



Australian Government
Australian Renewable
Energy Agency

ARENA

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Submission in response to the Reliability Frameworks Review Interim Report

Thank you for the opportunity to comment on the AEMC's Reliability Frameworks Review Interim Report. This submission builds on ARENA's previous submission to the Reliability Frameworks Review Issues Paper and seeks to update the Commission on new information flowing from ARENA's ongoing portfolio of investments and our consideration of the preliminary views set out by the Commission.

About ARENA

ARENA was established to make renewable energy solutions more affordable and increase the supply of renewable energy in Australia.

ARENA provides financial assistance to support innovation and commercialisation of renewable energy and enabling technologies. This assistance is designed to accelerate the commercialisation of these technologies by helping to overcome technical and commercial barriers. A key part of ARENA's role is to collect, store and disseminate knowledge gained from the projects and activities it supports for use by the wider industry.

The Commission would be aware that ARENA has identified 'delivering secure and reliable electricity' as one of its four investment priorities. We look forward to continuing to work closely with the Commission to ensure strong contribution from our project investments to the Reliability Frameworks Review and related work streams.

Summary of ARENA's Submission on the Issues Paper

ARENA's submission on the Issues Paper identified a number of themes which remain relevant in our consideration of the matters raised in Interim Report. These include the following:

- Reliability should be considered as a characteristic of the system as a whole. It can be delivered by various elements contributing in different ways, rather than individual generators (or other resources) needing to contribute in the same way.

- As the proportion of solar and wind energy increases, various approaches will be able to contribute to reliability. These could include resource diversity (geographic diversity, energy source diversity and greater demand side participation), greater interconnection of NEM regions, improved forecasting and greater use of storage to deliver services including energy over various timeframes and power for frequency control. Techniques can also be applied to variable renewable energy generators to increase their 'firmness' and 'dispatchability'.
- More electricity will come from distributed resources in the future and it is important that market incentives encourage efficient levels of participation in security and reliability service provision by these resources.
- Energy market frameworks should be planned for the future and be robust to a wide range of plausible outcomes - including a wide range of shares of variable and dispatchable renewable energy generation sources. New technologies will continue to deliver cheaper solutions into the future.
- ARENA can help industry get practical experience 'ahead of the curve' by funding demonstration (proof-of-concept) projects. These can also inform market design.

Response to the AEMC's Interim Report

We offer further discussion on matters raised in the Commission's Interim Report below.

Key Concepts

ARENA's experience supports the Commission's preliminary view that concepts such as 'dispatchability' and 'flexibility' are not binary and would be difficult to define at a facility level ('generating system', or 'generating unit' level). We note that variable renewable energy sources such as photovoltaics and wind can be managed to increase the firmness of their generation profile, to avoid negative market pricing or to help manage voltage at the network level. Complementary variable generators can also be coupled either at an individual site or geographically spread across a distribution or transmission network to enhance the firmness of supply. Firmness can also be achieved by market participants across the market through portfolio investments in complementary generation and/or demand-side resources.

ARENA also sees the potential for the coupling of energy storage with wind and solar emerging as a standard practice, driven by both market forces and current policy settings. Examples of this include Kennedy Energy Park (QLD), Lincoln Gap Wind Farm and Hornsdale Wind Farm (SA), Bulgana Green Power Hub (Vic).

ARENA has commissioned a quantitative comparison of alternative dispatchable renewable electricity options to explore the contributions to reliability in a high penetration renewables grid. The preliminary results of this analysis are encouraging and indicate that even with currently available technology and current pricing, dispatchable renewable energy is perhaps cheaper and easier to achieve than previously considered.¹

In the LCOE range of around \$100 to \$150/MWh, we now anticipate that a range of storage technologies can compete to provide firming and peaking capacity with a range of 30

¹ ITP Renewables, *Comparison of Dispatchable Renewable Electricity Generation Options, Preliminary Findings*, December 2017 - publication forthcoming

minutes to over 40 hours storage which compares favourably with the current costs for peaking generation in the market. A relatively low marginal cost is associated with extending storage to provide low-utilisation seasonal or emergency reserve capacity. A variety of these technologies are (or can be) synchronous, including biomass, concentrating solar thermal and hydro generation, while others can deliver sub-second frequency and voltage support services. The analysis also indicates that variable renewable energy generation will remain lower in cost and, as such, we expect it is likely to increase its share of the generation mix into the future. This should reduce average wholesale electricity costs to electricity consumers below the marginal cost of dispatchable renewable energy generation. It is important to note that these are current LCOE estimates and further work is planned to determine how actual future costs might benefit from varying learning rates across different technology types.

