AusNet Transmission Group Pty Ltd

Transmission Revenue Review 2017-2022

XC28 – HWPS 220kV Switchyard Redevelopment: Business Case (Public)

Submitted: 30 October 2015

EPMO Business Case
Application for Approval

XC28 - HWPS 220kV Switchyard Redevelopment, Stage 4

Program ID:	T0614
Project Number:	XC28
Project Initiator:	[C-I-C]
Initiating Dept. / Division:	Network Planning & Strategy / Asset Management
Prepared By:	[C-I-C]
Contact No:	[C-I-C]
Date of Submission:	4 December 2014
Target Project Start Date:	1 April 2015
Proposed In-Service Date:	31 October 2018
Target Project Completion Date:	31 January 2019

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1. PORTFOLIO

Check the relevant box below to reflect where the costs are to be directed for this proposed activity

Transmission	Electricity Dist.	Gas Dist.	ICT	Other
☒	☐	☐	☐	☐

Note, if the proposal spans more than a single line of business please indicate the relevant % splits (i.e., T%/E%/G%)

2. RECOMMENDATION

Approval is sought for expenditure of up to $24.7 M (including risk adjustments, overheads and finance charges) to replace seven 220 kV bulk oil type circuit breakers, nine current transformers, nine voltage transformers, and thirty-nine disconnectors in the Hazelwood Power Station 220 kV switchyard (HWPS). The key project driver is the health and safety risk presented by an unlikely explosive failure of any one of the deteriorating 220 kV circuit breaker bushings or post type current transformers. The project has been assessed as economic and is expected to be completed in January 2019.

Consistent with the original Value Engineering Study (2009) and the Planning Report submitted as part of the 2014-2017 transmission revenue reset (TRR), this project is the fourth and final stage of the redevelopment of the HWPS. A staged redevelopment of HWPS has been used to manage the asset failure risk in an uncertain planning environment, which included a previous government proposal for early closure of Hazelwood Power Station and some of the less efficient Latrobe Valley coal fired power stations.

3. FINANCIAL SUMMARY

TABLE 3a: Program / Project Expenditure & Revenue Forecasts

	First 5 years					
Project Expenditure Forecasts ($'000s)	**2014 / 15**	**2015 / 16**	**2016 / 17**	**2017 / 18**	**2018 / 19**	**Total**
P50 Direct Expenditure (excl Delivery risk)	126	1,611	7,611	8,318	3,905	21,570
Capitalised Finance Charges	1	67	216	121	88	493
Project Delivery Budget - P50 Direct & CFC's	**127**	**1,678**	**7,827**	**8,438**	**3,993**	**22,063**
P90 Delivery Risk Adjustment**	6	83	391	427	200	1,107
Overheads	9	113	533	582	273	1,510
Total CAPEX for Approval (incl risk, CFC's & OH's)	**142**	**1,873**	**8,751**	**9,447**	**4,467**	**24,680**
Operating Expenditure	-	-	-	-	-	-
Written Down Value (WDV) of Assets retired (non-cash)	-	-	-	-	-	-
Total Estimated Expenditure for Approval	**142**	**1,873**	**8,751**	**9,447**	**4,467**	**24,680**
Total Revenue	**(1)**	**86**	**556**	**1,380**	**2,024**	**105,469**
NPV (post Tax)						[C-I-C]
Payback Period (Discounted)						37.5
Internal Rate of Return (IRR)						7.80%
Corporate WACC (Post Tax Nominal)						7.39%

** Access to the P90 Delivery Risk component is subject to approval of a Change Request (CR) in EPPM and prior to exceeding the Project Delivery Budget

3.1. BUDGET PROVISION

3.1.1. CAPEX considerations

Select the most appropriate statement below (A, B or C)

A.	This Program / Project is within the approved capital budget list for the financial years as shown above	☒
B.	This Program / Project is not within the approved capital budget list but will be managed within the *total portfolio* budget for the financial years shown above	☐
C.	This Program / Project is not within budget and may require MD approval (per SP Authority Manual)	☐

3.1.2. OPEX requirements

Select the most appropriate statement below (A, B or both)

A.	The relevant cost centre manager(s) have agreed to accept any operating expenditure component as shown in the forecasts table above. **Management approval required at section 5**	☐
B.	The relevant cost centre manager(s) have acknowledged and agreed to potential Opex benefits / savings as a result of this Program / project. (Refer s.10 – 'Benefits' for further details)	☒

4. ENDORSEMENTS

**Note, by submitting this Business Case for approval to the EPMO it is expected that the relevant Line Managers or Program Managers have given their prior endorsement[1].

[C-I-C]

Manager Enterprise PMO
John Morris
Date: 6/2/2015

5. APPROVALS

[C-I-C]

General Manager Asset Management
[C-I-C]
Alistair Parker
Date: 4/2/2015.

Chief Financial Officer
[C-I-C]
Adam Newman
Date:

A/ Managing Director ALISTAIR PARKER
[C-I-C]
Nino Ficca
Date: 12/2/15

[1] In accordance with AusNet Services Portfolio Framework 'Plan Phase' process flows document on EPMO SharePoint site

6. STRATEGIC ALIGNMENT & IMPACT

Table 6a: Strategic Alignment & Impact

Strategic Driver	Alignment to Corporate Strategy	Response
Safety	Industry leader in safety performance	High
Business & Asset Performance	Safe, resilient and reliable networks	Extreme
Financial	Sustainable earnings and securityholder value growth	Medium
Customer	Highly developed customer service capability	Medium
People	High performing leadership, capability and culture	Medium

6.1. SAFETY > CONTRIBUTION TO MISSION ZERO

AusNet Services' responsibility to safety practices and procedures are incorporated in the Mission Zero vision. This project is aligned with the Mission Zero vision to minimise the health, safety, environmental and asset risks associated with deteriorating electrical equipment at HWPS.

6.2. BUSINESS & ASSET PERFORMANCE

6.2.1. REGULATORY DRIVERS

Safety ☒	Regulatory Compliance ☐	Reliability Improvement ☒	Quality of Supply ☐	Environmental ☒
Capacity ☐	Legislative Compliance ☐	Infrastructure Security ☐	Customer ☒	Asset Condition ☒

6.2.2. ALIGNMENT WITH REGULATORY SUBMISSIONS

The project has been included in the AER's capital allowance at a value of $5.9M (direct $2013-14) for the 2014-17 regulatory control period. AusNet Services will continue to seek funding for this project (i.e. direct expenditure in 2017/18 and 2018/19 financial years) in the next 2017-2023 TRR submission. Reprioritisation of transmission asset renewal projects will release sufficient funds for the business to proceed with the HWPS 220kV switchyard redevelopment, stage 4 without exceeding the regulatory approved capital budget for the current and next regulatory control period.

6.3. OTHER STRATEGIC DRIVERS

N/A

7. BACKGROUND

HWPS is the key 220 kV connection station for most of the power stations in the Latrobe Valley, including eight GDF SUEZ Hazelwood generators with a combined output of approximately 1600 MW.

The HWPS 220kV switchyard provides the switching for the eight generators and thirteen 220 kV lines that includes four lines to Hazelwood Terminal Station (HWTS), four lines to Jeeralang Terminal Station (JLTS), two lines to Yallourn Power Station (YPS), two lines to Rowville Terminal Station (ROTS), and one line to Morwell Power Station and Morwell Terminal Station (MPS/MWTS).

The station was constructed in the mid 1960s and the assets that are targeted for replacement in Stage 4 are in a deteriorated condition, with an average service age of 45 years. This project is the final stage in the replacement of all assets in the 220kV switchyard considered to be at a high risk of failure due to condition.

7.1. VALUE ENGINEERING STUDY[2]

AusNet Services undertook various studies including a Value Engineering Study (VE) to assess the most effective way to replace the deteriorated equipment at HWPS. The twenty five [C-I-C] bulk oil circuit breakers (CBs) were identified for replacement in these studies.

The primary objective of the Value Engineering Study was to determine the cost drivers of the project and the most economical option to replace the assets, taking the future plans for HWPS into consideration. AusNet Services, Australian Energy Market Operator (AEMO) and GDF SUEZ Hazelwood (formerly International Power Hazelwood) were involved in this study, confirming the future need for HWPS. The study also confirmed optimisation opportunities in the areas of outage scheduling, alternative circuit breaker management solutions, the elimination of a new control building, etc.

