TransGrid

TransGrid Revenue Proposal
2018/19 – 2022/23

Appendix Y

Network Capability Incentive Parameter Action Plan

1. Introduction

This plan is TransGrid's second Network Capability Incentive Project Action Plan (NCIPAP). It covers the 2018/19 to 2022/23 period.

This plan is required by the network capability component of the electricity transmission Service Target Performance Incentive Scheme Version 5 (STPIS).

1.1 Overview of the Network Capability Parameter

The network capability parameter is set out in Section 5 of the STPIS guideline.[1] The parameter measures the improvements in the capability of transmission assets through operating expenditure and minor capital expenditure on a TNSP's network that results in:

- improved capability of those elements of the transmission system most important to determining spot prices, or
- improved capability of the transmission system at times when Transmission Network Users place greatest value on the reliability of the transmission system.

The parameter has been designed to benefit both consumers and market participants, by creating an incentive for TNSPs to reveal the capability of parts of their existing network and to identify measures that would provide greater value to generators and customers. Generators benefit from increased network capability as they are less likely to be constrained from dispatching generation by network limits, leading to more efficient dispatch. Customers benefit from the resulting lower wholesale costs and efficient improvements in network capability to meet increases in peak demand. In this way, the new component seeks to encourage low cost solutions for limitations on all transmission equipment on the TNSP's transmission network which unnecessarily restricts energy flows.

The parameter has also been designed to encourage innovative projects to improve the capability of the network. The AER's draft decision[2] notes that:

"The rationale for the introduction of the NCC was to incentivise TNSPs to deliver efficient levels of network capability from existing assets when it is most needed……The NCC incentivises TNSPs to reveal the capability of parts of their existing network and to identify low cost measures to improve network capability that would provide greater value to generators and customers. This promotes the achievement of the principles set out in clause 6A.7.4 (b) of the NER and the National Electricity Objective (NEO), and is consistent with the STPIS objectives……."

This plan proposes 20 projects that will improve the capability of the network in terms of both the elements most important to determining spot prices and the times when users place the greatest value on the reliability of the system.

The elements most important to determining spot prices tend to be interconnectors and intra-regional cut sets. Many of the projects in the plan, such as dynamic line ratings, wave trap replacement, and transmission line reactive compensation, have been targeted at these network elements.

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1 AER, *Final Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme Version 5 (corrected)*, October 2015, pp12-19.

2 Explanatory statement section 5.3.1 - AER, Draft Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme, Version 5 June 2015.

2. Approach

This chapter outlines the approach TransGrid has used to identify and rank projects for the plan.

2.1 Requirements of the scheme

The STPIS requires this plan to:

- identify for every transmission circuit or injection point on its network, the reason for the limit for each transmission circuit or injection point.
- propose 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:
  - the total operational and capital cost of each priority project
  - the proposed value of the priority project improvement target in the limit for each priority project
  - the current value of the limit for the transmission circuits and/or injection points which the priority project improvement target is seeking to improve, and
  - the ranking of the priority projects in descending order based on the likely benefit of the priority project on customers or wholesale market outcomes
  - 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
  - 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 proposal for the regulatory control period[3]

The plan describes the proposed projects to be undertaken in the regulatory control period. Identification of the limits of transmission line, connection points and transformers has been provided in the STPIS RIN template.

2.2 Approach to Identifying Projects

TransGrid has systematically reviewed limits, operating conditions and constraints on its network to identify projects for inclusion in this plan. The reviews that have been undertaken to identify projects are:

- Review of the limits for each transmission line, connection point and transformer, including identification of all limiting factors less than the conductor thermal rating
- Identification of single and double contingencies where increased capability would improve wholesale market outcomes or supply to loads
- Studies on interconnectors
- Review of binding transmission constraints to identify capability improvements that would improve wholesale market outcomes
- Discussions with TransGrid's system operators to identify operating conditions where capability improvements could provide benefits

[3] AER, *Final Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme Version 5 (corrected)*, October 2015, pf12.

- Discussions with planning and operations staff at AEMO to identify operating conditions where capability improvements could provide benefits
- Discussions with asset management and design staff at TransGrid to identify innovations that could provide capability improvements

This work has been done in collaboration with AEMO in its role as national transmission planner and market operator.

2.3 Approach to Ranking Projects

The STPIS requires proposed projects to be ranked in descending order based on the likely benefit of the project to consumers or wholesale market outcomes.

TransGrid and AEMO have taken the following approach to categorising and ranking the projects:

- Projects to improve the network capability under system normal or single contingency events have been given priority over other projects, such as those that improve the network capability under multiple contingencies
- Projects with a primary benefit to increase network capability are prioritised over those with other benefits that are higher relative to their network capability benefits

The payback period is used to rank the projects.

Under the STPIS, the power of the incentive for a project depends on whether its priority is in the highest 50 per cent of projects or lowest 50 per cent of projects. Therefore, the exact ranking does not materially affect the power of the incentive under the scheme, provided projects are correctly allocated to the highest or lowest 50 per cent.

2.4 Consultation with AEMO

The STPIS requires TransGrid to consult with AEMO prior to submitting the plan as to:

- whether there is potential for co-ordinated projects with other TNSPs
- whether the proposed priority project improvement targets for its projects will result in a material benefit
- which projects should be classified as priority projects based on their likely benefit to consumers or wholesale market outcomes, and
- the ranking of the priority projects.[4]

TransGrid has worked collaboratively with AEMO in the development of this plan, including consultation on these four factors.

