AusNet Transmission Group Pty Ltd

Transmission Revenue Review 2017-2022

XB59 – HTS Redevelopment Project: Business Case (Public)

Submitted: 30 October 2015

Business Case Application for Approval

XB59 HTS Redevelopment Project

CAP #:	T0574
Project Initiator:	[C-I-C]
Contact No:	[C-I-C]
Initiating Dept / Div:	NSD
Prepared By:	[C-I-C]
Date of Submission:	July 2012
Target Project Start Date:	September 2012
Target Project Completion Date:	November 2017

SP AusNet
A member of Singapore Power Group

1. RECOMMENDATION

Approval is sought for a total expenditure of up to $64.3 million (including contingency allowance, overheads, finance charges and retirements) for the redevelopment of Heatherton Terminal Station (HTS), which includes the replacement of 220 kV switchgear, 66 kV switchgear and three 220/66 kV transformers. The project is required to address the deteriorating condition of the B1, B2 and B3 ASEA transformers, 220 kV switchgear and 66 kV switchgear, and eliminate the safety risk associated with an explosive failure of a 220 kV [C-I-C] current transformer or [C-I-C] transformer bushing.

The project benefits exceed the project costs and it is economic to proceed with the redevelopment of HTS. The project benefits include improved reliability of supply and reduced safety risk associated with a remote asset explosive failure. The project will ensure that SP AusNet meets 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 targets a completion date of November 2017 and will require Board approval.

2. STRATEGIC ALIGNMENT

Strategic Objective	Business Driver	Linkage
Strengthen	Regulated Network Reliability and Resilience	Strong
	Compliance	Moderate
Transform	Customer and Community	Strong
	Sustainability	Strong

3. FINANCIAL SUMMARY

Program / Project Expenditure Forecasts	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	Total
Program / Project Direct Expenditure	67	192	8,135	8,365	18,924	17,670	862	54,216
Program / Project Total Expenditure	73	224	9,290	10,081	22,281	20,845	1,540	64,336
Revenue	3	30	455	1,233	2,567	4,376	5,335	260,795
NPV								641
Payback Period (Discounted)								44.8
Corporate WACC (Post Tax Nominal)								[C-I-C]

4. ENDORSEMENTS

[C-I-C]

Manager PMO
Fiona Mendes
Date:

Network Owner
Kerry Karafotias
Date:

Finance Manager
Scott McFarlane
Date:

5. APPROVALS

Project Initiator
Melanie Tan
[C-I-C]

General Manager NSD
Charles Popple
Date: 3/9/2012

[C-I-C]

Chief Financial Officer
Geoff Nicholson
Date:

Director Regulation and Network Strategy
Alistair Parker
Date:
[C-I-C]

Managing Director
Nino Ficca
Date:

6. CONTRIBUTION TO MISSION ZERO

This project involves the replacement of transformers and post-type current transformers, as they present a safety risk in the remote event of an explosive failure which could potentially harm personnel working on site. Throughout the period of carrying out this project, the health and safety risks of working in a live switchyard will be treated by the following actions:

- Apply proven policies and practices relating to safe working in switchyards and access to plant and equipment
- Maximise the use of vacant locations for new construction
- Monitor the condition of the plant that present a safety risk and barricade it off or take further measures should their condition deteriorate and require further action

7. BACKGROUND

HTS is located approximately 20km south-east from Melbourne's CBD and is the main source of supply for a major part of south-eastern metropolitan Melbourne. The geographic supply area spans from Brighton in the north to Edithvale in the south. HTS is supplied radially from Rowville Terminal Station (ROTS) via Springvale Terminal Station (SVTS) with a double circuit 220 kV transmission line. Transformation at HTS comprises three 150 MVA 220/66 kV transformers that provide transmission connection services to the distribution network service provider, United Energy.

HTS was commissioned in 1964 and the primary and secondary assets installed at the time of station establishment have deteriorated and are reaching the end of their technical lives, resulting in high and increasing risks of failure, and inefficient operation and maintenance costs. A significant capital investment is required to address these risks and to ensure reliable electricity supplies from this key terminal station.

