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27/02/2017

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Dear Hugo,

South Australian Energy Transformation

TransGrid welcomes the opportunity to respond to the Project Specification Consultation Report (PSCR) on the South Australian Energy Transformation. The PSCR articulates well the drivers for the project and the challenges of the evolving power system.

The power system across the NEM, and particularly in South Australia, is experiencing a time of significant change. Now more than ever, it is vital that transmission infrastructure as the backbone of the power system is robust and provides a stable, interconnected platform to facilitate this evolution.

The benefits of interconnection are widely acknowledged. In its National Transmission Network Development Plan (NTNDP) 2016, AEMO highlighted the benefits of a more interconnected NEM. These include generation dispatch efficiencies, reliability benefits, resilience benefits and capital investment efficiencies. In a report for the Australian Energy Council, Acil Allen found that interconnector options between New South Wales and South Australia were the only individual options that would definitely meet the technical criteria to support the South Australian power system.

Interconnection between New South Wales and South Australia has unique technical benefits that make it an ideal solution to the South Australian Energy Transformation.

- The route of a new interconnector from New South Wales to South Australia would open up new corridors for renewable energy precincts, unlocking resources in renewable-rich areas in eastern South Australia and south-western New South Wales.
- An interconnector from New South Wales to South Australia would improve power system security by providing geographical and electrical route diversity. Conversely, additional interconnection to Victoria would exacerbate single points of failure near Tungkillo and Moorabool. A single credible or non-credible event at these points may impact both the Heywood interconnector and a new interconnector simultaneously.

TransGrid has commenced a program of internal and externally-commissioned studies in response to the evolving power system, to understand the best approach to a transition to the power system of the future. Early results from these studies indicate that:

- Increased interconnection between South Australia and states with lower long-run marginal cost (LRMC) generation, such as New South Wales, would decrease electricity prices in the NEM, and particularly in South Australia.
- Interconnection between New South Wales and South Australia would result in greater development of renewable generation in South Australia than comparable options to other states, during the Large-scale Renewable Energy Target (LRET) build period.
- Interconnection between New South Wales and South Australia would achieve higher benefits than comparable options between South Australia and Victoria.

While there has been some conjecture on the cost of interconnection, TransGrid has costed an interconnector from South Australia to New South Wales at between $500 million and $1.3 billion, depending on capacity and route. Modelling has demonstrated that benefits across the NEM will more than outweigh the cost, leaving electricity consumers better off overall. TransGrid is ready to fund investment in an interconnector, should the RIT-T support this investment.

TransGrid could construct an interconnector within 20-24 months from project approvals, depending on capacity. It is expected that project approvals would be able to be expedited given the importance of this project to South Australia's energy security.

Interconnection between New South Wales and South Australia is an ideal solution to the South Australian Energy Transformation

In the PSCR, ElectraNet identified three key factors underpinning the South Australian Energy Transformation:

- Facilitating greater competition between generators in different regions
- Providing appropriate security of electricity supply, including the management of inertia, frequency response and system strength
- Facilitating the transition to lower carbon emissions and the adoption of new technologies

An interconnector from New South Wales to South Australia addresses all of these requirements.

Facilitating greater competition between generators in different regions

An interconnector between New South Wales and South Australia would facilitate greater competition between generators across the NEM. Direct interconnection between New South Wales and South Australia would effectively enable the transfer of low cost renewable energy from South Australia to the eastern States and at other times the transfer of low cost energy from the eastern States to South Australia. This will lead to lower dispatch costs and consequently lower wholesale prices in general, and particularly in South Australia.

Providing appropriate security of supply

Security of supply concerns arise in particular in relation to the response of the South Australian power system during 'separation events', due to credible events during transmission outages or non-credible events during phenomena such as bushfires or storms.

An interconnector to New South Wales would improve security of supply in South Australia by providing an additional path of supply that is geographically and electrically independent of existing interconnection via Heywood and Murraylink. A second AC interconnector will inherently:

- Provide fault level contributions, improving system strength

- Provide effective management of rate of change of frequency (RoCoF) and inertia
- Provide greater sharing of frequency control ancillary services (FCAS) across regions
- Provide an additional and geographically diverse path for system restart in the event of a "system black" in one region

Overall, it would improve the resilience of the power system to disturbances.

Facilitating the transition to lower carbon emissions and the adoption of new technologies

A new interconnection also enables the further development of renewable power sources, both along the path of the interconnector and within South Australia. A route through eastern South Australia and south-west New South Wales would open up a new corridor for connection of renewable energy sources. An AC interconnector would allow cost-effective establishment of one or more intermediate switching stations to which new generation could connect. Weakly connected or currently unconnected areas would then have access to the grid.

