

Revised Appendix 6B:

**Network Capability
Incentive Parameter
Action Plan (NCIPAP)
2014-17**

Network Capability Incentive Parameter Action Plan (2014-17)

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1 Introduction and Background

1.1 Introduction

This document is an updated version of SP AusNet's Network Capability Incentive Parameter Action Plan (NCIPAP). This NCIPAP incorporates the following additional information received from AEMO since SP AusNet's original NCIPAP was submitted in February 2013:

- Seven additional priority projects; and
- Benefits analysis and subsequent prioritisation.

Due to the limited time SP AusNet has had to estimate the costs of the seven additional priority projects, the cost estimates presented should be considered to be high level. These will be refined during the 2014-17 regulatory control period and any changes will be reported as part of the annual Service Target Performance Incentive Scheme (STPIS) compliance report.

1.2 Background

Version 4 of the AER's STPIS contains a new Network Capability Component which is designed to promote efficient levels of network capability from existing assets when and where most needed to improve customer or wholesale market outcomes.

Under the Network Capability Component SP AusNet is required to submit a Network Capability Incentive Parameter Action Plan (NCIPAP). Clause 5.2(b) of the STPIS Guidelines sets out that the NCIPAP must:

1. Identify for every transmission circuit or injection point on its network, the reason for the limit for each transmission circuit or injection point.
2. 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:
 - a. The total operational and capital cost of each priority project
 - b. The proposed value of the priority project improvement target in the limit for each priority project
 - c. 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
 - d. The ranking of the priority projects in descending order based on the likely benefit of the priority project on customers or wholesale market outcomes

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 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 prepared jointly with AEMO.

The NCIPAP is structured as follows:

- Section 2 – provides an overview of the assessment of network limits that was undertaken by SP AusNet and AEMO to derive the list of priority projects.
- Section 3 – outlines the proposed priority projects, including a description of the project, the current limit, the improvement target and the estimated project cost.

2 Assessment of Network Limits

SP AusNet and AEMO undertook an exercise to identify the reason for the limit for each transmission circuit and injection point on SP AusNet's transmission network. The results of this analysis are attached (Revised Attachment 1 – Network Limits). The limits presented are for system normal

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conditions. In addition, a RADAR study¹ was carried out by SP AusNet to capture the limiting elements for the transmission lines under outage conditions.

Each limit was then assessed to 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 \$5 million, or the cost threshold for the regulatory investment test for transmission); 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.

From this, a list of potential NCIPAP projects was formed. This was then refined to exclude projects that were not suitable for inclusion due to, for example, the capital costs exceeding the RIT-T threshold, or the project already being approved or needed to be undertaken before summer 2012-13. Where multiple small projects have been identified at the same terminal station, they have been aggregated due to the significant efficiencies that would be incurred in undertaking multiple small projects located at the same terminal station simultaneously.

SP AusNet developed high level cost estimates for the refined list of NCIPAP projects, and AEMO established the indicative gross economic benefits that would be achieved when these constraints are removed, and has provided the priority order of the priority projects. This analysis is presented below.

The process followed to produce the NCIPAP is outlined in more detail in the document 'Description of process followed to identify priority projects for NCIPAP' which has been provided to the AER.

3 Proposed Priority Projects

SP AusNet and AEMO have identified 22 priority projects. Table 1 presents the priority projects in descending priority order and also the estimated cost (capex and opex) and indicative timing of each priority project. Both the cost estimates and the indicative timings may be updated during the regulatory control period.

Where a beneficial paper uprate has been identified as part of the project identification process, these have been included in the NCIPAP to be addressed during the forthcoming regulatory period. However, no expenditure is proposed for these due to the 'business as usual' nature of these revisions.

Table 1: Proposed Priority Projects (\$'000, real 2013-14)

Priority Project Ranking	Proposed Project Circuit/ Injection Point	Description	Indicative Completion Year	Total Expenditure
1	Altona Terminal Station (ATS)	- Protection setting change	2014/15	14
2	Rowville-Malvern No. 1 & 2 220kV circuits	- Install a wind monitoring scheme	2016/17	400
3	Dederang circuits	- Replacement of interplant connections - Protection setting change	2015/16	586
4	South Morang – Thomastown No. 1 & 2 220kV circuits	- Install a wind monitoring scheme	2016/17	600
5	Wodonga Terminal Station (WOTS)	- Replace 22kV cable	2015/16	778

¹ This report is available for review at the AER's request.

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		connections		
6	Rowville - East Rowville No.1 & No.2 220kV circuits and Rowville - Springvale No.2 220kV circuit	<ul style="list-style-type: none"> - Replacement of two 220kV isolators - Protection setting changes 	2015/16	999
7	Hazelwood – Loy Yang No.1, No.2 and No.3 500kV circuits	<ul style="list-style-type: none"> - Dynamic line model development and implementation 	2014/15	2
8	Templestowe Terminal Station (TSTS)	<ul style="list-style-type: none"> - Replace 66kV interplant connections - Review and uprate equipment ratings in RADAR 	2015/16	377
9	South Morang - Dederang No.1 and No.2 330kV circuits	<ul style="list-style-type: none"> - Develop the SOCS layout to display combined line and series capacitor bank ratings 	2015/16	72
10	APD and MOPS Inter-trip Control Schemes	<ul style="list-style-type: none"> - Establish 2 inter-trip control schemes 	2016/17	400
11	M2 Contingency Control Scheme	<ul style="list-style-type: none"> - Establish contingency control scheme 	2016/17	800
12	East Rowville-Cranbourne No.1 & No.2 220kV circuits	<ul style="list-style-type: none"> - Replace protection relays 	2015/16	1,033
13	Keilor-Sydenham No.1 500kV circuit and Keilor-South Morang No.1 500kV circuit	<ul style="list-style-type: none"> - Review and uprate equipment ratings in RADAR 	2014/15	0
14	Thomastown Terminal Station (TTS)	<ul style="list-style-type: none"> - Replace 66kV interplant connections - Review and uprate equipment ratings in RADAR 	2015/16	177
15	Ringwood Terminal Station (RWTS)	<ul style="list-style-type: none"> - Review and uprate equipment ratings in RADAR 	2014/15	0
16	Increase instrumentation range	<ul style="list-style-type: none"> - Replace existing transducers - Update SCADA mapping 	2016/17	400
17	Investigate fault level withstand capability of 220kV switchyards at HTS, KTS, MLTS, ROTs, RTS, RWTS, SVTS, TTS and WMTS	<ul style="list-style-type: none"> - Assess fault level capability at nominated terminal stations 	2016/17	5,300
18	Identify works to increase the fault level withstand capability to 40kA at 220kV switchyard at HTS, KTS, MLTS, ROTs, RTS, RWTS, SVTS, TTS and WMTS	<ul style="list-style-type: none"> - Identify works to increase fault level withstand capability 	2016/17	400
19	Geelong–Moorabool No.1 & No. 2 220 kV circuits	<ul style="list-style-type: none"> - Replacement of two 220kV isolators. 	2015/16	871
20	Geelong Terminal Station (GTS)	<ul style="list-style-type: none"> - Review and uprate equipment ratings in 	2014/15	0

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		RADAR		
21	Moorabool - Mortlake No.2 500kV circuit and Moorabool - Tarrone No.1 500kV circuit	- Review and update protection settings in TRESIS.	2014/15	0
22	Horsham Terminal Station (HOTS)	- Protection setting change	2014/15	14
Total Expenditure				13,223

The expenditure split between capex and opex is shown in the table below, and is identified for each project below. This has been derived consistently with SP AusNet's capitalisation policy.

