

# 1. AusNet Services' Asset Renewal Plan

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This section outlines AusNet Services' asset management strategy and approach, and lists the planned asset retirements and asset renewal projects planned for the next 10-year period. The asset renewal plan addresses asset failure risk based on asset condition and network performance. It also considers other operational factors that affect the economic service life of the electricity transmission assets.

AusNet Services' asset renewal plan does not propose any network changes that will have a material inter-network impact and AusNet Services has liaised with AEMO to integrate the asset renewal plan with AEMO's transmission augmentation plan for Victoria as well as AEMO's National Transmission Network Development Plan (NTNDP) and Integrated System Plan (ISP).

AEMO and AusNet Services confirm that the 2018 Asset renewal plan is aligned with the most recent NTNDP and the development strategies for current or potential national transmission flow paths that are specified in the NTNDP. No issues have been identified in the 2018 Asset renewal plan that may impact on any of the system constraints identified in the Transmission Annual Planning Report.

AEMO has also been consulted to review and assess the asset renewal plan in relation to the most recent power system frequency risk review.

Non-network options are considered in AusNet Services' asset renewal approach once an identified need has been determined and include options such as demand side response and embedded generation.

## **Asset management strategy, asset renewal approach and asset renewal objectives**

AusNet Services' electricity transmission Asset Management Strategy (AMS) provides robust technical direction for the responsible stewardship of electricity transmission assets that AusNet Services manages as a service to Victoria's energy users and the National Electricity Market (NEM).

The AMS is central to AusNet Services' Electricity Safety Management Scheme (ESMS) for managing Victoria's electricity transmission assets and the delivery of quality services to customers and value to shareholders. It summarises the medium term strategic actions for achieving regulatory and business performance targets, which are implemented via the programs of work.

The AMS is underpinned by the regulatory and commercial imperatives of delivering efficient cost and service performance. It recognises that cost and service efficiency does not mean lowest possible cost, nor does it mean guaranteed reliability. Instead, efficiency requires the costs and benefits of all expenditure decisions to be weighed against one another. A key element in this cost benefit analysis is the consideration of risk in relation to asset performance and network reliability.

AusNet Services' ongoing commitment to maintain compliance with the ISO 55001 standard ensures an auditable asset management system facilitating customer's expectations to safely maintain the quality, reliability and security of supply in an economic manner.

The objective of asset renewal is to achieve sustainable outcomes in the following areas:

- Safety of customers, the community and workers
- Quality, reliability and security of electricity transmission services
- Compliance with regulation, codes, licences, contracts and industry standards
- Minimising total life cycle costs through the consideration of capital costs, operation and maintenance costs and operational risk costs
- Minimising the volatility of renewal works and associated material, skill and revenue requirements
- Minimising project delivery risks and the potential impact of renewal works on network availability, market participants and connected parties
- Minimising immediate and future environmental impacts
- Minimising network security risks by replacing obsolete protection and control equipment that is no longer supported by manufacturers
- Modernisation of protection and control systems to provide remote interrogation and diagnostics

## Asset renewal options

Renewal on Performance Risk is employed to optimise the lifecycle cost of assets through consideration of health, safety and environmental factors as well as the community cost based on the performance of the assets. This strategy requires sufficient asset condition and performance monitoring to predict deterioration of the respective plant with sufficient lead-time to enable renewal prior to failure.

The following asset renewal options are considered in the asset renewal evaluation and project specification:

- Renewal by Asset Class is employed when a class of assets has either a higher than acceptable failure rate or exhibits a higher deterioration rate than its peers. This approach avoids wide spread deterioration in network performance due to multiple, asset class-related failures.
- Selective or Staged Replacement
- Renewal on a Bay-by-Bay (or Scheme/Network) basis is employed when it is economic to replace all primary plant and equipment within a specific bay or scheme. This strategy is often adopted for terminal station renewals.
- Replacement of Whole Station in Existing Location (Brownfield) is employed when it is economic to replace most assets as part of a single, coordinated project within the existing station (normally when station assets are approaching the end of their life and there are advantages in reconfiguring primary electrical circuits).
- Replacement of Whole Station in New Location (Greenfield) is employed for the construction of a replacement station on a new site. It is a more expensive strategy than works within an existing station due to the need to procure new land, establish key infrastructure, and to relocate lines. It is usually only economic when the existing infrastructure is inadequate and replacement works cannot occur without a sustained supply disruption due to limitations at the existing site.

## 10-year asset renewal plan

The 10-year plan (in calendar years) focuses on major asset renewal projects and has been finalised with input from AEMO in accordance with the integrated planning approach agreed with AEMO.

The description of the proposed replacement in Table 1 includes the main plant items. AusNet Services is undertaking asset condition surveys to quantify specific line works and the asset renewal plan allows for expected needs, such as the replacement of insulators and corroded conductors.

The project completion dates provide an indication of the likely timing of these projects and are subject to further analysis prior to committing to deliver these projects. A higher degree of uncertainty is placed on projects scheduled for the later part of the ten-year planning period. The cost estimates provided are indicative and could vary significantly due to factors such as the circuit outages required to safely implement the asset renewal. The cost estimates allow for the entire project cost including project management cost, overheads and finance cost.

Wherever possible, asset renewal works are planned at times that minimise the impact of circuit outages. The plan is subject to change based on the results of further asset condition analysis, asset failures necessitating a reprioritisation of projects and regulatory revenue decisions.

Five major redevelopment projects are planned to be completed during the ten year planning period namely Richmond, West Melbourne, East Rowville, Springvale and Red Cliffs terminal stations. The Richmond, West Melbourne, East Rowville and Springvale redevelopment projects are currently in their build phases.

Different replacement options for the Keilor 500/220 kV transformers are being considered in a joint study with AEMO to identify the most economic replacement option.

No urgent or unforeseen network issues have been identified to date.

Other than for minor scope, project completion date and estimated cost changes, no significant changes are reported in the current plan compared with last years' plan.

Table 1 provide the ten year asset retirement and renewal plan and Table 2 provides more details regarding the network constraints.

## Further information on the asset management strategy and methodology

Further information on the asset management strategy and methodology can be obtained by contacting the following person at AusNet Services:

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**Table 1: Ten-year asset renewal plan (cost estimates are in 2018 dollars)**

Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
YPS 220kV Circuit Breaker Replacement Stage 1	Yallourn Power Station Switchyard	21	2018	Seven 220kV Circuit Breakers and the associated Current Transformers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	Asset retirements are in progress and will continue in 2018	Switching/ generation constraints	Seven 220kV Circuit Breakers	Refurbishment, integrated replacement and staged replacement.	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change to in service date
FBTS 220kV and 66kV Circuit Breaker Replacement Stage 1	Fishermens Bend Terminal Station	17	2018	One 220kV Circuit Breaker and nine 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2018 to 2020	Load at risk	One 220kV Circuit Breaker and nine 66kV Circuit Breakers	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
SMTS 330/220kV Transformer Replacement - Stage 1	South Morang Terminal Station	34	2018	One 700 MVA 330/220 kV transformer	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	Asset retirements are in progress and will continue in 2018	Load at risk	One 700 MVA 330/220 kV transformer and 330kV switched bay	Integrated replacement, staged replacement, replacement with single phase or three phase transformers and replacement with larger transformers in consultation with AEMO	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
RTS Redevelopment	Richmond Terminal Station	188	2018	Five 150MVA 220/66kV transformers, two 165MVA 220/22kV transformers, 220kV switchyard, 66kV switchyard and 22kV switchyard	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	Asset retirements are in progress and will continue in 2018	Load at risk	Three 225MVA 220/66kV transformers, two 75 MVA 220/22 kV transformers, three breaker-and-half 220kV GIS switch bays, four 66kV GIS busses, 22kV GIS switchboard and associated protection and control systems	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
RWTS B4 Transformer and 66kV Circuit Breaker Replacement	Ringwood Terminal Station	16	2018	One 150 MVA 220/66kV transformer and six 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	Asset retirements are in progress and will continue in 2018	Load at risk	One 150 MVA 220/66kV transformer and six 66kV Circuit Breakers	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
HWPS 220kV Circuit Breaker Replacement - Stage 4	Hazelwood Power Station Switchyard	24	2019	Seven 220kV circuit breakers, nine current transformers, nine voltage transformers and thirty-nine disconnectors	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2018 to 2019	Load at risk	Seven 220kV circuit breakers, nine current transformers, nine voltage transformers and thirty-nine disconnectors	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change to Scope, cost & completion date
LYPS and HWTS 500kV Circuit Breaker Replacement Stage 1	Loy Yang Power Station Switchyard and Hazelwood Terminal Station	29	2019	Four 500kV circuit breakers, six 500kV current transformers and two 500kV voltage transformers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2018 to 2019	Switching/ generation constraints	Eight 500kV circuit breakers, six 500kV current transformers and two 500kV voltage transformers	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change to Scope, cost & completion date
HYTS 500kV switchgear replacement	Heywood Terminal Station	10	2019	500 kV instrument transformers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2018 to 2019	Switching constraints	Two 500kV circuit breakers and associated equipment	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change to in service date and cost estimate

Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
Transmission fall arrest installation program	Different locations of the transmission network	20	2019	None	Safety risk mitigation	N/A	Safety risk	Install fall arrests	Do Nothing (i.e. continue with the use of dual lanyard); Defer project to next Reset and Do installation work	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
Upgrade SCADA at Non-SCIMS and Old SCIMS Sites	Newport, Sydenham, Moorabool, Jeeralang, Rowville, Loy Yang, East Rowville, Springvale, Tyabb and Templestowe Terminal Stations	7	2019	Selected obsolete SCADA systems at Non-SCIMS and old SCIMS sites at 10 Stations	Obsolete technology. Compliance obligation.	2018 - 2019	Load at risk	Replace obsolete secondary assets with current standard equipment	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project	No change
ROTS No.2 SVC Controls and Protection Replacement.	Rowville Terminal Station	10	2020	ROTS No.2 SVC Controls and Protection Replacement.	Obsolete technology. Compliance obligation.	2019 - 2020	Load at risk	Replace with current standard assets	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change
North West Communication Network Replacement	Between Bendigo and north of Horsham	40	2020	Power Line Carrier (PLC) assets	Obsolete technology	2018 to 2020	Switching/ generation constraints	Combination of fibre optic and microwave technology	Business as usual, replace with fibre optic & microwave and replace with fibre optic	A request for proposal will not be issued for this project as it is a committed project	change to scope, cost & completion date (Four projects in the previous plan combined achieving delivery efficiency)
OTN Replacement program	Several terminal stations	7	2020	Telephony Network at 48 terminal stations	Obsolete technology. Compliance obligation.	2019 - 2020	Load at risk	Telephony Network at 48 terminal stations	Do nothing or End of Life replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
RS Battery & Charger Replacements 1	Several locations	10	2020	Selected obsolete communication and control batteries	End of Life replacement	2017-2020	Load at risk	Replace with current standard assets	Business as usual or asset replacement	A request for proposal will not be issued for this project as it is a committed project	No change
FBTS Transformer and circuit breaker replacement	Fishermens Bend Terminal Station	18	2020	One 150 MVA 220/66kV transformer, one 220kV circuit breakers and four 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2019 to 2020	load at risk (Refer Table 2 for details)	One 150 MVA 220/66kV transformer, one 220kV circuit breakers and four 66kV Circuit Breakers	Integrated replacement, staged replacement and replacement with larger transformers	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change in scope and cost
ERTS Redevelopment - Stage 1	East Rowville Terminal Station	14	2020	One 150 MVA 220/66kV transformer, two 220kV circuit breakers and three 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2019 to 2020	load at risk (Refer Table 2 for details)	One 150 MVA 220/66kV transformer, two 220kV circuit breakers and three 66kV Circuit Breakers	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change in scope and cost
WMTS Redevelopment	West Melbourne Terminal Station	128	2021	Four 150MVA 220/66kV transformers, 220kV switchyard, 66kV switchyard and 22kV switchyard	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2018 - 2021	Load at risk	Three 225MVA 220/66kV transformers, four breaker-and-half 220kV GIS switch bays, two 66kV GIS busses, 22kV GIS switchboard and associated protection and control systems	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	No change

Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
SVTS Redevelopment	Springvale Terminal Station	53	2021	Three 150 MVA 220/66kV transformers, four 220kV circuit breakers and nineteen 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2019 - 2021	Load at risk	Three 150 MVA 220/66kV transformers, twelve 220kV circuit breakers and nineteen 66kV Circuit Breakers	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	A request for proposal will not be issued for this project as it is a committed project and is already in its build phase	Change in cost estimate
Critical relay replacement at various terminal stations Stage 1 & 2	Several terminal stations	8	2021	Obsolete protection relays	Obsolete technology. Compliance obligation.	2020 to 2021	Load at risk	Replace with current standard assets	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
TSTS B2 Transformer and 66kV Circuit Breaker Replacement	Templestowe Terminal Station	34	2022	One 150 MVA 220/66kV transformer and thirteen 66kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2021 to 2022	load at risk (Refer Table 2 for details)	One 150 MVA 220/66kV transformer and thirteen 66kV Circuit Breakers	Integrated replacement, staged replacement, demand side management, embedded generation and retirement	2019	Change to completion date
HOTS SVC Controls and Protection Replacement	Horsham Terminal Station	9	2022	Selected SVC Controls and Protection assets	Obsolete technology. Compliance obligation.	2021 to 2022	Load at risk	Replace with current standard assets	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
Transmission ground wire & conductor replacement	KTS-BLTS, TTS-KTS, ROTS-RTS, DDTS-SMTS, HWPS-ROTS and YPS-ROTS transmission lines	18	2022	Selected groundwire & conductor sections	Condition and risk based replacement	2021 to 2022	Load at risk	Replace with new groundwire & conductor	Defer the work, selected asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
Transmission fall arrest installation program	SYTS-MLTS, MLTS-TRTS, MLTS-MOPS, MLTS-HYTS and HYTS-APD 500kV lines	16	2022	None	Safety risk mitigation	2021 to 2022	Safety risk	Install fall arrests	Do Nothing (i.e. continue with the use of dual lanyard); Defer project to next Reset and Do installation work	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
DC Supply Upgrade Stage 3	Ballarat, East Rowville, Frankston, Kerang, Shepparton, South Morang and Sydenham terminal stations	14	2023	Selected DC supply assets	Replacement of obsolete systems. Compliance	2022 to 2023	Load at risk	Replace obsolete secondary assets with current standard equipment	Integrated replacement and staged replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
Moorabool Terminal Station Circuit Breaker Replacement	Moorabool Terminal Station	25	2023	Eight 500kV circuit breakers and ten 500kV voltage transformers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2022 to 2023	Switching constraints	Eight 500kV circuit breakers and ten 500kV voltage transformers	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	Change in cost estimate



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SMTS 330/220kV Transformer Replacement - Stage 2	South Morang Terminal Station	35	2023	One 700 MVA 330/220 kV transformer	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2022 to 2023	load at risk (Refer Table 2 for details)	One 700 MVA 330/220 kV transformer and a spare phase	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2020	Change to completion date
MWTS 66kV Circuit Breaker Replacement	Morwell Terminal Station	10	2024	Thirteen 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	Thirteen 66kV circuit breakers	Integrated replacement, staged replacement, demand side management, embedded generation and retirement	2021	Change to in service date and cost estimate
RCTS Transformer and Circuit Breaker Replacement	Red Cliffs Terminal Station	18	2024	Two 70MVA 220/66kV transformers, two 21.5MVA 220/22kV transformers and two 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer, two 20/33 MVA 66/22kV transformers and two 66kV circuit breakers	Integrated replacement, staged replacement, demand side management, embedded generation and retirement	2021	Change in cost estimate
KGTS B2 and B3 Transformer and Circuit Breaker Replacement	Kerang Terminal Station	18	2024	Two 37MVA 220/66kV transformers and two 22kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	Two 37MVA 220/66kV transformers and two 22kV circuit breakers	Integrated replacement, staged replacement, replacement with larger transformers, demand side management, embedded generation and retirement	2021	Change in cost estimate
FBTS B3 Transformer and Circuit Breaker Replacement	Fishermens Bend Terminal Station	10	2024	One 150MVA 220/66kV transformer and four 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer and four 66kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2021	Change in scope and cost
RWTS B3 Transformer Replacement	Ringwood Terminal Station	10	2024	One 150MVA 220/66kV transformer	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2021	No change
LYPS and HWTS 500kV Circuit Breaker Replacement Stage 2	Loy Yang Power Station Switchyard and Hazelwood Terminal Station	40	2024	Fourteen 500kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	Switching/ generation constraints	Fourteen 500kV circuit breakers	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	New project
GTS B4 Transformer and 66kV Circuit Breaker Replacement	Geelong Terminal Station	16	2024	One 150MVA 220/66kV transformer and six 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2023 to 2024	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer and six 66kV circuit breakers	Integrated replacement, staged replacement, replacement with larger transformers, demand side management, embedded generation and retirement	2021	New project
TTS B4 Transformer and 66kV Circuit Breaker Replacement	Thomastown Terminal Station	25	2025	One 150MVA 220/66kV transformer and eleven 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer and eleven 66kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2022	Change to completion date

Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
BLTS 220kV, 66kV and 22kV Circuit Breaker Replacement	Brooklyn Terminal Station	19	2025	Four 220kV circuit breakers, thirteen 66kV circuit breakers and three 22kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	Four 220kV circuit breakers, thirteen 66kV circuit breakers and three 22kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2022	No change
Transmission line insulator replacement project	MLTS-TRTS, MLTS-MOPS, KTS-GTS, KTS-WMTS and TTS-KTS lines	35	2025	Selected insulators	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	Load at risk	New insulators	Business as usual, Defer the work and asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No Change
WOTS 330kV and 66kV Circuit Breaker Replacement	Wodonga Terminal Station	18	2025	Four 330kV circuit breakers and six 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	Four 330kV circuit breakers, six 66kV circuit breakers and one spare 75MVA 330/66kV transformer	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2022	No change
LY 66kV Circuit Breaker Replacement	Loy Yang 66kV Switch Yard	14	2025	Sixteen 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	Sixteen 66kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2022	No change
TSTS B3 Transformer Replacement	Templestowe Terminal Station	9	2025	One 150MVA 220/66kV transformer and one 66kV circuit breaker	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	One 150MVA 220/66kV transformer and one 66kV circuit breaker	Integrated replacement and staged replacement, replace with larger or smaller transformers, asset retirement, demand side management and embedded generation.	2022	No change
ROTS 220kV Circuit Breaker Replacement	Rowville Terminal Station	6	2025	Five 220kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2025	load at risk (Refer Table 2 for details)	Five 220kV circuit breakers	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
KTS A2, A3 and A4 500/220kV and B4 220/66kV Transformer Replacement	Keilor Terminal Station	55	2026	Three 750MVA 500/220kV transformers and one spare phase. One 150MVA 220/66kV transformer	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2024 to 2026	load at risk (Refer Table 2 for details)	Two 1000MVA 500/220kV transformers and a spare phase, one 150MVA 220/66kV transformer	Integrated replacement and staged replacement, replace with larger or smaller transformers, asset retirement, demand side management and embedded generation.	2022	Change to completion date
ERTS Redevelopment - Stage 2	East Rowville Terminal Station	24	2026	Two 150MVA 220/66kV transformers and fifteen 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2025 to 2026	load at risk (Refer Table 2 for details)	Two 150MVA 220/66kV transformers and fifteen 66kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2023	Change in scope and cost
TBTS B1 and B2 Transformer Replacement	Tyabb Terminal Station	17	2026	Two 150MVA 220/66kV transformers, one 220kV circuit breakers and four 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2025 to 2026	load at risk (Refer Table 2 for details)	Two 150MVA 220/66kV transformers, one 220kV circuit breakers and four 66kV circuit breakers	Integrated replacement, staged replacement, asset retirement, demand side management, embedded generation and retirement	2023	No change



Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
Transmission line conductor and ground-wire replacement project at 500kv lines along South-West area	SYTS-MLTS, MLTS-HYTS and HYTS-APD 500kV lines	48	2026	Selected groundwire & conductor sections	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2025 to 2026	Load at risk	Replace with new groundwire & conductor sections	Business as usual, Defer the work and asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
OPGW on ROTS-YPS No.5 & 6 Lines	ROTS-YPS No.5 & 6 Lines	7	2026	Selected groundwire sections	Obsolete technology. Compliance obligation.	2025 to 2026	Switching/ generation constraints	Optical Ground Wire (OPGW)	Business as usual, Defer the work and asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
YPS 220kV Circuit Breaker Replacement Stage 2	Yallourn Power Station Switchyard	27	2026	Eleven 220kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2025 to 2026	load at risk (Refer Table 2 for details)	Eleven 220kV circuit breakers	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	No change
SMTS 500kV GIS Replacement	South Morang Terminal Station	70	2026	Fifteen 500kV GIS circuit breakers and associated equipment	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2025 to 2026	load at risk (Refer Table 2 for details)	Fifteen 500kV GIS circuit breakers and associated equipment	Integrated replacement, staged replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	New Project
Transmission line conductor and ground-wire replacement project at 500kv lines along Latrobe valley	LYPS-HWTS, HWTS-CBTS, SMTS-SYTS and HWTS-ROTS 500kV lines	65	2027	Selected groundwire & conductor sections	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2026 to 2027	Load at risk	Replace with new groundwire & conductor sections	Business as usual, Defer the work and asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	New Project
SHTS B2 and B3 Transformer Replacement	Shepparton Terminal Station	17	2027	Two 150MVA 220/66kV transformers and five 66kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2027 - 2028	load at risk (Refer Table 2 for details)	Two 150MVA 220/66kV transformers and five 66kV circuit breakers	Business as usual, asset replacement, demand side management, embedded generation and retirement	2024	New Project
DDTS H3 330/220kV Transformer and 330kV Circuit Breaker Replacement	Dederang Terminal Station	20	2028	One 340MVA 330/220kV transformer and two 330kV Circuit Breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2027 - 2028	load at risk (Refer Table 2 for details)	One 340MVA 330/220kV transformer and two 330kV Circuit Breakers	Integrated replacement and staged replacement, replace with larger or smaller transformers, asset retirement, demand side management and embedded generation.	2025	New Project
GTS 220 kV Circuit Breaker Replacement	Geelong Terminal Station	9	2028	Five 220kV circuit breakers	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2027 - 2028	load at risk (Refer Table 2 for details)	Five 220kV circuit breakers	Business as usual, asset replacement and retirement	A request for proposal will not be issued for this project as it is a committed project	New Project
SMTS F2 Transformer and associated switchgear Replacement	South Morang Terminal Station	30	2028	1000MVA 500/330kV transformer with associated switchgear	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2026 - 2028	load at risk (Refer Table 2 for details)	1000MVA 500/330kV transformer with associated switchgear	Business as usual, asset replacement, demand side management, embedded generation and retirement	2024	New Project
Transmission line insulator replacement	ROTS-MTS, ROTS-RTS, NPSD-FBTS, FBTS-BLTS, CBTS-TBTS and CBTS-FTS lines	41	2028	Selected insulators	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2027 - 2028	Load at risk	New insulators	Business as usual, Defer the work and asset replacement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	New Project

Project Name	Location	Total Cost (Real \$M)	Target Completion (December)	Network Assets to be Retired	Reasons for Retirement	Date of Retirement	Constraints	Proposed Replacement	Options Considered	Request for Proposal Date	Changes Compared with Last Plan
SYTS 500kV GIS Replacement	Sydenham Terminal Station	50	2028	Five 500kV GIS CBs and associated equipment	Condition and age of assets presenting a safety, supply, environmental and collateral damage risk in the event of an asset failure.	2027 - 2028	Switching constraints	Five 500kV GIS CBs and associated equipment	Business as usual, asset replacement and retirement	A request for proposal will not be issued for this project as no alternative non-network solution is envisaged.	New Project

**Table 2: Detailed information of projects**

Project Name	TSTS B2 Transformer and 66kV Circuit Breaker Replacement										
Location of Constraint	630 - 658, Blackburn Road, Templestowe										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	450MVA										
Load forecast	<b>TSTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	377.3	377.6	377.0	374.5	371.3	369.9	374.1	379.7	380.5	380.9
	Summer50	328.3	330.0	329.2	325.6	325.7	325.4	325.2	329.5	328.9	331.1
	Winter10	241.5	240.2	239.5	238.1	236.7	236.2	234.6	233.5	233.5	232.7
	Winter50	233.9	232.3	231.8	230.5	228.6	227.9	226.4	225.0	224.6	223.8
Maximum energy at risk	24MWh in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Hours of load at risk	2 Hrs in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Value of Customer Reliability used	33,688 (\$/MWh)										
Expected unserved energy	0.2MWh (at 10 <sup>th</sup> percentile demand forecast)										
Cost of expected unserved energy	\$5,200 (at 10 <sup>th</sup> percentile demand forecast)										
Preferred network solution	Asset replacement										
Proposed timing	2022										
Existing generation at the location	One embedded generation unit over 1 MW										
Historic use of existing generation	No net generation to TSTS during 2017										
Emergency transfer capability	55MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										
Historic load trace											
Historic asset utilisation	75%										
Customer number and type at location	Number of Customers		Consumption								
	Residential	79,397		61.39%							
	Commercial	4,244		30.97%							
	Industrial	201		7.53%							

	Agricultural	81	0.12%
	Station peak demand – 306MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 22.4kA (3ph) 66kV – More than 21.8kA (3ph)		
Reactive capability of equipment	One 200MVAR 220kV cap bank One 50MVAR 66kV cap bank		
Forecast load flow	Same as load forecast in the above table		

Project Name	Moorabool Terminal Station Circuit Breaker Replacement		
Location of Constraint	680, Ballan Road, Moorabool		
Element	Switching station		
Constraint type	Switching constraints		
Existing element rating	2000MVA		
Load forecast	No directly connected load (switching station)		
Maximum load at risk	No directly connected load (switching station)		
Hours of load at risk	No directly connected load (switching station)		
Value of Customer Reliability used	41,410 (\$/MWh)		
Expected unserved energy	No directly connected load (switching station)		
Cost of unserved energy	No directly connected load (switching station)		
Preferred network solution	Asset replacement		
Proposed timing	2023		
Existing generation at the location	No directly connected generation		
Historic use of existing generation	Not applicable		
Emergency transfer capability	No directly connected load (switching station)		
Historic use of existing transfer capability	Not applicable		
Historic load trace			
Historic asset utilisation	47%		
Customer number and type at location	No directly connected load (switching station)		

Historic outage at location	No station black during last 5 years
Fault rating of equipment	500kV – More than 15.3kA (3ph) 220kV – More than 23.8kA (3ph)
Reactive capability of equipment	Two 150MVAR 220kV cap banks Two 100MVAR 500kV reactors One 100MVAR 220 kV reactor
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 200 -1000MVA.

Project Name	MWTS 66kV Circuit Breaker Replacement											
Location of Constraint	Monash Way. Morwell.											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	465MVA											
Load forecast	<b>MWTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	424.7	420.2	411.7	408.5	396.3	386.4	392.9	393.4	390.3	389.4	
	Summer50	389.9	387.3	381.3	375.2	374.3	366.6	367.8	371.5	367.2	369.2	
	Winter10	352.7	349.6	347.8	350.8	348.9	350.5	350.3	343.1	346.0	348.9	
	Winter50	343.0	338.6	337.8	342.6	340.5	340.9	341.4	335.3	336.4	337.5	
Maximum energy at risk	546MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast) 1,315MWh in 2017/18 (at 10 <sup>th</sup> percentile demand forecast)											
Hours of load at risk	18.9 Hrs in 2017/18 (at 50 <sup>th</sup> percentile demand forecast)											
Value of Customer Reliability used	38,863 (\$/MWh)											
Expected unserved energy	3.6MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast) 8.6MWh in 2017/18 (at 10 <sup>th</sup> percentile demand forecast)											
Cost of expected unserved energy	\$0.14 million in 2017/18 (at 50 <sup>th</sup> percentile demand forecast) \$0.33 million in 2017/18 (at 10 <sup>th</sup> percentile demand forecast)											
Preferred network solution	Asset Replacement											
Proposed timing	2024											
Existing generation at the location	229MW											
Historic use of existing generation	59MW during the 2016/17 peak demand 666,513MWh in 2017											
Emergency transfer capability	5MVA for summer 2017/18											
Historic use of existing transfer capability	Data not available											



Historic load trace			
Historic asset utilisation	80%		
Customer number and type at location		Number of Customers	Consumption
	Residential	133,599	34.17%
	Commercial	13,108	30.78%
	Industrial	2,100	23.81%
	Agricultural	18,605	11.24%
	Station peak demand – 405.6MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	66kV – More than 16.2kA (3ph) 22kV – More than 9.5kA (3ph)		
Reactive capability of equipment	No reactive assets		
Forecast load flow	Same as load forecast in the above table		

Project Name	RCTS Transformer and Circuit Breaker Replacement										
Location of Constraint	Pumps Road, Red Cliffs.										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	220/66kV – 280MVA 220/22kV – 70MVA										
Load forecast	<b>RCTS66 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	154.5	152.8	150.3	150.4	147.7	146.4	152.0	155.9	159.0	163.4
	Summer50	141.8	141.2	139.9	139.0	140.6	140.1	143.5	148.6	151.1	156.5
	Winter10	89.2	89.7	90.6	93.0	94.0	96.0	97.5	97.1	99.6	100.2
	Winter50	87.0	87.5	88.5	91.4	92.4	94.1	95.9	95.8	97.8	98.9
	<b>RCTS22 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	51.9	53.0	53.5	54.7	54.6	54.9	57.4	59.0	60.0	61.3
	Summer50	46.1	47.4	48.1	48.7	50.1	50.5	52.2	54.1	54.9	56.6
	Winter10	24.2	24.3	24.4	24.9	25.0	25.4	25.5	25.2	25.6	25.7
	Winter50	23.3	23.3	23.5	24.1	24.2	24.4	24.7	24.4	24.6	24.9
Maximum load at risk	None										
Hours of load at risk	Not applicable										
Value of Customer Reliability used	66kV – 41,588 (\$/MWh) 22kV – 41,624 (\$/MWh)										
Expected unserved energy	None										
Cost of unserved	Not applicable										

energy																
Preferred network solution	Asset Replacement															
Proposed timing	2024															
Existing generation at the location	4.42MW															
Historic use of existing generation	Data not available															
Emergency transfer capability	23.5MVA for summer 2017/18															
Historic use of existing transfer capability	Data not available															
Historic load trace																
Historic asset utilisation	57%															
Customer number and type at location	<table border="1"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>22,735</td> <td>31.69%</td> </tr> <tr> <td>Commercial</td> <td>2,716</td> <td>46.99%</td> </tr> <tr> <td>Industrial</td> <td>519</td> <td>15.38%</td> </tr> <tr> <td>Agricultural</td> <td>1,992</td> <td>5.94%</td> </tr> </tbody> </table> <p>Station peak demand – 148.2MW (66kV) Station peak demand – 39.9MW (22kV)</p>		Number of Customers	Consumption	Residential	22,735	31.69%	Commercial	2,716	46.99%	Industrial	519	15.38%	Agricultural	1,992	5.94%
	Number of Customers	Consumption														
Residential	22,735	31.69%														
Commercial	2,716	46.99%														
Industrial	519	15.38%														
Agricultural	1,992	5.94%														
Historic outage at location	No station black during last 5 years															
Fault rating of equipment	220kV – More than 4.0kA (3ph) 66kV – More than 8.4kA (3ph) 22kV – More than 6.5kA (3ph)															
Reactive capability of equipment	Two 40MVAR 220kV cap banks Two 11.1MVAR 66kV cap banks Two 8MVAR 22kV cap banks One 15MVAR 66kV reactor															
Forecast load flow	Same as load forecast in the above table															

