# Addressing the increasing risk of 33kV switchgear at Willoughby Subtransmission Substation

**DRAFT PROJECT ASSESSMENT REPORT**

**29 June 2026**

# Disclaimer

Ausgrid is registered as both a Distribution Network Service Provider and a Transmission Network Service Provider. This Draft Project Assessment Report has been prepared and published by Ausgrid under clause 5.17 of the National Electricity Rules to notify Registered Participants and Interested Parties of the results of the regulatory investment test for distribution and should only be used for those purposes.

This document does not purport to contain all of the information that a prospective investor or participant or potential participant in the National Electricity Market, or any other person or interested parties may require. In preparing this document it is not possible nor is it intended for Ausgrid to have regard to the investment objectives, financial situation and particular needs of each person who reads or uses this document.

This document, and the information it contains, may change as new information becomes available or if circumstances change. Anyone proposing to rely on or use the information in this document should independently verify and check the accuracy, completeness, reliability and suitability of that information for their own purposes.

Accordingly, Ausgrid makes no representations or warranty as to the accuracy, reliability, completeness or suitability for particular purposes of the information in this document. Persons reading or utilising this document acknowledge that Ausgrid and their employees, agents and consultants shall have no liability (including liability to any person by reason of negligence or negligent misstatement) for any statements, opinions, information or matters (expressed or implied) arising out of, contained in or derived from, or for any omissions from, the information contained in this document, except insofar as liability raised under New South Wales and Commonwealth legislation.

# Addressing the increasing risk of 33kV switchgear at Willoughby Subtransmission Substation

**Draft Project Assessment Report – 29 June 2026**

## Contents

# Executive Summary

The Willoughby 132/33kV Subtransmission Substation (STS) is in the Lower North Shore area and was commissioned in 1968. The 33kV switchgear at the site is the original equipment and has a unique design where the oil circuit breakers are installed within a building (which was a common practice of the NSW Electricity Commission in the 1960s).

To address known condition issues associated with ageing bulk oil circuit breakers in our network, Ausgrid has developed and has been implementing a strategy to replace our entire fleet since 2009. As of the date of this report, only 59 units remain in-service, with all remaining units planned for replacement within the current and next regulatory periods. Of the remaining units, 28 are installed at the Willoughby STS.

The building housing the switchgear at the Willoughby STS (the 'switchroom') is also the original building and is in poor condition. An independent structural and civil inspection of the building was undertaken in October 2024 by Qubist and identified a broad range of condition and compliance issues and recommended immediate replacement.

In addition to the asset condition issues at the Willoughby STS, the Lower North Shore area has emerged as a growing hub for data centres in Sydney in recent years. Three data centres are currently connected to the STS, and Ausgrid has received additional supply requests for three further data centre loads by 2030. Taking into account the existing underlying peak load, it is expected that Willoughby STS will exceed its capacity of 225 MVA by 2029/30.

Ausgrid is therefore undertaking a Regulatory Investment Test for Distribution (RIT-D) to assess options for ensuring reliable electricity supply to load supplied by the Willoughby 132/33kV STS, as well as facilitating the connection of major new customer load, going forward. This Draft Project Assessment Report (DPAR) has been prepared by Ausgrid and represents the second step in the application of the RIT-D. It follows publication of the Options Screening Notice.

## The 'identified need' for this RIT-D is to ensure we continue to satisfy our reliability and performance standards for customers, and meet increased customer demand

Ausgrid is obliged to comply with reliability and performance standards as part of our distribution license granted by the Minister for Industry, Resources and Energy under the *Electricity Supply Act 1995 (NSW)*. Under the license, reliability and performance standards are expressed in two measures:

- SAIDI[1] – which means the average derived from the sum of the durations of each sustained customer interruption (measured in minutes), divided by the total number of customers (averaged over the financial year); and
- SAIFI[2] – which means the average derived from the total number of sustained customer interruptions divided by the total number of customers (averaged over the financial year).

These two reliability measures capture two key aspects of supply disruptions to electricity customers, i.e., how long their electricity supply is off for as well as how often their electricity supply is off. Customers experience a better electricity service the lower each of these measures are.

The primary concern this RIT-D is seeking to address focuses on the increasing customer supply risks derived from the condition of the 33kV switchgear and switchroom at Willoughby STS. If action is not taken to address the deteriorating condition of this equipment, then our analysis shows that the unserved energy modelled will put these performance standards at risk. By addressing the reliability concerns associated with the aging assets, the proposed investment will deliver material net market benefits for customers from a reduction in Expected Unserved Energy (EUE), as well as through avoided safety risk costs and avoided maintenance and repair costs.

In addition, Ausgrid is obliged under clause 5.2.3(d) of the National Electricity Rules (NER) to review and process applications to connect to our network and to enter into connection agreements with applicants. Ausgrid has recently received formal connection applications from three major data centre customers in the Lower North Shore area, and the existing network cannot accommodate these loads without augmentation (and inaction would place Ausgrid in breach of these NER obligations).

[1] System Average Interruption Duration Index.
[2] System Average Interruption Frequency Index.

Overall, Ausgrid considers the identified need for this RIT-D to be a reliability corrective action, encompassing both the obligation to maintain reliable supply to existing customers and the obligation to facilitate the additional expected data centre load in the Lower North Shore area.

## Two credible network options have been assessed

We have identified and assessed two credible options as part of our network planning activities:

- Option 1 – single stage replacement – involves the construction of a new 33kV switchroom building, installation of new 33kV switchgear equipment and a fourth 132/33kV transformer, and retirement of existing buildings (i.e., existing 33kV switchrooms and control room).
- Option 2 – multiple stage replacement – involves a staged approach to addressing asset condition issues, whereby the existing 33kV switchgear is replaced like-for-like within the existing 33kV switchroom initially (i.e., an 'in situ' replacement), with construction of the new switchroom with new switchgear deferred by ten years (relative to Option 1).

Each option has been developed following an assessment of the various potential choices for addressing both the ageing 33 kV switchgear and switchroom to ensuring reliable supply of electricity, and the expected future data centre loads to ensure requested customer loads can be accommodated.

### Table E.0.1 – Summary of the estimated credible network option costs, $m (2025/26)

| | Labour | Materials | Contracted Services | Indirect cost | Total |
|---|---|---|---|---|---|
| Option 1 – Single stage replacement | **17.8** | **10.5** | **29.3** | **12.7** | **70.3** |
| Option 2 – Multiple stage replacement | **30.0** | **18.0** | **48.3** | **19.4** | **115.7** |

Although the existing 33kV circuit breakers are outdoor bulk oil type, they have been installed in enclosed rooms. This means that replacing them with modern equivalent circuit breakers in the existing building and enclosures under Option 2 while maintaining electrical clearances is complex, time-consuming and costly. The replacement of the circuit breakers in-situ in Option 2 also does not avoid the eventual need to build a new switchroom with new switchgear to address the condition issues with the current switchroom building.

Further, while Option 2 involves greater estimated capital costs than Option 1 for these reasons, we also consider that there is inherently more uncertainty in its cost estimates. Specifically, we consider the estimates for Option 2 to be at cost accuracy of -10% to +50%, compared to a cost accuracy of -10% to +25% for Option 1. This difference reflects the greater execution complexity and uncertainty associated with the staged in-situ works, which must be carried out in a live operational environment subject to constrained outage windows, resource pressures, and a number of unknown site conditions.

Overall, while Option 2 has been included as a potential credible option in this DPAR, it is considered an inferior option to Option 1 given it is more complex, higher cost, slower to deliver and more uncertain (in terms of both cost and timing).

## Non-network options and SAPS solutions are not considered viable for this RIT-D

Ausgrid has considered the ability of any non-network options (NNOs), as well as stand-alone power system (SAPS) solutions to assist in meeting the identified need.

An assessment regarding reducing the risk of unserved energy has shown that these alternatives are not expected to be able to cost effectively address the risk, compared to the two network options outlined above. This is driven primarily by the magnitude of the load reduction required and the likely cost of non-network solutions.

In addition, these solutions would not resolve the escalating safety risk costs and reactive maintenance costs associated with continued use of the switchgear and switchroom.

Our assessment of non-network solutions is detailed further in the separate Options Screening Notice released in accordance with clause 5.17.4(d) of the NER.

## Three different scenarios have been modelled to deal with uncertainty

RIT-D assessments are required to be based on cost-benefit analysis that includes an assessment of 'reasonable scenarios', which are designed to test alternate sets of key assumptions and whether they affect identification of the preferred option.

**Table E.0.2 – Summary of the three scenarios investigated**

| Variable | Scenario 1 – central demand scenario | Scenario 2 – low demand scenario | Scenario 3 – high demand scenario |
|---|---|---|---|
| **Scenario weighting** | **1/3** | **1/3** | **1/3** |
| Demand | Central forecast | Low forecast | High forecast |
| VCR (existing loads and future data centre load with available feeder bays) | $24.56/kWh across all scenarios | | |
| VCR (future data centre loads with no available feeder bays) | $13.08/kWh across all scenarios | | |
| Discount Rate | 3.70% across all scenarios | | |

The scenarios only differ by the demand forecasts given this is the key parameter affecting the ranking of the credible options. Ausgrid has adopted equal weightings across scenarios as a proportionate approach for this RIT-D, as the NPV assessment found that the ranking of the options was the same across all of the scenarios.

How the results are affected by changes to other variables (i.e. the VCR, discount rate and capital costs) have been investigated in the sensitivity analysis.

## Option 1 is the preferred option at this draft stage

Option 1 has the greatest estimated net market benefits of the two options across each of the scenarios investigated. The differences in net market benefits are primarily driven by the cost differences between the options, as well as Option 1 being able to have key works commissioned earlier (which allows additional EUE to be avoided).

**Table E.0.3 – Present value of net benefits relative to the base case by scenario and weighted, NPV $m**

| Option / scenario | Central demand | Low demand | High demand | Weighted | Rank |
|---|---|---|---|---|---|
| Option 1 – Single stage replacement | **118.1** | **130.2** | **107.0** | **118.4** | **1** |
| Option 2 – Multiple stage replacement | 109.0 | 120.9 | 98.0 | 109.3 | 2 |

Ausgrid therefore considers that Option 1 is the preferred option that satisfies the RIT-D. This finding is found to be robust to a range of general sensitivity tests investigated (covering assumed network costs, VCR values and discount rates), as well as a specific sensitivity that assumes that the works to replace the existing switchroom building and install new switchgear can be deferred five years longer than assumed under Option 2.

Moreover, Option 1 addresses the range of condition and compliance issues at the existing switchroom, i.e., those that Qubist recommended be addressed through immediate replacement. While the consequences of leaving these issues unaddressed under the base case have not been modelled as part of this DPAR, doing so would further support the identification of Option 1 as the preferred option for this RIT-D.

The specific scope of works for Option 1 includes:

- Early works to clear the area required for the new switchroom building;
- Construction of a new 33kV switchroom located within the existing Willoughby STS footprint;
- Installation of new 33kV indoor switchgear and associated controls and protection equipment;
- Installation of underground 33kV conduits and cables (to transfer connected loads to the new 33kV switchgear);

- Installation and commissioning of a new (fourth) 132/33kV transformer unit; and
- Decommissioning of redundant equipment and demolition of the existing 33kV switchroom (to slab level).[3]

The estimated capital cost of Option 1 is $70.3 million (2025/26), which is comprised of:[4]

- $35.1 million for the new 33kv switchgear;
- $14.5 million for the new 33kV switchroom (which includes $1.7 million of early works costs);
- $10.9 million for the new 33kV conduits and cables;
- $5.3 million for the 4th 132/33kV 120 MVA transformer; and
- $4.3 million of decommissioning costs.

Once fully commissioned, Option 1 will require approximately $25,700/year in planned routine maintenance costs.

Overall, Option 1 is the lowest cost of the two credible options assessed in this DPAR and delivers the greatest net benefits. It is also the least complex option and the option we consider has the most accurately estimated costs and timeframes.

The works required to accommodate the new data centre loads under Option 1 (i.e., new building and new switchgear in new bays) will be completed by 2029/30, from which point the avoided EUE associated with those loads will begin to be realised. After this timing, the project works are focused on the transfer of the existing loads at the STS to the new switchgear and switchroom.

Ausgrid considers that this DPAR and the accompanying detailed analysis identify Option 1 as the preferred option and that this satisfies the RIT-D. Ausgrid is the proponent for Option 1.

## Submissions and next steps

Ausgrid welcomes written submissions on this DPAR. Submissions are due on 10 August 2026 and should be addressed to:

Andrew Scott
Head of Asset Management & Planning (Acting)
Ausgrid
GPO Box 4009
Sydney 2001

Or

email to: assetinvestment@ausgrid.com.au

The next (and final) stage of this RIT-D involves publication of a Final Project Assessment Report (FPAR). The FPAR will update the quantitative assessment of the net benefit associated with the investment options, as required, in light of any submissions received on this DPAR. The entire RIT-D process is detailed in Appendix B.

---

[3] Removal of abandoned cables and services (e.g., sewer and water pipes) are excluded from the scope.

[4] Due to rounding, the sum of the individual component costs reported here adds to $70.1 million rather than the actual total expenditure estimate of $70.3 million.