This analysis indicates that if power system services are appropriately valued, and with a supportive and predictable policy environment, we may see a competitive deployment of energy storage well in advance of any major reliability issues emerging in wholesale markets. The multiple competing technologies and the wide range of power system services they can offer, also caution against overly prescriptive regulatory mechanisms that may stifle commercial innovation.

ARENA is aware of industry discussion of how classifications such as scheduled, semi-scheduled and unscheduled (currently defined at the level of the 'generating unit') are being challenged where variable renewable energy generators are looking to invest in storage. If a whole site needs to be reclassified to allow for the deployment of a relatively small amount of storage capacity, this may transfer operational costs and revenue risks to the proponent and discourage investment in storage which could otherwise be contributing to power system reliability and security.

Our experience therefore indicates that introducing fixed concepts, such as 'dispatchability' or 'flexibility', into the National Electricity Rules, at the facility level, risks distorting and inhibiting efficient investment. It may be most useful to instead focus on ensuring the various *services* (e.g. system inertia, sub-second frequency response, voltage support, demand response etc.) that contribute to a reliable and secure power system operation, are properly valued, and barriers to accessing markets for these services by existing participants and new entrants are minimised.

Forecasting and information provision

ARENA notes the Commission's analysis that inaccurate generation and demand forecasts have not contributed to reliability issues in the NEM and that AEMO's pre-dispatch forecasts are generally accurate, which results in an efficient amount of generation being dispatched. We further note the Commission's analysis which shows that, over the period 2007-08 to 2015-16, only 1.85% of outages across the NEM are currently the result of market 'reliability' or 'security' issues (such that might, in the future, be impacted by an increase in variable generation sources).

ARENA considers that a changing generation mix will, however, require new supply and demand forecasting approaches across all timescales. We observe a strong view in industry

that these issues can be readily managed. In this context, ARENA is investing in a number of renewable energy forecasting demonstration projects that will support Australia's shift to a reliable and secure high-penetration renewables grid. We consider that any current or anticipated challenges in accurately forecasting supply and demand should not present barriers to the widespread adoption of low-cost renewable energy generation and demand response capacity.

ARENA is observing the emergence of new renewable energy forecasting services businesses and considers that a more open and competitive market for forecasting services could greatly increase the pace of innovation and the rate of adoption of better approaches across industry. We therefore agree with the Commission's observation that the decentralisation of short-term supply and demand forecasting to market participants, coupled with appropriate incentives for them to improve forecast accuracy, offers an alternative to centralised forecasting by AEMO that may be more adaptive and accurate in the long term.

In early 2018, ARENA and AEMO will commence working with industry to develop a series of proof-of-concept demonstration projects exploring technologies that can provide accurate site-specific short-range (5-minute) forecasts for wind and solar farms. This will involve AEMO developing software to verify and accept participant self-forecasts and a co-design process to develop projects for potential funding by ARENA. The outcomes of this process will be shared widely across industry. We expect that ARENA and AEMO's work over the course of 2018 will demonstrate key dimensions of a more decentralised and accurate short-term forecasting system.

In its interim report, the Commission notes that *"allowing semi-scheduled generators to offer their availability could be worthwhile exploring on a trial basis. It is likely that allowing semi-scheduled generation to provide their own 'offers' of their availability into AEMO's system could be relatively low-cost. One way to manage this, for example, would be for this to occur on an opt-in basis. Undertaking this on a trial basis would allow a better understanding of any technical (e.g. SCADA) challenges associated with this"* (p.74).

We look forward to working with market bodies and industry to disseminate the results of the trial and continuing to explore how variable renewable energy generation can be better accommodated in market dispatch processes.

Contract market incentives

ARENA appreciates that long term system reliability will be underpinned by the effective operation of wholesale markets, including Exchange and OTC contract markets, and that these provide the basis for revenue risk management and project financing.

Australia's electricity contract markets have evolved principally of their own volition to match the specific needs of contract counterparties. ARENA considers that policy should seek to support their efficient operation and evolution.

