Westmead Zone Substation

Non-Network Options Report
8 March 2022

Endeavour Energy

CONTACT

If you have any comments or enquiries regarding this report or wish to submit your ideas regarding possible demand reducing initiatives please send to the following email and addressed to Head of Asset Planning and Performance:

consultation@endeavourenergy.com.au

Contents

1. Introduction

Westmead zone substation (ZS) was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads.

The Westmead Health Precinct includes:

- Westmead Hospital;
- Westmead Children's Hospital and supporting departments; and
- research facilities and accommodation.

This health precinct accounts for approximately two thirds of the entire Westmead ZS load. The other third is made up of residential and commercial loads in the surrounding area.

The Westmead Health Precinct is a high voltage customer currently supplied via four dedicated 11 kV feeders and, being the primary supply of a vital regional health facility, supply security of Westmead ZS is extremely important.

The precinct is currently undergoing a significant expansion that will result in a large increase in demand in coming years. Specifically, we expect demand in the development area to reach 38 MVA by 2023/24, after which it will grow to 67MVA in 2030/31 before continuing to increase in subsequent years. This will lead to rapidly increasing risks of customers losing supply from unplanned outages as firm capacity is exceeded. As these risk levels increase, intervention in the form of investment in additional electricity infrastructure or alternative non-network solutions is required.

The preliminarily preferred distribution network augmentation to support the development of the Westmead ZS was included in our most recent Distribution Annual Planning Report (DAPR), released in December 2020.[1] The project was not included in our revised regulatory proposal for the current period in January 2019 as the need for investment was not known about at that point in time.

We have now initiated a Regulatory Investment Test for Distribution (RIT-D) to investigate, and consult on, how to facilitate the expansion of load most efficiently in this area of our network. This non-network option report (NNOR) sets out the reasons why we consider that a non-network option could form a significant part of a potential credible option for this RIT-D and it represents the first formal stage of the RIT-D.

The second formal stage of this RIT-D the Draft Project Assessment Report (DPAR), which will include a full net present value (NPV) economic assessment of all credible options. We currently intend to publish the DPAR in September 2022.

Endeavour Energy applies a probabilistic planning methodology to evaluate the network constraints and value of expected unserved energy in order to determine the appropriate timing for network augmentation projects. The timing of the need is based on a cost benefit analysis which is when the annualised cost of the unserved energy is greater than the annualised cost of the investment.

Importantly, no construction on new distribution investments will commence until there is a high degree of certainty that the anticipated loads will be seeking connection to our network at the timing indicated. Further, we note that new customers will contribute to the costs of the investment (as well as the cost of the wider network), via their 'Distribution Use of System' tariffs.

[1] Endeavour Energy, *Distribution Annual Planning Report*, December 2020, p 54.

1.1 Invitation for submissions

We invite submissions from interested parties, especially proponents of non-network solutions, in response this report. We are interested in exploring all potential non-network solutions with proponents.

We recognise that some proponents may require information in addition to that provided in this report. If you do need further information, please contact us as early as possible, to ensure that adequate time is available to fully assess feasible network and non-network potential solutions. It is essential that any solutions are presented by proponents in sufficient time to allow for their evaluation and any necessary clarifications with proponents.

All enquiries should be made in writing and directed to:

Endeavour Energy
Head of Asset Planning & Performance
GPO Box 811
Seven Hills NSW 1730
Email: consultation@endeavourenergy.com.au

Submissions should be lodged with us on or before 10th June 2022.

Due to the lengthy timeframe required for consultation and to avoid delays in releasing information (this document) to the market, Endeavour Energy will develop in parallel a separate Request for Proposal (RFP) document that will formally request detailed submissions from the market via a formal procurement process. The RFP will be uploaded to a procurement platform such as Tenderlink (https://www.tenderlink.com/endeavourenergy/).

1.2 Next steps

Following consideration of submissions made in response to this NNOR, we will prepare the DPAR. That report will present a detailed assessment of all credible options to address the identified need, plus a summary and commentary on submissions received to this report.

At this stage, we intend to publish the DPAR in September 2022.

2. Identified need

This section sets out the 'identified need' for this RIT-D, as well as the key assumptions that underpin it. These assumptions have been used in making our determination that a non-network option could form a significant part of a potential credible option for this RIT-D and are provided to assist proponents prepare any solutions.

