Addressing increased customer demand requirements in the Rozelle area

FINAL PROJECT ASSESSMENT REPORT

14 DECEMBER 2018

Ausgrid

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Addressing increased customer demand requirements in the Rozelle area

Final Project Assessment Report – December 2018

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Executive Summary

This report investigates the most economic option for meeting the increased customer demand requirements in the Rozelle area

This Final Project Assessment Report (FPAR) has been prepared by Ausgrid and represents the final step in the application of the Regulatory Investment Test for Distribution (RIT-D) to options for ensuring the growing customer demand in Rozelle supply area is addressed in the most economic manner.

The future combined load is forecast to increase from several major customers in the Rozelle supply area and is anticipated to place significant constraints on the existing Rozelle subtransmission substation (STS) and the associated network. In particular, Roads and Maritime Services (RMS) has submitted connection requests for permanent firm electricity supply (N-1 supply) associated with the approved WestConnex Rozelle Interchange (Stage 3B of the WestConnex motorway project) and for the proposed Western Harbour Tunnel project. In addition, there are other significant load requirements currently foreshadowed at the vicinity of the Rozelle area, such as the redevelopment of the White Bay area, which is part of a broader initiative that is likely to integrate a future metro station and harbour activities into urban renewal plans.

Ausgrid has released a draft report in October 2018 and received no submissions

A Draft Project Assessment Report (DPAR) for this RIT-D was published on 26th October 2018. The DPAR presented one credible option for addressing the growing customer demand in the Rozelle area, assessed in accordance with the RIT-D framework and concluded that the preferred option was to upgrade the existing subtransmission substation (STS).

The DPAR called for submissions from parties by 7th December 2018. However, no submissions were received on either the DPAR or the separate non-network screening notice.

This report therefore re-presents the assessment in the draft report and maintains the conclusion that Option 1 is the preferred option

Ausgrid has identified one credible network option to address the increased customer demand requirements identified in the Rozelle area. This option involves:

- installation of a new 33kV switchgear arrangement capable to enable expansion in the future in a new switchroom building to be located on the existing Rozelle STS site;
- replacement of the existing 132/33kV 30MVA transformer No.2 with a new 60MVA unit;
- construction of new transformer bays to contain the existing and the replacement transformer;
- trenching work to install 33kV ductlines and cables to enable connection of existing and new customers; and
- transfer of the existing 33kV supply of Sydney Trains to the new switchgear and facilitate new 33kV connections.

The estimated capital cost of this option is $23.2 million in $2018/19, with operating costs expected to be around $116,000 per year. Construction is anticipated to begin in 2018/19, with planned commissioning in 2021/22.

Ausgrid considers that this FPAR, 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.

Next steps

Ausgrid intends to commence construction in 2018/19, with commissioning scheduled for 2021/22 to meet customers' requirements.

Any queries relating to this Final Project Assessment Report should be addressed to:

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1 Introduction

This Final Project Assessment Report (FPAR) has been prepared by Ausgrid and represents the final step in the application of the Regulatory Investment Test for Distribution (RIT-D) to options for addressing the expected capacity constraint in the Rozelle supply area in the near future.

Ausgrid has received connection applications from Roads and Maritime Services (RMS) to provide permanent firm electricity supply (N-1 supply) for the Rozelle Interchange (Stage 3B of the WestConnex motorway project) and for the proposed Western Harbour Tunnel project. These loads are significant and the available spare 11kV capacity in the area is not sufficient to support the expected load growth. Given the magnitude and supply redundancy requirements of the other expected load growth in the area, which includes other significant infrastructure/redevelopment works currently foreshadowed at the vicinity of the Rozelle network area, it is considered that a long term 33kV supply strategy is the most efficient way to supply these additional requirements going forward. Ausgrid considers that the growing customer demand in the area is most efficiently met by upgrading the existing Rozelle 132/33kV subtransmission substation (STS).

Ausgrid commenced consultation with the Inner West Council in late 2017 and a community consultation plan in March 2018 which included an information session, newsletters and updates to the broader community. Ausgrid will keep the community informed as the project progresses through notification letters and the Ausgrid website.

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 final report

Ausgrid has prepared this FPAR in accordance with the requirements of the NER under clause 5.17.4. It is the first stage of the formal consultation process set out in the NER in relation to the application of the RIT-D.

The purpose of the FPAR is to:

- describe the identified need Ausgrid is seeking to address, together with the assumptions used in identifying it;
- 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;
- provide reasons why Ausgrid has determined that classes of market benefits or costs do not apply to a credible option(s);
- present the results of a net present value analysis of each credible option and accompanying explanation of the results; and
- identify the proposed preferred option.

This FPAR follows the DPAR released in October 2018. The FPAR represents the final stage of the formal consultation process set out in the NER in relation to the application of the RIT-D as outlined in Appendix B. The entire RIT-D process is detailed in Appendix B.

1.2 No submissions were received on the DPAR

The DPAR presented a single credible option for addressing the growing customer demand in the Rozelle area. This preferred option includes the installation of new 33kV switchgear, replacement of an existing 132/33kV 30MVA transformer and construction of new transformer bays.

The DPAR also summarised Ausgrid's assessment of the ability of non-network solutions to contribute, which concluded that such solutions were not viable for this particular RIT-D. The DPAR was accompanied by a separate non-network screening notice which provided further detail on this assessment, in accordance with clause 5.14.4(d) of the NER.
The DPAR called for submissions from parties by 7th December 2018. However, no submissions were received on either the DPAR or the separate non-network screening notice.

1.3 Contact details for queries in relation to this RIT-D

Any queries in relation to this RIT-D should be addressed to:

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email to: assetinvestment@ausgrid.com.au

2 Description of the identified need

Ausgrid has received connection applications from RMS to provide N-1 supply for the Rozelle Interchange (Stage 3B of the WestConnex motorway project) and, more recently, for the proposed Western Harbour Tunnel. In accordance with section 5.3 of the NER, Ausgrid has an obligation to connect this customer into the network. In addition, there are other significant infrastructure and redevelopment works currently foreshadowed at the vicinity of the Rozelle area, such as the redevelopment of the White Bay area, which is part of a broader initiative that is likely to integrate a future metro station and harbour activities into urban renewal plans.

This section provides a description of the network area and the 'identified need' for this RIT-D.