Since 2012, ARENA has been a party to the financing of new renewable energy projects, with a total value of \$3.418b including an increasing number that incorporate some form of energy storage. In addition, ARENA has supported feasibility assessments of a number of pumped hydro projects including with Hydro Tasmania (Tas) Snowy 2.0 (NSW), Genex

Kidston (Qld) and Cultana (SA) which would provide significant new dispatchable generation and contribute to power system reliability. Overall, our experience indicates that electricity contract markets continue to demonstrate the capacity for change and they could support the effective integration of variable and dispatchable renewables and demand response into the future. This is consistent with Bluescope's welcome prediction that "*(n)ew markets are likely to develop to efficiently manage demand side response and firming requirements, potentially increasing the number and types of contracts available*" (p.87).

We expect that a long-term carbon reduction trajectory, that is well integrated into energy markets, will also bring forward, and lower financing costs for, new renewable generation investment that can contribute to system reliability and security. To the extent that the NEM invites participation by non-vertically-integrated generators and retailers, this will be reflected in greater contract market liquidity and retail competition which will benefit electricity consumers and promote greater innovation in energy service provision.

Wholesale market demand response

ARENA is contributing to the development of demand side services markets by funding a range of projects ranging from peer-to-peer energy trading, small-scale demand response aggregation, virtual power plants and our Reliability and Emergency Reserve Trader (RERT) trial with AEMO (discussed further under 'Strategic Reserve').

ARENA welcomes the Commission's consideration of barriers to the greater participation to demand side participation in wholesale markets. Our experience across a range of projects, at various scales, is that there is a large apparent gap between the technical and economic capacity for demand side participation (including demand response) and the levels seen participating in the NEM. As noted by the Commission, the barriers to greater demand side participation are complex and not all are related to market rules. However, while ARENA observes increasing interest in commercialising demand side services it is not clear that the current market design and settings will present the best framework to encourage an efficient level of demand side participation.

A key theme among the projects we are involved with is the challenge of accessing and combining value streams across wholesale, retail, networks and ancillary services markets. In particular, accessing the full 'value stack' required to achieve an appropriate return on a demand side investment (reflecting its overall value in the power system) inevitably requires partnering with a retailer, whose interests don't necessarily align with aggregators and customers seeking to enable demand response, and who are often pursuing a limited proprietary demand management solution or trial of their own.

In particular:

- there appear to be weak incentives for gentailers to cultivate a competitive market for demand side service provision; and
- new entrant retailers face significant regulatory complexity, upfront costs and customer acquisition hurdles. For example, a separate retail license is required for Victoria, the gaining of which, anecdotally, ARENA has heard expressed as a barrier to Victorian market entry.

While these issues are not all related to market design, it is appropriate to consider how market barriers such as 'bounded rationality' and 'split incentives' could be contributing to the highly opaque and shallow market for demand side services we see today, which provides limited choices for small to mid-sized electricity users. This contrasts somewhat to the relatively strong response to centrally contracted RERT trial auction discussed below under 'strategic reserves'.

Without advocating a specific policy solution, ARENA continues to support the recommendation of the Chief Scientist's *Independent Review into the Future Security of the NEM* that consideration be given to new mechanisms, or changes to the current arrangements, which would make it easier for customers and demand side service providers to access value from wholesale market participation. One objective of any reform could be that all electricity retailers have sufficient incentives to actively support consumers who choose to engage their own demand management service provider. Placing the power in the hands of consumers, rather than electricity retailers, would help promote innovation in technology and business models and ensure that an efficient level of demand side participation can be achieved.

Strategic reserves

ARENA notes the AEMC's analysis which shows that the vast majority (99.76%) of reliability issues faced by consumers are caused by network faults or security issues, rather than supply-demand imbalances. This analysis is set against a concern by stakeholders who see the generation mix (including thermal generation) as increasingly unreliable and thermal generation continuing to be withdrawn from the market without a clear plan for how peak demand will continue to be served in the medium term. While the concerns over supply and demand imbalances may be currently overstated, it is timely to consider the implications of thermal generation withdrawing from the market in the coming years.

ARENA's consideration of the issue of strategic reserves is linked to our above comments on key concepts, contract market operation and wholesale market incentives. In particular we note the potential for a regulated and long-term carbon reduction trajectory, such as could be developed for the National Energy Guarantee, to stimulate new investment in dispatchable renewable energy generation which may address concerns that electricity markets are not able to be relied on to deliver a reliable power system.

