RIT-D Draft Project Assessment Report

Providing increased supply capacity for the Menangle Development Area

17 March 2025

Endeavour Energy

POWER together

1. Executive Summary

This draft project assessment report (DPAR) has been prepared by Endeavour Energy in accordance with the requirements of clause 5.17.4 of the National Electricity Rules (NER). It represents the second stage in the Regulatory Investment Test – Distribution (RIT-D).

The purpose of this report is to demonstrate the basis for selection of the preferred option to provide increased supply capacity for the Menangle Development Area.

The Menangle Development Area is located approximately 40km south-west of Parramatta and is within the Greater Macarthur Growth Area. The Greater Macarthur Growth Area is a key part of the New South Wales Government's plan to support Greater Sydney's growing population through the development of new communities in land release areas.

The Menangle Development Area consists of five precincts that are in advanced stages of planning, re-zoning and early stage sales and marketing by their respective property developers. The precincts are:

- Menangle Park Precinct.
- Rosalind Park.
- West Hume Highway residential precinct.
- Southern Gateway Business Park.
- Macarthur Business Park.

These precincts are expected to result in approximately 10,200 new residential dwellings including complementary developments such as town centres, schools, community facilities and future commercial and industrial spaces. The area includes two specific business parks that are expected to be major employment hubs for the area. The business parks will take advantage of the close proximity to the Hume Highway which traverses the Menangle Development Area.

These developments are forecast to require a supply capacity of 92MVA by 2042 under the central demand forecast that we have prepared for the area. This greatly exceeds the supply capacity of the existing network in the area.

The identified need for this investment is 'reliability corrective action' because the investment is required to comply with our NER obligations to connect customers. The timing of the identified need for this RIT-D is determined by when the expected customer demand will materially exceed the existing network capacity. This is currently expected to be in 2027/28, based on our demand forecast.

This report follows publication of an options screening notice that found that a non-network solution is unlikely to form a potential credible option on a standalone basis or form a significant part of a potential credible option to meet the identified need for the Menangle Development Area. This is due to the level of forecast demand for the Menangle Development Area, the expected cost of non-network options and the limited capacity of the existing network to facilitate non-network technologies. It also found that a Stand-alone Power System (SAPS) solution could not contribute to meeting the identified need because the customer demand requirements of what is largely a greenfield development area are significant and therefore could not be supported by a network that is not part of the interconnected national electricity system with the ability to draw on grid-connected generation sources.

Two options were determined to be credible in addressing the identified need and have been assessed in comparison to a business-as-usual base case. These are:

- Option 1 - Establish Moreton Park Road Zone Substation (ZS) in Stage 1 and then establish a permanent Menangle Park ZS under Stage 2.
- Option 2 - Establish a permanent Menangle Park ZS under Stage 1 and then establish Moreton Park Road ZS in Stage 2.

Both options involve two stages and deliver largely identical network assets over their respective two stages of work but the options differ in the order of the delivery of network assets to support customer demand and

connection. The different order of staging and network asset delivery gives rise to both cost and benefit differences between the two options considered.

Economic assessment results for these two options are shown in Table 1. Under the NER, the preferred option is the credible option that maximises the present value of the net economic benefit to all those who produce, consume or transport electricity in the National Electricity Market (NEM) as well as that arising from changes in Australia's greenhouse gas emissions. Applying this definition, Option 2 is the preferred option at this draft stage because it has the highest net market benefits due to higher gross benefits and slightly lower costs in present value terms.

Table 1 – Economic assessment of credible options (weighted results)

Option	Description	Project capex ($M, real 2024/25)	PV of market benefits ($M, PV)	PV of costs ($M, PV)	NPV ($M, PV)	Rank
1	Establish Moreton Park Road ZS in Stage 1 and the permanent Menangle Park ZS in Stage 2.	105.5	458.7	57.2	401.5	2
2	Establish the permanent Menangle Park ZS in Stage 1 and Moreton Park Road ZS in Stage 2.	**105.1**	**504.7**	**56.3**	**448.4**	**1**

Under the updated NER relating to a Material Change in Circumstance (MCC), Endeavour Energy is required to set out in the DPAR (for consultation and confirmation in the Final Project Assessment Report (FPAR)), re-opening triggers for this RIT-D. Endeavour Energy has not identified any re-opening triggers that would be applicable for Stage 1 of the preferred option, and proposes to undertake a separate RIT-D process ahead of commencing Stage 2 of the project to reflect any changes in costs or demand forecasts at that time.

Endeavour Energy seeks written submissions from interested parties in relation to the preferred option outlined in this document.

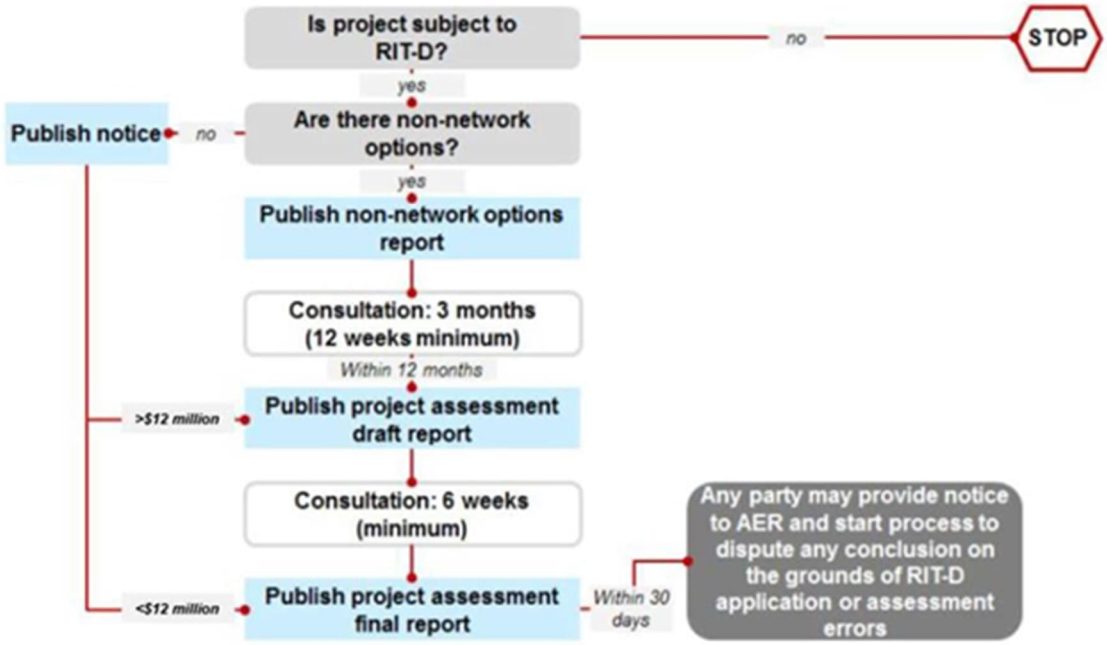
Submissions are due by **28 April 2025**.

All submissions and enquiries should be directed to Endeavour Energy's Portfolio Management office at consultation@endeavourenergy.com.au.