# 1 Introduction

This Draft Project Assessment Report (DPAR) has been prepared by Ausgrid and represents the second step in the application of the Regulatory Investment Test for Distribution (RIT-D) to options for ensuring reliable electricity supply to load supplied by the Willoughby 132/33kV Subtransmission Substation (STS), as well as facilitating the connection of major new customer load, going forward. It follows publication of the Options Screening Notice for this RIT-D.

The Willoughby 132/33kV STS is in the Lower North Shore area and was commissioned in 1968, with many of the original assets still in service. It supplies nearly 28,000 customers via Chatswood and Gore Hill zone substations (ZS), as well as several major customers such as Sydney Trains, Sydney Metro, the Lane Cove Tunnel, and three existing data centres.

The 33kV switchgear at this site is a unique design with oil circuit breakers installed within a building. Specifically, while the existing circuit breakers are outdoor bulk oil type, they have been installed in enclosed rooms – a common practice of the NSW Electricity Commission in the 1960s. Consequently, replacing them with modern equivalent circuit breakers in the existing building and enclosures while maintaining electrical clearances is complex, time-consuming and costly.

To address known issues associated with bulk oil circuit breakers, Ausgrid has developed and has been implementing a strategy to replace our entire fleet since 2009. As of the date of this report, only 59 units remain in service, with all remaining units planned for replacement within the current and next regulatory periods. Of the remaining units, 28 are installed at the Willoughby STS.

The building housing the switchgear at the Willoughby STS (the 'switchroom') is also the original building and is in poor condition. A structural and civil inspection of the building was undertaken in October 2024, which identified a broad range of condition and compliance issues.

In addition to these asset condition issues, the Lower North Shore area has emerged as a growing hub for data centres in Sydney in recent years, given its proximity to major fibre trunk connections, established electricity infrastructure, and transport links. Three data centres are already connected to the Willoughby STS, and Ausgrid has received additional supply requests for three further data centre loads – the first one targeting initial connection in 2028, the second seeking an expansion of their existing connection targeting 2029/30, and the third one requesting connection in 2030.

In total, Ausgrid expects that these new data centre loads will require more than 200 MVA of capacity. Taking into account the existing underlying peak load, it is expected that Willoughby STS will exceed its capacity of 225 MVA by 2029/30.

Ausgrid is therefore undertaking this RIT-D to assess options for addressing the risk associated with the ageing 33kV switchgear and switchroom at the Willoughby STS, as well as facilitating the additional expected data centre load.

If action is not taken, it is expected that Ausgrid will breach both our electricity distribution license reliability and performance standards, as well as its obligation to process and facilitate customer load requirements under Section 5.2.3 in the National Electricity Rules (NER).

Ausgrid has determined that non-network solutions are unlikely to form a standalone credible option, or form a significant part of a credible option, as set out in the separate notice released in accordance with clause 5.17.4(d) of the NER.

## 1.1 Role of this draft report

Ausgrid has prepared this DPAR in accordance with the requirements of the NER under clause 5.17.4. It is the second stage of the RIT-D process set out in the NER.

The purpose of the DPAR is to:

- Describe the need Ausgrid is seeking to address, including the assumptions used in identifying this need;
- Provide a description of each credible option assessed;
- Quantify relevant costs and market benefits for each credible option;
- Describe the methodologies used in quantifying each class of cost and market benefit;
- Explain why Ausgrid determined that some classes of market benefits or costs do not apply to options considered;
- Present the results of a net present value (NPV) analysis of each credible option and explain these results; and
- Identify the preferred option at this draft stage.

## 1.2 Submissions and next steps

Ausgrid welcomes written submissions on this DPAR. Submissions are due on 10 August 2026 and should be addressed to:

Andrew Scott
Head of Asset Management & Planning (Acting)
Ausgrid
GPO Box 4009
Sydney 2001

Or

email to: assetinvestment@ausgrid.com.au

The next (and final) stage of this RIT-D involves publication of a Final Project Assessment Report (FPAR). The FPAR will update the quantitative assessment of the net benefit associated with the investment options, as required, in light of any submissions received on this DPAR. The entire RIT-D process is detailed in Appendix B.

# 2 Description of the identified need

This section provides a description of the network area and the ‘identified need’ for this RIT-D, before presenting the key assumptions underlying the identified need.

## 2.1 Overview of the relevant network area and assets

The Willoughby STS is a 132/33kV STS that was commissioned in 1968 and is currently supplied by two 132kV feeders from Transgrid’s Sydney East Bulk Supply Point via Lindfield Sub-transmission Switching Station. It is equipped with:

- Three 132/33kV 120 MVA transformers (with provision to accommodate a fourth transformer); and
- Four sections of 33kV switchgear, which involve a unique design with 28 oil circuit breakers installed within enclosed rooms – a common practice of the NSW Electricity Commission in the 1960s.

Willoughby STS is connected to two downstream 33/11kV ZS – Chatswood and Gore Hill – which supply approximately 28,000 residential, commercial, and industrial customers in the Lower North Shore network area. It also directly supplies several major customers such as Sydney Trains, Sydney Metro, the Lane Cove Tunnel, and three existing data centres.

Willoughby STS is located within the Artarmon industrial/business precinct. A geographical overview of this area is shown in the figure below.

**Figure 2.1 – Geographical overview of the area serviced by Willoughby STS**


The 33kV switchgear at Willoughby STS, which has been in service since the site was commissioned in 1968, is approaching the end of its useful life and, as a result, has an increasing risk of failure.

To address known issues with bulk oil circuit breakers, Ausgrid has developed and been implementing a strategy to replace its entire fleet since 2009. As of the date of this report, only 59 units remain in service, with all remaining units planned for replacement within the current and next regulatory periods. Of the remaining units, 28 are installed at the Willoughby STS.

The 33kV switchgear equipment has been installed in two circuit breaker switchrooms, each containing two circuit breaker sections and each section in turn containing eight circuit breaker bays. These switchrooms are joined by a control room building creating a 'π' shaped arrangement, as shown in the figure below.

**Figure 2.2 – Willoughby STS aerial view**

Of the 32 available circuit breaker bays, there are currently 28 occupied with 33kV bulk oil circuit breakers.

The switchroom building at the Willoughby STS in which the switchgear is housed is also in poor condition. A structural and civil inspection of the building was undertaken by Qubist in October 2024, which identified a broad range of condition and compliance issues, including:

- Concrete cancer (i.e., exposed and corroded steel reinforcement) at multiple locations;
- Cracking in brickwork externally and on inner walls at multiple locations;
- Roof deterioration and holes in the internal ceilings of individual circuit breaker bays;
- Significant corrosion of steel supports, walkways, handrails, and platforms, with advanced pitting and flaking that compromise structural strength;
- Significant corrosion of all roller doors, with several assumed to be non-functional;

- Presence of asbestos-containing materials in various parts of the buildings and conduits, posing a safety exposure risk to personnel;
- Presence of Perfluorooctane Sulfonic Acid (PFOS) contamination; and
- Multiple Building Code of Australia (BCA) compliance issues.

On the basis of these findings, the condition assessment concluded that, although the switchroom does not present an immediate risk of structural failure, any works to replace the electrical infrastructure housed within it would necessitate significant associated civil works, including balcony repairs, fire system upgrades, and PFOS remediation. The combined cost and complexity of these works support immediate replacement of the buildings in their entirety rather than a program of repair and remediation.

Without action, the condition of the existing 33 kV switchgear and switchroom at Willoughby STS is expected to continue to deteriorate, resulting in prolonged outages to customers, increased safety risks and long repair times.

In addition, and separate to the condition issues, the Lower North Shore has experienced growing interest from data centre operators in recent years, driven by its proximity to major fibre trunk connections, established electricity infrastructure, and transport links. Three data centres are already connected to the Willoughby STS, and Ausgrid has received additional supply requests for three further data centre loads – the first one targeting initial connection in 2028, the second seeking an expansion of their existing connection targeting 2029/30, and the third one requesting connection in 2030.

Of the three new potential data centre loads:

- The first has a signed connection agreement with Ausgrid and is currently undertaking construction;
- The second is seeking expansion of an existing connection; and
- The third is in early design stage connection discussions with Ausgrid.

Each of the new data centre customers has requested N-1 supply and accommodating them all will require more than 200 MVA of capacity. In combination with the current peak load of 115 MVA at Willoughby STS, these new loads will exceed the existing transformer capacity of 225 MVA by 2029/30.

## 2.2 Summary of the identified need

Ausgrid is obliged to comply with reliability and performance standards as part of our distribution license granted by the Minister for Industry, Resources and Energy under the *Electricity Supply Act 1995 (NSW)*. Under the license, reliability and performance standards are expressed in two measures:

- SAIDI[5] – which means the average derived from the sum of the durations of each sustained customer interruption (measured in minutes), divided by the total number of customers (averaged over the financial year); and
- SAIFI[6] – which means the average derived from the total number of sustained customer interruptions divided by the total number of customers (averaged over the financial year).

These two reliability measures capture two key aspects of supply disruptions to electricity customers, i.e., how long their electricity supply is off for as well as how often their electricity supply is off. Customers experience a better electricity service the lower each of these measures are. Reliability standards applied to distribution networks typically set maximums in relation to each of these two measures.

The primary concern this RIT-D is seeking to address focuses on the increasing customer supply risks derived from the condition of the 33kV switchgear and switchroom at Willoughby STS. If action is not taken to address the deteriorating condition of this equipment, then our analysis shows that the unserved energy modelled will put these performance standards at risk. By addressing the reliability concerns associated with the aging switchgear, the proposed investment will deliver material net market benefits for customers from a reduction in Expected Unserved Energy (EUE), as well as through avoided safety risk costs and avoided maintenance and repair costs.

In addition, Ausgrid is obliged under clause 5.2.3(d) of the NER to review and process applications to connect to our network and to enter into connection agreements with applicants. As outlined in section 2.1, Ausgrid has received formal

[5] System Average Interruption Duration Index.
[6] System Average Interruption Frequency Index.

connection applications from three major data centre customers in the Lower North Shore area. The existing network cannot accommodate these loads without augmentation, and inaction would place Ausgrid in breach of these NER obligations.

Overall, Ausgrid considers the identified need for this investment to be a reliability corrective action, encompassing both the obligation to maintain reliable supply to existing customers and the obligation to facilitate the additional expected data centre load in the Lower North Shore area.

## 2.3 Key assumptions underpinning the identified need

This section summarises the key assumptions underpinning the identified need for this RIT-D.

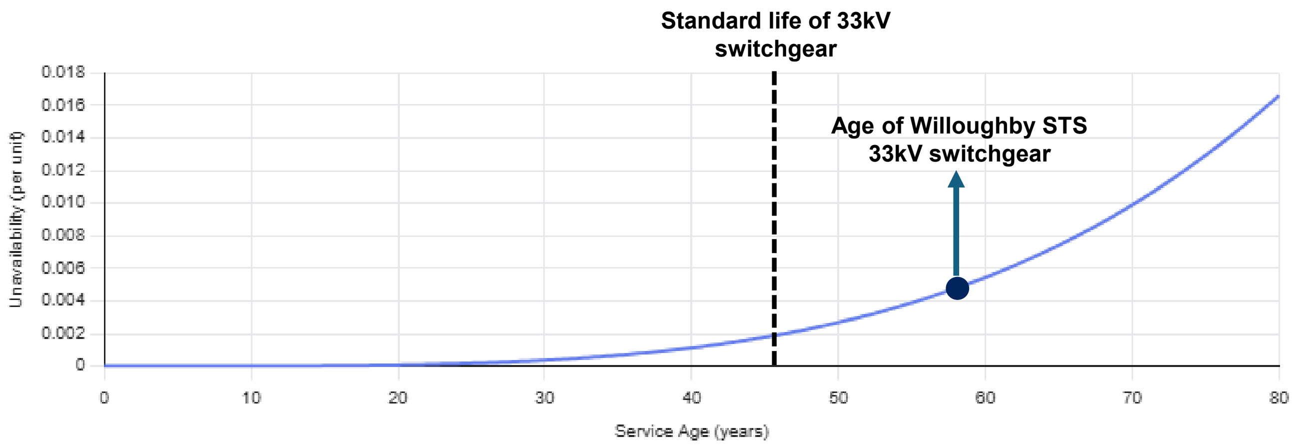
Appendix D provides additional detail on the assumptions used, and methodologies applied, to estimate the costs and market benefits as part of this RIT-D.

### 2.3.1 Probability of assets failing increases with age

Ausgrid has adopted well-accepted models for each major class of network asset to estimate the probability of failure. In general, the probability of failure increases with asset age.

Figure 2.3 shows unavailability plotted for 33kV bulk oil circuit breakers, considering failure rate parameters that represent strong wear-out behaviour (aging-driven failures). It shows robust performance in the early years (very low unavailability), with an accelerated failure region after 40 years of service. Considering that Willoughby STS was commissioned in 1968 and the 33kV switchgear remains original, the equipment is nearing the end of its service life.

**Figure 2.3 – Unavailability of 33kV bulk oil circuit breakers**




A Weibull analysis has been used to derive a probability distribution function for the asset's age at time of failure. This probability distribution considers a behaviour of the failure rate that assumes failures become more frequent as degradation mechanisms become noticeable (i.e., oil degradation, mechanical fatigue or insulation wear-out). The characteristic life of the asset matches the field experience, with 33kV circuit breakers nearing retirement.

This methodology is considered standard industry practice and is consistent with other RIT-Ds covering replacement works. A detailed discussion of the probability of failure and asset availability for switchgear is provided in Appendix D.

