# AusNet Transmission Group Pty Ltd

## Transmission Revenue Review 2017-2022

## XA14 – WMTS Redevelopment Project: Business Case (Public)

**Submitted: 30 October 2015**

# Business Case Application for Approval

## XA14 WMTS Redevelopment Project

| | |
|---|---|
| **CAP #:** | T0439 |
| **Project Initiator:** | [C-I-C] |
| **Contact No:** | [C-I-C] |
| **Initiating Dept / Div:** | NSD |
| **Prepared By:** | [C-I-C] |
| **Date of Submission:** | March 2012 |
| **Target Project Start Date:** | April 2012 |
| **Target Project Completion Date:** | November 2016 |

SP AusNet
A member of Singapore Power Group

## 1. RECOMMENDATION

Approval is sought for a total expenditure of up to $192.8 M (including risk adjustments, overheads and finance charges) for a complete redevelopment of West Melbourne Terminal Station (WMTS), including 220 kV, 66 kV and 22 kV switchgear as well as replacement of three 220/66 kV transformers. The key project driver is the condition of the B1, B2 and B3 [C-I-C] transformers, 220 kV and 66 kV switchgear, and the health and safety risks presented by the 22 kV metalclad switchgear, which cannot comply with contemporary arc fault containment requirements.

The community cost due to the increasing frequency and duration of service disruptions will exceed the proposed funding should the redevelopment of WMTS not proceed. It would also result in non-compliance with the formally accepted Electricity Safety Management Scheme in accordance with the Electricity Safety Act, and with respect to network performance and reliability requirements as stated in the National Electricity Rules.

The project targets a completion date of November 2016 and will require Board approval.

## 2. STRATEGIC ALIGNMENT

| Strategic Objective | Business Driver | Linkage |
|---|---|---|
| *Strengthen* | Regulated Network reliability and resilience | Strong |
| | Compliance | Strong |
| *Transform* | Customer and Community | Strong |
| | Sustainability | Strong |
| *Modernise* | New Technologies | Low |

## 3. FINANCIAL SUMMARY

| Program / Project Expenditure Forecasts | 2011 / 12 | 2012 / 13 | 2013 / 14 | 2014 / 15 | 2015 / 16 | 2016 / 17 | Total |
|---|---|---|---|---|---|---|---|
| Program / Project Direct Expenditure | 667 | 2,064 | 33,312 | 60,136 | 57,839 | 6,899 | 160,917 |
| Program / Project Total Expenditure | 793 | 2,519 | 40,538 | 74,194 | 66,966 | 7,836 | 192,846 |
| Revenue | 34 | 19 | 1,779 | 6,437 | 12,435 | 15,815 | 777,708 |
| NPV | | | | | | | 4,754 |
| Payback Period (Discounted) | | | | | | | 39.7 |
| Corporate WACC (Post Tax Nominal) | | | | | | | [C-I-C] |

## 4. ENDORSEMENTS

| | | |
|---|---|---|
| Manager PMO<br>Kerry Karafotias<br>Date: | Network Owner<br>Andrew Maticka<br>Date: | Finance Manager<br>Mark Campbell<br>Date: |

## 5. APPROVALS

| | | |
|---|---|---|
| Project Initiator<br>Herman De Beer<br>[redacted] [C-I-C]<br>General Manager NSD<br>Charles Popple<br>Date: 29 May 2012 | | Director Regulation and Network Strategy<br>Alistair Parker<br>Date:<br><br>Managing Director<br>Nino Ficca<br>Date: |
| | Chief Financial Officer<br>Geoff Nicholson<br>Date: | |

# 6. BACKGROUND

West Melbourne Terminal Station (WMTS) is one of the key terminal stations supplying the Melbourne CBD area. It provides both 220/66 kV and 220/22 kV transformation and supplies load to the West Melbourne area including Melbourne Docks, Docklands Areas, North Melbourne (including a railway substation), Parkville and Carlton, and the northern and western inner Central Business District.

The majority of the electricity assets at WMTS are approaching the end of their functional life. The condition of the assets is such that they present a high and increasing risk of failure. A significant capital investment is required to address these risks and to ensure reliable electricity supplies from this key terminal station.

The key project drivers include the following:

- Failure risk of three of the 150 MVA 220/66 kV transformers
- 220 kV, 66 kV and 22 kV switchgear condition and failure risk
- Health and safety risks to personnel and station assets presented by deterioration of 220 kV and 66 kV instrument transformers;
- Health and safety risks to personnel presented by the 22 kV metalclad switchgear, which cannot comply with contemporary arc fault containment requirements.

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]

## 6.1. Asset Condition

### Transformers

AMS 10-141[2] identifies that three of the WMTS transformers are showing the highest level of internal ageing of all transformers of this type and class. This is primarily the result of their high average loading and high operating temperatures during periods of high ambient temperature due to ineffective coolers. As the coolers are mounted on the tank walls, their effectiveness is degraded by hot air radiated from the tank. Based on the extent of deterioration of these units and the outcome of refurbishment of a similar transformer at TTS, their refurbishment is not considered economic. It is recommended that these transformers be replaced before end 2016 in order to manage the rising risk of failure.

### 220 kV Circuit Breakers

Of the population of 220 kV circuit breakers the oldest units, the five [C-I-C] circuit breakers (CB), present the greatest risk. They are of a minimum-oil type interrupter design with a spring type mechanism. Asset Management Strategy AMS 10-144[3] identifies that this family of circuit breakers have thus far provided reliable service but as the oldest 220 kV circuit breakers installed on the network they exhibit a range of condition and duty related defects with the potential to impact reliability and the cost of ownership.