2. RIT-D Process

This Draft Project Assessment Report (DPAR) has been prepared by Endeavour Energy in accordance with the requirements of clause 5.17.4 of the NER and represents the second step in the RIT-D process to determine the most efficient means of increasing supply capacity to meet the expected demand growth in the Menangle Development Area. It follows the earlier publication of an options screening notice. The RIT-D process is summarised in Figure 1 below.

Figure 1 – Overview of the RIT-D process



We note that each credible option considered in this DPAR involves two stages, however Endeavour Energy is only committing to the first stage of the investment following this RIT-D. The second stage of the preferred option identified in this RIT-D process will be further assessed and confirmed via a separate RIT-D at a later point in time, assuming that demand forecasts continue to indicate that a second stage is required.

2.1 Submissions requested to the DPAR

Endeavour Energy seeks written submissions from interested parties in relation to the preferred option outlined in this document. Submissions are due on or before **28 April 2025**.

2.2 Contact details

All submissions and enquiries should be directed to Endeavour Energy's Portfolio Management office at consultation@endeavourenergy.com.au.

3. Description of the identified need

This section provides a description of the identified need for this RIT-D and sets out the key assumptions and methodologies that underpin the identified need.

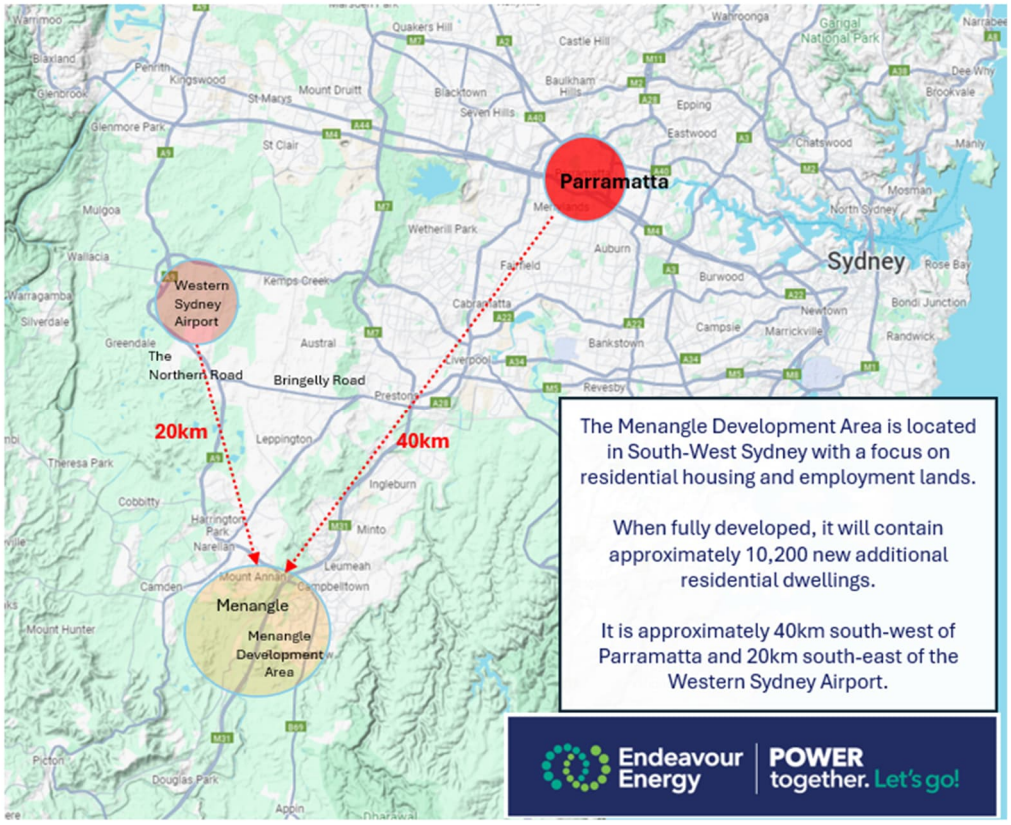
3.1 Relevant area of our network

The Menangle Development Area is located approximately 40km south-west of Parramatta and 20km south-east of the Western Sydney Airport. The area is traversed by the Hume Highway which is the major motorway through the area. The development in the area is largely along side of the Hume Highway with major precincts planned for both the east and west side of the Hume Highway. There is currently major road works being undertaken with bridges and merge lanes being constructed which will enable the road and traffic connectivity from the area to the Hume Highway.

Figure 2 below shows the location of the Menangle Development Area in relation to Parramatta and the Western Sydney Airport site.

The Menangle Development Area is a part of the Greater Macarthur Growth Area, a key part of the New South Wales Government's plan to support Greater Sydney's growing population through the development of new communities in land release areas.[1]

Figure 2 – Location of the Menangle Development Area in relation to Parramatta and the Western Sydney Airport site

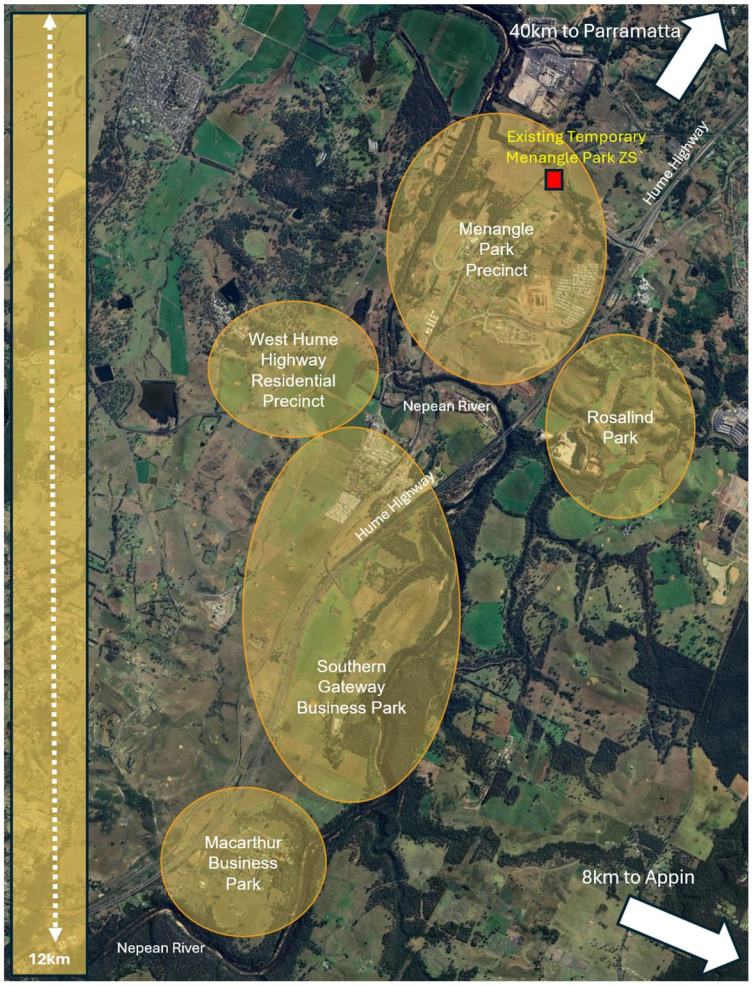


[1] NSW Government and Greater Sydney Commission, *Greater Sydney Region Plan 2018*, pp 8, 61.