2.5 Relationship with Capital and Operating Expenditure

The cost of the projects proposed in this plan have not been included in capital or operating expenditure in TransGrid's revenue proposal.

[4] AER, *Final Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme Version 5 (corrected)*, October 2015, p13.

3. Action Plan

TransGrid identified 22 projects to improve the capability of the network.

The projects are summarised in Tables 3.1 and 3.2 and detailed in the following sections.

The total value of the 22 projects identified and approved by AEMO is $47.51 million ($2017/18). One per cent of TransGrid's maximum allowed revenue in the revenue proposal for 2018/19 to 2022/23 is $39.7 million ($2017/18). As the total value of the AEMO approved projects is more than one per cent of maximum allowed revenue, TransGrid has excluded 2 projects, as identified in table 3.2, to ensure the action plan is aligned with the AER's guidelines with the total project value being less than 1% of MAR. TransGrid is proposing 20 projects with a total value of $39.0 million. The additional 2 projects remain documented in this plan, for transparency and consistency with the AEMO approval as included in this appendix.

Table 3.1 Proposed Network Capability Incentive Projects

Priority	Project Name
1	Deniliquin full SCADA Augmentation
2	North Western Transfer Tripping Scheme
3	Replace limiting high voltage plant at Wagga 132 kV substation (Line 99X rating augmentation)
4	Over Voltage Control After AUFLS Event
5	Remote or self reset of Bus Protection
6	Two way disconnector to replace line tee connection to Morven substation
7	Finley Full SCADA Augmentation
8	Installation of two way disconnector to replace line 976 tee connection to Murrumbateman substation
9	SMART wires on Upper Tumut-Yass 330 kV line
10	Dynamic Line Rating Monitoring
11	Implementation of transfer tripping Scheme at Cooma
12	Albury Area Under Voltage Load Shedding Scheme
13	Implementation of transfer tripping scheme at Gadara, Tumut and Burrinjuck
14	Taree 132kV Bus Capacity Augmentation
15	Capacitor bank to increase NSW-QLD transfer limit
16	Remote relay interrogation
17	Implement dynamic rating system for Darlington Point 330/220 tie transformers
18	Replace limiting high voltage plant on Mt Piper-Wallerawang 220 kV lines (TL 70 and 71)
20	Armidale capacitor transfer tripping scheme
21	Increase Ratings of Wagga-Lower Tumut 330 kV line (TL 051)

Table 3.2 Additional Projects Approved by AEMO

Priority	Project Name
19	Construction of Two-way Disconnector On Line 94M for Ilford Tee
22	Capacitor bank to improve NSW-VIC transfer limit

3.1 Deniliquin full SCADA Augmentation

Transmission circuit / injection point	*Deniliquin 66 kV system*
Project ranking	*2*
Scope of works	*Full SCADA connectivity of Deniliquin substation 66 kV*
Reasons to undertake the project	*Full SCADA control and monitoring improvements to significantly reduce the restoration time of the Deniliquin 66 kV supplies.*
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Reduction of restoration time to supply Deniliquin 66 kV network following a contingency.*
Completion date	*2018/19*
Capital cost	*$0.65 (m June 18)*
Operating cost	*nil*

3.2 North Western Transfer Tripping Scheme

Transmission circuit / injection point	*Tamworth, Armidale*
Project ranking	*4*
Scope of works	*Development of a transfer tripping scheme that would open the Narrabri-Moree 132 kV line (96M) in protection clearing time following outage of both Armidale-Tamworth 330 kV lines (85 and 86).*
Reasons to undertake the project	*Following an outage of line 85 or 86 (330 kV), to prevent excessive overloading voltage stability issues, the line 96M (132 kV) is opened. This requires reduction of Moree solar farm output to zero.*
Current value of the limit	*0 MVA*
Priority project improvement target	*Commissioning of transfer tripping scheme. Moree solar farm allowed to supply during outage of 85 or 86 line.*
Completion date	*2019/20*
Capital cost	*$0.12 (m June 18)*
Operating cost	*$2,400 (June 18)*

3.3 Replace limiting high voltage plant at Wagga 132 kV substation (Line 99X rating augmentation)

Transmission circuit / injection point	*99X/Wagga 132 kV substation*
Project ranking	*3*
Scope of works	*Replace wave trap on line 99X at Wagga 132 substation*
Reasons to undertake the project	*To increase Wagga 132 substation inter-connection thermal rating (26% rating increase).* *Improve supply reliability in SNSW and VIC-NSW transfers.*
Current value of the limit	*137 MVA (due to wave trap at Wagga 132 on line 99X)*
Priority project improvement target	*184 MVA (due to wave trap at Wagga 132 on line 99W)*
Completion date	*2020/21*
Capital cost	*$0.64 (m June 18)*
Operating cost	*nil*

3.4 Over Voltage Control After AUFLS Event

Transmission circuit / injection point	*On all main grid capacitor locations: Tomago, Newcastle, Vales Point, Beaconsfield, Sydney East, Sydney North, Sydney South, Sydney West, Kemps Creek, Regentville, Vineyard, Armidale, Dapto, Darlington Pt, Lismore, Muswellbrook, Tamworth330, Tuggerah, Wagga 330, Wellington, Yass.*
Project ranking	*1*
Scope of works	*Implementation of over-voltage control schemes to automatically configure all the existing capacitive plants to utilise reduced time-settings when the system frequency is below a certain level.*
Reasons to undertake the project	*To reduce the risk of overvoltage in the event of an under-frequency load shedding (UFLS) event.*
Current value of the limit	*N/A*
Priority project improvement target	*Safe operation of plant and control over voltages following UFLS action.*
Completion date	*20/21*