The key service constraints include the following:

- Security of supply risks presented by a failure of the 220/66 kV [C-I-C] transformer, 220 kV circuit breakers or 66 kV circuit breakers
- Health and safety risks presented by an explosive failure of a 220 kV [C-I-C] current transformer or [C-I-C] transformer bushing
- Operational and security of supply risks of the 220 kV switchyard switching configuration
- Plant damage risks presented by an explosive failure of a transformer bushing, 220 kV current transformer or [C-I-C] bulk oil circuit breaker

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 maintenance or replacement and is not intended to augment the transmission network.[1]

7.1. Asset Condition

220/66 kV Transformers

AMS 10-141[2] identifies that all three HTS transformers are showing accelerated ageing of the internal insulation. This is primarily due to the high average loading and operating temperatures during high ambient temperatures, along with ineffective operation of coolers on the [C-I-C] transformers. As the coolers are mounted on the tank walls, their effectiveness is degraded by hot air radiated from the tank. Refurbishment is no longer an economic option due to the severity of the transformer deterioration at HTS, and it is recommended to be replaced by the project target completion date of 2017.

220 kV Circuit Breakers

1 National Electricity Rules v50, section 5.6.5C

2 AMS 10-141 Asset Health Review for Power Transformers in Terminal Stations

There are two [C-I-C] minimum oil circuit breakers in the 220 kV switchyard, which are approaching an asset life of fifty years. Asset Management Strategy AMS 10-144[3] identifies this type of circuit breaker as one of the oldest in SP AusNet's 220 kV circuit breaker fleet. [C-I-C] circuit breakers are of a minimum-oil type interrupter design with a spring type mechanism. This type of circuit breakers have generally provided reliable service to date, however they have aged and are becoming less reliable as they exhibit a range of age and duty related defects, consequently they are targeted for replacement as part of station redevelopment projects.

220 kV Current Transformers

There are twelve [C-I-C] post-type current transformers installed at HTS. As described in Asset Management Strategy AMS 10-64[4], the family of [C-I-C] CTs are indicating thermal and partial discharge issues with worsening dissolved gas analysis (DGA) results. They present a risk to network reliability, 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 condition. Hence, replacement of these units is recommended.

66 kV Circuit Breakers

Eleven out of the sixteen 66 kV circuit breakers at HTS are of bulk-oil type, and the remaining five are SF6 gas insulated type. The service life of the [C-I-C] bulk-oil circuit breakers at HTS ranges from 46 to 48 years and are amongst the oldest circuit breakers installed in the network. Asset Management Strategy AMS 10-106[5] provides a summary of the key issues of [C-I-C] circuit breakers, which includes the following:

- Limited fault level capability requiring restrictive switching configurations
- Age/duty related deterioration including the erosion of arc control devices, bushing leakages, wear of operating mechanisms and drive system
- Maintenance intensive
- Manufacturer no-longer provide technical support or spares
- Insufficient bunding

Secondary Systems

New 220 kV and 66 kV protection and control systems are to be installed in conjunction with the replacement of transformer and switchgear, to avoid the complexity and associated risks of interfacing with existing systems. Most of the secondary systems to be replaced are also of an obsolete design and past their useful service lives. Asbestos containing materials are also to be removed in accordance with the policy as stated in Asset Management Strategy AMS 10-01[6].

7.2. Safety and Environmental Considerations

220/66 kV Transformers

As described in Asset Management Strategy AMS 10-67[7], Transformers B1, B2 and B3 at HTS have synthetic resin bonded paper (SRBP) 220 kV bushings. The bushings are of an obsolete design. Condition assessments indicate de-lamination of the SRBP core in several bushings on these transformers resulting in oil draining from the bushing into the transformer main tank. Frequent transformer outages are required to maintain oil conservator levels and to replace the oil lost from the bushings to prevent the ingress of moisture and subsequent bushing failure.

The failure of a transformer bushing has a high probability of causing a fire and many such failures have resulted in the complete destruction of the transformer plus damage to other equipment. SP AusNet's network experienced 220 kV bushing failures and transformer fires in 1965 &1987 at Dederang Terminal

3 AMS 10-144 Asset Health Review for Transmission Circuit Breaker
4 AMS 10-64 Instrument Transformers
5 AMS 10-106 Circuit Breakers
6 AMS 10-01 Asset Management Strategy
7 AMS 10-67 Power Transformers and Oil Filled Reactors

Station from this failure mechanism. Four recent interstate bushing failures in Queensland and New South Wales have involved catastrophic transformer failures. These failure modes present a safety risk to personnel working in the vicinity of the transformer due to the nature of the failure which under adverse circumstances could sometimes result in projectiles or oil fires.

SP AusNet has initiated two refurbishment projects X417[8] (Stage 1) and Project X834[9] (Stage 2) to replace this type of bushing on transformers where other key transformer components including the 'core and coils' are in a sound condition and additional transformer service life is probable.

66 kV Circuit Breakers

Most of the 66 kV circuit breakers at HTS are [C-I-C] bulk oil technology circuit breakers. As described in Asset Management Strategy AMS 10-54[10], bulk oil circuit breakers are expensive to maintain in comparison with the modern equivalent. Their failure modes include explosion and fire as consequences.