Figure 3 below shows the proposed five precincts for development of residential housing and enterprise business parks within the Menangle Development Area. The location of the existing temporary Menangle Park ZS is shown at the northern end of the area. The five precincts and their related development, customer demand and connection requirements form the identified need for this RIT-D. Our demand forecasts are based on our analysis of these precincts and their underlying customer demand requirements.

The area is approximately 8km from Appin, however there are strong and distinct geographical separations between the Menangle area and the Appin area due to the Nepean River and the steep terrain that is adjacent to the Nepean River in this area. The terrain is largely unsuitable for both underground cable and overhead lines and forms a border between the Menangle development area and the future Appin development area. The Appin are is not included in the identified need for this RIT-D and we expect to conduct a separate RIT-D for the Appin area in line with the customer demand.

Figure 3 – Proposed development precincts in the Menangle Development Area



In general, the Menangle Development Area is 'land locked' by the Nepean River and its steep terrain to the south-east. The southern most precinct will be adjacent to the Nepean River and will have a hard border with the adjacent area to the east, particularly Appin. The Menangle area and the Hume Highway through the area are being developed according to the New South Wales strategic plans for the Macarthur area.[2]

[2] See NSW Department of Planning and Environment, *Greater Macarthur 2040: An interim plan for the Greater Macarthur Growth Area*, November 2018, pp 19, 84.

3.2 Load characteristics and demand forecast

The Menangle Development Area will comprise five precincts which will include new residential dwellings and enterprise based business parks. Although the final name of the precincts may be changed, we have used the following precinct names in our analysis of the customer characteristics and the demand forecasts for the area:

- Menangle Park
- Rosalind Park
- West Hume Highway residential development area
- Southern Gateway Business Park
- Macarthur Business Park

Based on information from developers of these precincts and the local governments of Campbelltown City Council and Wollondilly Shire Council, we have developed three scenarios for the demand forecast for the area. The precincts are expected to contain 10,200 new residential dwellings and complementary developments of town centres, shopping villages, schools and community facilities.

Our demand forecasts are based on a level of growth in line with the delivery plans provided by developers and adjusted to align with the latest NSW Government Urban Development Program forecasts.[3]

Based on the proposed precincts, the development area will require 92MVA of electricity supply capacity by 2042. This is our central demand forecast for the Menangle Development Area as we have defined it in the identified need for this RIT-D.

[3] See NSW Government website, available at: https://www.planning.nsw.gov.au/policy-and-legislation/housing/urban-development-programs#udp-dashboards.

Table 2 provides a summary of the estimated new residential dwellings in the Menangle Development Area. This information is the basis of the demand forecasts. The demand forecasts for the enterprise business parks are based on our network connection request information.

Table 2 – Menangle Development Area precinct summary

Proposed Precinct	Estimate of total residential housing lots by 2042	Details
Menangle Park Precinct	3,800 homes and 2,000 apartments	A major residential centre with a mix of free standing residential homes and apartments. Includes a new school, town centre, community facilities and commercial functions and small scale employment lands.
Rosalind Park	1,500	A town or village centre with shopping and small commercial centre.
Future West Hume Highway Residential Precinct	1,900	A town or village centre, new school, tourism and tourist attraction development, environmental showcase demonstration, commercial and retail developments.
Southern Gateway Business Park	1,000	Residential, commercial and industrial developments. Development area to take advantage of proximity access to the Hume Highway allowing for transport and logistics operations.
Macarthur Business Park	Nil	Employment hub and business park. Likely to include transport and logistics functions using the proximity of access to the Hume Highway. Based on the zoning proposals and plans, no residential development is expected.

Table 3 below shows the assumptions that have been used by Endeavour Energy to develop the demand forecast from the underlying growth plans for the area. These demand forecast assumptions are based on our extensive experience in supplying Western Sydney and monitoring the adoption of new technology such as rooftop solar panels, electric vehicles and distributed battery storage systems. We expect residential and enterprise areas in the Menangle Development Area to utilise these latest end-use energy technologies.

Table 3 – Menangle Development area demand forecast assumptions

Assumption	Value and unit of measure
Residential Lot Freestanding Home	5.4kVA per Lot
Residential Terrace Home (semi-detached)	4.35kVA per Lot
Residential Apartment	3.3kVA per Lot
Town Centre Shopping Village	3.0MVA
School K-12	1.0MVA
School K-6	0.75MVA
Water Supply Services	0.3MVA
Residential Diversity Factor	0.8
Commercial Diversity Factor	0.6

The demand forecast for the enterprise based business parks are based on the connection applications in place with the proponents of those business parks.

Table 4 below shows the Menangle Development Area demand forecasts based on the precinct level demand forecast, our demand forecast assumptions of the residential development component and our analysis of the customer connection information for the enterprise based commercial and industrial customers expected primarily in the business park precincts.

Table 4 – Menangle Development Area demand forecasts

Precinct forecast (MVA)	2024	2025	2026	2027	2028	2029	2030	2031	2032		2037	2042
Menangle Park Precinct	3.9	5.5	8.2	10.6	13.0	15.8	18.1	19.9	21.7		28.6	29.8
Rosalind Park	0.0	0.2	2.6	3.7	4.8	5.6	6.6	7.5	7.5		7.5	7.5
West Hume Highway Residential Precinct	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.9	3.7		8.2	10.5
Southern Gateway Business Park	0.6	1.1	1.9	2.7	5.3	12.5	13.6	15.8	18.6		26.8	35.5
Macarthur Business Park	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3	1.9		5.0	8.2
Total Demand	**4.5**	**6.8**	**12.7**	**17.0**	**23.0**	**33.9**	**39.3**	**46.3**	**53.4**		**76.2**	**91.6**
Menangle Development Area demand forecast (MVA)	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**		**2037**	**2042**
High forecast	5.0	7.5	13.9	18.7	25.3	37.3	43.2	51.1	58.9		83.9	100.7
Central forecast	**4.5**	**6.8**	**12.7**	**17.0**	**23.0**	**33.9**	**39.3**	**46.3**	**53.4**		**76.2**	**91.6**
Low forecast	4.1	6.2	11.4	15.3	20.7	30.5	35.4	41.8	48.2		68.6	82.4

Based on the central demand forecast set out above we have developed additional demand forecasts by applying a 10% increase in MVA to derive a high demand forecast and a 10% decrease in MVA to derive a low demand forecast. Although this 10% variation on the higher and lower scenarios is somewhat arbitrary,

we have used the approach of selecting a variation that we believe would have equal probability across the three scenarios. Using our weighted approach to the economic evaluation, we believe that all three scenarios have an equal (33%) likelihood of occurring.

This range is selected to cover a range of factors which may change customer demand such as variations in the timing of developments or economic conditions. We note that the NSW government has made the development of this area a priority based on statements and their commitment to the extensive road works that we have observed in the area, including relocation of some of our distribution assets to facilitate the road works that we believe gives a higher degree of certainty in the customer demand and the timing of the demand as a requirement on the network to increase supply capacity.

