# 5.14.3

# Project justifications for 33kV switchgear replacements

Ausgrid

# Content

# 1 INTRODUCTION

## 1.1 What is the purpose of this document

This document is to provide a summary of the need, options, timing and costs for each of the 33kV switchgear replacement projects that we have identified in our proposed standard control capex for the 2019-24 regulatory period.

The purpose is to provide the AER, its consultants, and our stakeholders with a high level view of the need for individual 33kV switchgear projects, and to show that our analysis of timing, options and cost estimates is efficient and prudent as required by the National Electricity Rules.

## 1.2 Where does this document fit with other material in our regulatory proposal

The underlying strategy and planning context for developing the 33kV switchgear replacement program has been described in Attachment 5.01 (Ausgrid's proposed capital expenditure). This information is critical to understanding how Ausgrid has developed its 33kV switchgear program within the context of its total forecast capex. The key elements of Attachment 5.01 that should be read alongside this document include:

- Section 2 which explains the capital planning process
- Section 3 which explains how our total capex meets the requirements of 6.5.7 of the Rules
- Section 4 which explains Ausgrid's total replacement program, including an overall description of the subtransmission cable replacement program.

Attachment 5.01 also identifies a list of supporting attachments where further information on our capital planning process, key inputs and results of the AER's repex model can be found.

## 1.3 Structure and contents

The document provides a list of significant 33kV switchgear projects where we forecast to incur a capital cost in the 2019-24 regulatory period. We then provide a description of each of these projects including identifying the need, options, timing and costs. Underpinning documentation, including methodologies, area plans, cost benefit analysis and planning studies, is available on request.

# 2 PORTFOLIO OF PROJECTS

Table 1 identifies the most significant 33kV switchgear replacement projects where we expect to incur standard control capex in the 2019-24 regulatory period. The table provides the name of the project, expected start and end date, and the forecast SCS capex in the 2019-24 period.

***Table 1. Project list for 33kV Switchgear program***

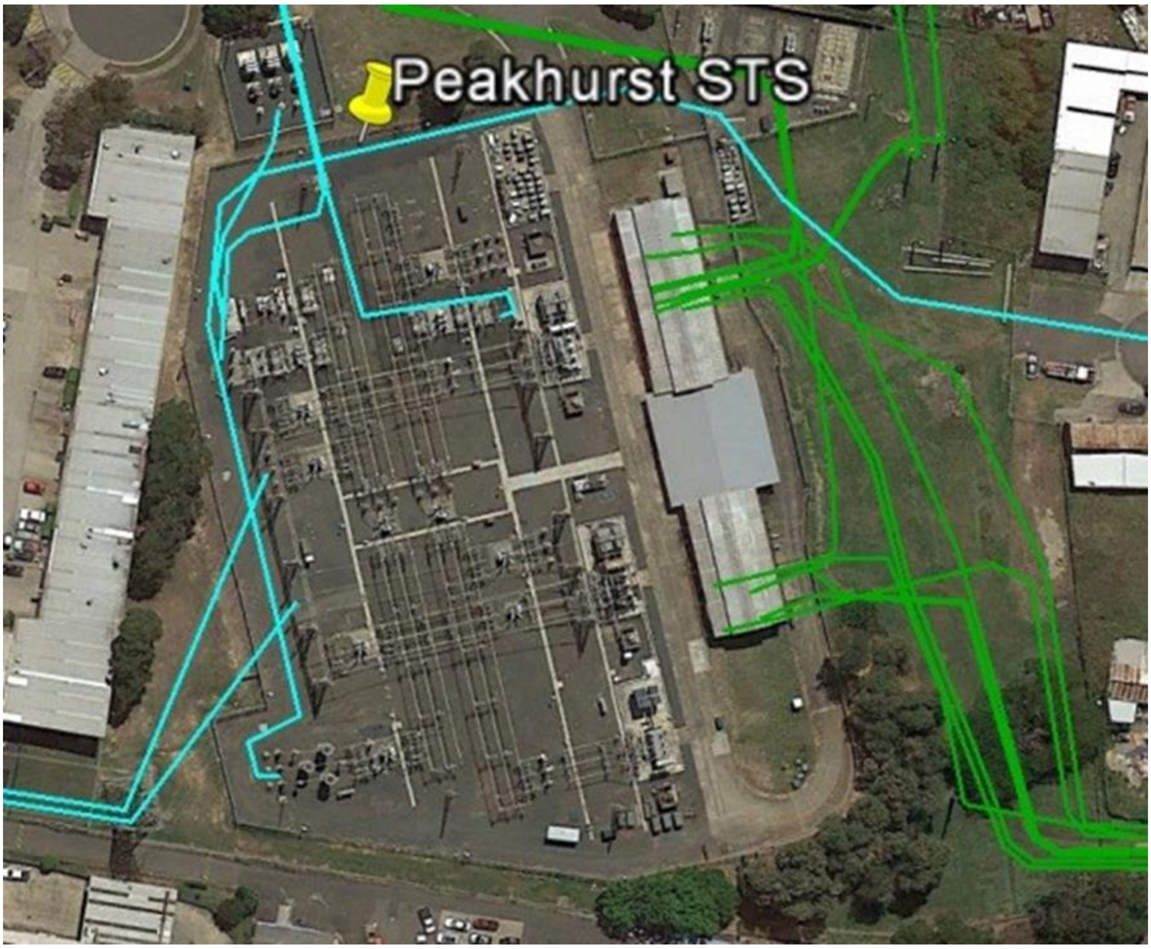
| Project name | 2019-24 Cost ($m, real FY19) | Total Cost ($m, real FY19) | Start | End |
|---|---|---|---|---|
| 1. Peakhurst STS | 19.4 | 22.1 | 2017 | 2022 |
| 2. Muswellbrook STS | 9.5 | 10.3 | 2017 | 2021 |
| 3. Awaba STS | 1.1 | 9.3 | 2016 | 2021 |
| 4. Sydney Airport STS | 5.5 | 6.2 | 2018 | 2021 |

