1. AusNet Services' Asset Renewal Plan

This section outlines AusNet Services' transmission asset renewal process and lists 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.

Asset renewal objectives

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.
- 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. The description of the scope of work in the table below 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.

Six major redevelopment projects are planned to be completed during the ten year planning period, namely Heatherton, Richmond, East Rowville, Springvale, Red Cliffs and West Melbourne Terminal Stations. The Heatherton and Richmond redevelopment projects are currently in their build phases with forecast completion dates of 2017 and 2018 respectively.

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.

Table 1: Ten-year asset renewal plan (cost estimates are in 2017 dollars)

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
DC Supply Upgrade at various stations	Various	DC Supply Upgrade at various stations	20	2017	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	Change to in service date
YPS 220kV CB Replacement Stage 1	YPS	Replace seven minimum oil 220kV CBs and the associated oil CTs	21	2017	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Refurbishment, integrated replacement and staged replacement.	Change to in service date
Transmission conductor replacement	Line	Transmission conductor replacement - selected section replacement on NPS-BLTS, KTS-GTS 1 & 3, ROTS-MTS, CBTS-FTS and SVTS-HTS 2 lines	7	2017	Risk based replacement	No alternative options have been identified	Scope Update
Operational Support Refresh	Network	TS OSS Enhancements, TS IED Comms SW migration, TS Remote Management of Comms Devices, TS Network and Application Test Lab, TS Network Management Systems Refresh, Hardened (Engineering) Servers Replacement	9	2017	Replacement of obsolete systems	Integrated replacement and staged replacement	Change in cost estimate
HTS Redevelopment	HTS	Replace B1, B2 and B3 transformers with 150MVA 220/66kV transformers, 220kV minimum oil CBs and 66kV bulk oil CBs. Replace associated protection and control systems	45	2017	Station redevelopment project. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	Change in cost estimate
FBTS 220kV and 66kV CB Replacement Stage 1	FBTS	Replace one minimum oil 220 kV CB, six 66kV bulk oil and three 66kV minimum oil CBs	17	2018	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
RTS Redevelopment	RTS	Replace with 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	188	2018	Station redevelopment project. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	Change in cost estimate
RWTS B4 Transformer and 66kV CB Replacement	RWTS	Replace B4 220/66kV transformer and six 66kV bulk oil CBs	16	2018	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
SMTS 330/220kV Transformer Replacement - Stage 1	SMTS	Replace the H2 transformer with a new 700 MVA 330/220 kV transformer and retain the existing H2 FERRANTI 330/220kV transformer as a cold spare transformer	34	2018	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement, replacement with single phase or three phase transformers and replacement with larger transformers in consultation with AEMO	No change
HWPS 220kV CB Replacement - Stage 4	HWPS	Replace, reconfigure and retire 220kV switchgear at HWPS to meet network requirements post Hazelwood Power Station closure	40	2020	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	Change to Scope, cost & completion date
Transmission fall arrest installation program	Line	Transmission cable fall arrest installation program on selected EHV (500, 330 and 220kV) towers along country areas	20	2019	Risk based replacement	Do Nothing (i.e. continue with the use of dual lanyard); Defer project to next Reset and Do installation work	No change
Upgrade SCADA at Non-SCIMS and Old SCIMS Sites	Various	Upgrade SCADA at Non-SCIMS and old SCIMS sites at 10 Stations – NPSD, SYTS, MLTS, JLTS, ROTS, LYPSA, ERTS, SVTS, TBTS and TSTS	7	2019	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	No change
ROTS No.2 SVC Controls and Protection Replacement.	ROTS	Replace SVC protection and controls on ROTS No.2 SVC	10	2020	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	Change to in service date

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
OTN Replacement program	Network	TS OTN Replacement (Phase 1 & Phase 2) - Replace end of life Operational Telephony Network at 48 terminal stations	7	2020	End of Life replacement	Do nothing or End of Life replacement	Change in cost estimate
FBTS Transformer and CB Replacement	FBTS	Replace the B4 transformer. Replace 220kV and 66kV circuit breakers	37	2020	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement and replacement with larger transformers	Change to project scope
FTS 66kV CB Replacement	FTS	Replace seven bulk oil 66kV CBs	6	2020	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
Comms battery upgrade and replacement program	Network	TS Battery replacement program, RS Battery & Charger Replacements 1, RS Battery & Charger Replacements Phase2, RS Battery & Charger Replacements Phase3 including protection & control batteries at selection stations	23	2020	Lifecycle replacement. New standard for battery rooms.	Business as usual or battery replacement	Change in scope and cost
Radio Replacement program	Network	TS RCTS-BSS Microwave, TS Replace Microwave COCK-TBTS, TS Replace Microwave MLTS-PTH, TS Replace Microwave MTBB-TATA, TS Seven Sites Radio Terminals Upgrade, Three Sites Radio Terminals Upgrade	7	2020	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	Change in cost estimate
TSTS B2 Transformer and 66kV CB Replacement	TSTS	Replace B2 ASEA 220/66kV transformer, two 66kV minimum oil CBs and thirteen 66kV bulk oil CBs, and install new protection and control systems	34	2021	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	Change to completion date
ERTS Redevelopment - Stage 1	ERTS	Replace three 220/66kV transformers, two 220kV minimum oil CBs and three 66kV bulk oil bus tie CBs	22	2020	Selective replacement of assets based on condition. Project addresses supply and safety risk.	Integrated replacement and staged replacement	New Project