3.3 Expected pattern of use

Due to the similarities in the expected residential housing development proposed in the Menangle Development Area and the large residential development at Oran Park, we have used the pattern of use from the Oran Park Zone Substation. Although Oran Park is located approximately 15km to the north-west, it has a modern contemporary residential housing stock and similar complementary developments to those expected in the Menangle area. We have also used the Oran Park area for our South Creek West area study in 2024 as we believe that it is representative of contemporary residential developments in Western Sydney.

We expect that the demand profile will be similar, including the time of day and day of week demand profiles and the seasonal variation in demand.

The penetration of rooftop solar is expected to be similar and we have assumed the solar penetration to be similar to Oran Park which has 30% of residential homes with a rooftop solar installation. The average size of rooftop solar system in the Oran Park ZS service area is 6.8kW. We expect similar sizing and penetration in the residential precincts of the Menangle development area.

The enterprise based business parks are also expected to include rooftop solar installations but are expected to have a flatter load profile and pattern of use.

The existing supply capacity currently servicing the Menangle Development Area has been included in our assessment of the identified need. The existing temporary Menangle Park ZS based on the mobile substation has a largely residential customer load, however it is also providing temporary supply to support the extensive road works in the area. We believe that the Oran Park ZS pattern of use is more representative of the eventual customer demand profile than the existing temporary substation.

Figure 4 below shows the load duration curve (LDC) for Oran Park ZS which we have used as the representative pattern of use for the Menangle Development Area. The LDC is based on the actual Oran Park ZS demand profile, however this has been normalised for the Menangle Development Area in our analysis of the identified need.

Figure 4 – LDC for Oran Park ZS assumed to be representative for the Menangle Development Area

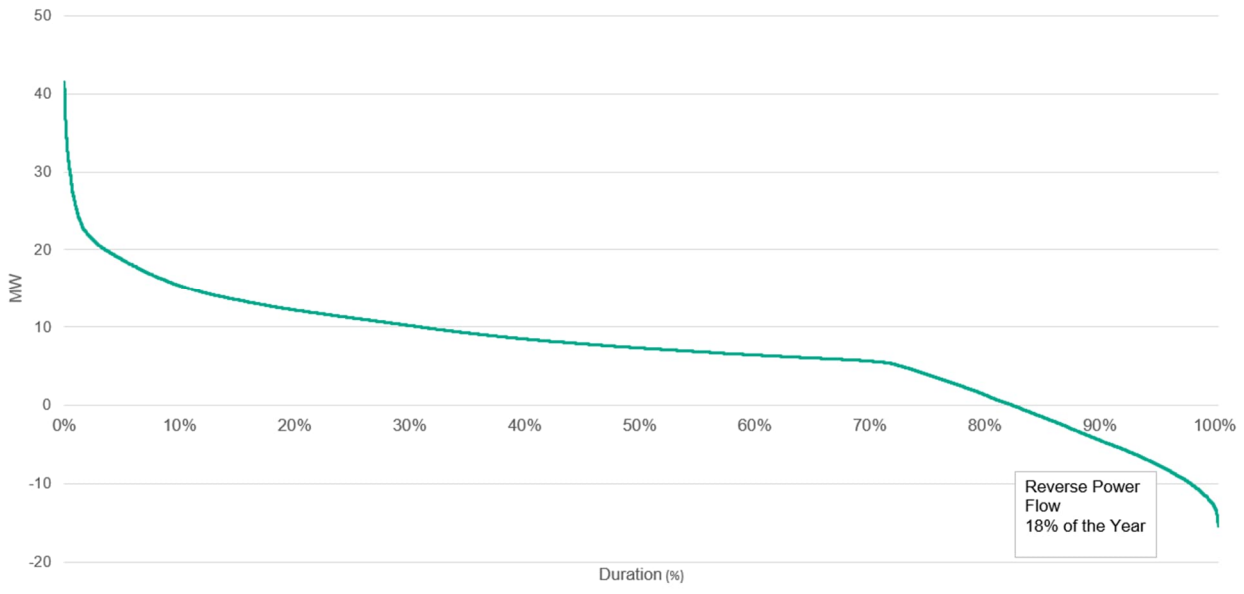
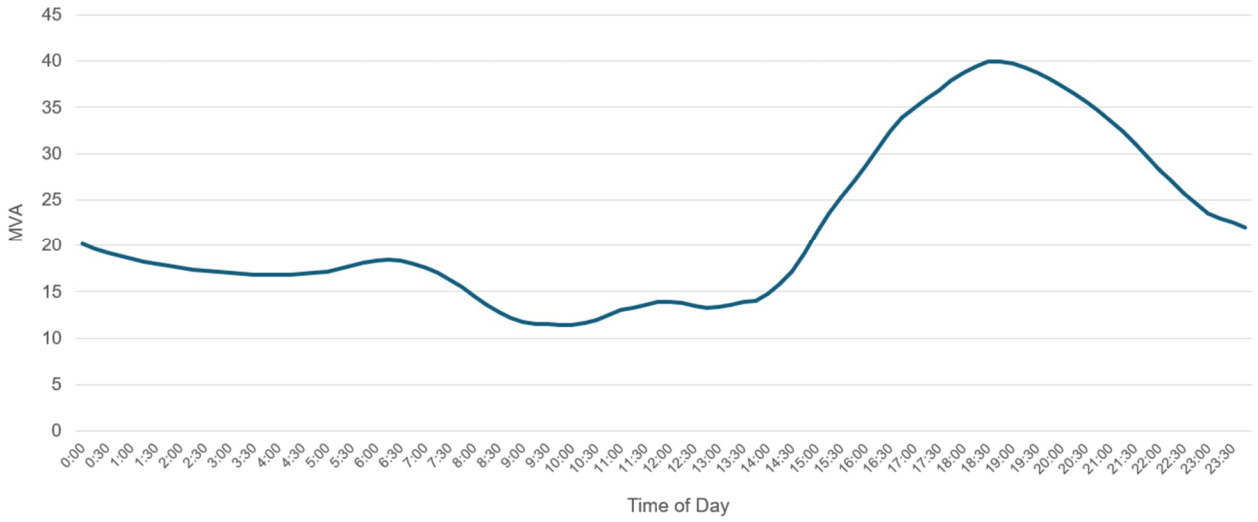


Figure 5 below shows the peak summer day profile for Oran Park ZS, that we expect to be similar to the Menangle Development Area and representative of the expected peak summer day load profile for the customers in the Menangle Development Area. The profile has been normalised in our analysis. We expect the peak demand to be on a hot summer day and at the time of day when the rooftop solar production decreases and the use of home air conditioning is high, typically between 6pm and 8pm.

Figure 5 – Peak summer day profile for Oran Park ZS assumed to be representative of the Menangle Development Area



3.4 Existing network

The Menangle Development Area is currently supplied by a 66/11 kV 15MVA mobile substation, the Menangle Park Mobile ZS. The mobile substation was commissioned in 2021 following the publication of the 'Menangle Park Greenfield Supply Area' FPAR in February 2019, which identified establishing the 15MVA mobile substation at the north end of the Menangle Development Area as the preferred option to service the initial development of the Menangle Park precinct. The mobile substation is connected to the Transgrid's Macarthur Bulk Supply Point via a single 66 kV feeder 85P.