### 220 kV Current Transformers

Of the 36 post-type Current Transformers (CTs) installed at WMTS, the 24 [C-I-C] units present a high level of failure risk. They are identified in AMS 10-122[4] as presenting the highest level of risk of all of the CTs installed on the network. The problems with this family of CTs include:

- Proven design and manufacturing deficiencies which can result in explosive failure of the primary insulation. A number of units operating at 500 kV and 330 kV have failed in service due to these deficiencies and dissolved gas analysis (DGA) of these 220 kV units shows that they too are trending in the same manner.

1 NER v46
2 AMS 10-141 Asset Health Review for Power Transformers in Terminal Stations 28/10/2010
3 AMS 10-144 Asset Health Review for Transmission Circuit Breakers 3/8/2011
4 AMS 10-122 Asset Health Review for Current Transformers in Terminal Stations 3/10/2011

- Failure of the bellows in the top cap which can lead to free breathing and degradation of the oil and paper insulation system.

These units present a significant risk to network reliability and in the event of an explosive failure they represent a risk to the safety of personnel and condition of near by equipment. They have a high and increasing cost of ownership due to the high frequency of oil sampling necessary for monitoring their condition. They are recommended for replacement within seven years.

The long term serviceability of [C-I-C] manufactured post type CTs in the WMTS switchyard is under question. However, the balance of 220 kV post type CTs are considered to be of satisfactory condition with potential for future service.

### 220 kV Capacitor Voltage Transformers

Of the 14 Capacitor Voltage Transformers (CVTs) installed at WMTS the condition of ten indicates they are in the latter part of their lives. Eight of these are single-phase matching units connected via a voltage tapping to the [C-I-C] CTs, which as noted above are considered to have a very limited remaining life, and two are [C-I-C] units.

AMS 10-64[5] notes that [C-I-C] CVTS have been previously replaced at various terminal stations due to oil leakage, corrosion and deterioration of the internal insulation system.

The [C-I-C] and [C-I-C] units at WMTS are recommended for replacement as these units are approximately 30 years of age and are identified in AMS 10-64 as being among the oldest on the 220kV network and they exhibit typical signs of age related deterioration.

### 220 kV Surge Arresters

Eighteen of the 33 surge arresters at WMTS are silicon-carbide type which, due to corrosion related problems have been targeted for replacement within the station redevelopment works. This is consistent with the Asset Management Strategy for Surge Diverters (AMS 10-73) which identifies the emerging problems with the silicon-carbide units and targets them for replacement at ages consistent with those of units at WMTS.

### 220 kV Isolators and Earth Switches

With the exception of the isolators incorporated into the GIS switchgear at WMTS, all of the isolators are of the vertical single-break type with service lives exceeding 30 years. Fifteen have service lives in excess of 45 years.

Asset Management Strategy AMS 10-59 - Isolators and Earthing Switches identifies a range of issues arising from service-age and duty related deterioration of isolators and earthing switches specifically:

- corrosion of drive linkages and contact assembles (due to dissimilar metals),
- deterioration of bearings due to contamination, hardening of grease, inadequate lubrication;
- deterioration of the brown porcelain pin and cap type insulators which incur moisture ingress to flanges leading to corrosion and their ultimate failure.

In addition it notes that the Switchgear isolators have a further service-age and duty related problem where the fixed contacts lose spring tension causing overheating of contact assemblies.

In line with the recommendations of AMS 10-59 all isolators and earthing switches 40 years old or greater should be replaced before the abovementioned issues impact upon their reliability

### 66 kV Circuit Breakers

Thirteen of the twenty-one 66 kV circuit breakers at WMTS are of a bulk-oil type, two are minimum-oil type, four are indoor GIS and two are an outdoor SF6 gas insulated type.

The [C-I-C] type [C-I-C] bulk-oil circuit breakers range in service-age from 44 to 49 years and are amongst the oldest installed on the network. To date they have been quite reliable but are exhibiting the following limitations in their potential for future service:

5 AMS 10-64 Instrument Transformers

- Marginal fault level ratings requiring restrictive switching configurations;
- Duty related deterioration and service-age related corrosion of components;
- Wear of drive linkages, dashpots and operating mechanisms;
- Erosion of arc control devices;
- Limited spares availability;
- Increasing need for maintenance intervention;
- Manufacturer no-longer provide technical support or spares.

The cost of ownership of bulk-oil circuit breakers is significantly higher than their modern counterparts. Asset Management Strategy AMS 10-54 Circuit Breakers, acknowledges the environmental risks associated with 66 kV bulk-oil circuit breakers and recommends their progressive replacement prior to the abovementioned factors impacting upon their reliability.

The remaining minimum-oil type, SF6 outdoor type and the GIS circuit breakers are in good condition and consistent with AMS 10-54 are considered suitable for further service, spares or replacements in other installations.

### 66kV Current Transformers

There are twelve post type current transformers installed at WMTS in conjunction with the outdoor minimum oil and SF6 circuit breakers. They are all of a similar design being an oil and paper based insulation system. Asset Management Strategy AMS 10-122 identifies the six [C-I-C] and [C-I-C] units as presenting the highest level of risk due to their documented modes of deterioration and nominates their replacement within 15 and 10 years respectively. The proposed redevelopment of WMTS provides an opportunity for their cost effective replacement.

