

24/04/2018

Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
Sydney NSW 1235

Lodged online via: www.aemc.gov.au

Dear John,

Draft Report: Frequency control frameworks review

TransGrid welcomes the opportunity to respond to the AEMC's draft report in relation to the its frequency control frameworks review.

TransGrid is the operator and manager of the high voltage transmission network connecting electricity generators, distributors and major end users in New South Wales and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is instrumental to an electricity system that allows for interstate energy trading.

As recognised by the AEMC, Australia is in the midst of an energy transformation. This is primarily driven by changing community expectations and choices, advances in renewable energy technologies, retirement of existing generation, and the adjustments required in Australia's economy to meet our international climate change commitments. These changes raise complex issues in relation to the design of the National Electricity Market (NEM) and have led to a greater focus on ensuring reliability of supply and where that supply comes from.

TransGrid supports the mix of system security services and energy supply that delivers a secure power system at the lowest long term cost for consumers. More specifically, TransGrid believes:

- > The suite of individualised ancillary service markets (including frequency control, system strength and inertia) need to be considered together, in order to understand how they would work simultaneously and across the power system. This ensures outcomes can be co-optimised and unintended consequences, such as where one service reduces security in another, can be avoided. This may include both market and non-market delivery mechanisms as appropriate.
- > Aggregated distributed energy resources (DER) are an emerging technology and its impacts on energy systems are not well understood. As such, TransGrid supports trials to better understand their capabilities. However, to better enable networks and market participants to plan for their usage, all participants along the supply chain should be involved. This includes transmission network service providers (TNSPs).
- > Over the medium term, increasing penetration of DER could have implications for the operation and security of the transmission network, so it is reasonable for TNSPs to have some visibility. As such, when an aggregator of DER reaches an appropriate trigger size, they should be required to undertake a connections process similar to generators. This ensures that their impacts on the power system as a whole can be understood and planned for.
- > Individualised ancillary service markets may give rise to price spikes, where adequate interconnection is unavailable. Interconnectors are a cost-effective approach for integrating and aggregating a large share of variable renewable energy and maintaining energy security.

TransGrid appreciates the opportunity to comment on the AEMC's draft report on the Frequency control frameworks review. We have provided more detailed comments and supporting evidence in the attachment. We look forward to ongoing and meaningful consultation with the AEMC regarding this review.

If you would like to discuss this submission, please contact Caroline Taylor, Manager, Regulation Policy on 02 9284 3715.

Yours faithfully



Anthony Meehan
Executive Manager, Regulation

1. Introduction

TransGrid fully supports efforts to maintain power system security and welcomes the opportunity to respond to the AEMC's Frequency control frameworks review draft report.

TransGrid is the operator and manager of the high voltage transmission network connecting electricity generators, distributors and major end users in New South Wales and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is central to interstate energy trading.

Australia is in the midst of an energy transformation. This is primarily driven by:

- > Changing community expectations and choices.
- > Advances in renewable energy technologies and increased penetration of asynchronous generation.
- > Retirement of existing synchronous generation.
- > Adjustments required in Australia's economy to meet our international climate change commitments.

These changes raise complex issues in relation to the design of the National Electricity Market (NEM), which must adapt and respond to these changes. The framework regulating the NEM must support the planning and operation of power system, and reflect desired policy outcomes – low-emissions, reliable supply of electricity at the lowest cost to consumers over the long run.

As the power system continues to change, new providers of important system security services – such as frequency control ancillary service (FCAS) – will need to be sourced. TransGrid supports reforms that will enable both energy and system security services to be provided to consumers at the lowest possible cost. As new energy technologies emerge and are adopted they may play a growing role in these markets.

While there are likely benefits of increasing utilisation of new technologies, such as distributed energy resources (DER), in ancillary markets, the impacts of changes (both the costs and benefits) needs to be further considered. As such, TransGrid supports trials to better understand their capabilities, and to enable networks and market participants to pre-empt and plan for the benefits and challenges that may arise from their usage.

TransGrid understands that as part of this draft report consultation the Australian Energy Market Commission (AEMC) is seeking views on: the use of primary governor response, the current and future structure of FCAS markets, and the potential use of DER in providing frequency control services.

This submission sets out our views on the issues identified by the AEMC, as well as the recommendations outlined in its draft report. It is structured as follows:

- > Chapter 2 sets out TransGrid's views on the participation of DER in frequency response markets. More specifically:
 - Section 2.1 discusses visibility of DER and aggregator impacts (AEMC's draft recommendation 4).
 - Section 2.2 discusses the technical implications of DER providing FCAS (AEMC's draft recommendations 5 and 7).
 - Section 2.3 discusses DER connection arrangements (AEMC's draft recommendation 6).
- > Chapter 4 sets out TransGrid's views on the future FCAS framework (AEMC's draft recommendation 8).