TransGrid considers that location of the interconnector terminal north of Adelaide at either Robertstown or Davenport provides superior access for renewables in highly productive renewable energy areas of the state. For example, an interconnector in this region could support large-scale solar farms. This would be expected to further drive down NEM prices as solar outputs are aligned to the daily pattern of demand and would provide time-diverse generation to complement the daily wind generation pattern in South Australia.

Additional transmission development also reduces power losses on the system.

Interconnection between New South Wales and South Australia is feasible and cost-effective

TransGrid has identified a range of feasible interconnection options between South Australia and NSW via the Buronga area. There is scope to undertake works in stages, progressively extending the works into the NSW system to fully develop the interconnection capability.

The main options are shown in Table 1.

Table 1 – Indicative interconnection capability from Buronga area to Robertstown

Option 2 sub-option	Additional import to South Australia	Additional export from South Australia
(a) Single circuit 275kV line from Buronga to Robertstown with minimal supporting works in NSW other than transformation at Buronga	300 MW	310 MW
(b) Double circuit 275kV line from Buronga to Robertstown, a new 275kV Buronga – Darlington Point line (in parallel with the existing 220kV line), transformation at Buronga, a new 330kV single circuit line from Wagga to Darlington Point (operating in parallel with the existing 330kV line)	500 MW	610 MW

Option 2 sub-option	Additional import to South Australia	Additional export from South Australia
(c) Double circuit 330kV line from Darlington Point to Robertstown (no connection or transformation at Buronga), a new single circuit 330kV line from Wagga to Darlington Point (operating in parallel with the existing 330kV line)	830 MW	760 MW

These options would all be designed with some controllability so that it is possible to optimise power flows between the new interconnector and Heywood interconnector. This provides a better outcome than could be achieved in an uncontrolled network where power transfer is determined by system impedances.

TransGrid's studies have shown that sub-options (a) and (b) deliver market benefits that support their development in relatively short timeframes.

Higher capacity options favour greater connection of renewables, both along the path of the interconnector and in existing networks. Sub-option (c) delivers the best potential to form future connection points for renewables along the line route, including in the Murray Basin and surrounding area.

TransGrid has also identified a range of technically feasible interconnection options between the Davenport area of South Australia and the 330kV or 500kV system in the Mt Piper area in central western NSW. These include both AC and DC interconnectors with intermediate switching stations. This route is longer than interconnection via the Buronga area and would require longer build times and additional costs, which are not sufficiently offset by the increase in benefits.

Interconnection between New South Wales and South Australia would improve power system security through route diversity

One specific benefit of all New South Wales interconnection options is that they would be geographically and electrically independent of the existing Heywood interconnector and Murraylink. There are no single points of failure that would affect the NSW interconnection as well as the Heywood and Murraylink interconnectors. The diversity of interconnection paths will markedly improve the security of the South Australian system.

During events on the Heywood interconnector that lead to its interruption, including non-credible double-circuit line outages, supply can be maintained over the NSW interconnector. If a decision is made to cover non-credible outages of the Heywood interconnector, it is expected that a Special Protection Scheme would be required to shed load when South Australia is importing and a generator run-back scheme would be required when South Australia is exporting at a high level. This is also a requirement for most of the other options.

The diversity of interconnection paths and additional network resilience will assist in maintaining the continuity of operation of the low carbon emission generation technologies.

In contrast, further development of the Heywood interconnector or development of an interconnection from the Horsham area to Tungkillo (such as Option 1 in the PSCR) exposes the future power system to single points of failure. A credible event during an existing outage,

or non-credible event during phenomena such as bushfires or storms, could lead to a significant system event around Tungkillo or on the 500kV system around Moorabool significantly affecting security of supply in South Australia. If a new interconnector from Victoria is added, with a capability similar to the existing Heywood interconnection, then there could be of the order of 1300 MW of power transfer through this area. Such power transfers may be of the same order of magnitude as the connected load in South Australia and it is not considered prudent planning to rely on a single avenue of connection.

Market Modelling Approach and Assumptions

TransGrid also welcomes the opportunity to comment on the Market Modelling Approach and Assumptions report. TransGrid supports the proposed approach in general, with some comments in response to specific questions.

What do you think of ElectraNet's proposed phased approach to assessing options? To what extent do you think this approach is appropriate for this situation?