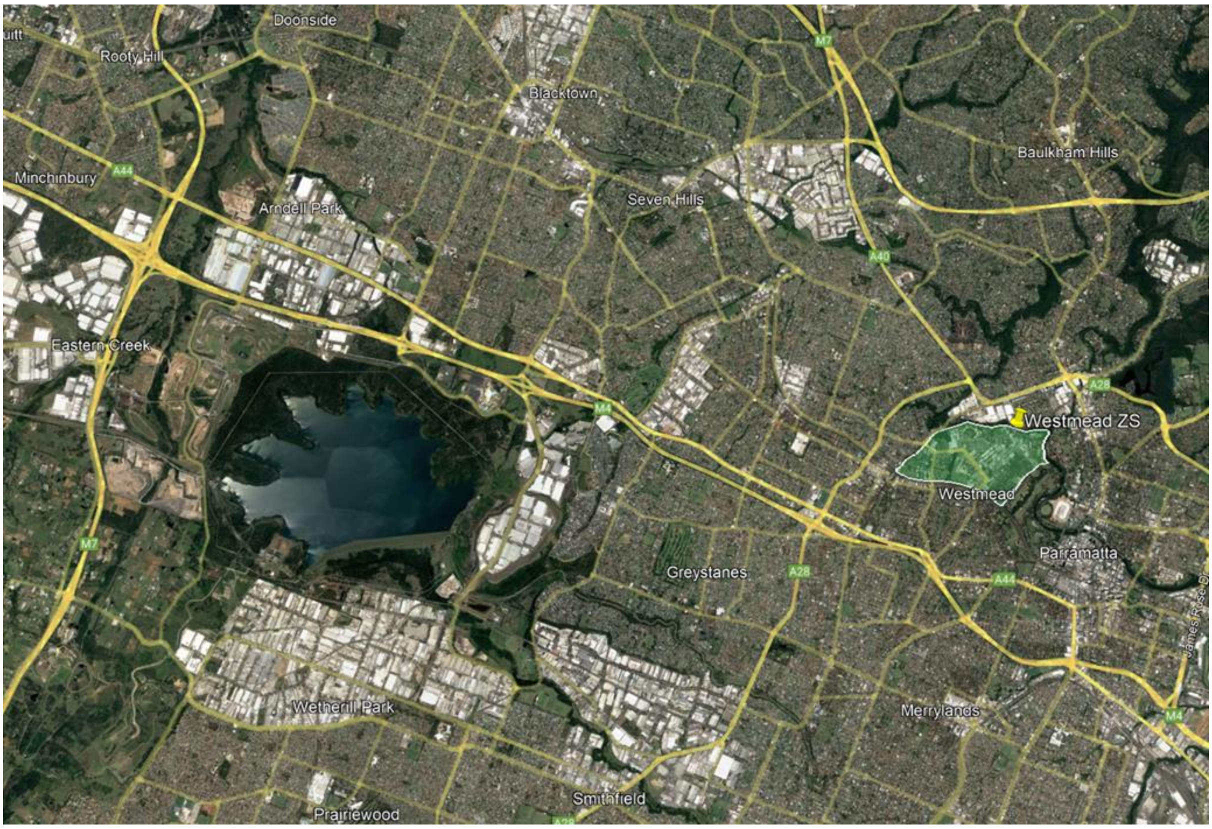
The timing of the identified need for this RIT-D, and so the required timing for credible options to address the need, is determined by a cost benefit analysis which is when the annualised cost of the unserved energy is greater than the annualised cost of the investment.

2.1 Relevant area of our network

Westmead ZS was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads. The Westmead Health Precinct includes Westmead Hospital, Westmead Children's Hospital and supporting departments, research facilities, and accommodation. The health precinct accounts for approximately two thirds of the entire Westmead ZS load, with the remaining third made up of load from residential and commercial loads in the surrounding area.

Figure 1 below shows the location of the existing Westmead ZS in our network.

Figure 1: Westmead ZS location in our network



The Westmead Health Precinct is a high voltage customer supplied via four dedicated 11 kV feeders.

The precinct is currently undergoing a significant expansion that will result in a large increase in demand. Specifically, more than $3 billion has been committed by government, universities and the private sector to upgrade and expand the precinct's health services, education and medical research facilities over the coming years.[2]

Figure 2 below shows the planned development included in the Westmead Health Precinct expansion.

Figure 2: Westmead Precinct Master Plan

Source: Westmead Redevelopment Plan (2016)

Other contributors to load growth include the adjacent Western Sydney University campus (currently under construction) and Parramatta Light Rail (a NSW government project expected to open in 2023)[3].

2.2 Planning Methodology

Endeavour Energy applies a probabilistic planning methodology to evaluate the network constraints and value of expected unserved energy in order to determine the appropriate timing for network augmentation projects. Network constraints are analysed in terms of the load at risk, energy at risk and the expected unserved energy over the 10-year planning forecast period. The trigger for network investment is based on a cost benefit analysis and comparing the annualised cost of the preferred network options with the option benefits. Network augmentation is only considered if the option benefit or the reduction in the cost of expected unserved energy outweighs the network augmentation cost required to reduce the unserved energy.

The calculation of the expected unserved energy is determined by taking a 30% weighting of the unserved energy at the 10% POE maximum demand forecast and a 70% weighting of the unserved energy at the 50% maximum demand forecast. This is to account for uncertainty in the demand forecast and is consistent with the practices adopted by AEMO and other distribution network businesses.

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[2] https://www.westmeadproject.health.nsw.gov.au/precinct/about-westmead-health-precinct

[3] https://www.parramattalightrail.nsw.gov.au/

As stated above, all of the energy at risk above ‘N’ capacity is taken to be expected unserved energy. However, where loads are between ‘N-1’ and ‘N’ capacity, the energy at risk is subject to a probability of an outage occurring to determine the expected unserved energy.

