TD-0007772 TSTS Transformer and Switchgear Replacement Business Case

Portfolio Business Line:		Work Category:	Work Code / Name:
Transmission		Replacement	2002 TCAPEX Station rebuilds
Project Start date:		**Commissioning Readiness Date:**	**Project Completion Date:**
14/01/2020		20/12/2024	20/03/2025
Delivery Budget ($):		**Management Reserve ($):**	**Total Estimated Expenditure for Approval ($):**
Capex ($)	$42.9 million	$832.4 k	$43.8 million
Opex ($)		Written Down Values: $0	
Is this budgeted in the current Portfolio FY Plan?			**Incremental change in Opex**
See below for 5-Year Capex Plan.			N/A

Source	Project Definition	Project Title	FY21	FY22	FY23	FY24	FY25
5-Year CAPEX Plan	TD-0007772	TSTS - Tx and Switchgear Replacement	N/A	$4,758,312	$15,734,457	$13,000,000	$8,000,000
BC planned spend profile			$233,439	$4,758,294	$16,071,800	$13,693,000	$8,172,325

Executive Summary:

This business case seeks approval to invest $43.8 million (including overheads, contingency allowance finance charges, and write downs) to replace two 220/66kV power transformers, thirteen 66 kV circuit breakers, twenty-three instrument transformers, and associated primary and secondary assets that are in poor condition and cause supply reliability, safety, environmental and operational issues at Templestowe Terminal Station (TSTS) in an integrated project.

The regulatory investment test (RIT-T) has been completed for this project with the publication of the Project Assessment Conclusions Report (PACR) in November 2020. No non-network proposals were received during the RIT-T consultation and a network solution was selected as the preferred solution to address the emerging asset failure risk at TSTS.

This project will improve the reliability of supply and reduce the safety risk associated with an unlikely asset explosive failure at TSTS; consistent with the regulatory obligation to maintain the quality, reliability and security of supply of prescribed transmission services as stated in the National Electricity Rules. The project is planned to be completed by March 2025.

This project will not have STPIS penalties for planned outages.

Project Initiator & Dept.	Prepared by:	Date BC submitted:
Transmission Network Planning		19/03/2021

Business Case e-sign-off

Key Project Details	
Project # / Title / Version	TD-0007772 TSTS Transformer and Switchgear Replacement
Revision (Y/N)	N
Endorsement:	
Name: Title: Manager, Transmission Network Planning	Name Title: Manager, Major Projects
Signature: **Endorsed via email**	Signature: **Endorsed via email**
Date: 19/03/2021	Date: 23/03/2021
Comments:	Comments:
Name Title: GM Finance - Networks & Technology	Name Title: A/GM Network Strategy & Planning
Signature: **Endorsed via email**	Signature: **Endorsed via email**
Date: 24/03/2021	Date: 22/03/2021
Comments: **Endorsed noting the comments under * below**	Comments:
Approvals:	
Name: Title: EGM, Network Management	Name: Title:
Signature:	Signature:
Date: 25/03/2021	Date: Mar 30, 2021
Comments: No questions other than ensuring we have robust procurement processes in place (or appropriate period contracts).	Comments:
Name: Title: Managing Director	
Signature:	
Date: Mar 30, 2021	
Comments:	

*** Endorsed noting the following**

- NPV overstates direct spend by $852K (spend/inflation timing) and understates CFCs by $755K. The net impact is not considered material in the context of a P75 estimate.

- Funding:

- TRR includes total TSTS project capex (2022-25) $37.6m in real $2020, which is consistent with $43.8M nominal.
- RIT-T includes $42.55m
- Financial Plan includes $41.5m

- Recommend a CMA Health Check be performed after the detailed design is completed in FY22 to confirm risk/contingency assumptions (no costed risk workshop has been performed).

TABLE OF CONTENTS

Business Case Accountability Matrix

The table below provides delineation and shows *who* is responsible to review *which* section of the BC. This will expedite approval as only the person best placed to review a specific section will be accountable for it.

When the business case is approved, all the stakeholders below will be copied into the confirmation email.

Name	Role	Section Developed	Section Reviewed	Reviewed / Endorsed
	Project Initiator	All aspects of the Business Case		15/02/21
	Project Sponsor/Owner		Executive summary Project Background Scope Schedule Options considered (economic & technical) Risk assessment Benefit assessment	15/02/21
	Benefit Owner/s		Financial assessment Options considered Benefit assessment	15/02/21

1. FINANCIAL SUMMARY

Transmission Regulatory Key	PS.

Table 1.1: Project Expenditure Forecast

Project Expenditure for approval (nominal)	First 5 years					Lifecycle Total
	2021	2022	2023	2024	2025	
Direct Capital expenditure	217.1	4,469.4	15,095.9	13,013.9	7,659.6	40,455.9
Overheads	9.1	186.8	631.0	544.0	320.2	1,691.1
Capitalised Finance Charges	3.8	102.1	344.9	135.1	192.5	778.5
Project Delivery Budget (SAP Capex budget)	**230.0**	**4,758.3**	**16,071.8**	**13,693.0**	**8,172.3**	42,925.4
Management Reserve	-	-	-	-	832.4	832.4
Total CAPEX for Approval (incl risk, CFCs & OHs)	**230.0**	**4,758.3**	**16,071.8**	**13,693.0**	**9,004.7**	43,757.8
Operating Expenditure for approval (Project Opex)	-	-	-	-	-	-
Written down value of assets retired/sold	-	-	-	-	-	-
Total Estimated expenditure for approval (nominal)	**230.0**	**4,758.3**	**16,071.8**	**13,693.0**	**9,004.7**	**43,757.8**

Table 1.2: Net Present Value of Cashflows (Financial Analysis)

Investment Option	NPV of cashflows	IRR	Payback period (yrs)
BAU	-	-	-
Option 1	6,154.0	4.6%	38
Option 2	4,961.0	4.5%	38

Table 2.3: Analysis of investment options

Analysis of investment options ($'000 - Present Value)	Capex	Opex	Total Financial Costs	Potential Costs	Other Economic Costs & (Benefits)	Total PV Cost	PV Cost Ratio (compared to BAU)
BAU	-	414.4	414.4	-	107,837.0	108,251.4	1.00
Option 1	37,662.9	205.1	37,868.0	-	16,078.4	**53,946.3**	**0.50**
Option 2	30,909.7	244.4	31,154.1	-	23,785.7	54,939.8	0.51

2. PROJECT BACKGROUND

Templestowe Terminal Station (TSTS) was commissioned in the 1960's. TSTS is in Templestowe next to the Manningham City Council Depot and is the main transmission connection point for distribution of electricity to about 116,000 customers in north-eastern metropolitan Melbourne. The communities supplied by TSTS spans from Eltham in the north to Canterbury in the south, and from Donvale in the east to Kew in the west. While 93% of these customers are residential, approximately 40% of energy supplied by TSTS is consumed by commercial customers– equivalent to 360 GWh per year.