### 2.3.2 Supply restoration takes time and has been considered to determine EUE

While the majority of the EUE for this RIT-D relates to new load that would exceed the current capacity of the Willoughby STS (outlined in the section below), the level of expected cost associated with any involuntary load shedding for currently connected load is dependent on underlying assumptions relating to supply restoration times.

Ausgrid considers that the time required for restoration after a switchgear failure of the type in the Willoughby STS can vary between 40 and 408 hours (i.e. 17 days) depending on the type of failure, with some complex failure cases requiring up to 600 hours (i.e. 25 days). Detailed restoration assumptions are set out in Appendix D.

It should be noted that the 33kV isolators and earth switches require manual operations through a series of mechanical drives and linkages. This requires the operator to be in close proximity to the equipment while it is operated. Switching time is two hours for isolators within Willoughby STS.

All 33/11kV zone substations (ZS) and major customers connected to Willoughby have at least N-1 supply arrangements. Some of the customers have no attributable EUE if there was an outage at Willoughby STS. This is the case of Sydney Trains and Sydney Metro, as they can automatically connect to a remote supply from another substation under loss of supply from Willoughby STS.

In the event of a total loss of supply to Willoughby STS, a portion of the residential and small commercial loads can be recovered by switching supply between ZS via the 11kV network after a time delay (i.e., by closing and opening normally open point on the network), as there are 11kV interconnections between Chatswood and Gore Hill ZS, and well as with neighbouring Crows Nest, Royal North Shore and North Sydney ZS.

Ausgrid has factored the ability to transfer load into our assessment of forecast unserved energy.

Whilst load to many customers can be restored through switching operations in the 11kV network combined with the use of mobile generation sets, the full incident recovery process (i.e., cable and/or substation equipment repairs) can take several weeks (which may result in unserved energy over this period).

In other cases, such as data centre connections, the customers have embedded generation to support loads for up to 48 hours in the event of total loss of supply.

### 2.3.3 Load forecasts

There are two distinct categories of load relevant for this RIT-D – namely:

- Existing load – comprising the approximately 28,000 current residential, commercial, and industrial customers supplied via the Chatswood and Gore Hill ZS, as well as the major customers currently connected directly to the Willoughby STS; and
- Future expected data centre load – comprising the three new expected data centre loads outlined above.

We have investigated how assuming different load forecasts going forward changes the EUE avoided (and therefore net market benefits) under the proposed options.

Specifically, three future load forecasts have been considered, which assume the following levels of expected load growth for existing loads:

- Central demand forecast – which applies our standard 50 per cent probability of exceedance ('POE50') forecasts;
- Low demand forecast – which applies our POE90 forecasts; and
- High demand forecast – which applies our POE10 forecasts.

Each demand forecast also assumes different levels of load from the first two, more certain, expected data centre loads. Specifically:

- Central demand forecast – assumes a 60% scaled load from these two loads.
- Low demand forecast – assumes a 40% scaled load from these two loads; and
- High demand forecast – assumes an 80% scaled load from these two loads.

These assumptions pick up that the new data centre loads have different inherent levels of uncertainty, as outlined above. The percentages assumed are reflective of ramp up rates experienced in recent years by similar customers in the network. The load forecasts also have slightly different assumed ultimate ramp up dates for these two data centre loads.

As the loads served from Willoughby STS become predominantly large customer loads, comprising data centre connections and infrastructure services, it is anticipated that the combined load will become more stable over time.

For the case of the potential third new data centre connection (i.e., the one in early design stage connection discussions with Ausgrid), we have included it equally in all three demand forecasts but capped the level of EUE in the NPV assessment. This is because there are no available feeder bays to connect the new load under the 'do nothing' case, and the current network arrangement at Willoughby STS will have all available connection bays in use with no means to accommodate the connection of the third data centre (i.e., in this case, every MW of load will be unserved if corrective action is not taken and, if uncapped, the EUE will increase exponentially, dwarfing the contribution to the avoided EUE from the currently connected and the other connecting loads in the existing arrangement).

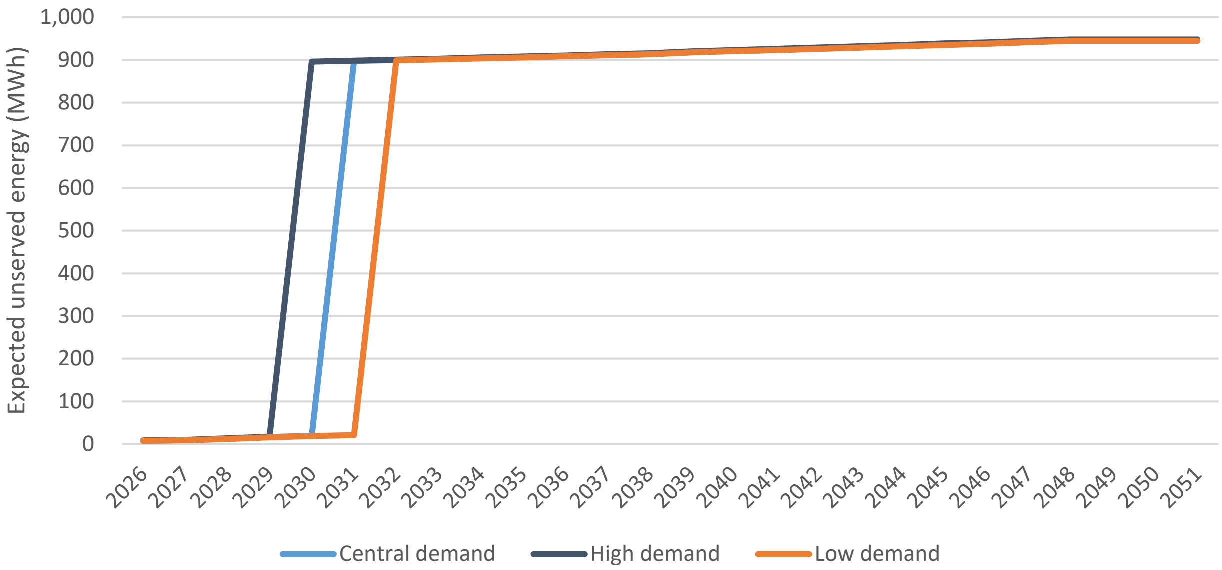
The cap applied to this third data centre load assumes the EUE values for the third connecting data centre reach the equivalent of 1 MW of load unserved each year, and we apply a 10% probability of proceeding as this customer is at early stages of the connection process.

We consider it appropriate to cap the level of EUE associated with the third potential data centre to avoid a situation where an exponential increase in EUE skews the assessment results, noting that this approach does not affect the identification of the preferred option as all options avoid that EUE equally.

Figure 2.4 shows the modelled levels of EUE under each of the three underlying demand forecasts investigated, over the next twenty-five years (which is the assessment period adopted for this RIT-D). For clarity, this figure illustrates the MWh of EUE assumed under each load forecast if no credible option is commissioned (i.e. under the 'do nothing' base case for that load forecast).

Appendix D provides additional detail on the assumptions underpinning the identified need (i.e. the assumed load duration curve and how the probability of switchgear failure has been modelled).

**Figure 2.4 – Forecast EUE under each of the three demand forecasts**



# 3 Two credible options have been assessed

This section provides details of the two credible network options that Ausgrid has identified as part of its network planning activities. Each option has been developed following an assessment of the various potential choices for addressing:

- The ageing 33 kV switchgear and switchroom to ensuring reliable supply of electricity; and
- The expected future data centre loads to ensure requested customer loads are accommodated.

All costs and benefits presented in this DPAR are in 2025/26 dollars, unless otherwise stated.

## 3.1 Option 1 – Single stage replacement of switchgear

Option 1 involves the construction of a new 33kV switchroom building, installation of new 33kV switchgear equipment and a fourth 132/33kV transformer, and retirement of existing buildings (i.e., existing 33kV switchrooms and control room).

To accommodate the new expected data centre loads, Option 1 expands the switchgear at Willoughby STS to include 30 feeder bays (an increase of six from the current configuration) and to include a fourth 132/33kV transformer. That is, the new 33kV switchroom will be larger than the existing switchroom. The fourth transformer is required under Option 1 (and Option 2) even if just one of the three new expected data centre loads connects.

The specific scope of works for Option 1 includes:

- Early works to clear the area required for the new switchroom building;
- Construction of a new 33kV switchroom located within the existing Willoughby STS footprint;
- Installation of new 33kV indoor switchgear and associated controls and protection equipment;
- Installation of underground 33kV conduits and cables (to transfer connected loads to the new 33kV switchgear);
- Installation and commissioning of a new (fourth) 132/33kV transformer unit; and
- Decommissioning of redundant equipment and demolition of the existing 33kV switchroom (to slab level).[7]

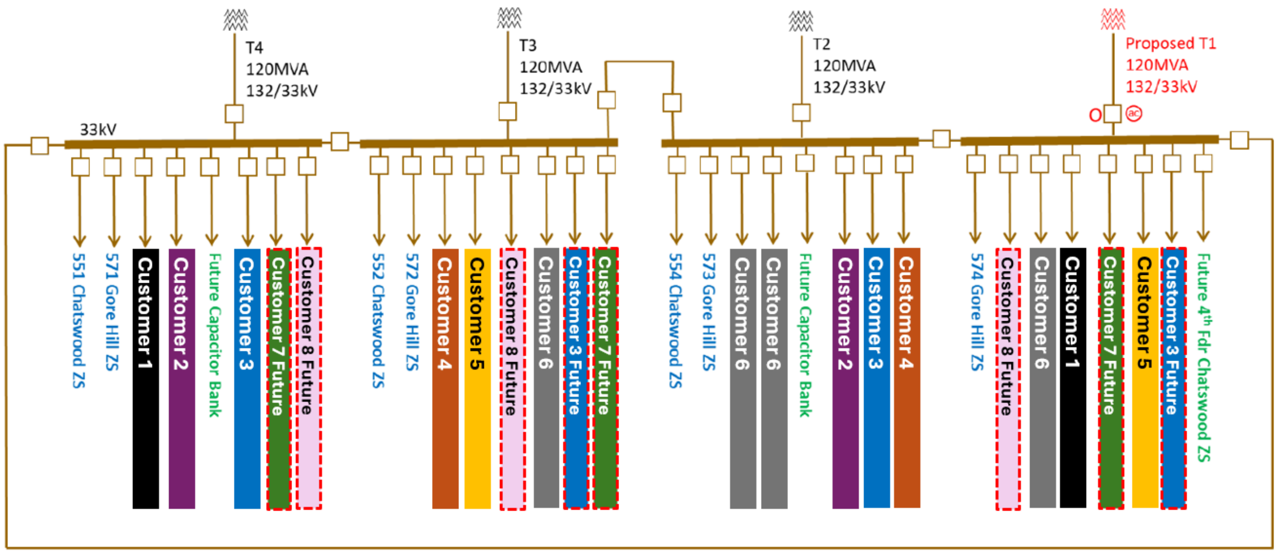
Figure 3.1 below illustrates the location of the existing 33kV switchroom and enclosed 33kV switchgear (to be decommissioned and replaced under this option) and the proposed new switchroom and associated works (shown in red).

**Figure 3.1 – Proposed location of the new switchroom relative to the existing 33kV buildings**

[7] Removal of abandoned cables and services (e.g., sewer and water pipes) are excluded from the scope.

Figure 3.2 provides a single-line diagram for Option 1 with the new transformer shown in red. All major loads have been redacted in the figure below to ensure confidentiality.

**Figure 3.2 – Single-line diagram for Option 1***




** The allocation of feeder bays depicted in this diagram is indicative and provided for illustration purposes.*

The estimated capital cost of Option 1 is $70.3 million (2025/26), which includes an estimated decommissioning cost of $4.3 million. Table 3.1 shows the breakdown of the estimated capital costs across key cost categories for this option.

**Table 3.1 – Breakdown of expected capital costs by key category for Option 1, $m (2025/26)**

| Component | Labour | Materials | Contracted Services | Indirect cost | Total |
|---|---|---|---|---|---|
| Option 1 – Single stage replacement | **17.8** | **10.5** | **29.3** | **12.7** | **70.3** |

Table 3.2 shows the breakdown of the estimated construction capital costs by component and over time for this option.

**Table 3.2 – Breakdown of expected capital cost over time for Option 1, $m (2025/26)**

| Component | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 | 2031/32 | 2032/33 |
|---|---|---|---|---|---|---|---|---|
| Early works for new switchroom | **0.2** | **1.5** | - | - | - | - | - | - |
| New 33kV switchroom | - | **5.2** | **7.6** | - | - | - | - | - |
| New 33kv switchgear | **2.9** | **6.7** | **8.3** | **8.3** | **4.5** | **3.0** | **1.4** | - |
| New 33kv conduits and cables | **0.3** | - | **0.4** | **4.3** | **3.1** | **1.7** | **1.1** | - |
| 4th 132/33kV 120 MVA transformer | - | - | **0.6** | **4.5** | **0.2** | - | - | - |
| Decommissioning cost | - | - | - | - | - | - | **0.1** | **4.2** |

The design, construction and equipping requirements are reasonably well understood for Option 1, taking into account the experience gained through similar projects recently completed (i.e., replacement of 33kV switchgear at Peakhurst STS with a new switchroom building).

Also included in the scope and estimated capital costs are works at remote ends of 33kV feeders supplying Gore Hill and Chatswood zone substations, as well as Sydney Trains and Lane Cove Tunnel, to upgrade protection systems.