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
HYTS 500kV CB Replacement	HYTS	Replace deteriorated 500kV switchgear	8	2021	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	Change to in service date
Critical relay replacement at various terminal stations Stage 1 & 2	Various	Replace obsolete protection relays	8	2021	Replacement of obsolete systems. Compliance. Safety	Integrated replacement and staged replacement	No change
WMTS Redevelopment	WMTS	Replace 220/66kV transformers, 220kV switch bays, 66kV switch bays and all protection and control systems. Retire two 220/22kV transformers and the 22 kV supply from WMTS	128	2021	Station redevelopment project. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	Change in cost estimate
SVTS Redevelopment	SVTS	Replace B1, B2 and B3 220/66kV transformers, four 220kV minimum oil CBs and selected 66 kV CBs	77	2021	Station redevelopment project. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement, replacement on a new site and replacement with larger transformers in consultation with Distribution Businesses	No change
All-dielectric Self Support (ADSS) cable Replacement Program	Network	TS Cable 909 Replace ADSS HTS-MTS, TS Cable 920 921 Replace NPSD-YARR-BLTS, TS Cable 910 Replace ADSS HTS-SVTS-ROTS, TS HWTS-TH5 ADSS Replacement, TS MWTS-TH5 ADSS Replacement, TS YPS-TH5 ADSS Replacement, TS Cable 916 Replace ADSS TTS-BTS, TS Cable 926 Replace ADSS FBTS-MARY	7	2022	End of life replacement	ADSS replacement	New Project
HOTS SVC Controls and Protection Replacement	HOTS	Replace obsolete SVC protection and controls at HOTS	9	2022	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	Change to in service date
Operational Data Network Replacement	Network	Replace end of life and unsupported network technology with a modern standards based system. 21 TS Sites SDH_PDH Replacement, TS WDM Replacement Ph1, TS WDM Replacement Ph2, TS Next Generation Network Phase 4, TS Next Generation Network Phase 5	15	2022	Lifecycle replacement	TDM, Packet and optical transport technologies	Change in cost estimate

