S&C ELECTRIC COMPANY
Excellence Through Innovation

141 Osborne Street
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Australia

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

Our Ref: JC 2018-050

6 February 2018

Dear Ms. Derby,

S&C Electric Company response to the AEMC Interim Report – Reliability Frameworks Review

S&C Electric Company welcomes the opportunity to provide a response to the Interim Report 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 the "wires and poles" activities of the networks, but has delivered over 8 GW wind, over 1 GW of solar and over 45 MW of electricity storage globally, including several battery projects in Australia.

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 emerging technologies and approaches.

Yours Sincerely

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General Comments

The AEMC has provided a comprehensive review of many and varied complex issues.

Long-term solutions needed

Many of the potential options discussed are described as "hard to do" or "difficult to deliver", with preference seemingly given to "easier" solutions (for instance see the discussion on Day-ahead Markets).

Power systems are naturally slow to evolve and while not advocating "revolution", decisions need to be made now that will deliver a fit-for-purpose system and fit-for-purpose markets and approaches that support the stated aspirations of Australia (well covered in the Context section, page 104).

Rather than seeking quick or easy wins, the assessment should be what approaches will deliver the NEM and in particular the reliability standard, we need in 5 years' time. Clearly the reliability standard that is acceptable now, will change in the future, but it is highly likely that higher reliability will be required in future, not less (e.g. recent outages in Victoria on Sunday 28 January 2018).

Some of the changes needed to deliver reliability in the future may challenge the status quo and the operation of incumbents. Often the simplest approach is more favourable to current business models, so care and caution are needed to ensure outcomes that support the new approaches and business models, such as demand side response that will provide flexibility.

Managing the "solar trough"

The Review makes passing mention to the "solar trough" (p70) and "afternoon ramping" (p57). This comprises two problems that both have the potential to impact negatively on reliability: minimum demand in the middle of the day and the need to manage a rapid increase in demand in late afternoon. See Figure 1 below extracted from National Grid's Future Energy Scenarios 2015.

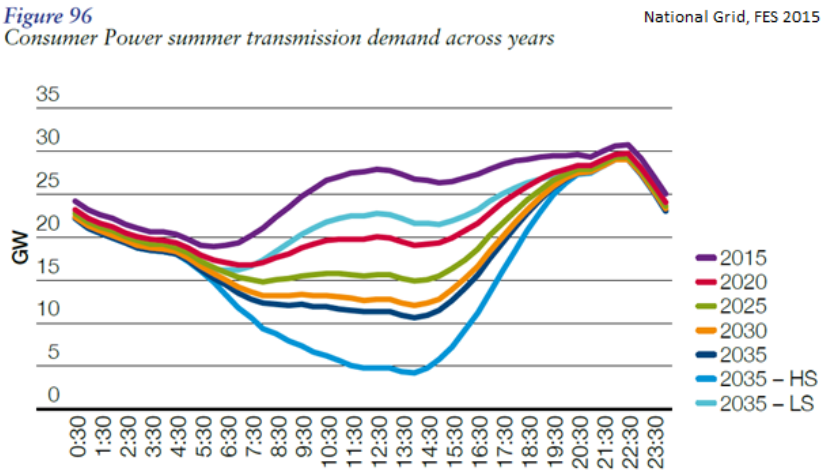

Figure 1: showing the "solar trough" on the GB system for a range of solar PV scenarios.

Minimum demand as a result of distributed solar PV generation is already having an impact at the distribution network level, but is also seen by the System Operator in Australia. Minimum demand can

be difficult to forecast as it involves predicting the behaviour of distributed generation, which is typically too small to be required to provide operational data to AEMO. Minimum demand creates less "space" within which to operate the system, that is, to hold must run plant necessary to keep the system secure. Figure 1 is already outdated for the UK with National Grid encountering troughs equivalent to 2035 on some summer days. The GB system has 7-8 GW of must run inflexibile nuclear and a minimum demand close to this level creates a range of problems.

In other jurisdictions demand side response and batteries provide a demand *turn up* service, increasing demand to allow critical plant to remain on the system (a security issue). In the UK there have been a significant number of settlement periods with negative wholesale prices (already occurring South Australia) and National Grid tend to constrain off (a paid service due to lost incentives and lost energy revenue) wind generation, since this can go to zero, but in some locations, such as behind the Cheviot Boundary, which is constrained, National Grid use a demand turn up service.

The second issue is the management of the afternoon ramp in demand as distributed solar PV generation diminishes as the sun begins to set. This is again a security and reliability problem, which requires generation that can ramp up very rapidly.

