Australian Government
Australian Renewable Energy Agency

ARENA

Submission in Response to the National Energy Guarantee Draft Design Consultation Paper

This submission seeks to provide the Energy Security Board (ESB) information and insights attained through ARENA's ongoing portfolio of investments. The submission focuses on design aspects of the reliability and emissions guarantee mechanisms that fall within the ESB's responsibility, rather than emissions reduction policy matters which are the responsibility of the Commonwealth.

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.

ARENA has identified 'delivering secure and reliable electricity' as one of its four investment priorities. Under this priority we are pursuing a range of projects that are demonstrating the potential for large-scale and distributed renewable energy generation and demand side resources to support power system reliability and security.

Summary

ARENA's experience indicates that the National Electricity Market can transition to higher shares of renewable energy without compromising power system reliability and security. The key points of this submission are:

- Reliability is likely to be supported by a range of both variable and dispatchable renewable energy technologies playing different roles in the market. Recent studies undertaken for ARENA indicate that the costs of energy storage (across all time-scales) and demand response may be lower than previously considered, which could support enhanced price and reliability outcomes for electricity consumers.
- Large-scale renewables and distributed energy resources (including demand response) are able to be deployed more rapidly and flexibly than traditional power generation technologies. This may allow retailers to move to more 'just in time' contracting models to hedge their wholesale market exposure. This suggests that shorter timescales for forecasting reliability gaps, and for compliance periods, may be appropriate.

- As different renewable energy storage technologies will be needed to support short term vs. seasonal storage requirements, investment decisions will be aided by a high degree of transparency regarding the 'shape' (and not just the size) of any forecast reliability gaps.

How will reliability be achieved in the future?

ARENA's submissions to the AEMC Reliability Frameworks Review[1] highlight how, as the proportion of variable renewable 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 flexibility for example, by using inverter controls to constrain power output.

ARENA has commissioned a quantitative comparison of alternative dispatchable renewable electricity options to explore the contributions to reliability in a high penetration renewables grid.[2] The preliminary results of this analysis are encouraging and indicate that even with currently available technology and current costs, dispatchable renewable energy is perhaps cheaper and easier to achieve than previously considered.

In the LCOE range of around $100 to $150/MWh, this study indicates that a range of storage technologies, combined with renewable generation, can compete to provide firming and peaking capacity with a range of 30 minutes to over 40 hours storage. This compares favourably with the current costs for peaking generation in the market. These estimates reflect technology costs in 2017, and can be expected to reduce over time with RD&D, global experience and manufacturing scale. Other studies, supported by ARENA, have forecast the cost for PV or wind with pumped hydro at $75-82/MWh for over 400GWh of storage.[3]

A relatively low marginal cost is associated with extending storage to provide low-utilisation long-term energy reserves, which could cover occasional periods of low renewable resource availability.

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 dispatchable renewables study also indicates that variable renewable energy generation will remain lower in cost than dispatchable options and, as such, we expect it is likely to increase its share of the generation mix into the future. This should keep average wholesale electricity costs to electricity consumers below the levelised cost of dispatchable renewable energy generation.

This analysis suggests that if power system services are appropriately valued, and with a supportive and predictable policy environment, we may see a competitive deployment of significant quantities

[1] https://www.aemc.gov.au/sites/default/files/2018-02/ARENA.pdf
[2] ITP Renewables, *Comparison of Dispatchable Renewable Electricity Generation Options, Preliminary Findings*, December 2017 - publication forthcoming
[3] A. Blakers, B. Lu, M. Stocks, (2017) *100% Renewable Electricity in Australia*, Energy vol 133. p.471-82

of energy storage in wholesale markets in response to identified market opportunities. The multiple competing technologies and the wide (and interlinked) range of power system services they can offer, also suggest that efficient investment will be facilitated by flexible and liquid markets that encourage innovation and are able to adapt quickly to changing market opportunities.

Forecasting a more complex and dynamic power system

Central forecasting of supply and demand takes on a more prominent role under the Guarantee with price and reliability outcomes for consumers more closely linked to the accuracy of a predicted 'reliability gap'. This highlights the need to both improve forecasting capability, and choose policy design parameters that allow investment decisions to be made as close as possible to the time of need - minimising exposure to the inherent uncertainty of long-term forecasts.

The challenge of accurate forecasting is complicated by significant changes in demand and supply side technologies and commercial models we expect to accelerate over the coming decade.

For example, Bloomberg New Energy Finance has forecast 2.7 million behind the meter solar-battery systems could be installed by 2030.[4] Based on an average sustained peak output of 5kW, this could represent over 13GW of dispatchable capacity and nearly 40% of current NEM peak demand.[5] The contribution of these resources to power system reliability is uncertain and will depend on a range of factors including consumer preferences, future market reforms, and the ability to make use of the capacity within the constraints of distribution network and electricity system security. Were AEMO to centrally procure additional capacity on the basis of on overly precautionary approach to forecasting the contribution of distributed energy resources, this could result in stranded investments in large-scale generation with costs borne by consumers.