7.2. AMS 10-305 PLANNING REPORT[3]

AusNet Services as a transmission network service provider (TNSP) is obligated to maintain a safe working environment for staff and contractors, maintain the reliability of customer supplies, and prevent escalation of operating and maintenance costs. In meeting the above requirements, AusNet Services included this project in the TRR submission for the period from 2014 to 2017. The planning report identified an increasing failure risk due to asset condition. These risks include health and safety risks, collateral damage risks, and security of supply risks presented by explosive failures of 220 kV [C-I-C] circuit breaker bushings, 220 kV [C-I-C] current transformers or [C-I-C] current transformers. Based on the analysis in the report, the most economical solution to address the emerging constraints at HWPS is to complete Stage 4 of the staged redevelopment which includes replacement of the deteriorated 220 kV bulk oil [C-I-C] circuit breakers and bay equipment. The economic timing for project completion was shown to be 2017.

7.3. PREVIOUS PROJECT STAGES

The staging of the redevelopment works at HWPS involves due consideration of the following factors.

- The risk of individual asset failure based on the condition assessment results.
- The criticality of the asset based on the switching arrangement and the impact on the interconnected transmission network.
- The long term requirements for the HWPS 220 kV switchyard.

7.3.1. Stage 1 – X711

Stage 1 of the redevelopment of HWPS included replacement of the Generator No.1 and 2 switch bays and all bus side isolators of the main No. 1 220 kV Bus in accordance with the VE study. The main reason for the replacement of the bus side isolators was to take advantage of the rare outage opportunity provided by planned maintenance of Generator No.1 and 2. The circuit breakers connecting Generator No.1 and 2 presented a higher failure risk compared with the other circuit breakers and have hence been included in Stage 1 of the redevelopment of HWPS. This project, X711 (Stage 1) has been completed in July 2013.

7.3.2. Stage 2 – X920

This project included replacement of five circuit breakers and their associated isolators. The project scope of works also included replacement of the Bus 2 isolators and earth switches. X920 has been completed in November 2014.

7.3.3. Stage 3 – XB56

[2] The Nous Group, *AusNet Services HWPS switchyard VE Study Report*, 090219 SPI07 AusNet Services HWPS switchyard VE Study report. PDF, 19th February2009.
[3] AMS 10-305 Planning Report – Project XC28 HWPS Circuit Breaker Replacement Stage 4

XB56 is currently in the delivery phase and is scheduled for completion in February 2016. It involves the replacement of eleven [C-I-C] bulk oil circuit breakers.

7.3.4. Stage 4 – XC28

This business case is for the final stage of the redevelopment of HWPS. It involves replacing the remaining seven 220 kV [C-I-C] bulk oil circuit breakers; nine [C-I-C] and [C-I-C] current transformers; nine [C-I-C] [C-I-C] and [C-I-C] voltage transformers; and thirty-nine [C-I-C] disconnectors and earth switches. The timing of this project has been determined such that design and procurement can proceed in the final year of XB56 delivery. This project is expected to be completed in January 2019.

Figure 1 below shows the scope of work for Project XC28 as well as the asset replacements of the first three stages (X711, X920 and XB56). Please refer to Section 8 for further details.

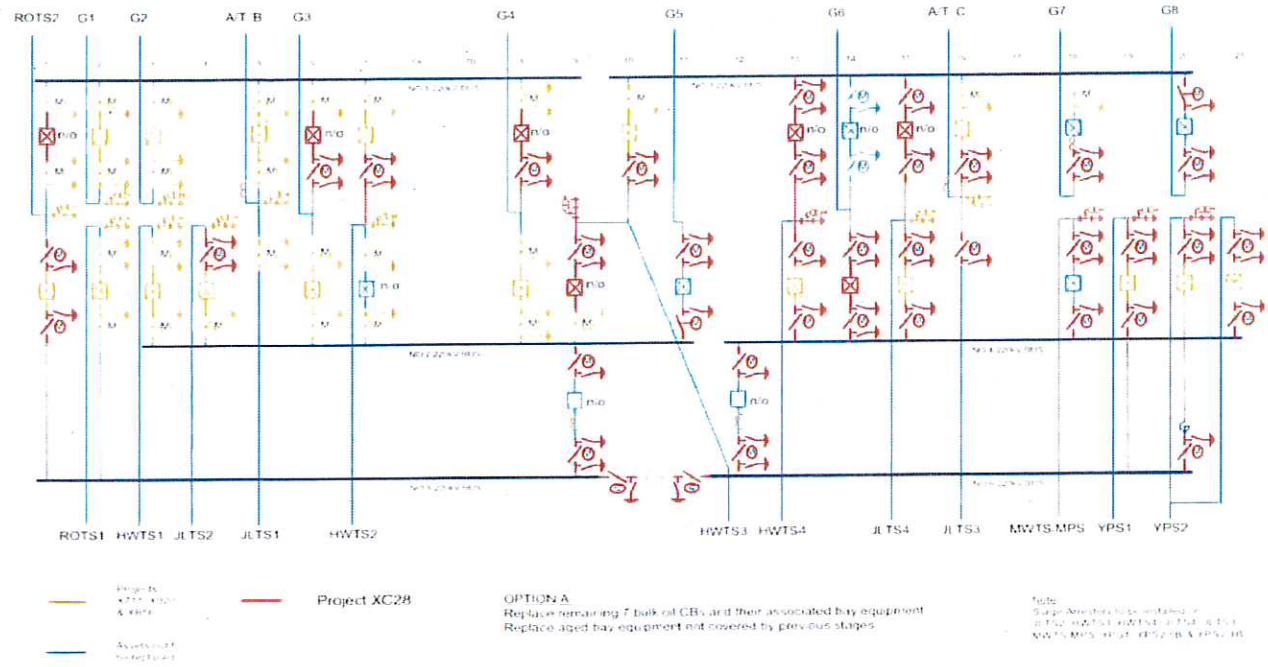


Figure 1: Single Line Diagram for the proposed (XC28) scope of works

7.4. ASSET CONDITION DRIVERS

Declining asset condition, increasing probability of asset failure and associated reliability, health and safety consequences are the primary drivers for this project. Based on the condition of the circuit breakers, current transformers and voltage transformers, supply security and worker safety risks have been quantified.

7.4.1. 220kV Circuit Breakers

The service life of the bulk oil circuit breakers at HWPS ranges from 42 to 46 years. This type of circuit breaker has the worst condition score (C5[4] very poor) of AusNet Services' 220 kV circuit breaker fleet. Project XC28 will replace the remaining 220 kV bulk oil circuit breakers installed on the transmission network.

This type of circuit breaker is highly maintenance intensive involving pneumatic drive mechanisms, hydraulics, oil filled bushings and in excess of 37,500 litres of mineral oil. They present health and safety issues for maintenance crews and the Asset Health Review identified the following major issues associated with the [C-I-C] circuit breakers:

- Bushing deterioration (for example: oil leakage, moisture ingress, overheating due to garter spring relaxation on 2000 A bushings, corrosion and general deterioration of top caps including gauge glasses, and performance limitations of bushing current transformers)
- Age and duty related deterioration (for example: mechanism wear, erosion of interrupter components, air leakage, corrosion, and limited availability of serviceable spares)

[4] Refer to Appendix C for asset condition score definition

- Maintenance resource intensive technology
- Physical nature of maintenance works (i.e. manual handling of large, heavy components and confined space in-tank work)
- Extensive oil handling required for contact inspections and to obtain bushing oil samples
- Environmental hazard presented by large oil volume (within the circuit breaker tanks and the bushings) and the expense for bunding in order to comply literally with EPA guidelines.

7.4.2. 220 kV Isolators

The 220 kV manually operated isolators are showing environmental and duty related wear. They have reliability issues driven by pin and cap insulator condition, worn bearings and worn fixed and moving contact assemblies. Furthermore, the inability to conduct major isolator maintenance works, due to outage constraints, has resulted in seized components further restricting the extent of scheduled maintenance activities.