TSTS is a 220/66 kV terminal station that provides connection services to four distribution network businesses: CitiPower, United Energy, Jemena and AusNet Electricity Services. TSTS is part of the eastern metropolitan 220 kV ring and is connected to Thomastown Terminal Station (TTS) and Rowville Terminal Station (ROTS) at 220 kV as shown in Figure 1.

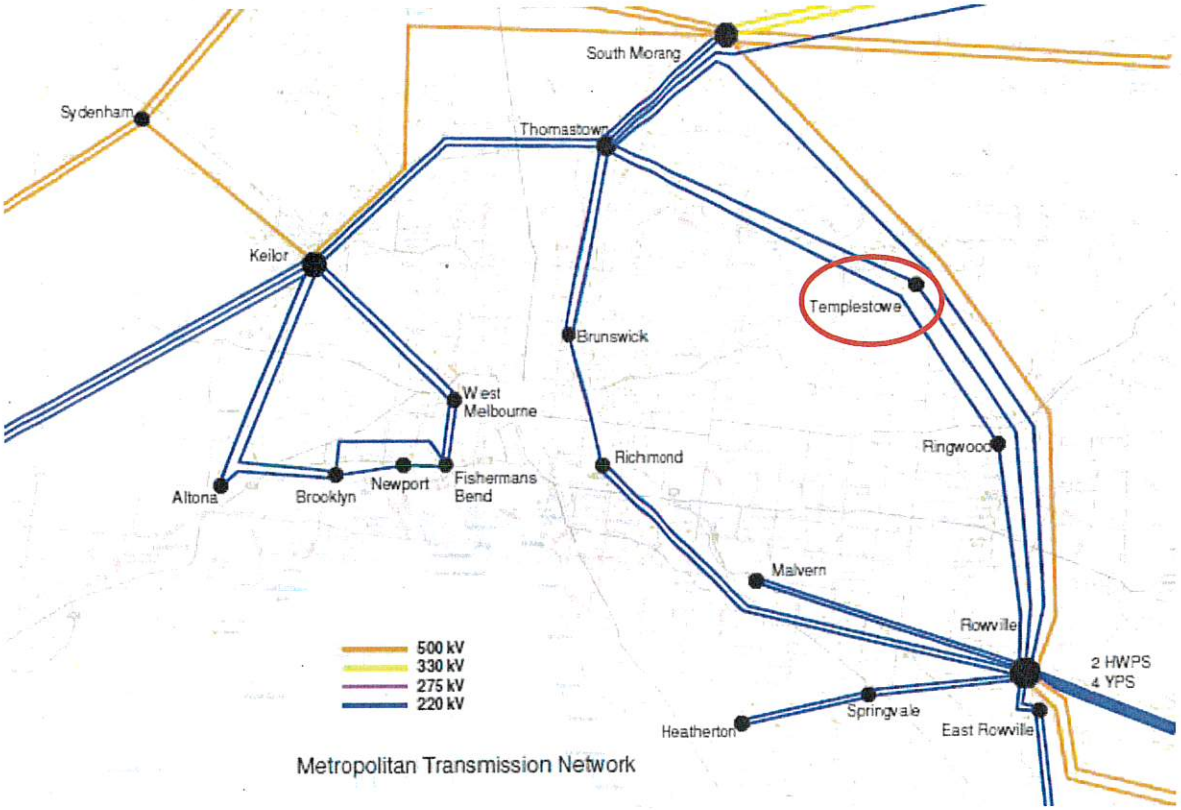

Figure 1 Metropolitan Melbourne Transmission Network

Details of the distribution network serviced by TSTS is presented in Appendix A.5.

Peak demand at TSTS is normally experienced during summer periods. The highest peak demand of 357.6 MW was recorded in the summer of 2008/09 during an extreme weather event. The annual peak demand has not reached that level since 2008/09, in the summer of 2018/19 peak demand was 337.2 MW.

The Australian Energy Market Operator (AEMO) forecasts that the peak demand at TSTS will grow at an average annual rate of 0.5% over the next ten years.

2.1 Asset Condition Drivers

AusNet Services classifies asset conditions using scores that range from C1 (initial service condition) to C5 (very poor condition). The asset condition assessment for TSTS was conducted in 2019 and reveals that several primary (power transformers, circuit breakers, instrument transformers, earth switches, isolators etc.) and

associated secondary (protection and control) assets at TSTS are in poor condition and present a material failure risk. For the selected assets, the probability of failure is high, and is likely to increase further if not replaced. Table below provides a summary of the condition of relevant major equipment.

Table 3 - Summary of major equipment condition scores

Asset class	Condition scores				
	C1	C2	C3	C4	C5
Power transformers				2	
66 kV circuit breakers				1	12
220 kV instrument transformers				3	6
66 kV instrument transformers				3	11
Station service transformers and switchboard					2

Power transformers

There are three 150 MVA 220/66 kV transformers at TSTS. The 'B2' and 'B3' transformers were manufactured by ASEA and Toshiba and commissioned in 1966 and 1968. The transformers have deteriorated significantly and according to the recent asset condition assessment report, these two transformers are in poor condition and in advanced deterioration. Assets in this condition (C4) requires remedial action within the next 2 - 10 years.

AusNet Services estimates that there is a high probability of either 'B2' or 'B3' transformer failure that will result in extended service interruption from the subsequent need for outages for repairs or replacement. The probability of a transformer failure is forecast to increase over time as the condition of these two transformers deteriorates further.

Replacement of the two power transformers have been recommended in AusNet Service's Power Transformer and Oil-filled Reactors Asset Management Strategy AMS 10-67.

66 kV circuit breakers

The scope of this project includes replacement of thirteen 66 kV circuit breakers at TSTS, including eleven bulk-oil circuit breakers and two minimum oil circuit breakers. The bulk-oil circuit breakers were manufactured by Gecaei between 1966 and 1968 are among the oldest circuit breakers installed in AusNet Services' transmission network. The majority of these circuit breakers have suffered significant deterioration and have reached the end of economic and technical life.

The bulk-oil circuit breakers have been assessed with condition scores C5 and present the following asset management challenges:

- duty-related deterioration including erosion of arc control devices,
- bushing oil leakages;
- wear of operating mechanisms and drive systems;
- intensive maintenance;
- lack of spares and manufacturer support;
- lack of oil containment bunding; and
- limited fault level capability requiring restrictive switching configurations.

The two minimum oil circuit breakers were manufactured by Gecaei and Sprecher and Schuh in 1966 and 1985 respectively are also in poor and deteriorating condition. Minimum Oil CB's are high maintenance and AusNet Services has been working towards phasing them out. The circuit breakers have been assessed as having a condition score C4 and approaching the end of their economic and technical life.

Replacement of the circuit breakers included in the scope of this project have been recommended in AusNet Service's Circuit Breaker Asset Management Strategy AMS 10-54.

Instrument transformers

Six 66 kV oil-insulated post-type current transformers and three 220 kV current transformers are in poor condition (C4 and C5) are selected to be replaced. All three current transformers have provided over 45 years of service. These current transformers demonstrate age related deterioration. There were some recent failures of this type of current transformers. In an explosive failure, porcelain projectiles could cause collateral damages to the adjacent plants and pose safety risks.