Negative Wholesale prices

The "solar trough" has created negative wholesale prices in a variety of countries, most notably Germany. The incentive for domestic behind-the-meter batteries coupled with rooftop solar PV was introduced in an attempt to resolve the negative wholesale prices for fossil fuel generators in Germany. However, the design of the incentive has not resulted in the hoped for reduction in export from distributed generation and Germany's fossil fuel generators rely on interconnection to the rest of Europe to sell their electricity (although the rest of Europe has an increasing penetration of distributed solar PV). The incentive requires householders to reduce their export to 50-60 % of the capacity of the solar PV system over the *entire lifetime* of that PV system. To address summer peak solar PV generation, the incentive should have been time resolved to reduce export between 1100-1500 every day. The same reduction in export can be achieved by providing a Feed-in-Tariff that is time based and appropriately values the generated electricity at the time of export (e.g. Hawaii and Victoria).

The current cap and floor on wholesale prices, particularly the floor, presumably protects conventional generators from being exposed overly negative wholesale prices that might be expected in summer in response to the export from distributed solar generation. It isn't clear how constraining the floor price will expose (conventional) generators to an investment signal that might otherwise resolve the need for both dispatchable and highly flexible generation.

Batteries

Batteries are a new technology that, as the AMEC rightly point, offer flexibility. They can respond extremely rapidly and can both import and export and are a potential tool to deliver both reliability and security to the NEM in the future.

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The Hornsdale 100 MW battery could be seen as a response to spot market volatility (Box 5.3, p99), but that asset was significantly subsidised by the South Australian Government, so it is debatable whether spot market volatility alone would have driven the deployment of that particular technology.

The AEMC should also be clear that the Hornsdale facility is operated to make a profit for the owners, as is to be expected and appropriate, and it is already clear that the operators are successfully using price arbitrage to charge the battery when prices are low (negative) and export the electricity when prices are very high, leveraging the current cap and floor settings (Figure 2). It is difficult to see how this mode of operation will place "downward pressure on power prices for South Australian consumers".

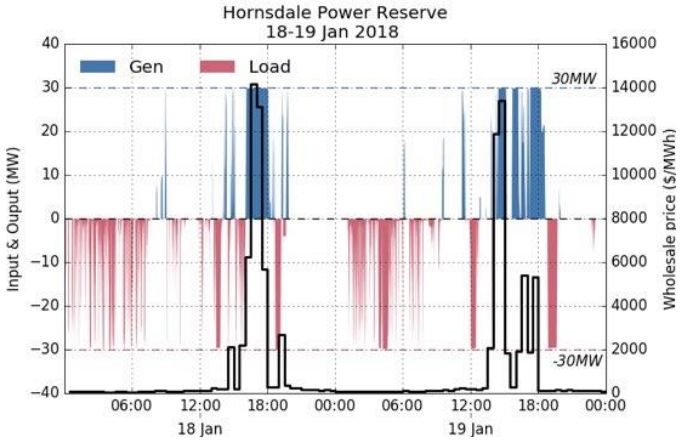

Figure 2: Arbitrage using the Hornsdale Power Reserve (http://reneweconomy.com.au/tesla-big-battery-moves-from-show-boating-to-money-making-93955/)

It also demonstrates that a battery operator/owner will pursue the income stream that offers the most value (as it should) and this may mean that selling electricity in the wholesale market is a more attractive financial option that providing security services. While the exact details of the contracts held by the Hornsdale facility are not available, it does demonstrate that batteries can provide security and reliability services. A well-designed battery can offer frequency support (security) and capacity (reliability) simultaneously (Figure 3).

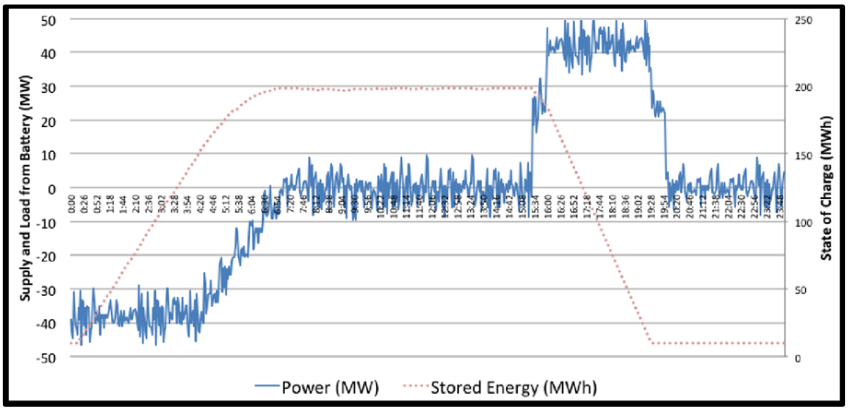

Figure 3: "Always On" operation of 50 MW battery

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A recent study on the All-Ireland system has shown that 360 MW of batteries could provide the equivalent inertia to the system of 3000 MW of conventional thermal generation (http://everoze.com/everoze-launches-batteries-beyond-the-spin-report-on-digital-inertia/).