# 3 PROJECT 1 – PEAKHURST STS

## 3.1 Project description

A project is proposed to replace the existing 33kV switchgear at Peakhurst 132/33kV Subtransmission Substation (STS) in the St George area of Ausgrid's network. It is shown in Figure 1. The switchgear is nearing the end of its life, and based on our analysis and the status of pre-requisite works the assets should be replaced by 2022. Our feasibility assessment suggested that the asset should be replaced with modern equivalent switchgear, requiring construction of a new building and switch room to replace the current building, which is seriously degraded. The project was deferred to take advantage of the retirement of several zone substations, which means that their feeders from Peakhurst will not need to be replaced. The total project cost is $22.1 million of which $19.4 million is forecast to be incurred in the 2019-24 period.

***Figure 1. Peakhurst STS***




## 3.2 Need

Peakhurst is a 132/33kV STS commissioned in 1964 in the St George area. It is equipped with three 132/33kV 120MVA transformers (two of them in service and the third on standby) and four sections of 33kV switchgear. It currently supplies six 33kV zone substations in the St George area: Arncliffe, Blakehurst, Mortdale, Rockdale, Riverwood and Sans Souci. Peakhurst STS has a firm rating capacity of 233MVA and a current peak load (summer driven) of 158MVA.

Condition issues have been identified in the following assets at Peakhurst STS:

- The 33kV switch room building and control room roof is in poor condition. The existing straw mat ceiling in the 33kV busbar chambers is a flammable material and is in relatively close proximity to live 33kV equipment. When in good condition risks have been manageable, however any water leaks can cause the straw material to disintegrate and this can cause failure of the electrical equipment contained in the building. Several beams and piles on the building have spalled concrete and exposed corroded steel reinforcement. In the event of fire, the building's physical structure does not allow contemporary levels of segregation within the switch room building.
- Most of the 33kV switchgear equipment is at end of its service life. In particular, there have been failures in the 33kV wall bushings due to their poor condition, with explosive failure modes attributed to degraded insulation quality. The 33kV isolators and earth switches are also in poor condition, with an operating system that requires manual operation through a series of drive rods and linkages.
- There are twenty eight 33kV bulk oil circuit breakers. The explosive failure mode of this equipment imposes a safety risk, because an explosion can create a pressure wave that could result in a failure of the inner switch room doors, walls or roof panels, and cause a fire.
- Although the existing 33kV circuit breakers are outdoor bulk oil-type, they have been installed in enclosed rooms (a common practice by the NSW Electricity Commission in the 1960s). Replacing the existing transformer and bus-section circuit breakers with modern equivalent circuit breakers in the existing enclosures while maintaining electrical clearances from live equipment is not feasible.

There is a window of opportunity to address the issues relating to building and equipment degradation before they progress further, thus avoiding the risk of sudden further deterioration and the need for unplanned intervention, with associated extended unplanned outages and repair times. A solution which mitigates these risks at Peakhurst STS is recommended.

## 3.3 Options

We examined the following options as part of the St George Area Plan (Ref 4):

1. Do nothing.
2. Greenfield replacement.
3. Brownfield replacement.

Option 2 considers the replacement of 33kV circuit breakers and associated secondary equipment in a new building on a vacant portion of the existing site, and demolition of the existing building. Option 3 involves the replacement of all assets within existing structures and refurbishment of existing structures.

It must be noted that under the do nothing option (Option 1), a failure with loss of supply may occur. This is categorised as a significant network risk, with possible likelihood of occurrence and with major network and reputation consequences.

Both the greenfield and the brownfield replacements have similar base costs, however they are significantly different once risks are quantified. The estimating risk for the greenfield development equates to approximately 10% of the project cost, whereas the equivalent risk for the brownfield development is approximately 40% of the project cost.

Whilst the brownfield replacement is technically feasible, it has significant engineering complexities, with associated construction safety, cost and timing risks. Site-specific design requirements would have to be specified to procure the equipment in the brownfield case.

The preferred solution is the greenfield switchroom construction (Option 2), because it can be delivered at the lowest Net Present Cost and lower risk to the network than the brownfield replacement works.