We note that both options have a relatively high upfront design cost given the complexity of the solutions.

The first year of capital costs above includes expenditure to-date on these design costs. This has also been included in the first year of costs for Option 2 (discussed below). While these costs are equal across both options and thus do not affect the identification of the preferred option under the RIT-D, they have been included in the cost estimates for continuity with our wider regulatory cost recovery process.

The operation of the new switchgear in the new switchroom is expected to take several years to fully implement, as the 33kV feeder changeovers must be carried out in stages. This staged process is usually undertaken in shoulder load periods (i.e., we have assumed no transfers will occur during summer/winter peaks).

However, there are significant benefits to the construction and equipping phases being able to occur largely independent of normal substation operations. Having the cable works complete and substation equipped provides significant redundancy for any equipment failure that may occur in the interim.

Overall, Option 1 is expected to take seven years to complete, with commissioning of all work by 2031/32. However, the timing of the bulk of the replacement works under Option 1 is determined by the timing of the new data centre load requirement, i.e., from 2029/2030.

Specifically, the works required to accommodate the new data centre loads under Option 1 (i.e., new building and new switchgear in new bays) will be completed by 2029/30, from which point the avoided EUE associated with those loads will begin to be realised. After this timing, the project works are focused on the transfer of the existing loads at the STS to the new switchgear and switchroom.

Once fully commissioned, Option 1 will require approximately $25,700/year in planned routine maintenance costs.

## 3.2 Option 2 – Multiple stage replacement of switchgear

Option 2 involves a staged approach to addressing asset condition issues at Willoughby STS, whereby the existing 33kV switchgear is replaced like-for-like within the existing 33kV switchroom initially (i.e., an 'in situ' replacement), with construction of the new switchroom with new switchgear deferred by ten years (relative to Option 1).

Although the existing 33kV circuit breakers are outdoor bulk oil type, they have been installed within an enclosed building. Consequently, replacing them with modern equivalent circuit breakers in the existing building and enclosures while maintaining electrical clearances is complex, time-consuming and costly.

To provide sufficient feeder bays at the Willoughby STS to accommodate the expected data centre loads, Option 2 offloads the current load at the Gore Hill ZS in order to decommission the site, disconnects it from Willoughby STS, and repurposes the four feeder bays at Willoughby STS that currently serve Gore Hill. As with Option 1, Option 2 also involves the installation of a new (fourth) 132/33kV transformer at Willoughby STS to facilitate these loads.

The specific scope of works for Option 2 occurs in two stages:

Stage 1 (completed by 2032/33):

- Installation of new 33kV switchgear in the existing 33V switchroom;
- Installation and commissioning of a new (fourth) 132/33kV transformer unit; and
- Transfer of 11kV load at Gore Hill ZS (80% to Royal North Shore Hospital and 20% to Chatswood ZS) and decommissioning of Gore Hill ZS.

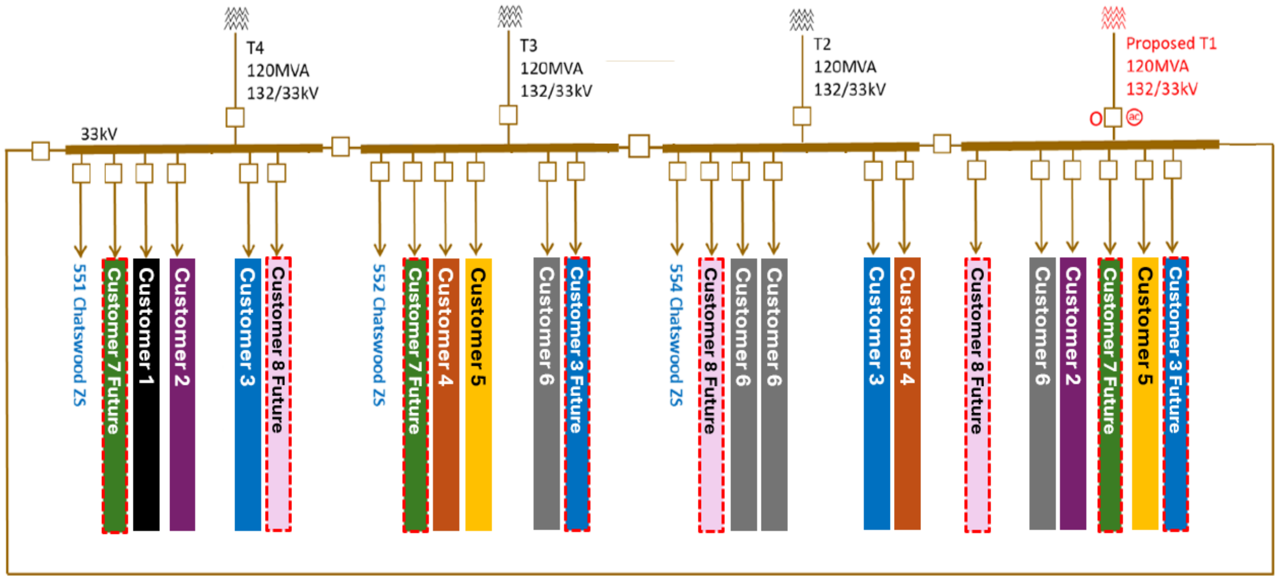
Stage 2 (completed by 2042/43):

- Early works to clear the area required for the new switchroom building;
- Construction of a new 33kV switchroom located within the existing Willoughby STS footprint;
- Installation of new 33kV indoor switchgear and associated controls and protection equipment;
- Installation of underground 33kV conduits and cables (to transfer connected loads from the existing 33kV switchgear to the new 33kV switchgear); and
- Decommissioning of redundant equipment and demolition the existing 33kV switchroom (to slab level).[8]

[8] Removal of abandoned cables and services (eg, sewer and water pipes) are excluded from scope.

Figure 7 provides a single-line diagram for Option 2 after the Gore Hill ZS load has been transferred (and prior to the Stage 2 works to establish the new switchroom and switchgear) with the new transformer shown in red. All major loads have been redacted in the figure below to ensure confidentiality.

**Figure 3.3 – Single-line diagram for Option 2***




** The allocation of feeder bays depicted in this diagram is indicative and provided for illustration purposes.*

The estimated construction capital cost of Option 2 is $115.7 million (2025/26), with an estimated decommissioning cost of $7.4 million. Table 3.3 shows the breakdown of the estimated construction capital costs across key cost categories for this option.

### Table 3.3 – Breakdown of expected capital costs by key category for Option 2, $m (2025/26)

| Component | Labour | Materials | Contracted Services | Indirect cost | Total |
|---|---|---|---|---|---|
| Option 2 – Multiple stage replacement | **30.0** | **18.0** | **48.3** | **19.4** | **115.7** |

Table 3.4 shows the breakdown of the estimated capital costs over time for this option for the first stage of work (i.e., everything excluding the new 33kV switchgear at Willoughby STS in the new switchroom).

### Table 3.4 – Breakdown of expected capital cost over time for Option 2 – first stage, $m (2025/26)

| Component | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 | 2031/32 | 2032/33 | 2033/34 |
|---|---|---|---|---|---|---|---|---|---|
| Replacement of 33kV switchgear | **3.1** | **2.9** | **4.3** | **5.7** | **5.7** | **4.3** | **3.6** | **0.7** | **-** |
| $4^{th}$ 132/33kV 120 MVA transformer | - | - | **0.6** | **4.5** | **0.2** | - | - | - | - |
| Gore Hill ZS 11kV load transfers | - | **0.3** | **1.2** | **6.1** | **4.5** | - | - | - | - |
| Decommission Gore Hill ZS | - | - | - | - | - | - | - | **0.8** | **2.3** |

Table 3.5 shows the breakdown of the estimated construction capital costs over time for the second stage of this option, i.e. the eventual new 33kV switchgear at Willoughby STS in the new switchroom.

**Table 3.5 – Breakdown of expected capital cost over time for Option 2 – second stage, $m (2025/26)**

| Component | 2034/35 | 2035/36 | 2036/37 | 2037/38 | 2038/39 | 2039/40 | 2040/41 | 2041/42 | 2042/43 |
|---|---|---|---|---|---|---|---|---|---|
| New 33kV switchgear at Willoughby STS in new switchroom | **1.2** | **2.2** | **13.4** | **16.3** | **12.7** | **7.6** | **4.7** | **2.5** | **-** |
| Decommissioning costs | - | - | - | - | - | - | - | **0.1** | **4.2** |

The in-situ replacement of the 33kV switchgear under Option 2 is expected to take eight years to complete, with commissioning expected in 2032/33. This is one year longer than for Option 1.

The extended program duration reflects the complexity associated with replacing the enclosed circuit breakers in-situ, whilst maintaining required electrical clearances and keeping the existing STS operational during construction.

Notwithstanding the additional complexity associated with in-situ replacement of the existing 33kV switchgear, Option 2 is staged similarly to Option 1 such that works required to accommodate new data centre loads will be completed by 2029/30, from which point avoided EUE associated with those loads will begin to be realised.

The remaining works are focused on the in-situ replacement of existing switchgear, which must be completed before EUE associated with existing connections can be avoided. Full commissioning of Option 2 is expected in 2032/33, at which point all avoided EUE will be realised.

The in-situ replacement works have significant risks that mean that there is a higher level of uncertainty around costs and timing than for the works under Option 1 (as outlined in section 4.3) – namely:

- A large volume of planned outages is required to do the staged replacement works, exposing a high number of customers to the risk of experiencing supply interruptions.
  - In particular, the replacement of the bus section circuit breakers will be a critical task.
  - Planned dual outages will be required for the bus section circuit breaker replacements, which in some combinations will cause Willoughby STS to operate with only one transformer in service (out of three) and Chatswood ZS to operate with only one transformer (out of three).
  - Such dual bus section outages can only occur in Spring or Autumn of each year, and obtaining permission from Ausgrid's control room to implement these planned outages for each step of work will be very challenging and could impact project timing.
- High demand of internal labour resources, with simultaneous field services groups/crews to be allocated at the same time for each circuit breaker replacement.
  - Senior technicians will be required due to the complexity of the work and committed to this project over a long period of time, which in turn will have impacts on other programs of work across Ausgrid.
- Unknown conditions in ground services.
  - There are several out-of-service cables that require identification and cutting/capping.
- Control and protection drawings not being fully up to date.
- Replacement of secondary cables (i.e., cables connecting control switches, protective relays and monitoring devices, used for transmitting electrical signals and data to monitor and operate equipment) will be difficult.
  - Firestopping barriers between rooms and around groups of cables will either require new routes or make stage replacement of cables difficult (i.e., removal of firestopping around a group of secondary cables while needing to keep many cables operational).
  - Segregation of secondary cables cannot be achieved for this option (i.e. old and new wiring will follow the same route, including the same floor and wall openings).
- Stage 1 works cannot support an expansion of the Chatswood ZS as no feeder bays will be available to provide 33kV supply to an additional transformer at this ZS site in the event all future customer loads are materialised.

Following commissioning of the Stage 1, Option 2 is expected to require $54,200/year in planned routine maintenance costs. The higher cost relative to Option 1 reflects the fact that, after Stage 1, the deteriorating condition of the 33kV switchroom has not been addressed under Option 2.

Routine maintenance is expected to increase annually at two per cent until the new switchroom is commissioned in 2042/43, after which Option 2 will require approximately $25,700/year in planned routine maintenance costs (i.e., the same as under Option 1).

A key uncertainty with Option 2 is the remaining life of the switchroom, and when it will ultimately need replacement. As noted in section 2.1, the most recent condition assessment of the 33kV switchroom recommends immediate building replacement in the event that works are undertaken on the assets housed within the switchroom.

While the ten-year deferral of building replacement under Option 2 is inconsistent with this recommendation, it has nonetheless been modelled as a potential credible option to capture potential uncertainty around the remaining serviceable life of the existing building.

Ausgrid has further considered the impact of being able to achieve an additional extension to the serviceable life of the switchroom building, by way of a sensitivity. In particular, Ausgrid assumes that the switchroom can remain in service for a further five years beyond the 2042/43 replacement adopted under Option 2, i.e., that replacement is not needed until 2047/48.

This sensitivity finds that even if the life of the existing switchroom did extend for this long (counter to the most recent condition assessment), the ability to defer its replacement does not change the conclusion of this DPAR (see section 5.4.3).

Overall, while Option 2 has been included as a credible option in this DPAR, it is considered an inferior option to Option 1 given it is more complex, higher cost, slower to deliver and more uncertain (regarding both cost and timing).

## 3.3 Social licence considerations

For the two credible options assessed in this RIT-D, the impact to the community will be minimal since the proposed works are to be undertaken within the existing substation site. Notwithstanding, the local community, Willoughby Council and surrounding neighbours have been, and will continue to be, notified of the project.

Given this is an industrial area and construction works will be contained within the existing substation site, community consultation has been focused on the neighbouring properties.

A summary of the stakeholder engagement outcomes to-date is as follows:

- The current tenant occupying the ex-Gore Hill depot did not raise concerns. Whilst they share a common driveway, access will be maintained for both Ausgrid's project and the tenant's activities throughout construction.
- Surrounding neighbours have not raised concerns besides from enquiring about parking impacts in adjacent roads or about the impacts of asbestos removal during any demolition work, for which Ausgrid will provide responses once the project progresses to the detailed design/development stage.
- Sydney Trains and Lane Cove Tunnel customers are impacted by having to upgrade protection relays to be suitable for use over fibre. This work is expected to take place between 2030 and 2032 and will increase future reliability, and Ausgrid will continue to engage with these customers as the project progresses to the detailed design/development stage.