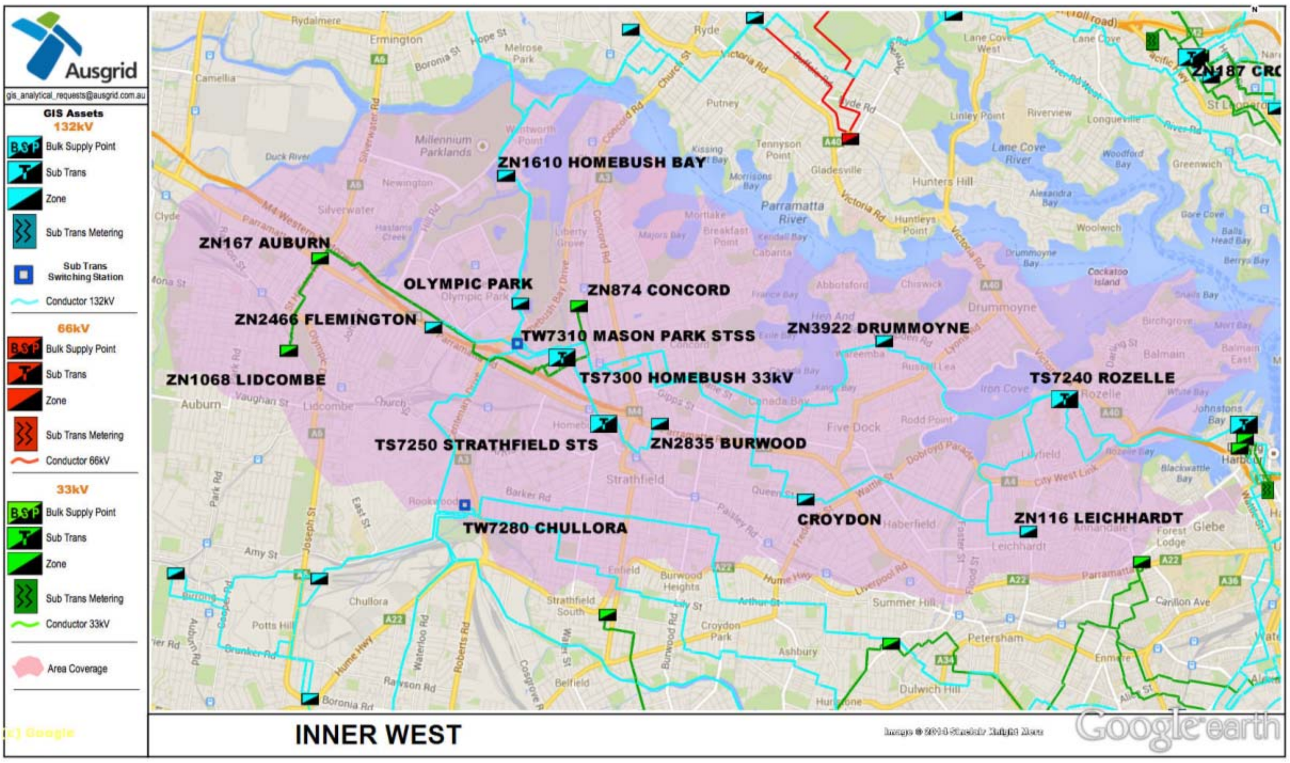
2.1 Overview of the Inner West network

The Inner West network area extends from Homebush Bay in the north, to Rozelle and Leichhardt in the south east. The area is divided by parts of the harbour and the Parramatta River. Parramatta Road runs through the southern part of the area. The Inner West is currently a mix of residential, commercial and industrial land use.

The network in this area is currently supplied from TransGrid's transmission system at Sydney North Bulk Supply Point (BSP) and via Chullora subtransmission switching station (STSS) from Beaconsfield BSP and Sydney South BSP.

The map below illustrates the Inner West network area.

Figure 2-1 – Inner West geographical network area



The Rozelle area, along the eastern boundary of the Inner West area will contain significant commercial load arising from the following developments:

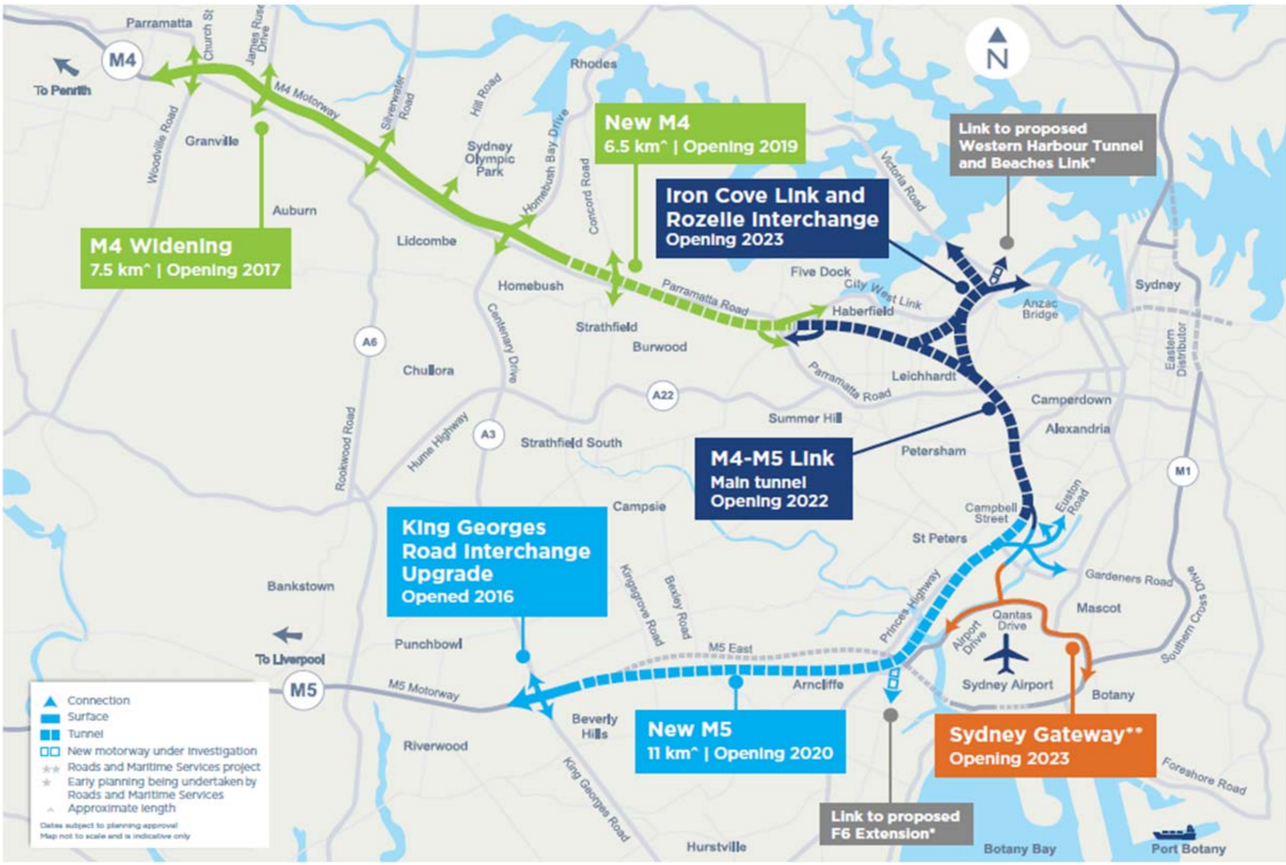
- major transport infrastructure services (i.e. the WestConnex motorway, and possibly the Western Harbour Tunnel and the Sydney Metro West projects) in the short and medium term; and
- Urban Growth NSW Bays West development, which includes urban renewal activities at White Bay, Rozelle Bay and the former Rozelle Rail Yards in the long term.

Whilst some of these developments are prospective and therefore their timing is yet to be established, commercial development is expected to mature in the medium term as a result of the active infrastructure construction of the WestConnex motorway.

2.2 Overview of the proposed motorway projects and load requirements

The WestConnex project involves the construction of a 33km tollway that will link Sydney's West with the airport and Port Botany precinct. The project has been split into three stages, being Stage 1 the M4 extension, Stage 2 the M5 East Corridor extension and Stage 3 the M4-M5 link (i.e. Stage 3A) and the Rozelle Interchange (i.e. Stage 3B)[1]. A general overview of the project is shown in the figure below.

Figure 2-2 – Overview of the WestConnex motorway project



Work is well advanced to provide permanent electricity supply to Stage 1 (26MVA from Homebush STS) and Stage 2 (36MVA from Alexandria STS). For Stage 3, a formal application was received in 2017 requesting permanent N-1 supply for the following purposes:

- 38MVA for the M4-M5 link Main Tunnel (Stage 3A); and
- 33MVA for the Rozelle Interchange (Stage 3B).

Electricity supply is required for these components of Stage 3 for tunnel ventilation, pumps and lighting at two separate points: one at the vicinity of St Peters and the other at the vicinity of Rozelle. The scale of expected load and supply redundancy requirements is such that it will cause significant constraints on the existing Ausgrid 11kV network, and therefore subtransmission supply is required to meet the proposed load requirements.