Fourteen other voltage transformers at the terminal station are in the same condition. Safety risks from these deteriorated assets are also present. Additionally, management of safety risks from potential explosive failures of instrument transformers of this type is costly due to the need for regular oil sampling and partial discharge condition monitoring.

Replacement of the instrument transformers included in the scope of this project have been recommended in AusNet Service's Instrument Transformer Asset Management Strategy AMS 10-64.

Station service transformers and switchboard

Alternating current supply comes from two station service transformers at TSTS that are at the end-of-serviceable-life. The station service transformers and the associated switchboard were installed in 1966.

Secondary systems

Unlike primary assets, secondary assets become obsolete within a typical time frame of 15 years when they are no longer supported by manufacturers, are technically incompatible with interfacing equipment or are no longer able to provide the functionality required to comply with industry standards or regulation. The condition of a secondary asset is assessed based on its capacity to deliver its designed function. The selected secondary assets for replacement have been based on the above criteria and the asset management strategy (AMS10-68).

Over the years, incremental upgrades of protection systems for specific primary assets within TSTS have been necessary. Some of the very old technologies such as electromechanical type relays from 1966 and first generation digital relays have mal-operated in the past and have been incrementally replaced with newer protection equipment. However, not all relays have been replaced, leaving various technologies designed in different time periods interacting with each other. These old relays are obsolete with no manufacturer support.

Further interfaces between existing equipment and the new protection systems required for new primary plant will complicate the non-standard protection system configuration even more and will increase the corresponding operation and maintenance costs. Therefore, replacement of the secondary systems is considered in the credible options in this project.

Replacement of the instrument transformers included in the scope of this project have been recommended in AusNet Service's Secondary Systems Asset Management Strategy AMS 10-68.

More details of selected asset to replaced are provided in Appendix A6.

2.2 Asset Failure Risks

The poor and deteriorating condition of assets at TSTS has increased the likelihood of failures. Such failures would result in prolonged outages. Without capital investment, affected assets are expected to deteriorate further and more rapidly. This will increase the probability of failure, resulting in a higher likelihood of electricity supply interruptions, heightened safety risks, environmental risks, collateral damage, and risk of increased costs resulting

from the need for emergency asset replacements and reactive repairs. The following sections discuss this in detail.

The emerging service constraints at TSTS are:

- Health and safety risks presented by a possible explosive failure of 66 kV instrument transformers, 66 kV bulk oil circuit breaker bushings and 220/66 kV transformer bushings;
- Security of supply risks presented by a failure of the 220/66 kV transformers or 66 kV circuit breakers;
- Collateral plant damage risks presented by an explosive failure of a transformer bushing, instrument transformer or bulk oil circuit breaker bushing; and
- Environmental risks associated with insulating oil spill or fire.

Supply risk considerations

In calculating the supply risk costs, AusNet Services has estimated the unserved energy based on AEMO demand forecasts for TSTS,[1] and has valued this expected unserved energy at an appropriate Value of Customer Reliability (VCR)[2]. The choice of VCR value is based on those published by AEMO, escalated to 2019/20 values, and the composition of customers supplied by the terminal station. The resulting estimate of the weighted VCR applicable for affected customers is $29,619 /MWh.

The total supply risk cost is calculated by estimating the impacts of different combinations of relevant outages to reliability of supply in the north-eastern metropolitan area and weighting them by their probabilities of occurrence.

Safety risk considerations

The *Electricity Safety Act 1998*[3] requires AusNet Services to design, construct, operate, maintain, and decommission its network to minimize hazards and risks to the safety of any person as far as reasonably practicable or until the costs become disproportionate to the benefits from managing those risks.

In implementing this principle for assessing safety risks from explosive asset failures, AusNet Services uses:

- a value of statistical life[4] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[5]; and

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[1] Australian Energy Market Operator (AEMO), *"2018 Transmission Connection Point Forecast for Victoria,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Victoria, viewed on 7 November 2019.

[2] In dollar terms, the Value of Customer Reliability (VCR) represents a customer's willingness to pay for the reliable supply of electricity. The values produced are used as a proxy, and can be applied for use in revenue regulation, planning, and operational purposes in the National Electricity Market (NEM). Australian Energy Market Operator, *"Value of Customer Reliability,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Value-of-Customer-Reliability-review, viewed on 7 November 2019.

[3] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Energy Safe Act 1998,"* available at http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/1D9C11F63DEBA5E2CA257E70001687F4/%24FILE/98-25aa071%20authorised.pdf, viewed on 7 November 2019.

[4] Department of the Prime Minister and Cabinet, Australian Government, *"Best Practice Regulation Guidance Note: Value of statistical life,"* available at https://www.pmc.gov.au/resource-centre/regulation/best-practice-regulation-guidance-note-value-statistical-life, viewed on 7 November 2019.

[5] Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13," available at https://www.safeworkaustralia.gov.au/system/files/documents/1702/cost-of-work-related-injury-and-disease-2012-13.docx.pdf, viewed on 7 November 2019.

- a disproportionality factor[6].

AusNet Services notes that this approach, including the use of a disproportionality factor, is consistent with practice notes[7] provided by the AER.

Financial risk considerations

As there is a lasting need for the services that TSTS provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.[8]

Environmental risk considerations

Environmental risks from plant that contains large volumes of oil, which may be released in an event of asset failure, is valued at $30,000 per event while risks from transformers with oil containing poly-chlorinated biphenyls (PCB), such as those at TSTS, are valued at $100,000 per event.

2.3 Future development plan

This proposal accommodates the following planned augmentations at TSTS: 500 kV development with 500/220 kV transformation; fourth 150 MVA 220/66 kV transformer; provision for two more 220 kV lines; and provision for two more 66 kV feeders.

2.4 Investment need

The present value of the baseline risk cost is $75 million over the fifty-year period from 2020/21 to cover the forty-five year expected life of the options. The key elements of the baseline risk cost are shown in the figure below. The largest component of the baseline risk cost comes from the supply interruption risk, borne by electricity consumers, from potential failure of assets.

[6] Health and Safety Executive's submission to the1987 Sizewell B Inquiry suggesting that a factor of up to 3 (i.e. costs three times larger than benefits) would apply for risks to workers; for low risks to members of the public a factor of 2, for high risks a factor of 10. The Sizewell B Inquiry was public inquiry conducted between January 1983 and March 1985 into a proposal to construct a nuclear power station in the UK.

[7] Australian Energy Regulator, *"Industry practice application note for asset replacement planning,"* available at https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning, viewed on 7 November 2019.