7.4.3. 220 kV Current Transformers

There are six single-phase 220 kV [C-I-C] current transformers and three single-phase 220 kV [C-I-C] current transformers installed at HWPS. The [C-I-C] current transformers are of similar design to the [C-I-C] current transformers and both types present an increasing failure risk due to their deteriorating condition.

AMS 10-122 identifies that [C-I-C] current transformers show a design and manufacturing deficiency which results in degradation of the primary insulation.

The [C-I-C] and [C-I-C] current transformers at HWPS 220 kV yard present a risk to network security, as well as a safety risk to personnel in the remote event of an explosive failure. They have a high and increasing cost of ownership consequent to the regular oil sampling necessary for monitoring their deteriorating condition.

7.4.4. 220 kV Capacitive Voltage Transformers

The [C-I-C] voltage transformers at HWPS have shown duty based deterioration. The [C-I-C] voltage transformers are prone to oil leaks and exhibit general deterioration with mild localised over-heating. The [C-I-C] capacitive voltage transformers show external environmental driven deterioration.

In recent years AusNet Services has had to replace two single-phase voltage transformers each year upon discovery of significant oil leakage or defects; mainly due to internal packet or component failures. Forced replacements on short timeframes have been necessary for units manufactured by [C-I-C] and [C-I-C].

The capacitive voltage transformer Asset Monitoring System (CAMS) have helped in detecting imminent failures in time to avoid major failures of voltage transformers over the last five years. AusNet Services, however, has had to undertake expensive urgent replacements due to forced outages.

7.4.5. Secondary Systems

The secondary systems at HWPS include the protection and control, SCADA, DC Systems and AC Systems.

The Number 5 and 6 bus protection schemes, and the associated VAT timers, resistors, LTB-type tripping relays and CAG34-type high impedance protection relays, along with the asbestos containing mounting panels have been in service for 40 years. In consideration of known reliability issues associated with the LTB trip relays, selective replacement of these remaining schemes is recommended.

The current check relays associated with the Number 2 to 5 and the Number 4 to 6 bus-tie circuit breakers and the auxiliary transformer protection (Aux 'B' and Aux 'C') present the risk that under high current faults, they may fail to operate correctly. This risk is significant at HWPS due to the high fault levels.

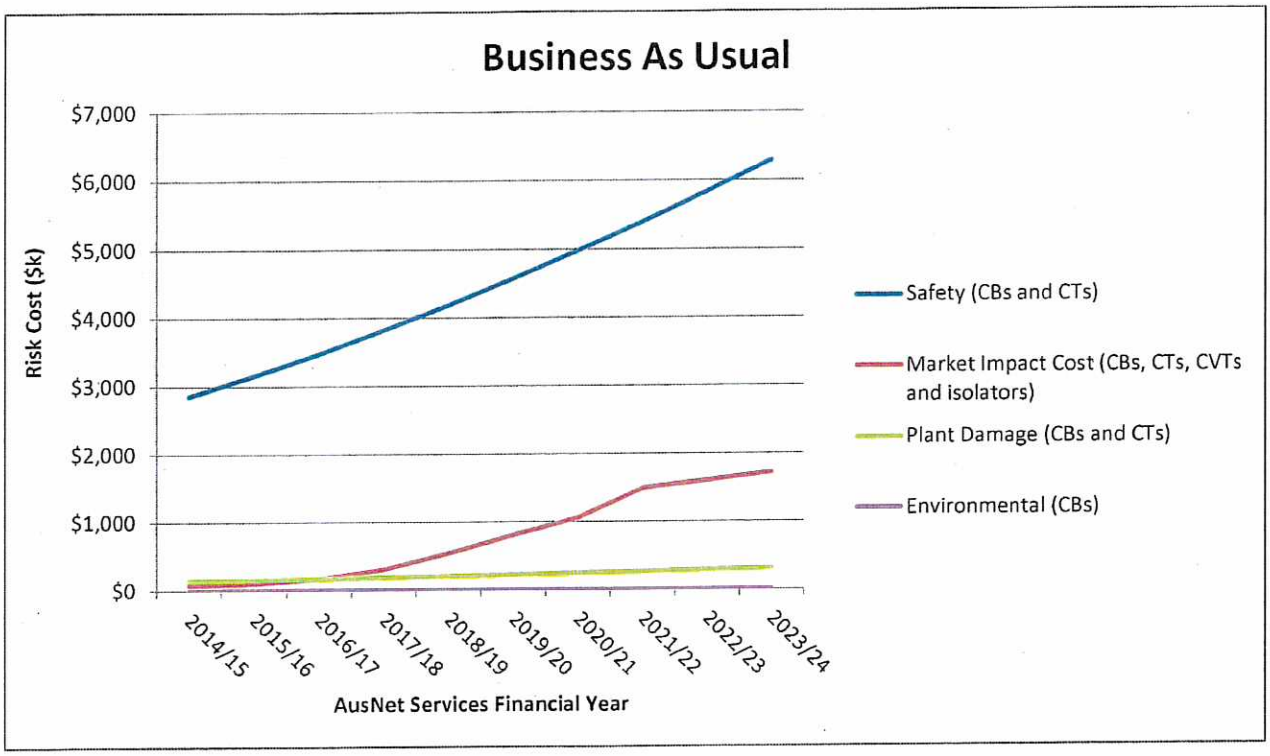
The legacy electromechanical CAG39 type circuit breaker fail relays associated with the JLTS Number 3 and 4 lines and the YPS Number 1 and 2 lines have provided 25 years' service. In consideration of the obsolete relay technology, and space restrictions within the HWPS relay room, it is recommended that these backup schemes be replaced.

7.5. EMERGING CONSTRAINTS

The key service constraints identified at HWPS are:

- Health and safety risks presented by potential explosive failures of 220 kV [C-I-C] circuit breaker bushings, 220 kV [C-I-C] or [C-I-C] current transformers.
- Security of supply risks presented by failures of 220 kV circuit breakers, instrument transformers or isolators. These constraints were quantified in a market benefit study performed by AEMO.
- Collateral damage risks to adjacent plant presented by explosive failures of 220 kV circuit breaker bushings or current transformers.
- Environmental risks presented by large volume of insulating oil.

The assessed risk cost of these constraints is illustrated in Figure 2 below.



7.6. SAFETY AND ENVIRONMENTAL CONSIDERATIONS

7.6.1. 220 kV Circuit Breakers

There is an increasing risk of explosive failure and consequential oil fires presenting a safety risk to personnel working in the vicinity of these bulk oil circuit breakers. Other safety risks associated with this type of circuit breaker include:

- Confined space hazards associated with circuit breaker maintenance, which results in inefficiencies and increases maintenance costs
- Major fire risks presented by large volume of insulating oil within the circuit breaker tanks and the high voltage bushings (up to 3 x 11,300 litres in the tanks and 6 x 600 litres in the bushings).
- Failures involving explosion, fire or oil release could potentially cause collateral damage to adjacent high voltage equipment, cable trenches, secondary cabling and secondary system functionality. Spillage of oil also poses environmental hazards as bulk oil circuit breakers are not positioned within a bunded area.
- Manual handling risks associated with routine maintenance works such as handling of large, heavy components such as the arc control chamber, resistors and capacitors from and within the confined space of the circuit breaker tank.

The Electricity Safety Act 1998 requires AusNet Services to design, construct, operate, maintain and decommission its supply network to minimise so far as is practicable the hazards and risks to the safety of any person arising from the supply network. This act further requires the establishment of an Electricity Safety Management Scheme (ESMS) involving a formal assessment of risks. The risk of explosive failure of circuit breakers has been identified in the ESMS formal risk assessment and the treatment of this risk is a factor in the program to replace 220 kV [C-I-C] bulk oil circuit breakers.

Maintenance of 220 kV [C-I-C] circuit breakers requires personnel to physically enter the circuit breaker tank to conduct routine preventive maintenance activities. Personnel are restricted to work in a confined space from which insulating oil has been drained. This presents several inherent safety risks including air supply, elevated ambient temperatures and slippery surfaces. The confined space also impinges on the manual handling of heavy circuit breaker components.

