S&C ELECTRIC COMPANY
Excellence Through Innovation

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Sarah-Jane Derby
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Our Ref: JC 2017-033 18 August 2017

Dear Ms. Derby,

S&C Electric Company response to the Reliability Frameworks Review Issues paper (EPR0060)

S&C Electric Company welcomes the opportunity to provide a response to the issues paper covering the Reliability Frameworks Review.

S&C Electric Company has been supporting the operation of electricity utilities in Australia for over 60 years, while S&C Electric Company in the USA has been supporting the delivery of secure electricity systems for over 100 years. S&C Electric Company not only supports "wires and poles" activities but has delivered over 8 GW wind and over 1 GW of solar globally. S&C Electric Company has been actively engaged in deploying Battery Energy Storage Systems for over 10 years, supporting a full range of business models and using a range of battery technologies, at the kW and MW scale, and currently has 76 MW/189 MWh in operation. In Australia, S&C projects include the Ergon Grid Utility Support System in Queensland, which reduces peak loads and provides voltage support on rural Single Wire Earth Return lines and the 2 MW battery for PowerCor in Victoria.

S&C Electric are particularly interested in facilitating the development of markets and standards that deliver secure, low carbon and low cost networks and would be very happy to provide further support to the Australian Market Energy Commission on the treatment and potential of these technologies.

Yours Sincerely

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General Comments

Dispatchability versus Flexibility

The Australian electricity system is changing and the incorporation of more variable generation needs a different approach. In Australia that approach seems to be a requirement for "dispatchability", where-as in other locations the requirement is for responsive "flexibility", e.g. UK (https://www.gov.uk/government/publications/upgrading-our-energy-system-smart-systems-and-flexibility-plan). Both approaches have merit, although only by facilitating flexibility, through new services, will new technologies, such as electricity storage, and new approaches such as demand side response, be engaged.

Not just generation

While variable generation presents a more complex challenge for the management of the NEM, not even large thermal generators are instantaneously responsive to ramping up and down and need notice. The most responsive widely deployed asset on the Australian system is likely to be wind generation, which can be curtailed to zero (at a cost via a system service).

We would agree that variable generation should not just "connect and forget" about their impact on the system and should have some degree of responsibility for managing their connection and sharing the costs of the impact of variability on the system. This could be through better shared forecasting with AEMO or some sort of "reliability" or "dispatchability" requirement. Currently what is envisaged via the Generator Reliability Obligation (GRO) is the investment in a physical asset. However, this "dispatchability" could equally be delivered as a location specific service through the market and would lead to the efficient deployment of dispatchable assets (which may be constructed by a renewable generator) at lowest cost.

Impact of New Markets and Services

The design of any new market or service in the market will need to be undertaken with care. Capacity Markets are a major intervention in the wider market and have unintended consequences if not well designed, e.g. UK Capacity Market, which inadvertently incentivised diesel generator farms under the demand-side response portion of the Market and this then required significant further intervention to ensure that the Market delivered desirable capacity. However, the UK Capacity Market did not bring forward any large gas turbine generators (CCGT), since the low clearing price of the reverse auction was delivered by other assets.

Further, a well-designed new service will bring forward the technologies and approaches best able to deliver that service, e.g. UK Enhanced Frequency Response. However, even if the service is intended for the transmission system, it is likely that the provider will connect assets to the distribution system, creating significant work for the DNSPs, plus the wider system implications of requiring the distribution network to support and sustain potentially rapidly acting services, which may cause constraints on the distribution network. Therefore, broad network consultation is needed between all levels of the system, when introducing new services or markets.

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Demand is Responsive or Unresponsive?

In the issues paper demand and electricity is variously described as "an 'on demand' product" that is "difficult to shift" (p17) versus "Price signals… can encourage customers to shift energy use…", "…that goes largely unnoticed by the customer.".

Some consistency is needed in the discussion of demand and demand response. Demand can be shifted and there is a wealth of evidence here in Australia and internationally that demonstrates that this is the case. This particularly true at the Commercial and Industrial (C&I) scale, where these customers already see price signals. However, residential customers often have no visibility of price signals, such as Use of System charges, since the retailers do not pass this through unmodified. This will have to change, if domestic-scale demand-side response is desired.