### 66 kV Voltage Transformers

All of the voltage transformers at WMTS are of an inductive type design. Seven are of an oil and paper based insulation system and have delivered more than 30 years service. In accordance with AMS 10-64 they are subject to condition monitoring via oil sampling and dissolved gas analysis, however based upon the observed ageing of their insulation system are considered to be in the latter part of their lives. All VTs are proposed for replacement as part of the redevelopment project.

### 66 kV Disconnect Switches

The majority of disconnect switches are of a simple, underslung design and are fitted with brown porcelain pin and cap type insulators. They range in age from 45 to 49 years. AMS 10-59[6] identifies the major problems with these switches as deterioration of the pin and cap insulators and potential loss of rating due to the combined effects of corrosion and contact wear. It recommends their replacement after 40 years service. As such the isolators will be replaced as part of the redevelopment project.

### 22 kV Switchgear

The 22 kV switchgear is of a "metalclad", indoor design and is comprised of seventeen bulk-oil circuit breakers and associated CTs and VTs configured in three busses. It is of [C-I-C] manufacture and has delivered more than 40 years service. The equipment requires increased maintenance intervention as the result of duty related deterioration which is compounded by the lack of spares and the absence of manufacturer's support.

In addition, the switchgear was not designed for, and cannot comply with current arc fault containment standards to ensure personnel safety during an explosive failure.

As such replacement of this switchgear and associated equipment is of some priority and replacement with a new switchboard early in the terminal station redevelopment project is recommended.

6 AMS 10-59 Disconnectors and Earth Switches

### Secondary Systems

Due to the difficulties and associated risks of interfacing with existing systems at WMTS new 220 kV and 66 kV protection systems will be installed. The majority of secondary systems at WMTS were installed when the station was originally developed and are now obsolete and beyond their technical service lives.

## 6.2. Safety Considerations

### 220 kV Switchyard

The twenty-four [C-I-C] post-type current transformers represent the highest safety risks within the 220 kV switchyard due to their known type problems, deterioration and failure modes. There have been several previous failures of post type current transformers (several of which were the same type) which have resulted in significant collateral damage to surrounding equipment from flying porcelain shards and burning oil. Such events present a major risk to the safety of personnel within 50 metres of the equipment failure.

### 66 kV Switchyard

The six [C-I-C] and [C-I-C] post-type current transformers have documented type problems and failure modes. They present an explosive failure risk similar to the [C-I-C] 220 kV current transformers.

### 22 kV Switchgear

The [C-I-C] 22 kV indoor metalclad switchgear presents a safety risk due to its non-compliance with contemporary arc fault containment standards. There have been a number of previous failures of this type of circuit breaker in the Victorian network, which have resulted in major damage to the entire switchboard and the switchroom due to the explosive failure of a circuit breaker and the resultant fire being fuelled from its expelled oil. Such an event would present a major risk to any personnel within the switchroom. The risk is further compounded by the documented service age and duty related deterioration of the switchgear which increases the likelihood of a failure.

## 6.3. Future Development Plans

The 220/66 kV augmentation planned at Brunswick Terminal Station (BTS) will provide a third 66 kV supply source to inner Melbourne and CBD loads. Significant load at WMTS is at risk (with network reconfiguration and radial supplies to zone substation JA (130 MVA) required on high demand days to avoid overloading the WMTS 220/66 kV transformers) until CitiPower is able to transfer load from WMTS to BTS.

The proposed redevelopment of WMTS with compact GIS technology will unlock the existing augmentation constraints at WMTS. It will provide for efficient future augmentations to meet the capacity demands of CitiPower's distribution network.

Through 2011 SP AusNet has consulted with the planning authorities for the shared transmission network (AEMO) and transmission connection network (CitiPower and Jemena) regarding the future planning requirements for WMTS. CitiPower and Jemena's ultimate development plan for WMTS includes up to seven 150 MVA 220/66 kV transformers. It is ultimately planned for the 22 kV supplies to be re-located from WMTS and the existing 220/22 kV transformers are expected to remain until around 2025.

The future planning requirements for WMTS include:

- 220 kV switching comprised of four diameters of circuit breaker-and-a-half configuration (12 circuit breakers) with an ultimate provision for six diameters;
- Acceptance of indoor gas insulated switchgear (GIS) as a viable technology for the replacement of the outdoor air insulated switchgear (AIS) for both the 220 kV and 66 kV switchyards due to site constraints, City of Melbourne planning requirements and the requirement to minimise supply outage risks during the redevelopment project;
- Utilising 150 MVA transformers to replace three of the existing 150 MVA 220/66 kV transformers and making provision for seven 150 MVA 220/66 kV transformers in the ultimate station layout.

- The use of a standard double-busbar switching configuration in GIS or a hybrid of AIS and GIS technology to replace the 66 kV outdoor switchyard. This approach is consistent with that agreed for the redevelopment of Richmond and augmentation of Brunswick Terminal Stations;
- For the ultimate station development, provision for six 66 kV busbars, each with four feeder switch bays, one capacitor bank switch bay and a single-switched transformer bay;
- Provision of 220 kV switching for the two existing 220/22 kV transformers until the 22 kV is migrated away from WMTS at some time beyond 2015.

## 7. WORK TO BE UNDERTAKEN

Redevelopment of WMTS 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 will however also address future transformation capacity limitations and 220 kV switching configuration constraints.