Capital cost	*$3.83 (m June 18)*
Operating cost	*nil*

3.5 Remote or self reset of Bus Protection

Transmission circuit / injection point	*ANM, Taree, Griffith, Beryl, Deniliquin, Moree, Narrabri, Munyang, Inverell, Yanco, Armidale, Pt Macquarie, Cowra, Forbes, Boambee South, Finley, Orange 132*
Project ranking	*5*
Scope of works	*Provide the Asset Monitoring Centre with high definition CCTV of busbar areas in the switchyard and facility to reset busbar protections via SCADA at selected sites.*
Reasons to undertake the project	*Installation of high definition Closed Circuit Television (CCTV) of busbar areas in the switchyard and facility to reset busbar protections via SCADA at selected sites will significantly reduce restoration time and duration of supply interruptions following a busbar fault.*
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Commissioning of CCTV system demonstrating of clear vision of busbars and change of work practice to allow remote switching of busbars.*
Completion date	*2022/23*
Capital cost	*$3.80 (m June 18)*
Operating cost	*$0.09 (m June 18)*

3.6 Two way disconnector to replace line tee connection to Morven substation

Transmission circuit / injection point	*Line 996 tee supply to Essential Energy's Morven 132/66kV substation*
Project ranking	*6*
Scope of works	*Installing a two way disconnector at line 996 tee connection to Morven substation.*
Reasons to undertake the project	*To reduce the duration of supply interruption to customers following any fault on line 996 which result in*

	the line being tripped.
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Installation of disconnector allowing reduction of restoration time following an outage of line 996.*
Completion date	*2020/21*
Capital cost	*$2.84 (m June 18)*
Operating cost	*$0.06 (m June 18)*

3.7 Finley Full SCADA Augmentation

Transmission circuit / injection point	*Finley 66 kV system*
Project ranking	*8*
Scope of works	*Full SCADA connectivity of Finley132kV substation*
Reasons to undertake the project	*Full SCADA control and monitoring improvements to significantly reduce the restoration time of the Finley 66 kV supplies.*
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Upgrade of SCADA System at Finley 132kV substation allowing control and monitoring of 66kV side of the substation.*
Completion date	*2018/19*
Capital cost	*$0.31 (m June 18)*
Operating cost	*Nil*

3.8 Installation of two way disconnector to replace line 976 tee connection to Murrumbateman substation

Transmission circuit / injection point	*Essential Energy Murrumbateman substation*
Project ranking	*9*
Scope of works	*Installation of a two way disconnector at line 976 tee connection to Murrumbateman substation*
Reasons to undertake the project	*Reduce duration of supply interruption to customers following any fault on line 976 which result in the line being tripped.*

Current value of the limit	*0 MVA (supply is limited to 0 MVA – interrupted if 967 is out of service)*
Priority project improvement target	*[the target value of the limits following the implementation of the priority project]*
Completion date	*2020/21*
Capital cost	*$2.70 (m June 18)*
Operating cost	*$0.05 (m June 18)*

3.9 SMART wires on Upper Tumut-Yass 330 kV line

Transmission circuit / injection point	*Upper Tumut-Yass 330 kV line 2*
Project ranking	*10*
Scope of works	*Installation of SMART wires to reduce reactance of Upper Tumut-Yass 330 kV line.*
Reasons to undertake the project	*To increase transfer capability of Upper Tumut-Yass 330 kV line.* *This project increases VIC-NSW transfer capability*
Current value of the limit	Snowy – NSW cut-set capacity = 2709 MW
Priority project improvement target	Increase the Snowy – NSW cut-set capacity by 26 MW to 2735 MW
Completion date	*2020/21*
Capital cost	*$5.60 (m June 18)*
Operating cost	*$0.11 (m June 18)*

3.10 Dynamic Line Rating Monitoring

Transmission circuit / injection point	*X5/1 Balranald – Darlington Point* *X5/3 Balranald – Buronga* *X2 Buronga – Broken Hill* *63 Wagga – Darlington Point* *99K Darlington Point – Griffith* *99D Darlington Point – Yanco* *99T Darlington Point – Coleambally* *99J Griffith – Yanco* *94K Parkes – Wellington* *94U Parkes – Forbes* *94H Parkes – Manildra* *72 Mt Piper – Wellington* *79 Wollar – Wellington* *945 Wellington – Molong*

	94B Wellington – Beryl *947 Wellington – Orange North* *9U4 Inverell – Glen Innes*
Project ranking	*11*
Scope of works	*Install Dynamic Line Ratings system*
Reasons to undertake the project	*To increase thermal capacity of selected transmission lines (4 to 20% rating increase)* *Reduce load shedding to manage overloads*
Current value of the limit	*Various*
Priority project improvement target	*4 to 20% increase from normal circuit rating during favourable weather conditions.*
Completion date	*2021/22*
Capital cost	*$5.16 (m June 18)*
Operating cost	*$0.10 (m June 18)*