Past incidents relating to the [C-I-C] bulk oil circuit breakers at HWPS (major and minor), include:

- 1992 – At HWPS, a [C-I-C] circuit breaker bushing explosion resulted in damage to adjacent bushings and an oil fire in cable trenches. The damage to adjacent plant required replacement of four bushings and secondary cabling for protection circuits.
- 17th May 2011 - At HWPS, two bushings on the No.6 bus side of the Yallourn Power Station-Hazelwood Power Station No.1 line [C-I-C] circuit breaker showed a temperature rise above nominal bushing head temperatures of 20°C and 40°C corresponding to absolute temperatures of 40°C and 60°C on the red phase and blue phase respectively. The bushings were replaced and potential explosive failures were averted.
- 21st July 2011 – At HWPS, Select Solutions discovered elevated operating temperatures on the red phase bushing head on the Hazelwood Terminal Station Number 3 line Number 3 bus circuit breaker ([C-I-C]). Frequent thermal scans indicate the operating temperature is high but stable.
- 22nd March 2013 - A circuit breaker was making a noise while operating. It was found[5] that noise was due to the driving shaft that swelled up causing it to push against the guide while trying to operate. The oil sample provided evidence of moisture in the oil of the blue phase which caused the swelling of the shaft.
- 12th August 2013 – At HWPS on one of the circuit breakers bushings on the ROTS No 2 220 kV Line No 1 Bus, a hot spot was discovered. The circuit breaker showed a temperature rise above nominal bushing head temperature of 20°C corresponding to absolute temperature of 60°C on the white phase. The bushing was replaced and a potential explosive failure was averted.

Other incidents associated with [C-I-C] and the higher rated [C-I-C] bulk oil circuit breakers have occurred at Thomastown Terminal Station, South Morang Terminal Station, Dederang Terminal Station and Rowville Terminal Station.

7.6.2. 220 kV Current Transformers

As described in AMS 10-64[6] , there have been a number of [C-I-C] current transformers removed from service in recent years due to rapid deterioration of the primary insulation and several explosive failures have occurred when deterioration was not detected. The [C-I-C] current transformers are of a similar design to the [C-I-C] current transformers and therefore have similar risks.

The potential safety risk to workers is AusNet Services' prime driver to replace the [C-I-C] current transformers. Secondary drivers include collateral damage risk due to projectiles, and fire and environmental damage due to oil spillage following an explosive failure. A progressive replacement in favour of toroidal current transformers incorporated within plant such as dead tank circuit breakers is part of AusNet Services' asset management strategy to address these risks.

7.7. FUTURE DEVELOPMENT PLANS

AEMO has been consulted regarding the proposed asset replacements and confirmed the on-going requirement for these assets in support of AusNet Services' asset renewal plan for HWPS.

[5] AusNet Services Investigation Report - JW420 CB Generating A Noise While Operating
[6] AMS 10-64 Instrument Transformers

8. WORK TO BE UNDERTAKEN/ DESCRIPTION OF PROGRAM/ PROJECT

Strategic Procurement	The replacement circuit breakers will have to comply with the high network fault current and circuit breaker lead times may be longer than normal.		
Key Milestones	Project outage requirements need to be coordinated with generator outages and the new assets are scheduled to be in-service by 31 October 2018. Project start: 1 April 2015 Design Completion: 31 December 2015 On-site Construction start date: 1 April 2016 AIS date: 31 October 2018 Project completion: 31 January 2019		
Summary of Project / Program Delivery Requirements	Replacement of seven 220 kV bulk oil circuit breakers, nine current transformers, nine voltage transformers, and thirty-nine disconnectors at HWPS.		
Program Deliverables – table of rates (if applicable)	N/A		
Projects within a Program (if applicable)	**Project No / Title**	**Approved (Y/N)**	**Total Cost** (Inc. OHD's & CFC's)
	N/A		
Other Associated projects	**Project No / Title**	**Approved (Y/N)**	**Total Cost** (Inc. OHD's & CFC's)
	X711 – Redevelopment of HWPS 220 kV Switchyard, Stage 1	Y (completed)	$6.8M
	X920- Redevelopment of HWPS 220kV Switchyard, Stage 2	Y (completed)	$10.5M
	XB56- Redevelopment of HWPS 220kV Switchyard, Stage 3	Y	$8.6M
	X949- Replace Pilot Wire Protection HWPS-HWTS & HWPS-JLTS	Y	$3.5M
	X721- Replace HWPS RTU	Y	$2.8M
	VD13- HWPS subsiding ground - restoration works	N	$0.5M

The scope of works (including design, supply, installation, test and commissioning) for the preferred option includes the following:

Primary Works

- Remove seven 220kV [C-I-C] Type [C-I-C] circuit breakers
- Supply and install seven new SF6 dead tank circuit breakers (including structures)
- Supply and install bus capacitive voltage dividers (CVD) to replace loss of circuit breaker capacitor tapping points
- Replace six 220kV [C-I-C] current transformers
- Replace three 220 kV [C-I-C] current transformers
- Replace six 220 kV [C-I-C] capacitive voltage transformers
- Replace two 220 kV [C-I-C] capacitive voltage transformers
- Replace one 220kV [C-I-C] capacitive voltage transformers
- Replace thirty nine 220 kV [C-I-C] [C-I- and [C-I- isolators and earth switches
- Install twenty seven (single phase) Surge Arrestors.

Secondary Works

- Interface and replace the protection and control schemes for the new circuit breakers
- Replace (selected) lines Y protections
- Replace bus protections
- Replace (selected) CBF protections and install them on existing line protections panel
- Replace existing DC inter trip for Generator circuit breaker with supervised X and Y trip signalling
- Revise CB Fail to facilitate removal of current check relays from metering current transformers
- Auxiliary transformers 'B' and 'C': Replace existing CT posts to facilitate removal of current check from metering current transformers.

Civil Works

- Equipment foundation and structure: provide foundations for new equipment and structures and all associated civil works
- Trench, pits and conduits: install new cable trenches to facilitate connection of secondary cabling to equipment and control building, install drainage and connection for new cable trench
- Earth grid and yard surface: repair affected earth grid and resurface affected areas following the completion of works
- Landscaping: all disturbed areas for temporary access roads and temporary construction site office and lay out areas to be reinstated and top soiled where required.

9. OPTIONS CONSIDERED

From previous analysis of all potential options for the redevelopment of HWPS, a staged redevelopment strategy was recommended. This is the fourth and final stage in the redevelopment project. Hence, the only three options considered for this project are:

- Business as usual
- Complete the redevelopment, stage 4
- Replace on failure

TABLE 9a: Analysis of Investment Options

		Economic Least Cost Analysis				Financial Return		
	Analysis of Investment Options ($'000s)	PV Capital Cost	PV Opex Costs	PV Community Costs & Benefits	Total PV Cost	NPV including Reg Return (post tax)	PV Cost Ratio	PV of Incentive / (Penalty)
1	Business As Usual	-	(153)	(58,098)	(58,251)	(498)	1.00	(407)
2	Complete Stage 4	(17,736)	(90)	(16,725)	(34,551)	855	116.46	(158)
3	Replace on Failure	(11,013)	(127)	(58,098)	(69,238)	417	72.78	(407)

All figures are in $000's unless otherwise stated.
(nominal and discounted)

9.1. BUSINESS AS USUAL (MANDATORY)

The "Business as usual" (BAU) option quantifies the base line risk (primarily health and safety risk and supply risk) at HWPS. It includes undertaking operational works to retain the existing circuit breakers and assessing the community cost, health and safety risk and asset management cost based on the expected increasing failure rate of these assets. This does not present a feasible option because of the increasing safety risk associated with asset failure.

This option is used for economic modelling purposes as it is inconsistent with the requirements of the Electricity Safety Act, the Occupational Health and safety Act and the National Electricity Rules (NER). This option does not represent a prudent management strategy for the remaining assets at HWPS. This option has a PV cost of $58.3 M.

PV of Capex and Opex	• No Capex for the "Business as usual" option • PV of Opex ($153k) quantifies the asset maintenance cost at HWPS over the 15 years analysis period.
PV of Community Costs & Benefits	• PV of community costs is $58.1M. • The key service constraints at HWPS are: - Health and safety risks presented by explosive failures of the 220 kV [C-I-C] circuit breakers, 220 kV [C-I-C] or [C-I-C] current transformers. - Market impact costs presented by failures of 220 kV circuit breakers, instrument transformers or isolators - Collateral damages to adjacent plant due to explosive failures of 220 kV circuit breakers or current transformers. Note: Refer to Appendix D for station risk costs.