The following is a summary of the proposed scope:

- Removal and retirement of all 220 kV switchyard plant and equipment and rack structures;
- Construction of a building to house the new 220 kV switchgear and associated protection and control equipment;
- Installation of four bays of 220 kV gas insulated switchgear (GIS) comprising twelve circuit breakers in a circuit breaker and a half configuration along with twenty-four isolators and earthing switches and associated instrument transformers;
- Removal and retirement of the outdoor 66 kV switchgear and equipment (capacitor banks will be retained);
- Construction of two buildings to each house a 66 kV GIS switchgear bus;
- Installation of ten bays of 66 kV GIS equipment in a double bus arrangement and its interconnection to the existing GIS equipment;
- Removal and retirement of the metalclad indoor 22 kV switchgear and its replacement with GIS equipment in a new dedicated building;
- Removal and retirement of the existing B1, B2 and B3 Transformers and their replacement with new units;
- Establish a new control room within the existing control building through the demolition of the existing mess room, cleaners store and amenities room;
- Establishment of new AC and DC supplies and associated distribution panels;
- Installation of new oil separation and treatment facility.

| | | | |
|---|---|---|---|
| **Strategic Procurement** | The 220/66 kV 150 MVA Transformers and GIS 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 2016 | | |
| **Composition of projects within the program** | N/A | | |
| **Other Associated Projects** | **Project Number/Title** | **Approved (Yes/No)** | **Cost** |
| No other associated projects | | | |
| | | | |

## 8. OPTIONS CONSIDERED

The options considered for the redevelopment of WMTS ranges from Greenfield to redevelopment of the terminal station on the existing site and are summarised below.

- Redevelopment with GIS for both the 220 kV and 66 kV using 150 MVA 220/66 kV transformers
- Redevelopment with GIS for both the 220 kV and 66 kV using 225 MVA 220/66 kV transformers
- Redevelopment with 220 kV GIS and 66 kV GIS/AIS using 150 MVA 220/66 kV transformers
- Greenfield GIS Redevelopment
- Staged Redevelopment
- Do Nothing

The range of options considered for the redevelopment of WMTS negated the need for a value engineering study at this stage.

Studies to confirm the weight carrying capacity of the Arden Street Bridge, which provides the only transformer access route to WMTS, will be completed before the end of the year and may result in a restriction to the size of transformer that could be considered for the redevelopment of WMTS.

### *8.1. PREFERRED OPTION - REDEVELOPMENT WITH GIS AND 150 MVA TRANSFORMERS*

Under this option new GIS would be installed within the station to replace the existing 220 kV and 66 kV AIS equipment. The estimated cost for this option is $192.8 M.

This redevelopment option offers all of the construction efficiency and reliability advantages inherent with compact indoor GIS with circuit outages only required for cutover purposes. It minimises the supply risks during the redevelopment project and takes into account the importance of the CBD load supplied from WMTS, and the concurrence of redevelopment projects at RTS and BTS.

Redevelopment of WMTS with 220 kV GIS and 66 kV GIS is more likely to receive planning approval as it complies with the City of Melbourne's plan for the Arden-Macaulay area and will deliver much improved site visual amenity.

This option provides for efficient future augmentation, allows for the ultimate plan for WMTS and is economically justified by 2015/16 via the community benefits delivered with more reliable transformers, 220 kV, 66 kV and 22 kV switchgear.

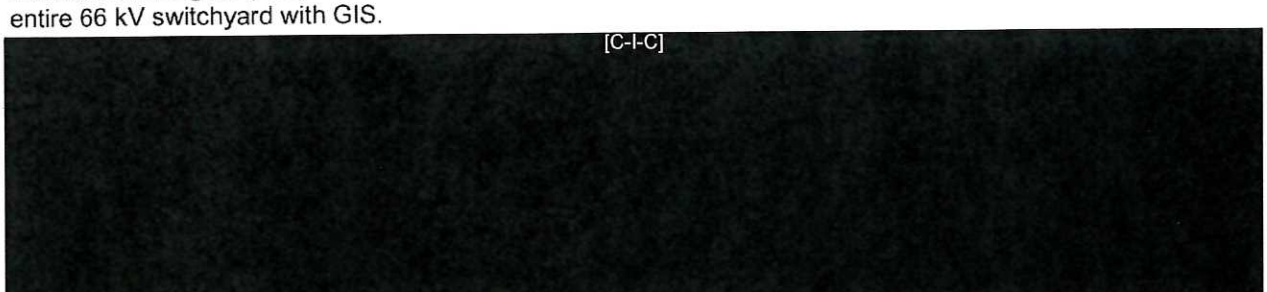
Sensitivity studies for discount rates and load growth scenarios confirmed that this is the most economic and credible option.

### *8.2. REDEVELOPMENT WITH GIS AND 225 MVA TRANSFORMERS*

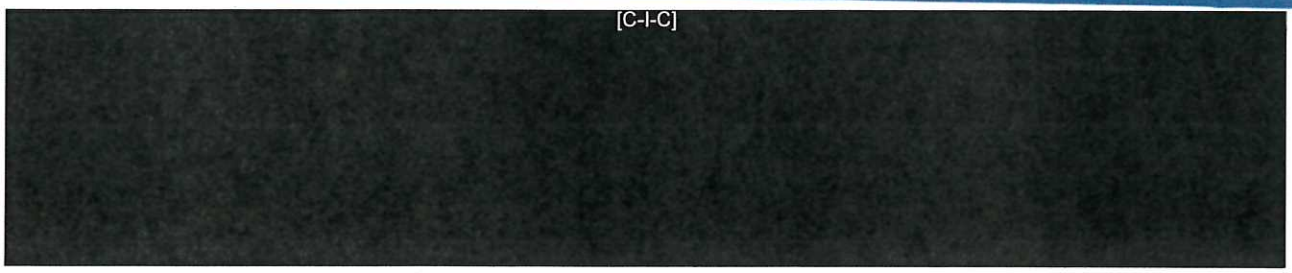
This option is similar to the preferred option except it employs larger capacity 225 MVA 220/66 kV transformers instead of 150 MVA transformers. Both transformer options can provide the same ultimate 220/66 kV transformation capacity requirements, but the higher initial cost for this option means that it has a higher present value cost compared with the preferred option. This option also has the disadvantage that one existing 220/66 kV transformer is still in good condition with an estimated 30 years remaining life.