2. Participation of DER in frequency response markets

2.1 Visibility of DER and aggregator impacts

TransGrid supports the use of DER to assist with the maintenance of system security, such as power system frequency control through changes to either supply or demand within the power system. TransGrid understands that it is likely this would be more effective through the aggregation of DER. However, the operation of aggregated DER at scale may give rise to complications for the power system network, such as stability risks for the power system or adverse interactions with other system security services.

Networks service providers (NSPs) require greater visibility and understanding of aggregate impacts of DER as invaluable inputs to load modelling and network planning. Lack of visibility of aggregated DER gives rise to operational impacts in real time. For example, changes in the behaviour of aggregated DER – such as shifting from providing active power output to demanding power – could cause instability of the power system. Without sufficient knowledge of such changes, Australian Energy Market Operator (AEMO) or network operators will be unable to prepare and respond, resulting in security risks on the whole power system.

TransGrid is also concerned with the potential impacts of an aggregator of DER on system security – in particular if the entities participate in ancillary service markets without any transparent technical characteristics. Under the arrangements outlined in the AEMC's draft recommendation 4, aggregators of DER at scale could produce large changes in the flow of energy across parts of the network within short periods of time – at one-point operating as demand while at another acting as a virtual generator. This could have serious implications for system security such as extreme voltage conditions, particularly where NSPs do not have visibility of the characteristics or operating procedures of the aggregated DER.

TransGrid understands that the current market of aggregated DER is small and its potential impacts on the network in the short term may not be significant. However, TransGrid is concerned that over the medium term an increasing penetration of DER could threaten system security and NSPs' ability to effectively plan the network will be undermined. As such, it is important to build a framework for the treatment of DER and aggregators of DER now to help avoid additional costs and regulatory changes in the future.

TransGrid recommends that aggregators of DER above a certain size threshold should be required to complete a network connections process, similar to that required under the National Electricity Rules for prospective generators and providers of system services seeking to join the network. The existing Rules for generator connections ensure minimum technical characteristics depending on the size and potential impact on the network. Treating aggregators of DER as a virtual generator creates a level playing field for different technology providers and provides accountability for technical requirements, whilst providing networks with the important information they need to plan the network and ensure its ongoing stability.

Under this proposal the requirements for aggregated DER would vary depending on size, consistent with the Rules for generators. This would reduce the regulatory burden for small DER aggregators who do not have a significant impact on the energy flows and stability of the transmission network. Also, only the technical requirements relevant to the services provided by aggregated DER (such as frequency control services) and the impact on the power system would need to be assessed through this process.

Treating aggregators of DER as virtual generators will also ensure that testing of the dynamics of the aggregation at the relevant connection points is undertaken, further guaranteeing that DER participants remain within the technical envelope. This will assist in reducing the need for both distribution and transmission network upgrades, and helps to avoid any upstream costs. Where costs do arise for NSPs in the coordination and aggregation of these services, they should be able to recover the efficient costs (including overheads) that are incurred.

2.2 Technical implications of DER providing FCAS

TransGrid supports the assumptions made by the AEMC regarding the drivers of frequency performance deterioration and the intention to allow the use of DER to assist in reversing this in the future. However, as mentioned in section 2.1, the potential impacts of DER providing FCAS on network security need to be considered further. This includes valuing both the costs and benefits of the proposed arrangement for consumers.

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As such, TransGrid supports the AEMC's draft recommendations 5 and 7, for further technical analysis to be undertaken on the use of DER for FCAS, regarding:

- > Technology types.
- > Metering and verification options.
- > Aggregation of DER and its impact on the local network and power system as a whole.
- > The impact of and to the network system under various network conditions.

However, the size of the trials may not be sufficiently large to demonstrate the potential impact of aggregated DER on the FCAS market and on transmission and distribution networks. Given this, caution should be taken about extrapolating trial outcomes when developing the Rules for DER participation in ancillary service markets.

TransGrid also notes that draft recommendation 7 relates specifically to distribution network service providers. However, trials of aggregated DER may have important implications for the transmission network. As such, TransGrid recommends broadening the scope to also include transmission network service providers (TNSPs). TNSPs' involvement should include both the planning and operation stages of the trial, and notification of start and commissioning dates should be provided. Draft recommendation 7 should also include further investigation into the appropriate technical standards that are appropriate for the controlled aggregated response, such as that arrangement recommended in section 2.1.

