Appendix 7B: Network Capability Incentive Parameter Action Plan

2023-27 Transmission Revenue Reset

PUBLIC

Submitted: 29 October 2020

Contents

1 Service Target Performance Incentive Scheme

Under the Network Capability Component (NCC) of the Service Target Performance Incentive Scheme (STPIS), AusNet Services is required to submit a Network Capability Incentive Parameter Action Plan (NCIPAP). The NCIPAP for the current 2017-22 regulatory control period has delivered significant consumer benefits and will continue to do so beyond the end of the current regulatory period.

Version 5 of the STPIS will continue to be applied to AusNet Services during the forthcoming 2023-27 regulatory control period.

Clause 5.2(b) of the STPIS Guidelines sets out that under the NCC, TNSPs must submit a NCIPAP:

1) *identifying for every transmission circuit and injection point on its network, the basis and cause for the limit for each transmission circuit and injection point.*
2) *proposing the priority projects to be undertaken in the regulatory control period to improve the limit of the transmission circuits and injection points listed above through operational and/or minor capital expenditure projects. This proposal must include:*
    - i. *the total operational and capital cost of each priority project*
    - ii. *the proposed value of the priority project improvement target in the limit for each priority project*
    - iii. *the current value of the limit for the transmission circuits and/or injection points which the priority project improvement target is seeking to improve*
    - iv. *the ranking of the priority projects in descending order based on the likely benefit of the priority project to customers or on wholesale market outcomes*
    - v. *for each priority project, how the achievement of the priority project improvement target would result in a material benefit being achieved, including an outline of the key assumptions on which this result is based*
    - vi. *in which the average total expenditure of the priority projects outlined in each regulatory year must not be greater than 1 per cent of the TNSP's average annual maximum allowed revenue proposed in its revenue proposal for the regulatory control period.*

Due to AEMO's role as the transmission network planner in Victoria, the analysis presented in this document has been reviewed by AEMO.

The NCIPAP is structured as follows:

- Section 2 – provides an overview of the assessment of network limits that was undertaken by AusNet Services and AEMO to derive a list of themes for potential priority projects; and
- Section 3 – outlines the areas for potential priority projects, including a description of the project, and the key assumptions underpinning the analysis.

2 Assessment of network limits

As part of the development of the NCIPAP, AusNet Services and AEMO undertook an exercise to identify the reason for the limit for every transmission circuit and injection point on AusNet Services' transmission network.

The results of this analysis were reviewed and updated by AEMO to provide an up-to-date assessment of network limits for the 2023-27 NCIPAP (refer to Attachment 1 – Network Limits). The limits presented are for system normal conditions.

Because the NCC already applies to AusNet Services, many projects that fit the criteria of the NCC already form part of the 2017-22 NCIPAP. However, we will continue to investigate the

capability of the network, should circumstances change during the 2023-27 regulatory control period, as additional projects can be proposed under STPIS Version 5.

We will continue to work with AEMO to assess the limits where there is potential economic merit and determine:

- Whether the limit of the transmission circuit or injection point could be increased through operating or minor capital expenditure (where 'minor' is defined as an estimated capital cost of less than $6 million, or the cost threshold for the regulatory investment test for transmission (RIT-T)); and
- Whether increasing the limit of the transmission circuit or injection point would either:
    - benefit wholesale market outcomes or
    - increase capability of the transmission system at times when network users place greatest value on the transmission system's reliability.

3 Areas for potential priority projects

AusNet Services and AEMO have identified several themes for potential priority projects. These are listed in Table 1 and outlined in detail below. The table below presents the details of each theme requiring further investigation. The timing of these projects is indicative, based on possible efficiencies where other work is planned to take place at a particular terminal station during the period.

Table 1: Priority Project themes summary

Proposed theme	Description
Transmission line upgrades	Minor augmentations primarily include installing wind monitoring and upgrading rating limiting terminal station equipment, to improve the thermal capacity of transmission lines. There are expected to be market benefits driven by new renewable generation connections in Western Victoria, which may exceed the thermal capacity of the existing transmission lines, if identified new connections proceed, and if no network augmentations are carried out.
Special Operation Controls Systems (SOCS)	SOCS to manage generation driven overloads. AEMO does not normally initiate the installation of a SOCS scheme to address generation driven local constraints, as these are typically addressed by local constraint equations. The installation of the SOCS will need to go through the minor augmentation process, including cost-benefit analysis. Support from the relevant generators will be required and some generators may ask for compensation if they think the SOCS will have adverse impact. If AusNet Services SOCS scheme can be economically justifiable, and all affected generators agree to proceed, we may agree to include this project into the 2023-27 NCIPAP.
Voltage Management	Voltage control/switching (including to purchase spare parts, spare units for aged reactive power plant beyond normal asset management practices). This would improve the reliability/availability of reactive plant to manage high voltage during minimum demand period. This could also include accelerated replacement works at KTS to improve overvoltage tolerance, or replacement works on the 500kV line circuit breakers to improve resilience/maintainability against possible future line switching.
Network Information	Additional High Speed Monitors (HSM) at a number of strategic system locations. AEMO operations is currently undertaking a review of their immediate operational requirements.
Innovation / Technology Trial	Potential for pilot project(s) to gain experience and real-world evidence on the capabilities of virtual transmission line (VTL), virtual synchronous machine (VSM), or other grid-forming technology, particularly as new needs can emerge rapidly, and such devices may be capable of providing multiple system benefits (reactive, inertia, time-shifting, system strength). In addition, understanding these new technologies in practice may provide useful information that facilitates the assessment and connection of commercial versions of these projects in future.

The following sections provide further details of each proposed project theme.