TransGrid considers the approach to carry out a first pass screening of costs and benefits, followed by detailed analysis of a shortlisted set of options and verification of outcomes, to be appropriate.

ElectraNet proposes to consider only the thermal capability of interconnectors in the screening phase, under the assumption that the large majority of the cost of an interconnector option is related to its thermal capability and that other limitations, such as stability, are less costly to solve.

In TransGrid's experience, the assumption is not necessarily correct. The planning of an interconnecting line to deliver a useful power transfer, with the aim of improving competition over very long distances, requires the consideration of losses and stability as well as thermal capability. Optimisation of losses may lead to large conductors with moderate loadings and therefore the interconnector may be optimised with a moderate conductor design temperature. The power transfer limit might then be the system stability or the capability of the network supporting the interconnector. From TransGrid's experience, solutions to stability limitations or constraints in supporting networks have not always been inexpensive or quick to achieve.

Hence, TransGrid considers that all network limitations should be addressed in the screening phase and market modelling process.

With regard to the overview of scenarios in Table 1, TransGrid considers that the last three factors (value of customer reliability, length of supply disruption and SA security obligations) should be treated as sensitivities to all three scenarios rather than a different fixed component of the high, central and low scenarios.

TransGrid agrees that it is sometimes difficult to address an option value benefit, but also notes that such a benefit may be important for an option. The solution to the South Australian issues may involve an option being progressively developed and combined with other developments with different needs and timings. There is also the need to address future capability to connect load and generation, for which AC tends to be more cost-effective than DC.

What do you think about ElectraNet's proposed tools and approaches for estimating market benefits? Are there any other considerations that you think should be included?

TransGrid considers that the development of an interconnector that is geographically and electrically independent of existing interconnectors is essential to the future security of the South Australian system.

Subsequent to the publication of the PSCR, South Australia experienced a further separation event on 1 December 2016. Taking this event into account, South Australia has experienced five separation events in the last six years. TransGrid considers that:

- The avoided cost of these events should be considered in the evaluation of options
- An interconnector from New South Wales to South Australia would provide significantly greater resilience to such events than an interconnector from South Australia to Victoria, and that the difference in frequency and consequence of such events between options should be considered
- In assessing the avoided cost of these events, performance of the power system over recent years (for example, since 2011) is more relevant than performance over the entire history of the NEM because it more meaningfully reflects the current state of the power system that has led to the drivers for the project

To what extent do you agree with the key components identified in ElectraNet's wholesale market modelling approach? Are there other factors you think need to be addressed?

Some of the options for interconnection involve the creation of new "loops", specifically connections between New South Wales and South Australia bypassing Victoria, and between Queensland and South Australia bypassing NSW and Victoria. The use of phase shifting transformers or other power flow control devices in some of the options provides some control over the power sharing between the parallel paths.

The creation of loops differs fundamentally from the existing National Electricity Market Dispatch Engine (NEMDE) model that has to deal only with pairs of areas in series. To fully capture the market benefits the model should not be constrained by the limitations of the existing NEMDE, but should anticipate that this could be changed in future if required by a new network configuration. The solution may not be to simply create new regions or adjust regional boundaries.

In summary, the market modelling must have the capability to accurately represent a loop structure between the NEM regions.

Would you like to provide any other feedback about the Market Modelling Approach and Assumptions Report?

ElectraNet has indicated that analysis on the potential effect of any state based renewable energy targets, such as the Victorian Renewable Energy Target (VRET), would be analysed as part of the phase 2 assessment of options.

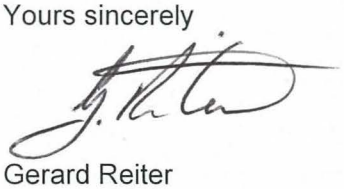
TransGrid considers that assumptions on state based renewable energy targets should be treated cautiously. Policy, including renewable energy policy, can change quickly and there is a high possibility that fixed assumptions may prove incorrect within a short space of time.

With regard to the VRET specifically, TransGrid considers that it has not been demonstrated that transmission network investments wholly within Victoria are the most efficient solution to integrate new generation. Therefore, TransGrid considers that transmission investment

foreshadowed in response to VRET is uncertain and should not be assumed for the purpose of option evaluation.

TransGrid appreciates the opportunity to assist the preparation of a robust RIT-T and looks forward to working further on these options. Please feel free to contact Andrew Kingsmill, Manager/Network Planning, on (02) 9620 0850 for any further assistance.

Yours sincerely



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