3.11 Implementation of transfer tripping Scheme at Cooma

Transmission circuit / injection point	*Cooma substation 132/66 kV*
Project ranking	*12*
Scope of works	*Implement a control system to trip Boco Rock windfarm, following a coincident outage both Williamsdale-Cooma 132 kV circuits (978 & 97D).*
Reasons to undertake the project	*To allow Boco Rock wind generator (113 MW) in service following an outage of line 978 or 97D. Without the proposed tripping scheme, output of these generator would be constraint to zero.* *Proposed tripping scheme would allow to operate Boco Rock wind generator at full output following a planned or unplanned outage of 978 or 97D 132 kV circuit.*
Current value of the limit	*0 MW*
Priority project improvement target	*Boco Rock wind generator allowed to operate at full output following a planned or unplanned outage of 978 or 97D 132 kV circuit.*
Completion date	*2021/22*
Capital cost	*$0.13 (m June 18)*

Operating cost	*Nil*

3.12 Albury Area Under Voltage Load Shedding Scheme

Transmission circuit / injection point	*Albury Area*
Project ranking	*13*
Scope of works	*Installation of under-voltage load shedding (UVLS) at Albury and ANM would enable the underlying 132kV system to remain closed during outage of a Jindera 330/132 kV transformer or Jindera-ANM 132 kV line or Jindera-Albury 132 kV line.*
Reasons to undertake the project	*To reduce amount of load at risk during outages of Jindera transformers and line 99B or 99H or 99Z or 996.*
Current value of the limit	*N/A*
Priority project improvement target	*Installation of UVLS allowing 132kV system to remain closed during outage of a Jindera 330/132 kV transformer or Jindera-ANM 132 kV line or Jindera-Albury 132 kV line.*
Completion date	*2018/19*
Capital cost	*$0.21 (m June 18)*
Operating cost	*$4,600 (June 18)*

3.13 Implementation of transfer tripping scheme at Gadara, Tumut and Burrinjuck

Transmission circuit / injection point	*Burrinjuck 132 kV, Blowering 132 kV and Gadara 132 kV*
Project ranking	*15*
Scope of works	*Implement a control system to trip Gadara-Tumut (99P), Tumut-Burrinjuck (992) and Tumut-Blowering(97B) 132 kV circuits following coincident outage of Yass-Burrinjuck (970) & Wagga-Gadara (993), Burrinjuck-Tumut (992) & 993, 970 & Gadara-Tumut (99P) or 992 & 99P 132 kV circuits.*
Reasons to undertake the project	*Generators at Burrinjuck, Blowering and Gadara are limited following a single outage of line 970, 992, 993 or 99P. Without the proposed tripping scheme, output of these*

	generators are constrained to zero. *Proposed tripping scheme would allow generators at Burrinjuck, Blowering and Gadara to operate at full output following a planned or unplanned outage of a single 132 kV circuit.*
Current value of the limit	*0 MVA*
Priority project improvement target	*Installation of tripping scheme would allowing generators at Burrinjuck, Blowering and Gadara to operate at full output following a planned or unplanned outage of a single 132 kV circuit.*
Completion date	*2018/19*
Capital cost	*$0.36 (m June 18)*
Operating cost	*Nil*

3.14 Taree 132kV Bus Capacity Augmentation

Transmission circuit / injection point	*Taree 132 kV*
Project ranking	*14*
Scope of works	*New CB bay including a set of CTs to establish two bus bar protection zones*
Reasons to undertake the project	*A trip of any busbar section would trip both busbars A and B, resulting into total supply interruption. It would take at least two hours for a TransGrid site person to attend Taree substation to arrange isolation and switching required for restoring the load.*
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Establishment of two bus bar protection zones at Taree 132kV substation.*
Completion date	*2020/21*
Capital cost	*$0.97 (m June 18)*
Operating cost	*$0.02 (m June 18)*

3.15 Capacitor bank to increase NSW-QLD transfer limit

Transmission circuit / injection point	*Queensland-New South Wales (QNI) interconnector*
Project ranking	*16*
Scope of works	*Installation of a 330 kV, 120 MVAr shunt capacitor bank at Armidale substation*
Reasons to undertake the project	*Increase voltage stability limits on QNI interconnector.*
Current value of the limit	*Various constraint equations in AEMO's NEMDE*
Priority project improvement target	*Installation of capacitor and update of constrain equations in AEMO's NEMDE*
Completion date	*2021/22*
Capital cost	*$4.69 (m June 18)*
Operating cost	*$0.09 (m June 18)*

3.16 Remote relay interrogation

Transmission circuit / injection point	*Various TransGrid substations - 73 sites*
Project ranking	*17*
Scope of works	*Installation of fault data interrogation system (FDIS) software at 73 TransGrid sites*
Reasons to undertake the project	*Installing the FDIS software at all TransGrid sites would enabling faster diagnostics and improving* accuracy of voltage and transient stability constraints, potentially improve inter-regional transfer limits.
Current value of the limit	*Protection relay fault information is presently stored at site, requiring a site visit to interrogate. Cost = $0.41m per annum*
Priority project improvement target	*Remove the costs of data collection, enabling improved accuracy of voltage and transient stability constraints and potentially improve inter-regional transfer limits, potentially realising market benefits of greater than $0.41m per annum.*
Completion date	*2020/21*