The proposed solution involves:

- Construction of a new building to be located within the existing substation site, to accommodate up to four sections of new 33kV indoor switchgear
- Installation and commissioning of three sections of new 33kV indoor switchgear
- Installation of new control and protection for the new 33kV switchgear, including panels at remote ends of 33kV feeders at Blakehurst, Mortdale, Riverwood and Sans Souci Zone Substations, as well as local 132kV control and protection and a new distributed SCADA system
- Installation of underground XLPE cable connections to transfer the following 33kV feeders to the new 33kV switchgear:
  - Feeders 765, 785 and 786 to supply Mortdale Zone Substation
  - Feeders 670, 778 and 779 to supply Riverwood Zone Substation
  - Feeders 706, 769 and 770 to supply Blakehurst and Sans Souci Zone Substations
  - No.1 & No.3 Capacitor banks at Peakhurst STS.
- Decommissioning and removal of the existing 33kV switchgear at Peakhurst STS. All 33kV bulk oil circuit breakers are to be drained of oil. All equipment is to be removed and scrapped once spare parts have been salvaged where appropriate. The existing switchroom building should be demolished to slab level.

The expected completion date of the new switch room and load transfers is 2021, with decommissioning and demolition activities to be completed a year later.

## 3.4 Timing

Although the expected value of reduction of unserved energy does not exceed the annualised cost of the network solution, there are some other benefits that must be considered if the existing asset is to be maintained in service. Safety is a major concern, because an explosive failure may occur and can scatter pieces of porcelain insulation or other equipment at high velocity in all directions. There is also a fire risk, because an explosion can also create a pressure wave that could result in failure of the inner switchroom doors, walls and/or roof panels, and cause fire in a building that does not have proper fire segregation. Retirement of this equipment is therefore urgent, because the present risk could lead to extended outages that cannot be mitigated with conventional repairs.

The anticipated project completion is December 2021, noting that completion also depends on the decommissioning of two zone substations currently supplied from Peakhurst. We anticipate that construction work will start in 2018 and end in 2021.

In the interim the safety and fire risks and the occurrence of unserved energy will remain.

## 3.5 Demand Management

The driver for this project is the need to effectively manage the safety and fire risk at the site. The safety risks and engineering complexities are too high to perform the rectification work on the buildings with the electrical equipment in operation.

Given the need to de-energise the 33kV equipment, only the removal of the entire load at Peakhurst STS would help manage the risk. A preliminary deferral analysis determined that this is not cost effective.

As part of the National Electricity Rules requirements, a Regulatory Investment Test for Distribution (RIT-D) will be conducted on this project. If, during the course of this process, a non-network option is found to offer a cost effective alternative to the preferred network option, the selected solution to the need will be modified accordingly.

## 3.6 Costing

We undertook a site specific estimate of the costs of the preferred solution, using the Business Planning and Consolidation (BPC) tool outlined in Attachment 5.03.

The cash flow for the project is outlined in the Table 2 below.

***Table 2. Project cash flows ($m, real FY19)***

| | Previous years | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Later years |
|---|---|---|---|---|---|---|---|
| Network Option | 2.7 | 7.3 | 8.3 | 3.8 | - | - | - |