ARENA's demand response competitive funding round

On 2 May 2017, ARENA and AEMO entered into a Memorandum of Understanding to jointly develop proof of concept projects that support the integration of renewable energy while maintaining system reliability and security. This includes the demand response funding initiative which is designed to deliver the following outcomes:

- Demonstrate that demand response is an effective source of reserve capacity for maintaining reliability of the electricity grid during contingency events, and that this resource can be rapidly established to provide such support;
- Provide an evidence base to inform the design of a new market, or other mechanism, for provision of demand response to assist with grid reliability and security;
- Inform price discovery, providing a benchmark for the cost of procuring demand response in the NEM; and

- Improve the commercial and technical readiness of demand response providers and technologies, including those involved in more innovative approaches such as engagement with mass market customers, or behavioural demand response.

The proposed approach is aligned with ARENA's investment priority to drive innovation in the delivery of secure and reliable electricity, specifically through helping develop and commercialise flexible capacity technologies and services that can complement variable renewable energy generation. As variable renewable energy generation grows, demand response can cost-effectively be used to offset short-term imbalances between supply and demand, and also provide reserve cover to prevent grid emergencies during extreme peaks or capacity shortfalls.

ARENA had set a target of securing up to 165 MW of demand response reserves through the competitive round based on consideration of a number of variables:

- Minimum size required to simulate the operation of a market mechanism to inform regulatory reform processes, including meaningful competition between providers and price discovery;
- Diversity of demand response providers, technologies, business models and customer segments (industrial, commercial and mass market);
- Making a material contribution to AEMO's requirements for contingency reserve capacity during summer peaks; and
- Total cost to ARENA, including consideration of joint funding provided by NSW Government (\$7.5 million).

The portfolio of ten projects funded by ARENA will provide 200MW of reserves in the third year of the program across Victoria, South Australia and NSW at an average ARENA grant of \$65,824/MW/year (plus usage payments from AEMO's RERT mechanism). This result exceeds the initial target set by ARENA of securing 165MW of reserves at an average cost of \$75,000/MW/year plus usage payments. This pricing is at the lower end of the range observed in a number of international examples of strategic reserves as identified in literature prepared for the AEMC during its consideration of a Demand Response Mechanism². This indicates that the potential for cost-effective demand response in the NEM may be greater than previously considered.

ARENA is providing grant funding (structured in installments with portions able to be varied based on performance) to assist a range of energy users to become demand response enabled including funding for equipment or appliance load controls, metering and communications technology, storage and distributed generation assets, while compensation for dispatch (the available capacity being used) is being paid by AEMO under the existing Short Notice Reliability and Emergency Reserve Trader (SN RERT) program. Under the terms of the funding program, usage payments through the RERT are capped at \$1,000/MWh with a maximum of 10 calls per year, each up to four hours.

² *International Review of Demand Response Mechanisms*, The Brattle Group, 2015

Figure 1: Breakdown of Demand Response Portfolio by Customer Type

	Project	Residential	Commercial	Industrial
NSW*	AGL	●	●	●
	Energy Australia NSW	●	●	●
	EnerNOC NSW		●	●
	Progressive Green (Flow Power)		●	●
VIC	Powershop	●	●	●
	United Energy Distribution	●	●	●
	EnerNOC VIC		●	●
VIC/SA	Energy Australia VIC/SA	●	●	●
	Planet Innovation/Zen	●	●	
	Intercast & Forge			●

ARENA expects that pricing for strategic reserves could be further reduced as the market for these services matures. In the selection process, consideration was given to the level of innovation (both technology as well as customer segment), which would not be a consideration in an ongoing market procurement, and the firmness of reserves offered.

Two near-activation events have occurred this summer:

- **30 November 2017** - AEMO was expecting an activation event a day before RERT Panel Agreements and ARENA Funding Agreements officially commenced. After AEMO confirmed which of ARENA's portfolio would be willing and ready to participate, AEMO sent Invitations to Tender (ITT's) to two projects.
- **19 January 2018** - AEMO sent ITTs to ARENA's two 60 minute product providers.