Willoughby Council has not raised any issues from the notification. The Council did send a reminder that, although Ausgrid is exempt, it would like us to consider replanting three trees for every single tree removed. Consideration will be given to implementing this recommendation during the construction stage of the project.

Ausgrid will also implement a plan to donate tree trunks that will be removed to make space for the new building (common to both credible options) to the local Men's Shed to support mental health, so that they can be repurposed to make woodwork/craft/furniture.

Given there are no material social licence concerns, credible options are not expected to impose social licence costs in this case.

## 3.4 Options considered but not progressed

Ausgrid also considered several other options that have not been progressed because they were found to be technically or economically infeasible. The table below summarises Ausgrid's consideration and position on each of these options.

### Table 3.6 – Options considered but not progressed

| Description | Reason why option was not progressed |
|---|---|
| Like-for-like switchgear replacement only | Only undertaking like-for-like switchgear replacement has been ruled out as it would not address the building condition issues or enable the connection of the additional data centre load. This option is therefore not considered technically feasible. |
| Repairing, instead of replacing, the switchroom building under Option 2 | Only some of the building condition issues can be repaired and doing so would not extend the service life of the building overall. The building has fundamental condition issues (e.g., concrete cancer) that mean that the entire building needs replacing. This option is therefore not considered technically feasible. |
| Commissioning a new greenfield STS | A greenfield STS was ruled out due to it requiring a longer delivery timeframe that would not accommodate data centre loads (and so is therefore considered not technically feasible). The construction of a new STS would also cost orders of magnitude more than the credible options assessed, without providing a commensurate increase in expected market benefits, and is also therefore considered to not be economically feasible under the RIT-D. |
| Using non-network solutions either in combination with, or in-place of, a network option. | Ausgrid has considered how non-network solutions (e.g., demand management) could potentially defer the timing of the preferred network solution and whether the EUE could be cost effectively reduced. An assessment of the potential for non-network options has shown that these alternatives would not be cost effective due to the magnitude of the load reduction required.<br>This result is driven primarily by the significant amount of EUE that the identified network options allow to be avoided, compared to the base case, and the likely cost of non-network solutions. In addition, these solutions would not resolve the escalating safety risk costs and reactive maintenance costs associated with continued use of the switchgear. This is detailed further in the separate Options Screening Notice released in accordance with clause 5.17.4(d) of the NER. |
| Transferring and/or connecting customers to SAPS | Ausgrid has considered the feasibility of SAPS, informed by its trial of SAPS with selected customers living in fringe-of-grid areas of Ausgrid's network.<br>Based on Ausgrid's trial, the cost of SAPS would limit the number of customers available to reduce demand given the deferral funds available and consequently, the reduction in demand would not be sufficient to defer or postpone the network solution. In addition, these solutions would not resolve the escalating reactive maintenance costs associated with continued use of the ageing switchgear. This is detailed further in the separate Options Screening Notice released in accordance with clause 5.17.4(d) of the NER. |

# 4 How the options have been assessed

This section outlines the methodology that Ausgrid has applied in assessing market benefits and costs associated with the credible options considered in this RIT-D. Appendix D presents additional detail on the assumptions and methodologies employed to assess the options.

## 4.1 All options have been assessed against a 'base case'

All costs and benefits for each credible option have been measured against a 'business as usual' base case.

Under this base case, Ausgrid:

- will experience an increasing risk of failure for the 33 kV switchgear at Willoughby STS resulting in an increasing risk of prolonged unserved energy in the Lower North Shore network area, as well as escalating reactive maintenance and safety risk costs;
- increasing planned routine maintenance and refurbishment costs given the ageing assets;[9] and
- will not be able to supply any of the customer requested load with the existing Willoughby STS given the lack of spare bays.

The range of condition and compliance issues with the existing switchroom (i.e., those that Qubist recommended be addressed through immediate replacement) would also result in longer repair times, with consequently greater unserved energy, and higher safety costs under the base case. We have not modelled these explicitly as part of this DPAR as we do not consider it proportionate. Specifically, modelling these consequences would require significant resources and effort and would only result in Option 1 being even more strongly preferred over Option 2 (given Option 1 replaces the switchroom earlier).

Overall, the base case is not a realistic state of the world, because of Ausgrid's reliability obligations and our obligation to facilitate the additional expected data centre load under Section 5.2.3 in the NER. The base case has instead only been defined and used to align with the RIT-D framework.

## 4.2 General overview of the assessment framework

The RIT-D analysis has been undertaken over a 25-year period, from 2025/26 to 2050/51.

Ausgrid considers that a 25-year period is appropriate as it takes into account the size, complexity and expected life of the relevant credible options to provide a reasonable indication of the market benefits and costs of the options. The assessment period is five years longer than our typical RIT-D assessment period, in light of the sensitivity covering an extended life for the existing switchroom (as outlined in section 3.2 and section 5.4).

Where the capital components of the credible options have asset lives greater than the end of the assessment period, Ausgrid has taken a terminal value approach to incorporate capital costs in the assessment, which ensures that the capital cost of long-lived options is appropriately captured in the assessment period. This ensures that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or asset life. The terminal values have been calculated as the undepreciated value of capital costs at the end of the analysis period and can be interpreted as a conservative estimate for benefits (net of operating costs) arising after the analysis period.

Ausgrid has adopted a real, pre-tax discount rate of 3.70% as the central assumption for the NPV analysis. This represents Ausgrid's opportunity cost for its capital investments. As non-network or SAPS options have been found to be not viable, Ausgrid considers that the appropriate discount rate is the regulated cost of capital.

To test the results against variations in the discount rate, an upper value sensitivity of 10% has been adopted to align with the parameters prepared and consulted on by AEMO in the 2025 Inputs, Assumptions and Scenarios Report.[10] For a lower value sensitivity for this RIT-D, we have applied 3.61% based on the latest AER Final Decision for a DNSP's regulated weighted average cost of capital (WACC) at the time of preparing this DPAR.[11]

---

[9] These are assumed to be $71,865 in 2026/27 and increase at 2% each year in real terms.

[10] AEMO, *2025 Inputs, Assumptions and Scenarios Report*, Final report, August 2025, p 158.

[11] Specifically, the 2026/27 pre-tax real WACC for Powercor, see: AER, *SCS PTRM – Final Decision – Powercor distribution determination 2026-31*, 30 April 2026, 'WACC' tab.

## 4.3 Ausgrid's approach to estimating project costs

Ausgrid has estimated capital costs by considering the scope of works necessary under the credible options together with costing experience from previous projects of a similar nature. Where possible, Ausgrid has also estimated capital costs using supplier quotes or other pricing information.

All cost estimates are prepared in real, 2025/26 dollars based on the information and pricing history available at the time that they were estimated. The cost estimates do not include or forecast any real cost escalation for materials.

Ausgrid does not generally apply the Association for the Advancement of Cost Engineering (AACE) international cost estimate classification system to classify cost estimates. Doing so for this RIT-D would involve significant additional costs, which would not provide a corresponding increase in benefits compared with the use of our standard estimates and so this has not been undertaken.

Different levels of cost accuracy exist for Option 1 and Option 2 due to the difference in scope of works proposed under each option. Specifically, a cost accuracy of -10% to +25% applies to Option 1, while a cost accuracy of -10% to +50% applies to Option 2. This difference reflects the greater execution complexity and uncertainty associated with the staged, in-situ works under Option 2, which must be carried out in a live operational environment subject to constrained outage windows, resource pressures and a number of unknown site conditions.

Reactive and routine operating and maintenance costs are based on a fleet level assessment of assets and works of similar nature. These costs are included for each year in the planning period from when the options are commissioned, as well as in the base case.

## 4.4 Market benefits are expected from avoided unserved energy

Ausgrid considers that the only relevant category of market benefits prescribed under the NER for this RIT-D relates to changes in involuntary load shedding.

While the options also provide avoided maintenance cost benefits compared to the base case (i.e., reduced corrective maintenance costs and lower planned routine maintenance costs), as well as avoided safety risk costs, these are not considered 'market benefits' under the NER (but have been estimated in the NPV assessment).

The approach Ausgrid has adopted to estimate the financial impact of avoided unserved energy is outlined in section 4.4.1 below. Further details on the assumptions and methodology considered are presented in Appendix D.

In addition, Appendix C summarises the market benefit categories that Ausgrid considers are not material for this RIT-D.

### 4.4.1 Avoided unserved energy

EUE is the amount of energy that customers request to utilise but cannot be supplied due to a network capacity limitation. A reduction of the unserved energy expected from the credible option, relative to the base case, results in a positive contribution to market benefits.

As outlined in section 2.3.3, there are two distinct categories of load relevant to the consideration of EUE for the purposes of this DPAR assessment:

- Existing load – comprising the approximately 28,000 current residential, commercial, and industrial customers supplied via the Chatswood and Gore Hill ZS, as well as the major customers currently connected directly to the Willoughby STS; and
- Future expected data centre load – comprising the three new expected data centre loads.

The benefit from avoided EUE for each option is derived by the estimated quantity in MWh of involuntary load shedding avoided under the base case, compared to the case with the option in-place, multiplied by the Value of Customer Reliability (VCR). The VCR is measured in dollars per MWh and is used as proxy to evaluate the economic impact of unserved energy on customers under the RIT-D.

To account for the difference in customer type and load characteristics, Ausgrid has applied two VCRs throughout the assessment period. These reflect:

- For existing loads and future load with available feeder bays (which is just one data centre load), the customer load weighted average VCR based on the forecast 2030/31 load mix served by the Willoughby STS, which equates to $24.56/kWh; and

- For future loads with no currently available feeder bays (i.e., the remaining two new data centre loads), the VCR for very large industrial loads (over 10 MVA), which equates to $13.08/kWh.

In each case, VCR estimates are calculated using the most recent estimates published by the AER,[12] escalated from October 2025 to June 2026 dollars using actual monthly CPI data published by the ABS and forecast inflation drawn from the RBA's most recent Statement on Monetary Policy.[13]

The 2030/31 load mix is used as the basis for the load-weighted average VCR as it reflects a mature forecast profile that incorporates both the existing customer base and anticipated future connections, including committed data centre load. Applying this mix as a fixed rate throughout the assessment period avoids the complexity of a time-varying VCR whilst remaining representative of the long-run load composition at the substation. We consider this a proportionate approach for this RIT-D and do not consider it material to the identification of the preferred option.

Table 4.1 presents the calculation of the customer load weighted average VCR.

**Table 4.1 – Customer load weighted average VCR (forecast 2030/31 load mix)**

| Customer type | Load (MWh) | Weight (%) | VCR ($/kWh, October 2025) | VCR ($/kWh, June 2026) |
|---|---|---|---|---|
| **Residential (NSW, climate zone 5)** | 115,471 | 8.68 | 36.72 | 37.85 |
| **Small and medium commercial** | 61,687 | 4.64 | 54.64 | 56.32 |
| **Small industrial and large commercial** | 144,667 | 10.87 | 45.08 | 46.46 |
| **Large industrial** | 61,453 | 4.62 | 34.08 | 35.13 |
| **Very large business (services)** | 159,763 | 12.00 | 34.37 | 35.43 |
| **Very large business (industrial)** | 787,769 | 59.19 | 12.69 | 13.08 |
| **Customer load weighted average VCR** | | | 23.74 | 24.56 |

*Source: AER, Values of Customer Reliability 2025 – Annual Adjustment Summary, December 2025; ABS, Consumer Price Index, Australia, March 2026, Series A130393720C; RBA, Statement on Monetary Policy, May 2026, p 4.*

We have also undertaken sensitivity analysis on the VCR, using values that are 30% lower and 30% higher than the central load-weighted rate, consistent with the AER's most recently specified +/- 30% confidence interval.[14]

## 4.5 Three different scenarios have been modelled to address uncertainty

RIT-D assessments are required to be based on cost-benefit analysis that includes an assessment of 'reasonable scenarios', which are designed to test alternate sets of key assumptions and whether they affect identification of the preferred option.

While load forecasts are not a determinant of the identified need (since the reliability standards expected to be breached relate to the *duration* and *frequency* of supply interruptions and Ausgrid's obligation to connect load – none of which are affected by underlying load forecasts), Ausgrid has investigated how assuming different load forecasts going forward changes the expected net market benefits under the options.

The scenarios adopted for this RIT-D only differ by the demand forecasts. How the results are affected by changes to other variables (i.e. the VCR, discount rate and capital costs) have been investigated in the sensitivity analysis.

A summary of the key variables in each scenario is provided in the table below.

---

[12] AER, *Values of Customer Reliability 2025 Annual Adjustment Summary*, December 2025.

[13] ABS, *Consumer Price Index, Australia*, March 2026, Series A130393720C; RBA, *Statement on Monetary Policy*, May 2026, p 4.

[14] AER, *Values of Customer Reliability – Final Report on VCR values*, December 2019, p. 84. While the AER re-estimated its VCR values in 2024, we note that no confidence level was provided. We have therefore continued to apply the previous confidence level stipulated in the 2019 AER VCR report.