2.3 Key assumptions underpinning the identified need

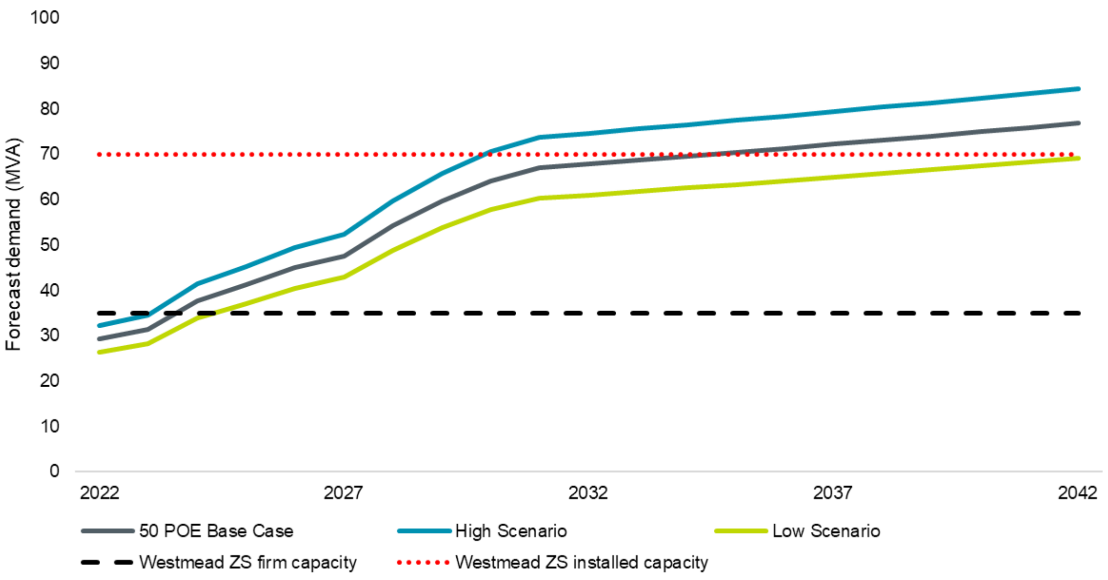
The identified need arises because of the large increase in demand arising from the ongoing expansion at the Westmead Health Precinct, coupled with demand growth from the Western Sydney University and Parramatta Light Rail.

The existing network has insufficient capacity to supply the increase in demand and additional capacity into the area as demand is expected to continue growing up to 2050/51 and beyond.

2.3.1 Demand forecasts

Figure 3 below shows our peak summer load forecasts under a central, low and high demand forecasts for the Westmead ZS.

Figure 3: Westmead ZS demand forecasts, 2022-2042



The three demand forecasts investigate different assumed load uptake rates. There is not expected to be significant uncertainty regarding the timing of load connecting and so this remains constant across the three forecasts.

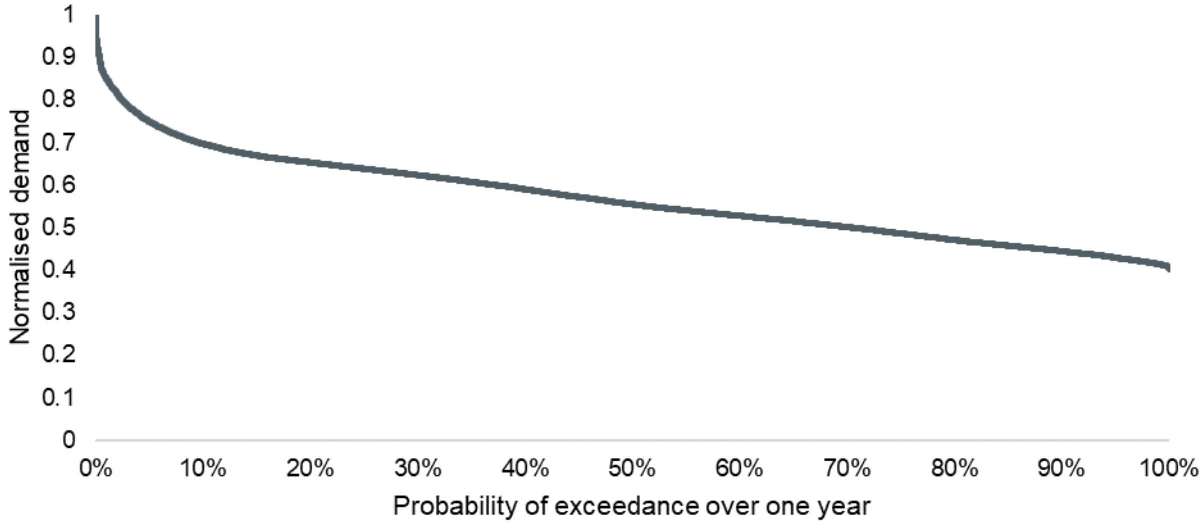
Figure 3 shows that demand is expected to exceed the capacity at Westmead ZS in 2023/24 under the base and high demand forecasts. Under the low scenario, demand is expected to exceed capacity in 2024/25.