Whilst there is available 33kV supply at the vicinity of St Peters for Stage 3A (i.e. from Alexandria STS), an augmentation of the subtransmission network supplying the Rozelle area will be required for Stage 3B.

In addition, the Western Harbour Tunnel[2] would include a new tunnel from the Rozelle Interchange, under the Sydney Harbour, to the Warringah Freeway and a major upgrade of the Warringah Freeway between Willoughby Road and the northern approach to the Sydney Harbour Bridge. The project will deliver a new crossing of Sydney Harbour, creating a Western bypass of the Sydney CBD to take pressure of the congested Sydney Harbour Bridge, ANZAC Bridge and Western Distributor corridors.

[1] Details of the overall motorway project are available at https://www.westconnex.com.au/.

[2] This project is currently at planning stage. Community engagement on the proposed reference design has commenced in October 2018 (https://www.rms.nsw.gov.au/projects/sydney-north/western-harbour-tunnel-beaches-link/index.html).

2.3 Existing supply arrangements in the Rozelle area

Rozelle 132/33kV STS is situated close to the point at which Victoria Road crosses the Parramatta River. It predominantly functions as a 132kV transmission switching station, interconnecting Drummoyne, Leichhardt, Croydon, Pyrmont and City Central substations.

Currently, the 33kV supply at Rozelle STS is solely dedicated to provide electricity to the Sydney Trains network, and there is no 33kV busbar. Electricity distribution to Rozelle and adjacent suburbs is provided at 11kV, and there is no other accessible 33kV source in this area.

The figure below shows an overview of the existing Rozelle STS, highlighting its 132kV and 33kV feeder connections.

Figure 2-3 – Overview of Rozelle STS

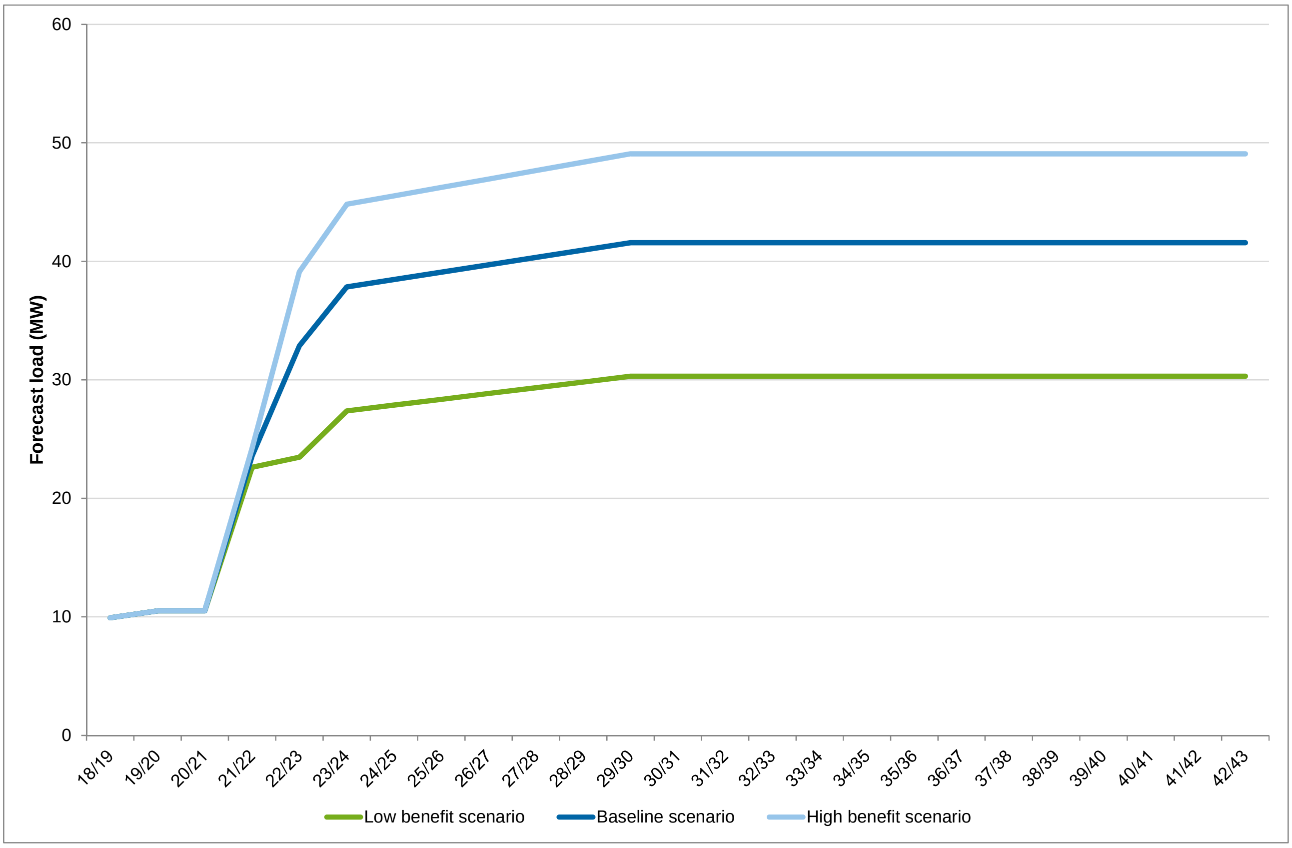
Rozelle STS has space available for expansion and is located at a point that is suitable to service a significant load such as the Rozelle Interchange. It is anticipated that the Rozelle Interchange will require permanent N-1 electricity supply to begin test and trials in 2022, ahead of opening the motorway link to traffic in 2023.

It is expected that the Western Harbour Tunnel will require permanent N-1 electricity supply few years later. In addition, there are other large expected loads associated with the redevelopment of urban areas[3] such as White Bay and Rozelle Bay, for which Rozelle STS is also well located to service these loads. In turn, it is likely that urban renewal plans will integrate a new metro station in the Bays Precinct, for which supply for the construction and operation can be provided from Rozelle STS.

Figure 2-4 outlines three scenarios for these expected loads in the Rozelle area. Included in the baseline scenario forecast are loads for Sydney Trains, Rozelle Interchange, Western Harbour Tunnel and White Bay redevelopment. The high benefit scenario includes all loads in the baseline scenario plus new commercial load in the White Bay area. The low benefit scenario forecast includes Sydney Trains, Rozelle Interchange and White Bay redevelopment. At this stage, the forecast scenarios exclude load from a possible Metro station or traction supply.

[3] A description of this urban renewal initiative is available at the following link https://thebayssydney.nsw.gov.au/

Figure 2-4 – Demand forecast in the Rozelle area



2.4 Statement on the 'identified need' and Ausgrid's obligation to connect customers

This RIT-D has been initiated to investigate, and consult, on how to most efficiently allow the connection of the new major loads requesting connection in the Rozelle area. Importantly, no construction will commence until material components of connection agreements contracts have been executed.

Ausgrid has a requirement to connect customers under section 5.2.3(d) of the NER, which states that "A Network Service Provider must:

(1) Review and process applications to connect or modify a connection which are submitted to it and must enter into a connection agreement…

(6) Permit and participate in commissioning of facilities and equipment which are to be connected to its network in accordance with rule 5.8;"

Specific tariff arrangements will be established to recover the majority of the cost of the augmentation from the beneficiaries (i.e. the new customers), taking into account their share in the capacity added to the network.

These customers will be charged a cost reflective network price, determined specifically from this network augmentation investment, plus allocated costs from the use of the upstream system - i.e. through 'Network Use of System (NUOS) charges.

3 One credible option has been identified to address the need

This section describes the credible option Ausgrid has identified as part of its network planning activities to date. Other options could technically address the identified need, but are unable to meet the customer required connection date or cost significantly more without providing corresponding increases in benefits. Ausgrid has therefore identified only one credible option as other options are deemed non-credible on the basis they do not meet the customer's requirements or are not economically feasible. More details of other options considered are set out in section 3.2.