Due to the large volume of insulating oil within the tanks and the high voltage bushings, failures could potentially cause collateral damage to adjacent high voltage plant, cable trenches, secondary system etc. Spillage of oil also poses environmental hazards as bulk oil circuit breakers are not positioned within a bunded area.

220 kV Current Transformers

There are twelve [C-I-C] post-type current transformers at HTS 220 kV switchyard. As described in Asset Management Strategy AMS 10-64[11], several explosive failures[12] have confirmed that single-phase, porcelain clad, oil insulated current transformers present an unacceptable risk. This risk includes the risk of incurring availability penalties, supply outages, collateral damages, environment damage and possible injury to staff. A progressive replacement in favour of toroidal current transformers incorporated within plant such as dead tank circuit breakers is part of SP AusNet's asset management strategy to address these risks.

7.3. Community Expectations

[C-I-C]

[C-I-C] The station is situated in an industrial area and is zoned for this purpose. It is some distance and across a major arterial road from an established residential area. The new station with an AIS design will be quite consistent with its location.

[C-I-C]

7.4. Station Reliability Considerations

The existing 220 kV switchyard includes an open ring bus with two incoming lines from SVTS, and three 150 MVA 220/66 kV transformers. There are only two bus tie circuit breakers in the 220 kV switchyard, interconnecting the four busbars. No circuit breakers are installed for the switching of the SVTS No.1 and No.2 incoming lines and 220/66 kV transformers.

8 X417 220kV Transformer Bushing Replacement - Stage 1 at Ballarat Terminal Station, Ringwood Terminal Station and West Melbourne Terminal Station, completed in 2007

9 X837 220kV Transformer Bushing Replacement - Stage 2 at West Melbourne Terminal Station, Richmond Terminal Station, Ballarat Terminal Station, Geelong Terminal Station, Shepparton Terminal Station and Morwell Power Station, target completion in 2014

10 AMS 10-54 Circuit Breakers

11 AMS 10-64 Instrument Transformers

12 Moorabool Terminal Station 2002 & 2005, Jeeralang Terminal Station 2003, Ballarat Terminal Station 2006 and Terang Terminal Station 2006

This arrangement is less secure than the breaker-and-half switching configuration suggested for 220 kV and higher transmission voltages in AEMO's "Guidelines for Shared Transmission Connections in Victoria"[13]. It also presents operational risks as multiple circuits are switched by a single circuit breaker.

The Victorian Annual Planning Report (VAPR) 2011 foreshadows the need to upgrade the SVTS-HTS 220 kV lines with higher rated conductors based on the forecast HTS demand and identified constraints on the SVTS-HTS 220 kV lines. SP AusNet is also investigating the condition of the conductors and anticipates the need for reconductoring of these lines around 2023. Reconductoring work to either replace or augment the existing conductors will require about 62 low demand days to complete the SVTS-HTS line section.

The load at HTS will be at risk should reconductoring of the SVTS-HTS 220 kV circuits be undertaken without a third supply to HTS. This risk can be reduced by providing for proper switching of the lines and transformers at HTS and has been considered in the option analysis. Joint planning by AEMO, United Energy and SP AusNet confirmed the need to improve the 220 kV switching at HTS and the parties agreed that double or single switching of circuits should be used for the redevelopment of HTS as site constraints prevents it to be changed to breaker-and-half switching.

7.5. Future Development Plans

HTS 66 kV is a summer peaking station with a recorded peak demand of 282MW (293MVA) for summer 2011/2012. The demand at HTS is forecasted to increase consistently, but at a lower rate than earlier demand forecasts. According to the 2011 Transmission Connection Planning Report (TCPR), a major outage of one transformer at HTS over the summer of 2016/2017 would lead to involuntary supply interruptions that would cost consumers $46.3 million (based on a value of customer reliability of $70,109/MWh) in the absence of any other operational response to mitigate the impact of a forced transformer outage.