### *8.3. REDEVELOPMENT WITH 66 KV GIS/AIS AND 150 MVA TRANSFORMERS*

This option replaces part of the existing 66 kV switchyard with GIS and the remainder with conventional air insulated switchgear (AIS). It provides a more cost effective alternative compared with the replacement of the entire 66 kV switchyard with GIS.



[C-I-C]



## 8.4. GREENFIELD GIS REDEVELOPMENT

This option involves the construction of an entire terminal station on a new site employing GIS.

Typically a new site can only be justified on the basis of the inadequacy or condition of the existing infrastructure, inadequate space for future development or unacceptable project risks associated with a brown field type redevelopment. It is inherently more expensive than works within an existing terminal station primarily due to costs associated with:

- Procurement of land and long lead time to develop the new site;
- Necessary planning and building permits and establishment of easements and permits for incoming and outgoing circuits;
- Rerouting of 220 kV, 66 kV and 22 kV lines and cables, which may require new underground cables when overhead line connections to the new site are not possible;
- Establishment of basic infrastructure such as switchyard civil works, access roads, drainage, water supply, security fencing and buildings.

The existing infrastructure at WMTS is in good condition and the existing site has sufficient available space to accommodate its proposed ultimate development using GIS equipment.

Further; extensive investigations confirmed that there is no suitable land available in the vicinity of WMTS and it is highly likely that Council constraints and public concerns would preclude Greenfield development in this area – reference to the Councils published re-development plan for the area.

The cost of this option is much higher than the other options and this option is therefore not considered viable from both cost and practicality perspectives.

## 8.5. STAGED ASSET RENEWAL

This option proposes replacement of assets as a series of discrete, separate projects undertaken over a number of years, targeting the replacement of the highest risk assets. For WMTS based on the hierarchy of risks this would typically result in a number of asset replacement projects over a timeline as follows:

- 2012-13 Replacement of the B Transformers and 22 kV Switchgear;
- 2018 Replacement of 220 kV Switchgear;
- 2020 Replacement of the 66 kV switchgear;

Outcomes of this approach are:

- Multiple planned circuit outages are required as each asset class is progressively replaced;
- Asset replacement is performed in a planned manner thus reducing the risks presented by replacement-on-failure;
- Engineering & design is undertaken on a planned basis and can realise greater efficiencies relative to the replacement-on-failure option but remains less efficient than for a single consolidated project;
- Multiples of engineering, design & construction activities required for each asset class replacement project;
- Multiple planned circuit outages are required for each project which present risks to network performance which would continue for the duration of all of the asset replacement projects – over a significant number of years;
- Some items of at-risk plant will remain in service for an extended period (until the last project is completed) with an increasing deterioration and hence failure risk;
- Inability to migrate to a more effective switching configuration through the piecemeal nature of the asset replacement works;

- Inability to efficiently accommodate future augmentation requirements;
- Social amenity (visual, noise, soil and water pollution) cannot meet the changing needs of the neighbourhood in which it is located.

This option is inconsistent with the City of Melbourne's plans for the Arden-Macaulay area and it cannot deliver the ultimate planning requirements for WMTS. The supply risks during the construction periods would be much higher than the alternative options.

The age and condition of the WMTS assets suggest that little deferment of capital expenditure is possible and that the inefficiencies associated with multiple projects and the community cost of a less reliable supply from WMTS make this option uneconomic. This option is hence rejected on both technical and economic grounds.

### *8.6. DO NOTHING *MANDATORY*

This option assumes that the condition of the assets will continue to deteriorate; assets will fail with increasing frequency and the duration of service disruptions will increase. This option establishes the community cost associated with service failures and serves as a baseline in the economic evaluation with which to compare the reliability improvements offered by the replacement options.

The most critical assets are three of the existing four 150 MVA 220/66 kV transformers where significant energy is at risk following an outage of one of these transformers during a high demand period. Failure of a transformer will cause long term disruption to customer supplies, particularly in the event of a major failure where replacement with a spare transformer would be required.

The present value of community cost has been assessed to be more than $2.58 BN over 20 years, which indicates that the proposed investment to improve the reliability of the supply from WMTS is economic.

This option is not consistent with SP AusNet's network reliability and performance obligations under the National Electricity Rules nor with the formally accepted Electricity Safety Management Scheme in accordance with the Electricity Safety Act. Prudent asset management, reliability of customer supplies and personnel health and safety determined that this option is used for economic comparative purposes only.