Ausgrid has considered whether there are non-network options that could address the identified need. However, non-network options cannot address the significant load requirements by customers. Ausgrid has therefore published a non-network screening notice setting out that a non-network option is unlikely to exist.

The identified credible option involves upgrading Rozelle 132/33kV STS by constructing a new building to accommodate new 33kV switchgear equipment in a configuration that can be expanded in the future (if required by additional loads) and replacing one of the two 132/33kV transformers on site. This option is able to meet the customer's required load and timing. Table 3.1 provides a summary of this option. All costs in this section are in $2018/19, unless otherwise stated.

Table 3.1 – Summary of the credible option considered

Option details	Key components	Capital Cost	Completion date
Option 1 – Rozelle STS upgrade	Installation of new 33kV switchgear arrangement (expandable configuration) in a new building on the Rozelle STS site Replacement of one of the two transformers on site with a 60MVA unit Rebuild transformer bays to contain the existing and the replacement transformer Transfer of the existing 33kV supply of Sydney Trains to the new 33kV switchgear and installation of ductlines to facilitate new 33kV customer connections	$23.2 million	2021/22

3.1 Option 1 – Rozelle STS upgrade

The option involves the installation of new 33kV switchgear in a new switchroom building to be located at the western end of the Rozelle STS site, and the replacement of existing 132/33kV 30MVA transformer No.2 with a new 60MVA unit. The new building will accommodate a 33kV switchgear arrangement suitable to meet N-1 supply requirements of the identified customers and with the capability to be expanded in the future, if new load requirements are realised. The construction work also includes new transformer bay walls and bunds/bases to contain the existing and the replacement transformer. The project will also involve trenching to install 33kV ductlines, which will exit the new building and continue along part of the nearest road (i.e. Manning Street) and which are required to connect the existing 33kV cable with the new equipment and provide new connection points for WestConnex Stage 3B and the future prospective customers.

The estimated capital cost of this option is approximately $23.2 million and its commissioning date is expected to be in 2021/22. Once the upgrade is completed, operating costs are expected to average 0.5% of the capital expenditure per annum (i.e. $116,000 per year).

Considering this project is triggered by major customers requesting network connection, specific tariff arrangements will be established to recover the cost of the shared network augmentation from beneficiaries, taking into account their share in the capacity added to the network. The cost recovery mechanism will be part of the customer connection agreements and acts as a means of mitigating against the risk of having stranded network assets. It is noted that customers will directly fund dedicated assets associated with their connections.

Ausgrid intends to undertake the upgrade works via a mix of internal and external resources. Commissioning works will be delivered using internal resources.

3.2 Options considered but not progressed

Ausgrid has considered three other options that have not been progressed, because they were found technically and/or commercially unfeasible, or unable to meet the customer's required connection date. The table below summarises Ausgrid's consideration and position on each of these potential options.

Table 3.2 – Options considered but not progressed

Options	Description	Reason why option was not progressed
Alexandria STS expansion	Works to connect new feeders to WestConnex Rozelle Interchange site Installation of a third 132/33kV 120MVA transformer on Alexandria STS Future installation of new 33kV switchgear to supply prospective requirements in the Rozelle area This option is estimated to cost Ausgrid $37 million in total ($14 million in 2019-2023 and $23 million in 2023-2027), noting that the customers will also incur in significant expenditure.	The connection of additional 33kV cables may require complex civil works (i.e. underbore) due to cable access/egress issues in the underground routes at Alexandria STS. It will not avoid the need to augment the network at Rozelle to accommodate future load requirements in this area. In addition, the customers will be required to install long distance cables on congested roads.
Construction of a new 132/33kV STS in the Rozelle area on a new site	Acquisition of a new site Construction of a two transformer 132/33kV STS Associated 132kV feeder works Installation of 33kV ductlines to facilitate customer connection This option is estimated to cost in excess of $40 million	The network component of this option is more expensive than Option 1 and it would also have an additional land cost associated with it. We therefore consider it commercially infeasible, i.e. it would cost more than Option 1 and would not provide any additional benefits. There is also uncertainty associated with the timing of the land acquisition process under this option. We are not confident that this process would be able to be completed sufficiently quickly to meet the customer requested connection date.

It should be noted that connecting these new customers to the existing 33kV arrangement at Rozelle STS is not possible because as mentioned previously in section 2.3, there is no 33kV busbar, and therefore permanent N-1 supply cannot be provided.

The existing Rozelle STS has no spare 132kV feeder bays available and requires extensive network augmentation to supply the loads at 132kV. Further, the anticipated customer developments in the area are small to medium term loads (in the order of 10MVA to 35MV) and supplying the loads at 132kV would under-utilise 132kV assets as well as limit future connections in the area.

Ausgrid has also considered the ability of non-network solutions to assist in meeting the identified need. A demand management assessment has determined that non-network options cannot cost-effectively address the need to connect the customer loads. This result is explained in detail in the separate 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 option.

4.1 General overview of the assessment framework

All costs and benefits for the credible option have been measured against a ‘do nothing’ base case. Under this base case, Ausgrid cannot supply the customer’s requested load because there is no 33kV busbar at Rozelle STS and there is no other available source of 33kV supply in the Rozelle area. Note the base case is not a realistic option as Ausgrid has an obligation to process and facilitate customer connection requirements under Section 5.2.3 in the NER. The base case is therefore included in this RIT-D for illustrative purposes only.

The RIT-D analysis has been undertaken over a 20-year period, from 2019 to 2039. Ausgrid considers that a 20-year period 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. While the capital components of the credible option have asset lives greater than 20 years, Ausgrid has taken a terminal value approach to incorporate capital costs in the assessment, which ensures that the capital cost of long-lived credible options is appropriately captured in the 20-year assessment period.

Given that no non-network options have been found to be viable, the appropriate discount rate is considered to be the regulated cost of capital. As a result, Ausgrid has adopted a real, pre-tax discount rate of 4.19 per cent, equal to the latest AER Final Decision for a DNSP’s regulatory proposal at the time of preparing this FPAR[4].

4.2 Ausgrid’s approach to estimating project costs

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

4.3 Market benefits are expected from reduced involuntary load shedding

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

The approaches and assumptions Ausgrid has made to estimate the financial impact in eliminated unserved energy are outlined in section 4.3.1 below.

Appendix C outlines the categories of market benefit that Ausgrid considers are not material for this particular RIT-D.

Avoided unserved energy (changes in involuntary load shedding)

Unserved energy (USE) 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.

The Expected Unserved Energy (EUE) is the probability weighted average amount of load that would need to be involuntarily curtailed due to system limitations (i.e. the network being overloaded). These limitations arise from the unavailability of network elements and the resulting reduction in network capacity to supply the load. It also relates to the availability of network connectivity and design configuration at the substation.