Project Name	KGTS B2 and B3 Transformer and Circuit Breaker Replacement											
Location of Constraint	Loddon Valley Highway, Kerang.											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	109MVA											
Load forecast	<b>KGTS66 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	64.8	65.2	65.0	65.5	64.5	63.9	65.7	66.5	66.7	67.2	
	Summer50	57.2	57.8	57.9	57.9	58.6	58.2	59.1	60.4	60.4	61.5	

	Winter10	47.6	47.6	47.7	48.6	48.8	49.5	49.9	49.4	50.3	49.8
	Winter50	46.4	46.2	46.5	47.6	47.8	48.3	48.9	48.5	49.2	48.9
	<b>KGTS22 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	15.2	15.2	15.1	15.2	14.9	14.7	15.2	15.4	15.4	15.6
	Summer50	13.3	13.5	13.3	13.3	13.4	13.2	13.5	13.7	13.7	13.9
	Winter10	11.8	11.8	11.9	12.1	12.2	12.4	12.6	12.4	12.7	12.3
	Winter50	11.3	11.3	11.3	11.7	11.7	11.9	12.1	12.0	12.2	11.8
Maximum energy at risk	None										
Hours of load at risk	Not applicable										
Value of Customer Reliability used	36,805 (\$/MWh)										
Expected unserved energy	None										
Cost of expected unserved energy	Not applicable										
Preferred network solution	Asset Replacement										
Proposed timing	2024										
Existing generation at the location	None										
Historic use of existing generation	Not applicable										
Emergency transfer capability	1MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										
Historic load trace											
Historic asset utilisation	78%										
Customer number and type at location		Number of Customers				Consumption					
	Residential	13,202				52.62%					
	Commercial	2,112				30.49%					
	Industrial	447				1.97%					
	Agricultural	2,214				14.92%					
	Station peak demand –70.3MW										
Historic outage at location	No station black during last 5 years										
Fault rating of equipment	220kV – More than 3.1kA (3ph) 66kV – More than 3.9kA (3ph) 22kV – More than 7.4kA (3ph)										

Reactive capability of equipment	Two 15MVAR 66kV cap banks One 5.9MVAR 22kV cap bank One 19.4 MVAR 66kV reactor
Forecast load flow	Same as load forecast in the above table

Project Name	TTS B4 Transformer and 66kV Circuit Breaker Replacement											
Location of Constraint	15, High Street, Thomastown.											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	750MVA											
Load forecast	<b>TTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	549.8	552.5	553.4	545.7	542.4	543.0	544.9	553.0	549.4	551.0	
	Summer50	503.9	506.9	508.9	500.4	499.2	501.8	501.1	507.9	505.8	508.0	
	Winter10	420.1	423.2	426.3	421.6	421.1	425.5	425.6	430.1	434.2	438.4	
	Winter50	409.6	412.3	415.8	411.0	410.1	414.2	414.3	418.9	422.3	425.8	
Maximum energy at risk	None											
Hours of load at risk	Not applicable											
Value of Customer Reliability used	40,028 (\$/MWh)											
Expected unserved energy	None											
Cost of expected unserved energy	Not applicable											
Preferred network solution	Asset replacement											
Proposed timing	2025											
Existing generation at the location	20MW											
Historic use of existing generation	25,895MWh in 2017											
Emergency transfer capability	67.2MVA for summer 2017/18											
Historic use of existing transfer capability	Data not available											
Historic load trace												
Historic asset utilisation	54%											
Customer number and type at location	Number of Customers			Consumption								
	Residential	147,803			32.12%							

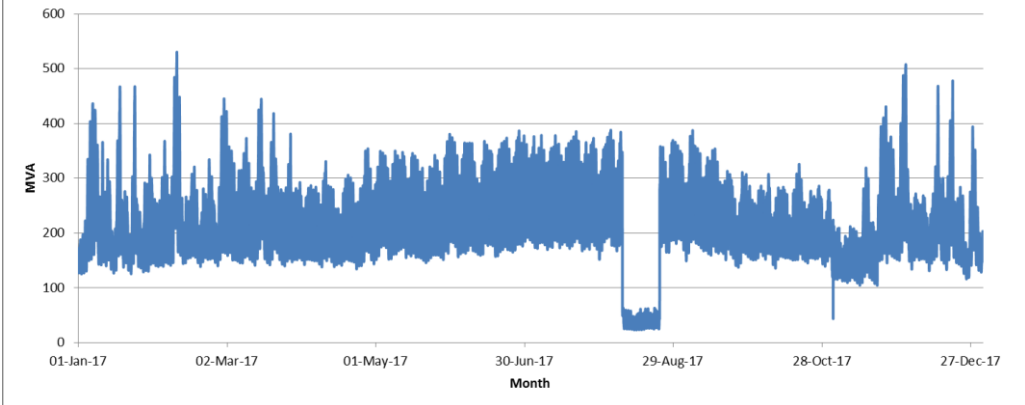
	Commercial	14,143	48.29%
	Industrial	1,270	19.59%
	Agricultural	11	0.00%
Station peak demand – 428.3MVA			
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 26.1kA (3ph) 66kV – More than 15.6kA (3ph)		
Reactive capability of equipment	Two 200MVAR 220kV cap banks Three 50MVAR 66kV cap banks		
Forecast load flow	Same as load forecast in the above table		

Project Name	FBTS B3 Transformer and Circuit Breaker Replacement											
Location of Constraint	132-140, Turner Street, Fishermens Bend											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	450MVA											
Load forecast	<b>FBTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	327.2	329.3	329.6	333.8	330.6	328.8	340.8	347.6	351.3	356.7	
	Summer50	298.5	301.5	302.9	304.0	309.2	308.7	315.5	324.4	326.3	333.7	
	Winter10	245.7	250.1	254.3	262.5	267.2	274.5	280.7	281.5	290.2	297.1	
	Winter50	228.8	232.6	237.0	246.2	250.5	256.7	263.1	264.5	271.6	279.2	
Maximum energy at risk	None											
Hours of load at risk	Not applicable											
Value of Customer Reliability used	46,914 (\$/MWh)											
Expected unserved energy	None											
Cost of unexpected unserved energy	Not applicable											
Preferred network solution	Asset Replacement											
Proposed timing	2024											
Existing generation at the location	15.81MW											
Historic use of existing generation	Data not available											
Emergency transfer capability	22MVA for summer 2017/18											
Historic use of existing transfer capability	Data not available											

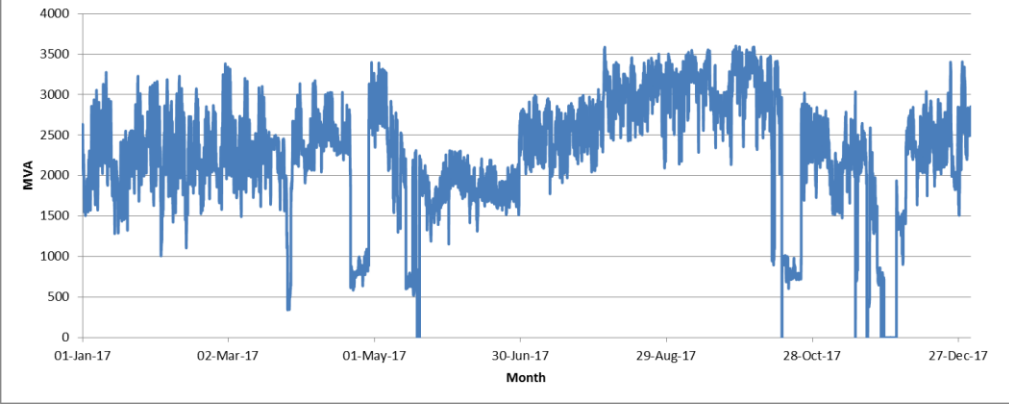


Historic load trace			
Historic asset utilisation	63%		
Customer number and type at location		Number of Customers	Consumption
	Residential	30,833	12.01%
	Commercial	6,820	83.19%
	Industrial	328	4.80%
	Agricultural	-	0.00%
	Station peak demand – 273.7MW		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 25.2kA (3ph) 66kV – More than 21.8kA (3ph)		
Reactive capability of equipment	One 200MVAR 220kV cap bank		
Forecast load flow	Same as load forecast in the above table		

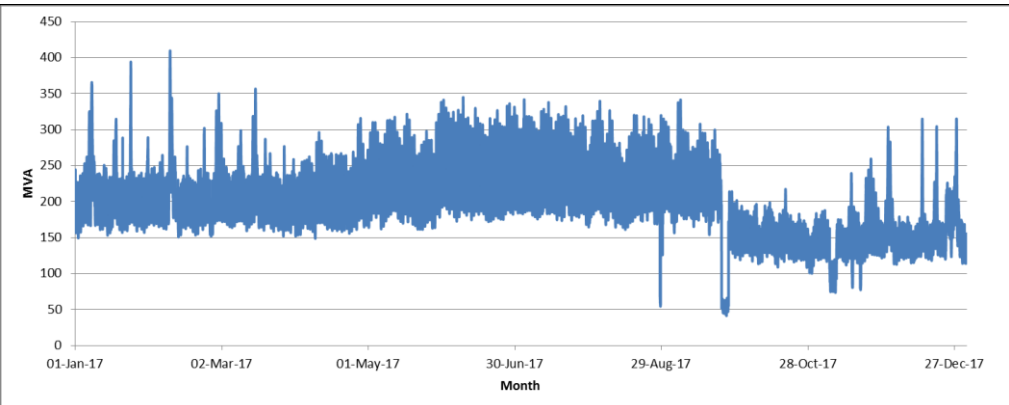
Project Name	RWTS B3 Transformer Replacement										
Location of Constraint	59 – 61, Heatherdale Road, Ringwood.										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	220/66kV – 600MVA 220/22kV – 150MVA										
Load forecast	<b>RWTS66 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	524.9	522.2	517.1	516.8	508.7	503.4	514.8	522.5	525.2	528.3
	Summer50	454.0	452.4	448.0	443.5	444.7	440.9	443.9	451.9	451.6	457.0
	Winter10	361.8	357.9	354.9	355.7	352.5	352.4	351.3	344.9	346.3	347.6
	Winter50	352.0	347.3	344.6	346.8	343.2	342.0	341.3	335.7	335.5	335.2
	<b>RWTS22 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	91.8	91.1	89.9	88.7	86.9	85.9	86.9	87.7	87.8	87.5
	Summer50	82.5	82.3	81.2	79.7	79.2	78.5	78.4	79.2	78.8	79.2
	Winter10	66.7	66.4	66.1	66.5	66.1	66.5	66.7	66.4	67.1	67.7
	Winter50	62.8	62.4	62.2	62.7	62.4	62.5	62.8	62.5	62.9	63.3
Maximum energy at risk	None										
Hours of load at risk	Not applicable										
Value of Customer Reliability used	66kV – 37,119 (\$/MWh) 22kV – 38,738 (\$/MWh)										
Expected unserved energy	None										