SP AusNet as the transmission network service provider (TNSP) has the ownership, operation and maintenance responsibility for HTS. The augmentation responsibility lies with AEMO for the shared transmission network and with United Energy for the transmission connection assets. Any significant asset replacements at HTS must consider the longer term shared network and connection network needs to ensure individual decisions will not impede efficient future augmentation or compromise security of supplies. AEMO and United Energy have considered their future needs at HTS, and communicated the following to SP AusNet:

- The ultimate station development should provide for at least two more 220 kV line switch bays for transmission lines or underground cables to Dandenong Terminal Station (DNTS) Cranbourne Terminal Station (CBTS), or Mordialloc Terminal Station (MCTS).
- Reconfiguration of the 220 kV switchyard to provide switching for all lines and transformers with one transformer double switched.
- Utilising 150 MVA transformers to replace the existing three 150 MVA 220/66 kV transformers and making provision for five 150 MVA 220/66 kV transformers for the ultimate station layout.
- Provision of twelve 66 kV feeders and four 50 MVAR 66 kV capacitor banks for the ultimate station layout

13 Guidelines for Shared Transmission Connections in Victoria, published by AEMO.

8. WORK TO BE UNDERTAKEN

Redevelopment of HTS is driven primarily by the deteriorated condition of both primary and secondary assets and the consequential plant failure risks, and increasing operating and maintenance costs. The proposed redevelopment also includes a reconfiguration of the 220 kV switchyard to alleviate the operational and supply security constraints.

The following is a summary of the proposed scope of work:

- Remove the existing bus tie circuit breakers for bus 2-4 and bus 1-3.
- Remove the existing B1, B2 & B3 Transformer 66 kV circuit breakers.
- Remove the existing B1, B2 and B3 transformers.
- Replace the existing 220 kV buses including insulators and supports.
- Supply and install three 150 MVA 220/66 kV three phase transformers (B1, B2 and B3) including all associated primary and secondary connections.
- Supply and install four new 220 kV dead tank circuit breakers including associated ROIs, earth switches, voltage transformers, primary and secondary connections for the switching of the B1, B2 and B3 transformers (B1 and B2 single switched, B3 double switched).
- Supply and install two new 220 kV dead tank circuit breakers including associated ROIs, earth switches, voltage transformers, primary and secondary connections for the switching of the SVTS incoming lines.
- Supply and install three new 66 kV dead tank circuit breakers including associated isolators, primary and secondary connections for the switching of the B1, B2 and B3 transformers.
- Replace 66 kV buses including support structures.
- Remove the existing 66 kV [C-I-C] circuit breakers.
- Supply and install eight new 66 kV dead tank circuit breakers including associated isolators, and primary and secondary connections.

Strategic Procurement	The 220/66 kV 150 MVA Transformers are long lead time items that requires consideration when planning the delivery of this project		
Program Timing	The project is scheduled to be completed by November 2017		
Composition of projects within the program	N/A		
Other Associated Projects	**Project Number/Title**	**Approved (Yes/No)**	**Cost**
No other associated projects			

9. OPTIONS CONSIDERED

The options considered for the redevelopment of HTS are:

- Redevelopment with AIS for both the 220 kV and 66 kV using 150 MVA transformers (preferred)
- Redevelopment with GIS for both the 220 kV and 66 kV using 150 MVA transformers
- Like for Like Replacement
- Staged Redevelopment (for preferred option only)
- Do Nothing

9.1. OPTION 1 - REDEVELOPMENT WITH AIS AND 150 MVA TRANSFORMERS (PREFFERED)

This option involves replacing all three 150 MVA 220/66 kV transformers with the same size transformers, as well as the 220 kV and 66 kV switchgear with air insulated switchgear. The 220 kV switchyard is to be reconfigured to provide switching for all lines and transformers, in order to alleviate the operational and security of supply risks. This option complies with AEMO and United Energy's future plans for HTS.

This option provides the most cost-effective manner to address the station service constraints. It is broken down into two sub-options, i.e. single integrated project (option 1a) and staged redevelopment (option 1b).

The staged development (option 1b) involves replacing assets in two discrete, separate projects and allows deferral of capital expenditure (for the second stage of project) for about five years. The first stage targets assets with higher failure probabilities and higher failure consequences. Optimum work sequences, minimum planned outages, project delivery efficiencies and minimum risk to customer supplies during the delivery of project defines the precise project staging. The proposed work for HTS development stage one includes replacement of all three 220/66 kV transformers and associated 220 kV and 66 kV transformer circuit breakers, installation of 220 kV circuit breakers for the SVTS incoming lines and the replacement of 220 kV buses. Stage two includes replacement of the 66 kV buses and the remaining 66 kV bus tie circuit breakers and 66 kV feeder circuit breakers. The PV cost for the staged redevelopment is $150.6M.

The single consolidated project (option 1a) is more efficient and has a lower capital cost then the combined stage 1 and stage 2 capital cost of option 1b. It also has a comparatively lower risk of asset failure prior to replacement. Based on the economic analysis, the single project (option 1a) has the best economic outcome with the lowest PV cost ($134.9M) of all technically feasible options. Hence, it is identified as the most economic option for this project.