9.2. PREFERRED OPTION 2 – COMPLETE STAGE 4 OF THE STAGED REDEVELOPMENT

The preferred option will complete the staged redevelopment of HWPS in 2018. This option will mitigate the constraints at the site by reducing the health and safety risks 'So Far As Is Practicable' commensurate with obligations under the Electricity Safety Act and Occupational Health and Safety Act, reduce security of supply risks at this key generation connection point, and limit collateral plant damage risks presented by explosive failures.

This option is aligned with the planning report, AMS 10-305, which concluded the most economical solution to address the emerging constraints at HWPS is to complete Stage 4 of the staged redevelopment by 2017. The preferred option has the lowest present value (PV) cost of $34.6 M.

PV of Capex and Opex	• PV of Capex is $17.7M. • PV of Opex ($90k). Lower than the BAU option as some assets at HWPS are replaced by end 2018 and the new assets have a relatively lower maintenance cost.

PV of Community Costs & Benefits	• PV of community costs and benefits is $16.7M. • The network risks that are reduced by option 2 are: - Health and safety risks presented by explosive failures of 220 kV [C-I-C] circuit breakers, 220 kV [C-I-C] or [C-I-C] current transformers. - Market impact costs presented by failures of 220 kV circuit breakers, instrument transformers or isolators - Collateral damages to adjacent plant due to explosive failures of 220 kV circuit breakers or current transformers. Note: Refer to Appendix D for station risk costs.

9.3. OPTION 3 – REPLACE ON FAILURE

This option is similar to the "Business as usual" option, but includes the capital cost of replacement. It involves undertaking operational works to retain the existing circuit breakers and replacing each asset upon failure. This option poses a significant supply risk to the community through a series of prolonged supply outages as failed plant is replaced. It may also have a financial impact on AusNet Services through the Market Impact Component of the Service Target Performance Incentive Scheme (STPIS). Moreover, the 220 kV circuit breakers and current transformers at HWPS also present a safety risk should they fail explosively and this risk cannot be managed with a "replace on failure" strategy.

Such a strategy would involve workers replacing failed equipment in a switchyard containing other equipment in a deteriorated condition with a known hazardous mode of failure. This is inconsistent with the requirements of the Electricity Safety Act and AusNet Services Transmission Group's accepted Electricity Safety Management Scheme. This option has a PV cost of $69.2M.

PV of Capex and Opex	• PV of Capex is $11M. • PV of Opex ($127k). Lower than the BAU option as some assets at HWPS are replaced by end 2018 and the new assets have a relatively lower maintenance cost.
PV of Community Costs & Benefits	• PV of community costs and benefits is $58.1M. • The network risks are the same as "Business as usual" option.

9.4. CONCLUSION AND RECOMMENDATION

The most economic option to address the emerging constraints at HWPS is to complete Stage 4 of the staged redevelopment (Option 2), which involves replacing seven 220 kV bulk oil type circuit breakers, nine current transformers, nine voltage transformers, and thirty-nine disconnectors in the Hazelwood Power Station 220 kV switchyard. This option has the lowest present value cost ($34.6M) with a total capital expenditure of $24.7M (including contingency allowance, overheads, and finance charges).

10. BENEFITS

10.1. FINANCIAL BENEFITS

TABLE 10a: Financial Benefits derived from the Program / Project

	First 5 years					
Project Financial Benefits ($'000s)	**2014 / 15**	**2015 / 16**	**2016 / 17**	**2017 / 18**	**2018 / 19**	**Total**
Incremental Opex (Costs) / Savings	-	-	-	-	-	165
Distribution Incentive Revenue (S Factor / GSL's)	-	-	-	-	-	-
Transmission Incentive Revenue (AIS, AER, MIPS)	(21)	(24)	(27)	(30)	(34)	(295)
Unregulated Revenue	-	-	-	-	-	-

All figures are in $000's unless otherwise stated. (nominal)

Note, the above financial benefits represent **incremental** benefits in comparison to the Business As Usual option.
The opex savings in the table above is calculated based on the reduction of opex due to asset renewal and commences following project completion.

10.1.1. OPEX Savings

TABLE 10b: Incremental Opex Savings (if applicable)

Unit of Measure	No of Units	Annual Rate (Real)	Annual Savings (Real, $000's)	Expenditure Category
Estimated Reduced Operating and Maintenance Cost	7 CBs	$4k	$9k	Labour

10.1.2. Incentive Scheme Benefits (if applicable)

Not applicable for Transmission

10.2. NON-FINANCIAL BENEFITS

TABLE 10d: Non-Financial Benefits derived from the Program / Project

	First 5 years					
Project Non-Financial Benefits ($'000s)	**2014 / 15**	**2015 / 16**	**2016 / 17**	**2017 / 18**	**2018 / 19**	**Total**
Safety	-	-	-	-	-	85,476
System Capacity	-	-	-	-	-	26,646
Bushfire Mitigation	-	-	-	-	-	-
Environmental Risks - Other	-	-	-	-	-	47
Regulatory Compliance	-	-	-	-	-	-
Legislative Compliance	-	-	-	-	-	-
Corporate Image	-	-	-	-	-	-

All figures are in $000's unless otherwise stated. (nominal)
The above table represents the incremental benefits / (costs) comparing the chosen project option to the "Business As Usual" option.

Note, the above non-financial benefits represent incremental benefits in comparison to the Business As Usual option.

The system capacity benefit in the table above is calculated based on the reduction of supply risk and plant damage risk due to asset renewal and commences following project completion.

10.3. OTHER QUALITATIVE BENEFITS

N/A

11. RISK ASSESSMENT

11.1. EXISTING RISKS ADDRESSED BY THE PROJECT

Risk(s) addressed by project	Division owning risk	Category of risk (where listed)	Managing Risk – Project specific impact(s)
• Customer Supply Risk	• Asset Management	• Emerging Risk	• Reduce the market impact costs presented by a failure of the 220 kV circuit breakers, instrument transformers or isolators
• Safety Risk	• Asset Management	• Safety risk	• Significantly reduce the health and safety risks presented by explosive failures of 220 kV [C-I-C] circuit breakers, 220 kV [C-I-C] or [C-I-C] current transformers

11.2. PROJECT DELIVERY RISKS (KNOWN)

What are the known delivery risks attributable to this project and how are these being managed?

Project Risk	What could occur / Consequence	Likelihood	Actions and controls in place to manage/reduce risk
• Project cost/time overrun risks	• Delays in delivery due to wet weather and outage restrictions can result in higher costs and increase the risk of asset failure. • Failure of the equipment prior to replacement. This can result in resequencing of the project as the project team would be expected to stop work and restore the asset.	• Low	• Communication with outage planners in the control room and power station. • The project manager in consultation with asset engineering will assess the level of asset condition monitoring required and the prioritisation of works. • Emergency replacement
• Major safety incident risk	• General project safety risks and the unlikely event of an explosive failure of CBs and CTs can result in a major safety incident.	• Low	• The project manager in consultation with asset engineering will assess the level of condition monitoring and controls required.
• Brownfield site issues	• Project Delays • Additional costs • Design rework	• Low	• The project is a rebuild of an existing terminal station. Most issues have been identified in the first three stages. The project manager will ensure that: ▪ lessons learned from stages 1, 2, and 3 are considered, ▪ all project risks are assessed, and ▪ costed mitigation plans are completed, prior to commencement of construction activities. Variations from the original business case, including scope and cost, must be brought to the attention of EPMO/Asset Management for assessment and approval.
• Environmental risk	• Contamination of water/air • Health Issues • Protests from Neighbours • Corporate Image suffers • Litigation • Involvement of the Environment Protection Authority (EPA) • Project Delays	• Low	• PCB/Asbestos Handling Procedures • Oil Handling Procedures • HSE Procedures • Field Work Procedures • Experienced Management Team • Corporate Communication Team • Legal support

(Refer to the Risk Management Guide for assistance in populating this table)

12. OTHER REGULATORY CONSIDERATIONS

12.1. REGULATORY INVESTMENT TEST (R-I-T)

A Regulatory Investment Test (RIT-T) is not required for this project because it does not enhance the capacity to transmit or distribute more electricity, and the proposed expenditure relates to asset replacement and is not intended to augment the transmission network.[7]

12.2. REGULATORY FUNDING

Regulatory funding concerns are dealt with under sections 13.3 (Revenue) and 13.4 (Financial Risks), p.19.