[8] The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

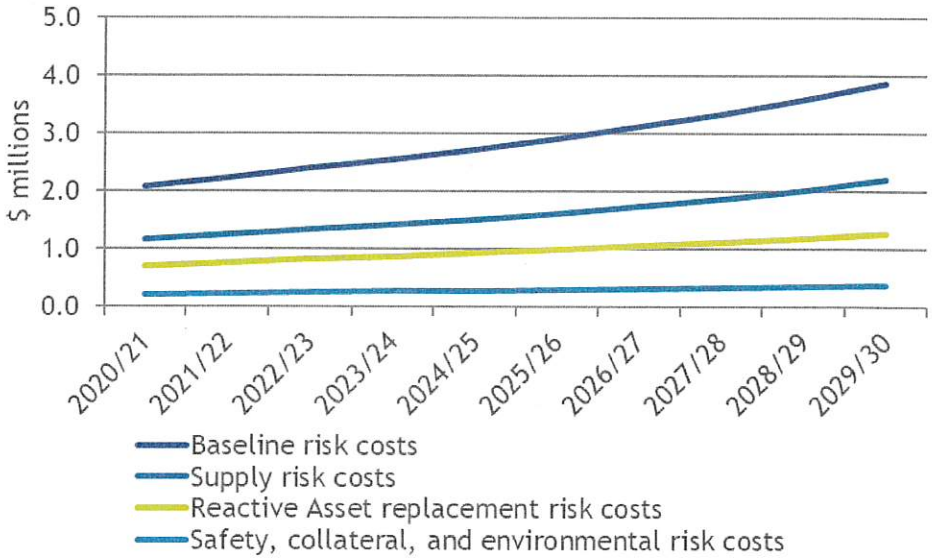


Figure 2 Baseline risk costs

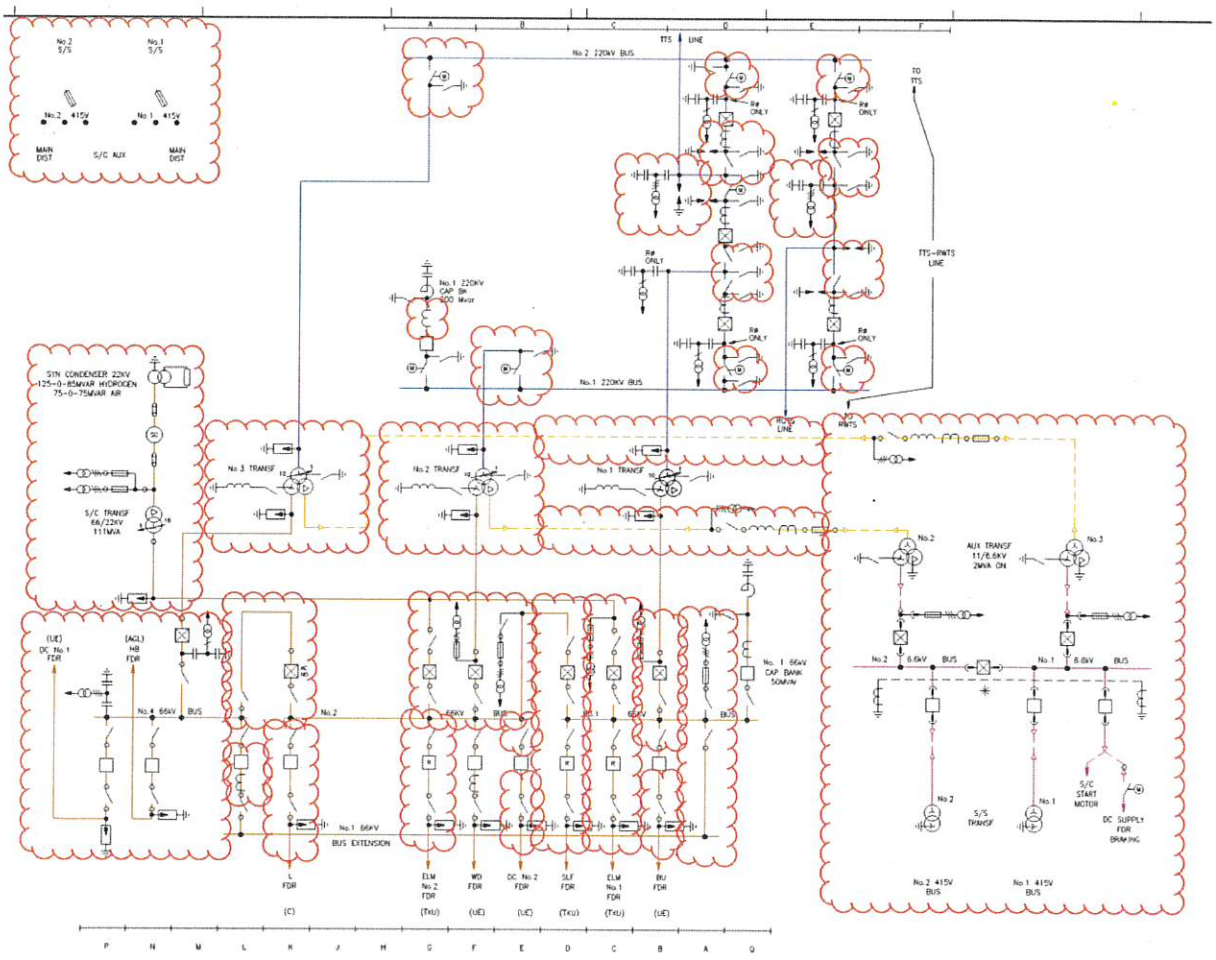
With the selected asset replacement, AusNet Services will be able to maintain supply reliability in north-eastern metropolitan Melbourne and mitigate safety, environmental, and operational risks, as required by the National Electricity Rules (NER) and Electricity Safety Act.

3. SCOPE – HIGH LEVEL

The following is a summary of the scope of work for the preferred option (Integrated Replacement) to address the identified risks at TSTS.

a. Replace the B2 and B3 220/66 kV transformers with the same size (150 MVA) - The first transformer will be replaced in a new location so that security of supply is maintained at all times during the project
b. Replace thirteen 66 kV bulk oil circuit breakers
c. Replace three 220kV current transformers
d. Replace six 66kV current transformers
e. Replace eight 66kV voltage transformers
f. Replace six 220kV voltage transformers
g. Replace two station service transformers
h. Replace 66 kV isolators, reactors, 220 kV earth switches
i. Removal of the retired synchronous condenser
j. Works on secondary assets:
    a. 220 kV protection and control
    b. Transformer protections
    c. 66 kV protection and control
    d. Decommission and removal of all protection and control panels associated with the retired synchronous condenser
    e. ITCs and secondary cabling works
    f. SCADA RTUs and racks replacements
    g. Replacement of metering cubicles
    h. Installation of AC and DC Supplies

A single line diagram of the proposed works is shown below, assets marked in red are planned to be replaced as part of this project. A detailed scope of work is attached in Appendix A1.