9.2. OPTION 2 - REDEVELOPMENT WITH GIS AND 150 MVA TRANSFORMERS

This option employs gas insulated switchgear (GIS) to replace the 220 kV and 66 kV switchyard equipment, and replaces the existing transformers with the same size 150 MVA transformers. The compact nature of GIS will reduce the footprint of the terminal station, but it is more expensive compared to the AIS option. HTS is located in an industrial area and it is considered that an AIS Redevelopment will be acceptable to the council and community. Screening of the site has also been included in the project scope to deliver improved site visual amenity and improve the likelihood of receiving planning approval for the AIS option. No objections have been raised with continuing with AIS at HTS.

This option is discarded base on economic grounds (PV cost of $195.8M), but it is recognised that there is a small risk that a planning application for a redevelopment with AIS may not be successful. All measures to minimise this risk has and will be taken. SP AusNet is obliged to pursue the most economic option (AIS redevelopment of HTS) until it is proven that it is no longer a credible option[14].

9.3. OPTION 3 – LIKE FOR LIKE REPLACEMENT

Under this option, assets are replaced before failure on a like-for-like basis and assets with high failure risks are replaced in-situ. A weakness in this approach is that it fails to take advantage of an opportunity to rationalise assets or to improve network configuration by removing the operational and security of supply risks imposed by the 220 kV switching at HTS.

14 National Electricity Rules Clause S6A.2.2 Prudency and efficiency of capital expenditure.

SP AusNet and AEMO's planned reconductoring of the SVTS-HTS 220 kV lines cannot be undertaken unless a costly third transmission line from either Malvern Terminal Station (MTS) or Dandenong Terminal Station (DNTS) is provided or the switching is improved at HTS.

This option has relatively low capital cost associated with replacing only two bus tie circuit breakers in the 220 kV switchyard. Despite the low capital cost, this option is not recommended due to the following limitations:

- Security of supply and operating risk associated with the 220 kV switchyard configuration
- 220 kV operational restrictions
- The existing 220 kV switchyard configuration cannot be expanded to accommodate the ultimate station requirements due to space constraints
- Prolonged outages to reconductor the SVTS-HTS 220 kV circuits and the high cost to provide a third 220 kV supply to HTS supports more reliable transformer and line switching at HTS

AEMO and United Energy furthermore support a reconfiguration of the 220 kV switchyard as part of the HTS redevelopment, and to provide switching for the incoming lines and 220/66 kV transformers to improve the security of supply at HTS. The Like-for-like replacement option has a higher PV cost ($137.4) than the preferred option and is hence not further considered.

*9.4. OPTION 4 – DO NOTHING *MANDATORY*

This option defines the safety risk, service risk, and operation and maintenance costs to retain all the existing assets in service as long as possible. The maintenance frequency and cost will become more intensive over time. Safety risk and community cost increases based on deteriorating transformers and switchgear condition and consequent escalating asset failure risk as well as continued demand growth. This option serves as a baseline in the economic cost-benefit evaluation.

This option is inconsistent with SP AusNet's obligations under the National Electricity Rules (NER) to maintain the quality, reliability, safety and security of transmission services. It is also inconsistent with SP AusNet's accepted Electricity Safety Management Scheme (ESMS) to design, construct, operate, maintain and decommission its supply network to minimize as far as practicable the hazards and risks to the safety of any person, and of damage to the property of any person. Prudent asset management and personnel health and safety risks determined that this option is used for economic comparative purposes only. The PV cost for this option is extremely high ($339.7M).

10. BENEFITS

Business Driver	Strengthen	Regulated Network Reliability and Resilience	Strong
Benefit & Measure	▪ Network reliability and availability will be enhanced by replacing assets in poor condition		

Business Driver	Strengthen	Compliance	Moderate
Benefit & Measure	▪ The proposed redevelopment project will ensure continued compliance with the network performance and reliability requirements defined in the NER ▪ Reduced safety risk to personnel. ▪ Compliance with the Electricity Safety Act and ESMS		

Business Driver	Transform	Customer and Community	Strong
Benefit & Measure	▪ Customer service is improved by reducing the risk of their supply being adversely impacted. ▪ Reconfiguration of 220 kV switching arrangement will increase security of supplies from HTS and allow for cost efficient future augmentations		

Business Driver	Transform	Sustainability	Strong
Benefit & Measure	• The new transformers will have lower losses than the existing transformers, allowing power to be transmitted more efficiently. ▪ Environmental risk and safety risk will be minimised ▪ Reconfiguration of 220 kV switchyard facilitates the future development of the station ▪ Lower operation and maintenance cost		

11. RISK OF PROJECT NOT BEING APPROVED

Business Driver	Strengthen	Regulated Network Reliability and Resilience	Strong
Benefit & Measure	▪ Community impact due to increasing frequency and duration of service disruptions ▪ Additional costs associated with emergency replacement ▪ Potential transmission incentive scheme penalties associated with transformer outages or SVTS line outages		

Business Driver	Strengthen	Compliance	Moderate
Benefit & Measure	▪ Non-compliance with the network performance and reliability requirements stated in the National Electricity Rules. ▪ Non-compliance with the accepted Electricity Safety Management Scheme.		