Wind and solar generator systems also have substantially shorter project development times than traditional generation assets, and this could contribute to a more flexible and responsive supply side. ARENA's experience is that the development times for large-scale solar are often under 2 years. Batteries can also be deployed rapidly, as evidenced by the 100MW Neoen-Tesla 'big battery' which was completed within 100 days of contracting. ARENA is also pursuing investments in large-scale battery projects (to be finalised) that we expect will be deployed within 7 months of contracting. The ARENA-AEMO Reliability and Emergency Reserve Trader (RERT) trial suggests that the lead time for demand response could be substantially shorter than this.

The RERT trial also indicates that the potential for cost-effective demand response in the NEM may be greater than previously considered and this will provide a further resource for retailers to hedge their wholesale market positions.

The rate of deployment is also flexible. For example Green Energy Markets have estimated that around 2.3 GW of large-scale solar was under construction in January 2018[6] which is up from 1.3GW only 6 months earlier.[7]

[4] Bloomberg New Energy Finance, February 2017.
[5] Based on current NEM peak demand of around 35GW
https://www.aer.gov.au/wholesale-markets/wholesale-statistics/seasonal-peak-demand-nem
[6] Green Energy Markets, Renewable Energy Index, January 2018.
[7] Green Energy Markets, Renewable Energy Index, July, 2017.

The move to more cost reflective pricing, combined with smart device controls, also has the potential to reduce retailer wholesale market exposure and therefore their hedge contracting requirements. As costs come down, ARENA sees strong interest, especially by smaller retailers, in making use of customer-hosted assets as a form of physical hedge.

These trends have a number of implications for the process of forecasting of a reliability gap and the design of the Guarantee:

- Modelling in a highly complex and dynamic market environment will inevitably be reflected in uncertainty in modelling results. Forecasts are also more able to be contested due to the need to make assumptions about the scope and rate of already rapid technology and commercial innovation. To the extent that a precautionary approach is adopted in forecasting a future reliability gap, this could result in a systemic bias towards over investment.
- Retailers will have a greater range of supply and demand side options to quickly respond to an emerging 'short position'. Many of these options will have shorter lead times than has traditionally been possible. It therefore may be cost-effective for retailers to move to more 'just in time' contracting and investment patterns. This suggests that long range forecasts may be less accurate (and biased towards forecasting a higher reliability gap), and that shorter term forecasting and compliance timeframes may be more appropriate.
- Physical hedges by retailers, such as through the deployment of behind-the-meter solar-storage systems or contracting for demand response, may play a much greater role in managing the wholesale market exposure of retailers. It is important that this is valued appropriately in determining the risk positions of individual retailers, and the forecasting of a reliability outcome in a region.

Transparency regarding the shape of any reliability gap

The above mentioned dispatchable renewables study also indicates that a range of renewable energy storage options may emerge to play different roles in the market. For example, pumped hydro or hydrogen may be effective for seasonal storage, while batteries or demand response, may support shorter term imbalances in supply and demand.

This analysis suggests that investment decisions may be highly sensitive to the shape (and not just the quantity) of any reliability gap. A long-duration gap that is associated with compounding seasonal factors would necessitate a different technology solution compared to a gap constituted by many short-duration, supply shortfalls. This indicates that efficient investment will be supported by a high degree of transparency in modelling assumptions and outputs.

The shape of a reliability gap also has implications for the types of hedges retailers may be required to procure during a compliance period. Different supply and (increasingly) demand side resources and commercial arrangements, will be valued differently under alternate retail models and with different customer load profiles. A retailer may have an overall short position in relation to their own contract book while being well hedged against the forecast incidence of a regional reliability gap. Conversely, a retailer may be well hedged overall, other than at times when the a regional reliability issue is forecast to arise. The shape of the regional reliability gap, and the shape of a retailer's specific market exposure, may need to be considered when determining compliance obligations so as to ensure obligations are structured to achieve the reliability outcome in an efficient manner.

Complexity and interactions with the contract market

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. 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, potentially increasing the number and types of contracts available.

ARENA is also witnessing significant innovation in electricity retailing by new entrant retailers, incorporating more behind the meter energy resources and greater overall demand side participation. These new retail models are providing greater choice for electricity customers and learning for the industry as a whole. ARENA's view is that enhanced competition and continuing innovation in electricity retailing will be critical in driving the effective and efficient integration of large-scale and distributed energy resources.

The reliance of the guarantee mechanisms on monitoring and verification of retailer contract positions imposes significant new complexity on the market. ARENA notes the ESB's consideration of these issues and and welcomes its commitment to ensuring that the policy does not further entrench market power issues or adversely affect contract market liquidity.