Capital cost	*$1.94 (m June 18)*
Operating cost	*$0.04 (m June 18)*

3.17 Implement dynamic rating system for Darlington Point 330/220 tie transformers

Transmission circuit / injection point	*Darlington Point 330/220 kV*
Project ranking	*18*
Scope of works	*Develop & implement dynamic rating system for Darlington Point 330/220 kV transformers*
Reasons to undertake the project	*To increases thermal rating of Darlington Point 330/220 kV transformers (1% rating increase). Reduces potential constraints on VIC-NSW interconnector flows and renewable generation*
Current value of the limit	*200 MVA Normal Rating*
Priority project improvement target	*202 MVA during favourable conditions*
Completion date	*2019/20*
Capital cost	*$0.6 (m June 18)*
Operating cost	*Nil*

3.18 Replace limiting high voltage plant on Mt Piper-Wallerawang 220 kV lines (TL 70 and 71)

Transmission circuit / injection point	*Mt Piper-Wallerawang 330 kV lines (70 & 71)*
Project ranking	*19*
Scope of works	*Replace limiting HV plant and upgrade secondary plant limitations on Mt Piper-Wallerawang 330 kV lines at Mt Piper and Wallerawang substations.*
Reasons to undertake the project	*To improve Mt Piper-Wallerawang 330 kV summer 15 minute thermal rating from 1428 MVA to 1700 MVA (19% rating increase). Allows increased renewable generation to NSW load centre.*
Current value of the limit	*1428 MVA*
Priority project improvement target	*1300 MVA*
Completion date	*2021/22*

Capital cost	*$3.33 (m June 18)*
Operating cost	*$0.07 (m June 18)*

3.19 Construction of Two-way Disconnector On Line 94M for Ilford Tee

Transmission circuit / injection point	*Essential Energy Ilford substation*
Project ranking	*20*
Scope of works	*Installation of a two way disconnector at line 94M tee connection*
Reasons to undertake the project	*To reduce the duration of supply interruption to customers following any fault on line 94M which result in the line being tripped.*
Current value of the limit	*0 MVA (supply is limited to zero until switching allows it to be restored)*
Priority project improvement target	*Installation of disconnector on 94M*
Completion date	*2020/21*
Capital cost	*$2.80 (m June 18)*
Operating cost	*$0.06 (m June 18)*

3.20 Armidale capacitor transfer tripping scheme

Transmission circuit / injection point	*Armidale 132 kV substation*
Project ranking	*21*
Scope of works	*Implementation of transfer tripping scheme for the Armidale 132 kV capacitor bank*
Reasons to undertake the project	*To allow the 132 kV capacitor bank at Armidale to remain in service following an outage of a Armidale 330/132 kV transformer.* *This project improves QNI transfer capability*
Current value of the limit	*Market impact due to additional QNI constraints as a result of unavailability of Armidale capacitors during Armidale transformer outages. Market impact = $0.03 million/year*
Priority project improvement target	*Remove market impact to realised a Market benefit = $0.03 million/year (based on the historical binding constraints information).*

Completion date	*2022/23*
Capital cost	*$0.20 (m June 18)*
Operating cost	*Nil*

3.21 Increase Ratings of Wagga-Lower Tumut 330 kV line (TL 051)

Transmission circuit / injection point	*O51 Wagga-Lower Tumut 330 kV line*
Project ranking	*7*
Scope of works	*Replace wave traps at LTSS and increase CT ratio at Wagga SS.*
Reasons to undertake the project	*To increase Wagga-LTSS 330 kV line thermal rating (20% rating increase).* *Reduce network constraints and market costs*
Current value of the limit	Line wave trap limit to 1143 MVA (2000 amps)
Priority project improvement target	Replaced line wave trap improves the limit to 1371 MVA (2400 amps)
Completion date	*2020/21*
Capital cost	*$0.30 (m June 18)*
Operating cost	*Nil*

3.22 Capacitor bank to improve NSW-VIC transfer limit

Transmission circuit / injection point	*Victoria-New South Wales interconnector*
Project ranking	*22*
Scope of works	*Installation of a 330 kV 100 MVAr shunt capacitor bank at Stockdill substation.*
Reasons to undertake the project	*Relieve voltage stability limits that cause constraints on NSW export to Victoria* *Project increases NSW to VIC transfer capability*
Current value of the limit	*Voltage stability limits that cause constraints on NSW export to Victoria.Market impact = $0.79 million /year*
Priority project improvement target	*Remove voltage stability limits realising Market benefit = $0.79 million/year (based on 100 MVAr*

	capacitor).
Completion date	*2021/22*
Capital cost	*$5.51 (m June 18)*
Operating cost	*$0.11 (m June 18)*

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

21 December 2016

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Dear Nalin,

AEMO review of TransGrid's Network Capability Incentive Parameter Action Plan (NCIPAP) for 1 July 2018 to 30 June 2023

I am writing to you regarding AEMO's review of proposed projects under TransGrid's NCIPAP for the regulatory period 1 July 2018 to 30 June 2023. This review was required under clause 5.2 of the Service Target Performance Incentive Scheme (STPIS) Guidelines.

For the next regulatory period TransGrid has proposed 22 NCIPAP projects with an estimated total capital cost of $47 million, as summarised in Attachment 1.

In reviewing TransGrid's proposed submission, AEMO agrees with the assessment of project need, improvement targets, likely material benefits, and ranking of proposed projects. AEMO's assessment on how each of the projects results in material benefit is also included in Attachment 1 for your consideration.

If you have any questions or would like to seek any clarification please contact me on (03) 9609 8312.

Yours sincerely

Christian Schaefer
A/Group Manager Forecasting and Planning

cc: Mr Chris Pattas, General Manager Networks (Investment and Pricing), AER

Attachments:

(1) TransGrid's NCIPAP proposal for the regulatory period 1 July 2018 – 30 June 2023 - AEMO Review.

