Ausgrid

Revised Proposal

Attachment 5.14.3.1

Project justification for 33kV switchgear replacements (Addendum)

January 2019

Content

1 OBJECTIVE

1.1 What is the purpose of this document

We do not intend to revisit the 33kV switchgear replacement projects which we included in Attachment 5.14.3 from our original proposal as inclusions in our revised 2019-24 AER capex forecast. This document (5.14.3.1) is an addendum to Attachment 5.14.3 to address the addition of Willoughby STS 33kV switchgear replacement.

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 program within the context of its total forecast capex.

2 ADDITIONAL PROJECTS

Table 1 identifies the additional 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 expected direct cost ($m real FY19) in the 2019-24 period.

Table 1. Project list for 33kV Switchgear program

Project name	Direct cost ($m, real FY19)		Start	End
	2019-24	Total		
Additional Project				
5. Willoughby STS	9.2	24.9	2022	2027

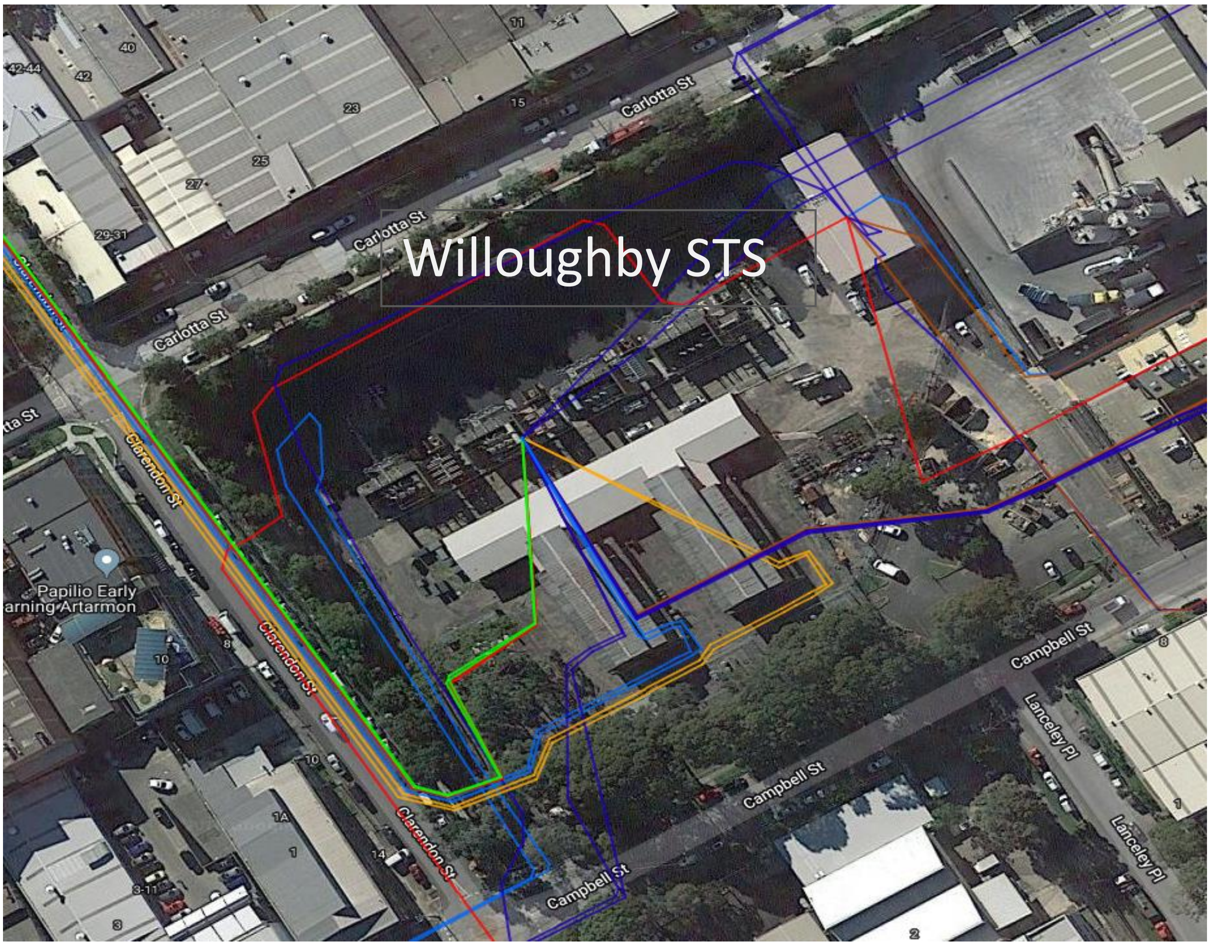
Section 3.0 provides the project justification for 33kV switchgear replacement at Willoughby Subtransmission Substation.

3 PROJECT 5 – WILLOUGHBY STS

3.1 Project description

A project is proposed to replace the existing 33kV switchgear at Willoughby 132/33kV Subtransmission Substation (STS) in the Lower North Shore 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 2026. 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 direct project cost is $24.9 million of which $9.2 million is forecast to be incurred in the 2019-24 period.

Figure 1. Willoughby STS



3.2 Need

Willoughby is a 132/33kV STS commissioned in 1968 in the Lower North Shore area. It is equipped with three 132/33kV 120MVA transformers (all three in service) with provision for the fourth transformer in future and four sections of 33kV switchgear. The STS is supplied by four 132kV cables from TransGrid's Sydney East 330/132kV Bulk Supply Point (BSP) via Ausgrid's Lindfield 132kV Subtransmission Switching Station (STSS).