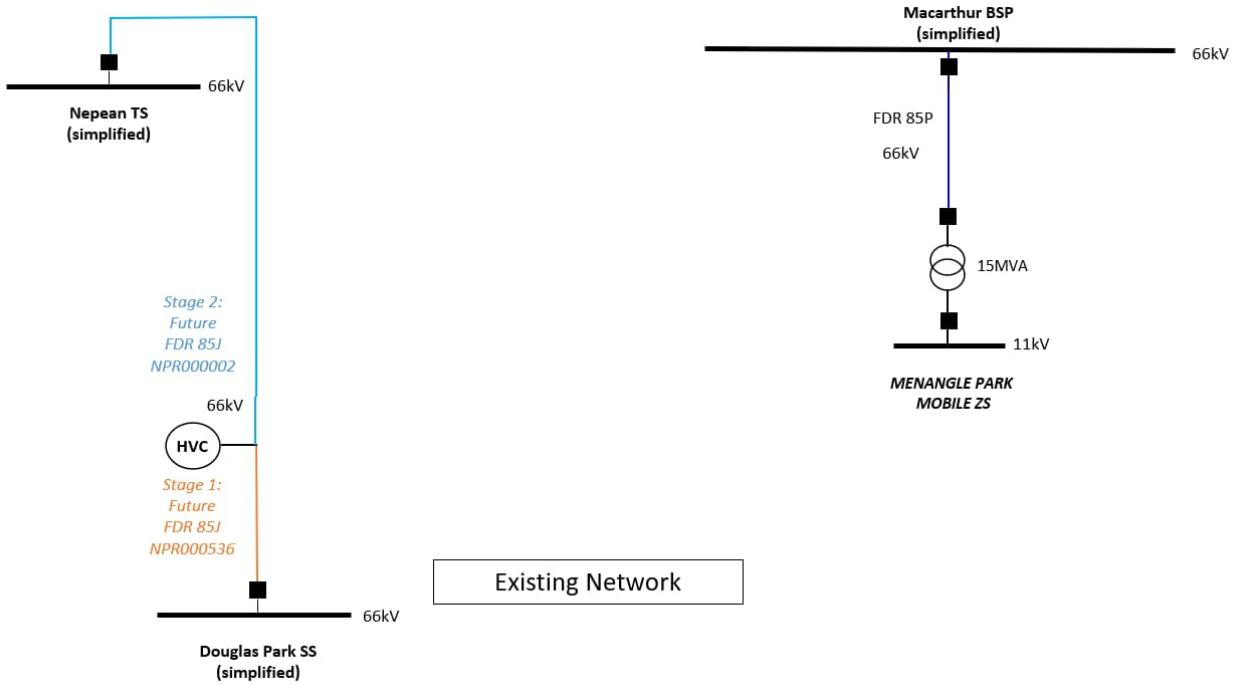
The previous RIT-D conducted in 2018 and 2019 was concluded in February 2019 with the FPAR publication. The identified need in that RIT-D was the supply to the initial development of the Menangle Park Precinct which is one of the five precincts contemplated in this RIT-D for the larger area that we have defined as the Menangle Development Area. The February 2019 FPAR indicated that a permanent Menangle Park ZS would be required at a later date.

The commissioning of the Menangle Park mobile ZS in 2021 included key network components with the 66kV feeder supply 85P and the two 11kV distribution feeders servicing the area.

Figure 6 – Cover page of the FPAR - establishing the existing temporary Menangle Park ZS based on a mobile substation and the 66kV supply to the site and the two 11kV distribution feeders

Figure 7 below shows a simplified single line diagram of the existing 66kV network in the Menangle Development Area. The existing 66kV network in the area includes 85P which is supplied from Transgrid's Macarthur BSP and there is 66kV feeder 85J which is supplied from Douglas Park Switching Station and will be extended to Nepean TS by a separate project.

Figure 7 - High level simplified single line diagram of existing 66kV supply network



The Menangle Park mobile substation has a single transformer with a total capacity of 15MVA. If there is a failure of the 15MVA transformer or a failure on the 66kV transmission feeder 85P then there is only a firm backup capacity of 5.67MVA from the adjacent zone substations via feeders NN1251 and T874.

Table 5 below shows the firm capacity available to the Menangle Development Area from the adjacent zone substations at Ambarvale ZS and Nepean ZS. For the purpose of our analysis of the available spare capacity or firm capacity for the Menangle Development Area, the value is rounded to 5.7MVA.

Table 5 – Firm capacity available from the adjacent zone substations via the 11kV distribution network

Zone Substation	Backup Feeder	Design Rating (MVA)	Spare Capacity (MVA)
Ambarvale	T874	5.62	3.36
Nepean	NN1251	6.10	2.31
Total		**11.72**	**5.67**

Figure 8 below shows the existing 11kV distribution network in the Menangle Development Area including the existing 11kV feeders from the mobile Menangle Park ZS (they are labelled A0724 and A0727) , it also shows the feeder ties to the adjacent zone substations and Nepean ZS (NN1251) and Ambarvale ZS (T874).

The existing 11kV network is sufficient for the existing customer base and it provides a wide geographical spread for supply to the development area to support the initial development of many of the precincts. However, the demand forecast will require additional supply capacity and also additional 11kV feeders to further cover the development area to enable customer connections.