**Table 4.2 – Summary of the three scenarios investigated**

| Variable | Scenario 1 – central demand scenario | Scenario 2 – low demand scenario | Scenario 3 – high demand scenario |
|---|---|---|---|
| Demand | Central forecast | Low forecast | High forecast |
| VCR (existing loads and future data centre load with available feeder bays) | $24.56/kWh across all scenarios | | |
| VCR (future data centre load with no available feeder bays) | $13.08/kWh across all scenarios | | |
| Discount Rate | 3.70% across all scenarios | | |

Option 1 is found to be preferred across all scenarios and so the weightings of the scenarios do not influence the RIT-D outcome. Ausgrid has therefore adopted equal weightings across scenarios as a proportionate approach for this RIT-D.

# 5 Assessment of the credible options

This section summarises the results of the NPV analysis, including the sensitivity analysis undertaken. All credible options assessed as part of this RIT-D have been compared against a 'do nothing' base case (as outlined in section 4.1).

## 5.1 Gross benefits

Table 5.1 below summarises the gross benefit of the credible options relative to the base case in present value terms. The gross benefit has been calculated for each of the three demand scenarios outlined in section 4.5 and is also provided on a weighted basis.

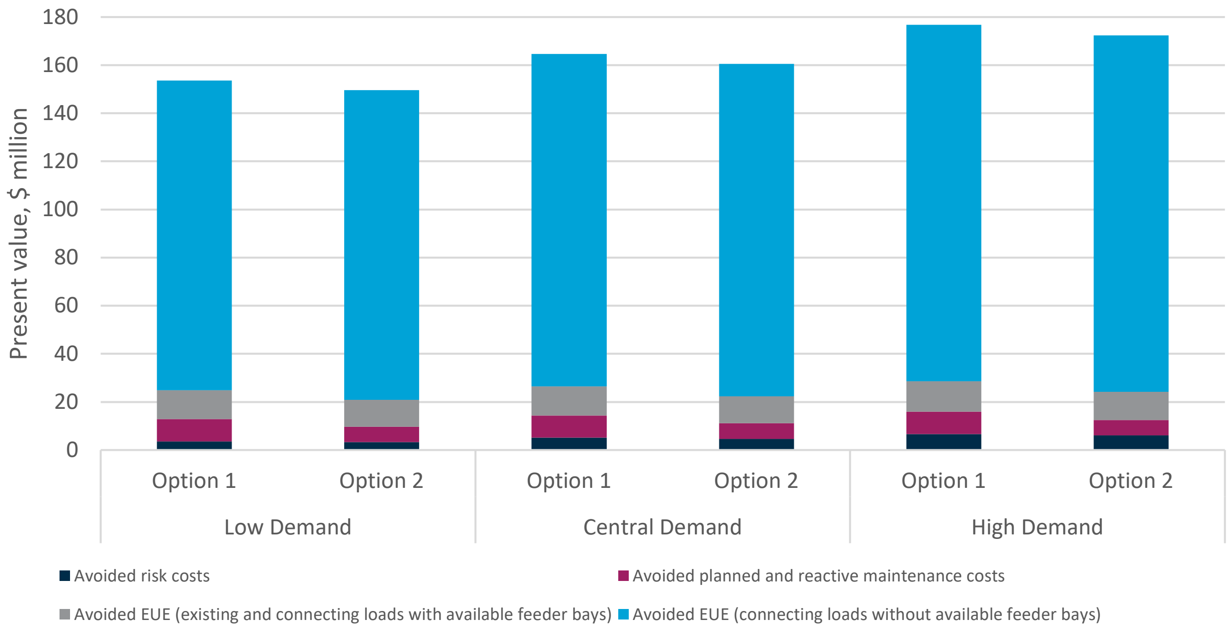
**Table 5.1 – Present value of gross benefits of credible options relative to the base case, PV $m**

| Option / scenario | Central demand | High demand | Low demand | Weighted benefits |
|---|---|---|---|---|
| Scenario weighting | 1/3 | 1/3 | 1/3 | - |
| Option 1 | 156.2 | 168.2 | 145.0 | 156.5 |
| Option 2 | 154.8 | 166.7 | 143.8 | 155.1 |

Option 1 is found to deliver greater overall benefits in all scenarios than Option 2. This is driven by the fact that Option 1 is be commissioned earlier in 2030/31, while Option 2 is commissioned later in 2032/33, and so Option 1 avoids greater levels of expected unserved energy (for existing and connecting loads with available feeder bays) and corrective maintenance costs.

Figure 5.1 below provides a breakdown of all benefits relating to each credible option. For clarity, we have combined in this chart the 'market benefit' under the RIT-D (i.e., reduced involuntary load shedding) with avoided maintenance cost benefits (i.e., reduced corrective maintenance costs and avoided planned routine maintenance costs).

**Figure 5.1 – Breakdown of benefits of each option relative to the base case, PV $m**




## 5.2 Estimated costs

Table 5.2 below summarises the cost of the credible options relative to the base case in present value terms. Option costs comprise capital costs and ongoing operating and maintenance costs.

Option costs do not vary across demand scenarios. Variations in the capital costs have been tested as part of the sensitivity analysis.

### Table 5.2 – Present value of costs of credible options relative to the base case, PV $m

| Option / scenario | Central demand | High demand | Low demand | Weighted costs |
|---|---|---|---|---|
| Scenario weighting | 1/3 | 1/3 | 1/3 | - |
| Option 1 | (38.0) | (38.0) | (38.0) | (38.0) |
| Option 2 | (45.8) | (45.8) | (45.8) | (45.8) |

## 5.3 Net present value assessment

Table 5.3 below summarises the net market benefit in NPV terms for the credible options under each scenario. The net market benefit is the gross benefit (as set out in table 5.1) minus the costs of the option (as set out in table 5.2), all in present value terms.

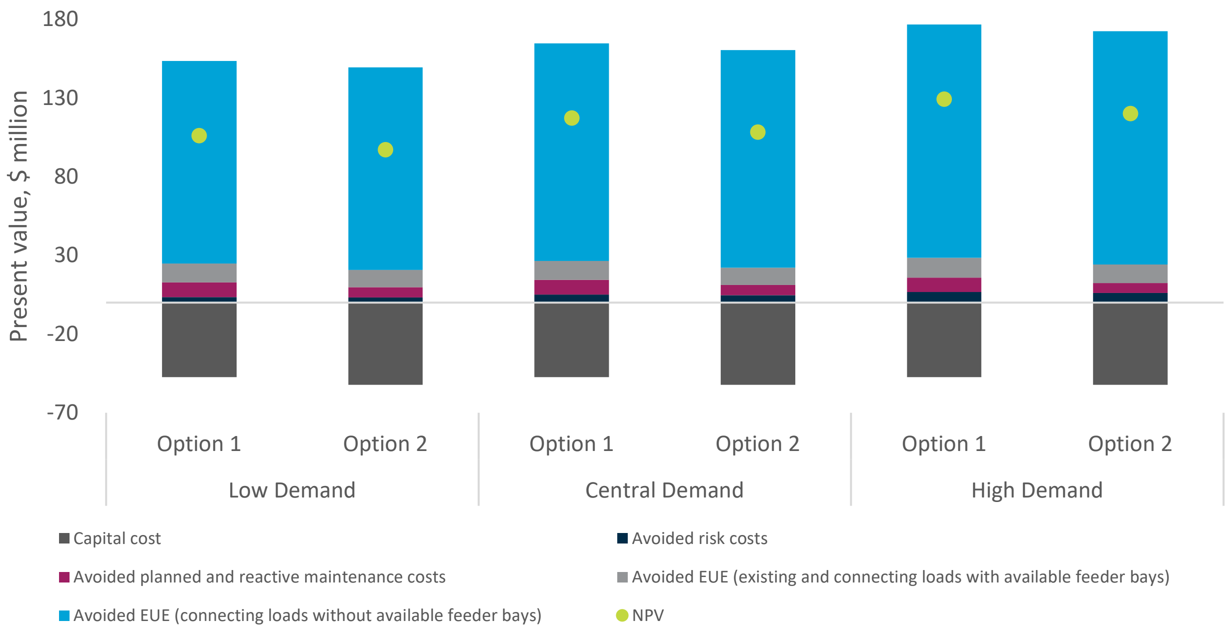
Option 1 has the greatest estimated net market benefits of the two credible options in each of the scenarios investigated (and therefore also on a weighted basis). The differences in net market benefits are primarily driven by the cost and timing differences between the options.

### Table 5.3 – Present value of net benefits relative to the base case, NPV $m

| Option / scenario | Central demand | High demand | Low demand | Weighted | Rank |
|---|---|---|---|---|---|
| Scenario weighting | 1/3 | 1/3 | 1/3 | - | - |
| **Option 1** | **118.1** | **130.2** | **107.0** | **118.4** | **1** |
| Option 2 | 109.0 | 120.9 | 98.0 | 109.3 | 2 |

Figure 5.2 provides a breakdown of the net present value assessment for each credible option by costs and benefits.

### Figure 5.2 – Breakdown of net present value assessment




## 5.4 Sensitivity analysis results

Ausgrid has undertaken a sensitivity testing exercise to understand the robustness of the RIT-D assessment to underlying assumptions about key variables.

In particular, we have undertaken two tranches of sensitivity testing – namely:

- Step 1 – testing the sensitivity of the optimal timing of the project ('trigger year') to different assumptions in relation to key variables; and
- Step 2 – once a trigger year has been determined, testing the sensitivity of the total NPV benefit associated with the investment proceeding in that year, in the event that actual circumstances turn out to be different.

That is, having assumed to have committed to the project by the dates determined in Step 1, Ausgrid has also looked at whether the ranking of the options changes when key assumptions are varied under Step 2 of the sensitivity testing.

We outline how each of these two steps has been applied to test the sensitivity of the key findings in the subsections below.

### 5.4.1 Step 1 – sensitivity testing of the assumed optimal timing for the credible options

Ausgrid has estimated the optimal timing for each option according to when the expected annual benefit from the proposed option exceeds its annualised cost, consistent with the AER guidance on how to determine the economically prudent and efficient timing for asset retirement.[15] This process was undertaken for both the central set of assumptions (i.e., the central scenario) as well as a range of alternative assumptions for key variables.

The optimal timing of Option 1 is found to be invariant to the assumptions of:

- a 10% decrease in the assumed network capital costs;
- a 25% increase in the assumed network capital costs for Option 1;
- a 30% increase/decrease in the assumed operating costs;
- a 30% increase/decrease in the assumed health and safety risk costs;
- a 30% higher/lower VCR;[16] and
- a lower and higher discount rate assumption (3.61% and 10%, respectively).

Overall, the optimal commissioning date for Option 1 under all the sensitivities is 2030/31, which is the timing that has been assumed in the core net benefits assessment.

**Figure 5.3 – Option 1's distribution of optimal project commissioning years under each sensitivity**


[15] AER, *Industry practice application note – Asset replacement planning*, January 2019, pp 36-37. The optimal timing is defined as the point in time where if the option were to be commissioned in that specific year, the net operating benefits would exceed the annualised cost.

[16] For the load-weighted VCRs applied to existing loads and connecting data centre loads with available feeder bays, the high and low VCRs are $31.93/kWh and $17.19/kWh, respectively. For the VCRs applied to connecting data centre loads with no available feeder bays, the high and low VCRs are $17.00/kWh and $9.16/kWh, respectively.

Similarly, the optimal timing of the first stage of Option 2 is found to be invariant to all the assumptions of the assumptions tested. The only difference in assumptions relative to Option 1 is that the high capital cost scenario applies a 50% increase to capital costs for Option 2 (rather than the 25% escalation applied to Option 1). As we explain earlier, this difference reflects the greater execution complexity and uncertainty associated with staged, in-situ works proposed for the first stage of works under Option 2.

Overall, the optimal commissioning date for the first stage of Option 2 under all of the sensitivities is 2030/31. As we discuss in section 3.2, Option 2 is staged such that works required to accommodate new data centre loads will be completed ahead of full commissioning. It follows that this optimal year reflects the point at which Option 2 begins to accrue benefits associated with avoided EUE from new data centre loads, rather than the year of full commissioning. Under the central scenario, this implies a full commissioning year of 2032/33, which is the timing assumed in the core net benefits assessment.[17]

**Figure 5.4 – Option 2's distribution of optimal project commissioning years under each sensitivity**


### 5.4.2 Step 2 – Sensitivity of the overall net market benefit

Ausgrid has also conducted sensitivity analysis on overall net market benefits, based on the assumed option timing established in step 1.

Specifically, Ausgrid has investigated the same sensitivities under this second step as in the first step, i.e.:

- a 25% increase and a 10% decrease in the assumed network capital costs for Option 1;
- a 50% increase and a 10% decrease in the assumed network capital costs for Option 2;
- a 30% increase/decrease in the assumed network operating costs;
- a 30% increase/decrease in the assumed risk costs;
- 30% higher VCRs ($31.93/kWh and $17.00/kWh) and 30% lower VCRs ($17.19/kWh and $9.16/kWh); and
- a lower and higher discount rate assumption (3.69% and 10%, respectively).

The results of the sensitivity tests are presented in table 5.4 below and show that Option 1 remains the top-ranked option across all the general sensitivities modelled.

[17] Consistent with this interpretation, the Stage 2 capital costs associated with the second stage of Option 2 (i.e., the new switchroom and switchgear) have been excluded from the optimal timing assessment.