2.3.2 Expected pattern of use

Since the forecast loads are yet to connect, we have assessed the identified need by scaling the existing load profile for the Westmead ZS.

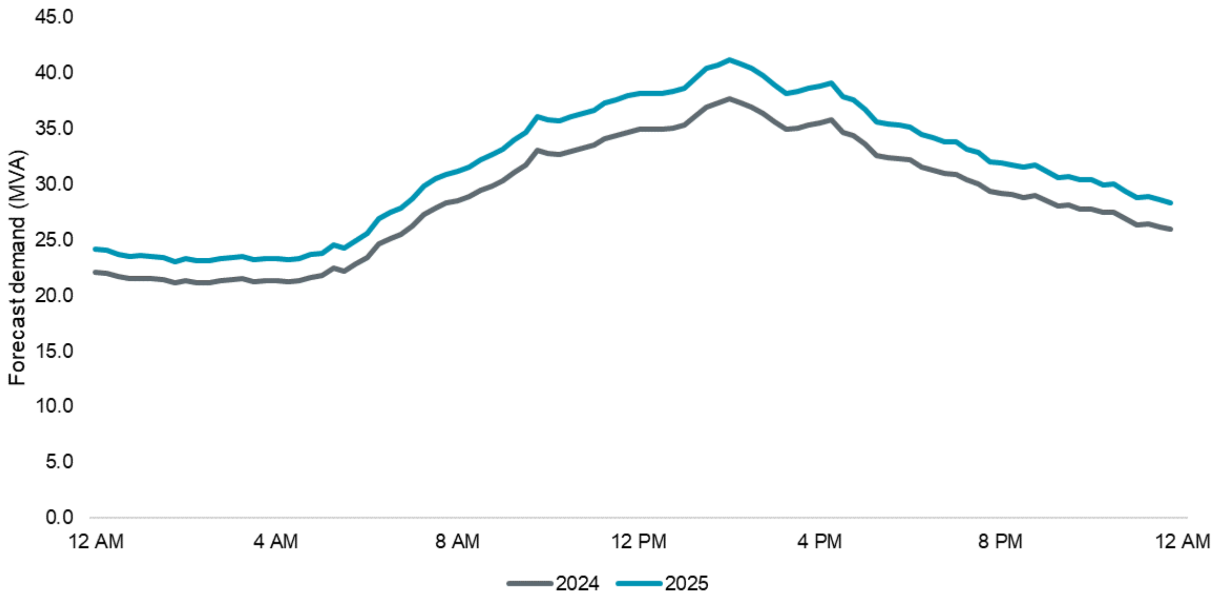
Figure 4 presents the normalised load duration curve (LDC) assumed for the Westmead ZS load demand profile.

Figure 4 – Normalised LDC assumed for Westmead ZS



Similarly, Figure 5 presents the assumed forecast peak day profile for the Westmead ZS load in 2023/24 based on the current demand profile. Specifically, we have scaled the peak day profile observed in 2020/21, such that the peaks in 2023/24 and 2024/25 correspond to 37.7 MVA and 41.2 MVA, respectively.

Figure 5 – Peak summer day profile assumed for Westmead ZS

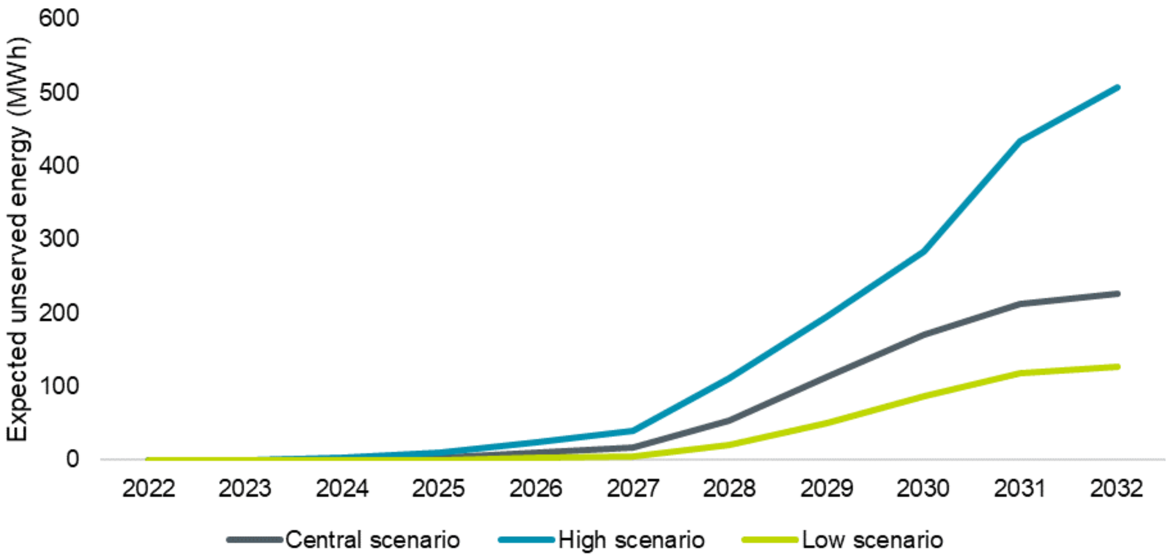


2.3.3 Expected unserved energy if action is not taken

The existing distribution network is insufficient to meet the supply needs of the new load from 2023/24 under the central and high demand forecasts (and 2024/25 under the low forecast). If network augmentation is not undertaken, there will therefore be significant unserved energy in the next few years.