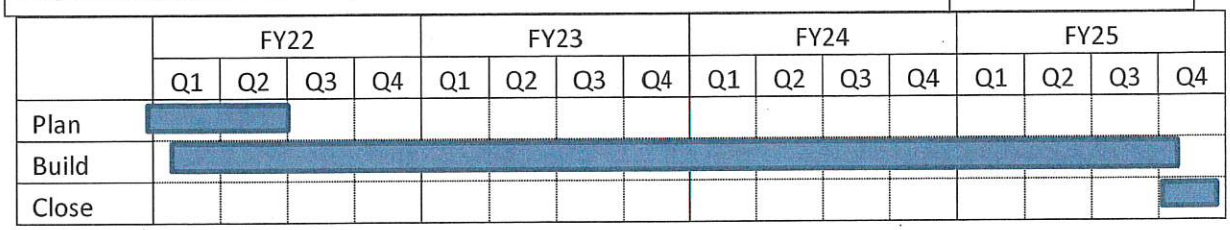


3.1 Standards to be developed for this project

The engineering standards for this project are current and available via ECM and no new standards are required for this project.

4. SCHEDULE

Key Milestone	Date
Stage Gate 2 Approval	14/01/2020
Control Estimate Complete	20/12/2022
Commissioning Readiness Complete (Should be in SAP)	20/12/2024
Project Completion / Regulatory Commencement	20/03/2025



5. OPTIONS CONSIDERED

The following options have been considered and assessed over their forty-five years life from FY21.

Option	Description Summary
BAU	Business as Usual
1	Preferred Option 1: Integrated Replacement
2	Option 2: Staged Replacement with Deferred Replacement of B2 Transformer

5.1 Business as usual / Do nothing

The Business as Usual (BAU) option quantifies the base line risk (primarily supply and financial risk) at TSTS. It is used for modelling purposes in the economic cost-benefit analysis to determine the economical time for the asset replacement option with the lowest PV cost to proceed. A failure of any of the deteriorated assets at TSTS (220/66 kV transformers, 66 kV circuit breakers, or 220 kV or 66 kV instrument transformers) poses a material supply and safety risk.

The "Business as usual" option does not address the following AusNet Services obligations:

- under the National Electricity Rules to maintain the quality, reliability and security of supply of prescribed transmission services
- under the Electricity Safety Act to operate, maintain and decommission the supply network to minimise as far as practicable the hazards and risks to the safety of any person arising from the supply network

This option has a total present value (PV) cost of $75 million, which is mainly due to escalating supply and financial risks costs. Note that this PV cost includes the Opex and all the risk cost component for this option in the economic assessment. The Business as Usual option is not an economical option or a prudent management strategy for the assets at TSTS.

Capex and Opex	No capex is included in this option. Opex consists of transformer and circuit breaker operation and maintenance costs, which is estimated at $16K pa given the age and condition of the assets at TSTS.
Community Costs & Benefits	The community cost of the BAU option includes safety, supply, collateral, financial and environmental risk cost as well as transformer losses. The monetised risk has been calculated in accordance with AMS 10-24 and the following input assumptions: 1. Supply risk cost – the N-1 risk cost is insignificant while the N-2 risk cost is substantial. The supply risk cost is evaluated using the VCR for TSTS ($29,619/MWh) 2. Safety risk cost - $0.044M (weighted with the likelihood of consequence) 3. Environmental risk cost - $0.1M 4. Collateral damage risk cost - $1M 5. Transformer losses – includes load losses based on the forecast demand at TSTS as well as no load losses using the following assumptions for losses on the two old transformers.

	Old	New
No load losses (kW)	95	50
Load losses @ 150 MVA (kW)	776	475

The annual risk cost and operating cost of the deteriorated switchgear at TSTS increases from $2.4 M to $4.7 M over the period from FY21 to FY32. (See detailed breakdown for each voltage in the table below).

Business as Usual	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Capex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Annual payment for Non-Network Options	0	0	0	0	0	0	0	0	0	0	0	0
RISK AND OPERATING COST												
Transformer Safety, Collateral, Enviromental and Reactive Asset replacement Risk	0.415	0.446	0.478	0.511	0.546	0.582	0.620	0.659	0.700	0.742	0.786	0.831
220 kV Circuit Breaker Risk Cost	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
220 kV Instrument Transformer Risk Cost	0.132	0.144	0.156	0.168	0.181	0.195	0.209	0.224	0.239	0.255	0.272	0.289
66 kV Circuit Breaker Risk Cost	1.177	1.251	1.327	1.406	1.487	1.571	1.661	1.753	1.854	1.967	2.078	2.194
66 kV Instrument Transformer Risk Cost	0.153	0.166	0.179	0.193	0.207	0.223	0.238	0.255	0.272	0.289	0.308	0.327
22 kV Circuit Breaker Risk Cost	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22 kV Instrument Transformer Risk Cost	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N-1 Transformer Supply Risk	0.072	0.067	0.062	0.056	0.051	0.047	0.044	0.041	0.043	0.049	0.052	0.055
N-2 Transformer Supply Risk	0.110	0.125	0.141	0.158	0.178	0.199	0.224	0.252	0.286	0.327	0.369	0.415
N-3 Tranformer Supply Risk	0.025	0.034	0.044	0.058	0.075	0.095	0.121	0.152	0.190	0.236	0.291	0.357
N-4 Tranformer Supply Risk	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Transformer Maintenance	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Circuit Breaker Maintenance	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
Transformer Losses	0.312	0.310	0.307	0.305	0.302	0.300	0.298	0.296	0.296	0.297	0.297	0.297
Annual Risk Cost and Operating Cost	2.413	2.558	2.710	2.871	3.043	3.228	3.431	3.649	3.896	4.179	4.470	4.782

5.2 Preferred option – Integrated Replacement

This option involves replacement of the B2 and B3 220/66 kV transformers, thirteen 66 kV circuit breakers, twenty-three instrument transformers, and associated secondary assets that are in poor condition in a single integrated project.

This option addresses all the identified risks and has the lowest PV cost ($53.9 M) of all technically feasible options considered. Note that this PV cost includes the capex, opex and all the risk cost component for this option in the economic assessment. This option is the preferred option identified in the RIT-T. Therefore, this option is recommended for approval.

The project is already economic however allowing for construction lead time, the earliest commissioning date is in December 2024.

Capex and Opex	The project capex cost is $42.9 M (excluding asset retirement cost and management reserve). The project will deliver a $10k saving in Opex annually. The saving is due to the lower expected maintenance cost associated with the new transformers and switchgear.
Community Costs & Benefits **(Regulated projects)**	The residual safety, supply, collateral and environmental risk cost will be negligible after project completion as it addresses all the identified risks.
Incentive Benefits **(Electricity only)**	

5.3 Option 3 - Staged Replacement with Deferred Replacement of B2 Transformer

This option considers the economic feasibility of staging the asset replacement works over two phases. Stage 1 includes replacement of the B3 transformer and all 220 kV and 66 kV switchgear that are in poor condition. The replacement of the B2 transformer is deferred to a second stage.

The total PV of cost of this option ($54.9 M) is higher than the preferred option and it does not address all the identified risks. Note that this PV cost includes the capex, opex and all the risk cost component for this option in the economic assessment. This option is not recommended.