Attachment 1

TransGrid's NCIPAP proposal for the regulatory period 1 July 2018 - 30 June 2023 - AEMO Review

											AEMO Review		
TransGrid project ID	TransGrid Project Ranking	Project name	Transmission circuit/Injection point	Scope of works	Project reason	Completion date	Capital cost estimate ($M)	Operating cost estimate ($M)	Market benefit per annum ($M)	Pay back period (years)	AEMO's Ranking of projects	Review of material benefit	Benefit category
1499	1	Deniliquin full SCADA Augmentation	Deniliquin substation 66 kV	Full SCADA connectivity of Deniliquin substation 66 kV	Full SCADA capacity at Deniliquin 66 kV substation to provide full operating and monitoring facilities. Proposed project is to reduce the restoration time of the Deniliquin 66 kV supplies following an outage 66 kV feeder or terminal equipment.	During 2018-2023	0.65	0.000	0.59	1.10	1	TransGrid targets to reduce supply restoration time at Deniliquin 66 kV substation from 3 hours to 0.5 hours, after an outage of 66 kV feeders or terminal equipment at Deniliquin 66 kV substation. Market benefits based on reduction in expected unserved energy (USE) due to reduced restoration time after an outage.	Reduce restoration time
1477	2	North Western Transfer Tripping Scheme	Tamworth-Armidale 132 kV network	The North Western transfer tripping scheme would open the Narrabri-Moree 132 kV line (96M) in protection clearing time following outage of both Armidale-Tamworth 330 kV lines (85 and 86).	One of a 132 kV circuit between Tamworth and Armidale need to be opened following an outage of line 85 or 86 to avoid potential thermal overloading and voltage stability issues. The proposed tripping scheme is to avoid switch off a 132 kV line between Tamworth and Armidale following the first outage of Tamworth-Armidale 330 kV line (line 85 or 86). Instead, it will trip 132 kV line 96M following a second outage (line 86 or 85). This will enable Moree solar farm at full output following an outage of 330 kV line 85 or 86.	During 2018-2023	0.12	0.002	0.09	1.37	2	Proposed tripping scheme is to allow Moree solar farm to generate at full output following an outage of a Armidale-Tamworth 330 kV line (Line 85 or 86). Market benefits based on improved access to low cost solar power generation after an outage.	Improve transfer capability
1426	3	Replace limiting high voltage plant at Wagga 132 kV substation (Line 99X rating augmentation)	Wagga substation 132 kV	Replace wave trap on line 99X between Wagga 330/132 kV and Wagga 132 substation	To increase thermal rating of 132 kV line (line 99X) between Wagga 330/132 kV and Wagga 132 substation (34% rating increase). Improve supply reliability in Southern NSW and VIC-NSW transfers.	During 2018-2023	0.64	0.000	0.37	1.75	3	Proposed augmentation is to improve thermal rating of 132 kV line between Wagga 330/132 kV and Wagga 132 kV substation (line 99X). Market benefits based on reduction in expected USE and, improved access to low cost generation.	Improve transfer capability

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1520	4	Over Voltage Control After AUFLS Event	On all main grid capacitor locations: Tomago, Newcastle, Vales Point, Beaconsfield, Sydney East, Sydney North, Sydney South, Sydney West, Kemps Creek, Regentville, Vineyard, Armidale, Dapto, Darlington Pt, Lismore, Muswellbrook, Tamworth330, Tuggerah, Wagga 330, Wellington, Yass.	Implementation of over-voltage control schemes to automatically configure all the existing capacitive plants to utilise reduced time-settings when the system frequency is below a certain level.	To reduce the risk of overvoltage in the event of an under-frequency load shedding (UFLS) event. High overvoltage conditions could lead to flash overs, resulting in miss-operation of protection leading to additional load shed, generator tripping and safety risks to personal in the switchyard.	During 2018-2023	3.83	0.000	1.84	2.08	4	Proposed overvoltage control scheme is to avoid possible flashovers and miss-operation of protection system, following an UFLS event. Market benefits based on reduced expected USE after an UFLS event.	Safe operation of assets
1422	5	Remote or self reset of Bus Protection	ANM, Taree, Griffith, Beryl, Deniliquin, Moree, Narrabri, Munyang, Inverell, Griffith, Yanco, Armidale, Pt Macquarie, Cowra, Forbes, Boambee South, Moree, Finley, Orange.	Provide the Asset Monitoring Centre with high definition CCTV of busbar areas in the switchyard and facility to reset busbar protections via SCADA at selected sites.	Installation of high definition Closed Circuit Television (CCTV) of busbar areas in the switchyard and facility to reset busbar protections via SCADA at selected sites to reduce restoration time and duration of supply interruptions following a busbar fault.	During 2018-2023	3.80	0.076	1.90	2.08	5	TransGrid targets to reduce supply restoration time by half of the original restoration time at selected sites. Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time
1626	6	Two way disconnector on Wagga-ANM 132 kV line (line 996) to the tee connection to Morven substation	Wagga-ANM 132 kV line (996) and a tee connection on line 996 to Morven 132/66kV substation	Installing a two way disconnector on line 996 tee connection to Morven substation.	Reduce duration of supply interruption to customers following any fault on line 996 which result in the line being tripped. Two way disconnector will allow to disconnect faulty section of line and restore supply via unfaulty section of line.	During 2018-2023	2.84	0.057	1.36	2.18	6	TransGrid targets to reduce supply restoration time to Morven substation from 24 hours to 0.5 hours, following an outage of Wagga-ANM 132 kV line (Line 996). Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time
1463	7	Finley Full SCADA Augmentation	Finley 66 kV system	Full SCADA connectivity of Finley substation 66 kV	Full SCADA control and monitoring improvements to reduce the restoration time of the Finley 66 kV supplies.	During 2018-2023	0.31	0.000	0.10	3.10	7	Proposed SCADA augmentation is to reduce restoration time of supply to Finley 66 kV network following a contingency. Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time