Demand response, through load shedding, is currently an *emergency* action in response to a contingency. We need to move away from demand response as a "last resort" and it needs to be a standard approach to providing flexibility in the NEM. E.g. Short-Term Operating Reserve in the UK, which is tendered on a seasonal basis (http://www2.nationalgrid.com/UK/Services/Balancing-services/Reserve-services/Short-Term-Operating-Reserve/Short-Term-Operating-Reserve-Information/). National Grid (the GB TSO) has invested considerable time and effort in facilitating C&I demand response through its Power Responsive programme (http://powerresponsive.com/). Domestic-scale demand response has been shown to be too expensive because currently the loads are small (but this will change) and domestic customers need a great deal of support to engage with a demand response programme and remain engaged. Aggregators in the UK also tend to only work with the C&I sector.

The need for Visibility

Network Service Providers will need to have visibility of assets providing system services or just connected to the system. The AEMO, COAG-endorsed, register will be critical for supporting forecasting and management of distributed resources that impact on both the distribution and transmission system.

The additional of behind-the-meter electricity storage (batteries) will complicate the forecasting of distributed solar PV. Without a battery solar PV generation is strongly related to weather (and cloud cover), with a modification by demand through self-consumption. With a battery, the demand becomes more complex (demand increases as the battery charges) and without visibility of the state of charge of the battery it will be very difficult to predict when distributed small-scale solar PV will export to the wider network. This will affect the ability of the DNSP to manage their network and will affect the TNSP and AEMO, which sees solar PV as minimum demand and ramping.

Domestic-scale Demand Response is not Fast

While domestic-scale demand response is a source of flexibility it is complex to engage and secure. The coordination of many small loads, including the need for an "opt out" ability, means that the service will not be fast enough to provide a fast frequency response service at the sub-second level. Large C&I assets, may be able to provide a sub-second fast frequency response service.

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Aggregated Domestic-scale Batteries versus a Single Battery

UKPN's Low Carbon London innovation project showed that domestic customers had a 24% response rate in the demand-side response program. This means that any aggregator hoping to deliver a 1 MW FCAS response needs to hold 4.5 MW of domestic batteries.

A domestic system is currently about 7 kW and costs AUD15-20K. This means an aggregator will need to contract with 650households to guarantee delivery of the 1 MW. Those householders will have spent 650 x $15,000 = $9.8-13M combined to deliver that guaranteed 1 MW of response.

A utility or third-party storage developer could deploy a 1 MW battery, which would precisely and efficiently deliver a 1 MW FCAS service. The cost of that utility-owned 1 MW battery would be $2-3M. So potentially, "the system" could get 3-5 MW of batteries for the cost needed to guarantee delivery of 1 MW of response from domestic behind-the-meter batteries. That utility cost or some of it (some of the income from services would offset the cost of the asset) would be passed on to end consumers.

This is why CSIRO-ENA Electricity Network Transformation Roadmap (p39), which states “Increased penetration of customer owned generators and electricity storage systems which, if left unmanaged may impact the supply and demand balance in distribution networks”… and “On current projections, investment in battery storage is likely to reach a critical mass before 2030 and without appropriate incentives or orchestration, mass scale battery charging profiles could lead to export/import imbalance in distribution networks or new peak demand events…”.

The case for domestic-scale batteries delivering system security at lowest cost, has not been successfully made. It is likely that Commercial and Industrial (C&I) scale behind-the-meter batteries will make more economic sense, in terms of the impact that asset will have on the energy costs of the C&I customer and the ability to deliver a service. This is because any battery owned and operated by C&I customers is at a larger-scale, so easier to engage and incentivise, since C&I customers can be exposed to time-variable network charges/energy costs.

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Response to Questions

Question 1 Assessment principles

(a) Do stakeholders agree with the Commission's proposed assessment principles?

A market approach, such as new service, is preferable to a regulated approach. However, the NEM is not a "level playing field" and care will be need to ensure that any new flexibility/reliability service delivers approaches that are cost-effective and address wider policy issues, such as reductions in carbon emissions.

(b) Are there any other relevant principles that should be included in the assessment framework?

The impact of climate change policies at the Federal and State level cannot be ignored and while there is no sustainability component to the NEO, these policies will impact on investment and delivery.

Question 2 Assessment approach

Are there any comments, or suggestions, on the Commission's proposed assessment approach?

