market registration and the fees for registering a 10MW unit, for example, should be proportional to fees associated with the registration of a 100MW generator.[313]

AGL also noted that in terms of determining TUOS or DUOS, consideration should be given to recent tariff reform in order to send appropriate investment signals for storage

309 AEMO, submission on discussion paper, p5.

310 Ibid., p6.

311 TransGrid, submission on discussion paper, pp3-4.

312 Clean Energy Council, submission on discussion paper, p9.

313 AGL, submission on discussion paper, p19.

and other new technologies. Storage owners or operators should be entitled to payment for avoided TUOS and there should be more transparency in the process for assessment by networks.[314]

B.5.4 Provision of ancillary services (sections 5.4, 5.4.1-5.4.3)

The AEMC asked the following questions in its discussion paper:

- What are the implications of current arrangements for ancillary service provision and cost recovery for storage?
- Are there other services that could potentially be provided by storage – such as a substitute for inertia through very fast response services – and does a lack of a market for these represent a potential barrier or opportunity?

Intelligent Energy Services commented on the ability of storage technology to provide ancillary services. It stated that even where a service such as the provision of FCAS is market-based and competitive at the wholesale level, there is a question as to how this service provision is to be measured and certified at small embedded installations. It submitted that there is scope for pricing innovation in this area. Specific proposals for changes to the market include:

- Moving to a five minute pricing interval. Wholesale prices are currently set as the arithmetic average of six sequential five minute prices, which removes any impact of price variation and associated causes and responses due to market events within the half hour. This averaging of prices reduces the value of a response to wholesale prices by storage owner/operators and the market as a whole. A solution to this could be the introduction of a ramping ancillary service spanning the half hour time period and a simple mechanism to price and settle this service. This would benefit smaller service providers as they may be able to provide services for 5 or 10 minutes but would be less equipped to provide services for the entire 30 minutes. These services represent a potential value stream, particularly as the inertia of the system decreases. Also if prices are not reflective of the 5 minute level (or a shorter FCAS level, described below), storage may represent an additional requirement for FCAS as they are more likely to respond at retail price boundaries.[315]
- Establishing a 4 second FCAS market. In determining the providers of power variations that cause frequency deviations AEMO use 4 second SCADA measurements of actual generation and load. A 4 second FCAS market would be an extension of the current causer pays logic and could be an overlay on the current arrangements and does not require the making of offers. In order to establish this market, suitable rules and certification procedures would be required and studies would be needed to ensure the arrangements were stable in a system control sense. This market would not only allow storage to participate

314 AGL, submission on discussion paper, p19.

315 Intelligent Energy Systems, submission on discussion paper, p2.

in the provision of FCAS but would also avoid causing additional instabilities through the simultaneous switching of storage devices.[316]

- Pricing distribution network constraints. A price-oriented approach to addressing potential constraints on the distribution network could be employed. This would involve the DNSP providing information on potential network constraints and the loading on these critical network elements. The information provided by the DNSP would be used to evaluate whether capital expenditure should take place or if small scale responses, in the form of load management, is more efficient and should continue. The size of payments for small scale responses would be determined by the cost of increasing capacity with capital expenditure.[317]

- Pricing of voltage deviations and reactive power. Voltage at the distribution level may require closer control as storage penetration increases. A pricing algorithm could be used to value reactive power injections and offtakes according to a formula based on voltage deviations.[318]

316 Intelligent Energy Systems, submission on discussion paper, p2.

317 Ibid., p3.

318 Ibid., p4.