Table 2: Capital and Operating Expenditure (\$m, real 2013-14)

Capex	Opex	Total
7.49	5.73	13.22

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

3.1 Priority Project 1 – Altona Terminal Station (ATS)

Transmission Circuit / Injection Point	Altona Terminal Station (ATS)
Limit and Reason for the Limit	The summer cyclic rating of the secondary winding of the B4 220/66kV transformer at ATS is 1520A. The transformer capacity is limited by the secondary protection relay with a rating of 1000 A.
Project	Protection setting change of the SEL 387-5 protection relay at ATS
Limit Addressed	Loading constraint of the B4 220/66kV transformer at ATS
Project Description	The High Voltage Overcurrent Setting on the SEL 387-5 relay is limiting the transformer capacity. Change the protection setting to achieve required limit and test relay on site.
Present Limit	ATS 220/66 kV B4 transformer rating 174 MVA but limited by protection limit of 114 MVA
Target Limit	ATS 220/66 kV B4 transformer capability 174 MVA.
Capital Cost	\$0
Operating Cost	\$14k
Priority Project Outcome	Increase limiting factor of the secondary winding of the B4 220/66kV transformer at ATS to 1520A.
Reasons to undertake the project:	The TCPR shows the ATS 220/66 kV transformation N-1 capacity as 174 MVA. The DNSPs were not aware of the limitation caused by the protection limit, which limits the transformation capacity to 114 MVA. The maximum demand at ATS was 189.4 MVA in summer 2012/13 and is forecasted to increase. Having identified this limitation, the DNSPs have requested to remove the protection limit as soon as possible. This increase in rating would avoid or minimise potential load shedding from 2013/14 onwards due to the forecast load growth at ATS. This project would increase the reliability of supply to customers connected to ATS.
Benefit:	Removal of the protection limit will allow full utilisation of the transformer capability. This project increases the ATS 220/66 kV B4 transformer capability by 60 MVA.

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3.2 Priority Project 2 - Rowville - Malvern No.1 & 2 220 kV circuits

Transmission Circuit / Injection Point	Rowville – Malvern No.1 & 2 220 kV circuits
Limit and Reason for the Limit	AEMO identified loading constraints for the Rowville – Malvern 220kV lines in the Victorian Annual Planning Report 2013. Under peak demand conditions in summer and following an outage of one of the Rowville – Malvern 220kV circuits, the remaining Rowville – Malvern 220kV circuit is forecast to be loaded above its short term (15-minute) rating (237MVA at 45 °C and 0.6 m/s wind speed) from summer 2013-14.
Project	Install a wind monitoring scheme for the Rowville–Malvern No.1 & 2 220 kV circuits
Limit Addressed	Loading constraints of the Rowville – Malvern No.1 & 2 220 kV circuits under single contingency events
Project Description	Installation of a wind monitoring station at Malvern Terminal Station (there is an existing wind monitoring station at Rowville Terminal Station). Changes to the control and protection schemes to incorporate wind monitoring stations outputs.
Present Limit	Ratings of Rowville-Malvern 220 kV circuits: 204 MVA continuous and 237 MVA short-term
Target	Implement dynamic rating for both ROTS-MTS 220 kV circuits. The scheme will be designed to achieve ratings of ROTS-MTS circuits under favourable ambient conditions as 234 MVA for system normal operation and 267 MVA under contingent conditions provided pre-contingency loading is less than 60% of 234 MVA.
Estimated Capital Cost	\$400k
Operating Cost	\$0
Priority Project Outcome	Dynamic line rating scheme for the Rowville – Malvern No.1 & 2 220 kV circuits
Reasons to undertake the project: An increase in the rating of the Rowville-Malvern 220 kV circuits is expected under favourable ambient and wind speed conditions with the application of dynamic line rating. This increase in rating would avoid or minimise potential load shedding from 2013/14 onwards due to the forecast load growth at Malvern Terminal Station. This project would increase the security of supply to customers connected to Malvern Terminal Station.	
Benefits: AEMO's 2013 Victorian Annual Planning Report assessment identified net market benefit for implementation of a wind monitoring scheme on the Rowville-Malvern 220 kV circuits for 2014/15 and 2015/16 are \$38,000 and \$132,000 respectively. The gross market benefits for 2014/15 and 2015/16 are \$86,000 and \$181,000 respectively.	

3.3 Priority Project 3 – Dederang circuits

Transmission Circuit / Injection Point	(1) Dederang-Glenrowan No.3 220kV circuit (2) Dederang-Murray No.1 & No.2 330kV circuit (3) Dederang- Wodonga No.1 330kV circuit [Limiting element at Dederang Terminal Station (DDTS)]
Limit and Reason for the Limit	The Dederang-Glenrowan No.3 220kV circuit is rated at 450 MVA (continuous rating at 35 °C) and is double switched at DDTS. The line is limited by the interplant connections (431 MVA) and secondary plants at DDTS when single switched due to plant outages. The Dederang-Murray No.1 and No.2 330kV circuits are rated at 1043 MVA (continuous rating at 35 °C) and is switched in a circuit breaker and a half switch bay at DDTS. The line is limited by the interplant connections (943 MVA) for a circuit breaker outage at DDTS. The Dederang-Wodonga No.1 330kV circuit are rated at 977 MVA (continuous rating at 35 °C) and is switched in a circuit breaker and a half switch bay at DDTS. The line is limited by the interplant connections (943 MVA) for a circuit breaker outage at DDTS. The line capacity is also limited by secondary protection relays with a lower rating of 915 MVA at DDTS.

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Project	Replacement of the 330kV and 220 kV interplant connections and protection setting change at DDTS
Limit Addressed	Loading constraint of the above 220kV and 330kV lines under single contingency event
Project Description	Replace the 330kV and 220 kV interplant connections at DDTS to enable full use of the capacity of the 330kV and 220kV lines connected at DDTS. Change the protection settings to achieve required limits and test relays on site.
Present Limit	DDTS-GNTS No.3 220 kV circuit capability limited by interplant connections with rating of 431 MVA; DDTS-MSS No.1 and No.2 330 kV circuits capability limited by interplant connections with rating of 943 MVA; and DDTS-WOTS 30 kV circuit capability is limited by protection limit of 915 MVA.
Target Limit	Full use of line thermal capacity of 450MVA, 1043MVA and 977MVA of the (1) Dederang-Glenrowan No.3 220kV circuit, (2) Dederang-Murray No.1 and No.2 330kV circuit and (3) Dederang- Wodonga No.1 330kV circuit respectively during both normal and contingency conditions.
Capital Cost	\$586k
Operating Cost	\$0
Priority Project Outcome	Full use of line thermal capacity of 450MVA, 1043MVA and 977MVA of the (1) Dederang-Glenrowan No.3 220kV circuit, (2) Dederang-Murray No.1 and No.2 330kV circuit and (3) Dederang- Wodonga No.1 330kV circuit respectively during both normal and contingency conditions.
Reasons to undertake the project: The Murray - Dederang 330 kV circuits thermal capacity is one of top 20 binding Vic transmission constraints. In 2011 and 2012 the Marginal Cost of Constraints (MCC) have been \$87,009 and \$212,498. The upgrade of the 330kV and 220kV interplant connections and the protection setting changes will enable full use of the capacity of the 330kV and 220kV lines	
Benefits: This project would increase the market benefit and reduce the generation dispatch costs.	