## 9. BENEFITS

| | | | |
|---|---|---|---|
| **Business Driver** | Strengthen | Regulated Network Reliability and Resilience | Strong |
| **Benefit & Measure** | ▪ By replacing these high risk assets, that are in poor condition, network reliability and availability will be enhanced | | |

| | | | |
|---|---|---|---|
| **Business Driver** | Strengthen | Compliance | Strong |
| **Benefit & Measure** | ▪ The proposed redevelopment project will ensure continued compliance with the network performance and reliability requirements defined in the NER | | |

| | | | |
|---|---|---|---|
| **Business Driver** | Transform | Customer and Community | Strong |
| **Benefit & Measure** | ▪ Customer service is improved by reducing the risk of their supply being adversely impacted. | | |

| | | | |
|---|---|---|---|
| **Business Driver** | Transform | Sustainability | Strong |
| **Benefit & Measure** | • The new transformer will have lower losses than the existing transformers, allowing power to be transmitted more efficiently.<br>▪ Removal of health and safety risk associated with older plant, particularly the 22 kV switch board. | | |

| | | | |
|---|---|---|---|
| **Business Driver** | Modernise | New Technologies | Low |
| **Benefit & Measure** | ▪ The new 220 kV and 66 kV GIS will reduce the terminal station's footprint and improve the visual amenity. | | |

## 10. RISK OF PROJECT NOT BEING APPROVED

- The community cost due to the increasing frequency and duration of service disruptions will exceed the cost of funding improvements in the reliability of electricity supplies from WMTS.
- Non-compliance with the network performance and reliability requirements stated in the National Electricity Rules.
- Non-compliance with the accepted Electricity Safety Management Scheme.

## 11. DELIVERY PROJECT RISKS (KNOWN)

| *RISK* | *WHAT COULD OCCUR* |
|---|---|
| ▪ Safety risk by 22 kV switchgear deemed unacceptable | ▪ Project timeline disrupted to advance switchboard replacement, cost increase due to multiples of design and construction |
| ▪ Failure of an existing B transformer | ▪ Immediate replacement with spare required resulting in scope change to project and likely cost increase |
| ▪ Inability to support peak loading | ▪ Installation of additional B transformer advanced. Increased costs due to multiples of design and construction works |
| ▪ Increase in 220 kV CT or CB failure rate | ▪ Replacement of 220 kV CTs or CBs to be undertaken prior to the project. Increase in costs due to multiples of design and construction |
| ▪ Delay to Distribution Business works | ▪ Delay to project delivery, increased costs, increased risk to supply reliability |

# 12. FINANCIAL IMPACTS

## 12.1. EXPEND CAT /WORK CODE:

CG1R

## 12.2. ECONOMIC EVALUATION OPTIONS

For the full Financial Evaluation of the options considered and supporting financial details refer to the attached WMTS NPV Model

### TABLE: Financial Analysis of Preferred Option

| Financial Forecasts ($'000s) | 2011 / 12 | 2012 / 13 | 2013 / 14 | 2014 / 15 | 2015 / 16 | 2016 / 17 | 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 Req Return |
|---|---|---|---|---|---|---|
| Do Nothing | - | (484) | (2,577,535) | - | (2,578,019) | (7,044) |
| Redevelop with GIS and 150 MVA Transformers | (125,359) | (147) | (135,941) | - | (261,447) | 4,754 |
| Redevelop with GIS and 225 MVA Transformers | (136,547) | (147) | (135,941) | - | (272,635) | 5,224 |
| Redevelop with 66 kV GIS/AIS and 150 MVA Transformers | (112,642) | (147) | (215,118) | - | (327,907) | 4,419 |
| Greenfield GIS Redevelopment | (245,122) | (147) | (168,188) | - | (413,456) | 10,237 |

*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 | Total |
|---|---|---|---|---|---|---|---|
| Design | [C-I-C] | | | | | | |
| Internal Labour | | | | | | | |
| Materials | | | | | | | |
| Plant & Equipment | | | | | | | |
| Contracts | | | | | | | |
| Meter Costs | | | | | | | |
| Project P50 Risk Allowance | | | | | | | |
| **Project Direct Expenditure (P50)** | 667 | 2,064 | 33,312 | 60,136 | 57,839 | 6,899 | 160,917 |
| 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** | 793 | 2,519 | 40,538 | 74,194 | 66,966 | 7,836 | 192,846 |
| 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 | Post 2016 / 17 |
|---|---|---|---|---|---|---|---|
| Opex (Costs) / Savings | - | $35 | $35 | $36 | $37 | $38 | $710 |
| OH&S | - | - | - | - | $539 | $580 | $17,206 |
| System Capacity | - | - | - | - | $117,781 | $5,807 | $11,837,989 |
| Environmental Risk | - | - | - | - | - | - | - |
| Regulatory Compliance | - | - | - | - | - | - | - |
| Bushfire Mitigation | - | - | - | - | - | - | - |
| Corporate Image | - | - | - | - | - | - | - |
| Reliability | - | - | - | - | - | - | - |
| Incentive Revenue | - | - | - | - | - | - | - |
| Asset Failure Risk | | | | | | | $16,026 |
| Gas Mains Renewal | | | | | | | |