Figure 8 – Existing 11kV distribution network in the Menangle Development Area

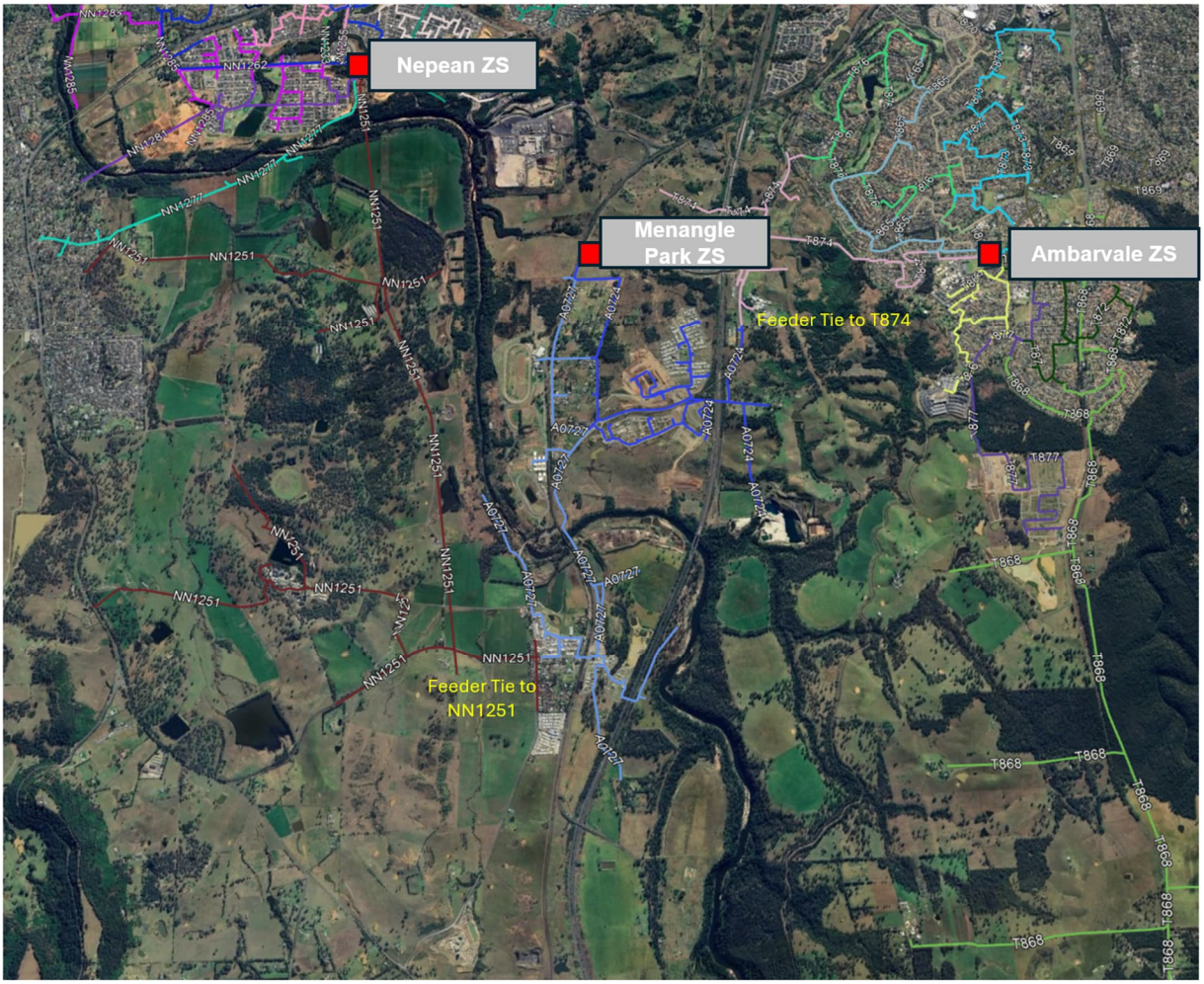


Table 6 sets out the network constraints in the Menangle Development Area.

Table 6 – Network constraints in the Menangle Development Area

Network Constraint	Description
Lack of firm capacity in the existing Menangle Park mobile substation	The existing temporary Menangle Park mobile substation consists of one (1) transformer and although it is well maintained and has provided excellent service reliability since its establishment on the site in 2021, if it were to fail then there is no alternative back-up to provide 66/11 kV transformation for the Menangle Development Area. The only firm capacity is available via the 11kV distribution network from Ambarvale ZS and Nepean ZS.
Lack of 11kV distribution network capacity with cross zone feeder ties	The adjacent zone substations at Nepean ZS and Ambarvale ZS have limited available supply capacity. There are only two adjacent 11kV feeders from these zone substations to provide a limited back up in the event that there is an outage of the existing Menangle Park ZS. The main constraints in the 11kV distribution system are the voltage regulation due to the distance of both Nepean ZS and Ambarvale ZS from the load and the thermal capacity of the existing 11kV feeders.

3.5 Expected unserved energy if action is not taken

If network augmentation is not undertaken, there will be a significant increase in expected unserved energy over the next two decades as demand in the Menangle Development Area increases.

The expected unserved energy is determined from the difference between the firm capacity available and the demand forecast for Menangle development area.

We have used the firm capacity available via the 11kV distribution network to determine the load at risk and the expected unserved energy.

Based on the demand forecast there will be load at risk from late 2024/25 due to the central demand forecast exceeding the firm capacity of the network. The total capacity of the existing Menangle Park mobile substation will be exceeded in 2026/27 when the demand forecast will exceed the 15MVA capacity.

In summary, the existing network provides:

- A limited firm capacity of 5.7MVA which is insufficient to supply the development area from 2024/25 onwards; and
- A total capacity of 15MVA which is insufficient to supply the development area from 2026/27.

Table 7 shows the demand forecasts and the existing capacity in the Menangle Development Area. It presents the three (3) demand forecast scenarios and the load at risk under the central demand forecast scenario.

Figure 9 shows the Load at risk and the three demand forecast scenarios. The existing network supply capacities from the mobile substation and the 11kV distribution network are also shown. Figure 10 clearly shows the expected unserved energy if no action is taken in the Menangle Development Area.

Table 7 – Demand forecasts and existing capacity in Menangle Development Area

Demand Forecast (MVA)	2024	2025	2026	2027	2028	2029	2030	2031	2032		2037	2042
High Forecast	5.0	7.5	13.9	18.7	25.3	37.3	43.2	51.1	58.9		83.9	100.7
Central Forecast	**4.5**	**6.8**	**12.7**	**17.0**	**23.0**	**33.9**	**39.3**	**46.3**	**53.4**		**76.2**	**91.6**
Low Forecast	4.1	6.2	11.4	15.3	20.7	30.5	35.4	41.8	48.2		68.6	82.4
Capacity (MVA)	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**		**2037**	**2042**
Menangle Park Mobile ZS (Total Capacity)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0		15.0	15.0
Supporting 11kV Network (Firm Capacity)	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7		5.7	5.7
Load At Risk (MVA) (Central)	**0.0**	**1.1**	**7.0**	**11.3**	**17.3**	**28.2**	**33.6**	**40.6**	**47.7**		**70.5**	**85.9**