3.4 Priority Project 4 - South Morang – Thomastown No.1 & 2 220 kV circuits

Transmission Circuit / Injection Point	South Morang -Thomastown No.1 & 2 220 kV circuits
Limit and Reason for the Limit	AEMO identified an operational loading constraint on the South Morang– Thomastown 220 kV circuits with prior outage conditions of a 500/220 kV transformer or any other major element in the Greater Melbourne area. The South Morang to Thomastown 220 kV circuits are rated at 549 MVA continuous and 604 MVA short term (at 45 °C and 0.6 m/s wind speed).
Project	Install a wind monitoring scheme for the South Morang – Thomastown No.1 & 2 220 kV circuits
Limit Addressed	Operational loading constraint for the South Morang – Thomastown No.1 & 2 220 kV circuits
Project Description	Installation of wind monitoring stations at South Morang and Thomastown Terminal Stations. Required changes to the control and protection schemes to incorporate wind monitoring station outputs.
Present Limit	South Morang-Thomastown No.1 and No.2 220 kV circuit rating: 549 MVA continuous
Target Limit	Implement dynamic rating for both SMTS-TTS 220kV circuits. The scheme will be designed to achieve ratings of SMTS-TTS circuits as 628MVA for system normal operation under favourable ambient conditions. No increase in the emergency rating is expected.
Estimated Capital Cost	\$600k
Operating Cost	\$0
Priority Project Outcome	Dynamic line rating scheme for the South Morang to Thomastown No.1 and 2 220 kV circuits
Reasons to undertake the project:	

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Thermal capacity of the South Morang-Thomastown 220 kV circuits is one of top 25 binding Vic transmission constraints. This increase in rating would minimise the market congestion caused by thermal limitation of these circuits. Particularly this limitation is likely to occur during prior outage of a 500/220 kV transformer or other major plant in the Greater Melbourne area.

Benefits: AEMO considers improvement on thermal rating likely to reduce the market spot prices caused by the South Morang-Thomastown 220 kV circuits.

3.5 Priority Project 5 – Wodonga Terminal Station (WOTS)

Transmission Circuit / Injection Point	Wodonga Terminal Station (WOTS)
Limit and Reason for the Limit	The summer cyclic rating of the tertiary winding of the No.1 and No.2 330/66/22 kV transformers at WOTS are both 1154A. The 22kV cables connecting the transformers to the 22kV switchroom has a lower rating of 830A and are limiting the capacity of the transformers.
Project	Replace the 22kV cable connections between the 22 kV switchroom and the No.1 and No.2 transformers at WOTS
Limit Addressed	Loading constraint of the No.1 and No.2 330/66/22 kV transformers at WOTS
Project Description	Replace the 22kV cable connections between the 22 kV switchroom and the No.1 and No.2 transformers at WOTS to match or exceed the cyclic rating of the transformers
Present Limit	The 22 kV side of WOTS 330/66/22 kV No.1 and No.2 transformers rating is 44 MVA and limited by the 22 kV cable rating of 32 MVA
Target Limit	The 22 kV side of WOTS 330/66/22 kV No.1 and No.2 transformers capability is 44 MVA.
Capital Cost	\$778k
Operating Cost	\$0
Priority Project Outcome	Increase the limiting factor of the tertiary winding of the WOTS No.1 and 2 330/66/22 kV transformers to 1154A.
Reasons to undertake the project: The 22kV cable upgrades enable full use of the installed transformer capacity. This increase in rating would avoid or minimise potential load shedding from 2013/14 onwards due to the forecast load growth at Wodonga Terminal Station. This project would increase the reliability of supply to customers connected to Wodonga Terminal Station.	
Benefit: WOTS 330/66/22 kV transformer 22 kV side capability increases by 12 MVA.	

3.6 Priority Project 6 – Rowville - East Rowville No.1 & No.2 220kV circuit & Rowville - Springvale No.2 220kV circuit

Transmission Circuit / Injection Point	Rowville - East Rowville No.1 & No.2 220kV circuit & Rowville - Springvale No.2 220kV circuit [Limiting element at Rowville Terminal Station (ROTS)]
Limit and Reason for the Limit	These circuits are rated at 800 MVA (continuous) at 35 °C and are connected in circuit breaker and a half switch bays at ROTs. The secondary protection relays for the ERTS No.1 and No.2 lines at ROTs have lower rating settings of 686 MVA. The two 220kV isolators in the SVTS No.2 line bay at ROTs have lower ratings of 495MVA compared with the line. During a prior outage of the circuit breaker between Rowville No.4 220 kV bus and Rowville-Springvale No.2 220 kV circuit, this circuit can be switched on to Rowville No.1 220 kV bus. In this switching configuration two 220 kV isolators between Rowville No.1 220 kV bus and Rowville-Springvale No.2 220 kV circuit would limit the flow on the Rowville-Springvale 220 kV circuits to 495 MVA compared with the line rating of 800 MVA.
Project	Replace the two 220kV isolators in the SVTS No.2 line bay at ROTs and make protection setting changes for the Rowville - East Rowville No.1 and

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	No.2 220kV circuits at ROTS.
Limit Addressed	Loading constraint of the Rowville - East Rowville No.1 and No.2 220kV circuits and Rowville - Springvale No.2 220kV circuit under single contingency events
Project Description	Replace two 220kV isolators in the SVTS No.2 line bay at ROTS, change the relay settings for the Rowville - East Rowville No.1 and No.2 220kV circuits at ROTS to achieve the required limit and test relays on site.
Present Limit	ROTS-ERTS No.1 and 2 220 kV circuits capability limited by protection limit of 686 MVA. Rating of isolators between ROTS No.1 220 kV bus and ROTS-SVTS No.2 line limited to 495 MVA.
Target Limit	ROTS-ERTS No.1 and 2 220 kV circuits capability limited by circuit rating of 800 MVA. Rating of isolators between ROTS No.1 220 kV bus and ROTS-SVTS No.2 line increased to 800 MVA or higher.
Capital Cost	\$999k
Operating Cost	\$0
Priority Project Outcome	Full use of line capacity for each line (800MVA).
<p>Reasons to undertake the project: The replacement of the 220kV isolators at Springvale will remove the constraints on the Rowville-Springvale 220 kV circuits during a prior outage of a circuit breaker at Rowville Terminal Station.</p> <p>The protection setting change on the Rowville-East Rowville 220 kV circuits will allow increased loading on these lines with a prior outage of the Cranbourne 500/220 kV transformer and a subsequent outage of a Rowville-East Rowville 220 kV circuit.</p>	
<p>Benefit:</p> <p>Replacement of isolators at Rowville on the ROTS-SVTS No.2 220 kV circuit would increase the loading on Rowville-Springvale 220 kV circuits by 305 MW during a prior outage of a circuit breaker at Rowville on the Rowville-Springvale No.2 220 kV circuit.</p> <p>The protection setting upgrade on the ROTS-ERTS 220 kV circuits would increase the rating of these circuits by 114 MVA.</p> <p>This project would increase the reliability of supply to customers connected at Springvale, Heatherton, East Rowville, Cranbourne and Tyabb Terminal Stations as well as for BlueScope steel.</p>	