Business Driver	Transform	Customer and Community	Strong
Benefit & Measure	▪ Customer supply is impacted due to asset failure		

Business Driver	Transform	Sustainability	Strong
Benefit & Measure	• Operation and maintenance cost escalating to inefficient levels		

12. DELIVERY PROJECT RISKS (KNOWN)

Risk	What could occur
▪ Failure of existing B transformers prior to replacement	▪ Immediate replacement with metro spare transformer resulting in project scope change and a likely cost increase
▪ Failure of 220 kV or 66 kV switchgear prior to replacement	▪ Emergency replacement resulting in project scope changes and likely cost increases
▪ Delays in project delivery	▪ It would increase the risk of a transformer or circuit breaker failure

13. FINANCIAL IMPACTS

13.1. EXPEND CAT /WORK CODE:

CI10

13.2. ECONOMIC EVALUATION OPTIONS

For the full Financial Evaluation of the options considered and supporting financial details refer to the attached HTS Redevelopment Project NPV Model V0.05 in PET.

TABLE: Financial Analysis of Preferred Option

Financial Forecasts ($'000s)	2011 / 12	2012 / 13	2013 / 14	2014 / 15	2015 / 16	2016 / 17	2017 / 18	Total
Revenue	[C-I-C]							
Expenses								
Capital								
Savings								
Working Capital								
Residual Revenue								
Tax Paid								
Net Cash Flow (excludes financing)								
NOPAT (EVA, excludes interest)								
Capital Charge								
EBITDA								
EBIT								
NPAT								
Earnings / (Loss) per Share, cents								[C-I-C]
NPV								
WACC (Post Tax Nominal)								

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

TABLE: Economic Analysis of Options

Economic Analysis of Options ($'000s)	PV Capital Cost	PV Opex Costs	PV Community Benefits	PV Proceeds From Sales	Total PV Cost	NPV including Reg Return
Do Nothing	-	(138)	(339,597)	-	(339,735)	**(89)**
Redevelop with AIS and 150 MVA Transformers - Single Project	(39,499)	(103)	(95,310)	-	(134,913)	**641**
Redevelop with AIS and 150 MVA Transformers - Staged Development	(40,296)	(119)	(110,211)	-	(150,626)	**697**
Redevelop with GIS and 150 MVA Transformers	(100,395)	(103)	(95,310)	-	(195,808)	**1,670**
Like for Like Replacement	(37,230)	(96)	(100,067)	-	(137,393)	**602**

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

TABLE: Project Expenditure Forecasts

Project Expenditure Forecasts ($'000s)	2011 / 12	2012 / 13	2013 / 14	2014 / 15	2015 / 16	2016 / 17	2017 / 18	Total
Design	[C-I-C]							
Internal Labour								
Materials								
Plant & Equipment								
Contracts								
Meter Costs								
Project P50 Risk Allow ance								
Project Direct Expenditure (P50)	67	192	8,135	8,365	18,924	17,670	862	54,216
Delivery Risk Adjustment =(P90-P50)	[C-I-C]							
Project Direct Expenditure plus risk (P90)								
Overheads								
Finance Charges								
Operating Costs / (Savings)								
WDV (Written Down Value) of Assets to be retired								
Total Estimated Expenditure for Approval	73	224	9,290	10,081	22,281	20,845	1,540	64,336
NPV								[C-I-C]
Corporate WACC (Post Tax Nominal)								

TABLE: Contribution of Projects to Key Business Metrics

Contribution of Projects to Key Business Metrics	2011 / 12	2012 / 13	2013 / 14	2014 / 15	2015 / 16	2016 / 17	2017 / 18	Post 2016 / 17
Opex (Costs) / Savings	-	-	-	-	-	-	$14	$79
OH&S	-	-	-	-	-	-	$435	$3,558
System Capacity	-	$0	$0	$0	$0	$0	$58,813	$555,618
Environmental Risk	-	-	-	-	-	-	$1	$8
Regulatory Compliance	-	-	-	-	-	-	-	-
Bushfire Mtigation	-	-	-	-	-	-	-	-
Corporate Image	-	-	-	-	-	-	-	-
Reliability	-	-	-	-	-	-	-	-
Incentive Revenue	-	-	-	-	-	-	$14	$107
Asset Failure Risk								
Gas Mains Renew al								