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
Transmission ground wire & conductor replacement	Line	Replace ground wire / conductors on selected transmission lines; ROTS-RTS 1, ROTS-RTS 4, DDTS-SMTS 2, HWPS-ROTS, YPS-ROTS 7 & 8, YPS-ROTS 5 & 6 and NPSD-BLTS	18	2022	Risk based replacement	Defer the work	Scope Update
Transmission fall arrest installation program	Line	Transmission fall arrest installation program on 500kV, 330kV and 220kV line towers	16	2022	Risk based replacement	Do Nothing (i.e. continue with the use of dual lanyard); Defer project to next Reset and Do installation work	No change
HOTS-ARTS Line Communications	HOTS-ARTS Line	Install 80km of Optical Ground Wire (OPGW) on HOTS-ARTS Line	9	2022	Risk based replacement	OPGW, UG fibre, radio and PLC	Change in cost estimate
LYPS 500kV CB Replacement Stage 1	LYPS	Replace 500kV circuit breakers	20	2022	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
DC Supply Upgrade Stage 3	Various	Upgrade the DC Supply at Stations not covered by X803 & XA29 (BATS – 50VDC COMMS A&B; ERTS – 50VDC COMMS A&B; FTS – 250VDC Supply; FTS – 50VDC Control Supply; KGTS – 50VDC COMMS A&B; SHTS – 50VDC COMMS A&B; SMTS – 250VDC Y Supply (500kV RLY HOUSE); SMTS – 50VDC COMMS A&B; SMTS – 125VDC X&Y Supplies (Series Capacitor bank control building) and SYTS – 50VDC COMMS A&B)	14	2023	Replacement of obsolete systems. Compliance	Integrated replacement and staged replacement	Change to in service date and cost estimate
Moorabool Terminal Station CB Replacement	MLTS	Replace 500kV and 220kV circuit breakers	31	2023	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
MWTS 66kV CB Replacement	MWTS	Replace 66kV minimum oil and bulk oil CBs	9	2023	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
RCTS B1 and B2 Transformer, 66kV and 22kV CB replacement	RCTS	Replace 1A, 1B, 2A and 2B transformers with a 220/66/22 kV transformer and 66kV and 22kV circuit breakers	19	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	Change to Scope, cost & completion date
HOTS 66kV CB Replacement	HOTS	Replace five 66kV bulk oil CBs, one 66kV LTCB and provide new protection and CB Management	6	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
KGTS B2 and B3 Transformer and CB Replacement	KGTS	Replace B2 and B3 BRUCEPEE transformers. Replace 22kV circuit breakers	20	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement, staged replacement and replacement with larger transformers	No change
TTS B4 Transformer and 66kV CB Replacement	TTS	Replace B4 150MVA 220/66kV transformer and eleven bulk oil and minimum oil 66kV CBs. Install new transformer protection and CB management system	25	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement. Asset Retirement	No change
BATS B2 220/66kV Transformer Replacement	BATS	Replace B2 transformer with 150MVA 220/66kV transformer	9	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Defer the work	New Project
FBTS B3 Transformer and CB Replacement	FBTS	Replace B3 150MVA 220/66kVtransformer 220kV and 66 kV circuit breakers	12	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
RWTS B3 Transformer Replacement	RWTS	Replace B3 150MVA 220/66kV transformer	10	2024	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project
BLTS 220kV, 66kV and 22kV CB Replacement	BLTS	Replace four 220kV minimum oil CBs, 66kV CBs and 22kV CBs	19	2025	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
KTS A2, A3 and A4 500/220kV and B4 220/66kV Transformer Replacement	KTS	Replace A2, A3 and A4 transformers with two 1000MVA 500/220kV transformers and a spare phase. Replace B4 transformer with a 150MVA 220/66kV transformer. Install new transformer protection	55	2025	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement. Replace with larger transformers. Asset Retirement.	Change to project scope and cost
Transmission line structure, conductor and insulator replacement	Line	Transmission line structure, conductor and insulator replacement on MLTS-TRTS 1 500 kV, MLTS-MOPS 2 500 kV, MSS-DDTS 1 330 kV, KTS-GTS 2 220 kV, KTS-WMTS 1 220 kV, KTS-WMTS 2 220 kV, TTS-KTS 2N 220 kV, TTS-KTS 2S 220 kV, ROTS-MTS 3 220 kV, ROTS-RTS 1 220 kV, NPSD-FBTS 220 kV, FBTS-BLTS 220 kV, CBTS-TBTS 1 220 kV, CBTS-TBTS 2 220 kV and CBTS-FTS 1 66 kV lines	35	2025	Risk based replacement	Defer the work	Scope Update
ROTS 220kV CB Replacement	ROTS	Replace 5 x minimum oil 220kV CBs	6	2025	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	No change
WOTS 330kV and 66kV CB Replacement	WOTS	Replace 330kV and 66kV circuit breakers and purchase a spare transformer	18	2025	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project

Project Name	Location	Scope of Work Summary	Total Cost (Real $M)	Target Completion (yearend)	Project Purpose	Options Considered	Changes Compared with Last Plan
LY 66kV CB Replacement	LY	Replace 16 x 66kV minimum oil CBs and provide 12 x CB Management	14	2025	Selective replacement of assets based on condition. Project addresses supply and safety risk.	Integrated replacement and staged replacement	New Project
TSTS B3 Transformer Replacement	TSTS	Replace B3 Toshiba 150MVA 220/66kV transformer	9	2025	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Defer the work	New Project
ERTS Redevelopment - Stage 2	ERTS	Replace selected 66kV CBs	10	2026	Selective replacement of assets based on condition. Project addresses supply and safety risk.	Integrated replacement and staged replacement	New Project
SMTS 330/220kV Transformer Replacement - Stage 2	SMTS	Replace the H1 transformer with a new 700MVA 330/220 kV transformer and retire both old H transformers. Purchase a spare 330/220kV single phase transformer	35	2026	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project
TBTS B1 and B2 Transformer Replacement	TBTS	Replace B1 and B2 WILSON 150MVA 220/66kV transformers	17	2026	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project
YPS 220kV CB Replacement Stage 2	YPS	Replace 9 x minimum oil 220kV CBs. Provide new CB Management	27	2026	Selective replacement of assets based on condition. Project addresses supply, safety, environmental and collateral plant damage risk	Integrated replacement and staged replacement	New Project
Transmission line structure, conductor and insulator replacement	Line	Transmission line structure, conductor and insulator replacement	48	2026	Risk based replacement	Defer the work	New Project
OPGW on ROTS-YPS No.5 & 6 Lines	ROTS-YPS Lines	Install Optical Ground Wire (OPGW) on remaining sections of ROTS-YPS No. 5 & 6 Lines, into ERTS 82 km	7	2026	Risk based replacement	OPGW, UG fibre, radio and PLC	New Project