Cost of expected unserved energy	Not applicable															
Preferred network solution	Asset Replacement															
Proposed timing	2024															
Existing generation at the location	None															
Historic use of existing generation	Not applicable															
Emergency transfer capability	49.6MVA for summer 2017/18															
Historic use of existing transfer capability	Data not available															
Historic load trace	 <p>Note: Sag in August is due to 66kV data error.</p>															
Historic asset utilisation	71%															
Customer number and type at location	<table border="1" data-bbox="389 1137 1193 1332"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>180,988</td> <td>45.35%</td> </tr> <tr> <td>Commercial</td> <td>13,575</td> <td>37.79%</td> </tr> <tr> <td>Industrial</td> <td>2,776</td> <td>15.60%</td> </tr> <tr> <td>Agricultural</td> <td>1,892</td> <td>1.27%</td> </tr> </tbody> </table> <p>Station peak demand – 445.3MVA (66kV) Station peak demand – 86.5MVA (22kV)</p>		Number of Customers	Consumption	Residential	180,988	45.35%	Commercial	13,575	37.79%	Industrial	2,776	15.60%	Agricultural	1,892	1.27%
	Number of Customers	Consumption														
Residential	180,988	45.35%														
Commercial	13,575	37.79%														
Industrial	2,776	15.60%														
Agricultural	1,892	1.27%														
Historic outage at location	No station black during last 5 years															
Fault rating of equipment	220kV – More than 21.4kA (3ph) 66kV – More than 14.9kA (3ph) 22kV – More than 13.4kA (3ph)															
Reactive capability of equipment	One 200MVAR 220kV cap bank Two 50MVAR 66kV cap banks Two 12MVAR 22kV cap banks															
Forecast load flow	Same as load forecast in the above table															

Project Name	LYPS and HWTS 500kV Circuit Breaker Replacement Stage 2
Location of Constraint	Bartons Ln, Traralgon & 530, Tramway Road, Hazelwood North
Element	Generator connection station (LYPS), Switching station (HWTS)
Constraint type	Switching/ generation constraints
Existing element rating	HWTS - 2400MVA LYPS – 4000MVA
Load forecast	No directly connected load (switching station)
Maximum load at	No directly connected load (switching station)

risk	
Hours of load at risk	No directly connected load (switching station)
Value of Customer Reliability used	41,410 (\$/MWh)
Expected unserved energy	No directly connected load (switching station)
Cost of unserved energy	No directly connected load (switching station)
Preferred network solution	Asset replacement
Proposed timing	2024
Existing generation at the location	LYPS – Scheduled generation - LYPA , LYPB, LYGS & BLLY HWTS - None
Historic use of existing generation	LYPS – Market participant (scheduled generation) HWTS- Not applicable
Emergency transfer capability	Not applicable
Historic use of existing transfer capability	Not applicable
Historic load trace	 <p>Note: Sags are due to data errors.</p>
Historic asset utilisation	63%
Customer number and type at location	No directly connected load (switching station)
Historic outage at location	No station black during last 5 years
Fault rating of equipment	LYPS 500kV – More than 22.6kA (3ph) 66kV – More than 13.0kA (3ph) HWTS 500kV – More than 22.6kA (3ph) 220kV – More than 16.3kA (3ph)
Reactive capability of equipment	Not applicable
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 1000 -3600MVA

Project Name	GTS B4 Transformer and 66kV Circuit Breaker Replacement
Location of Constraint	362, Anakie Road, Geelong.
Element	Connection station

Constraint type	Load at risk											
Existing element rating	600MVA											
Load forecast	<b>GTS 1-2 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	203.3	204.5	203.9	205.5	202.9	201.3	207.3	210.4	211.9	214.2	
	Summer50	182.2	183.9	184.0	184.1	186.4	185.6	188.9	193.2	193.7	197.3	
	Winter10	169.6	170.6	172.2	176.5	178.4	182.0	184.8	184.2	188.6	187.8	
	Winter50	163.2	163.9	165.6	170.6	172.3	175.2	178.3	178.0	181.4	181.1	
	<b>GTS 3-4 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	317.5	316.5	312.9	312.8	306.7	302.1	308.1	310.1	309.7	310.6	
	Summer50	270.4	270.2	267.8	265.4	266.2	262.6	264.6	268.1	266.4	268.7	
	Winter10	207.5	206.9	206.9	209.7	209.7	211.9	213.0	209.9	212.9	216.5	
	Winter50	198.4	196.9	197.5	201.2	201.1	202.4	203.9	201.3	203.2	207.3	
	Maximum energy at risk	None										
	Hours of load at risk	Not applicable										
	Value of Customer Reliability used	42,205 (\$/MWh)										
	Expected unserved energy	None										
Cost of expected unserved energy	Not applicable											
Preferred network solution	Asset Replacement											
Proposed timing	2024											
Existing generation at the location	25.7MW											
Historic use of existing generation	Data not available											
Emergency transfer capability	6.7MVA for summer 2017/18											
Historic use of existing transfer capability	Data not available											
Historic load trace	 <p>Note: Sags after September are due to B2 data errors.</p>											
Historic asset utilisation	68%											
Customer number and type at location		Number of Customers				Consumption						
	Residential	133,625				31.97%						
	Commercial	9,725				65.40%						
	Industrial	1,426				2.13%						

	Agricultural	994	0.50%
	Station peak demand – 406.5MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 22.0kA (3ph) 66kV – More than 15.3kA (3ph)		
Reactive capability of equipment	One 50MVAR 66kV cap bank One 25MVAR 66kV cap bank		
Forecast load flow	Same as load forecast in the above table		

Project Name	BLTS 220kV, 66kV and 22kV Circuit Breaker Replacement										
Location of Constraint	70 – 84, Kyle Road, Brooklyn.										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	220/66kV - 450MVA 220/22 – 150MVA										
Load forecast	<b>ATS-BLTS66 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	317.0	338.5	351.8	351.6	342.2	341.2	346.1	351.0	350.9	353.0
	Summer50	290.7	312.6	326.8	325.1	319.9	320.1	322.3	327.8	327.6	331.1
	Winter10	284.4	316.6	319.8	323.0	318.1	322.6	325.0	325.7	330.3	333.9
	Winter50	267.4	299.0	302.4	305.8	300.6	304.4	306.9	307.9	311.4	315.2
	<b>BLTS22 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	84.6	83.6	82.1	81.6	79.9	78.5	79.7	80.2	80.2	80.6
	Summer50	72.4	71.7	70.6	69.6	69.6	68.4	68.9	69.9	69.7	70.5
	Winter10	67.1	67.3	67.8	69.3	69.8	71.2	72.1	71.6	73.2	73.7
	Winter50	66.2	66.3	66.8	68.7	69.2	70.2	71.2	71.0	72.2	72.8
	Maximum energy at risk	None									
Hours of load at risk	Not applicable										
Value of Customer Reliability used	66kV – 43,147 (\$/MWh) 22kV – 48,171 (\$/MWh)										
Expected unserved energy	None										
Cost of expected unserved energy	Not applicable										
Preferred network solution	Asset Replacement										
Proposed timing	2025										
Existing generation at the location	51.2MW										
Historic use of existing generation	Data not available										
Emergency transfer capability	54MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										

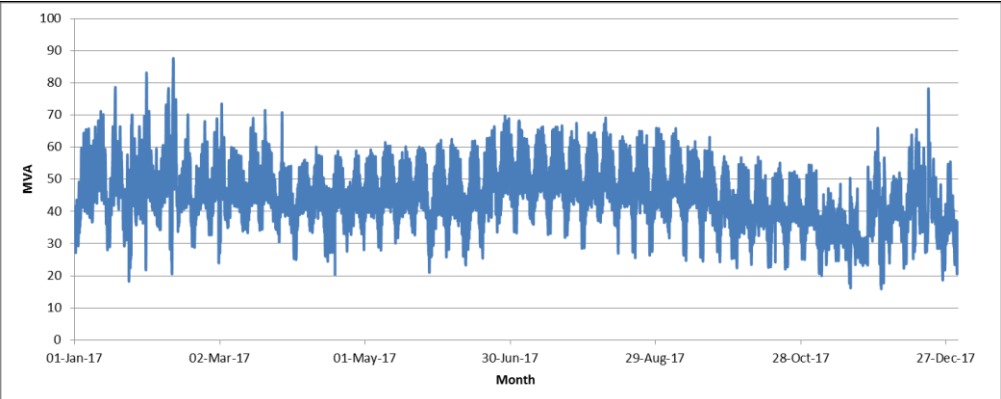


Historic load trace																		
Historic asset utilisation	68%																	
Customer number and type at location	<table border="1"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>71,482</td> <td>26.62%</td> </tr> <tr> <td>Commercial</td> <td>5,007</td> <td>61.76%</td> </tr> <tr> <td>Industrial</td> <td>1,858</td> <td>11.05%</td> </tr> <tr> <td>Agricultural</td> <td>239</td> <td>0.57%</td> </tr> </tbody> </table> <p>Station peak demand –307MVA (66kV) Station peak demand –68.7MVA (22kV)</p>				Number of Customers	Consumption	Residential	71,482	26.62%	Commercial	5,007	61.76%	Industrial	1,858	11.05%	Agricultural	239	0.57%
	Number of Customers	Consumption																
Residential	71,482	26.62%																
Commercial	5,007	61.76%																
Industrial	1,858	11.05%																
Agricultural	239	0.57%																
Historic outage at location	No station black during last 5 years																	
Fault rating of equipment	220kV – More than 22.8kA (3ph) 66kV – More than 19.8kA (3ph) 22kV – More than 14.3kA (3ph)																	
Reactive capability of equipment	One 200MVAR 220kV cap bank																	
Forecast load flow	Same as load forecast in the above table																	

Project Name	KTS A2, A3 and A4 500/220kV and B4 220/66kV Transformer Replacement											
Location of Constraint	Dodds Road, Keilor.											
Element	Switching station/Connection station											
Constraint type	Load at risk											
Existing element rating	500/220kV – 2250MVA 220/66kV – 750MVA											
Load forecast	<b>KTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	595.9	605.3	613.3	615.5	620.6	625.9	637.5	652.8	656.5	665.4	
	Summer50	529.1	537.9	546.0	545.6	554.4	561.0	567.6	581.5	585.2	594.7	
	Winter10	446.6	454.3	463.4	467.9	475.7	485.8	492.0	499.4	509.9	518.1	
	Winter50	417.7	424.5	434.1	438.9	446.1	455.5	461.8	469.3	478.4	487.0	
Maximum energy at risk	7.7MWh in 2018 (at 10 <sup>th</sup> percentile demand forecast)											
Hours of load at risk												
Value of Customer Reliability used	38,752 (\$/MWh)											
Expected unserved energy	0.1MWh in 2018 (at 10 <sup>th</sup> percentile demand forecast)											
Cost of expected unserved energy	\$3,230 (at 10 <sup>th</sup> percentile demand forecast)											
Preferred network solution	Asset Replacement											
Proposed timing	2026											