Capex and Opex	The capex for the stage 1 of this option is $34.9m (excluding asset retirement cost and management reserve). The capex for stage 2 will be considered as separate project and is not included in here. The project will deliver a $7.8k saving in Opex annually. The saving is due to the lower expected maintenance cost associated with the new transformers and switchgear.
Community Costs & Benefits	The residual safety, supply, collateral and environmental risk cost will be low after project completion. This project would address some of the identified risks, but not all.
Incentive Benefits (Electricity only)	

6. BENEFIT ASSESSMENT

It is not necessary to identify benefits from each category – insert N/A where not applicable

Note: Productivity and Cost Avoidance are to be detailed in Non-financial benefits section

Financial Benefits

Financial Benefits are those that will have a direct bottom line (budget) impact on the profitability of AusNet Services (opex or propex or incentive, either on planned levels of expenditure and incentives, or growth (Revenue increase). Financial Benefits associated an increased Regulatory Asset Base are not considered appropriate benefits for a Regulated Business Case.

Note: Productivity and Cost Avoidance are to be detailed in Non-financial benefits (section 6.2)

8 Financial Benefits Summary							
Financial Benefit Category	**Details and Measure (baseline, metric, and target)**	**Benefit Start to Full Realisation Date**	**Capex**		**Opex**		**Business Benefit Owner** *Who stands to gain the most from the benefit? Must be role specific and cost centre provided*
			Labour	**Non-Labour**	**Labour**	**Non-Labour**	
1.Cost Efficiency – Reduction							
Recurring cost savings		Benefit start Full Realisation Date	$	$	$	$	Role: Cost centre:
One-off cost savings			$	$	$	$	
2. Growth (Revenue Increase)			**Capex**		**Opex**		
Recurring Revenue (incl. incentives)		Benefit start Full Realisation Date	$		$		Role: Cost centre:
One-off Revenue			$		$		

Financial Benefits Summary (Definitions)		
Financial Benefit Item	**Definition**	**Example**
Labour	Reduced FTE – Reduced opex / capex	Decrease current asset maintenance costs
Non-Labour	Reduced material costs	Reduce working capital requirements
Recurring savings (Planned)	Improved cost-to-serve	Reduced costs – once off / sustainable Reduced energy losses
One-off savings (Planned)		
Recurring Revenue (incl. incentives)	Reduced debtor / creditor days Improved Net Working Capital position Improved collections / margins on customer contributions	Increased customer contributions Improved incentive payments
One-off Revenue		

Non-Financial Benefits

Non-Financial Benefits are those that will have a business benefit which will not directly impact the financials (cost centre / budget) of AusNet Services.

Every effort must be made to quantify these so they can be measured and tracked.

#	Benefit Category	Benefit Sub-Category	Benefit Name (& description)	Benefit Start to Full Realisation Date	Measure - Baseline, Metric and Target	Assumptions	Business Benefit Owner
	Duplicate benefits must be avoided in the Benefit Assessment.	*Use one of the existing categories below.*	*Provide a short benefit name and a description of what benefit is being provided by the program, project, or initiative.*	*When can benefits (i) start to be tracked (date after key milestone) and (ii) when will they be fully realised?*	*What is the baseline, metric used, and the result expected?*	*Provide the assumptions behind how the program, project or initiative will deliver the benefit.*	*Who stands to gain the most from the benefit? (e.g. Business Owner) Must be role specific*
3	**Future Ready Capabilities and Culture** *Benefits that enhance the capabilities or culture of AusNet Services to make the organisation a more enjoyable and desirable place to work*	Productivity		Benefit start 20/12/2024 Full Realisation Date 20/12/2024			
		People and Culture		Benefit start 20/12/2024 Full Realisation Date 20/12/2024			
4	**Compliance** *Benefits to meet compliance against a specific reg \ legal obligation*	Regulatory & Legal	Environmental benefits (by removing risks) NER obligations (to maintain the quality, reliability and security of supply) ESA obligations	Benefit start 20/12/2024 Full Realisation Date 20/12/2024	Avoiding possible environmental damage due oil spills Comply with NER and ESA obligations		

#	Benefit Category	Benefit Sub-Category	Benefit Name (& description)	Benefit Start to Full Realisation Date	Measure - Baseline, Metric and Target	Assumptions	Business Benefit Owner
5	**Customer Centricity** *Benefits that provide direct improvement of our services to customers or enhance AusNet Services' reputation within the community*	Customer – General	Reliable power supply to customers	Benefit start 20/12/2024 Full Realisation Date 20/12/2024	Customer satisfaction		
6	**Risk Management** *Benefits that reduce the risk of either a poor outcome associated with one (or more) of the other benefit categories or a risk of future cost increase.*	Risk Controls	Security of supply risk – due to the reduction in failure rate. There are over 116,000 customers supplied by TSTS. The supply risk is demonstrated by the graph in section 2. There are also benefits from reduction in environmental and emergency replacement risk cost.	Benefit start 20/12/2024 Full Realisation Date 20/12/2024	Mitigate risk of prolonged outage affecting 380,000 customers by purchasing and storing the transformer before the realisation date. (Delivering scope of business case by the planned realisation date). SAIDI Mitigate risk of oil-spills and needing to urgently replace assets when they fail.		–
		Cost Avoidance	Possible STPIS incentive – due to one or more transformer unplanned outages	Benefit start 20/12/2024 Full Realisation Date 20/12/2024	STPIS - A loss of supply event as a result of any unplanned transformer or CB outage could incur STPIS service component penalty	Possibility of failing one or both transformers before planned replacement	
7	**Mission Zero** *Benefits that provide a safer working environment for staff, our customers, and the community*	Safety – General	Safer work environment for the employees due to replacement of assets in poor condition.	Benefit start 20/12/2024	Safer work environment		–

TSTS Transformer and Switchgear Replacement

#	Benefit Category	Benefit Sub-Category	Benefit Name (& description)	Benefit Start to Full Realisation Date	Measure - Baseline, Metric and Target	Assumptions	Business Benefit Owner
				Full Realisation Date 20/12/2024			

7. RISK ASSESSMENT

7.1 Project delivery risk (known)

Project Risk	What could occur?	Consequence *Rating 1-5**	Likelihood *Rating (Almost Certain ~ Rare) **	Current Risk Rating *Rating A-E**	Actions and controls in place to manage/reduce risk	Target Risk Level *A-E**
Plant explosive failure during project delivery phase	Safety risk and supply outages	4	Unlikely	C	Monitor assets during project. Safety review completed prior to project start.	C
Plant failure during project delivery phase	Supply outages	2	Unlikely	D	Contingency plans, load transfers and monitor assets for any deterioration in condition.	E
Brown Field Redevelopment	Supply outages	2	Unlikely	D	Manage outages and limit it to the lower demand period.	E
Delays in Delivery of Transformers	Supply Outages	2	Unlikely	D	Allow long lead time with supplier	E
Incorrect engineering design	Supply Outages	2	Unlikely	D	Detailed scope and design provided to manufacturer	E

Refer to the Risk Assessment Criteria document on the Risk Management SharePoint site on the Loop: Link

Has a Costed Risk Workshop been conducted to calculate Management Reserve for this project?	☐ Yes	☒ No

7.2 Other risks

No other known risk at this stage.