3.7 Priority Project 7– Hazelwood – Loy Yang No.1, 2 & 3 220 kV circuits

Transmission Circuit / Injection Point	Hazelwood – Loy Yang No.1, 2 & 3 500 kV circuits
Limit and Reason for the Limit	AEMO identified an operational loading constraint on the Hazelwood – Loy Yang 500 kV circuits with a prior outage of one of the other parallel transmission lines between Hazelwood and Loy Yang. Each of the Hazelwood – Loy Yang 500 kV circuits are rated at 3204 MVA and 4191 MVA at 35 °C and 5 °C. With a prior outage of one of the parallel circuits and for secure operation the loading on the remaining two lines are limited to the thermal capacity of a single circuit. This is to ensure that for the next contingent outage of a Loy Yang–Hazelwood 500 kV circuit, the last remaining parallel circuit loading remains within its thermal capacity. The total generation connected at Loy Yang 500 kV, including 600 MW import from Tasmania, is about 3800 MW. There is no generation constraint during low ambient temperature periods with a prior outage of a Loy Yang-Hazelwood 500 kV circuit. A prior outage of a Loy Yang–Hazelwood 500 kV circuit at an ambient temperature of 35 °C can limit generation to about 600 MW from Loy Yang 500 kV including import from Tasmania.
Project	Dynamic line model development and implementation to enable the calculation of continuous and short-term line ratings dynamically based on ambient temperature.
Limit Addressed	Operational loading constraint for the Hazelwood – Loy Yang No.1, 2 & 3 500 kV circuits

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Project Description	Develop and implement a thermal model to calculate continuous and short-term ratings for the Hazelwood-Loy Yang 500 kV circuits based on ambient temperatures.
Present Limit	Hazelwood-Loy Yang No.1, 2 & 3 500 kV circuit capability 3204 MVA (summer continuous)
Target Limit	Hazelwood-Loy Yang No.1, 2 & 3 500 kV circuits capability implemented in the thermal line model based on ambient temperatures. This is likely to provide short-term ratings higher than the continuous ratings under favourable ambient temperature and operating conditions.
Estimated Capital Cost	\$0
Operating Cost	\$2k
Priority Project Outcome	Dynamic line thermal model development and implementation for the Hazelwood-Loy Yang No.1, 2 & 3 500 kV circuits based on ambient temperatures.
Reasons to undertake the project: Market constraints were recorded during prior outage of a Hazelwood-Loy Yang 500 kV circuit. The proposed project would enable applying short-term ratings to the Hazelwood-Loy Yang 500 kV circuits under favourable ambient temperatures and operating conditions. Availability of short term rating information avoids or minimises the market constraints caused by the Hazelwood-Loy Yang 500 kV circuits.	
Benefits: The proposed project will enable application of short term ratings for the Hazelwood-Loy Yang 500 kV circuits based on ambient temperatures. This project will reduce generation dispatch costs.	

3.8 Priority Project 8 – Templestowe Terminal Station (TSTS)

Transmission Circuit / Injection Point	Templestowe Terminal Station (TSTS)
Limit and Reason for the Limit	The summer cyclic rating of the secondary winding of the TSTS B1, B2 and B3 220/66 kV transformer are 1636A, 1528A and 1684A. The B1 and B3 transformer are limited by the 66kV busbars (1585A) and the 66kV interplant connections (1510A). The cost of busbar replacement is significant and outside the scope of the NCIPAP. The B2 transformer is limited by 66kV interplant connections that have incorrect equipment ratings recorded in RADAR (SP AusNet database).
Project	Replace the 66kV interplant connections between the 66kV busbars and the B1 and B3 transformers at TSTS and review and uprate equipment ratings in RADAR
Limit Addressed	Loading constraint of the B1, B2 and B3 220/66 kV transformers at TSTS
Project Description	Replace the limiting 66kV interplant connections between the 66kV busbar and the B1 and B3 transformers at TSTS to match or exceed the B1 and B3 transformer ratings. Review and uprate equipment ratings in RADAR.
Present Limit	TSTS 220/66 kV B1 transformer rating 187 MVA and limited by interplant connection rating of 173 MVA; TSTS 220/66 kV B3 transformer rating 192 MVA and limited by interplant connection rating of 173 MVA; and TSTS 220/66 kV B2 transformer rating 175 MVA and limited by interplant connection rating of 173 MVA;
Target Limit	TSTS 220/66 kV B1 transformer rating 187 MVA and limited by 66 kV busbar rating of 181 MVA; TSTS 220/66 kV B3 transformer rating 192 MVA and limited by 66 kV busbar rating of 181 MVA; and TSTS 220/66 kV B2 transformer capability 175 MVA.
Capital Cost	\$377k
Operating Cost	\$0
Priority Project Outcome	Increase the limiting factor of the B1 and B3 220/66 kV transformers branches to the busbar rating of 1585A.

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	Increase the limiting factor of the B2 220/66 kV transformer branch to 1528A.
Reasons to undertake the project:	This project increases the B1, B2 and B3 220/66 kV transformation capacity at TSTS. This increase in rating would minimise potential load shedding from 2013/14 onwards due to the forecast load growth at Templestowe terminal station. This project would increase the reliability of supply to customers connected to Templestowe terminal station.
Benefit:	TSTS 220/66 kV transformer capability increases by 8 MVA.

3.9 Priority Project 9 – South Morang - Dederang No.1 & No.2 330kV circuits

Transmission Circuit / Injection Point	South Morang - Dederang No.1 & No.2 330kV circuits [System Overload Control Schemes (SOCs) layout modification]
Limit and Reason for the Limit	AEMO uses real time rating information from SOCs to operate the transmission system. The presentation of the South Morang (SMTS) series capacitor banks and South Morang to Dederang (DDTS) 330 kV line ratings in SOCS needs some modification to avoid operators interpreting the rating information incorrectly and constraining flows on the 330 kV interconnector between NSW and Victoria.
Project	Develop the SOCS layout to display the combined SMTS-DDTS 330kV line and series capacitor bank ratings
Limit Addressed	Correctly displaying the SMTS-DDTS 330kV line ratings in SOCS will minimise the risk of operators interpreting the rating information incorrectly and constraining flows on the 330 kV interconnector between Victoria and New South Wales.
Project Description	Modify the SOCs interface to display a calculated value for the Continuous, 5 minute and 15 minute ratings being the lower of the line and the capacitor bank ratings for each of Continuous, 5 minute and 15 minute ratings and include a SCADA solution to monitor whether the 330kV series capacitors are in service or bypassed.
Capital Cost	\$72k
Operating Cost	\$0
Priority Project Outcome	Improved presentation of rating information for the SMTS-DDTS 330kV lines and series capacitor banks in SOCS to assist operators and minimise the risk of operators interpreting the rating information incorrectly.
Reasons to undertake the project:	SMTS-DDTS 330 kV line thermal capacity is one of top 20 binding Victorian transmission constraints. In 2011 and 2012 the marginal cost of constraints have been \$12,584 and \$38,874. Any incorrect interpretation of the rating of the SMTS-DDTS 330 kV circuits can result in market congestion and increased generation dispatch costs. This project is to modify the SOCS layout to improve the presentation of the line and capacitor bank ratings to operational staff.
Benefit:	Improved the operational visibility of the line and series capacitor thermal constraints on the South Morang-Dederang 330 kV circuits. This project will improve the market benefit to the customers.