# 4 PROJECT 2 – MUSWELLBROOK STS

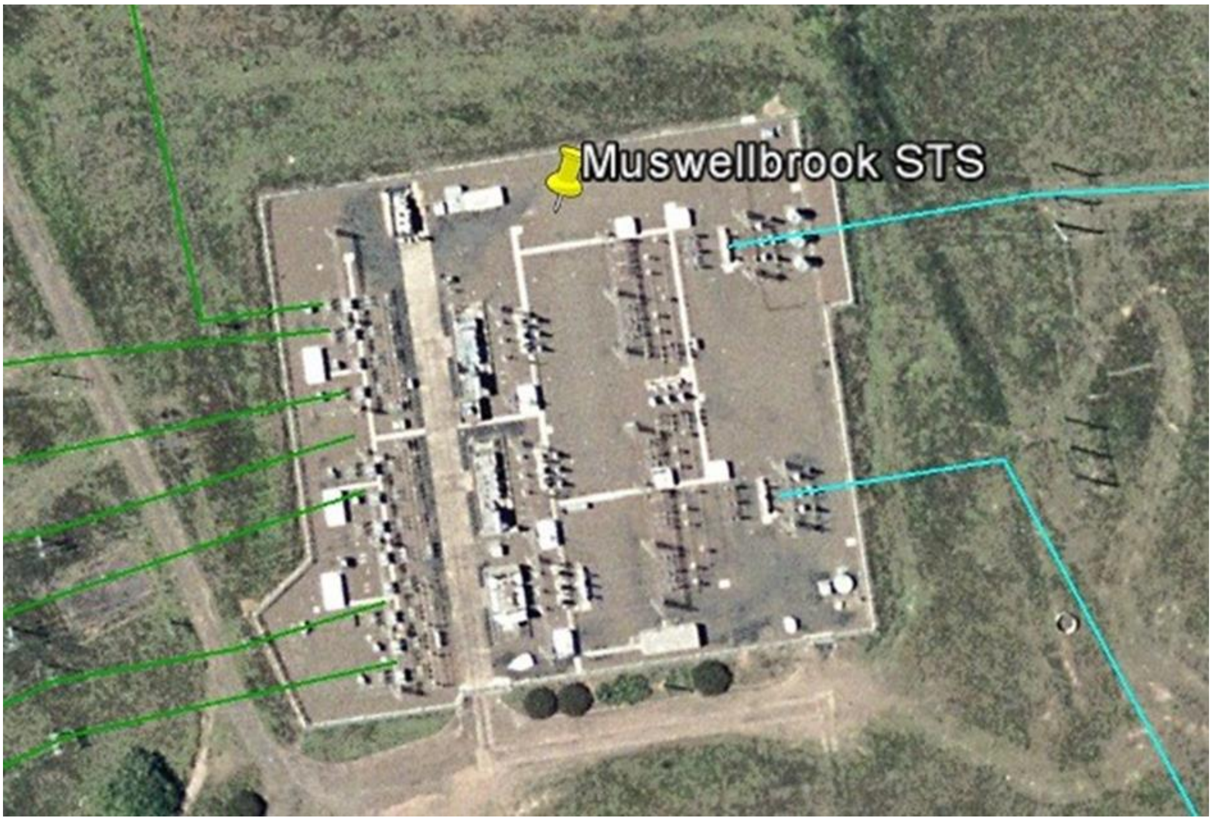
## 4.1 Project Description

Muswellbrook STS was commissioned in 1964, utilising the switchyard of the old Muswellbrook Power Station that operated adjacent to the site. It is located in the Upper Hunter region of Ausgrid's network.

A project is proposed to retire the 33kV switchyard at Muswellbrook 132/33kV STS, and rearrange the configuration of the substation to maintain a reliable supply for existing and future load requirements in this network area. It is shown in Figure 2 below. The scope of work includes the retirement of twelve aged and obsolete 33kV bulk oil circuit breakers and associated equipment, and their replacement with two modern equivalent 33kV circuit breakers. One of the existing 33kV feeders will be reconnected to the Muswellbrook 33/11kV Zone Substation, where the 33kV busbar will be extended to accommodate a 33kV circuit breaker. This work is scheduled for completion by 2020.

The total project cost of the 33kV works at the Muswellbrook STS is $10.3 million of which $9.5 million is forecast to be incurred in the 2019-24 period.

***Figure 2. Muswellbrook STS***




## 4.2 Need

The Muswellbrook STS is of entirely outdoor construction. It supplies the town and district of Muswellbrook via Muswellbrook Zone Substation, and also supplies the Muswellbrook Coal Company. It also provides a normally-open backup supply to the 33kV network that serves the Moonan and Rouchel Zones from Scone Zone Substation. Voltage constraints prohibit supply of all the Muswellbrook STS and Muswellbrook Coal Company load from Scone 33kV.

Condition issues have been identified in the 33kV circuit breakers, as there is a history of failures of circuit breakers of this age and type. The consequences can be extremely serious, including explosion, fire, and failure to open or close the associated circuit when required. Failure to open when required to disconnect a faulted circuit would result in live wires remaining at the site of the fault, causing danger to people and possible initiation of a fire due to arcing. Continuing to operate these circuit breakers to failure is therefore assessed to not be a feasible option.

Further, the 33kV network in the Upper Hunter area has limited transfer capability, since the Muswellbrook STS is the main source of 33kV supply in the area. Although the present load is not high, it is too high to be transferred away cost effectively.

## 4.3 Options

We examined the following options as part of the Upper Hunter Area Plan (Ref 5 and 6):

1. Do nothing.
2. Greenfield replacement.
3. Brownfield replacement.

Option 2 involves the establishment of a new 132/11kV Zone Substation to replace both Muswellbrook 132/33kV STS and Muswellbrook 33/11kV Zone Substation. Option 3 involves refurbishment of the substation site to retire the 33kV switchgear that is redundant to the network, and replace the minimum equipment to maintain 33kV supply to Muswellbrook Zone Substation and the existing connections to supply coal mines.

It must be noted that under the do nothing option (Option 1), a failure with loss of supply may occur. This is categorised as a significant network risk, with a possible likelihood of occurrence and major network and reputation consequences.

The preferred solution is the Brownfield replacement (Option 3), because it can be delivered at a lower Net Present Cost than the Greenfield replacement option.

At Muswellbrook STS, the preferred solution is to:

- Replace the minimum equipment required to maintain 33kV supply to Muswellbrook Zone Substation and the existing connections to supply coal mines
- Retire the 33kV switchgear that is redundant to the network.

This minimum arrangement will replace 33kV equipment in two feeder bays and two transformer circuit breakers.

## 4.4 Timing

Although the expected value of reduction of unserved energy does not exceed the annualised cost of the network solution, there are some other benefits that must be considered if the existing asset is to be maintained in service. Safety is a major concern, because an explosive failure may occur and can scatter pieces of porcelain insulation or other equipment at high velocity in all directions. Retirement of this equipment is therefore urgent, because the present risk could lead to extended outages that cannot be mitigated with conventional repairs.

The replacement is planned to be substantially complete in 2020, with minor work in 2021. We anticipate that construction work will start in 2018 to achieve this date.

In the interim the risk to safety and the occurrence of unserved energy will remain.