Figure 9 – Load at risk due to insufficient capacity at Menangle Park Mobile ZS

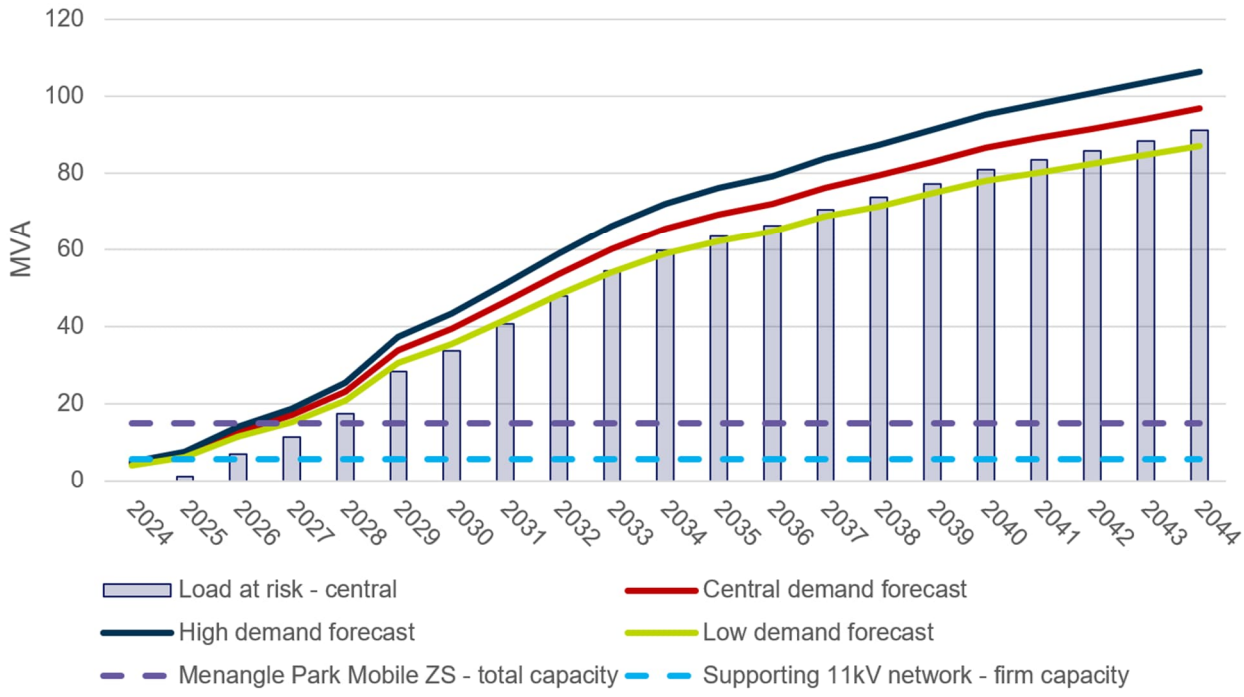
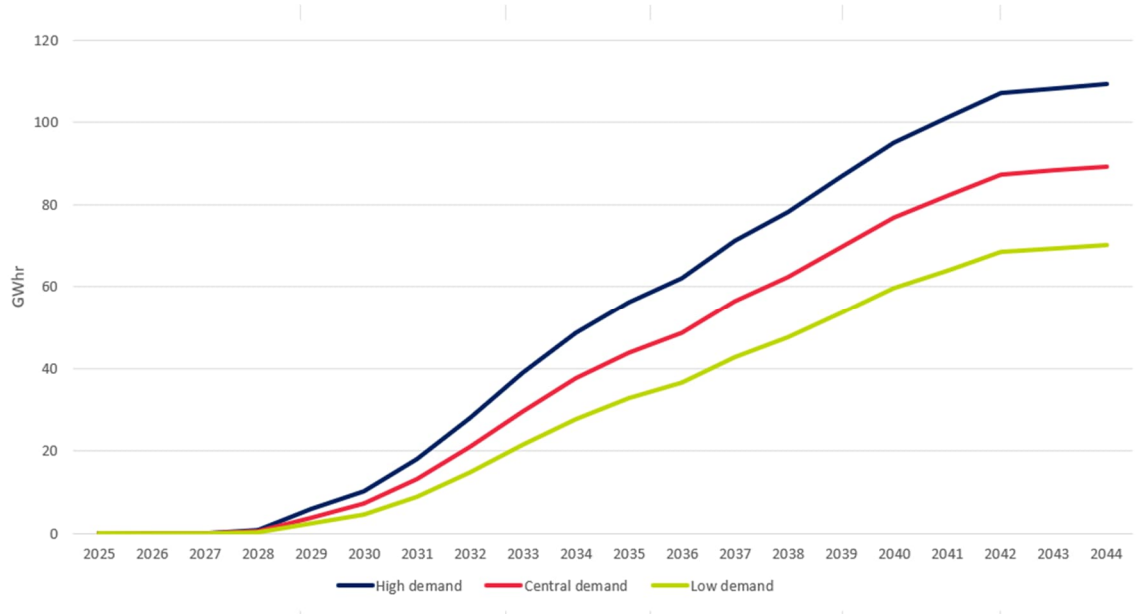


Figure 10 – Expected unserved energy profiles in each demand scenario



Although we expect there to be significant market benefits associated with providing supply to the Menangle Development Area, we consider the need for this investment to be a 'reliability corrective action' due to our regulatory obligations to connect new customers. These regulatory obligations are set out in the box below.

Identified need' for this RIT-D

We have initiated a RIT-D to investigate, and consult on, how to most efficiently provide supply to future load developments in the Menangle Development Area.

Endeavour Energy is required to connect customers under section 5.2.3(d) of the National Electricity Rules (NER), which state 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;"

We therefore consider the identified need for this investment to be a 'reliability corrective action' under the RIT-D because investment is required to comply with the above NER obligations.

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 when the expected load (customer base) requiring connection will exceed the existing network capacity. This is likely to occur from late 2024/25, and based on the connection enquiries received to date, customer demand and consequently network load requirements in this area are expected to continue to grow.

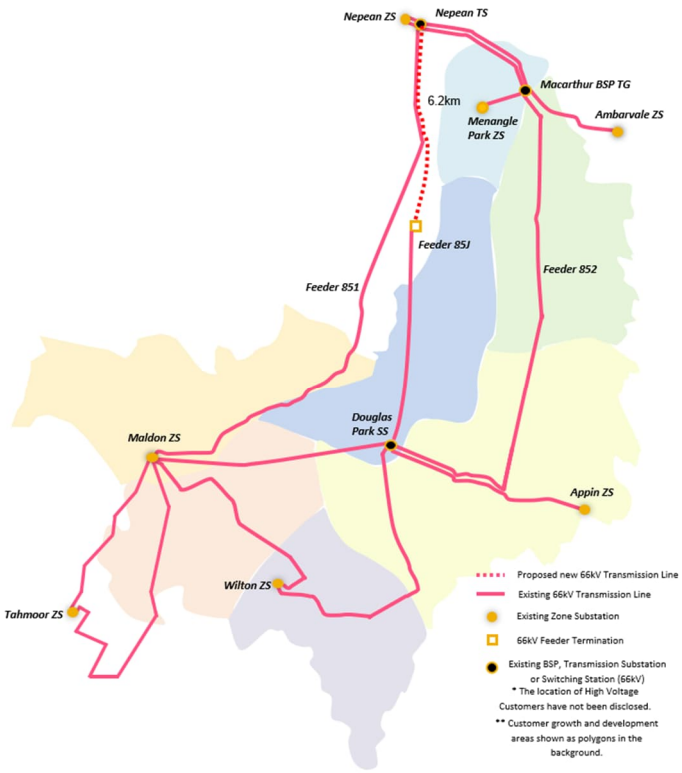
3.6 Related Projects

In the analysis of the existing network and the credible options to meet the identified need of the Menangle Development Area, a related project to meet the supply requirements of the Southern Macarthur Growth Area were considered and referenced.

In October 2024, Endeavour Energy published the FPAR for the Southern Macarthur Growth Area[4], the preferred option proposes the extension of the existing 66kV feeder 85J to connect the Nepean TS to the Douglas Park Switching Station (SS). This 66kV feeder extension is required to provide additional supply capacity and security to the Southern Macarthur area that is located further south of the Menangle Development Area and includes the existing customer base at Wilton, Tahmoor, Appin and Maldon including major customers engaged in mining activities, building materials manufacture and water pumping and treatment. The extension to feeder 85J is planned to be completed by December 2025[5]. This is a separate RIT-D and with a separate identified need, however the route of 85J will be reasonably close to the Menangle Development Area and provides a future 66kV supply option which is nearby and represents an economically efficient connection to the 66kV network. Both of the network options identified for the Menangle Development Area include a 66kV connection to 85J to provide supply to a proposed new zone substation, Moreton Park Road ZS.