Figure 6 below presents the estimated unserved energy if no action is taken under each of the three demand forecasts. We have only presented the next ten years to enable the differences to be clearly seen in the initial years (but we note that the unserved energy forecasts are expected to continue to increase significantly after 2031/32).

Figure 6 – Expected unserved energy under the base case (ie, with no investment)



We propose to cap the expected future unserved energy, in MWh, as part of the forthcoming DPAR NPV assessment, as the uncapped value of unserved energy will otherwise become unrealistically high (since, in reality, we would undertake investment to avoid widespread customer outages). Using the very large uncapped values has the potential to distort the comparison of net market benefits between credible options. The approach of capping USE in the base case is in-line with other RIT-Ds (and RIT-Ts) and does not affect the ranking of the overall options.[4,5]

2.3.4 Proposed scenarios for the forthcoming RIT-D NPV assessment

We propose to assess three alternative future scenarios as part of the DPAR NPV assessment, namely:

- a central scenario – consisting of assumptions that reflect a central set of variable estimates, which, in our opinion, provides the most likely scenario;
- a high benefit scenario – reflecting an optimistic set of assumptions, which have been selected to investigate an upper bound on reasonably expected market benefits; and

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[4] We note that this is also consistent with the approach proposed by Dr Biggar in his review of the Powering Sydney's Future RIT-T (see: Biggar, D., *An Assessment of the Modelling Conducted by TransGrid and Ausgrid for the "Powering Sydney's Future" Program*, May 2017, p. 27). While Dr Biggar suggests capping the 'congestion cost' (calculated as the unserved energy valued at the VCR) in such assessments, we consider it more intuitive to cap the underlying unserved energy, in MWh, and continue to value it at the appropriate VCR. This is the approach that has been adopted by other DNSPs and is effectively equivalent to the approach proposed by Dr Biggar.

[5] See for example: Ausgrid, *Ensuring reliable supply for the Sydney Airport network area*, Final Project Assessment Report, 6 March 2020, p. 15.

- a low benefit scenario – reflecting 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 the potential market benefits that could be realised under each credible option.

A summary of the key variables/framework expected to be used for each scenario is provided in Table 1 below.

Table 1 – Proposed scenarios for the forthcoming RIT-D NPV assessment

Parameter/ scenario	Central scenario	High benefits	Low benefits
Capex	Central estimates	-25%	+25%
Demand	Central demand forecast (see section 2.3.1)	High demand forecast (see section 2.3.1)	Low demand forecast (see section 2.3.1)
VCR	Load-weighted AER VCR	+30%	-30%
Discount rate	3.26%	2.22%	4.30%

We consider that the central scenario is the most likely, since it based primarily on a set of expected/central assumptions. We propose to therefore assign this scenario a weighting of 50 per cent in the NPV assessment, with the other two scenarios being weighted equally at 25 per cent each.

We propose to assess all credible options across a 20-year assessment period, which is after the point at which network Option 1 and Option 2 require a new 132 kV feeder from West Parramatta ZS (in 2034/35), as outlined in section 3 below.

3. Summary of potential network credible options

We have identified four potential network options for supplying the Westmead Health Precinct, namely:

- Option 1 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section;
- Option 2 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard;
- Option 3 – Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard; and
- Option 4 – Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation

Option 1 and Option 2 require a new 132 kV feeder from West Parramatta ZS in the future to supply the planned second Westmead ZS (currently expected to be in 2034/35). This second Westmead ZS is not related to the identified need for this RIT-D and, instead, is required to meet ongoing load growth in the area and its timing does not differ across the credible options, or demand forecasts, for this RIT-D.

Each of the four network options are further discussed in sections 3.1 to 3.4 below.

At this stage, based on our early internal NPV assessment, the preliminarily preferred network option is Option 3, i.e., establishing a third 132/11kV 45 MVA transformer at the Westmead ZS. The estimated annual deferred augmentation cost associated with this option is $0.41 million.[6]

3.1 Option 1 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section

This option involves installing a third 33/11kV 35MVA transformer that would be tail ended onto a new 33kV feeder from Baulkham Hills terminal station. The 11kV side of the transformer would be connected to a new 11kV bus section.

A line diagram for Option 1 is shown in Figure 7.