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1627	8	Two way disconnector on Yass-Canberra 132 kV line (line 976) to the tee connection to Murrumbateman substation	Yass-Canberra 132 kV line (976) and a tee connection on line 976 to Murrumbateman 132/66kV substation	Installing a two way disconnector on line 976 tee connection to Murrumbateman substation.	Reduce duration of supply interruption to customers following a fault on line 976 which result loss of supply to Murrumbateman. Two way disconnector will allow to disconnect faulty section of line and restore supply via unfaulty section of line.	During 2018-2023	2.72	0.054	0.88	3.29	8	TransGrid targets to reduce supply restoration time to Murrumbateman substation from 24 hours to 0.5 hours, following an outage of Yass-Canberra 132 kV line (Line 976). Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time
1713	9	SMART wires on Upper Tumut-Yass 330 kV line	Upper Tumut-Yass 330 kV line	Installation of SMART wires to reduce reactance of Upper Tumut-Yass 330 kV line.	To increase transfer capability of Upper Tumut-Yass 330 kV line. This project increases VIC-NSW transfer capability	During 2018-2023	5.60	0.110	1.79	3.33	9	Proposed SMART wires is to increase transfer capability of Upper Tumut-Yass 330 kV line. This is an exploratory type of project. Increase in rating and its application in real-time operation yet to be proved. Market benefits based on reduction in expected USE and, improved access to low cost generation.	Improve transfer capability
1579	10	Dynamic Line Rating Monitoring	X5/1 Balranald – Darlington Point X5/3 Balranald – Buronga X2 Buronga – Broken Hill 63 Wagga – Darlington Point 99K Darlington Point – Griffith 99D Darlington Point – Yanco 99T Darlington Point – Coleambally 99J Griffith – Yanco 94K Parkes – Wellington 94U Parkes – Forbes 94H Parkes – Manildra 72 Mt Piper – Wellington 79 Wollar – Wellington 945 Wellington – Molong 94B Wellington – Beryl 947 Wellington – Orange North 9U4 Inverell – Glen Innes	Install Dynamic Line Ratings system	To increase thermal capacity of selected transmission lines (4 to 20% rating increase) De-rating lines are possible in order to protect the assets and the system during unfavourable climate conditions.	During 2018-2023	5.16	0.103	1.62	3.40	10	Proposed dynamic line rating monitoring scheme is to improve rating of transmission circuits under favourable climate conditions. Also the same scheme could de-rate the lines during unfavourable climate conditions to protect assets. Market benefits based on improved access to low cost generation.	Improve transfer capability

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1459	11	Transfer tripping Scheme at Cooma	Cooma substation 132/66 kV	Implement a control system to trip Boco Rock windfarm, following a coincident outage both Williamsdale-Cooma 132 kV circuits (978 & 97D).	During an outage of line 978 or 97D, the Boco Rock wind farm constrained to zero MW to avoid potential islanding. The proposed tripping scheme is to allow Boco Rock wind generator (113 MW) in service following an outage of line 978 or 97D.	During 2018-2023	0.13	0.000	0.04	3.61	11	Proposed tripping scheme is to allow up to 100% generation output from Boco Rock wind farm, following an outage of 132 kV line 978 or 97D. Market benefits based on improved access to low cost wind generation after an outage.	Improve transfer capability
1535	12	Albury Area Under Voltage Load Shedding Scheme	Albury Area	Installation of under-voltage load shedding (UVLS) scheme at Albury and ANM. This is to enable the underlying 132 kV system to remain closed during outage of a Jindera 330/132 kV transformer or Jindera-ANM 132 kV line (99H) or Jindera-Albury 132 kV line (99B) or ANM-Albury 132 kV line (99Z) or Wagga-ANM 132 kV line (996).	To reduce amount of load at risk during outages of Jindera transformers or line 99B or 99H or 99Z or 996.	During 2018-2023	0.21	0.004	0.06	3.76	12	Proposed UVLS scheme is to reduce load at risk at ANM and Albury following a single outage. Market benefits based on reduction in expected USE after an outage.	Improve transfer capability
1401	13	Transfer tripping scheme at Gadara, Tumut and Burrinjuck	Burrinjuck 132 kV, Blowering 132 kV and Gadara 132 kV	Implement a control system to trip Gadara-Tumut (99P), Tumut-Burrinjuck (992) and Tumut-Blowering(97B) 132 kV circuits following coincident outage of Yass-Burrinjuck (970) & Wagga-Gadara (993), Burrinjuck-Tumut (992) & 993, 970 & Gadara-Tumut (99P) or 992 & 99P 132 kV circuits.	During an outage of 132 kV line 970 or 993 or 992 or 99P, generators at Burrinjuck, Blowering and Gadara constrained to zero MW output. Proposed tripping scheme is to unconstraint output from these generators, following an outage of single 132 kV circuit.	During 2018-2023	0.36	0.007	0.10	3.80	13	Proposed control scheme is to allow up to 100% generation output from Blowering and Burrinjuck hydro generators, following a single outage. Market benefits based on improved access to low cost hydro generation after an outage.	Improve transfer capability