Dispatchable generation has not demonstrated great reliability in the recent past, with large thermal generators failing in high temperatures and operational decisions resulting in large thermal plant being unavailable at times of system stress.

"Dispatchability" of generation is not the only approach. There seems to be a desire for dispatchable assets, rather than a flexibility or reliability service, which would facilitate the role of a range of technologies and approaches including electricity storage and demand response.

Question 3 Forecasting

(a) What are stakeholders' views on the variances occurring in forecasting? Could these variances be minimised through more sophisticated forecasting techniques?

Both demand and generation, including conventional large thermal generation, are highly dependent on weather and climate. Australia is experiencing changes in weather patterns as a result of climate change and there is also climate variability, such as El Nino/La Nina cycles, to manage.

More sophisticated modelling is a potential approach to better forecasting demand and generation, but any modelling is significantly dependent on the input data to any model. AEMO's reliance on commercial products from a commercial meteorological company, rather than creating a strong relationship with the National Meteorological Organisation, the Bureau of Meteorology, has not been helpful (e.g. AEMO's failure to forecast the significant storms of 28 September 2016, in South Australia).

Australia's electricity network is Critical Infrastructure, the provision of electricity is a lifeline service and the loss of electricity has significant impacts on the health, wealth and well-being of Australians. The heatwave of 2009 in SE Australia has been estimated to have cost $800M, largely as a result of a loss of electricity (Chhetri et al., 2012). Given the dependence of the NEM on the weather and climate precise forecasting is essential and the current approach is not delivering the necessary precision.

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The Transmission System Operators (TSO) in other countries (e.g. UK) have excellent modelling for wind output and are developing forecasting capabilities for solar PV. National Grid are able to forecast wind output to 94% and wind generation is also very flexible, providing responsive system balancing services to the TSO.

(b) Are forecasting errors impacting on NEM reliability?

Yes, errors in the forecasting of demand and available generation are increasing the cost of operating the NEM and leading to reliability issues, that is forecastable events are being treated as contingencies.

Question 4 Options to accommodate intermittent generation

(a) Do stakeholders consider that facilitating additional dispatchable generation, or facilitation of more flexible energy sources, or a combination of both, can more easily achieve the aims of better incorporating intermittent generation into the NEM?

Flexibility is likely to be a more cost-effective approach to managing intermittent generation, than investing in new dispatchable (i.e. large thermal) generation.

(b) What outcomes do stakeholders consider are necessary in order to better incorporate intermittent generation sources into the NEM, from a reliability point of view?

Acknowledgement that (i) better forecasting demand and generation is necessary and also very possible using high quality weather data and appropriate models; (ii) That intermittent (variable is more appropriate) generation has a broader role in supporting operation of the NEM by providing accurate forecasts and operational specifications to AEMO and (iii) the development of a new "flexibility" ancillary service to provide both footroom and headroom.

(c) What factors should be taken into account when considering a Generator Reliability Obligation?

It is entirely appropriate that variable generation should have some role in mitigating the nature of its variability. Currently renewable generation is very "plug and play" and has no need to contribute to the costs or implications of the variable nature of the generation. The nature of the incentives this generation receives, at all scales, is time and location independent, which further exacerbates the impact of poorly forecast variability on the wider system.

A Generator Reliability Obligation could also be a purchased service, rather than a requirement to invest in a physical asset. A renewable generation developer could either choose to invest in an asset, e.g. electricity storage, or purchase a flexibility/reliability service to meet an obligation. By creating a new service, a new provider, such as a third party battery operator, may deploy and offer the service to generators, as well as providing other system services. If the renewable generator decides to invest in a "reliability" asset (accruing develop,ent cost-saving due to already having land and connection arrangements), then they can use the asset themselves to meet reliability requirements as well as providing other system services, which may be "reliability" to other renewable generators.

Any approach taken to deliver "reliability" will result in increased costs to the end customer, regardless of whether it is a service or an asset, since the costs will be passed through to the end customer. However,

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a service approach would be an efficient way to deliver reliability, rather than requiring all newly connecting generators to invest in a specific asset, in an unplanned and piecemeal fashion and if that reliability/flexibility service was delivered by electricity storage, other support services could also be offered to the system by the same asset.

Question 5 Credible contingences

(a) Do stakeholders have any views on whether the existing credible contingency definitions may, or may not, be appropriate given the changing generation mix?