13. FINANCIAL IMPACTS

13.1. EXPENDITURE CATEGORY /WORK CODE:

CI20 – Other Station Works

13.2. FINANCIAL ANALYSIS OF PREFERRED OPTION

For the full Financial Evaluation of the options considered and supporting financial details refer to the attached XC28 HWPS CB Stage 4 NPV V010.xlsm in EPPM.

TABLE 13.3a: Summary Profit & Loss Statement

	First 5 years					
Summary Profit and Loss ($'000s)	**2014 / 15**	**2015 / 16**	**2016 / 17**	**2017 / 18**	**2018 / 19**	**Total**
Revenue	[C-I-C]					
Incentive Scheme Revenue						
Opex Costs						
Opex Savings						
Net Gain / (Loss) on Disposal of Replaced Assets						
EBITDA						
EBIT						
NPAT						[C-I-C]
Earnings / (Loss) per Share, cents						
NPV (Post Tax)						
Internal Rate of Return (IRR)						
Corporate Discounting WACC (Post Tax Nominal)						

All figures are in $000's unless otherwise stated. (nominal)

TABLE 13.3b: Summary Cashflow Statement

	First 5 years					
Summary Cashflow ($'000s)	**2014 / 15**	**2015 / 16**	**2016 / 17**	**2017 / 18**	**2018 / 19**	**Total**
Net Operating Cashflows	(15)	71	501	1,245	1,826	87,441
Investing Cashflows (including Capex)	(134)	(1,723)	(8,144)	(8,900)	(4,178)	(23,080)
Financing Cashflows	77	671	4,311	4,379	1,256	(64,361)
Total Cashflows	**(72)**	**(981)**	**(3,331)**	**(3,276)**	**(1,097)**	**0**
Payback Period (Discounted)						37.5

[7] National Electricity Rules v50, section 5.6.5C

TABLE 13.3c: NPV Breakdown

NPV Breakdown	PV (000's)
Reg Revenues	25,498
S-Factor	-
GSL Benefits	-
Transmission Incentive Scheme	(178)
Non-Regulated Revenues	-
Opex Costs	(178)
Opex Savings	80
Proceeds From Sale of Replaced Assets	-
Capex	(18,456)
Tax	(5,911)
Total	**855**

(nominal and discounted)

TABLE 13.3d: Project Expenditure Forecasts

Project Expenditure Forecasts ($'000s)	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	Total
Design	[C-I-C]					
Internal Labour						
Materials						
Plant & Equipment						
Contracts						
Meter Costs						
Other						
Project P50 Direct Expenditure	126	1,611	7,611	8,318	3,905	21,570
Finance Charges	[C-I-C]					
Project P50 Direct & CFC's						
Delivery Risk Adjustment =(P90-P50)						
Project P90 Direct (incl risk adj) & CFC's						
Overheads						
Total CAPEX for Approval						
Operating Costs						
WDV (Written Dow n Value) of Assets to be retired						
Total Estimated Expenditure for Approval	142	1,873	8,751	9,447	4,467	24,680
NPV (Post Tax)						[C-I-C]
Corporate WACC (Post Tax Nominal)						

TABLE 13.3e: Capitalised Finance Charges (Interest during Construction)

Financial Year ($'000s)		Month	Project Direct Expenditure				Net Monthly Expenditure	Cummulative WIP Balance	Transferred into RAB (Sarcoded)	Customer Contribution Receipted Into Trust	Finance Charges	Total Finance Charges	Cumulative Finance Charges
			Project Direct Expenditure $Real	Project Direct Expenditure $Nominal	Overheads	Totals							
	2014 / 2015	Apr-14	4	4	0		4	4	-		-		-
		May-14	4	4	0		4	8	-		-		-
For A to P:		Jun-14	4	4	0		4	12	-		-		-
Direct	126	Jul-14	4	4	0		4	16	-		-		-
Overheads	9	Aug-14	4	4	0		4	20	-		-		-
Finance Charges	1	Sep-14	6	6	0		6	26	-		-		-
	135	Oct-14	13	13	1		14	40	-		-		-
Error checks		Nov-14	17	17	1		19	59	-		-		-
($Real)		Dec-14	13	13	1		14	73	-		-		-
Direct	-	Jan-15	15	15	1		16	90	-		-		-
Overheads	-	Feb-15	19	19	1		20	111	-		0		0
		Mar-15	23	23	2	134	24	135	-		1	1	1
	2015 / 2016	Apr-15	94	97	7		104	240	-		1		2
		May-15	201	206	14		220	462	-		2		4
For A to P:		Jun-15	201	206	14		220	686	-		3		7
Direct	1,611	Jul-15	197	202	14		216	906	-		4		11
Overheads	113	Aug-15	197	202	14		216	1,127	-		5		16
Finance Charges	67	Sep-15	197	202	14		216	1,349	-		6		22
	1,791	Oct-15	136	140	10		150	1,505	-		7		28
Error checks		Nov-15	136	140	10		150	1,662	-		7		36
($Real)		Dec-15	155	159	11		170	1,840	-		8		44
Direct	-	Jan-16	19	19	1		21	1,869	-		8		52
Overheads	-	Feb-16	19	19	1		21	1,897	-		8		60
		Mar-16	19	19	1	1,723	21	1,926	-		8	67	68
	2016 / 2017	Apr-16	1,453	1,530	107		1,637	3,578	-		16		84
		May-16	251	264	19		283	3,878	-		17		101
For A to P:		Jun-16	251	264	19		283	4,179	-		18		119
Direct	7,611	Jul-16	251	264	19		283	4,482	-		20		139
Overheads	533	Aug-16	328	345	24		369	4,872	-		21		160
Finance Charges	216	Sep-16	328	345	24		369	5,264	-		23		183
	8,360	Oct-16	1,529	1,610	113		1,723	7,017	-		31		213
Error checks		Nov-16	328	345	24		369	7,418	-		32		246
($Real)		Dec-16	328	345	24		369	7,821	-		34		280
Direct	-	Jan-17	1,529	1,610	113		1,723	-	9,544		-		-
Overheads	-	Feb-17	328	345	24		369	371	-		2		281
		Mar-17	328	345	24	8,144	369	743	-		3	216	285
	2017 / 2018	Apr-17	328	354	25		378	1,126	-		5		290
		May-17	1,682	1,817	127		1,944	3,083	-		13		303
For A to P:		Jun-17	480	519	36		555	3,654	-		16		319
Direct	8,318	Jul-17	473	510	36		546	4,219	-		18		337
Overheads	582	Aug-17	473	510	36		546	4,786	-		21		358
Finance Charges	121	Sep-17	473	510	36		546	-	5,332		-		-
	9,020	Oct-17	473	510	36		546	549	-		2		360
Error checks		Nov-17	473	510	36		546	1,100	-		5		365
($Real)		Dec-17	473	510	36		546	1,653	-		7		372
Direct	-	Jan-18	1,598	1,726	121		1,847	3,515	-		15		388
Overheads	-	Feb-18	389	420	29		449	3,982	-		17		405
		Mar-18	389	420	29	8,900	449	-	4,431		-	121	-
	2018 / 2019	Apr-18	389	431	30		461	463	-		2		407
		May-18	389	431	30		461	928	-		4		411
For A to P:		Jun-18	313	346	24		371	1,304	-		6		417
Direct	3,905	Jul-18	913	1,012	71		1,083	2,398	-		10		427
Overheads	273	Aug-18	313	346	24		371	2,781	-		12		439
Finance Charges	88	Sep-18	913	1,012	71		1,083	3,881	-		17		456
	4,266	Oct-18	251	279	19		298	4,197	-		18		475
Error checks		Nov-18	22	25	2		27	4,242	-		18		493
($Real)		Dec-18	20	23	2		24	-	4,266		-		-
Direct	-	Jan-19	-	-	-		-	-	-		-		-
Overheads	-	Feb-19	-	-	-		-	-	-		-		-
		Mar-19	-	-	-	4,178	-	-	-		-	88	-
Total						23,080					493	493	
Cash flow amount should equal the total directs as shown on page 1 of the A to P							Total Including Finance Charges				23,573		