Response to Specific Sections of the Review

3.1: Reliability and Security

It is not possible to have a reliable system without security, where-as it is possible to have a secure system that is unreliable. Currently there is a lack of Frequency Control in the NEM, which is outside the required standard.

Australians are paying more than ever for FCAS yet frequency is not being controlled. This would suggest that the service is not delivering the control that providers are being paid to deliver and it would be interesting to understand the quality of the current service and whether it is meeting expected delivery targets.

Since a lack of security has a negative impact on reliability it is difficult to see how both can be assessed in isolation, particularly in the context of the future design of markets. There is much yet to be resolved in successfully managing frequency in the NEM and depending on the final approaches taken, there may be a consequent impact on reliability and the ability of participants to provide reliable services.

3.2: Dispatchability and Flexibility

The AEMC explores the continuum of what is dispatchable and what is flexible, but the new National Energy Guarantee (NEG) favours dispatchabilty, rather than flexibility. In most jurisdictions it is flexibility that is favoured and flexibility can come from flexible generation (e.g. gas engines), demand side response, interconnectors and storage. Interconnectors are a limited option in Australia, given the geographic distances needed to link regions and gas engines are reliant on fossil fuels. Demand said response and electricity storage both have the benefit of benefit of only providing import (demand turn up), but also export, in the case of back-up generation behind the meter or demand reduction.

Reliability is defined as the exact matching of generation with demand. As generation becomes more variable it is appropriate to develop variable demand, that can be dispatched, either up or down, to better meet the available generation.

Dispatchable generation is typically slow and/or inflexible. Neither is a good fit for the increasing penetration of variable renewable generation.

The AEMC also points out that speed of response (e.g. the afternoon ramp following the “solar trough”) is going to become increasingly critical. However, generally markets, with a few exceptions, do not value speed nor do they value accuracy of response, that is, the provider delivered exactly what was required by the System Operator in terms of capacity and speed (rate). If markets do not appropriately value a service, then there is not a strong signal to potential investors.

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4: Forecasting

Accurate and precise forecasting of generation and demand obviously supports reliability and we would support all measures that enable AEMO to better forecast demand and generation.

In the UK, Retailers (Suppliers) are subject to "imbalance" assessments that incentivises Retailers to ensure that purchased generation matches demand. Mismatches are subject to cost-reflective "imbalance" charges. The suggestion that Retailers to contribute to AEMO's forecasting by providing forecasts of demand is a good one, but Retailers, particularly the large incumbent Gentailers, encompass multiple regions, so it is not clear how the demand forecast data could be provided in a format that is readily digestible for AEMO. But this regional issue is not a reason not to pursue the approach.

It should also be noted that the NEG will place additional requirements on Retailers, but clearly flexible and responsive demand will be needed to deliver reliability in the future.

Tempus is currently working with Origin in Australia, but its business model in the UK, was as an Aggregator/Retailer (Supplier) that purchased a fixed amount of generation and then minimised costs by ensuring that demand was flexible and exactly matched the purchased profile of generation. Thus reducing the "imbalance" costs. In this approach, generation was fixed and demand was fully flexible. Note, that in order to access the value in "imbalance" payments, Tempus needed to become a licensed Retailer (Supplier) and this is an increasingly common issue for unregulated Aggregators in the GB market. Obtaining a Retailer licence, as AEMC have indicated, can result in a large burden for a new business to overcome and will result in additional costs (responsibilities) that may erode the original value in the new business model.

It of great concern that the rebidding practices of generators has been found to be a significant factor in impacting negatively on the ability of AEMO to prepare accurate forecasts. AEMC states that rebidding is necessary for a functioning market, but it would be interesting to see further work on the impact of Generator rebids on forecasting and confirmation that such rebidding is essential in a functioning market.

Distributed resources, both generation and demand, pose a number of forecasting problems to the System Operator. However, distributed generation presumably has an impact on demand profiles and would also be seen by the Retailers.

If demand side response is to become a key tool, then who ever manages that resource (see Section 6) would presumably be forecasting that response and providing that information to AEMO through a variety of markets.

If distributed generation, load or storage wishes to participate in the markets, then it would be appropriate to ensure those assets are registered and that AEMO are aware of their location, capacity, etc. This may be achieved via an Aggregator or Retailer.