It currently supplies two 33kV zone substations in the area, Chatswood and Gore Hill. It also supplies some of the major customer loads for Sydney Trains, Lane Cove Tunnel, Gore Hill Technology Park Data Centre and committed load from Sydney Metro-North West. A number of other enquiries have been received, however these have not been factored into the demand forecasts as they have not yet progressed sufficiently to do so. Willoughby STS has a firm rating capacity of 233MVA (with possibility to increase to 313MVA in the future) and a current peak load (summer) of 114.6MVA.

Condition issues have been identified in the following assets at Willoughby 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. 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 Willoughby STS is recommended.

3.3 Options

We examined the following options to address 33kV switchgear issues at Willoughby STS as part of Ausgrid's planning process:

1. Do nothing.
2. Greenfield replacement.
3. Brownfield replacement (Like for Like).

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 like for like replacement of all existing 33kV switchgear within the existing building and refurbishment of existing structures at Willoughby STS. This option is not considered feasible due to unavailability of some of the assets like dead tank transformer and bus section circuit breakers of required ratings for procurement from any manufacturer.

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 interruption and reputation consequences.

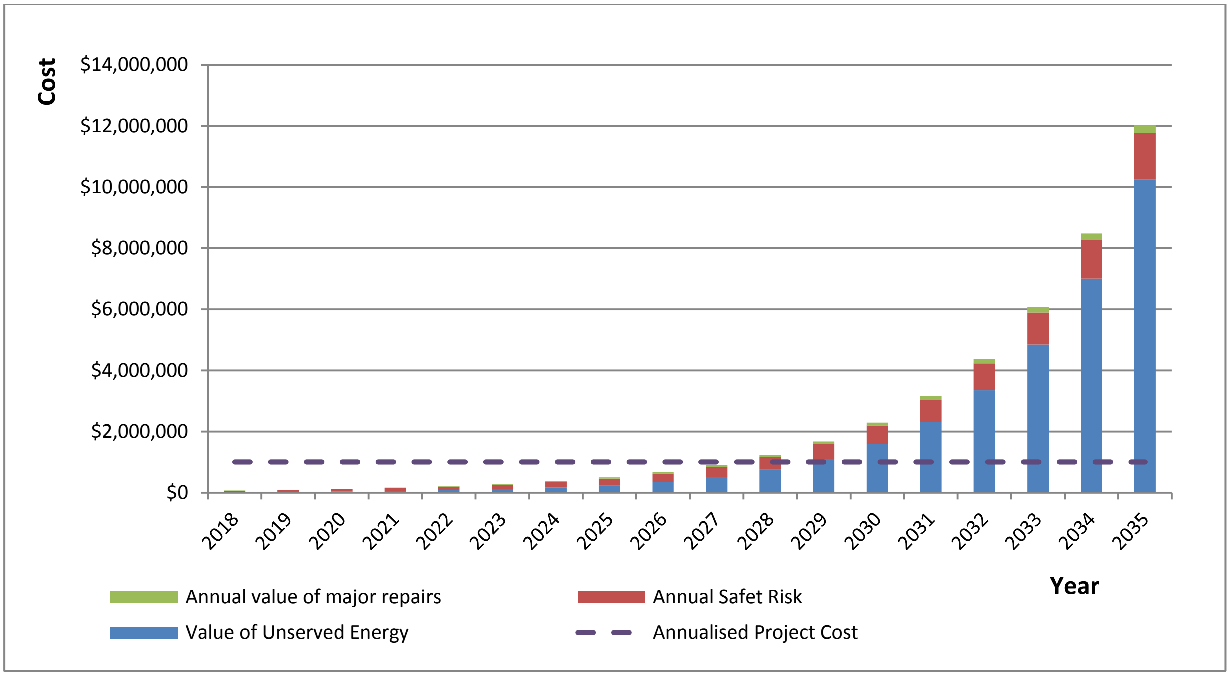
The preferred solution is the greenfield switchroom construction (Option 2) and the proposed solution involves:

- 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 of new control and protection for the new 33kV switchgear, including panels at remote ends as well as local 132kV control and protection and a new distributed SCADA system;
- Installation of underground XLPE cable connections to transfer the existing 33kV feeders to the new 33kV switchgear; and
- Decommissioning and removal of the existing 33kV switchgear at Willoughby 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.

3.4 Timing

Cost benefit analysis, including consideration of unserved energy, repair costs, and safety risks, identified that by 2027 the benefits of the project are equivalent to the annualised costs and by 2028 the benefits exceed the costs. This is illustrated in the graph below.

Figure 2. Risk cost versus project deferral benefit – Willoughby STS



Considering the number of 33kV feeder transfers required following commissioning of the new switchboard and the need to coordinate these transfers with connections of the new major customers, while maintaining supply security to existing significant loads, it is necessary to commence works earlier than would be the case for a less complicated project.

We forecast that construction work will start in 2022 with completion in 2027, consistent with decommissioning the existing switchboard and removal of the risk by 2028.

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

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

	Previous years	2019-20	2020-21	2021-22	2022-23	2023-24	Later years
Network Option	-	-	-	0.3	1.3	7.6	15.7