7 April 2019

Level 22
530 Collins Street
Melbourne VIC 3000

Postal Address:
GPO Box 2008
Melbourne VIC 3001

T 1300 858724
F 03 9609 8080

Sebastian Roberts
General Manager
Australian Energy Regulator
GPO Box 520
Melbourne VIC 3001

Dear Sebastian,

Re: AER Information Request- SAET RIT-T Dispute

Thank you for your letter dated 1 April 2019, which requested AEMO's guidance on the concerns raised by SACOSS in their dispute to the SAET RIT-T. Information was requested regarding the achievability of a Special Protection Scheme (SPS) to support the modelled combined flows across both Heywood and the proposed new interconnector in the South Australia Energy Transformation RIT-T. Specific feedback was requested on:

1. The feasibility of an SPS as proposed for the new interconnector in ElectraNet's PACR.
2. Design studies undertaken to date in relation to the SPS for the proposed interconnector and/or any completed studies for similar requirements in the NEM or any other jurisdiction.
3. What other measures are likely to be required to manage system security for example limiting transfer capabilities/flows on either the proposed interconnector or Heywood.

As a part of our National Planning function, AEMO has worked closely with ElectraNet through the SAET RIT-T, the 2018 Power System Frequency Risk Review, and the 2018 Integrated System Plan. AEMO is confident that the proposed solution in the SAET is robust and in the long-term interests of consumers.

1. The feasibility of an SPS as proposed for the new interconnector in ElectraNet's PACR

The preferred solution in the RIT-T is a new 330 kV line from Wagga Wagga in New South Wales to Robertstown in South Australia. This line has a notional capability of 800 MW based on continuous thermal ratings. The RIT-T analysis is based on a maximum combined transfer capacity of 1,300 MW into South Australia, and 1,450 MW out of South Australia across the new interconnector and the existing Heywood interconnector. Each interconnector is a double-circuit line whose total loss is considered non-credible.

Experience indicates that the non-credible loss of the Heywood interconnector occurs around once in four years. Despite that, it is considered necessary that the South Australian region remains synchronously connected in the unlikely event where one of the interconnectors is unexpectedly tripped. This would be managed by the implementation of an SPS which would detect the loss of one and quickly trip load or generation (or provide

battery response) in South Australia as necessary to ensure flows on the other remain within its dynamic stability limits.

As with most RIT-T analyses, while a considerable amount of preliminary design work is complete, a final detailed design is not yet available. In line with usual practice, if the new interconnector is approved the detailed design and construction will commence. Ensuring the final product delivers all the required outcomes and maintains security is an important and usual part of that process. At this stage, it is important that the performance of the preferred project can be delivered at close to the projected costs.

Your letter specifically requested advice on the technical requirements, the feasibility of operating timeframes, scheme reliability and the process to develop approve and commission the scheme.

1.1 Technical requirements

The modelling and design of an SPS to support the proposed interconnector was initiated during the early stages of the SAET RIT-T. As an outcome of the 2018 Power System Frequency Risk Review, AEMO recommended the need to upgrade the System Integrity Protection Scheme (SIPS) in South Australia. The design of this SIPS upgrade has considered the ultimate need for an interconnector SPS.

The SPS is being designed such that the loss of one South Australia interconnector will not result in cascade tripping of the parallel interconnector. In accordance with S5.1.8 of the NER, AEMO and ElectraNet are collaborating to ensure that the ultimate design is robust.

The current SPS proposal includes pre-arming load, generation, and battery storage blocks to ensure an optimal response depending on initial system conditions. Studies are also assessing impacts such as voltage deviation, rate of change of frequency, system strength and transient stability.

1.2 Feasibility of operating timeframes

The speed at which an SPS can respond is fundamental to the design process, is affirmed by simulation and will be fully tested as components of the scheme are deployed. Protection equipment and communications systems can be designed to act extremely quickly but the design would balance that with ensuring the accuracy and robustness of the detection and activation processes. Recent international experience suggests that a modern SPS such as this will be able to respond within 100 ms to 200 ms. Experience in Australia and internationally suggests that these times are achievable. The time taken by the SPS to act would be designed to keep the system within its dynamic stability limit for that time.

1.3 Scheme reliability

The reliability of the proposed SPS will be paramount. Because of this, the status of the SPS will be communicated to AEMO and TNSP control rooms. As is the case with traditional protection systems, this SPS will be designed so that no single component failure, communication failure, or outage condition will result in the inability of the system to either operate when it is required, or result in undesirable operation of the scheme. If the SPS is

taken out of service, the interconnector capacity can be constrained. Further, if the SPS were to fail, backup emergency frequency control systems will mitigate a system black event under a range of conditions. The approach being taken to ensure the reliability of this SPS is consistent with other SPSs in the NEM and internationally.

1.4 Process to develop approve and commission

The design of the SPS and the studies to finalise the parameters are well under way. While the design of the SPS is the primary responsibility of ElectraNet, engineers at ElectraNet and AEMO are currently both undertaking detailed EMT studies using PSCAD to ensure a robust solution is provided for this project. When complete, ElectraNet will propose the detailed SPS design and AEMO will approve it.

Following the detailed design, hardware-in-the-loop testing will be used to verify the capability of the real-time embedded systems. ElectraNet is installing this SPS in consultation with AEMO, as required under S5.1.8 of the NER. Further, as a part of the commissioning for the proposed SA to NSW interconnector, AEMO will be required to incrementally release any new transfer capacity into the market under NER 5.7.7. This is an important practice to verify that the system can be operated securely at new levels and will consider operation of the SPS.

2. Design studies undertaken to date

Detailed feasibility studies have demonstrated the capability of an SPS to achieve interconnector transfer levels outlined in the SAET RIT-T. AEMO is currently working with ElectraNet on an upgrade to the South Australia SIPS, which will form the first stage of this SPS.

The proposed interconnector SPS will require very detailed design, which is commonplace internationally, and similar to Australian schemes such as:

- The Interconnector Emergency Control Scheme (IECS) in Victoria
- The Frequency Control System Protection Scheme (FCSPS) in Tasmania
- The Network Control System Protection Scheme (NCSPS) in Tasmania

Importantly we note that while these schemes require careful design, commissioning and management, their cost is immaterial in the total project cost of a major network project.

3. Other measures required to manage system security

AEMO will use reasonable endeavours, as required by the NER, to ensure that power system security is maintained. For the commissioning of any new interconnectors and SPSs, this will include:

- Inter-network testing will be used to incrementally release new interconnector capacity in a safe approach.
- Combined interconnector limits will consider the capability and status of SPSs.

- AEMO will continue to review power system frequency risks (including the need for Protected Events) at least every two years in the PSFRR.
- Outages of control schemes may at times require reducing transfer capability to levels where SPSs are functional.
- Consideration of system strength and inertia requirements relating to functionality of control schemes.

AEMO has reviewed the outcomes of the SAET RIT-T and is working closely with ElectraNet on the design for an interconnector SPS. AEMO is confident that the proposed solution in the SAET and the approach taken to design the SPS is robust and in the long-term interests of consumers. Should you have any questions, please contact Craig Price, Group Manager System Planning on (03) 9609 8590.

Your sincerely,

Dr. Alex Wonhas

Chief System Design and Engineering Officer