3.10 Priority Project 10 - APD and MOPS Inter-trip Control Schemes

Transmission Circuit / Injection Point	Moorabool (MLTS) - Mortlake (MOPS) - Heywood (HYTS) - Portland Aluminium Customer Substation (APD) No.2 500 kV circuit
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Limit and Reason for the Limit	<p>(1) Prior outage of the HYTS-APD No.1 500 kV circuit with subsequent trip of the APD A2 transformer or APD No 1 500 kV bus. This may lead to over voltage on the 500 kV circuit breaker and associated plant at APD of the HYTS-APD No 2 500 kV circuit.</p> <p>(2) Prior outage of the HYTS-APD No 2 500 kV circuit with subsequent trip of the MLTS-MOPS No 2 500 kV line or vice-versa. This may lead to overvoltage at MOPS and HYTS on the MOPS-HYTS No.2 500 kV circuit.</p>
Project	APD Inter-trip Control Scheme (APDICS) and MOPS Inter-trip Control Scheme (MOPSICS)
Limit Addressed	<p>During a prior outage of the HYTS-APD No.1 500 kV circuit, the APD Inter-trip Control Scheme will allow management of over voltages by tripping the APD-HYTS-MOPS No.2 500 kV circuit following a next contingency, instead of prior to a contingency.</p> <p>During a prior outage of the HYTS-APD No 2 500 kV circuit or MLTS-MOPS No 2 500 kV circuit, the MOPS Inter-trip Control Scheme will allow management of over voltages by tripping the HYTS-MOPS No.2 500 kV circuit following a next contingency, instead of prior to a contingency.</p>
Project Description	<p>APD Inter-trip Control Scheme: A duplicated control scheme is required to cover a prior outage of either the APD-HYTS No. 1 500 kV circuit or the APD No. 3 500 kV bus and a subsequent tripping of the APD A2 transformer or APD No. 1 500kV bus. The control scheme is to detect the specified conditions and trip the MOPS - HYTS – APD No. 2 500 kV circuit.</p> <p>MOPS Inter-trip Control Scheme: A duplicated control scheme is required to cover a prior outage of either the APD-HYTS No. 2 500 kV circuit or the APD No. 1 500 kV bus and a subsequent tripping of the MOPS-MLTS No. 2 circuit or vice versa. The control scheme is to detect the specified conditions and trip the MOPS - HYTS – APD No. 2 500 kV circuit.</p> <p>The APD Inter-trip Control Scheme and MOPS Inter-trip Control Scheme will be incorporated in one scheme.</p>
Present Limit	During a prior outage of plant connected at APD or MLTS the potential overvoltage is managed by changing protection settings. Following restoration of plant, the protection setting is reset for normal operation. Any error in setting the protection could result in potential overvoltage and damage to plant.
Target Limit	Prevent potential overvoltage at APD 500 kV bus during a prior outage of plant connected at APD and MLTS. Minimise potential human error.
Estimated Capital Cost	<p>\$400k</p> <p>The APD inter-trip control scheme and MOPS inter-trip control scheme could only be carried out for this price provided the M2 contingency control scheme is completed.</p>
Operating Cost	\$0
Priority Project Outcome	Fully functional APD Inter-trip Control Scheme (APDICS) and MOPS Inter-trip Control Scheme (MOPSICS) are provided for this line
<p>Reasons to undertake the project:</p> <p>APD Inter-trip Control Scheme: To prevent potential overvoltage conditions on circuit breakers and associated plant at APD connected to HYTS-APD No.2 circuit.</p> <p>MOPS Inter-trip Control Scheme: To prevent potential excessive voltage levels at HYTS 500 kV and on the HYTS – MOPS No.2 500 kV circuit.</p>	
<p>Benefits: Proposed control schemes will provide increased maintenance window for elements in MLTS-MOPS-HYTS-APD 500 kV circuits. Human error minimised. Potential damage to plant is minimised.</p>	

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3.11 Priority Project 11 - M2 Contingency Control Scheme

Transmission Circuit / Injection Point	M2 500/275/22kV transformer at Heywood Terminal Station (HYTS)
Limit and Reason for the Limit	The M2 Contingency Control Scheme will prevent voltage collapse and Heywood 500/275 kV M2 transformer overload with prior outage of the APD-HYTS No.1 500 kV circuit plus contingent outage of the MLTS-MOPS No.2 500 kV circuit.
Project	M2 Contingency Control Scheme
Limit Addressed	The control scheme will prevent voltage collapse and overloading of Heywood 500/275 kV M2 transformer following a prior outage of APD-HYTS No.1 500 kV circuit plus contingent outage the MLTS-MOPS No.2 500 kV circuit.
Project Description	A duplicated control scheme is required to cover prior outages between HYTS and APD associated with the No. 1 Line and a subsequent outage of the MLTS-MOPS No. 2 Line, or the reverse. Either scenario may lead to voltage collapse and plant overload. The control scheme is to detect the specified conditions and trip the APD potlines.
Present Limit	During a prior outage of the HYTS-APD No.1 500 kV circuit, VIC to SA export would be reduced to manage potential over loading on the HYTS M1 transformer.
Target Limit	During a prior outage of the HYTS-APD No.1 500 kV circuit, reduction in VIC to SA export would be minimised to manage potential over loading on HYTS M1 transformer.
Estimated Capital Cost	\$800k
Operating Cost	\$0
Priority Project Outcome	Fully functional M2 contingency control scheme is provided for the M2 transformer at HYTS
Reasons to undertake the project: To prevent voltage collapse and plant overload during certain contingency scenarios.	
Benefits: Proposed control schemes will provide increased maintenance window for elements in MLTS-MOPS-HYTS-APD 500 kV circuits. Avoidance of pre-contingent action will reduce the generation dispatch costs.	

3.12 Priority Project 12 – East Rowville-Cranbourne No.1 & No.2 220kV circuit

Transmission Circuit / Injection Point	East Rowville-Cranbourne No.1 & No.2 220kV circuit [Limiting element at East Rowville Terminal Station (ERTS)]
Limit and Reason for the Limit	The East Rowville-Cranbourne No.1 and No.2 220kV circuit are both rated at 827 MVA (continuous) at 35 °C. The capacity of these two circuits is limited by secondary protection relays with a lower rating of 800 MVA.
Project	Replace protection relays at ERTS
Limit Addressed	Loading constraint of the East Rowville-Cranbourne No.1 and No.2 220kV circuits
Project Description	Protection relays are limiting the capacity of the East Rowville-Cranbourne No.1 and No.2 220kV circuits. Replace protection relays (RXIB) to achieve the required limit, also replace transducers that have a maximum range of 1600A.
Present Limit	East Rowville-Cranbourne No.1 and No.2 220 kV circuits capability 800 MVA.
Target Limit	East Rowville-Cranbourne No.1 and No.2 220 kV circuits capability 827 MVA
Capital Cost	\$1,033k
Operating Cost	\$0
Priority Project Outcome	Remove the protection limitation to enable full use of the rating (827 MVA) of the East Rowville-Cranbourne No.1 and No.2 220kV circuits.
Reasons to undertake the project: The relay protection setting changes to eliminate the protection constraint on the East Rowville-Cranbourne No.1 and No.2 220kV circuits. These circuits can experience	

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high loading during prior outage of a 500/220 kV transformer at Rowville.

Benefits:

This project increases the capability of East Rowville-Cranbourne 220 kV circuits by 27 MVA. This increased capability will reduce any potential constraints during prior outage of Rowville 500/220 kV transformers.