If credible contingencies are occurring more frequently due to the changing generation mix then the NEM needs better management to ensure that contingencies aren't the new normal. A forecasting error is ***not*** a credible contingency. Many of the issues are caused by poor forecasting, and it is clear forecasting can be performed better, but requires better forecasting from both AEMO and variable generators, with the latter sharing their forecasts with AEMO to support operation of the NEM.

(b) What are the differences in the impact of the changes in the generation mix on these definitions? Do these differ depending on whether they are thought of as relating to 'reliability' or 'security'?

System security, is not the same as system reliability, but the two are closely related. A secure (stable) system is required to reliably deliver electricity. Both security and reliability are impacted by forecasting error and it is clear that there are major issues with forecasting both demand and generation. The weather is usually well-predicted by the Bureau of Meteorology, so understanding both generation and demand should be entirely predictable and contingencies should not be used to address failures forecasting, but rather address unexpected failures in generation or demand assets.

(c) In reviewing the appropriateness of these definitions, are there any particular principles or considerations that the AEMC should take into account?

The Bureau of Meteorology provide detailed seasonal and climate outlooks (e.g. El Nino-Southern Ocean Oscillation (ENSO) Wrap Up), which should support AEMO in longer term adequacy assessments and positioning.

Question 6 Interconnector

(a) What role can interconnectors play in relation to reliability?

Interconnection is another source of system flexibility, which would support reliability.

(b) What factors should the Commission consider in this regard?

The current transmission investment framework is not fit for purpose for many reasons, but it is highly unlikely that RIT-T would support the investment needed for new interconnectors.

Question 7 Contract market

(a) Is generation and load becoming more capable of varying production and output in shorter timeframes, and if so, what will be the role of contracts? If generation and load could respond instantaneously to spot market signals, how would this change the contract market?

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There are certainly sources of flexibility that can be provided by generation (particularly wind) and demand. Electricity storage is also an excellent source of flexibility. However, there is currently no value to providing flexibility in the NEM today and it is difficult to see how the contract market could support flexibility.

The GB TSO initiated the "Power Responsive" programme (http://powerresponsive.com/) to better facilitate demand side participation in system balancing services. This programme focuses on C&I customers and developing appropriate contracts and tendering mechanisms that allow the demand side to engage with the electricity system.

(b) The proportion of intermittent generation in the market is increasing. Caps and swaps have traditionally been sold by dispatchable generators, which can turn on or off at will to 'back' their contractual obligations. How will the volume and type of contracts traded change as the generation mix evolves? Will this have implications for reliability?

Wind generation can be used as a flexible resource (and to provide inertia services), so it would appear that there is a lack of knowledge about what intermittent generation can actually do.

Electricity storage is not only "dispatchable" generation, but critically can provide footroom, that is increase demand to absorb electricity. In the UK Flexitricity provide a demand-side footroom service to the GB TSO, behind constraint boundaries (that is, it is a locational service).

Thermal plant, large and small, is not the only route to a reliable electricity system.

(c) How significant is the demand-side in driving behaviour in the contract market?

In as much as the NEM is focused entirely on ensuring generation meets demand, then it is a significant driver. But demand can be flexible too and so the market needs to recognise this.

(d) Over time, spot prices may become increasingly decoupled from domestic demand (as discussed in Box 6.3). More and more, spot prices may come to be driven by relatively unpredictable natural forces (like wind and sunshine), as well as by movements in international markets (like the demand for gas). How will this affect the role of prices in supporting reliability through domestic investment and operation?

AEMC needs to decide whether renewable generation in the form of wind and solar is truly unpredictable or whether Australia doesn't yet have appropriate tools to manage variable generation. Other countries are making great progress towards managing the penetration of variable generation.

Visibility of distributed variable generation is possibly more problematic than perhaps forecasting its output (or the impact on minimum demand), but again other countries are managing this.

Where an incentive to deploy variable generation is fully decoupled from time and location, then there is no price signal to drive investment at the rooftop domestic level. If the incentive for rooftop solar takes no account of the impact of midday peak generation on the wider market for electricity generation, then there is no driver to reduce export to the wider system. If a feed-in-tariff was zero at midday, this might drive self-consumption (which would still present as a minimum demand issue) and/or domestic scale

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batteries. The latter would be further incentivized, if the retail price for importing electricity in the evening reflected the true price. As long as small end consumer are oblivious to the true use of system and wholesale costs, there is no reason to modify behaviour.