3.1.1 Transmission line upgrades

During 2020 VAPR studies, AEMO have identified potential for high overloading on several lines, due to additional new generation connections:

- Ballarat – Terang – Moorabool 220 kV line;
- Horsham – Murra Warra 220 kV line;

- Red Cliffs – Wemen – Kerang – Bendigo 220 kV line; and
- Ballarat – Waubra 220kV line.

Separately,

- the Bendigo – Shepparton – Glenrowan – Dederang 220 kV line has also been identified as potential for economic merit, due to high New South Wales to Victoria imports.

These assets have been identified in the Network Limits spreadsheet as having potential for economic merit as NCIPAP projects. Conceptually, potential priority projects addressing these lines would be the same as those pursued in the current 2017-22 NCIPAP.

In addition to the above transmission line limitations, AEMO identified the following shared network transformer limitation during the 2020 VAPR system studies:

- High overloading of the Moorabool 500/220 kV transformer for a credible contingency (tripping of the other Moorabool 500/220 kV transformer), due to additional new generator connections on the 500 kV lines west of Moorabool Terminal Station (MLTS).

3.1.2 SOCS

Development of a new SOCS on the Horsham – Murra Warra – Kiamal – Redclifs 220 kV line will relieve generation driven constraints by enabling post contingent tripping of generation input rather than pre-contingent constraints being imposed. Benefits of the scheme would include:

- increased capability to operate 220 kV lines at increased rating (from 15 to at least 5 minute); and
- fuel cost savings by avoiding substitution of higher cost generation due to existing line rating limits imposed pre-contingency.

This potential project has a trial/pilot element in that existing SOCS operate through control and tripping of load connected to the network, whereas the proposed scheme is intended to relieve generation driven constraints and therefore will require agreements to trip generation.

AEMO are continuing to conduct studies to ascertain the locations where a new SOCS would provide greatest benefit. At this stage, the location considered most likely by AEMO and AusNet Services is the Horsham to Redcliffs 220 kV lines where an increasing number of generation connections are being made and constraints currently exist, including:

- Red Cliffs – Wemen – Kerang – Bendigo; and
- Ballarat – Waubra – Ararat.

Future projects may emerge as a result of ongoing AEMO studies on transmission circuits and injection points. These have the potential to develop into NCIPAP projects for new SOCS, where this would alleviate the constraint.

3.1.3 Voltage Management

Risks associated with voltage management and control in the transmission network during minimum demand periods are escalating within Victoria due to minimum demand declining more rapidly than previously forecast. Absorbing reactive support assets exist throughout the network to provide high voltage management and control services. The need for these services has increased dramatically in recent years and frequently exceeds the existing reactive support capability. Interim operational measures such as line switching and market intervention are being utilised more frequently, reducing security of the network, and increasing costs to consumers.

A RIT-T completed by AEMO will deliver additional reactive support capability between 2022 and 2025. The lengthy process to justify investment through the RIT-T process combined with long lead times to procure and install reactive support for the transmission network do not align with

the pace of change currently being observed. AEMO has a high expectation that additional absorbing reactive support will be required within the 2023-27 regulatory control period.

Criticality and utilisation of existing reactive plant has increased and is expected to increase further by the 2023-27 regulatory control period, therefore a series of projects that reduce the risks associated with critical reactive support assets and make provision for additional reactive support to be added to the network in shorter timeframes may be proposed as minor augmentation projects under the NCC scheme.

Failure of identified high criticality assets has the potential to significantly reduce the voltage management capability and repair/replacement timeframes could significantly impact network operation. Risks could be reduced by improving the reliability/availability of reactive plant to manage high voltage through the following:

- purchase spare parts, spare units for aged reactive power plant beyond normal asset management practices;
- accelerated replacement works at KTS to improve overvoltage tolerance; and
- replacement works on the 500 kV line circuit breakers to improve resilience/maintainability against possible future line switching

AEMO has suggested a potential NCIPAP project may help reduce risks for high criticality assets that provide voltage control services.

3.1.4 Network Information

AEMO published the Renewable Integration Study: Stage 1 (RIS)[1] in April 2020 finding that the growth in variable renewable generation is increasing the complexity of the system and creating challenges for existing tools and processes used for system security analysis and assessment. Tools and processes used to model the system, assess outages, and measure system performance are becoming increasingly computationally complex and more costly in time and resources.

Action item 2.4 from the RIS is for AEMO to develop a detailed proposal outlining requirements, timing, and method to achieve specified NEM high-speed monitoring (phasor measurement units) to cover more points, allowing better visibility of performance of the system, and help operators to understand the changing power system.

AEMO has commenced development of this plan and identified eleven Victorian locations where HSM are required. Five of these HSM installation will be implemented during the current 2017-22 regulatory control period with the remainder to be implemented during the forthcoming 2023-27 regulatory control period. Provision of real time data will improve the understanding of network capability in real time and allow system operators to operate closer to maximum capability by removing uncertainty that must currently be factored into operational decisions.

3.1.5 Innovation / technology trial

AEMO's RIS describes many emerging challenges for power system operation as the penetration of renewable energy increases over the five-year period leading up to 2025. A range of new technologies are in development that may be capable of providing multiple system benefits including reactive support, inertia, time-shifting, and system strength.

[1] https://aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf?la=en

A minor augmentation project incorporating a battery with grid forming inverter technology is a potential NCIPAP project that would provide the opportunity to test and trial service capability within the transmission system.

4 Attachment 1 – Network limits

In accordance with clause 5.2(b)(1) of the STPIS, the attached spreadsheet entitled “AusNet Services - NCIPAP 2023-27 Network Limits.xlsx” identifies for every transmission circuit and injection point on AusNet Services’ network, the basis and cause for the limit for each transmission circuit and injection point. This attachment is Commercial-In-Confidence.