13.3. REVENUE

It is reasonable to assume that all costs incurred in this project will be included in the regulated asset base (RAB) and generate revenue accordingly for the following reasons:

NER Schedule 6A.2.1 "Establishment of opening regulatory asset base for a regulatory control period" Clause (f) (1) requires that:

> "The previous value of the regulatory asset base **must be increased by the amount of all capital expenditure incurred** during the previous control period, including any capital expenditure determined for that period under clause 6A.8.2(e)(1)(i) in relation to contingent projects where the revenue determination has been amended by the AER in accordance with clause 6A.8.2(h) **(regardless of whether such capital expenditure is above or below the forecast capital expenditure for the period** that is adopted for the purposes of the transmission determination (if any) for that period)." **(Emphasis added)**

Furthermore, the AER recognises that it does not approve individual projects. For example, in the January 2008 AusNet Services Revenue Determination:

> "... the AER reiterates that the total forecast capex approved is an allowance only, and is not tied to a fixed, project specific, work program. Within the approved allowance, AusNet Services retains the discretion regarding the allocation and expenditure of capex, and is expected to be responsive to changing conditions in order to meet the prescribed capex objectives."

13.4. FINANCIAL RISKS

The project has been included in the AER's capital allowance and final determination for the 2014-17 regulatory control period. Noting that the AER does not approve individual capital projects and AusNet Services has the ability to prioritise works within the period, it is unlikely AusNet Services would be required to fund a capital shortfall due to the HWPS 220kV switchyard redevelopment, stage 4. Any shortfall in funding would at worst be limited to the financing cost incurred until the end of the period, as the National Electricity Rules (NER) require that "the value of the regulatory asset base must be increased by the amount of all capital expenditure incurred regardless of whether such capital expenditure is above or below the forecast capital expenditure for the period".

Reprioritisation of transmission asset renewal projects will release sufficient funds for the business to proceed with the HWPS 220kV switchyard redevelopment, stage 4 without exceeding the regulatory approved capital budget for the current regulatory control period. The new assets will roll into the Regulatory Asset Base (RAB) at the end of the next regulatory period at their depreciated constructed value.

The financial risks are being treated as follows:

- AEMO has confirmed the on-going need of the HWPS facilities in accordance with the proposed Stage 4 replacement scope of work,
- A detailed Project Execution Plan will minimise the number and duration of outages, limiting the associated rebate cost;
- The project cost estimate includes the additional cost that may arise from a brown field development, and
- Capital efficiency will be targeted by a combination of foreign exchange hedging, period order purchasing, fixed-price subcontracts and in-house project execution processes.

13.5. CORPORATE ACCOUNTING AND TAX ADVICE

13.5.1. Accounting Review

The project is a standard business transaction and does not require any special corporate accounting, tax advice, or sign off.

13.5.2. Asset Retirements

The existing circuit breakers, current transformers, voltage transformers, isolators and other associated plant will be retired from service. At the completion of this project, no assets being retired will have a written down value. This value was calculated by the fixed assets accounting team. Refer to the attached XC28 WDV Request.xlsb in EPPM for further details.

13.5.3. Contributed (Gifted) Assets

N/A

14. PROPERTY & ACCOMMODATION CONSIDERATIONS

14.1. PROPERTY

N/A

14.2. ACCOMMODATION

N/A

14.3. HARDWARE & PERIPHERALS

N/A

APPENDIX A – STAGE FUNDING

Refer to 'Staged Fund_BA' sheet within the NPV model. Costs are to be assigned to each phase of the project lifecycle (Idea, Plan, Build, and Close) as per the AusNet Services Portfolio Framework.

Project Expenditure Forecasts	IDEA	PLAN	BUILD	CLOSE	Total
Design	[C-I-C]				
Internal Labour					
Materials					
Plant & Equipment					
Contracts					
Meter Costs					
Other					
P50 Project Direct Expenditure	36	1,305	18,710	100	20,151
Delivery Risk Adjustment =(P90-P50)	[C-I-C]				
P90 Project Direct Expenditure incl risk					
Operating Costs					
WDV (Written Down Value) of Assets to be retired					
Total Expenditure for Approval Excl Overhead and CFC's	38	1,371	19,671	105	21,185

All figures are in thousands and expressed in 2014 / 15 real dollars

APPENDIX B – DELIVERABLES

Note: 'AMIS' refers to Asset management information systems, which include the following systems for Transmission and Distribution: Q4, Maximo 5 (Transmission), Maximo 6 (Distribution), SDME (Spatial Data Management – Electricity), Radar (Transmission equipment and protection ratings) and Tresis (device setting information). SAP will replace a number of these systems in 2015.

B.1 DESIGN DELIVERABLES

- Detailed Design Service Provider (DSP) Scope
- Detailed design drawings
- AMIS deliverables:
  - Creation of "Proposed Assets" and updates on all known asset data to be delivered as a component of the design/scoping stage.
  - Creation of preventive / inspection maintenance cycles to occur as a component of the Asset creation in AMIS – Q4, Maximo5, Maximo6 or SAP.
  - Work order creation for build/retirements in AMIS – Q4, Maximo5, Maximo6 or SAP.
- AMIS Closeout – Detailed Asset information and as-built drawing (redlines) to be updated upon Practical completion.

B.2 PROCUREMENT DELIVERABLES

Item	Type	Quantity	Estimated Delivery Month
Circuit Breaker	220kV	7	April-16 to Sept-18
Current Transformers	220kV	9	April-16 to Sept-18
Voltage Transformers	220kV	9	April-16 to Sept-18
Disconnectors	220kV	39	April-16 to Sept-18

B.3 CONSTRUCTION/BUILD DELIVERABLES

- Refer Appendix B.5 for a more detailed scope
- Progress reporting
- AMIS (Asset Management Information Systems):
  - Data updated according to as-built drawings and installed equipment data (e.g. serial numbers). This must be completed either before the installation is placed into operation on the network.
  - Each Work Order to be closed upon completion of the activity

B.4 HANDOVER DELIVERABLES

- As built drawings
- Commissioning documents
- Equipment manuals (if applicable)
- Warranties/Guarantees (if applicable)
- Spare parts (if applicable)

B.5 SCOPE (IF AVAILABLE)

Refer to the attached XC28 HWPS 220kV Rebuild Stage 4 Planning Estimate Rev4.doc in EPPM.

APPENDIX C – ASSET CONDITION

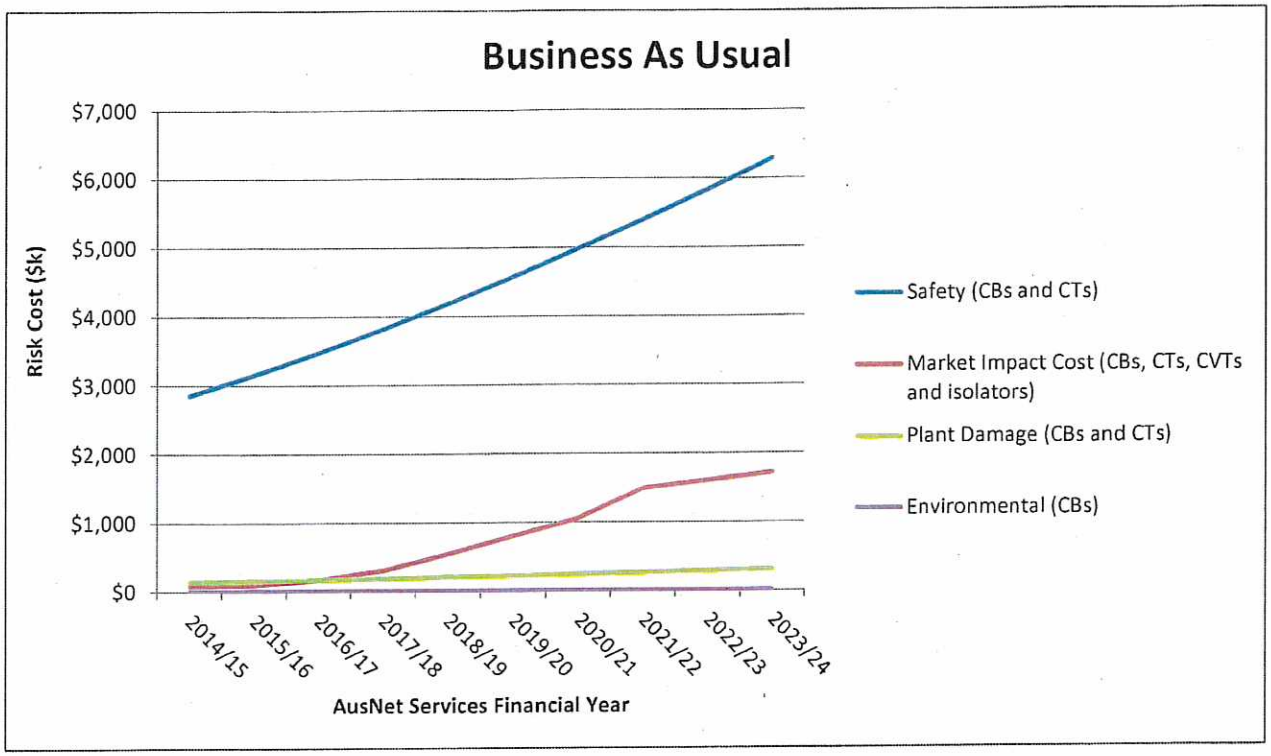
TABLE: Condition score definition and recommended action