Through the process of implementing the funding round we are able to make the following observations:

- There is already some depth to the market for contractable demand response. ARENA received 24 applications representing over 450MW of capacity. While ARENA was only able to provide support to 200MW of those applications, we also note that AEMO has entered into separate contracts for additional supplies of reserve through the Long Notice RERT, creating approximately 1GW of total reserves. Importantly, these reserves were mobilised within very short timeframes (less than six months), and in the context of a new contract structure and approach in the NEM. We would expect that if a permanent strategic reserve were created, greater competition would result in larger quantum of reserves at lower prices.
- Because projects funded through this initiative have only been operational since December, ARENA is not in a position to share detailed performance data with the AEMC at this time. However, we note that customer recruitment, whilst challenging, has been achieved by the majority of projects and contracted reserves are now in

place. Six projects have tested so far demonstrating dispatch of fully contracted capacity. Two projects plan to test in late February to early March

- Not unexpectedly, the operation of the selected baseline is complex. The diversity of customer energy use profiles and the impact of that on the calculation of delivered demand response during activations is the subject of ongoing discussions with our project portfolio. We have observed that the current baseline calculation methodology tends to favour constant loads over variable or intermittent loads and this could be barrier to participation by some potential providers. We expect to be able to share in-depth information with AEMC and other market stakeholders once further data has been gathered.
- Initial feedback from proponents indicates continuing difficulty in accessing small customer identification data and meter data by non-retail providers of demand response and this is a major barrier to their participation in the demand response mechanism. In order to measure demand response provided, AEMO requires certain data points from all providers. One such point is the two digit Data Stream Suffix associated with a customer's energy meter. While customers are able to request access to this number from their energy retailer (and retailers are obliged to provide it under the Rules), the practical experience of some of our projects is that this information has been very difficult to obtain, creating a further barrier for specialist demand response aggregators to recruit customers. Permissioned access to a standardised set of energy consumer data may be a simple way to overcome this barrier to demand side participation (noting the ongoing work by COAG Energy Council and other market bodies on improving access to customer data). Feedback from stakeholders indicates there may be room to improve Metering Data Provision Procedures.

Expanding RERT capacity beyond the current trial will require alternative funding sources which would ultimately impact consumer electricity bills. ARENA notes that further costs may arise to the extent that providers choose to reserve their capacity for an out-of-market reserve auction that could otherwise be offered in-market, potentially at a price lower than the market cap. ARENA therefore considers that the development of a strategic reserve mechanism, either as an enhancement or a replacement of the RERT, would need to be accompanied by reforms that ensure easy access by demand response capacity providers to the electricity market and with a full consideration of cost and reliability trade-offs.

ARENA commends the work undertaken by an AEMO-led working group on the detailed scoping of a potential reserve mechanism, which includes detailed proposals for dealing with potential perverse outcomes, as well as other market design considerations. The designs proposed by the working group reflect many of the lessons gleaned from the delivery of the ARENA and AEMO demand response program.

A first public report on outcomes of the trial to date is expected to be released mid-2018.

Day-ahead market

We note that the case for a Day-ahead Market could increase to the extent that renewable energy storage providers are able to access more accurate estimates of price and demand for the following day's trade. Better forecasts of market conditions, informed by better

demand and renewable energy resource forecasts, could allow for more efficient utilisation of energy storage capacity by helping to optimise charging cycles. On the other hand, as recognised in the AEMC's five-minute settlement rule change decision, capacity that can respond to near-real-time requirements has a real value to the electricity system, suggesting any day-ahead market should be considered as a complement rather than a substitute for a near-real-time market such as provided by today's spot market design.

As noted by AEMO, demand response could also benefit to the extent providers require significant advance notice to activate. While ARENA is observing a trend towards more dynamic and automated energy storage and demand response that is better equipped to act at short notice, or in near-real time, it is likely that longer-notice demand response is likely to be a valuable potential contributor to the market for some time.

ARENA notes that the development of a day-ahead market would be a substantial reform to the National Electricity Market that may take a number of years to complete. We agree with the Commission that caution needs to be exercised to ensure any policy is designed to address specific problems in the market, however the future state of the market also needs to be considered including an increasingly high penetration of variable *and* dispatchable renewable energy generation sources and energy storage. ARENA would welcome, and offers to support, further analysis by the Commission on a day-ahead market under these conditions. We also note and support the Commission's observation that there may be more immediate actions that could be done to assist with addressing issues with reliability in the NEM.

Thank you for considering our submission in response to the Reliability Frameworks Review Interim Report. We look forward to working with you through this important work program.

Please feel free to contact me if we can be of any assistance.

Sincerely

Jon Sibley

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