5: Contract Markets

AEMC is determined that the contract market is liquid. Although several respondents have presented evidence to show it is illiquid. AEMC state that information not freely available (piii) and any market where opacity is a factor, is unlikely to be liquid. AEMC further state that not all energy is traded openly,

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can be traded through bilateral contracts and off-market arrangements and all of these approaches result in illiquidity. Vertical integration and monopoly activities precipitate illiquidity. The ACCC Retail Electricity Pricing Inquiry Preliminary Report (September 2017) strongly suggested monopoly practices in all states. Illiquidity is a fact in many electricity markets globally (e.g. UK) where all electricity is not moved through exchanges or the wholesale market and Australia is no different and the AEMC needs to exercise caution when asserting that the electricity markets and contract arrangements in Australia are fully liquid.

In an illiquid market it would be difficult for new entrants to make headway, as incumbents leverage their vertical integration and consolidated position. Indeed, the AEMC states several times in the Review that it is difficult for new entrants, new retailers and DSR providers to establish themselves in the current NEM. This indicates a serious market flaw that supports incumbents over new approaches and new entrants.

Additionally, AEMC discusses the impact of "late bidding" by generators (p64), which certainly suggests some misuse of current arrangements that negatively impacts on reliability.

6: Role of DSR

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.

In the Review AEMC is supportive of the future role for demand side response (p34), however the Review also discusses a number of barriers to demand side response providers accessing the market.

The AEMC is very fixated on demand **turn down**, but demand **turn up**, is an increasingly important system service (e.g. UK). It should be noted that demand side response can encompass **export** from behind-the-meter Commercial and Industrial (larger capacity than domestic) generation (back-up diesels) or storage, as well as demand turn down and demand turn up (import). All of these options can provide valuable flexibility that will support reliability.

At the domestic-scale demand turn up is well-established, e.g. Economy 7 and 10 hot water and storage heating in the UK and hot water in NZ (the latter run by distribution networks, the former via Retailers). These are fully-automated services and help to manage inflexible nuclear overnight in the UK. Demand turn up services help to manage the "solar trough" and peaks in renewable generation that would otherwise be spilled.

However, fully-automated services require access to communications and as the UK is discovering with the loss of radio-teleswitching, it is critical to ensure that distributed resources have standard communication protocols, particularly as in Australia the demand side is underdeveloped, so appliances are being installed, which may need to communicate in the future. Work is needed on ensuring that appliances (batteries, hot water services, EVs, etc.) have the ability to accept signals to control their energy use or the ability to be easily retro-fitted with controllers.

Aggregation is underdeveloped in Australia and in other locations Aggregators have had to become retailers to access the full value available from demand side opportunities. Most Retailers do not benefit by demand turn down (they make money by selling more electricity, not less), but where Retailers are

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required to be in balance (e.g. UK via the imbalance payments), then using demand response is a key tool in delivering that balance (as well as hedges). It is difficult to see why an Australian Retailer would actively engage in demand side response, other than the new innovative Retailers who are exploiting demand side response to deliver a new product to customers (e.g. Flow).

Aggregators have the option of delivering demand side response to many participants in the electricity system, not just the System Operator. In the UK, Distribution Networks may use an Aggregator to help manage network constraints through demand response and as the AEMC points out, Aggregators tend to be specialists who can help customers, particularly commercial and Industrial customers, manage their demand and energy use to deliver cost savings.

Box 6.4 demonstrating how a Retailer might use demand response is highly complex…

Currently, market arrangements do not facilitate the participation of demand side response and the major participants in the NEM agree that demand side response is a key flexibility tool for delivering a reliable and secure system. Therefore, market arrangements need to change to exploit demand side response services. If Aggregators have to be retailers to extract full value and retailers aren't interested or incentivised to deliver demand side response, then how will it ever happen?

7: Reserves

Rather than the RERT, an intervention by AEMO, or a new outside-market reserve, such as a Strategic Reserve, it would be better to create a new market service, analogous to the UK's Short-Term Operating Reserve, which operates to provide rapid response to balance generation and demand. This is a significant market for demand side services in the UK.

AEMO and the AEMC agree that a specific range of "RERT" products should be developed to ensure the service is better standardised, so if new products are going to be developed to manage short-falls, perhaps a market would help.

8: Day-ahead Markets

The AEMC argues that there is already an ad hoc day-ahead solution and that there is not convincing evidence that a day-ahead market is needed. If there already an ad hoc day-ahead process, then clearly there is a need and it should be properly formalised and the only discussion should be the format of the day-ahead market.

If the US-model, Participant-SO, will improve reliability and support AEMO to deliver reliability at a lower cost, then this should be the preferred option. It also has the benefit of promoting demand side response and other sources of rapidly responding flexibility.

The European-model, participant-participant, is just another risk management contracting arrangement, with all the issues of illiquidity covered in Section 5. It is hard to see how this model would support AEMO to deliver reliability and just adds further opacity to an already opaque market, stymying innovation and new approaches. The Review gives no confidence that the European-model, while easier to deliver (see earlier General Comments on long-term solutions), would deliver fit-for-purpose future market arrangements.