*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 $Nominal | Overheads | Totals | | | | | | | |
| | 2011 / 2012 | Apr-11 | 360,000 | 360 | 25 | | 385 | 385 | - | | 3 | | 3 |
| | | May-11 | - | - | - | | - | 391 | - | | 3 | | 5 |
| For A to P: | | Jun-11 | - | - | - | | - | 393 | - | | 3 | | 5 |
| Direct | 667 | Jul-11 | - | - | - | | - | 396 | - | | 3 | | 11 |
| Overheads | 47 | Aug-11 | - | - | - | | - | 399 | - | | 3 | | 13 |
| Finance Charges | 46 | Sep-11 | 217,500 | 218 | 15 | | 233 | 636 | - | | 4 | | 18 |
| | 760 | Oct-11 | - | - | - | | - | 640 | - | | 4 | | 22 |
| Error checks | | Nov-11 | - | - | - | | - | 644 | - | | 4 | | 27 |
| ($Real) | | Dec-11 | - | - | - | | - | 649 | - | | 4 | | 31 |
| Direct | - | Jan-12 | 45,000 | 45 | 3 | | 48 | 702 | - | | 5 | | 36 |
| Overheads | - | Feb-12 | 22,255 | 22 | 2 | | 24 | 751 | - | | 5 | | 41 |
| | | Mar-12 | 22,255 | 22 | 2 | 714 | 24 | 780 | - | | 5 | 46 | 46 |
| | 2012 / 2013 | Apr-12 | 22,255 | 23 | 2 | | 24 | 789 | - | | 5 | | 51 |
| | | May-12 | 44,509 | 46 | 3 | | 49 | 844 | - | | 6 | | 57 |
| For A to P: | | Jun-12 | 1,544,509 | 1,588 | 111 | | 1,698 | 2,557 | - | | 17 | | 74 |
| Direct | 2,064 | Jul-12 | 44,509 | 46 | 3 | | 49 | 2,624 | - | | 16 | | 92 |
| Overheads | 144 | Aug-12 | 44,509 | 46 | 3 | | 49 | 2,691 | - | | 18 | | 111 |
| Finance Charges | 207 | Sep-12 | 44,509 | 46 | 3 | | 49 | 2,759 | - | | 19 | | 130 |
| | 2,415 | Oct-12 | 44,509 | 46 | 3 | | 49 | 2,827 | - | | 19 | | 149 |
| Error checks | | Nov-12 | 44,509 | 46 | 3 | | 49 | 2,896 | - | | 20 | | 169 |
| ($Real) | | Dec-12 | 44,509 | 46 | 3 | | 49 | 2,965 | - | | 20 | | 189 |
| Direct | - | Jan-13 | 44,509 | 46 | 3 | | 49 | 3,034 | - | | 21 | | 210 |
| Overheads | - | Feb-13 | 44,509 | 46 | 3 | | 49 | 3,104 | - | | 21 | | 231 |
| | | Mar-13 | 44,509 | 46 | 3 | 2,209 | 49 | 3,175 | - | | 22 | 207 | 253 |
| | 2013 / 2014 | Apr-13 | 44,509 | 47 | 3 | | 50 | 3,247 | - | | 22 | | 275 |
| | | May-13 | 89,019 | 94 | 7 | | 100 | 3,371 | - | | 23 | | 298 |
| For A to P: | | Jun-13 | 1,147,918 | 1,208 | 85 | | 1,293 | 4,699 | - | | 32 | | 330 |
| Direct | 33,312 | Jul-13 | 1,147,918 | 1,206 | 85 | | 1,293 | 6,030 | - | | 41 | | 371 |
| Overheads | 2,332 | Aug-13 | ######### | 16,628 | 1,164 | | 17,792 | 23,986 | - | | 163 | | 534 |
| Finance Charges | 1,796 | Sep-13 | 1,147,918 | 1,206 | 85 | | 1,293 | 25,451 | - | | 174 | | 708 |
| | 37,440 | Oct-13 | 1,147,918 | 1,208 | 85 | | 1,293 | 26,928 | - | | 184 | | 892 |
| Error checks | | Nov-13 | 1,147,918 | 1,208 | 85 | | 1,293 | 28,415 | - | | 194 | | 1,086 |
| ($Real) | | Dec-13 | 1,147,918 | 1,206 | 85 | | 1,293 | 29,912 | - | | 204 | | 1,290 |
| Direct | - | Jan-14 | 2,942,920 | 3,096 | 217 | | 3,315 | 33,456 | - | | 229 | | 1,519 |
| Overheads | - | Feb-14 | 2,942,920 | 3,096 | 217 | | 3,315 | 37,023 | - | | 252 | | 1,772 |
| | | Mar-14 | 2,942,920 | 3,096 | 217 | 35,644 | 3,315 | 40,815 | - | | 277 | 1,796 | 2,049 |
| | 2014 / 2015 | Apr-14 | ######### | 11,709 | 820 | | 12,529 | 53,509 | - | | 365 | | 2,414 |
| | | May-14 | 3,606,391 | 3,795 | 266 | | 4,166 | 58,073 | - | | 397 | | 2,811 |
| For A to P: | | Jun-14 | 2,547,492 | 2,751 | 193 | | 2,944 | 61,437 | - | | 420 | | 3,230 |
| Direct | 60,136 | Jul-14 | 9,871,313 | 10,661 | 746 | | 11,408 | 73,346 | - | | 501 | | 3,731 |
| Overheads | 4,209 | Aug-14 | 3,121,945 | 3,372 | 236 | | 3,608 | 77,482 | - | | 529 | | 4,260 |
| Finance Charges | 5,411 | Sep-14 | 3,121,945 | 3,372 | 236 | | 3,608 | 81,648 | - | | 556 | | 4,816 |
| | 69,756 | Oct-14 | 3,210,964 | 3,469 | 243 | | 3,711 | 85,946 | - | | 587 | | 5,405 |
| Error checks | | Nov-14 | 3,210,964 | 3,469 | 243 | | 3,711 | 90,274 | - | | 617 | | 6,022 |
| ($Real) | | Dec-14 | 9,385,879 | 10,137 | 710 | | 10,847 | 101,810 | - | | 695 | | 6,717 |
| Direct | - | Jan-15 | 2,062,059 | 2,227 | 156 | | 2,383 | 104,015 | - | | 717 | | 7,434 |
| Overheads | - | Feb-15 | 2,062,059 | 2,227 | 156 | | 2,383 | 6 | 107,295 | | 6 | | 7,439 |
| | | Mar-15 | 2,636,511 | 2,848 | 199 | 64,345 | 3,047 | 3,073 | - | | 21 | 5,411 | 7,459 |
| | 2015 / 2016 | Apr-15 | 9,960,331 | 11,037 | 773 | | 11,810 | 14,884 | - | | 102 | | 7,561 |
| | | May-15 | 2,547,492 | 2,823 | 198 | | 3,021 | 18,129 | - | | 124 | | 7,685 |
| For A to P: | | Jun-15 | 3,606,391 | 3,996 | 280 | | 4,276 | 22,558 | - | | 154 | | 7,839 |
| Direct | 57,839 | Jul-15 | ######### | 11,325 | 397 | | 12,332 | 35,139 | - | | 239 | | 8,078 |
| Overheads | 4,049 | Aug-15 | 2,547,492 | 2,823 | 198 | | 3,021 | 2 | 38,151 | | 2 | | 8,080 |
| Finance Charges | 754 | Sep-15 | 2,547,492 | 2,823 | 198 | | 3,021 | 3,043 | - | | 21 | | 8,101 |
| | 62,642 | Oct-15 | 2,497,492 | 2,768 | 194 | | 2,961 | - | 6,004 | | - | | - |
| Error checks | | Nov-15 | 2,497,492 | 2,768 | 194 | | 2,961 | 2,982 | - | | 20 | | 8,121 |
| ($Real) | | Dec-15 | 1,923,040 | 2,131 | 149 | | 2,280 | 5,296 | - | | 36 | | 8,157 |
| Direct | - | Jan-16 | 9,246,860 | 10,247 | 717 | | 10,964 | - | 16,282 | | - | | - |
| Overheads | - | Feb-16 | 2,497,492 | 2,768 | 194 | | 2,961 | 2,962 | - | | 20 | | 8,177 |
| | | Mar-16 | 1,923,040 | 2,131 | 149 | 61,968 | 2,280 | 5,298 | - | | 36 | 754 | 8,213 |
| | 2016 / 2017 | Apr-16 | 1,923,040 | 2,186 | 153 | | 2,339 | 7,690 | - | | 52 | | 8,266 |
| | | May-16 | 1,348,587 | 1,533 | 107 | | 1,641 | - | 9,330 | | - | | - |
| For A to P: | | Jun-16 | 1,348,587 | 1,533 | 107 | | 1,641 | 1,652 | - | | 11 | | 8,277 |
| Direct | 6,894 | Jul-16 | 217,057 | 247 | 17 | | 264 | 1,929 | - | | 13 | | 8,290 |
| Overheads | 483 | Aug-16 | 255,831 | 291 | 20 | | 311 | 2,256 | - | | 15 | | 8,306 |
| Finance Charges | 110 | Sep-16 | 267,057 | 304 | 21 | | 325 | 2,595 | - | | 18 | | 8,323 |
| | 7,491 | Oct-16 | 707,487 | 804 | 56 | | 861 | - | 5,459 | | - | | - |
| Error checks | | Nov-16 | - | - | - | | - | - | - | | - | | - |
| ($Real) | | Dec-16 | - | - | - | | - | - | - | | - | | - |
| Direct | - | Jan-17 | - | - | - | | - | - | - | | - | | - |
| Overheads | - | Feb-17 | - | - | - | | - | - | - | | - | | - |
| | | Mar-17 | - | - | - | 7,381 | - | - | - | | - | 110 | - |
| Total | | | | | | 172,181 | | | | | 8,323 | 8,323 | |
| Cash flow amount should equal the total directs as shown on page 1 of the A to P | | | | | | Total Including Finance Charges | | | | | 180,504 | | |