This project would reduce the generation dispatch costs.

3.13 Priority Project 13 – Keilor-Sydenham No.1 500kV circuit & Keilor-South Morang No.1 500kV circuit

Transmission Circuit / Injection Point	Keilor-Sydenham No.1 500kV circuit & Keilor-South Morang No.1 500kV circuit [Limiting element at Keilor Terminal Station (KTS)]
Limit and Reason for the Limit	The Keilor-Sydenham No.1 500kV circuit and Keilor-South Morang No.1 500 kV circuit are both rated at 3204 MVA (continuous) at 35°C and connected in a circuit breaker and a half switch bay at KTS. The line capacity is limited by secondary equipment at KTS with ratings in the range of 873 MVA to 1949 MVA. A project (XC06) was completed to increase the rating of the secondary equipment, however the new ratings have not been updated in RADAR (SP AusNet database).
Project	Review and uprate equipment ratings in RADAR
Limit Addressed	Loading constraint of the Keilor-Sydenham No.1 500kV circuit and Keilor-South Morang No.1 500kV circuit during prior outage of 500 kV circuit breakers at KTS
Project Description	Review and uprate equipment ratings in RADAR
Present Limit	Keilor-Sydenham No.1 500 kV circuit: Protection limit 873 MVA to 1949 MVA Keilor-South Morang No.1 500 kV circuit: Protection limit 873 MVA to 1506 MVA
Target Limit	Keilor-Sydenham No.1 500 kV circuit: Secondary plant limit 2078 MVA; and Keilor-South Morang No.1 500 kV circuit: Secondary plant limit 2078 MVA
Capital Cost	\$0
Operating Cost	\$0
Priority Project Outcome	Remove the protection constraints for the Keilor-Sydenham No.1 500 kV circuit and Keilor-South Morang No.1 500 kV circuit. This will result in increased ratings of 2078 MVA.
Reasons to undertake the project:	The secondary equipment is limiting line capacity due to incorrect equipment ratings recorded in RADAR (SP AusNet database). The database will be reviewed and updated by SP AusNet.
Benefit:	This project increases supply reliability to Greater Melbourne area and reduce generation dispatch costs.

3.14 Priority Project 14 – Thomastown Terminal Station (TTS)

Transmission Circuit / Injection Point	Thomastown Terminal Station (TTS)
Limit and Reason for the Limit	The summer cyclic ratings of the secondary winding of the TTS B1, B2, B3 and B5 220/66 kV transformers are 1758A, 1497A, 1367A and 1505A respectively. The TTS 66 kV busbars are rated 1585A. The cost of busbar replacement is significant and outside the scope of the NCIPAP. The B transformer capacity at TTS is also limited by 66kV interplant connection (1460A) and secondary equipment (638A), with some incorrect ratings recorded in RADAR (SP AusNet database).
Project	Replace the 66kV interplant connections between the 66kV busbars and the B1 and B2 transformers at TTS, review and uprate equipment ratings in RADAR

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Limit Addressed	Loading constraints of the B1, B2, B3 and B5 220/66 kV transformers at TTS
Project Description	Replace the limiting 66kV interplant connections between the 66kV busbars and the B1 and B2 transformers at TTS to match or exceed the B1 and B2 transformer ratings, review and uprate equipment ratings in RADAR
Present Limit	TTS 220/66 kV B1 transformer rating 201 MVA and limited by interplant connection rating of 167 MVA; TTS 220/66 kV B2 transformer rating 171 MVA and limited by interplant connection rating of 167 MVA; and TTS 220/66 kV B5 transformer rating 172 MVA and limited by interplant connection rating of 167 MVA;
Target Limit	TTS 220/66 kV B1 transformer rating 201 MVA and limited by 66 kV busbar rating of 181 MVA; TTS 220/66 kV B2 transformer capability 171 MVA; and TTS 220/66 kV B5 transformer capability 172 MVA.
Capital Cost	\$177k
Operating Cost	\$0
Priority Project Outcome	Increase the limiting factor of the TTS B1, B2, B3 and B5 220/66 kV transformer branches to 1585A (bus rating), 1497A, 1367A and 1505A respectively.
Reasons to undertake the project: This project increases the 220/66 kV transformation capacity at TTS	
Benefit: TTS 220/66 kV transformer capability increases by 14 MVA. This project increases supply reliability to customers connected at Thomastown terminal station.	

3.15 Priority Project 15 – Ringwood Terminal Station (RWTS)

Transmission Circuit / Injection Point	Ringwood Terminal Station (RWTS)
Limit and Reason for the Limit	The summer cyclic rating of the secondary windings of the RWTS B2 and B3 220/66 kV transformers are rated at 1623A and 1660A respectively. The B2 and B3 transformer capacity is limited by 66kV interplant connections with a lower rating of 1510 A. This is due to incorrect equipment ratings recorded in RADAR (SP AusNet database). The capacity of the transformers is also limited by the 66kV busbars with a rating of 1585A. The cost of busbar replacement is significant and outside the scope of the NCIPAP.
Project	Review and uprate equipment ratings in RADAR
Limit Addressed	Loading constraint of the RWTS 220/66 kV transformers (B2 and B3)
Project Description	Review and uprate the 66kV interplant connection ratings in RADAR.
Present Limit	RWTS 220/66 kV B2 transformer rating 185 MVA and limited by interplant connection rating of 173 MVA; and RWTS 220/66 kV B3 transformer rating 190 MVA and limited by interplant connection rating of 173 MVA
Target Limit	RWTS 220/66 kV B2 transformer rating 185 MVA and limited by 66 kV busbar rating of 181 MVA; and RWTS 220/66 kV B3 transformer rating 190 MVA and limited by 66 kV busbar rating of 181 MVA.
Capital Cost	\$0
Operating Cost	\$0
Priority Project Outcome	Increase the limiting factor of the RWTS B2 and B3 220/66 kV transformer branches to the busbar rating of 1585A.
Reasons to undertake the project: The 66kV interplant connections are limiting the 220/66 kV transformation capacity at RWTS due to incorrect equipment ratings recorded in RADAR (SP AusNet database). The database will be reviewed and updated by SP AusNet.	
Benefit:	

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The database will be reviewed and updated by SP AusNet.