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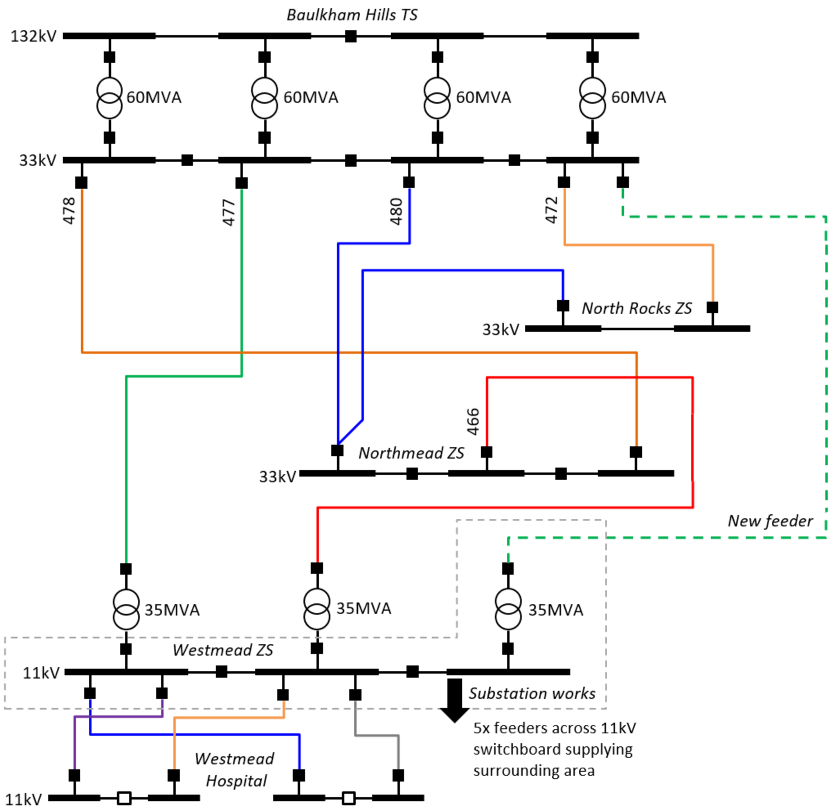
[6] Please note that this assumes a one year deferral as well as the central commercial discount rate and central capital cost estimate (both outlined above in Table 1).

Figure 7: Option 1 line diagram



While this option addresses the load at risk, it is nevertheless a 33kV option, meaning that a 132kV feeder from West Parramatta ZS would still be needed to supply the future second Westmead ZS in 2034/35. This requirement is intended to be modelled in the DPAR economic assessment for this option.

The 33/11kV 35MVA transformer, 11kV bus section, and 33kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $11.5 million.

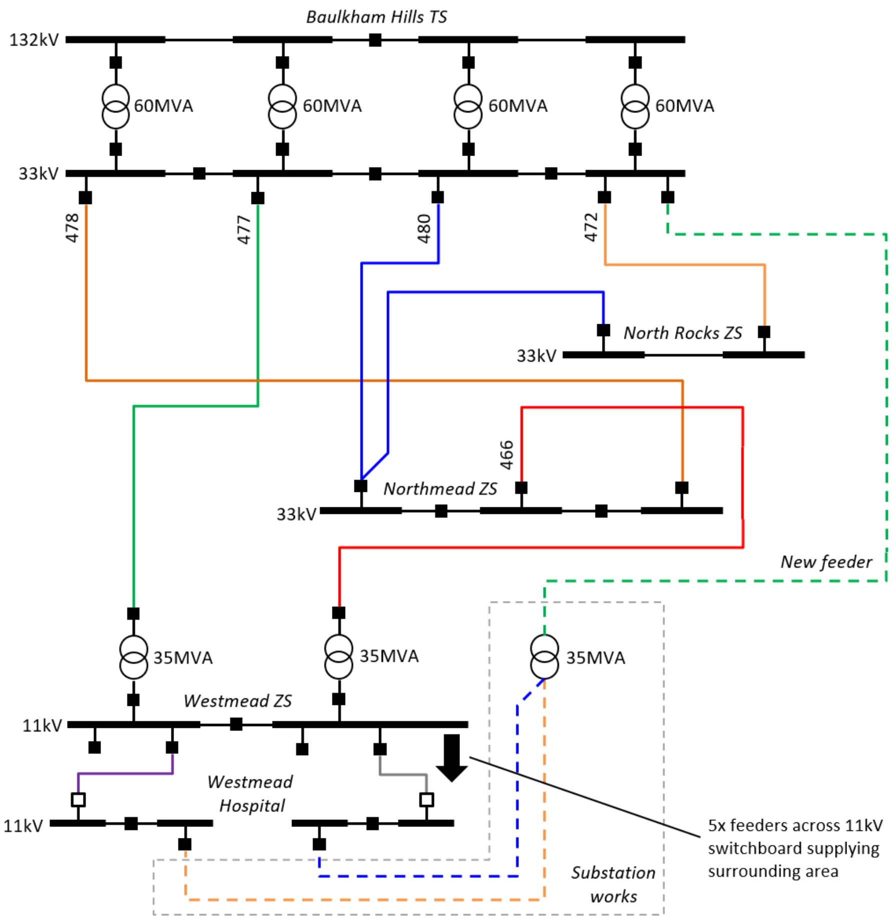
The 132kV transmission feeder from West Parramatta ZS will be built over two years at a capital cost of $8.85 million, and will be commissioned in 2034/35.