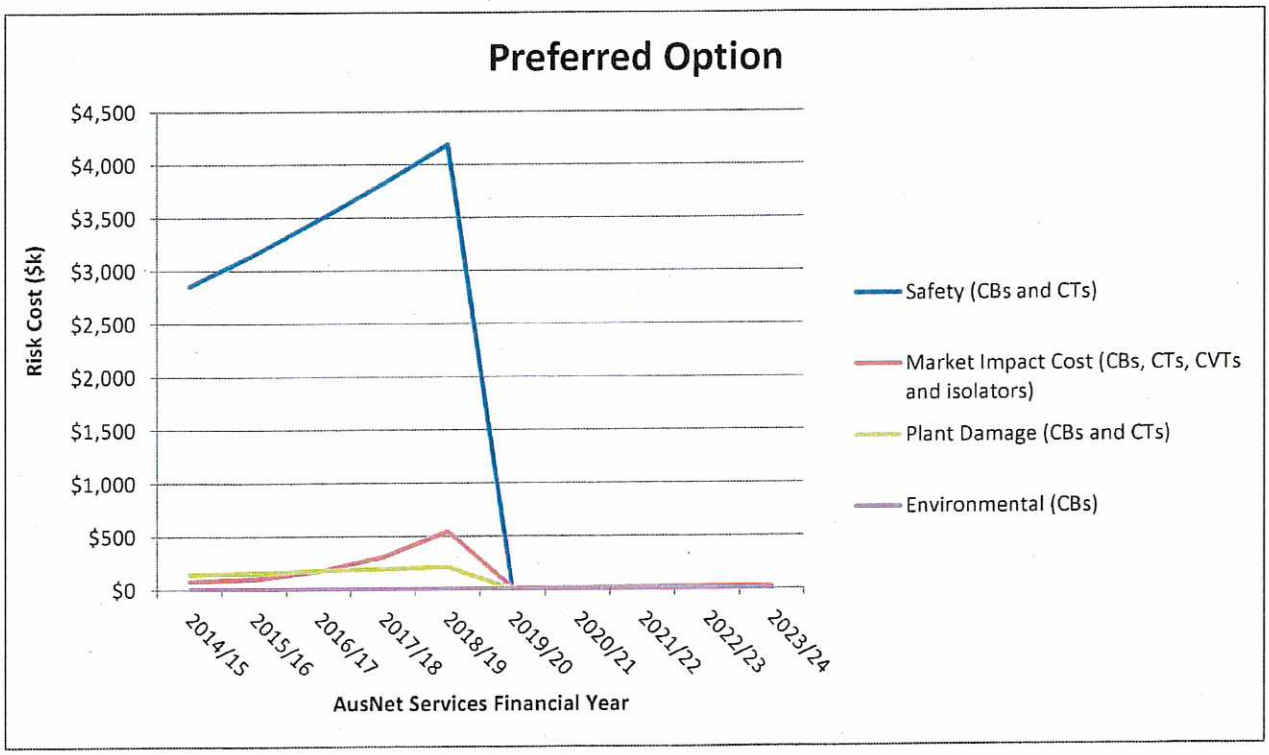
Condition Score	Condition Description	Recommended Action
C1	Very good or original condition	No specific actions required, continue routine inspection maintenance and condition monitoring
C2	Better than average condition for age	
C3	Average condition for age	
C4	Poor	Remedial action/replacement within 2-10 years
C5	Very poor and approaching end of life	Remedial action/replacement within 1-5 years

TABLE: Condition assessment criteria of circuit breakers

Condition Score	Condition Description	Summary of details of condition score
C1	Very Good	These CBs are generally less than 15 years old and in good operating condition with no past history of significant defects or failures. Manufacturer support and spares are readily available for routine maintenance.
C2	Good	This category includes CBs which may have some minor issues such as minor oil or SF6 leaks from seals, minor corrosion but minimal mechanism and drive system wear and do not require intervention between scheduled maintenance. Manufacturer support and spares are available.
C3	Average	This category includes CBs which may have developed several issues due to in service related deterioration, such as interrupters wear, oil/SF6 leaks, corrosion, mechanism wear or re- adjustment required and requiring increased maintenance. Spares and manufacturer support for these breakers is becoming limited.
C4	Poor	This category includes CBs which have developed an increasing number of issues and will have a history of failures and deterioration such as interrupters wear out, worsening oil or SF6 leaks, significant contact and latching mechanism wear. Local manufacturer support and spares is typically not available and reverse engineering, salvaging parts from retired equipment or in situ repair becoming the practical solution. Specialist targeted maintenance is required to manage specific known defects.
C5	Very Poor	This category includes CBs which are typically maintenance intensive and have history of significant failures, problematic interrupters, widespread oil and SF6 leaks, component breakages and typically worn out or unreliable operating mechanisms. The maintenance that can be performed to restore condition is very limited. They are no longer supported by the manufacturer and no new spares are available. The maintenance of CBs in this category is typically no longer economical compared to asset replacement.

APPENDIX D – HWPS RISK COSTS





EPMO Business Case Review Summary

Project No / Title	**XC28 – HWPS 220kV Switchyard Redevelopment Stage 4**
Portfolio	Transmission Company Capex
Revision (Y/N)	Original
Project Capex Budget for Approval (P50 + CFC's)	$22,063k
Total Estimated Expenditure for Approval (incl OHDs & risk)	$24,680k
Financial Years (FY) of Spend	2014/15 – 2018/19
Enterprise Portfolio Review	
Project NPV (post tax)	$855K
IRR	7.80% (compares WACC 7.39%)
Payback	37.5 years
1. Bus Case review	Business Case review completed.
2. NPV model review	NPV model review completed.
3. Business Benefits	Replace seven 220 kV bulk oil type circuit breakers, nine current transformers, nine voltage transformers, and thirty-nine disconnectors in the Hazelwood Power Station 220 kV switchyard (HWPS). The key project driver is the health and safety risk presented by an unlikely explosive failure of any one of the deteriorating 220 kV circuit breaker bushings or post type current transformers. The project has been assessed as economic and is expected to be completed in January 2019.
4. Budget Allowance	This project is within the approved capital budget list for the financial years as shown above. It has been included in the AER's capital allowance at a value of $5.9M (direct $2013-14) for the 2014-17 regulatory control period. AusNet Services will continue to seek funding for this project (i.e. direct expenditure in 2017/18 and 2018/19 financial years) in the next 2017-2023 TRR submission.
5. Accounting notes	None
6. Other issues to note	This project is the fourth and final stage of the redevelopment of the HWPS. A staged redevelopment of HWPS has been used to manage the asset failure risk in an uncertain planning environment, which included a previous government proposal for early closure of Hazelwood Power Station and some of the less efficient Latrobe Valley coal fired power stations.
Date review completed	16/12/2014
Prepared by	[C-I-C] [redacted]
Approval signature	Date 23-1-15