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

TABLE: 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 $Nominal	Overheads	Totals							
	2011 / 2012	Apr-11	-	-	-		-	-			-		-
		May-11	-	-	-		-	-	-		-		-
For A to P:		Jun-11	-	-	-		-	-	-		-		-
Direct	67	Jul-11	-	-	-		-	-	-		-		-
Overheads	5	Aug-11	-	-	-		-	-	-		-		-
Finance Charges	-	Sep-11	-	-	-		-	-	-		-		-
	72	Oct-11	-	-	-		-	-	-		-		-
Error checks		Nov-11	8	8	1		9	9	-		-		-
($Real)		Dec-11	5	5	0		5	14	-		-		-
Direct	-	Jan-12	18	18	1		19	33	-		-		-
Overheads	-	Feb-12	34	34	2		36	70	-		-		-
		Mar-12	2	2	0	72	2	72	-		-	-	-
	2012 / 2013	Apr-12	10	10	1		11	83	-		-		-
		May-12	7	7	1		8	90	-		-		-
For A to P		Jun-12	9	9	1		10	101	-		1		1
Direct	192	Jul-12	9	9	1		10	112	-		1		1
Overheads	13	Aug-12	49	50	4		54	167	-		1		3
Finance Charges	15	Sep-12	49	50	4		54	222	-		2		4
	221	Oct-12	9	9	1		10	233	-		2		6
Error checks		Nov-12	9	9	1		10	245	-		2		7
($Real)		Dec-12	9	9	1		10	257	-		2		9
Direct	-	Jan-13	9	9	1		10	268	-		2		11
Overheads	-	Feb-13	9	9	1		10	280	-		2		13
		Mar-13	9	9	1	206	10	292	-		2	15	15
	2013 / 2014	Apr-13	145	152	11		163	456	-		3		18
		May-13	300	316	22		338	802	-		5		23
For A to P:		Jun-13	397	416	29		447	1,257	-		9		32
Direct	6,135	Jul-13	397	416	29		447	1,716	-		12		44
Overheads	569	Aug-13	436	459	32		491	2,222	-		15		59
Finance Charges	421	Sep-13	3,616	3,807	266		4,073	6,338	-		43		102
	9,125	Oct-13	416	438	31		469	6,854	-		47		149
Error checks		Nov-13	416	438	31		469	7,372	-		50		199
($Real)		Dec-13	401	422	30		452	7,879	-		54		253
Direct	-	Jan-14	401	423	30		452	8,388	-		57		310
Overheads	-	Feb-14	401	423	30		452	8,901	-		61		371
		Mar-14	401	423	30	8,705	452	9,418	-		64	421	435
	2014 / 2015	Apr-14	52	56	4		60	9,543	-		65		501
		May-14	23	24	2		26	9,634	-		66		566
For A to P:		Jun-14	23	24	2		26	9,727	-		66		633
Direct	8,365	Jul-14	34	37	3		39	9,833	-		67		700
Overheads	586	Aug-14	34	37	3		39	9,940	-		68		768
Finance Charges	961	Sep-14	34	37	3		39	10,048	-		69		837
	9,912	Oct-14	44	47	3		50	10,168	-		84		906
Error checks		Nov-14	34	37	3		39	10,277	-		70		976
($Real)		Dec-14	1,698	1,824	126		1,962	12,924	-		84		1,060
Direct	-	Jan-15	1,245	1,344	98		1,443	13,857	-		95		1,155
Overheads	-	Feb-15	1,764	1,905	133		2,038	16,004	-		109		1,264
		Mar-15	2,763	2,984	209	6,951	3,193	19,330	-		132	961	1,396
	2015 / 2016	Apr-15	1,805	2,000	140		2,140	21,617	-		148		1,544
		May-15	1,045	1,158	81		1,239	23,014	-		157		1,701
For A to P:		Jun-15	1,055	1,169	82		1,251	24,431	-		167		1,868
Direct	18,924	Jul-15	1,561	1,730	121		1,851	26,462	-		181		2,049
Overheads	1,325	Aug-15	1,055	1,169	82		1,251	15,319	12,500		105		2,154
Finance Charges	1,573	Sep-15	1,023	1,133	79		1,215	16,845	-		114		2,269
	21,821	Oct-15	3,273	3,627	254		3,881	20,687	-		141		2,409
Error checks		Nov-15	1,023	1,133	79		1,213	22,030	-		150		2,559
($Real)		Dec-15	1,371	1,519	106		1,625	23,315	-		163		2,722
Direct	-	Jan-16	1,286	1,425	100		1,525	10,414	15,000		73		2,794
Overheads	-	Feb-16	1,298	1,438	100		1,538	12,035	-		82		2,876
		Mar-16	1,286	1,425	100	20,248	1,525	13,650	-		93	1,573	2,960
	2016 / 2017	Apr-16	1,260	1,432	100		1,532	15,287	-		104		5,073
		May-16	1,241	1,411	99		1,509	14,395	2,500		98		3,172
For A to P:		Jun-16	1,250	1,422	100		1,521	16,026	-		109		3,281
Direct	17,670	Jul-16	2,786	3,167	222		3,389	19,542	-		133		3,415
Overheads	1,237	Aug-16	1,321	1,502	105		1,607	21,300	-		145		3,560
Finance Charges	1,504	Sep-16	1,295	1,473	103		1,576	23,030	-		157		3,717
	20,411	Oct-16	1,289	1,465	103		1,568	24,770	-		169		3,887
Error checks		Nov-16	1,263	1,436	101		1,537	26,488	-		181		4,067
($Real)		Dec-16	1,073	1,220	85		1,305	12,362	15,000		58		4,125
Direct	-	Jan-17	1,043	1,186	83		1,269	14,248	-		97		4,253
Overheads	-	Feb-17	988	1,121	78		1,200	15,555	-		106		4,360
		Mar-17	734	835	58	15,907	893	16,561	-		113	1,504	4,473
	2017 / 2018	Apr-17	682	795	56		851	12,497	5,000		86		4,558
		May-17	15	17	1		19	12,602	-		88		4,644
For A to P:		Jun-17	10	12	1		13	12,701	-		97		4,741
Direct	662	Jul-17	10	12	1		12	12,801	-		87		4,828
Overheads	60	Aug-17	10	12	1		12	12,902	-		85		4,907
Finance Charges	523	Sep-17	8	9	1		9	13,000	-		80		4,986
	1,446	Oct-17	5	6	0		6	-	13,007		-		-
Error checks		Nov-17	-	-			-	-			-		-
($Real)		Dec-17	-	-	-		-	-			-		-
Direct	-	Jan-18	-	-	-		-	-			-		-
Overheads	-	Feb-18	-	-	-		-	-			-		-
		Mar-18	-	-	-	923	-	-	-		-	523	-
Total						58,011					4,996	4,996	
Cash flow amount should equal the total directs as shown on page 1 of the A to P							Total Including Finance Charges				63,007		