3.2 Option 2 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard

As with Option 1, this option involves installing a third 33/11kV 35MVA transformer that would be tail ended onto a new 33kV feeder from Baulkham Hills terminal station. However, different to Option 1, the 11kV side of the transformer would be directly connected to Westmead Hospital's 11kV switchboard.

The line diagram for Option 2 is shown in Figure 8.

Figure 8: Option 2 line diagram



Similar to Option 1, this option also addresses the load at risk, but since it is a 33kV option, a 132kV feeder from West Parramatta ZS would still be needed to supply the future second Westmead ZS in 2034/35. This requirement is intended to be modelled in the DPAR economic assessment for this option.

The 33/11kV 35MVA transformer and 33kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $10.8 million.

As with Option 1, the 132kV transmission feeder from West Parramatta ZS will be built over two years at a capital cost of $8.85 million, and will be commissioned in 2034/35.

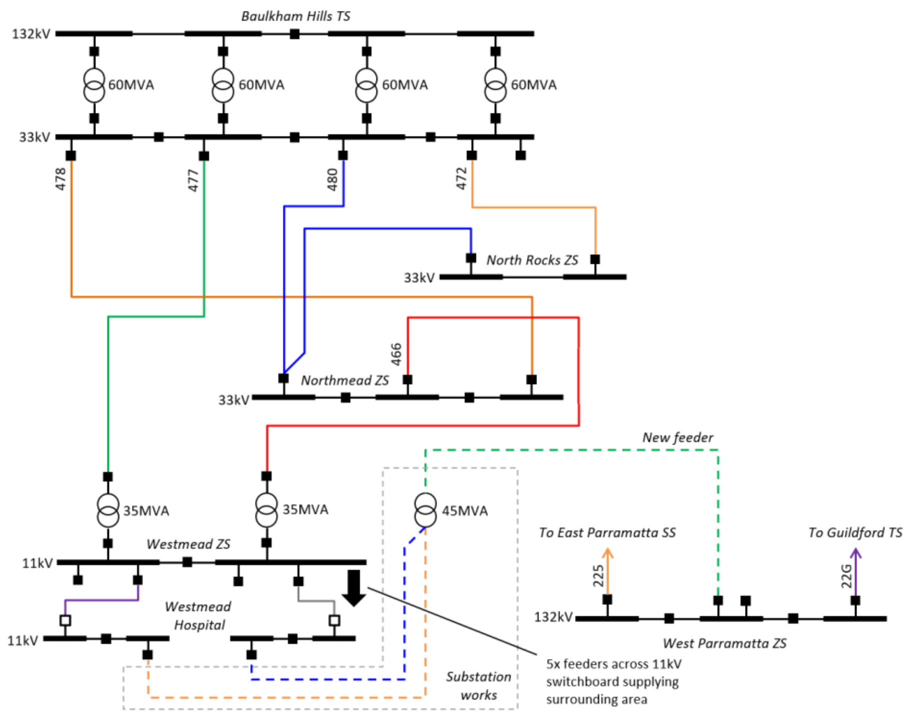
3.3 Option 3 – Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard

This option involves installing a third 132/11kV 45MVA transformer that would be tail ended onto a new 132kV feeder from West Parramatta ZS. The 11kV side of the transformer would be directly connected to Westmead Hospital's 11kV switchboard.

This option addresses the load at risk and the 132kV feeder can be utilised in the future to supply the second zone Westmead substation.

The line diagram for Option 3 is shown in Figure 9.

Figure 9: Option 3 line diagram



The 132/11kV 45MVA transformer and 132kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $12.5 million.

Unlike Options 1 and 2, there is no need to construct another 132kV transmission feeder in the future.

Further, this option has the benefit of providing the hospital with primary and backup supplies from two separate bulk supply points (Holroyd BSP and Sydney West BSP).

This option may require a section of the proposed 132kV feeder to be relocated if developments result in road layout changes in the Cumberland Hospital area. This potential relocation cost is considered speculative at this stage and we intend to investigate a sensitivity in the DPAR to see if it affects the outcome of the assessment (although our preliminary internal assessment suggests it will not).

3.4 Option 4 – Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation

This option involves establishing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS. This will allow a total of 10MVA load to be transferred from Westmead ZS to the two other zone substations.

The load transferred under this option would allow the installation of the third transformer under Option 3 to be deferred by two years from 2023/24 to 2025/26 under the central demand forecasts.

The three new 11kV feeders will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $2.72 million, after which the 132/11kV 45MVA transformer and 132kV transmission feeder for Option 3 will be constructed over three years (2023/24 to 2025/26) at a total capital cost of $12.5 million. As with Option 3, there is no need to construct another 132kV transmission feeder in the future after the 132/11kV 45MVA transformer and 132kV transmission feeder have been built.

3.5 Options considered but not progressed

There are no other network options that have been considered but not progressed.