Existing generation at the location	8MVA		
Historic use of existing generation	Data Not available		
Emergency transfer capability	62MVA for summer 2017/18		
Historic use of existing transfer capability	Data not available		
Historic load trace			
Historic asset utilisation	78%		
Customer number and type at location		Number of Customers	Consumption
	Residential	119,521	38.40%
	Commercial	6,934	47.22%
	Industrial	1,590	14.26%
	Agricultural	572	0.12%
	Station peak demand – 603.9MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	500kV – More than 18.2kA (3ph) 220kV – More than 25.6kA (3ph) 66kV – More than 15.2kA (3ph)		
Reactive capability of equipment	One 200MVAR 220kV cap bank Two 50MVAR 66kV cap banks		
Forecast load flow	Same as load forecast in the above table		

Project Name	WOTS 330kV and 66kV Circuit Breaker Replacement										
Location of Constraint	Whytes Road, Wodonga.										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	150MVA										
Load forecast	<b>WOTS66 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	58.0	56.5	54.4	53.0	50.5	48.3	48.2	47.2	46.0	45.0
	Summer50	54.0	52.8	51.0	49.3	48.2	46.3	45.4	45.0	43.6	42.9
	Winter10	40.3	38.9	37.7	37.3	36.4	36.0	35.6	34.6	34.7	34.8
	Winter50	39.2	37.7	36.6	36.4	35.5	35.0	34.7	33.8	33.7	33.7
	<b>WOTS22 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	38.1	38.7	38.9	39.7	39.5	39.5	41.1	42.2	42.8	43.7
	Summer50	34.8	35.5	35.9	36.2	37.1	37.3	38.3	39.6	40.1	41.2
	Winter10	31.7	32.4	33.1	34.3	35.1	36.1	36.9	37.0	38.1	39.2

	Winter50	31.0	31.5	32.3	33.7	34.4	35.3	36.2	36.3	37.2	38.1																
Maximum energy at risk <sup>1</sup>	46MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast) 559MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast)																										
Hours of load at risk	19 Hrs in 2017/18																										
Value of Customer Reliability used	41,205 (\$/MWh)																										
Expected unserved energy	0.2MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast) 2.4MWh in 2017/18 (at 50 <sup>th</sup> percentile demand forecast)																										
Cost of expected unserved energy	\$8,220 (at 50 <sup>th</sup> percentile demand forecast) \$0.10 million (at 10 <sup>th</sup> percentile demand forecast)																										
Preferred network solution	Asset Replacement																										
Proposed timing	2025																										
Existing generation at the location	58MVA																										
Historic use of existing generation	19,161.6MWh																										
Emergency transfer capability	1MVA for summer 2017/18																										
Historic use of existing transfer capability	Data not available																										
Historic load trace																											
Historic asset utilisation	58%																										
Customer number and type at location	<table border="1"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>21,669</td> <td>28.48%</td> </tr> <tr> <td>Commercial</td> <td>2,382</td> <td>35.75%</td> </tr> <tr> <td>Industrial</td> <td>196</td> <td>29.73%</td> </tr> <tr> <td>Agricultural</td> <td>2,638</td> <td>6.03%</td> </tr> </tbody> </table>													Number of Customers	Consumption	Residential	21,669	28.48%	Commercial	2,382	35.75%	Industrial	196	29.73%	Agricultural	2,638	6.03%
	Number of Customers	Consumption																									
Residential	21,669	28.48%																									
Commercial	2,382	35.75%																									
Industrial	196	29.73%																									
Agricultural	2,638	6.03%																									
	Station peak demand –88.2MVA																										
Historic outage at location	No station black during last 5 years																										
Fault rating of equipment	330kV – More than 10.1.4kA (3ph) 66kV – More than 14.9kA (3ph) 22kV – More than 13.4kA (3ph)																										
Reactive capability of equipment	One 150MVAR 330kV cap bank																										
Forecast load flow	Same as load forecast in the above table																										

Project Name	LY 66kV Circuit Breaker Replacement
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<sup>1</sup> Assuming no generation from Hume power station (HPS). No energy at risk with HPS generating at full capacity to WOTS. HPS can generate either to WOTS or Jindera (NSW).

Location of Constraint	Bartons Ln, Traralgon
Element	Switching station
Constraint type	Load at risk
Existing element rating	No transformers
Load forecast	No directly connected load (switching station)
Maximum load at risk	No directly connected load (switching station)
Hours of load at risk	No directly connected load (switching station)
Value of Customer Reliability used	41,410 (\$/MWh)
Expected unserved energy	No directly connected load (switching station)
Cost of unserved energy	No directly connected load (switching station)
Preferred network solution	Asset Replacement
Proposed timing	2025
Existing generation at the location	None
Historic use of existing generation	Not applicable
Emergency transfer capability	No directly connected load (switching station)
Historic use of existing transfer capability	No directly connected load (switching station)
Historic load trace	
Historic asset utilisation	43%
Customer number and type at location	No directly connected load (switching station)
Historic outage at location	No station black during last 5 years
Fault rating of equipment	
Reactive capability of equipment	Two 30MVAR 66kV cap banks
Forecast load flow	Expected to be between 5-35MVA

Project Name	TSTS B3 Transformer Replacement
Location of Constraint	630 - 658, Blackburn Road, Templestowe

Element	Connection station										
Constraint type	Load at risk										
Existing element rating	450MVA										
Load forecast	<b>TSTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	377.3	377.6	377.0	374.5	371.3	369.9	374.1	379.7	380.5	380.9
	Summer50	328.3	330.0	329.2	325.6	325.7	325.4	325.2	329.5	328.9	331.1
	Winter10	241.5	240.2	239.5	238.1	236.7	236.2	234.6	233.5	233.5	232.7
	Winter50	233.9	232.3	231.8	230.5	228.6	227.9	226.4	225.0	224.6	223.8
Maximum energy at risk	24MWh in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Hours of load at risk	2 Hrs in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Value of Customer Reliability used	33,688 (\$/MWh)										
Expected unserved energy	0.2MWh (at 10 <sup>th</sup> percentile demand forecast)										
Cost of expected unserved energy	\$5,200 (at 10 <sup>th</sup> percentile demand forecast)										
Preferred network solution	Asset replacement										
Proposed timing	2025										
Existing generation at the location	One embedded generation unit over 1 MW										
Historic use of existing generation	No net generation to TSTS during 2017										
Emergency transfer capability	55MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										
Historic load trace											
Historic asset utilisation	75%										
Customer number and type at location		Number of Customers				Consumption					
	Residential	79,397				61.39%					
	Commercial	4,244				30.97%					
	Industrial	201				7.53%					
	Agricultural	81				0.12%					
	Station peak demand – 306MVA										
Historic outage at location	No station black during last 5 years										
Fault rating of	220kV – More than 22.4kA (3ph)										

equipment	66kV – More than 21.7kA (3ph)
Reactive capability of equipment	One 200MVAR 220kV cap bank One 50MVAR 66kV cap bank
Forecast load flow	Same as load forecast in the above table

Project Name	ROTS 220kV Circuit Breaker Replacement	
Location of Constraint	890, Wellington Road, Rowville.	
Element	Switching station	
Constraint type	Load at risk	
Existing element rating	2000MVA	
Load forecast	No directly connected load (switching station)	
Maximum load at risk	No directly connected load (switching station)	
Hours of load at risk	No directly connected load (switching station)	
Value of Customer Reliability used	41,410 (\$/MWh)	
Expected unserved energy	No directly connected load (switching station)	
Cost of unserved energy	No directly connected load (switching station)	
Preferred network solution	Asset replacement	
Proposed timing	2025	
Existing generation at the location	No directly connected generation	
Historic use of existing generation	Not applicable	
Emergency transfer capability	No directly connected load (switching station)	
Historic use of existing transfer capability	Not applicable	
Historic load trace		
Historic asset utilisation	99%	
Customer number and type at location	No directly connected load (switching station)	
Historic outage at location	No station black during last 5 years	
Fault rating of equipment	500kV – More than 18.4kA (3ph) 220kV – More than 26.2kA (3ph)	

Reactive capability of equipment	Three 200MVAR 220kV cap banks
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 200 -1500MVA.

Project Name	ERTS Redevelopment - Stage 2												
Location of Constraint	Police Road, Rowville.												
Element	Connection station												
Constraint type	Load at risk												
Existing element rating	600MVA												
Load forecast	<b>ERTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>		
	Summer10	488.7	491.1	492.7	490.8	490.7	494.1	504.6	518.2	527.1	530.6		
	Summer50	446.1	451.8	452.4	450.3	452.4	457.8	462.1	473.3	480.1	487.5		
	Winter10	382.3	385.9	389.9	392.4	394.3	398.1	403.7	409.2	414.6	418.8		
	Winter50	378.3	381.4	384.9	387.3	388.7	392.2	397.4	402.7	407.9	411.5		
Maximum energy at risk	None												
Hours of load at risk	Not applicable												
Value of Customer Reliability used	37,376 (\$/MWh)												
Expected unserved energy	None												
Cost of expected unserved energy	Not applicable												
Preferred network solution	Asset Replacement												
Proposed timing	2026												
Existing generation at the location	16.6MW												
Historic use of existing generation	11.6MW during the 2016/17 peak demand												
Emergency transfer capability	103MVA for summer 2017/18												
Historic use of existing transfer capability	Data not available												
Historic load trace													
Historic asset utilisation	74%												
Customer number and type at location		Number of Customers				Consumption							
	Residential	114,106				43.98%							



	Commercial	8,764	42.25%
	Industrial	1,146	13.41%
	Agricultural	429	0.35%
Station peak demand – 453.4MVA			
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 28.5kA (3ph) 66kV – More than 16.0kA (3ph)		
Reactive capability of equipment	Four 50MVAR 66kV cap banks		
Forecast load flow	Same as load forecast in the above table		