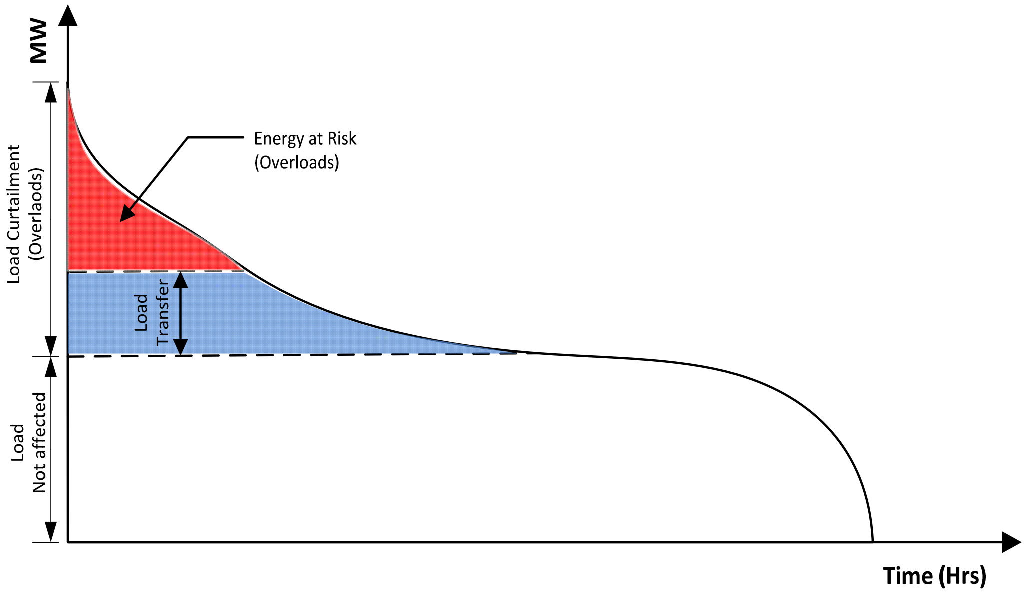
The load duration curve at a substation is used to determine the energy at risk and/or the amount of load curtailment required at certain loading levels. The amount of load curtailment can be determined by using a discrete number of load points and the capacity adequacy at the substation following various credible contingencies and/or outages (i.e. single or multiple transformers out of service).

The following diagram illustrates the load curtailment due to overloads and the treatment of load transfer capability. During an overload condition, initially the necessary amount of load is shed, and then partial load is restored via available load transfer opportunities to surrounding zone substations. Energy at risk due to overloads of the network is illustrated in

[4] See TasNetworks’ PTRM for the 2017-19 period, available at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/tasnetworks-determination-2017-2019/final-decision

the diagram below, noting that if the load cannot be supplied due to network connectivity, the load will be lost regardless its size and therefore the entire load duration curve will be used in the estimation.

Figure 4-1 – Illustration of Load Curtailment



$$Energy\ At\ Risk\ (Overloads) = Area\ of\ the\ curve\ (as\ shown\ above)$$

The calculation of the energy at risk considers the substation load forecast which includes the quantity of new additional load requested in the customer connection application. The expected unserved energy is the energy at risk weighted by the probability of each state and/or state probabilities of all credible contingencies or outages.

The market benefit of the preferred option by eliminating unserved energy with a network solution is estimated by multiplying the expected unserved energy by the Value of Customer Reliability (VCR). The VCR is measured in dollars per kWh and is used as a proxy to evaluate the economic impact of unserved energy on customers under the RIT-D.

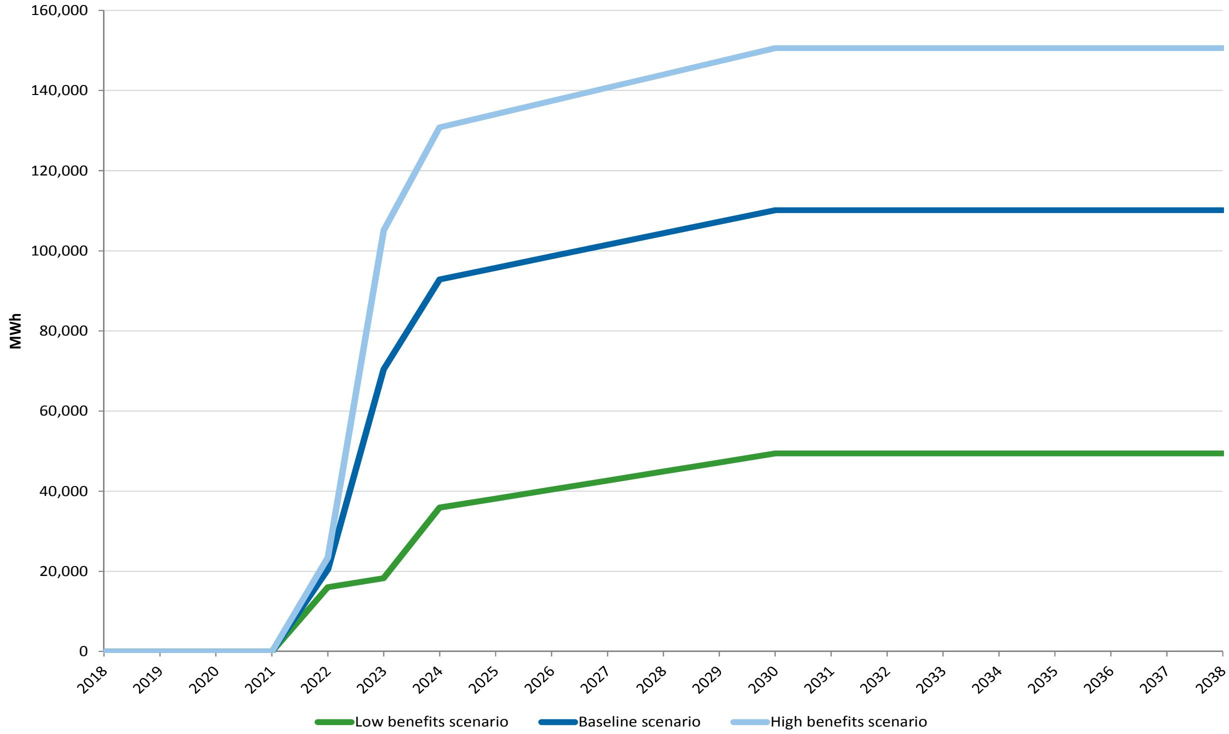
Ausgrid has applied a VCR estimate of $41/kWh, which has been derived from the 2014 AEMO VCR estimates[5]. In particular, Ausgrid has escalated the AEMO estimate to dollars of the day using the CPI. We have also investigated the effect of assuming both a lower and higher underlying VCR estimate. The AEMO Value of Customer Reliability – Application Guide[6] recommends using values of ± 30% of the base case VCR for the purposes of testing how sensitive investment decisions are to the VCR input. Thus, a lower VCR of $29/kWh and a higher VCR of $53/kWh have been chosen as reasonable for the low and high benefit scenarios.

High and low forecasts are derived from varying the timing and magnitude of the new customer loads. The load forecast is primarily impacted by the magnitude of the concurrent loads associated to major infrastructure services and the redevelopment of the Bays areas. Included in the baseline scenario forecast are loads for Sydney Trains, Rozelle Interchange, Western Harbour Tunnel and White Bay redevelopment. The high benefit scenario includes all loads in the baseline scenario plus new commercial load in the White Bay area. The low benefit scenario forecast includes Sydney Trains, Rozelle Interchange and White Bay redevelopment.

Figure 4-2 shows the assumed levels of expected unserved energy at the expected demand forecast scenario over the next twenty years. For clarity, this figure illustrates the MWh of unserved energy assumed if no credible option is commissioned. The level of USE is kept at the value in the tenth year for all remaining years in the assessment period. This recognises that in reality action would be taken before this occurred, and does not affect identification of the preferred option.

[5] AEMO, *Value of Customer Reliability Review*, September 2014, Final Report.
[6] AEMO, *Value of Customer Reliability – Application Guide*, December 2014, Final Report, section 3.4, p. 15.

Figure 4-2 – Assumed level of USE under each of demand forecast scenarios



4.4 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. Ausgrid has elected to assess three alternative future scenarios – namely:

- low benefit scenario – Ausgrid has adopted a number of assumptions that give rise to a lower bound NPV estimate for each credible option, in order to represent a conservative future state of the world with respect to potential market benefits that could be realised under each credible option;
- baseline scenario – the baseline scenario consists of assumptions that reflect Ausgrid's central set of variable estimates which, in Ausgrid's opinion, provides the most likely scenario; and
- high benefit scenario – this scenario reflects an optimistic set of assumptions, which have been selected to investigate an upper bound on reasonably expected market benefits.