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1414	14	Taree 132kV Bus Capacity Augmentation	Taree 132 kV	New CB bay including a set of CTs to establish two bus bar protection zones	A trip of a busbar section would trip both busbars A and B, resulting into total supply interruption. TransGrid requires at least two hours for a person to attend Taree substation to arrange necessary isolation and switching for restoring the load.	During 2018-2023	0.97	0.019	0.27	3.88	14	Proposed project is reduce the restoration time from 2 hours to zero at Taree 132 kV substation. Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time
1701	15	Capacitor bank to increase NSW-QLD transfer limit	Queensland-New South Wales (QNI) interconnector	Installation of a 330 kV, 120 MVAr shunt capacitor bank at Armidale substation	Increase voltage stability limits on QNI interconnector, during export from NSW to QLD.	During 2018-2023	4.69	0.094	1.26	4.02	15	Proposed capacitor bank is to increase QNI (NSW to QLD) transfer limit. Market benefits based on improved access to low cost generation.	Improve transfer capability
1402	16	Remote relay interrogation	Trans Grid substation - 73 sites	Installation of fault data interrogation system (FDIS) software at 73 TransGrid sites	Installing the FDIS software all TransGrid sites is to reduce operational costs.	During 2018-2023	1.94	0.040	0.41	5.25	16	Proposed remote relay interrogation project allows TransGrid to reduce operational cost. Market benefits based on reduced operational cost.	Reduce operational cost
1392	17	Dynamic rating system for Darlington Point 330/220 tie transformers	Darlington Point 330/220 kV	Develop & implement dynamic rating system for Darlington Point 330/220 kV transformers	To increases thermal rating of Darlington Point 330/220 kV transformers (50% rating increase).	During 2018-2023	0.60	0.000	0.11	5.71	17	Proposed dynamic rating system is to improve rating of Darlington Point 330/220 kV transformers. Market benefits based on improved access to low cost generation.	Improve transfer capability
1703	18	Replace limiting high voltage plant on Mt Piper-Wallerawang 220 kV lines (TL 70 and 71)	Mt Piper-Wallerawang 330 kV lines	Replace limiting high voltage plant and upgrade secondary plant on Mt Piper-Wallerawang 330 kV lines at Mt Piper and Wallerawang substations.	To improve Mt Piper-Wallerawang 330 kV summer 15 minute thermal rating from 1428 MVA to 1700 MVA (19% rating increase).	During 2018-2023	3.33	0.067	0.60	6.30	18	Proposed replacement of high voltage plant and secondary systems is to improve rating of Mt Piper-Wallerawang 330 kV lines. Market benefits based on improved access to low cost generation.	Improve transfer capability
1632	19	Two way disconnector on Beryl-Mt Piper 132 kV line (line 94M) to the tee connection to Ilford substation	Beryl-Mt Piper 132 kV line (94M) and a tee connection on line 94M to Ilford substation	Installing a two way disconnector on line 94M tee connection to Ilford substation.	Reduce duration of supply interruption to customers following a trip of line 94M which result in the loss of supply to Ilford substation. Two way disconnector is to disconnect faulty section of line 94 M and restore supply via unfaulty section of line.	During 2018-2023	2.81	0.056	0.49	6.45	19	TransGrid targets to reduce supply restoration time to Ilford substation from 24 hours to 0.5 hours, following an outage of Beryl-Mt Piper 132 kV line (Line 94M). Market benefits based on reduction in expected USE due to reduced restoration time after an outage.	Reduce restoration time

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1557	20	Armidale capacitor transfer tripping scheme	Armidale 132 kV substation	Implementation of transfer tripping scheme for the Armidale 132 kV capacitor bank	This project is to improve QNI transfer capability during an outage of a Armidale 330/132 kV transformer. Proposed tripping scheme allows to keep 132 kV capacitor bank at Armidale substation in service and, to trip following a second outage.	During 2018-2023	0.20	0.000	0.03	6.67	20	Proposed transfer tripping scheme is to increase QNI transfer capability during an outage of a 330/132 kV transformer at Armidale substation. Market benefits based on improved access to low cost generation.	Improve transfer capability
1540	21	Increase Ratings of Wagga-Lower Tumut 330 kV line (TL 051)	Wagga-Lower Tumut 330 kV line	Replace wave traps at LTSS and increase CT ratio at Wagga SS.	To increase Wagga-LTSS 330 kV line thermal rating (20% rating increase).	During 2018-2023	0.30	0.000	0.04	7.32	21	Proposed augmentation is to improve rating of Wagga-Lower Tumut 330 kV line. Market benefits based on improved access to low cost generation.	Improve transfer capability
1699	22	Capacitor bank to improve NSW-VIC transfer limit	Victoria-New South Wales interconnector	Installation of a 330 kV 100 MVAr shunt capacitor bank at Stockdill substation.	Relieve voltage stability limits that cause constraints on export from NSW to Victoria.	During 2018-2023	5.51	0.110	0.79	8.10	22	Proposed capacitor bank is to increase NSW to VIC transfer capability limit during high demand periods in southern NSW. Market benefits based on improved access to low cost generation.	Improve transfer capability
Total cost							**46.71**	**0.80**					