3.16 Priority Project 16 - Increase instrumentation range

Transmission Circuit / Injection Point	<ol style="list-style-type: none"> 1) Ballarat – Waubra 220kV circuit 2) Horsham – Waubra 220kV circuit 3) Bendigo – Kerang 220kV circuit 4) Dederang – Wodonga 330kV circuit 5) Horsham – Red Cliffs 220kV circuit 6) Kerang - Wemen 220kV circuit 7) Moorabool – Terang 220kV circuit 8) Red Cliffs – Wemen 220kV circuit 9) East Rowville – Cranbourne 220kV circuit 10) Rowville- Ringwood 220kV circuit 11) Thomastown – Ringwood 220kV circuit
Limit and Reason for the Limit	AEMO has identified scenarios where line loadings exceed existing instrumentation ranges for the above transmission circuits
Project	Increase the instrumentation range of the eleven transmission circuits mentioned above.
Limit Addressed	Network constraints due to limited instrumentation ranges for certain operational conditions for the eleven transmission circuits specified above.
Project Description	This project includes instrumentation range changes at multiple stations. Works includes replacement of existing transducers and SCADA mapping updates to incorporate the new increased instrumentation range.
Present Limit	<p>Existing instrumentation ranges are:</p> <ol style="list-style-type: none"> 1) BATS-WBTS 220 kV circuit at BATS -250/+450 MW and at WBTS - 450/+250 MW 2) HOTS-WBTS 220 kV circuit at HOTS -250/450 MW and at WBTS - 450/+250 MW 3) BETS-KGTS 220 kV circuit at BETS -300/300 MW and at KGTS - 300/+300 MW 4) DDTS-WOTS 330 kV circuit at WOTS -1600/+800 MW 5) HOTS-RCTS 220 kV circuit at HOTS -300/+300 MW and at RCTS - 250/+250 MW 6) KGTS-WETS 220 kV circuit at KGTS -300/+300 MW and at WETS - 400/+400 MW 7) MLTS-TGTS 220 kV circuit at MLTS +400/+0 MW 8) RCTS-WETS 220 kV circuit at RCTS -250/+250 MW 9) ERTS-CBTS 220 kV circuit at ERTS -200/+600 MW 10) ROTS-RWTS 220 kV circuit at ROTS -600/+600 MW and at RWTS - 500/+500 MW 11) TTS-RWTS 220 kV circuit at RWTS -500/+500 MW and at TTS N/A MW
Target Limit	<p>Target instrumentation ranges are:</p> <ol style="list-style-type: none"> 1) BATS-WBTS 220 kV circuit at BATS -524/+524 MW and at WBTS - 524/+524 MW 2) HOTS-WBTS 220 kV circuit at HOTS -524/+524 MW and at WBTS - 524/+524 MW 3) BETS-KGTS 220 kV circuit at BETS -455/+455 MW and at KGTS - 455/+455 MW 4) DDTS-WOTS 330 kV circuit at WOTS -1600/+1600 MW 5) HOTS-RCTS 220 kV circuit at HOTS -455/+455 MW and at RCTS - 455/+455 MW 6) KGTS-WETS 220 kV circuit at KGTS -455/+455 MW and at WETS - 455/+455 MW 7) MLTS-TGTS 220 kV circuit at MLTS -400/+400 MW 8) RCTS-WETS 220 kV circuit at RCTS -400/+400 MW 9) ERTS-CBTS 220 kV circuit at ERTS -600/+600 MW

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	<p>10) ROTS-RWTS 220 kV circuit at ROTS -1086/+1086 MW and at RWTS - 1086/+1086 MW</p> <p>11) TTS-RWTS 220 kV circuit at RWTS -922/+922 MW and at TTS -922/+922 MW</p> <p>(Note: Proposed ranges are to match the line winter rating or one side of existing instrumentation range. These ranges can be rounded):</p>
Estimated Capital Cost	\$400k
Operating Cost	\$0
Priority Project Outcome	Increase the instrumentation range of the circuits referred above.
Reasons to undertake the project:	
This project addresses the instrumentation range limitations of multiple transmission circuits identified by AEMO.	
Benefits: The increased instrumentation ranges will allow operational staff to monitor power flow for wide range of operational conditions. This will allow operational staff to take most effective operational action to maintain system security.	
The proposed project will improve the reliability to customers and reduce the generation dispatch costs.	

3.17 Priority Project 17 - Investigate fault level withstand capability of 220kV switchyards at HTS, KTS, MLTS, ROTS, RTS, RWTS, SVTS, TTS and WMTS

Transmission Circuit / Injection Point	Heatherton Terminal Station (HTS), Keilor Terminal Station (KTS), Moorabool Terminal Station (MLTS), Rowville Terminal Station (ROTS), Richmond Terminal Station (RTS), Ringwood Terminal Station (RWTS), Springvale Terminal Station (SVTS), Thomastown Terminal Station (TTS) and West Melbourne Terminal Station (WMTS)
Limit and Reason for the Limit	The fault level capability of some equipment, structures and earth grid may limit the maximum acceptable fault level of the terminal stations listed above following an increase in the system fault level as a result of a major augmentation or generation connection.
Project	<p>Assess the fault level capability of the nominated terminal stations by taking into consideration:</p> <ol style="list-style-type: none"> 1) Busbar/supports; 2) Rack/Gantries/Structures; 3) Interplant connections 4) Connections to earth grid; 5) Earth Grid; 6) the fault carrying capacity of ground wires, OPGW and step/touch potentials at the first few towers outside the terminal station 7) any other components
Limit Addressed	The study will establish the fault level rating of the equipment, structures and earth grid for the terminal stations listed above.
Project Description	This project includes site investigations and analysis of the fault level capability of existing equipment, structures and earth grids at HTS, KTS, MLTS, ROTS, RTS, RWTS, SVTS, TTS and WMTS
Estimated Capital Cost	\$0
Operating Cost	\$5,300k
Priority Project Outcome	Provision of report detailing the fault level capability of the equipment, structures and earth grid at the nine specified terminal stations.
Reasons to undertake the project:	
The fault level capability of some existing equipment, structures and earth grids at the above terminal stations may limit future operation of these terminal stations at higher fault levels. This study will establish each component's fault capability and hence the maximum fault level that the terminal station can be operated at should network fault levels increase in future due to new generation connections or major network augmentations.	

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Benefits:

This project will ascertain whether the existing equipment and structures at the above terminal stations have a higher fault withstand capability than the existing maximum fault level or the fault withstand capability assigned to each component. The project will assist AEMO to identify the fault level mitigation works that would be required for new generation connections or future major augmentation of the transmission network.

3.18 Priority Project 18 - Identify works to increase the fault level withstand capability to 40kA at 220kV switchyard at HTS, KTS, MLTS, ROTS, RTS, RWTS, SVTS, TTS and WMTS

Transmission Circuit / Injection Point	Heatherton Terminal Station (HTS), Keilor Terminal Station (KTS), Moorabool Terminal Station (MLTS), Rowville Terminal Station (ROTS), Richmond Terminal Station (RTS), Ringwood Terminal Station (RWTS), Springvale Terminal Station (SVTS), Thomastown Terminal Station (TTS) and West Melbourne Terminal Station (WMTS)
Limit and Reason for the Limit	The fault level capability of some equipment, structures and earth grid may limit the maximum acceptable fault level of the terminal stations listed above following an increase in the system fault level as a result of a major augmentation or generation connection.
Project	Identify the works to be carried out on equipment and structures at the nominated nine terminal station 220 kV switchyards to increase the 220 kV fault level withstand capability to 40 kA.
Limit Addressed	Identify works required to increase the 220 kV fault level withstand capability to 40 kA at the specified terminal stations
Project Description	Prepare a report that describes the works to increase the fault level withstand capability of the 220kV switchyards to 40kA for equipment and structures at HTS, KTS, MLTS, ROTS, RTS, RWTS, SVTS, TTS and WMTS.
Estimated Capital Cost	\$0
Operating Cost	\$400k
Priority Project Outcome	Provision of high level scope of works to increase the fault level withstand capability to 40kA at HTS, KTS, MLTS, ROTS, RTS, RWTS, SVTS, TTS and WMTS.
Reasons to undertake the project:	
To facilitate future works to increase the fault level withstand capability of the nominated nine 220 kV terminal stations to 40 kA.	
Benefits:	
Identify options to increase the fault level capability at the most limiting terminal stations. This project would allow economical replacement of the fault level limiting elements when the system fault level increases or to accommodate new generation connections.	