Given that no non-network options have been found to be viable, Ausgrid considers the appropriate discount rate is the regulated cost of capital, which is equivalent to 4.19 per cent at the time of preparing this FPAR and is used across all scenarios investigated.

A summary of the key variables in each scenario is provided in Table 4.1.

Table 4.1 – Summary of the three scenarios investigated

Variable	Scenario 1 – baseline	Scenario 2 – low benefits	Scenario 3 – high benefits
Load Growth	Expected load growth (includes Sydney Trains, Rozelle Interchange, Western Harbour Tunnel and White Bay redevelopment)	Lower than expected growth (includes Sydney Trains, Rozelle Interchange and limited White Bay redevelopment)	Higher than expected growth (expected load growth plus new commercial load in the White Bay area)
Capital Cost	100 per cent of capital cost estimate	125 per cent of capital cost estimate	75 per cent of capital cost estimate
VCR	$41/kWh (Derived from AEMO VCR estimate of $38.35/kWh at state level, CPI indexed)	$29/kWh (30 per cent lower than AEMO VCR estimate)	$53/kWh (30 per cent higher than AEMO VCR estimate)

Ausgrid considers that the baseline scenario is the most likely, since it is based primarily on a set of expected/central assumptions. Ausgrid has therefore assigned this scenario a weighting of 50 per cent, with the other two scenarios being weighted equally with 25 per cent each. However, Ausgrid notes that the identification of the preferred option is the same across all three scenarios, i.e. the result is insensitive to the assumed scenario weights.

5 Assessment of credible options

This section provides a description of the credible network option Ausgrid has identified as part of its network planning activities to date. The option is compared against a base case 'do nothing' option.

5.1 Gross market benefits estimated for the credible option

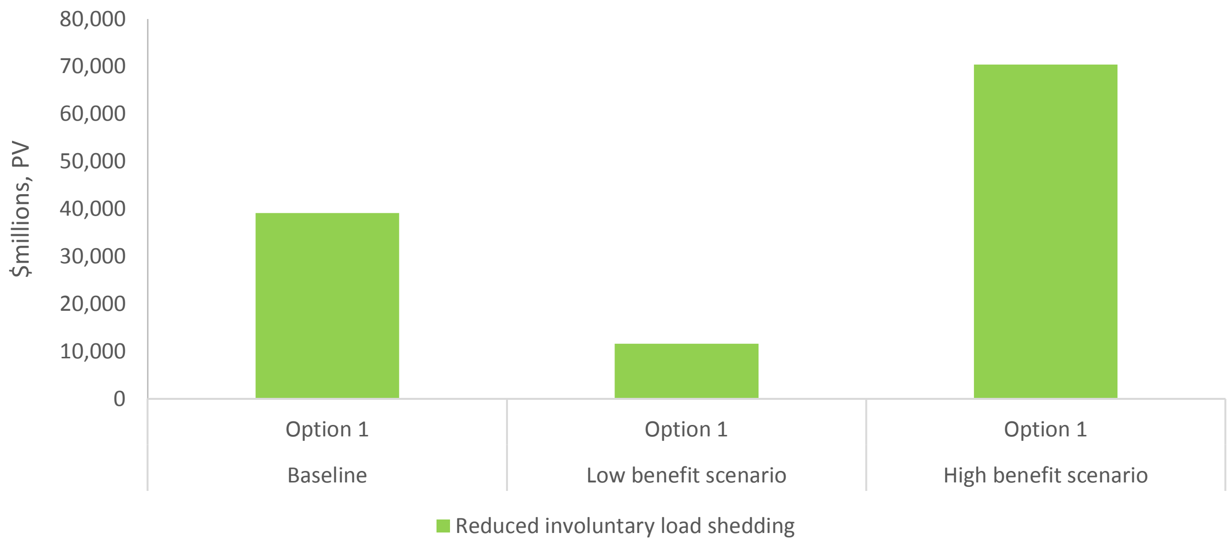
The table below summarises the gross benefit of Option 1 relative to the 'do nothing' base case in present value terms. The gross market benefit for each option has been calculated for each of the three reasonable scenarios outlined in the section above.

Table 5.1 – Present value of gross benefits of Option 1 relative to the base case, $m 2018/19

Option	Baseline scenario	Low benefit scenario	High benefit scenario	Weighted benefits
Scenario weighting	50%	25%	25%	
Option 1	39,117	11,602	70,362	40,049

The figure below provides a breakdown of all benefits relating to each credible option. In this case, the only relevant market benefit is the avoidance of unserved energy.

Figure 5-1 – Present value of estimated benefits relative to the base case, PV $m 2018/19



5.2 Estimated costs for each credible option

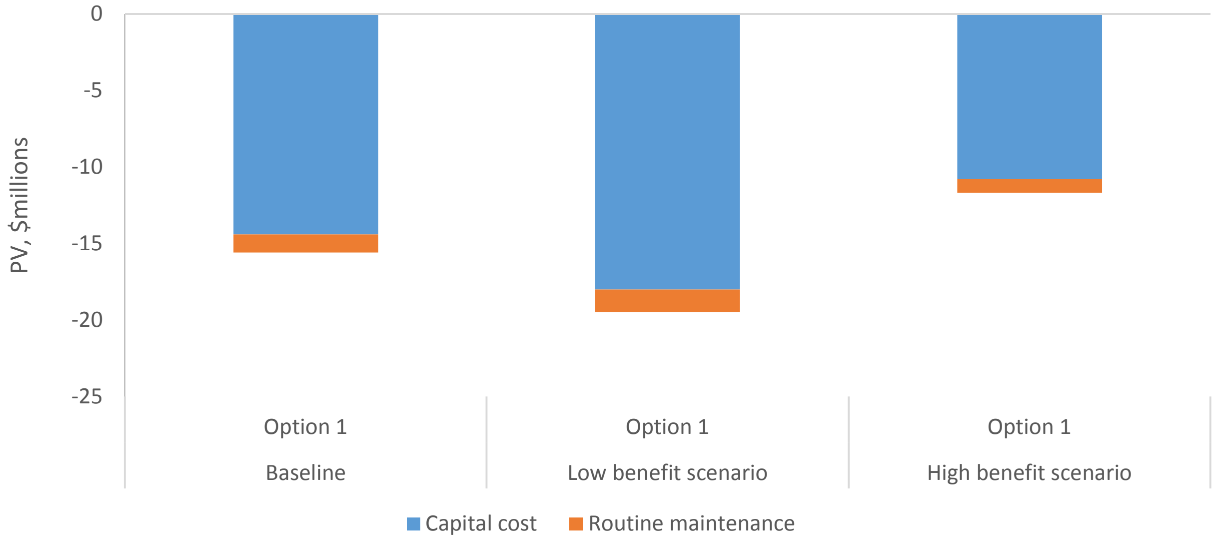
The table below summarises the costs of Option 1 relative to the base in present value terms. The cost is mostly capital expenditure and also includes operating costs. The cost has been calculated for each of the three reasonable scenarios, in accordance with the approaches set out in Section 4.

Table 5.2 – Present value of costs of Option 1 relative to the base case, NPV $m 2018/19

Option	Baseline scenario	Low benefit scenario	High benefit scenario	Weighted costs
Scenario weighting	50%	25%	25%	
Option 1	-15.6	-19.5	-11.7	-15.6

The figure below provides a breakdown of costs relating to each credible option. Capital cost is the predominant expenditure incurred under Option 1.

Figure 5-2 – Present Value of costs of each credible option relative to the base case, PV $m 2018/19



5.3 Net present value assessment outcomes

The table below summarises the net market benefit in NPV terms for Option 1 under each scenario. The net market benefit is the gross market benefit (as set out in Table 5.1) minus the cost of each option (as set out in Table 5.2), all in present value terms. Overall, Option 1 demonstrates net economic benefits, driven by avoiding unserved energy.