8. HIGH LEVEL CHANGE IMPACTS

8.1 High Level Impacts

Considering a BAU asset installation project, this project is not expected to change the system, processes, people or culture. Accordingly, change impact is none or minimal.

Attach the completed Rapid Change Impact Assessment here.

RAPID CHANGE
IMPACT ASSESSMEN

8.2 Stakeholder Groups impacted by the change(s)

Not applicable

9. PROJECT GOVERNANCE

1. **AusNet Services Portfolio Framework for governance on capital investments applies.**
2. **CMA mandatory requirements will be followed including monthly forecasting, monthly status reports (updates on scope, cost, and time), stage gates, and change control request process.**
3. **Establishment of a Project Reference Group or Steering Committee comprising key strategic and operational representatives to oversee the project and provide:**
    - Oversight of project status
    - Guidance and direction
    - Review and endorsement for project key deliverables/decisions
    - Dissemination of information to other relevant parties
    - Facilitate the Transition to Support Process
4. Escalation Process for resolution of risks and issues.

10. FINANCIAL ASSESSMENT

Capex profit centre	13260
Propex profit centre	Not Applicable
Opex (BAU) owner & cost centre	Not Applicable

10.1 Capex Breakdown

Capex Breakdown (incl mngt reserve - nominal)	First 5 years					Lifecycle Total
	2021	2022	2023	2024	2025	
Design	-	1,998.4	-	247.6	1,415.2	3,661.2
Internal Labour	217.1	188.7	754.9	745.7	492.3	2,398.8
Materials	-	1,503.0	6,390.4	3,910.9	1,064.4	12,868.7
Plant & Equipment	-	56.8	579.3	590.9	341.6	1,568.6
Contracts	-	651.7	6,650.2	6,783.2	3,920.9	18,006.0
Meter Costs	-	-	-	-	-	-
Risk	-	70.7	721.1	735.5	425.2	1,952.5
Other	-	-	-	-	-	-
Management Reserve	-	-	-	-	832.4	832.4
Total Capex	217.1	4,469.4	15,095.9	13,013.9	8,492.0	41,288.2

10.2 Opex Breakdown

Opex excl Project implementation (nominal)	First 5 years					Lifecycle Total
	2021	2022	2023	2024	2025	
BAU Total Opex	16.1	16.5	16.8	17.1	17.5	1,365.5
Incremental Opex Costs - Option 1	-	-	-	-	-	-
Opex Savings - Option 1	-	-	-	-	(10.4)	(770.8)
Net Budget impact (split by division below)	-	-	-	-	(10.4)	(770.8)
New Cost profile	**16.1**	**16.5**	**16.8**	**17.1**	**7.1**	**594.7**

10.3 Division Budget Impact

Budget impact by division (nominal)	First 5 years					Lifecycle Total
	2021	2022	2023	2024	2025	
RES	-	-	-	-	(10.4)	(770.8)
Ops&Services	-	-	-	-	-	-
Mondo	-	-	-	-	-	-
Finance	-	-	-	-	-	-
Technology	-	-	-	-	-	-
Strategy & Transformation	-	-	-	-	-	-
People, Safety & Customer	-	-	-	-	-	-
Governance	-	-	-	-	-	-
Managing Director	-	-	-	-	-	-
Total Budget impact: Option 1	-	-	-	-	(10.4)	(770.8)

10.4 NPV Build-up Assessment

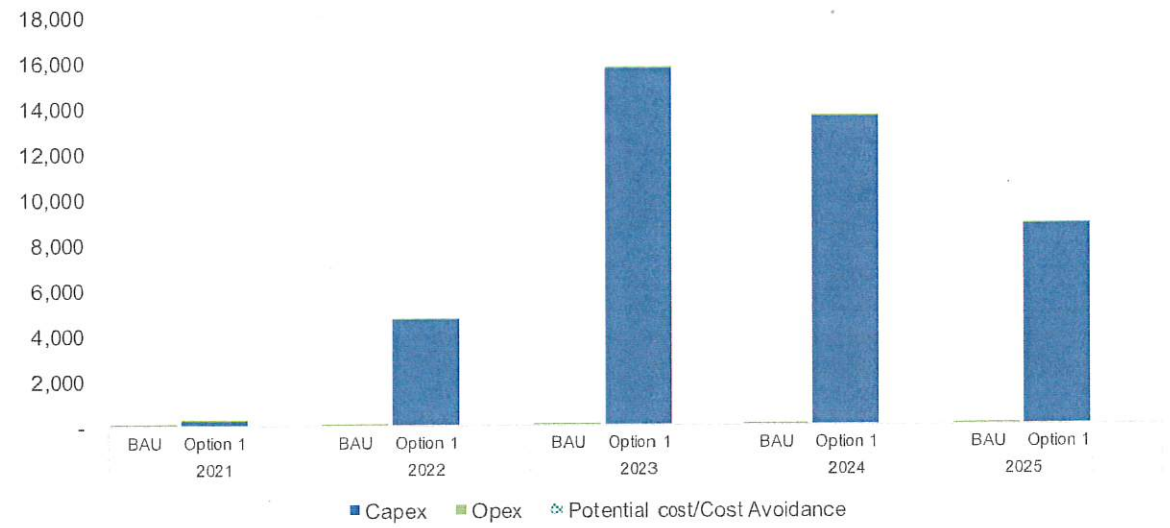
NPV buildup all options

	BAU	Option 1	Option 2
Regulated Revenue			
Return on assets	-	29,588.9	24,243.1
Regulatory Depreciation	-	13,656.9	11,189.1
Opex allowance	557.2	264.0	319.1
Efficiency Benefit	-	-	-
Tax Allowance	-	4,106.2	3,352.3
Imputation credits	-	(1,642.5)	(1,340.9)
Total Regulated Revenue	557.2	45,973.5	37,762.7
Proceeds from Sale of replaced assets	-	-	-
Unregulated Revenue	-	-	-
Opex	(557.2)	(264.0)	(319.1)
Capex	-	(37,208.6)	(30,552.7)
Tax Payable	-	(2,347.6)	(1,927.0)
NPV	-	6,153.1	4,964.2