## 4.5 Demand Management

The timing for this project is not driven by the result of a Cost Benefit Analysis (CBA), but by the safety concerns about the condition of the 33kV switchgear, and the potential for it exploding. Given the need to de-energise the 33kV equipment for safety reasons, only the removal of the entire load at Muswellbrook STS would help manage the risk. A preliminary deferral analysis determined that this is not cost effective.

As part of the National Electricity Rules requirements, a RIT-D will be conducted on this project. If, during the course of this process, a non-network option is found to offer a cost effective alternative to the preferred network option, the selected solution to the need will be modified accordingly.

## 4.6 Costing

We undertook a site specific estimate of the costs of the preferred solution, using the BPC tool outlined in Attachment 5.03.

The cash flow for the project is outlined in the Table 3 below.

***Table 3. Project cash flows ($m, real FY19)***

| | Previous years | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Later years |
|---|---|---|---|---|---|---|---|
| Network Option | 0.8 | 5.4 | 4.1 | - | - | - | - |

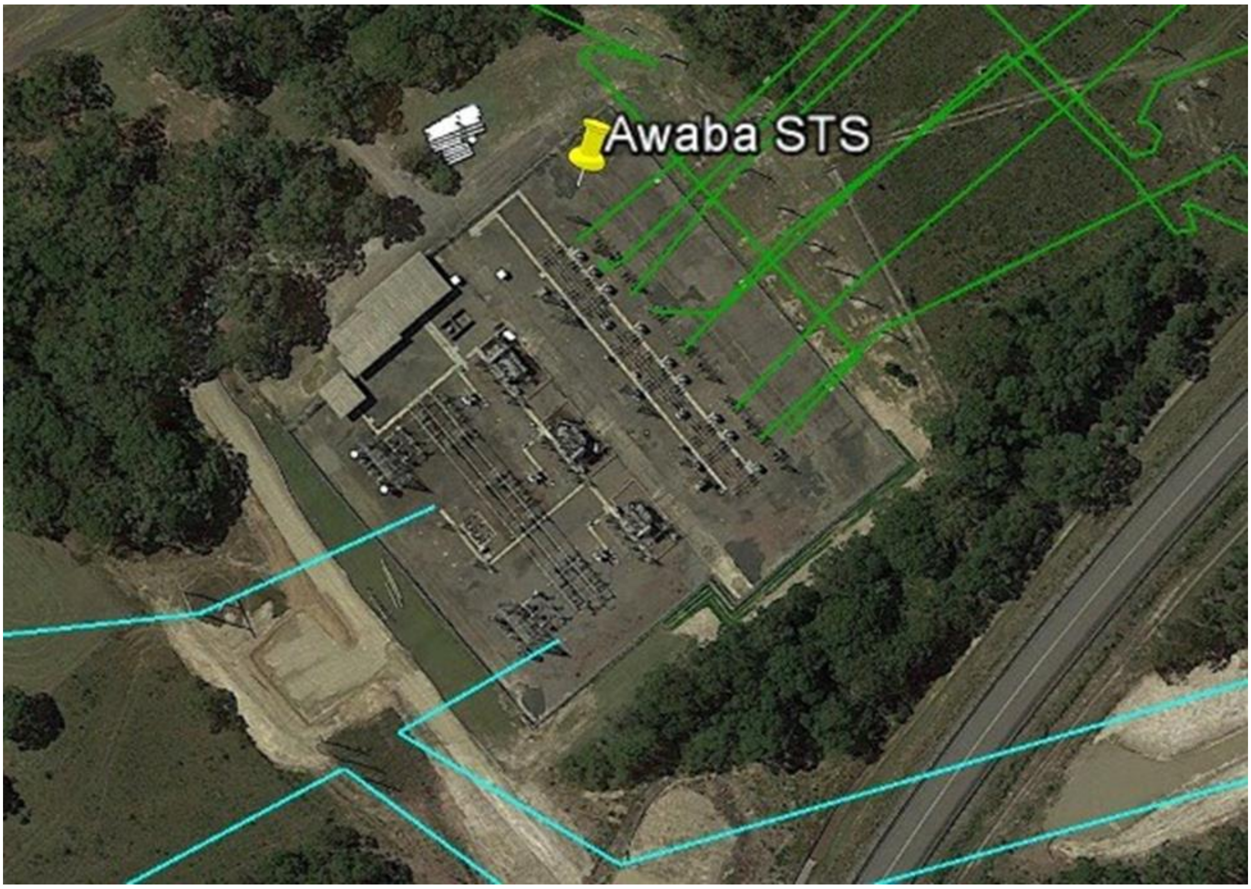
# 5 PROJECT 3 – AWABA STS

## 5.1 Project description

The project is to replace existing 33kV switchgear at Awaba STS in the West Lake Macquarie area of Ausgrid's network. It is shown in Figure 3 below. The switchgear is over 50 years old, and has been assessed as nearing the end of its life and as posing a risk to safety and reliability of supply. The proposed project involves rebuilding Awaba as a 33kV Switching Station by 2021. It includes decommissioning the 132kV busbar and associated 132/33kV transformers, installing 33kV feeder bays and a busbar as a switching station, and rearranging the 33kV network supply from Argenton STS to the new switching station.