Table 5.3 – Present value of weighted net benefits relative to the base case, $m 2018/19

Option	Weighted PV costs	Weighted PV benefits	Weighted NPV of Market Benefit
Option 1	-15.6	40,049.2	40,033.7

Ausgrid notes that the project trigger year is dependent on the WestConnex project requirement date outlined in their connection application, as Ausgrid has an obligation to facilitate the customers' connection and due to the absence of a 33kV busbar at the existing Rozelle STS or other accessible 33kV source in the area.

Ausgrid has conducted sensitivity analysis on the overall NPV of the net market benefit, testing the following factors:

- a lower than expected and higher than expected load growth;
- a lower than expected and higher than expected capital cost; and
- a lower VCR ($29/kWh) and a higher VCR ($53/kWh).

The results of the sensitivity test are presented in the table below, showing that Option 1 has positive net market benefit across all variables.

Table 5.4 – Sensitivity testing results, $m PV 2018/19

Sensitivity	Option 1
Baseline	**39,101**
25 per cent lower capital cost	**39,105**
25 per cent higher capital cost	**39,097**
VCR $53/kWh	**50,836**
VCR $29/kWh	**27,366**

6 Proposed preferred option

Option 1 has been found to be the preferred option, which satisfies the RIT-D. Ausgrid is the proponent for Option 1 and is currently in consultation with the community and the Inner West Council. A community consultation plan was initiated in March 2018 and included a community information session, as well as newsletters and updates to the broader community.

The scope of works Option 1 involves:

- installation of new 33kV switchgear arrangement sufficient to supply currently understood loads, capable of expansion in the future, in a new switchroom building to be located at the western end of the existing Rozelle STS site;
- replacement of the existing 132/33kV 30MVA transformer No.2 with a new 60MVA unit;
- construction of new transformer bay walls and bunds/bases to contain the existing and the replacement transformer;
- Trenching work to facilitate the transfer of the existing 33kV supply of Sydney Trains and the connection of the new customers.

The estimated capital cost of this option is $23.2 million. Ausgrid notes that these upgrade works will be a shared network asset which will become part of Ausgrid's Regulatory Asset Base. Specific tariff arrangements will be established to recover the cost of the augmentation from the beneficiaries (i.e. the new customers), taking into account their share in the capacity added to the network.

These customers will be charged a cost reflective network price, determined specifically from this network augmentation investment, plus allocated costs from the use of the upstream system - i.e. through 'Network Use of System (NUOS) charges. It is noted that customers will directly fund the dedicated assets associated with their connections.

Construction of Option 1 will only commence once material components of connection agreement contracts have been executed. The construction is anticipated to commence in 2018/19, with commissioning in 2021/22.

Figure 6-1 – Location of Rozelle STS in relation to new customers

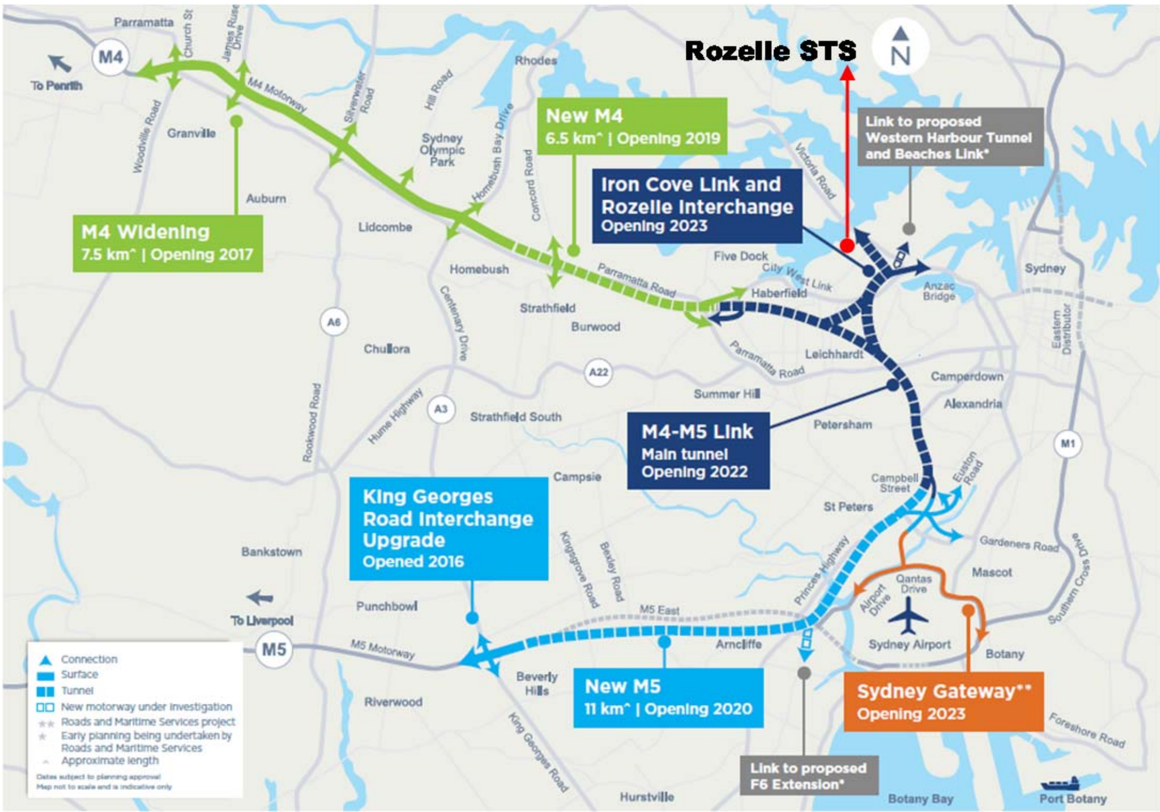


Figure 6-2 – Site map outlining proposed upgrades to Rozelle STS

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

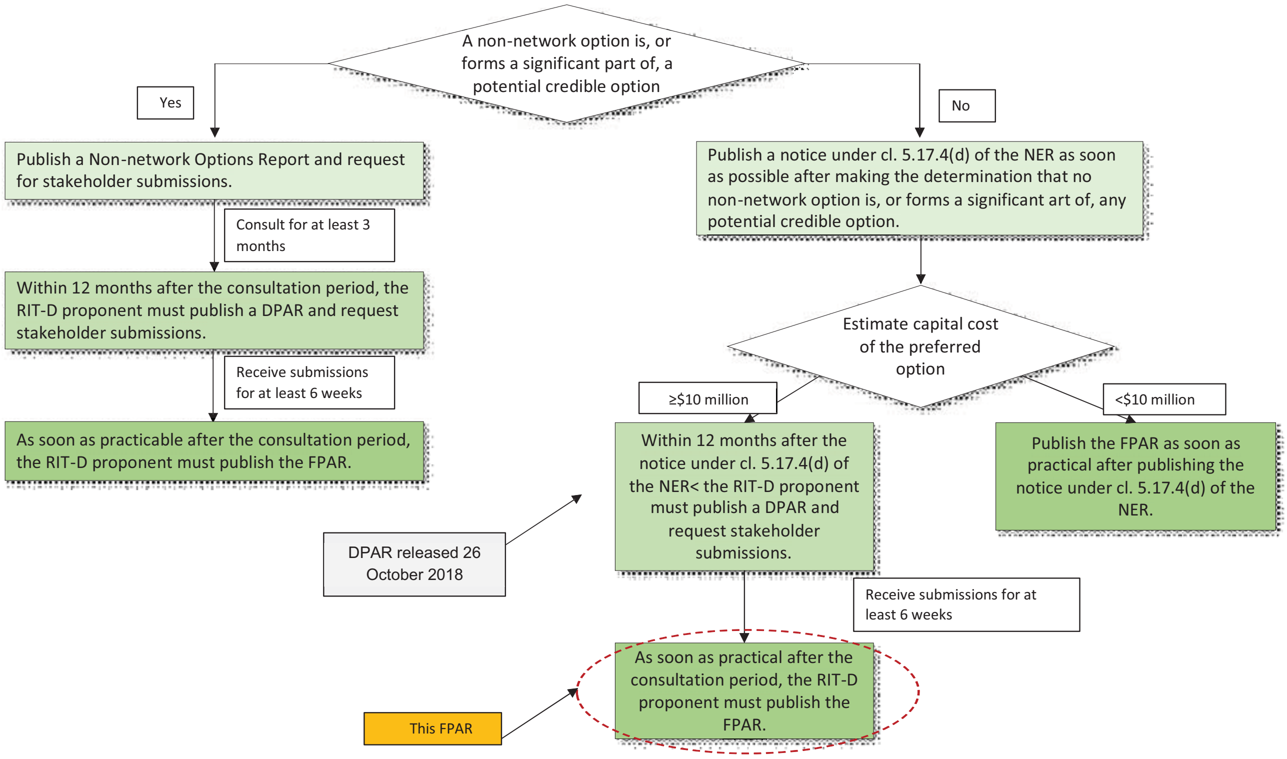
Appendix A – Checklist of compliance clauses