**Table 5.4 – NPV results from sensitivity tests, weighted across demand scenarios, NPV $m**

| Sensitivity | Option 1 | Option 2 |
|---|---|---|
| Core weighted results | **118.4** | 109.3 |
| High capital costs[18] | **106.6** | 83.2 |
| Low capital costs (-10%) | **123.2** | 114.6 |
| High operating costs (+30%) | **121.2** | 111.3 |
| Low operating costs (-30%) | **115.6** | 107.4 |
| High risk costs (+30%) | **120.0** | 110.7 |
| Low risk costs (-30%) | **116.9** | 107.9 |
| High VCR[19] | **163.8** | 154.5 |
| Low VCR | **73.0** | 64.2 |
| High discount rate (10%) | **28.4** | 27.9 |
| Low discount rate (3.69%) | **120.6** | 111.4 |

We do not find any realistic boundary values for the above key variables that would make Option 2 preferred over Option 1. The exception is for the higher discount rate, where the boundary value at which Option 2 becomes equal to Option 1 is 10.39%, i.e., only marginally above the 10% sensitivity test. However, this does not take into account the greater degree of uncertainty in relation to the costs and timing for Option 2.

We have also undertaken a standalone sensitivity that considers the impact of a longer serviceable life for the switchroom building. The results of this sensitivity are presented in section 5.4.3 below.

### 5.4.3 Assuming the switchroom remains in service longer under Option 2

We have investigated the impact of assuming that the switchroom is able to remain in service for a further five years beyond the 2042/43 replacement assumed under Option 2, i.e., that replacement is not needed until 2047/48. This sensitivity finds that if the eventual replacement of the switchroom (and the need for new switchgear) was able to be further deferred under Option 2, it would still not become the preferred option, as shown in table 5.5 below (although the difference between Option 1 and Option 2 in this case is very minor).

**Table 5.5 – Present value of net benefits relative to the base case, NPV $m**

| Option / scenario | Central demand | High demand | Low demand | Weighted | Rank |
|---|---|---|---|---|---|
| Scenario weighting | 1/3 | 1/3 | 1/3 | - | - |
| **Option 1** | **118.1** | **130.2** | **107.0** | **118.4** | **1** |
| Option 2 – extended 33kv switchroom life | 117.8 | 129.7 | 106.8 | 118.1 | 2 |

Moreover, we note that this sensitivity assumes that the switchroom replacement is able to be undertaken at a later date without any consequences (besides a slightly higher level of planned routine maintenance). This ignores the range of condition and compliance issues with the existing switchroom (i.e., those that Qubist recommended be addressed through immediate replacement), as listed in section 4.1. Taking account of these potential impacts (i.e., longer repair times, with consequently greater unserved energy, and higher safety costs under the base case) would result in Option 1 being more strongly preferred over Option 2 under this sensitivity (given Option 1 replaces the switchroom earlier).

[18] Different levels of cost accuracy exist for Option 1 and Option 2 due to the difference in scope of works proposed under each option. Specifically, a cost accuracy of +25% applies to Option 1, while a cost accuracy of +50% applies to Option 2. This difference reflects the greater execution complexity and uncertainty associated with the staged, in-situ works under Option 2.

[19] For the load-weighted VCRs applied to existing loads and connecting data centre loads with available feeder bays, the high and low VCRs are $31.93/kWh and $17.19/kWh, respectively. For the VCRs applied to connecting data centre loads with no available feeder bays, the high and low VCRs are $17.00/kWh and $9.16/kWh, respectively.

# 6 Proposed preferred option

Ausgrid considers that Option 1 is the preferred option that satisfies the RIT-D. It involves the construction of a new 33kV switchroom building, installation of new 33kV switchgear equipment and a fourth 132/33kV transformer, and retirement of existing buildings (i.e., existing 33kV switchrooms and control room).

This finding is found to be robust to a range of general sensitivity tests investigated (covering assumed network costs, VCR values and discount rates), as well as a specific sensitivity that assumes that the existing switchroom lasts five years longer than assumed under Option 2.

Moreover, Option 1 addresses the range of condition and compliance issues at the existing switchroom, i.e., those that Qubist recommended be addressed through immediate replacement. While the consequences of leaving these unaddressed under the base case have not been modelled as part of this DPAR, doing so would further support the identification of Option 1 as the preferred option for this RIT-D.

The specific scope of works for Option 1 includes:

- Early works to clear the area required for the new switchroom building;
- Construction of a new 33kV switchroom located within the existing Willoughby STS footprint;
- Installation of new 33kV indoor switchgear and associated controls and protection equipment;
- Installation of underground 33kV conduits and cables (to transfer connected loads to the new 33kV switchgear);
- Installation and commissioning of a new (fourth) 132/33kV transformer unit; and
- Decommissioning of redundant equipment and demolition of the existing 33kV switchroom (to slab level).[20]

The estimated capital cost of Option 1 is $70.3 million, which is comprised of:[21]

- $35.1 million for the new 33kV switchgear;
- $14.5 million for the new 33kV switchroom (which includes $1.7 million of early works costs);
- $10.9 million for the new 33kV conduits and cables;
- $5.3 million for the 4th 132/33kV 120 MVA transformer; and
- $4.3 million of decommissioning costs.

Also included in the scope and estimated capital costs are works at remote ends of 33kV feeders supplying Gore Hill and Chatswood zone substations, as well as Sydney Trains and Lane Cove Tunnel, to upgrade protection systems.

Once fully commissioned, Option 1 will require approximately $25,700/year in planned routine maintenance costs.

Overall, Option 1 is the lowest cost of the two credible options assessed in this DPAR and delivers the greatest net benefits. It is also the least complex option and the option we consider has the most accurately estimated costs and timeframe.

The works required to accommodate the new data centre loads under Option 1 (i.e., new building and new switchgear in new bays) will be completed by 2029/30, from which point the avoided EUE associated with those loads will begin to be realised. After this timing, the project works are focused on the transfer of the existing loads at the STS to the new switchgear and switchroom.

Ausgrid considers that this DPAR, and the accompanying detailed analysis, identify Option 1 as the preferred option and that this satisfies the RIT-D. Ausgrid is the proponent for Option 1.

It should be noted that impact to the community is anticipated to be minimal because the proposed works are to be undertaken within the substation site. Notwithstanding, the local community, Willoughby Council and surrounding neighbours have been notified of the project. Communications will continue through key stages of the project.

[20] Removal of abandoned cables and services (e.g., sewer and water pipes) are excluded from the scope.

[21] Due to rounding, the sum of the individual component costs listed here adds to $70.1 million rather than the actual total estimated expenditure of $70.3 million.

# Appendix A – Checklist of compliance clauses

This table below sets out a compliance checklist that demonstrates the compliance of this DPAR with the requirements of clause 5.17.4(r) of the NER version 245.

| Clause | Summary of requirements | Section in the DPAR |
|---|---|---|
| 5.17.4(r) | The matters specified as requirements for the DPAR, as outlined below in clause 5.17.4(j). | See below |
| | A summary of any submissions received on the DPAR and the RIT-D proponent's response to each such submission | NA |
| 5.17.4(j) | (1) a description of the identified need for the investment | 2 |
| | (2) the assumptions used in identifying the identified need | 2.3 |
| | (3) if applicable, a summary of, and commentary on, the submissions on the non-network options report | NA |
| | (4) a description of each credible option assessed | 3 |
| | (5) where a DNSP has quantified market benefits, a quantification of each applicable market benefit for each credible option | 5 |
| | (6) a quantification of each applicable cost for each credible option, including a breakdown of operating and capital expenditure | 5.2 |
| | (7) a detailed description of the methodologies used in quantifying each class of cost and market benefit | 4 & Appendix D |
| | (8) where relevant, the reasons why the RIT-D proponent has determined that a class or classes of market benefits or costs do not apply to a credible option | Appendix C |
| | (9) The results of a net present value analysis of each of credible option and accompanying explanatory statements regarding the results | 5 |
| | (10) the identification of the proposed preferred option | 6 |
| | (11) for the proposed preferred option, the RIT-D proponent must provide:<br>(i) details of technical characteristics;<br>(ii) the estimated construction timetable and commissioning date (where relevant);<br>(iii) the indicative capital and operating cost (where relevant);<br>(iv) a statement and accompanying detailed analysis that the proposed preferred option satisfies the RIT-D; and<br>(v) if the proposed preferred option is for reliability corrective action and that option has a proponent, the name of the proponent | 6 |
| | (12) Contact details for a suitably qualified staff member of the RIT-D proponent to whom queries on the draft report may be directed. | 1.2 |
| | (13) if the estimated capital cost of the proposed preferred option is greater than $100 million (as varied in accordance with a cost threshold determination), include the RIT reopening triggers applying to the RIT-D project. | NA |

In addition, the table below outlines a separate compliance checklist demonstrating compliance with the binding guidance in the latest AER RIT-D guidelines.[22]

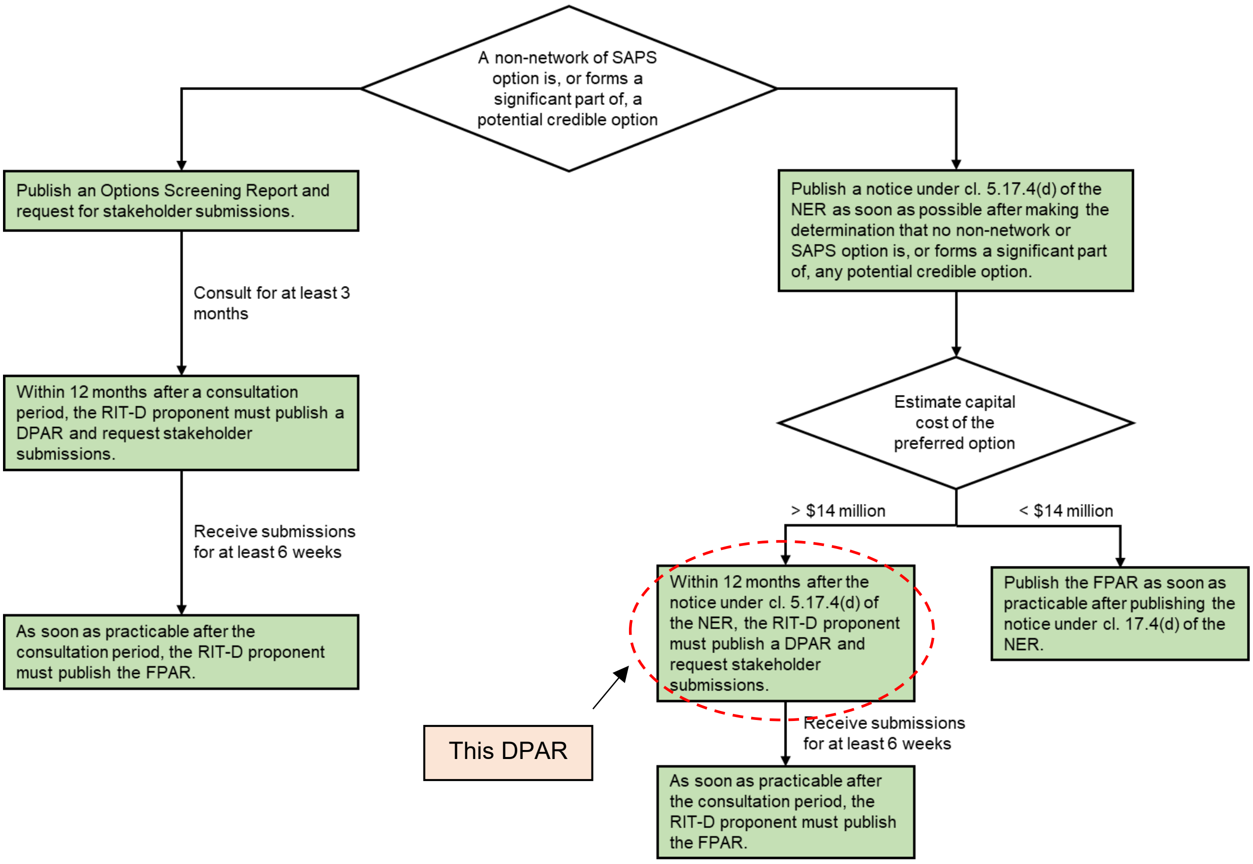
| Guidelines section | Summary of requirements | Section in the DPAR |
|---|---|---|
| 3.2.5 | A RIT-D proponent must consider social licence issues in the identification of credible options. | 3.3 |
| 3.5A.1 | Where the estimated capital costs of the preferred option exceed $100 million (as varied in accordance with a cost threshold determination), a RIT–D proponent must, in a RIT-D application:<br>• outline the process it has applied, or intends to apply, to ensure that the estimated costs are accurate to the extent practicable having regard to the purpose of that stage of the RIT-D<br>• for all credible options (including the preferred option), either<br>– apply the cost estimate classification system published by the AACE, or<br>– if it does not apply the AACE cost estimate classification system, identify the alternative cost estimation system or cost estimation arrangements it intends to apply, and provide reasons to explain why applying that alternative system or arrangements is more appropriate or suitable than applying the AACE cost estimate classification system in producing an accurate cost estimate | NA |
| 3.5A.2 | For each credible option, a RIT-D proponent must specify, to the extent practicable and in a manner which is fit for purpose for that stage of the RIT-D:<br>• all key inputs and assumptions adopted in deriving the cost estimate<br>• a breakdown of the main components of the cost estimate<br>• the methodologies and processes applied in deriving the cost estimate (e.g. market testing, unit costs from recent projects, and engineering-based cost estimates)<br>• the reasons in support of the key inputs and assumptions adopted and methodologies and processes applied<br>• the level of any contingency allowance that have been included in the cost estimate, and the reasons for that level of contingency allowance | 3 & 4.3<br>3.1 & 3.2 |
| 3.5.5 | The RIT-D proponent is required to provide the basis for any social licence costs in their RIT-D reports and may choose to refer to best practice from a reputable, independent and verifiable source. | NA – no material social licence costs are anticipated |
| 3.4.4 & 3.7.3 | Where calculating the benefit from changes in Australia's greenhouse gas emissions, a RIT-D proponent is required to:<br>• include the following emissions scopes, unless the change relative to the base case can be demonstrated to be immaterial to the RIT outcome:<br>o direct emissions from generation<br>o direct emissions other than from generation, e.g. sulphur hexafluoride.<br>• estimate the change in annual emissions between the base case and the credible option, and multiplying this change by the annual VER to arrive at the annual benefit from changes in Australia's greenhouse gas emissions.<br>A RIT-D proponent is required to use the prevailing VER under relevant legislation or, otherwise, in any administrative guidance that we may have published for assessing the changes in Australia's greenhouse gas emissions benefit class.<br>Where emissions beyond CO2 are changed by a credible option, the RIT-D proponent is required to convert alternative forms of emissions to CO2-e. | NA – see Appendix C |
| 3.8.1 | Where the estimated capital cost of the preferred option exceeds $100 million (as varied in accordance with an applicable cost threshold determination), a RIT-D proponent must undertake sensitivity analysis on all credible options, by varying one or more inputs and/or assumptions. | NA |