4. Required technical characteristics of non-network options

This section sets out the technical characteristics that a non-network option would be required to deliver to assist with meeting the identified need.[7] This information is provided to enable proponents of non-network solutions to understand the identified need further and to tailor their proposals accordingly.

Endeavour Energy wants to explore all possible non-network solutions with proponents to deliver the most efficient overall option to the satisfy the identified need.

At a high-level, we consider at this stage that demand management is the most likely non-network technology able to assist with meeting the identified need for this RIT-D and we have already had preliminary discussions with a number of demand aggregators active in the area.

We do not expect that batteries will be able to credibly assist with meeting the identified need, primarily due to the magnitude and shape of the new load in question. Further, we consider that land and planning constraints would likely prevent the use of batteries and/or generation in the relevant area, given it is primarily a residential area.

Endeavour Energy welcomes submissions from potential proponents who consider that they could offer a credible non-network solution that is both commercially and technically feasible under the RIT-D.

We recognise that proponents may require additional specific information to develop their proposals. Accordingly, we encourage proponents to contact us as early as possible to ensure that we can provide all necessary information that they may require.

4.1 The size of load reduction or additional supply

Table 2 below presents the estimated annual load at risk under the central demand forecasts.

Table 2 – Estimated Westmead ZS load at risk, central demand forecasts

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Load At Risk (MVA)	-	-	2.7	6.2	10.0	12.6	19.2	24.8	29.2	32.0

The estimated load at risk represents the size of load reduction and/or additional supply that would be required from a non-network solution in each year to avoid one of the network options (which are designed to avoid all of the load at risk) being commissioned.

We expect at this stage that non-network options may be able to credibly defer the commissioning of a network option by one or two years. On account of the size of the load at risk, we do not expect non-network solutions to be able to credibly form standalone options, i.e., without being combined with a network option.

4.2 Location

We are seeking network support located in the Westmead area. This includes all loads that are supplied by the Westmead substation at 11 kV. Specifically, this covers the portion of the suburb of Westmead that is north of the railway line.

The target area for load reduction is shown in Figure 7.

[7] In accordance with Clause 5.17.4(e)(4) of the Rules.

Figure 10 – Demand reduction target area

4.3 Operating profile

To maintain reliable supply, network support would be required to provide a back-up supply for peak days over the summer period. Table 3 sets out the key expected technical characteristics that a network support solution would need to exhibit.

Table 3 – Non-network option technical characteristics

Objective	Target
Time of year	1 November 2023 to 31 March 2024 1 November 2024 to 31 March 2025
Time of Day	11am to 5pm (Summer period)
Season	Summer 2023/24 and 2024/25
Day type	Days above 30ºC
Demand reduction required	Refer to Table 2

4.4 Contribution to power system reliability

Proposed services must be capable of reliably meeting electricity demand under a range of conditions and must meet all relevant National Electricity Rules requirements related to grid connection (if this is required as part of the solution).

Endeavour Energy has obligations under the National Electricity Rules, its distributor's licence and connection agreements to ensure supply reliability is maintained to its customers. Failure to meet these obligations may give rise to liability. Proponents of non-network options must also be willing to accept any liability that may arise from its contribution to a reliability of supply failure.

Endeavour Energy operates under the NSW Electricity Licence Conditions and is required to maintain standards for reliability. The licence conditions stipulate the average reliability performance levels that are acceptable for different network supply categories. The relevant performance levels are detailed below in Table 4.

Table 4 – Applicable reliability standards

Feeder/network type	Average reliability duration standards (minutes per customer)	Average reliability interruption duration standards (number per customer)	Equivalent average service availability (% of time)
Urban network (overall)	80	1.2	99.98
Individual urban feeder	350	4	99.93

Non-network options should have adequate availability levels to contribute to maintaining reliability performance within these licence condition requirements.

4.5 Contribution to power system fault levels

Non-network solutions are not required to address any existing issues in relation to fault levels as part of this RIT-D.

Appendix A – Checklist of compliance clauses

This section sets out a compliance checklist that demonstrates the compliance of this NNOR with the requirements of clause 5.17.4(e) of the National Electricity Rules version 177.

Clause 5.17.4(e) requirements	Section of this NNOR
(1) a description of the identified need	**Error! Reference source not found.**
(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-D proponent considers reliability corrective action is necessary;	2.3
(3) if available, the relevant annual deferred augmentation charge associated with the identified need;	3
(4) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction or additional supply; (ii) location; (iii) contribution to power system security or reliability; (iv) contribution to power system fault levels as determined under clause 4.6.1; and (v) the operating profile;	4
(5) a summary of potential credible options to address the identified need, as identified by the RIT-D proponent, including network options and nonnetwork options;	3
(6) for each potential credible option, the RIT-D proponent must provide information, to the extent practicable, on: (i) a technical definition or characteristics of the option; (ii) the estimated construction timetable and commissioning date (where relevant); and (iii) the total indicative cost (including capital and operating costs); and	3
(7) information to assist non-network providers wishing to present alternative potential credible options including details of how to submit a non-network proposal for consideration by the RIT-D proponent.	1 & 4

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