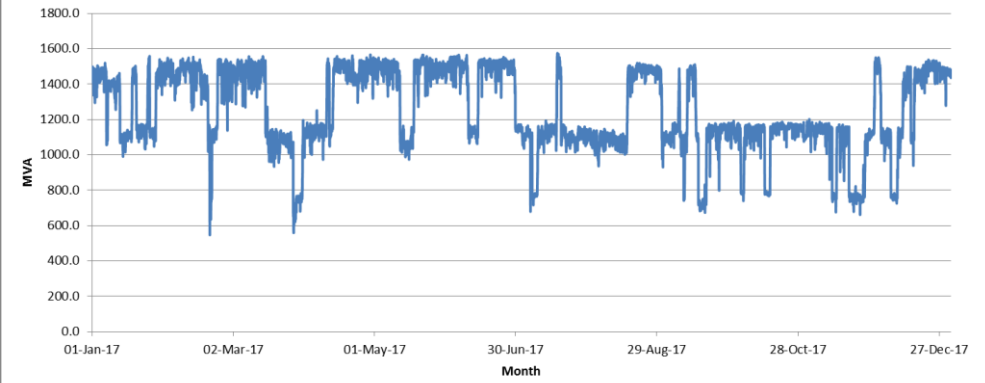
Project Name	SMTS 330/220kV Transformer Replacement - Stage 2										
Location of Constraint	385, McDonalds Road, South Morang.										
Element	Switching station/ Connection station										
Constraint type	Load at risk										
Existing element rating	500/330kV – 1000MVA 330/220kV – 1200MVA 220/66kV – 450MVA										
Load forecast	<b>SMTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	327.9	336.1	343.4	348.4	353.8	359.0	363.5	369.3	372.6	376.9
	Summer50	299.4	305.9	311.8	315.6	319.9	324.7	328.3	333.1	336.4	340.4
	Winter10	238.0	243.5	247.0	255.5	261.3	261.6	263.1	263.8	268.4	276.0
	Winter50	232.0	236.7	240.7	249.8	255.2	255.0	256.8	257.9	261.4	269.6
Maximum energy at risk	1,712MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 4,943MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)										
Hours of load at risk											
Value of Customer Reliability used	38,008 (\$/MWh)										
Expected unserved energy	7MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 21MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)										
Cost of expected unserved energy	\$0.28 million in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) \$0.81 million in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)										
Preferred network solution	Asset Replacement										
Proposed timing	2023										
Existing generation at the location	150MW										
Historic use of existing generation	80,800MWh in 2017										
Emergency transfer capability	33MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										

Historic load trace			
Historic asset utilisation	59%		
Customer number and type at location		Number of Customers	Consumption
	Residential	101,342	43.57%
	Commercial	6,671	43.07%
	Industrial	688	10.38%
	Agricultural	3,068	2.98%
	Station peak demand –264.7MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	500kV – More than 20.2kA (3ph) 330kV – More than 19.2kA (3ph) 220kV – More than 21.6kA (3ph) 66kV – More than 21.3kA (3ph)		
Reactive capability of equipment	Two 186MVAR 330kV series cap banks (on DDTS 1 & 2 lines)		
Forecast load flow	Same as load forecast in the above table		

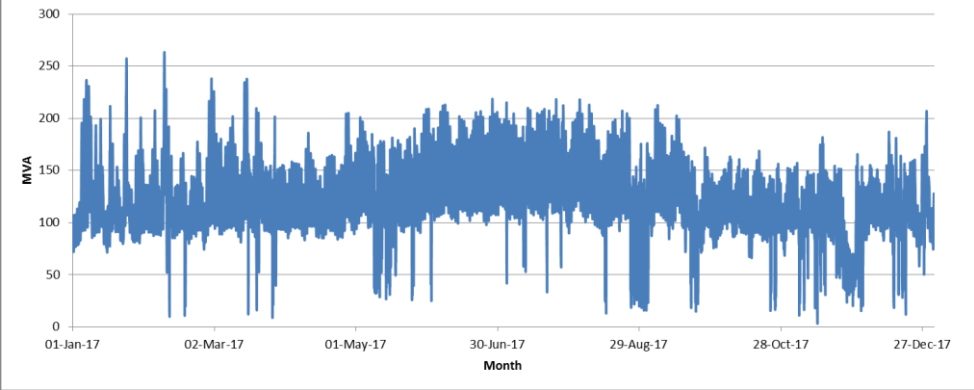
Project Name	TBTS B1 and B2 Transformer Replacement										
Location of Constraint	21, Thornell Lane, Tyabb.										
Element	Connection station										
Constraint type	Load at risk										
Existing element rating	450MVA										
Load forecast	<b>TBTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	313.1	310.4	310.9	309.5	312.3	317.9	323.8	334.3	341.4	343.4
	Summer50	281.6	279.1	279.6	278.4	280.9	285.9	291.2	300.7	307.1	308.8
	Winter10	208.1	210.8	213.3	215.4	217.6	220.5	224.0	227.6	231.1	234.5
	Winter50	205.3	207.9	210.1	212.0	214.1	216.8	220.0	223.4	226.6	229.8
Maximum energy at risk	5MWh in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Hours of load at risk	2 Hrs in 2017										
Value of Customer Reliability used	31,588 (\$/MWh)										
Expected unserved energy	0.03MWh in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Cost of expected unserved energy	\$1,000 in 2027 (at 10 <sup>th</sup> percentile demand forecast)										
Preferred network solution	Asset Replacement										
Proposed timing	2026										

Existing generation at the location	3MW		
Historic use of existing generation	Data not available		
Emergency transfer capability	22MVA for summer 2017/18		
Historic use of existing transfer capability	Data not available		
Historic load trace			
Historic asset utilisation	60%		
Customer number and type at location		Number of Customers	Consumption
	Residential	108,555	73.18%
	Commercial	5,534	24.06%
	Industrial	417	2.76%
	Agricultural		0.00%
	Station peak demand –279MVA		
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	220kV – More than 15.0kA (3ph) 66kV – More than 18.5kA (3ph)		
Reactive capability of equipment	One 50MVAR 66kV cap banks		
Forecast load flow	Same as load forecast in the above table		

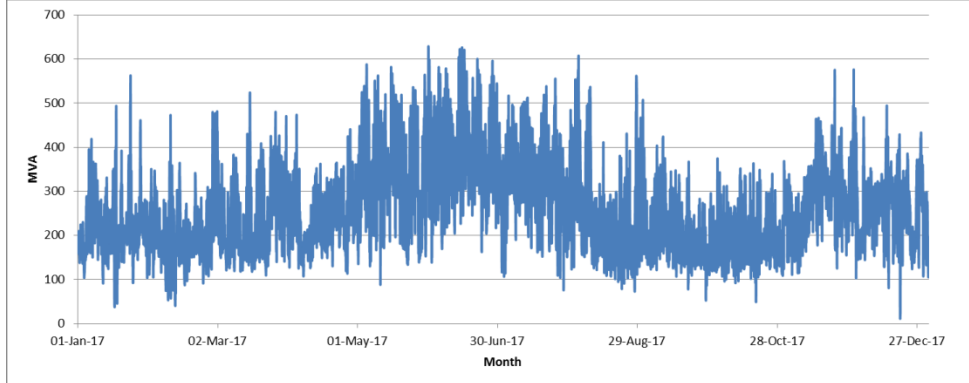
Project Name	YPS 220kV Circuit Breaker Replacement Stage 2
Location of Constraint	Station Close, Yallourn.
Element	Generator connection station, Switching station
Constraint type	Switching/ generation constraints
Existing element rating	1,480MVA
Load forecast	No directly connected load (switching station)
Maximum load at risk	No directly connected load (switching station)
Hours of load at risk	No directly connected load (switching station)
Value of Customer Reliability used	41,410 (\$/MWh)
Expected unserved energy	No directly connected load (switching station)
Cost of unserved energy	No directly connected load (switching station)

Preferred network solution	Asset Replacement
Proposed timing	2026
Existing generation at the location	YPS – Scheduled generation (Market participant)
Historic use of existing generation	YPS – Scheduled generation (Market participant)
Emergency transfer capability	Not applicable
Historic use of existing transfer capability	Not applicable
Historic load trace	
Historic asset utilisation	80%
Customer number and type at location	No directly connected load (Generator connection station)
Historic outage at location	No station black during last 5 years
Fault rating of equipment	220kV – More than 23.1kA (3ph) 66kV – More than 8.5kA (3ph)
Reactive capability of equipment	Not applicable
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 500 -1600MVA.

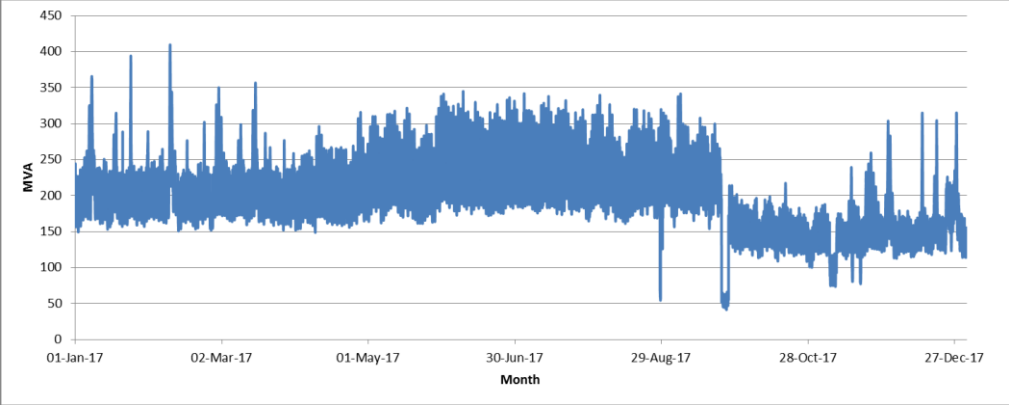
Project Name	SMTS 500kV GIS Replacement											
Location of Constraint	385, McDonalds Road, South Morang.											
Element	Switching station/ Connection station											
Constraint type	Load at risk											
Existing element rating	500/330kV – 1000MVA 330/220kV – 1200MVA 220/66kV – 450MVA											
Load forecast	<b>SMTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	327.9	336.1	343.4	348.4	353.8	359.0	363.5	369.3	372.6	376.9	
	Summer50	299.4	305.9	311.8	315.6	319.9	324.7	328.3	333.1	336.4	340.4	
	Winter10	238.0	243.5	247.0	255.5	261.3	261.6	263.1	263.8	268.4	276.0	
	Winter50	232.0	236.7	240.7	249.8	255.2	255.0	256.8	257.9	261.4	269.6	
Maximum energy at risk	1,712MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 4,943MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)											
Hours of load at risk												
Value of Customer	38,008 (\$/MWh)											