## 12.3. BUDGET PROVISION

The project has budget allocation (CAPEX) in the Transmission Company Funded allowance for the 2011/12, 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17 financial years.

## 12.4. REVENUE

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."*

On this basis it is reasonable to assume that all costs incurred in this project will be included in the RAB and generate revenue accordingly.

### *12.5. 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 WMTS 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 approve the associated capital expenditure allowance if an approved business case is available at the next regulatory review, funding is committed and construction is underway. It is also worth noting that this project was foreshadowed in the previous revenue submission and was not challenged by the Regulator at that stage.

AEMO (the Australian Energy Market Operator) and the two Distribution Businesses (CitiPower and Jemena) supplied from WMTS have confirmed the ongoing need of the WMTS facilities in accordance with the proposed redevelopment,

Reprioritisation of transmission asset renewal projects will release sufficient funds for the business to advance the WMTS 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 (the Australian Energy Market Operator) and the two Distribution Businesses (CitiPower and Jemena) supplied from WMTS have confirmed the ongoing need of the WMTS 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.

### *12.6. ASSET RETIREMENTS, CONTRIBUTED (GIFTED) ASSETS, CUSTOMER CONTRIBUTION REVENUE*

The table below summarises the assets that will be retired. The projected written down value for all assets to be replaced is $4.296 M.

| Asset Type | Net Book Value |
|---|---|
| Infrastructure | 578,290 |
| Secondary Equipment | 2,133,416 |
| Switchgear | 701,941 |
| Transformer | 882,162 |
| **Grand Total** | **4,295,810** |

### 12.7. 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.