Question 8 External factors

What external factors (that is, not the contract, or spot price) are influencing investment, retirement and operational decisions in the NEM?

Clearly, the approach to mitigating climate change has a huge impact on investment, retirement and operational decisions within the NEM. Regardless of the "political climate", Australia is transitioning to a lower carbon electricity system. This is largely uncoordinated due to the lack of Federal political leadership, with the fragmentation of approaches strongly state-based and on political lines. The lack of clear direction from the Federal Government is critically hampering the operation and future development of the NEM. If the sustainability remains as an oblique driver on the NEM, then it will be very difficult to deliver a stable and reliable electricity system.

Question 9 Efficacy and efficiency of information provision

(a) What is the potential for the reports (Energy Adequacy Assessment Projection, Electricity Statement of Opportunities and PASA) to be streamlined or made more efficient given existing interactions?

No response

(b) Is the information provided by the reports adequate given that it has the purpose of information provision to the market for reliability and investment purposes?

No response

(c) In particular, is the information around planned generation maintenance and outages adequate?

No response

(d) What other information do stakeholders rely on?

No response

Question 10 Role of interventions

(a) What is the role of intervention mechanisms in the reliability frameworks? Does this role change in times of uncertainty?

Intervention should be kept to minimum and only used to address a market imbalance or unfairness.

(b) To what extent do stakeholders consider that intervention mechanisms inhibit market-based responses, and create distortions within the framework?

All interventions inhibit market-based responses (where there is a market to facilitate a response). Ad hoc interventions create uncertainty and inhibit investment.

(c) To what extent are interventions preferable to load shedding?

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Load shedding is an "extreme" demand side response. Demand side response is going to become a standard and vital service for balancing the NEM and will involve participants who are willing to move their load. If an "intervention" is needed, it is to ensure that the necessary flexibility services are created to reduce the reliance on load shedding.

Question 11 Triggers for intervention

Do stakeholders consider that there is sufficient transparency about the existing triggers for intervention?

No Response

Question 12 Efficiency of the RERT

Do stakeholders consider that the RERT is still a relevant mechanism to ensure a reliable supply of energy in the NEM?

If the RERT is becoming more used, then this suggests that a specific new service is needed that operates within the normal market.

Question 13 RERT procurement trigger

(a) To what extent do stakeholders consider that the fact that AEMO can only trigger the RERT for anticipated shortfalls is still appropriate?

If, after adequate planning, there is an unexpected shortfall, then the RERT is appropriate. But better forecasting and planning should minimise the need for RERT.

(b) Is the procurement trigger still appropriate in a world where shortfalls are less predictable, and there is increased demand-side participation?

RERT should a "last resort", with a new flexibility/reliability service to support the management NEM as the generation fleet changes.

Question 14 RERT lead time

(a) To what extent do stakeholders consider that the lead times for the RERT constrain the ability of market-based reserve contracts being realised?

See above.

(b) What are stakeholders' views on the need for the long-notice RERT?

Better planning and forecasting, plus increased participation from flexible approaches should reduce the need for long-notice RERT.

(c) Does the long-notice RERT have the potential to limit a market response?

See above.

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Question 15 Price discovery

To what extent do stakeholders consider that the price discovery process of the RERT could be improved?

If the need for the RERT was largely replaced by better forecasting/planning and a flexibility service, then the RERT could be part of the wider suite of flexibility provision.

Question 16 Demand response for reliability purpose

(a) What are the reasons why most demand response providers have not participated in the RERT to date?

Demand response is poorly enabled and poorly facilitated in the NEM. This true even for "standard" services, rather than the complex RERT mechanism. As the role for the demand-side in providing system services grows, providers may be more comfortable in participating in RERT.

(b) What findings can be taken from the ARENA-AEMO trial in terms of how demand response could be better incorporated into the RERT?

No Response.

Question 17 Efficacy of directions and clause 4.8.9 instructions

(a) Are reliability directions fit-for-purpose given existing trends such as the start-up time of generating units and other trends such as higher penetration of variable, renewable energy in the NEM?

No Response

(b) Are reliability directions and clause 4.8.9 instructions needed given the existence of the RERT?

No Response

(c) Is the notification process for directions - amount of notice given and clarity - adequate?

No Response