Reliability used																
Expected unserved energy	7MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 21MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)															
Cost of expected unserved energy	\$0.28 million in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) \$0.81 million in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)															
Preferred network solution	Asset Replacement															
Proposed timing	2026															
Existing generation at the location	150MW															
Historic use of existing generation	80,800MWh in 2017															
Emergency transfer capability	33MVA for summer 2017/18															
Historic use of existing transfer capability	Data not available															
Historic load trace																
Historic asset utilisation	59%															
Customer number and type at location	<table border="1" data-bbox="391 1198 1193 1391"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>101,342</td> <td>43.57%</td> </tr> <tr> <td>Commercial</td> <td>6,671</td> <td>43.07%</td> </tr> <tr> <td>Industrial</td> <td>688</td> <td>10.38%</td> </tr> <tr> <td>Agricultural</td> <td>3,068</td> <td>2.98%</td> </tr> </tbody> </table>		Number of Customers	Consumption	Residential	101,342	43.57%	Commercial	6,671	43.07%	Industrial	688	10.38%	Agricultural	3,068	2.98%
	Number of Customers	Consumption														
Residential	101,342	43.57%														
Commercial	6,671	43.07%														
Industrial	688	10.38%														
Agricultural	3,068	2.98%														
	Station peak demand –264.7MVA															
Historic outage at location	No station black during last 5 years															
Fault rating of equipment	500kV – More than 20.2kA (3ph) 330kV – More than 19.2kA (3ph) 220kV – More than 21.6kA (3ph) 66kV – More than 21.3kA (3ph)															
Reactive capability of equipment	Two 186MVAR 330kV series cap banks (on DDTs 1 & 2 lines)															
Forecast load flow	Same as load forecast in the above table															

Project Name	DDTS H3 330/220kV Transformer and 330kV Circuit Breaker Replacement
Location of Constraint	Yackandandah-Dederang Road, Dederang.
Element	Switching station
Constraint type	Load at risk
Existing element rating	905MVA
Load forecast	No directly connected load (switching station)
Maximum load at	No directly connected load (switching station)

risk	
Hours of load at risk	No directly connected load (switching station)
Value of Customer Reliability used	41,410 (\$/MWh)
Expected unserved energy	No directly connected load (switching station)
Cost of unserved energy	No directly connected load (switching station)
Preferred network solution	Asset replacement
Proposed timing	2028
Existing generation at the location	No directly connected generation
Historic use of existing generation	Not applicable
Emergency transfer capability	No directly connected load (switching station)
Historic use of existing transfer capability	Not applicable
Historic load trace	
Historic asset utilisation	69%
Customer number and type at location	No directly connected load (switching station)
Historic outage at location	No station black during last 5 years
Fault rating of equipment	330kV – More than 16.8kA (3ph) 220kV – More than 18.1kA (3ph)
Reactive capability of equipment	Two 225MVAR 330kV cap banks One 100MVAR 220kV cap bank
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 100 -600MVA.

Project Name	GTS 220 kV Circuit Breaker Replacement											
Location of Constraint	362, Anakie Road, Geelong.											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	600MVA											
Load forecast	<b>GTS 1-2 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	203.3	204.5	203.9	205.5	202.9	201.3	207.3	210.4	211.9	214.2	

	Summer50	182.2	183.9	184.0	184.1	186.4	185.6	188.9	193.2	193.7	197.3
	Winter10	169.6	170.6	172.2	176.5	178.4	182.0	184.8	184.2	188.6	187.8
	Winter50	163.2	163.9	165.6	170.6	172.3	175.2	178.3	178.0	181.4	181.1
	<b>GTS 3-4 (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
	Summer10	317.5	316.5	312.9	312.8	306.7	302.1	308.1	310.1	309.7	310.6
	Summer50	270.4	270.2	267.8	265.4	266.2	262.6	264.6	268.1	266.4	268.7
	Winter10	207.5	206.9	206.9	209.7	209.7	211.9	213.0	209.9	212.9	216.5
	Winter50	198.4	196.9	197.5	201.2	201.1	202.4	203.9	201.3	203.2	207.3
Maximum energy at risk	None										
Hours of load at risk	Not applicable										
Value of Customer Reliability used	42,205 (\$/MWh)										
Expected unserved energy	None										
Cost of expected unserved energy	Not applicable										
Preferred network solution	Asset Replacement										
Proposed timing	2028										
Existing generation at the location	25.7MW										
Historic use of existing generation	Data not available										
Emergency transfer capability	6.7MVA for summer 2017/18										
Historic use of existing transfer capability	Data not available										
Historic load trace	 <p>Note: Sags after September are due to B2 data errors.</p>										
Historic asset utilisation	68%										
Customer number and type at location		Number of Customers				Consumption					
	Residential	133,625				31.97%					
	Commercial	9,725				65.40%					
	Industrial	1,426				2.13%					
	Agricultural	994				0.50%					
	Station peak demand – 406.5MVA										
Historic outage at location	No station black during last 5 years										
Fault rating of	220kV – More than 22.0kA (3ph)										



equipment	66kV – More than 15.3kA (3ph)
Reactive capability of equipment	One 50MVAR 66kV cap bank One 25MVAR 66kV cap bank
Forecast load flow	Same as load forecast in the above table

Project Name	SMTS F2 Transformer and associated switchgear Replacement											
Location of Constraint	385, McDonalds Road, South Morang.											
Element	Switching station/ Connection station											
Constraint type	Load at risk											
Existing element rating	500/330kV – 1000MVA 330/220kV – 1200MVA 220/66kV – 450MVA											
Load forecast	<b>SMTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	327.9	336.1	343.4	348.4	353.8	359.0	363.5	369.3	372.6	376.9	
	Summer50	299.4	305.9	311.8	315.6	319.9	324.7	328.3	333.1	336.4	340.4	
	Winter10	238.0	243.5	247.0	255.5	261.3	261.6	263.1	263.8	268.4	276.0	
	Winter50	232.0	236.7	240.7	249.8	255.2	255.0	256.8	257.9	261.4	269.6	
Maximum energy at risk	1,712MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 4,943MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)											
Hours of load at risk												
Value of Customer Reliability used	38,008 (\$/MWh)											
Expected unserved energy	7MWh in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) 21MWh in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)											
Cost of expected unserved energy	\$0.28 million in 2026/27 (at 50 <sup>th</sup> percentile demand forecast) \$0.81 million in 2026/27 (at 10 <sup>th</sup> percentile demand forecast)											
Preferred network solution	Asset Replacement											
Proposed timing	2028											
Existing generation at the location	150MW											
Historic use of existing generation	80,800MWh in 2017											
Emergency transfer capability	33MVA for summer 2017/18											
Historic use of existing transfer capability	Data not available											
Historic load trace												
Historic asset utilisation	59%											
Customer number		Number of Customers					Consumption					

and type at location	Residential	101,342	43.57%
	Commercial	6,671	43.07%
	Industrial	688	10.38%
	Agricultural	3,068	2.98%
Station peak demand –264.7MVA			
Historic outage at location	No station black during last 5 years		
Fault rating of equipment	500kV – More than 20.2kA (3ph) 330kV – More than 19.2kA (3ph) 220kV – More than 21.6kA (3ph) 66kV – More than 21.3kA (3ph)		
Reactive capability of equipment	Two 186MVAR 330kV series cap banks (on DDTS 1 & 2 lines)		
Forecast load flow	Same as load forecast in the above table		

Project Name	SYTS 500kV GIS Replacement
Location of Constraint	Victoria Road, Sydenham.
Element	Switching station
Constraint type	Switching constraints
Existing element rating	No transformers
Load forecast	No directly connected load (switching station)
Maximum load at risk	No directly connected load (switching station)
Hours of load at risk	No directly connected load (switching station)
Value of Customer Reliability used	41,410 (\$/MWh)
Expected unserved energy	No directly connected load (switching station)
Cost of unserved energy	No directly connected load (switching station)
Preferred network solution	Asset replacement
Proposed timing	2028
Existing generation at the location	No directly connected generation
Historic use of existing generation	Not applicable
Emergency transfer capability	No directly connected load (switching station)
Historic use of existing transfer capability	Not applicable

Historic load trace	
Historic asset utilisation	33%
Customer number and type at location	No directly connected load (switching station)
Historic outage at location	No station black during last 5 years
Fault rating of equipment	500kV – More than 18.5kA (3ph)
Reactive capability of equipment	Not applicable
Forecast load flow	Switching station – load flow vary on the switching arrangement, generation dispatch etc. Switching station is expected to handle switching between 100 -1500MVA.

Project Name	SHTS B2 and B3 Transformer Replacement											
Location of Constraint	280, Verney Road, Shepparton.											
Element	Connection station											
Constraint type	Load at risk											
Existing element rating	450MVA											
Load forecast	<b>SHTS (MVA)</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
	Summer10	296.7	298.0	294.5	294.9	288.5	283.6	291.3	294.2	294.3	296.0	
	Summer50	271.6	274.0	272.0	269.6	271.3	267.6	270.7	275.5	274.2	277.9	
	Winter10	202.7	205.6	207.2	212.2	213.9	217.7	220.3	218.3	222.7	225.2	
	Winter50	197.9	200.7	202.7	208.9	210.5	213.5	216.6	215.1	218.3	221.8	
Maximum energy at risk	None											
Hours of load at risk	Not applicable											
Value of Customer Reliability used	40,104 MVA											
Expected unserved energy	None											
Cost of expected unserved energy	Not applicable											
Preferred network solution	Asset Replacement											
Proposed timing	2027											
Existing generation at the location	13.45MW											
Historic use of existing generation	Data not available											
Emergency transfer	None											

capability																
Historic use of existing transfer capability	Data not available															
Historic load trace																
Historic asset utilisation	60%															
Customer number and type at location	<table border="1"> <thead> <tr> <th></th> <th>Number of Customers</th> <th>Consumption</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>56,720</td> <td>39.74%</td> </tr> <tr> <td>Commercial</td> <td>7,243</td> <td>50.10%</td> </tr> <tr> <td>Industrial</td> <td>1,423</td> <td>1.82%</td> </tr> <tr> <td>Agricultural</td> <td>5,798</td> <td>8.33%</td> </tr> </tbody> </table> <p>Station peak demand –270.8MW</p>		Number of Customers	Consumption	Residential	56,720	39.74%	Commercial	7,243	50.10%	Industrial	1,423	1.82%	Agricultural	5,798	8.33%
	Number of Customers	Consumption														
Residential	56,720	39.74%														
Commercial	7,243	50.10%														
Industrial	1,423	1.82%														
Agricultural	5,798	8.33%														
Historic outage at location	No station black during last 5 years															
Fault rating of equipment	220kV – More than 6.9kA (3ph) 66kV – More than 12.6kA (3ph)															
Reactive capability of equipment	Four 25MVAR 66kV cap banks															
Forecast load flow	Same as load forecast in the above table															

Notes:

1. Already committed and in-progress projects are not included in Table 2
2. Some assets like communication assets, protection assets etc. provide secondary services for primary assets to deliver their functions. These secondary assets cannot be replaced with standalone non-network solution. Therefore further details of these projects are not included in Table 2.
3. The transmission line asset replacement projects in Table 1 are only selected part replacements (condition based replacement of selected insulators, ground wire sections, conductor sections, tower members etc.) to maintain the transmission line to meet AusNet Services obligations (safety & reliability) and hence do not envisage any economically viable non-network solution to replace the services provided by the transmission line. Further details of these projects could be provided “as required” basis.