The total project cost is $9.3 million of which $1.1 million is forecast to be incurred in the 2019-24 period.

***Figure 3. Awaba STS***




## 5.2 Need

The Awaba 132/33kV STS was commissioned in 1960 and much of the original equipment is still in service.

Awaba is an entirely outdoor substation which, after the commissioning of Toronto West 132/11kV Zone Substation, supplies only industrial load that comprises two coal mines and a supply to Sydney Trains.

The condition of many assets (132kV transformers & switchgear, 33kV switchgear, control & protection, instrument transformers and the control building) indicates that retirement or replacement is required.

The 132/33kV transformers are 45-48 years old and are being managed by the Ausgrid Zone & STS Transformer Strategy.

Two 132kV circuit breakers are considered to be in poor condition and have been prioritised for replacement in the 132kV General Circuit Breaker Replacement Program. Their replacement has been delayed pending the identification of a preferred overall strategy.

All original fourteen 33kV oil circuit breakers (OCBs) are considered to be in poor condition and have been prioritised for replacement in the 33kV Bulk Oil Circuit Breaker Replacement Program. Their replacement has also been delayed pending the identification of a preferred strategy.

There are a total of twenty-eight 33kV isolators and earth switches that are fifty-four years old and have passed their serviceable life time. These items have been identified for replacement under the 33kV Essante Isolator Replacement Program.

The 33kV busbar in the Awaba STS switchyard is below minimum height requirements, creating a safety hazard.

The Awaba STS switch room and control building are serviceable but are suspected to have asbestos-containing material in the fire doors, compressed tar switchboards, amenity walls and ceiling.

## 5.3 Options

The following options (in addition to "Do Nothing", which is not feasible) were assessed as part of the West Lake Macquarie Area Plan process:

1. Minimal refurbishment of Awaba 132/33kV STS.
2. Decommission Awaba STS, supply loads from Argenton STS.
3. Rebuild Awaba STS as 33kV switching station supplied from Argenton STS.
4. Retain 132kV and Refurbish 33kV Switchgear at Awaba STS.
5. Rearrange 132kV and Refurbish 33kV Switchgear at Awaba STS.
6. Retire Awaba and Supply loads from Argenton.

These are further detailed below.

### 5.3.1 Option 1 Minimal refurbishment of Awaba 132/33kV STS

This option proposes to do minimal refurbishment to maintain operation of the existing Awaba STS. This would involve proactively replacing or retiring aged equipment (including 132kV and 33kV switchgear, isolators, earth switches and instrument transformers). It would also include refurbishment of the 33kV busbar to achieve minimum safety clearances.

### 5.3.2 Option 2 Decommission Awaba STS, supply loads from Argenton STS

This option proposes to retire Awaba STS, and transfer the supply to SRA Awaba and the existing major customer substations of Newstan, Awaba State Mine and Stockton Borehole onto a 33kV ring supplied from Argenton STS. All equipment at Awaba STS would be decommissioned. This option would require extensive overhead feeder works.

While Option 2 has the lowest NPV cost, the reliability of the resulting network is reduced and poses an increased risk of disconnection of supply. It would also result in some customers receiving supply through equipment that is owned by another customer, rather than from Ausgrid directly. This is considered by both Ausgrid and the major customer, Sydney Trains, to be technically unacceptable.

### 5.3.3 Option 3 Rebuild Awaba STS as 33kV switching station supplied from Argenton STS

This option proposes to decommission the 132kV transformers and busbar at Awaba STS, and then rebuild the required 33kV busbar and feeder bays as a switching station. SRA Awaba and Newstan Zone Substation would be fed from the rebuilt Awaba SS while Awaba State Mine would be included in the ring fed from Argenton STS, requiring overhead feeder works. Option 3 would also address the condition of the building and other issues noted above.

Option 3 removes the possibility of supplying parts of the Argenton/ Awaba network from an alternative 132kV source (Awaba) in the event of a double circuit overhead line fault on the lines supplying Argenton, but the risk of this being required is considered to be acceptably low.

### 5.3.4 Option 4 – Retain 132kV and Refurbish 33kV Switchgear at Awaba STS

Option 4 is similar to option 3 except that instead of a 33kV switching station, the 132kV bar of the STS is retained in its existing condition. In addition, the 33kV switchgear would be refurbished and consolidated. The 33kV busbar would be supplied using the existing 132/33kV transformers. This removes the need for any 33kV feeder work beyond connecting the feeders to the switchgear.

### 5.3.5 Option 5 – Rearrange 132kV and Refurbish 33kV Switchgear at Awaba STS

This is similar to option 4, but rearranges the 132kV lines and switchgear to provide a minimal alternative supply to this part of the network. This was found to be not feasible for technical reasons.

### 5.3.6 Option 6 – Retire Awaba and Supply loads from Argenton

This is similar to Option 2, but assumes a different method of supplying Sydney Trains (The “T” option). This is considered to provide a less adequate and reliable supply to the critical Sydney Trains load than the preferred option.

The proposed solution is Option 3, which rebuilds Awaba as a 33kV Switching Station, because it is the most cost effective solution that meets the requirements of a critical infrastructure customer in this network area.