3.19 Priority Project 19 – Geelong–Moorabool 220kV circuits (No. 1 & No. 2)

Transmission Circuit / Injection Point	Geelong–Moorabool No.1 and 2 220 kV circuits [Limiting element at Geelong Terminal Station (GTS)]
Limit and Reason for the Limit	The Geelong–Moorabool 220 kV circuits are rated at 827 MVA (continuous rating at 35 °C). Both lines are single switched at GTS. The MLTS No.1 220kV line No.2 bus side ROI (remote operated isolator) and the MLTS No.2 220kV line side isolator are rated 800 MVA and 819 MVA respectively. Both these isolators are limiting the line capacity.
Project	Replacement of two 220kV isolators connecting the MLTS No.1 line and MLTS No.2 line at GTS
Limit Addressed	Loading constraint of the Geelong–Moorabool No.1 and 2 220 kV circuits
Project Description	Replacement of two 220kV isolators connecting the MLTS No.1 and MLTS No.2 lines at GTS to enable full use of the line capacity.
Present Limit	Ratings of Geelong-Moorabool No.1 220 kV circuit: 800 MVA continuous and

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	Geelong-Moorabool No.2 220 kV circuit: 819 MVA continuous
Target	Rating of Geelong-Moorabool No.1 and 2 220 kV circuits: 827 MVA continuous
Capital Cost	\$871k
Operating Cost	\$0
Priority Project Outcome	Full use of line capacity of 827 MVA for the Geelong–Moorabool No.1 and 2 220kV circuits.
<p>Reasons to undertake the project: Approximately 27 MVA rating increase on the two Moorabool-Geelong 220 kV circuits is expected with replacement of isolators at GTS. This increase in rating would avoid or minimise potential load shedding from 2016/17 onwards due to forecast load growth at Geelong Terminal Station. However the increase in demand growth could be slowed down due to the closure of the Ford manufacturing plant. This project would increase the reliability of supply to customers connected to Geelong and Point Henry Terminal Stations.</p>	
<p>Benefit: AEMO's 2013 Victorian Annual Planning Report assessment identified net market benefit for replacing isolators on the Geelong-Moorabool 220 kV circuits for 2016/17 and 2017/18 of \$182,000 and \$472,000 respectively. The gross market benefits for 2016/17 and 2016/17 are \$288,000 and \$578,000 respectively.</p>	

3.20 Priority Project 20 – Geelong Terminal Station (GTS)

Transmission Circuit / Injection Point	Geelong Terminal Station (GTS)
Limit and Reason for the Limit	The summer cyclic rating of the secondary winding of the B2 and B4 220/66kV transformers at GTS are 1481A and 1565A respectively. The transformer capacity is limited by the 66kV interplant connections with a lower rating of 1460 A. This is due to incorrect equipment ratings recorded in RADAR (SP AusNet database).
Project	Review and uprate equipment ratings in RADAR
Limit Addressed	Loading constraint of the B2 and B4 220/66kV transformers at GTS
Project Description	Review and uprate equipment ratings in RADAR
Present Limit	GTS 220/66 kV B2 transformer rating 169 MVA and limited by interplant connection rating of 167 MVA; and GTS 220/66 kV B4 transformer rating 179 MVA and limited by interplant connection rating of 167 MVA
Target Limit	GTS 220/66 kV B2 transformer rating 169 MVA; and GTS 220/66 kV B4 transformer rating 177 MVA
Capital Cost	\$0
Operating Cost	\$0
Priority Project Outcome	Increase limiting factor of the secondary winding of the B2 and B4 220/66kV transformer at GTS to 1481A and 1550A respectively. (The B4 transformer is limited by a 66kV interplant connection rated at 1550A that has insufficient benefit to proceed with the replacement of the interplant connection.)
<p>Reasons to undertake the project: The 66kV interplant connections are limiting the 220/66 kV transformation capacity at GTS due to incorrect equipment ratings recorded in RADAR (SP AusNet database).</p>	
<p>Benefit: The database will be reviewed and updated by SP AusNet.</p>	

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3.21 Priority Project 21 – Moorabool - Mortlake No.2 500kV circuit & Moorabool - Tarrone No.1 500kV circuit

Transmission Circuit / Injection Point	Moorabool - Mortlake No.2 500kV circuit & Moorabool - Tarrone No.1 500kV circuit [Limiting element at Moorabool Terminal Station (MLTS)]
Limit and Reason for the Limit	The Moorabool - Mortlake No.2 500kV circuit and Moorabool - Tarrone No.1 500kV circuit are both rated at 2858 MVA (continuous) at 35 °C. The secondary protection relays for these two lines have a lower rating setting of 2165 MVA at MLTS. The relay settings are incorrectly recorded in SP AusNet's TRESIS database.
Project	Review and uprate protection settings in TRESIS
Limit Addressed	Line loading constraint
Project Description	Review and uprate protection settings in TRESIS sheet Nr. 48038 (X prot-P546), Nr. 48039 (Y prot-L90), Nr. 48689 (X prot-P546) and Nr. 48688 (Y prot-L90)
Present Limit	Moorabool-Mortlake No.2 500 kV circuit capability is 2165 MVA; and Moorabool-Tarrone No.1 500 kV circuit capability is 2165 MVA
Target Limit	Moorabool-Mortlake No.2 500 kV circuit capability is 2858 MVA; and Moorabool-Tarrone No.1 500 kV circuit capability is 2858 MVA
Capital Cost	\$0
Operating Cost	\$0
Priority Project Outcome	Remove the protection constraints for both the Moorabool - Mortlake No.2 500kV circuit and Moorabool - Tarrone No.1 500kV circuit
Reasons to undertake the project: The secondary equipment is limiting the line capacity due to incorrect protection settings recorded in TRESIS (SP AusNet database). The database will be reviewed and updated by SP AusNet.	
Benefit: Increase protection limits of Moorabool-Mortlake No.2 and Moorabool-Tarrone No.1 500 kV circuits by 600 MVA.	

3.22 Priority Project 22 – Horsham Terminal Station (HOTS)

Transmission Circuit / Injection Point	Horsham Terminal Station (HOTS)
Limit and Reason for the Limit	The summer cyclic rating of the secondary windings of the HOTS B2 and B3 220/66kV transformers are 1047A. The B2 and B3 transformer capacity at HOTS is limited by transformer secondary protection relays with a lower rating of 924 A.
Project	Protection setting change of the Duo-Bias relays at HOTS
Limit Addressed	Loading constraint of the B2 and B3 220/66kV transformers at HOTS
Project Description	High Voltage Overcurrent Settings on the Duo-Bias relays are limiting the transformer capacity. Change the protection settings to achieve required limits and test relays on site.
Present Limit	HOTS 220/66 kV B2 and B3 transformer rating 120 MVA and limited by protection limit of 106 MVA
Target Limit	HOTS 220/66 kV B2 and B3 transformer capability 120 MVA.
Capital Cost	\$0
Operating Cost	\$14k
Priority Project Outcome	Increase limiting factor of the secondary winding of the HOTS B2 and B3 220/66kV transformers to 1047A.
Reasons to undertake the project: This project increases the 220/66 kV transformation capacity at HOTS	
Benefit: Increase of transformer capacity. Based on 2012 connection point forecasts, additional capacity will be	

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beneficial beyond the next 5 years.

Attachment 1 – Network Limits

This attachment is Commercial-In-Confidence.