13.3. BUDGET PROVISION

The project has budget allocation (CAPEX) in the Transmission Company Funded allowance for each of the 2012/13 through 2017/2018 financial years.

13.4. REVENUE

It is reasonable to assume that all costs incurred in this project will be included in the 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 SP AusNet 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, SP AusNet 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."*

13.5. FINANCIAL RISKS

The majority of the project will be completed in the next regulatory control period and will be subject to approval of the capital expenditure allowance set at the next Transmission Revenue Reset (TRR) by the Australian Energy Regulator (AER). Noting that the AER does not approve individual capital projects and SP AusNet has the ability to prioritise works within the period, it is unlikely SP AusNet would be required to fund a capital shortfall due to the HTS rebuild. 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".

The AER will be most likely to consider the associated capital expenditure forecast reasonable, and so approve it in SP AusNet's allowance, if an approved business case is available at the next regulatory review, funding is committed and the project is underway. Additional funding for the increased cost of GIS will be sought by defining Council and community rejection of the AIS proposal as a trigger under the "Contingent Project" regulatory funding arrangement in the unlikely event that a more expensive GIS redevelopment be required. The outcome of the planning decision will be communicated to the Board, confirming that the forecast capital expenditure still applies or whether a revision of the business case would be required to approve the additional cost of GIS.

Reprioritisation of transmission asset renewal projects will release sufficient funds for the business to advance the HTS Redevelopment Project without exceeding the regulatory approved capital budget. 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 and United Energy have confirmed the ongoing need of the HTS facilities in accordance with the proposed redevelopment,
- A detailed Project Execution Plan will minimise the number and duration of outages, limiting the associated rebate cost;
- The project has been carefully estimated to cover the additional cost that may arise because this is 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.

13.6. ASSET RETIREMENTS, CONTRIBUTED (GIFTED) ASSETS, CUSTOMER CONTRIBUTION REVENUE

The projected written down value for all assets to be replaced in November 2017 is $232,108.72. This value was calculated by the fixed assets accounting team.

13.7. CORPORATE ACCOUNTING AND TAX ADVICE

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