TSTS Transformer and Switchgear Replacement

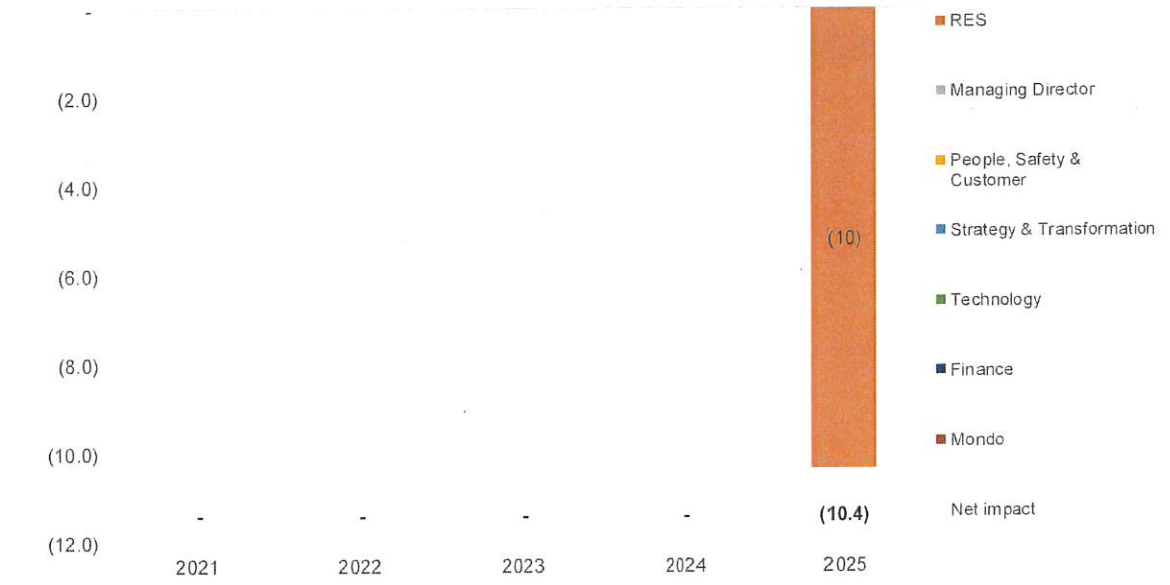
BAU vs Option 1 Least Cost Analysis - 5 year view

Nominal



Option 1 incremental budget impact compared to BAU

Nominal



11. CORPORATE ACCOUNTING CONSIDERATIONS

11.1 Asset Retirements

The project includes retirements of:

1. Two 150 MVA 220/66 kV B type transformers;
2. Thirteen 66 kV CB;
3. Three 220 kV CTs;
4. Six 66 kV CTs;
5. Six 220 kV VTs;
6. Eight 66 kV VTs;
7. Two station service transformers, isolators, reactors, earth switches, ROI;
8. Secondary assets, which includes: 220 kV protection and control, transformer protections, 66 kV protection and control, all protection and control panels associated with the retired synchronous condenser, SCADA RTUs and racks, metering cubicles

The total written down values (WDV) of the project is $0. (WDV spread sheets were uploaded and available in PPM) and is also attached in Appendix A.

11.2 Contributed (Gifted) Assets

Not Applicable

11.3 Assets to be created

Description of Asset	Quantity	Estimated Cost (total)	Expected Asset Life
E.g. Software 150 MVA 220/66 kV transformers;	*2* 2	*$$$* $12.1 m	*5* 45
E.g. Software 66kV Equipment	*2* 13 CBs 6 CTs 8 VTs	*$$$* $10.3m	*5* 45
E.g. Current Transformer 220 kV Equipment	*2* Three CTs Six VTs	*$$$* $7.7m	*20* 45
Station Service transformer	Two	$0.507m	45

Protection and control		$8.6M	15 Years
Modified and Replaced 66kV Poles		$0.213m	45 Years
Other secondary (SCADA, Metering & monitoring, Comms, Digital network/asset data interface etc		$4.5M	15 Years
Totals		$43.8m	

Total Estimated Cost must match the Delivery Budget (+CFC & O/H) on page 1.

11.4 Accounting Review

Income Statement (nominal)	First 5 years					Lifecycle Total
	2021	2022	2023	2024	2025	
Regulated revenue	16.1	30.6	241.5	969.4	1,595.9	108,375.2
Incentive Revenue	-	-	-	-	-	-
Unregulated Revenue	-	-	-	-	-	-
Total Revenue	16.1	30.6	241.5	969.4	1,595.9	108,375.2
Net Opex	(16.1)	(16.5)	(16.8)	(17.1)	(7.1)	(594.7)
Net (gain) / loss on disposal of fixed assets	-	-	-	-	-	-
EBITDA	-	14.1	224.7	952.3	1,588.8	107,780.4
Depreciation	-	(5.0)	(106.5)	(442.4)	(726.3)	(40,824.2)
EBIT	-	9.1	118.3	509.9	862.5	66,956.2
Interest	-	(5.1)	(109.1)	(451.5)	(729.4)	(21,337.7)
NPBT	-	4.0	9.1	58.4	133.1	45,618.4
Tax	-	(1.2)	(2.7)	(17.5)	(39.9)	(13,685.5)
NPAT	**-**	**2.8**	**6.4**	**40.9**	**93.1**	**31,932.9**

Appendix A

1. *Attach files as objects, or upload to PPM and advise here.*
2. *Detailed Scope of Work should be attached here. Insert file as object where possible. Attach If applicable*
3. *Planning extract (AMS, AMP, ESV directive letter, AER submission etc.). Insert screenshot and highlight relevant section.*
4. *Detailed Cost Benefit Analysis Assumptions*
5. *Applicable AusNet Engineering Standards*

A.1 Scope of works	The scope of work is detailed in chapter 2 of the following attached file. TD-0007772 TSTS Redevelopment Rev 5
A.2 Asset Management Strategy Extract	None
A.3 ESV or Legal Directive	None
A.4 Detailed Cost and Benefit Assumptions	Cost estimate, economic analysis and NPV model were uploaded and available in PPM and are also attached here. Note that there is $233,439 expected to be spent on this project for FY21. TSTS Economic Model 2019 Rev12_2C TD-0007772 Business Case Evaluation_v6.xls
A.5 Distribution Single Line Diagram	The electricity distribution networks are supplied at 66 kV via three 150 MVA 220/66 kV transformers and nine 66 kV distribution feeder connections. The TSTS 66 kV switchyard includes three busbars, three bus-ties, nine feeders and a 50 MVar capacitor bank. The figure below shows the 66 kV switching configuration at TSTS and the 66 kV distribution networks supplied from TSTS.

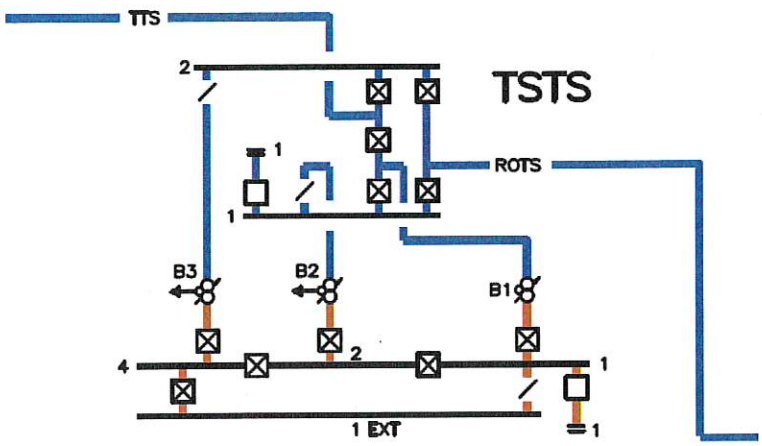


Figure 3 Single Line Diagram of the 66 kV Distribution Networks Supplied from TSTS

A.6 Asset Information

TD0007772_ Asset_Information.doc

A.7 Written Down Values

WDV_20210318.xlsb