[22] See: AER, Regulatory investment test for distribution: Application guidelines, November 2024.

| Guidelines section | Summary of requirements | Section in the DPAR |
|---|---|---|
| 3.9.4 | If a contingency allowance is included in a cost estimate for a credible option, the RIT-D proponent must explain:<br>• the reasons and basis for the contingency allowance, including the particular costs that the contingency allowance may relate to, and<br>• how the level or quantum of the contingency allowance was determined. | NA |
| 3.11.2 | For a proposed concessional finance agreement to be included in the RIT stage of a project, a proponent is required to have, and provide, reasons and evidence to explain why they are confident the agreement is likely to be executed.<br>The proponent is required to also provide details about the benefit to be shared with consumers, including about how the sharing of that benefit will occur, along with supporting evidence and information to substantiate these matters.<br>If a proponent seeks to include an unexecuted concessional finance agreement in the RIT-D, they must undertake sensitivity testing for the scenario the agreement doesn't eventuate. | NA |
| 4.1 | RIT-D proponents are required to describe in each RIT-D report:<br>• their assessment of the requirement for community engagement, including reasons for that assessment, and<br>• as applicable:<br>– how they have engaged with community stakeholders and sought to address any relevant concerns identified through this engagement<br>– how they plan to engage with these stakeholder groups | 3.3 |

# Appendix B – Process for implementing the RIT-D

For the purposes of applying the RIT-D, the NER establishes a three-stage process: (1) the Non-Network Options Report (or notice circumventing this step); (2) the DPAR; and (3) the FPAR. This process is summarised in the figure below.



# Appendix C – Market benefit classes considered not material

The market benefits that Ausgrid considers will not materially affect the outcome of this RIT-D assessment include:

- changes in the timing of unrelated expenditure;
- changes in voluntary load curtailment;
- changes in costs to other parties;
- changes in load transfer capability and capacity of embedded generators to take up load;
- option value;
- changes in electrical energy losses; and
- changes in Australia's greenhouse gas emissions.

The reasons why Ausgrid considers that each of these categories of market benefit is not expected to be material for this RIT-D are outlined in the table below.

### Table C.0.1 – Market benefit categories under the RIT-D not expected to be material

| Market benefits | Reason for excluding from this RIT-D |
|---|---|
| Timing of unrelated expenditure | The options are not expected to affect the timing or amount of any other expenditure for unrelated needs. |
| Changes in voluntary load curtailment | The level of voluntary load curtailment currently present in the National Electricity Market is limited. Where the implementation of a credible option affects pool price outcomes, and in particular results in pool prices reaching higher levels on some occasions than in the base case, this may have an impact on the extent of voluntary load curtailment.<br><br>None of the options in this RIT-D are not expected to affect the pool price and so there is not expected to be any changes in voluntary load curtailment. |
| Costs to other parties | This category of market benefit typically relates to impacts on generation investment from the options. The options in this RIT-D will not affect the wholesale market and so we have not estimated this category of market benefit. |
| Changes in load transfer capacity and embedded generators | Load transfer capacity between substations is predominantly limited by the high voltage feeders that connect substations. The options under consideration do not affect high voltage feeders and therefore are unlikely to materially change load transfer capacity. While Option 2 reduces the load transfer capacity in our network (given the Gore Hill ZS load is transferred), we do not consider this material to the outcome of the RIT-D (given this is the least preferred option), as these loads are relatively small compared to the magnitude of loads from major customers connected and connecting to Willoughby STS.<br><br>Consequently, Ausgrid has not attempted to estimate any benefits from changes in load transfer capacity and embedded generators. |

| | |
|---|---|
| Option value | Option value arises where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change, and the credible options considered are sufficiently flexible to respond to that change.<br><br>Option 1 does not involve stages or any other flexibility and so we do not consider that option value is relevant for it.<br><br>While Option 2 involves a second stage, it is driven by the age and condition of the switchroom, as opposed to an external driver that Ausgrid would learn about and be able to respond to in the future. We therefore do not consider Option 2 to have the requisite flexibility to justify modelling option value, and we note that the sensitivity outlined in section 5.4.1 goes towards this and shows that, even if the building lasts longer than currently expected, Option 2 is not preferred. |
| Changes in electrical energy losses | Ausgrid does not expect that the credible options considered will lead to significant changes in network losses and so have not estimated this category of market benefits. |
| Changes in Australia's greenhouse gas emissions | None of the options are expected to result in materially different levels of greenhouse gas emissions (including sulphur hexafluoride (SF6) emissions), as they do not affect either the pattern of generator dispatch in the wholesale market or the level of expected SF6 leakages from network assets. |

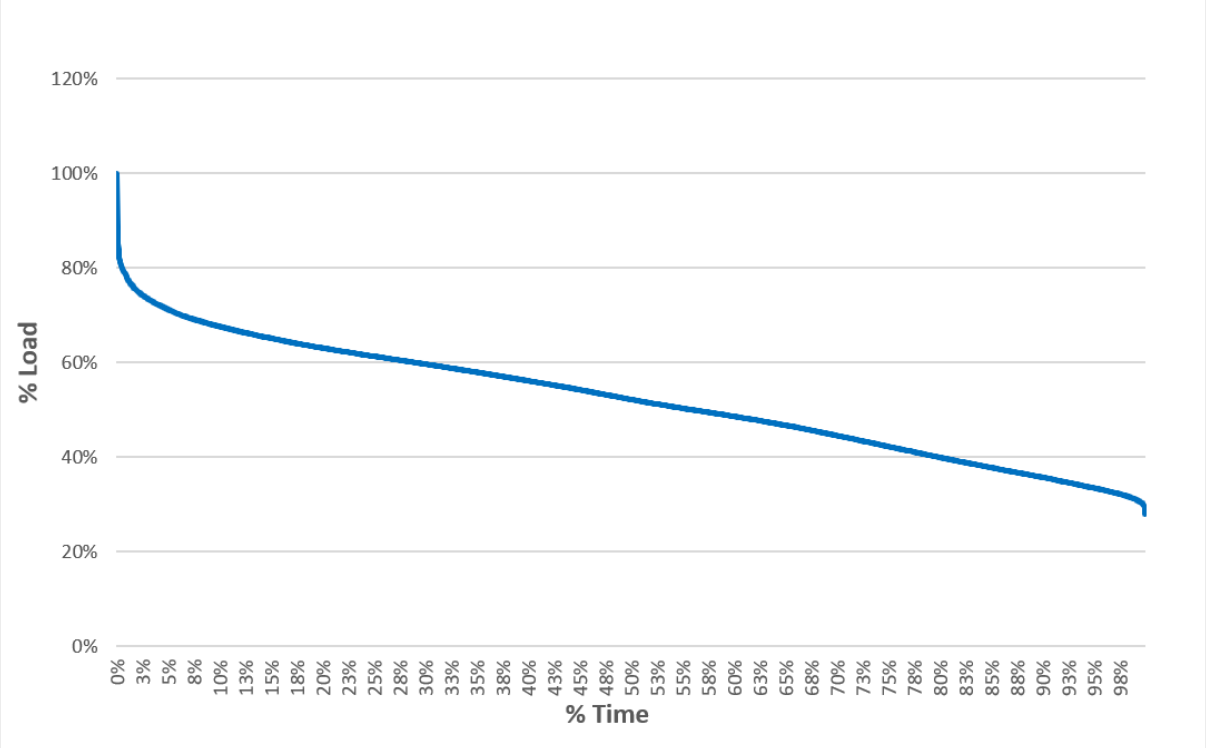
# Appendix D – Additional detail on the assessment methodology

This appendix provides additional detail on key input assumptions that are used in the evaluation of the base case and the credible options.

## D.1 Characteristic load duration curve

The load duration curve used in the analysis is presented in the figure below. It is assumed that the load types supplied will not change substantially into the future and therefore the load duration curve will maintain its characteristic shape.

**Figure D.1 – Load duration curve**




## D.2 Load transfer capacity and supply restoration

Willoughby STS load area is classified as urban and has 33kV connections with Chatswood and Gore Hill zone substations. For load transfer capacity, the cost benefit analysis only considered Sydney Metro (North West Rail Link), which has a current forecast of undiversified load of 11.19MW.

In the event of an equipment outage, the network may be returned to a normal configuration by one of the following actions:

- repairing the failed equipment
- initiating a contingency plan
- replacing the failed equipment with spares.

The assumed supply restoration actions and the time taken to implement the action are detailed in the table below. These actions are the most likely actions for the contingencies considered in this planning study.

**Table D.1 – Supply restoration assumptions**

| Equipment outage | Action | Time |
|---|---|---|
| 33kV switchgear failure | Repair – the circuit breaker / isolator is repaired on site. | 408 hours<br>600 hours for complex cases |

## D.3 Safety risk assumptions

Safety risk costs are predicated on the consequence of a severe safety event occurring, the probability of exposure to the of consequence of a severe safety event, and the probability of failure.

Ausgrid estimates the consequence of a severe safety event occurring to be $5.86 million for an event (Value of Statistical Life updated by the Australian Government in November 2024, escalated to 2025/26 dollars), which reflects the severe consequence of an explosive failure of switchgears at Willoughby STS that would lead to a number of fatalities. A gross disproportion factor of 6 is used, which is of accepted practice for balancing workers and public safety risks.

The probability of exposure to a severe event is estimated to be 0.02 annually, which equates to approximately one event in every 50 years. This is made up of 20 site visits for eight-hour periods each (160 hours annually), which translates to a probability of 0.0183 annually. Only 10 per cent of the exposure is expected be categorised as severe, resulting in a probability of exposure to a severe event of 0.00183 annually.

The probability of exposure is multiplied by the probability of occurrence of equipment failure described below.

## D.4 Probability of failure

Ausgrid has adopted probability models to estimate expected failure of different network assets. A summary of the models adopted, and the key parameters used are summarised in the table below.

**Table D.2 – Summary of failure probability models used to estimate failure probability.**

| Network asset type | Failure probability model | Key parameters |
|---|---|---|
| 33kV switchgear | Weibull analysis | Age of switchboard.<br>Age of functional failure of failed switchboard.<br>Age of retirement for switchboard that were retired before the point of failure. |

The failure rate of the switchgear equipment is expressed in terms of the Weibull distribution parameters given below.

**Table D.3 – Switchboard parameters for the Weibull analysis**

| Equipment | Condition | Shape | Scale |
|---|---|---|---|
| 33kV Bulk Oil Circuit Breakers | Poor | 4.88 | 58.3 |

The following equation is used to calculate the yearly major failure rates based on the Weibull parameters related to the subtransmission substation 33kV bulk oil circuit breaker.

**Equation 1**

$$f = \left(\frac{\beta}{\mu}\right) \times \left(\frac{t}{\mu}\right)^{(\beta-1)}$$

Where:

$f$ is the failure rate

$t$ is the age (in years)

$\beta$ is the shape parameter

$\mu$ is the scale parameter

Equation 2 shows how the failure rate is used to calculate unavailability for failures.

**Equation 2**

$$U = \frac{f \times MTTR_{weeks}}{52 + f \times MTTR_{weeks}}$$

Unavailability of each network element is calculated for pre switching and post switching scenarios, by using Equations 3 and 4.

**Equation 3**

$$Pre - switching\ unavailability = \frac{8760 \times \lambda \times r_s}{f \times r_r + 8760}$$

**Equation 4**

$$Post - switching\ unavailability = \frac{8760 \times \lambda \times (r_r - r_s)}{f \times r_r + 8760}$$

Where:

| | |
|---|---|
| $f$ | is the failure rate |
| $r_s$ | is the switching time (in hours) |
| $r_r$ | is the repair time (in hours)] |

Ausgrid