2.3 DER connection arrangements

TransGrid strongly believes that DER should be supported by clear and proportionate connection guidelines. Without the appropriate standards and guidelines, operation of the power system may become more costly in the future. This may occur through the need for additional testing against non-AS4777 compliant inverters to ensure they meet performance standards or the need to be upgrade or replace equipment to meet AS4777 standards.

In relation to the AEMC's draft recommendation 6, TransGrid supports Energy Networks Australia's development of DER connection guidelines. TransGrid looks forward to working with Energy Networks Australia to develop the DER connections guidelines and the expected application of AS4777.

3. Future FCAS framework

TransGrid supports the Energy Networks Australia – CSIRO 'Electricity Network Transformation Roadmap' and the emphasis it places on the positive role DER could play in system security, including participation in the FCAS market.¹ Therefore, TransGrid supports the AEMC's draft recommendation 8a – a broader review of the market ancillary service specification (MASS) by AEMO to better enable DER in providing FCAS.

However, as mentioned in section 2.1, the power system operates within a technical envelope. Changes to the operation of individual parts of the power system can have upstream network impacts, which affect the stability of the system as a whole. As a result, the different markets cannot be considered in isolation; the impact on system security will be the result of their interaction at each point in time.

When considering the future of the FCAS markets and changes to the existing frequency control framework, it is important to consider how the suite of individualised markets would work simultaneously and across the power system. Considering one market in isolation, or conducting individual and simultaneous reviews and rule changes, obscures their impact on the power system.

Relying on a suite of individual ancillary service markets (and other delivery frameworks for system security services including system strength) also gives rise to:

¹ CSIRO and Energy Networks Australia 2017, Electricity Network Transformation Roadmap: Final Report.

- > A lack of co-optimisation, where the provision of one service may have an unintended negative impact on another.
- > Reduced efficiency in streamlining services.
- > An increased risk to total system security from operation of disparate markets.
- > Ineffective competition due to a lack of sufficient participants

Issues with frequency control services can arise when FCAS is required to be sourced from within particular regions of the power system. This gives rise to issues and limitations within the current market, including excess price and system instability. When interconnection of the NEM is operating, there is sufficient competition across the NEM. However, when an interconnector is unavailable, the relatively limited number of FCAS providers in parts of the NEM has led to inefficiencies and instances of very high prices.

This issue is evident through episodes of significant price spikes of FCAS in South Australia in late 2015 following upgrades of the Heywood interconnector. The total cost for FCAS in the NEM between 11 October and 10 November 2015 was around \$27 million above the historical average.²

In October 2017, both planned and unplanned network outages in Victoria that affected the Heywood interconnector saw the price of FCAS in South Australia reach around \$10,000 to 11,000/MW. This was well above the spot price for electricity of \$160 to -30/MWh³ over the same period.⁴

The inclusion of DER and other new technologies in FCAS markets will assist in improving market efficiencies via increased competition. However, the impacts are largely unknown and the level of competition that is provided via increased utilisation of DER may not be enough to ensure market outcomes are achieved. As such, further investigation into the costs and benefits of DER participation (including potential costs of network augmentation) needs to be conducted. Given this, TransGrid supports the AEMC's draft recommendation 8b – the development of a work program for substantive changes to FCAS frameworks, which is informed by investigations undertaken by AEMO (including trials) and an assessment into the above.

Greater interconnection across the NEM would also improve liquidity and competition in the FCAS market by removing regional constraints. Expanding the role of transmission networks to be able to provide frequency support and other ancillary support services, for a commensurate return for risk and services provided, would improve liquidity and competition in the provision of these services, delivering lower costs for consumers.

TransGrid encourages the AEMC to seek solutions which are robust in the long term, and which provide system security at the lowest cost to consumers. As such, investigations into the future of the FCAS framework should consider alternative approaches to market solutions alone, as without the appropriate conditions, markets may not provide lowest cost for consumers in the long-run. This includes the provision of other system support services, such as inertia and system strength.

4. Next steps

TransGrid appreciates the opportunity to comment on the draft report of the Frequency control frameworks review. We look forward to ongoing and meaningful consultation with the AEMC on the issues and recommendations made above.

If you would like to discuss this submission, please do not hesitate to contact Caroline Taylor, Manager, Regulation Policy on (02) 9284 3715.

² AEMO, NEM – Market Event Report – High FCAS Prices in South Australia – October and November 2015, December 2015

³ The negative spot prices were driven by large amounts of wind generation in South Australia.

⁴ AER, AER reports on high ancillary services prices in South Australia in October 2017, 12 January 2018.