The proposed solution includes decommissioning the 132kV busbar and associated 132/33kV transformers, installing 33kV feeder bays and a busbar configured as a switching station (five circuit breakers for outgoing feeders, two busbar sections and one bus-section circuit breaker), and rearranging the 33kV network supply to the new switching station from Argenton STS.

## 5.4 Timing

Although the expected value of reduction of unserved energy does not exceed the annualised cost of the network solution, there are some other benefits that must be considered if the existing asset is to be maintained in service. Safety is a major concern, because an explosive failure may occur and can scatter pieces of porcelain insulation or other equipment at high velocity in all directions. Retirement of this equipment is therefore urgent, because the present risk could lead to extended outages that cannot be mitigated with conventional repairs.

The replacement is planned to be complete in 2021. We anticipate that construction work will start in 2018 to achieve this date.

In the interim, the risk to security and safety will remain.

## 5.5 Demand Management

The timing for this project is not driven by the result of a CBA, but by safety and reliability concerns related to the condition of the equipment at the subtransmission substation. As a partial reduction in the load does not help reduce the risk, only the removal of the entire load at Awaba STS offers a viable demand management solution. A preliminary deferral analysis determined that this is not cost effective.

As part of the National Electricity Rules requirements, a RIT-D will be conducted on this project. If during the course of this process a non-network option is found to offer a cost effective alternative to the preferred network option, the selected solution to the need will be modified accordingly.

## 5.6 Costing

We undertook a site specific estimate of the costs of the preferred solution, using the BPC tool outlined in Attachment 5.03.

The cash flow for the project is outlined in Table 4 below.

***Table 4. Project cash flow ($m, real FY19)***

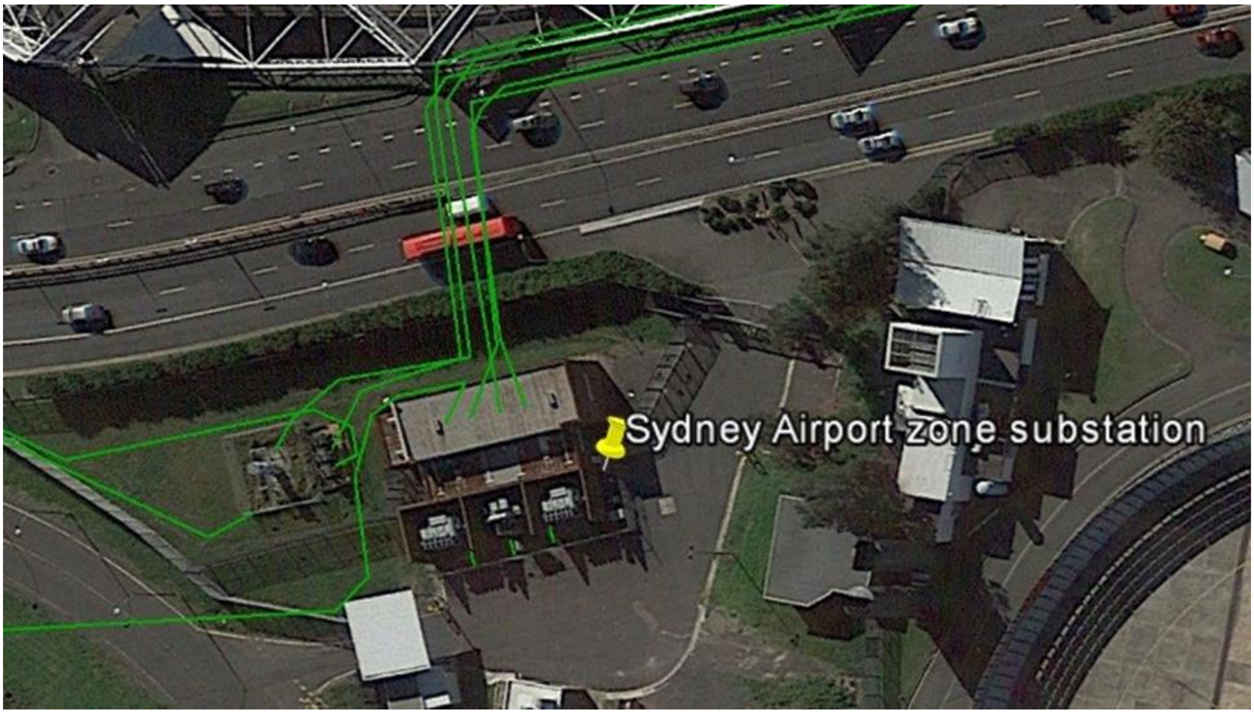
| | Previous years | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Later years |
|---|---|---|---|---|---|---|---|
| Network Option | 8.2 | 0.6 | 0.5 | - | - | - | - |

# 6 PROJECT 4 – SYDNEY AIRPORT ZONE SUBSTATION

## 6.1 Project description

The project is to replace the existing 33kV switchgear at Sydney Domestic Airport Zone Substation in the Eastern Suburbs region of Ausgrid's network. It is shown in Figure 4 below. The switchgear is nearly 50 years old and nearing the end of its life. Based on achieving coordination with other works and the needs of the customer (Sydney Airports Corporation Ltd) the asset should be retired by 2020. The proposed solution involves the installation of a new 33kV busbar with eight circuit breakers and the retirement of existing 33kV circuit breakers at Sydney Domestic Airport Zone Substation. The replacement of these assets must be coordinated with the termination of four new 33kV cables that will be laid from Alexandria STS to the Airport, replacing five aged HSL cables from Bunnerong STS. The total project cost is $6.2 million, of which $5.5 million is forecast to be incurred in the 2019-24 period.