This section sets out a compliance checklist that demonstrates the compliance of this FPAR with the requirements of clause 5.17.4(r) of the National Electricity Rules version 107.

Rules clause	Summary of requirements	Relevant sections in the FPAR
5.17.4(r)	The matters detailed in that report as required under 5.17.4(j)	See rows below
5.17.4(j)	A summary of any submissions received on the DPAR and the RIT-D proponent's response to each such submission	Section 1.2
	(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;	5.1
	(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
	(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: (i) details of technical characteristics; (ii) the estimated construction timetable and commissioning date (where relevant); (iii) the indicative capital and operating cost (where relevant); (iv) a statement and accompanying detailed analysis that the proposed preferred option satisfies the regulatory investment test for distribution; and (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 final report may be directed.	1.3

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 FPAR; and (3) the FPAR. This process is summarised in the figure below.



Appendix C – Market benefit classes considered not relevent

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

- changes in voluntary load curtailment;
- costs to other parties;
- load transfer capability and embedded generators;
- option value; and
- electrical energy losses.

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.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	Ausgrid does not expect the project will have any effect on unrelated expenditures in other parts of the network. Accordingly, Ausgrid considers the market benefit from changes in timing of unrelated expenditure is not material.
Changes in voluntary load curtailment	Ausgrid notes that the level of voluntary load curtailment currently present in the NEM 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. Ausgrid notes that none of the options are 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. Ausgrid notes that none of the options will 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. Credible options under consideration do not affect high voltage feeders and therefore are unlikely to materially change load transfer capacity. Further, credible options are unlikely to enable embedded generators in Ausgrid's network to be able to take up load given the size and profile of the load serviced by network assets currently considered for replacement. Consequently, Ausgrid has not attempted to estimate any benefits from changes in load transfer capacity and embedded generators.
Option value	Option values arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change, and the credible options considered have sufficiently flexible to respond to that change. Ausgrid notes that the credible option provides the flexibility to install additional capacity at Rozelle STS in the event other significant customer connections occur in the area. In particular, a provision has been made for the future expansion of the 33kV switchgear arrangement, augmentation of 132/33kV transformers to 120MVA units by rebuilding the existing transformers bays to be able to accommodate such larger units, and also for the future installation of one neutral earthing reactor per 120MVA transformer. However, Ausgrid has not estimated the option value associated with this flexibility on account of the uncertainty surrounding the timing of the new equipment, as well as the fact that the calculations will not affect the identification of the preferred option, since there is only one credible option.
Changes in electrical energy losses	Ausgrid does not expect that any of the credible options considered would lead to significant changes in network losses and so have not estimated this category of market benefits.

Appendix D – Additional detail on the assessment methodology

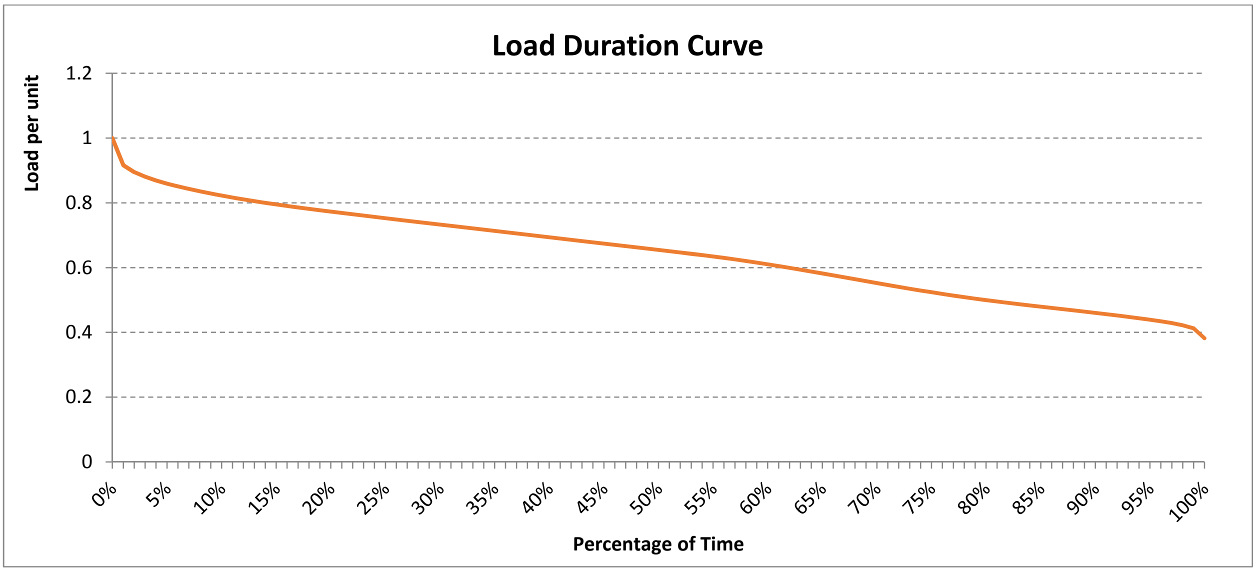
This appendix presents additional detail on the supply restoration assumptions and probability of failure assumptions.

D.1 Characteric load duration curves

The load duration curve for Rozelle STS is presented in Figure D.1 below.

It is assumed that the load types supplied by this substation will not change substantially into the future and therefore the load duration curves will maintain their characteristic shape.

Figure D.1 – Load duration curve for Rozelle STS



D.2 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.1 – Summary of failure probability models used to estimate failure probability

Network asset type	Failure probability model	Key parameters
Subtransmission substation transformer	Weibull distribution function	Transformer failure rate Age of transformer at failure in years Repair time

Transformers

The failure rate of transformers is expressed in terms of the Weibull distribution with sets of parameters for different transformer types.

Table D.2 – Transformer parameters

Transformer	Type	Year of commissioning	μ factor	β factor	MTTR* (Weeks)
Transformer No.1	132kV Bushing Type (132/33kV)	2008	160.8	2.33	6
Transformer No.2	132kV Bushing Type (132/33kV)	1954	160.8	2.33	6

* Mean Time To Repair

The following equation is used to calculate the yearly major failure rates based on the Weibull parameters related to the zone substation transformer.

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)

β is the shape parameter

μ is a 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

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

Equation 4

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

where:

f is the failure rate

r_s is the switching time (in hours)

r_r is the repair time (in hours)