*Figure 4. Sydney Airport Zone Substation*




## 6.2 Need

The Sydney Airport Zone Substation was commissioned in 1969 and much of the original equipment is still in service. This substation primarily supplies the critical Sydney Airport load, but also some commercial load at the airport through a network owned by the Sydney Airport Corporation Ltd.

The need to replace the 33kV switchgear at Sydney Airport Domestic Zone Substation is driven by condition. The switchgear is compound filled and, based on its age, condition and a risk assessment, was due for replacement in 2016. The 33kV switchgear uses oil circuit breakers and is an orphan technology. Consequently in the event of a catastrophic failure there are no available spares to undertake replacement. Depending on the severity of the damage to the switchboard, this might leave the substation abnormally switched for an extended period

Despite its poor condition, the replacement of 33kV switchgear was deferred in order to co-ordinate with 33kV feeder replacement works, described in the subtransmission cables justification document.

Alexandria 132/33kV STS has recently been commissioned. The route length for 33kV cables from Alexandria STS to the Sydney Airport ZS is approximately 2 km, compared to the 10 km route if the existing feeders from Bunnerong had been replaced like-for-like.

It has been determined that it would be cost effective to address the 33kV switchgear condition issues at the same time as the 33kV feeder replacement works.

## 6.3 Options

The following options were considered for the connection of the new 33kV cables that originate from Alexandria:

- Option 1 is to connect two of the cables directly to two of the SACL-owned 33/11kV transformers at the Sydney Airport Domestic Zone Substation, and two cables would connect to the International Zone that also supplies SACL at that site. An existing 33kV tie between the two Zones would also terminate on a third transformer at Sydney Domestic Zone. This arrangement does not require a 33kV busbar, and consequently all the 33kV circuit breakers could be retired. SACL engineering staff and their advisory consultants have objected to this approach, claiming that it would reduce their reliability of supply and operational flexibility, having regard for the fact that there will be four incoming feeders instead of five. SACL also raised concerns about Ausgrid requiring access to SACL 11kV switchgear to isolate Ausgrid 33kV feeders. Concerns were also raised within Ausgrid about protection arrangements and the technical viability of tail-end connections at a customer transformer without a point of isolation.
- Option 2 has the same arrangement of feeders, but inserts a 33kV circuit breaker that would be owned by Ausgrid at each 33kV cable termination to the transformer, requiring three circuit breakers at the Sydney Domestic Airport Zone Substation. This arrangement would address most of the above technical issues, but would not restore the operational flexibility to the present level, because of the reduced number of feeders terminating at this Zone Substation.
- Option 3 terminates two of the cables at Sydney Domestic and two at International Zone, with one 33kV tie between the two zones. It requires two busbar panels and eight circuit breakers to be replaced at Sydney Domestic Airport Zone. Essentially the current operational flexibility is retained with one less incoming 33kV feeder.

The outcome of joint planning with the Customer is to replace the 33kV switchgear using the eight circuit breaker arrangement of Option 3, in conjunction with replacing the 33kV feeders from Bunnerong with 33kV feeders from Alexandria. The timing of this decision is unknown.

It is likely that a separate site will be identified within the SACL property, and a building would need to be constructed to accommodate the 33kV busbars and circuit breakers.

The cost estimate in the section below is based on this option.

## 6.4 Timing

The timing is determined by the need to terminate the replacement 33kV cables at Alexandria STS. The Sydney Airport Corporation is planning developments that will increase the load requirement at the airport in the future.

There is insufficient data to develop a failure model for this class of switchgear, and hence it has not been possible to undertake a formal Cost Benefit analysis for this project.

Based on latest information, we expect that construction work will start in 2018 and end in 2020.

As this project concerns a dedicated supply to a single customer site, it is not appropriate to consider deferral of this project with traditional demand management.

## 6.5 Demand Management

The timing for this project is not driven by the result of a CBA, but by reliability concerns related to the condition of the equipment. As a partial reduction in the load does not help reduce the risk, only the removal of the entire load offers a viable demand management solution. A preliminary deferral analysis determined that this is not cost effective.

As part of the National Electricity Rules requirements, a RIT-D will be conducted on this project. If during the course of this process a non-network option is found to offer a cost effective alternative to the preferred network option, the selected solution to the need will be modified accordingly.

## 6.6 Costing

We undertook a site specific estimate of the costs of the preferred solution, using the BPC tool outlined in Attachment 5.03.

The cash flow for the project is outlined in Table 5 below.

***Table 5. Project cash flow ($m, real FY19)***

| | Previous years | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Later years |
|---|---|---|---|---|---|---|---|
| Network Option | 0.7 | 4.9 | 0.5 | - | - | - | - |