Figure 11 is taken from the Southern Macarthur Growth Area Final Project Assessment Report (FPAR) and shows the 6.2km extension of the 66kV feeder 85J and its proximity to the existing Menangle Park ZS.

Figure 11 – Related project: Extension of the 66kV Feeder 85J from Nepean TS to Douglas Park SS



[4] This separate RIT-D is based on the customer demand further south (in Appin, Wilton, Maldon and Tahmoor) and the reliance on the two existing feeders 851 and 852 which during peak demand conditions are unable to mutually back up each other to secure supply to the south. See Endeavour Energy, *RIT-D Final project assessment report: Southern Macarthur Growth Area*, 11 October 2024.

[5] See Endeavour Energy, *RIT-D Final project assessment report: Southern Macarthur Growth Area*, 11 October 2024.

4. Proposed options to meet the identified need

Two credible network options were identified to provide increased supply capacity to the Menangle Development Area and have been assessed in comparison to a base case.

The options are both staged and involve a similar scope of work and network assets:

- Option 1 – Establish Moreton Park Road ZS in 2027/28 and then establish a permanent Menangle Park ZS in 2030/31.
- Option 2 – Establish a permanent Menangle Park ZS in 2027/28 and then establish Moreton Park Road ZS in 2030/31.

This section provides detailed information on the scope and cost of the two options. The key network components and increased supply capacity provided by each option are discussed. It also discusses options that were considered but were not progressed further.

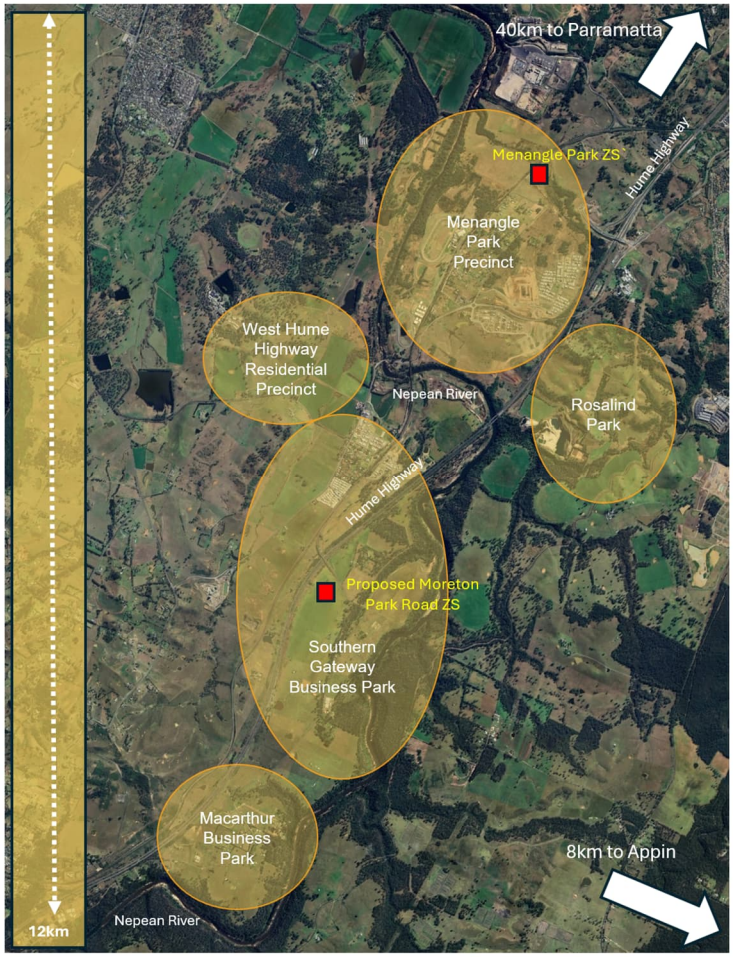
4.1 Option 1 – Establish Moreton Park Road ZS in 2027/28 and then establish a permanent Menangle Park ZS in 2030/31

Option 1 provides increased supply capacity to the Menangle Development Area in two stages:

- Stage 1 – establish a 66/11kV Moreton Park Road ZS with 35MVA firm capacity (70MVA installed capacity) to be commissioned in 2027/28; and
- Stage 2 – establish a permanent 66/11kV Menangle Park ZS with 35MVA firm capacity (70MVA installed capacity) to be commissioned in 2030/31. Including decommissioning of the existing 15MVA mobile substation which is currently on the site.

Figure 12 below shows the location of the stage 1 and stage 2 scope of works proposed under Option 1 in relation to the planned precincts in the Menangle Development Area. The proposed Moreton Park Road ZS would possibly be located within the Southern Gateway Business Park subject to a detailed site assessment. The permanent Menangle Park ZS would be located on the site of the existing temporary mobile substation. The two locations would be approximately 6km apart and provide geographic coverage of the entire Menangle Development Area. The total length of the development area is 12km and is centred on both sides of the Hume Highway and also the geographical features of the Nepean River. The steep terrain of the Nepean River limits the ability to provide 11kV distribution feeders at an economic cost and in some areas are not technically or environmentally feasible. Given the geographical constraints and the length of the development area, the cost of developing 11kV distribution feeders are key considerations in the assessment of the options and their ability to service the developments across the entire area.

Figure 12 – Location of proposed stage 1 and 2 relative to the planned precincts in the Menangle Development Area



4.1.1 Stage 1

Under Stage 1 of Option 1, the 66kV supply to the proposed new Moreton Park Road ZS would be from the feeder 85J which is being extended as part of a separate project to provide augmented supply to the Southern Macarthur area.

The connection to the Moreton Park Road ZS would be established during 2027/28. This is likely to require an underbore of the Hume Highway and include an overhead to underground deviation because the 66kV within the Menangle Development area will be via underground cable and use the existing or proposed public roads as a line route.

The costs of these 66kV transmission feeder works are shown in Table 9 below.

4.1.2 Stage 2

Under Stage 2 the 66kV supply would be established to the permanent Menangle Park ZS from the existing 66 kV feeder (85P) connected to the Macarthur Bulk Supply Point (BSP) with a new 66 kV feeder (85U) from Macarthur BSP. The existing 66 kV feeder 85P will be relocated from the existing 15MVA mobile substation and terminated onto the proposed new 66kV busbar. The mobile substation would be decommissioned and

removed from site to an appropriate storage location for future use. The decommissioning costs are included in the RIT-D analysis.[6]

4.1.3 Distribution Feeders

In addition to establishing two new zone substations across the two stages of the option, there is also the need under this option, Option 1 (and Option 2) to establish new 11 kV distribution feeders. The cost estimates for Option 1 include the scope of works required to establish feeders from Moreton Park Road ZS to the customer demand network load centred around the precincts of Rosalind Park and Menangle Park until 2030. These areas are located to the north of the Menangle Development Area.

A major part of the cost of these 11kV distribution feeders will be met by developers and customers to the degree that they are dedicated assets for their benefit on a user pays principle. For the purposes of this economic evaluation, we have included the costs of these feeders, consistent with RIT-D guidelines for the inclusion of costs, risks and benefits to all market participants.

Under Option 1, a customer demand of approximately 24.7MVA, based on the central demand forecast, will need to be serviced from Moreton Park Road ZS to the load centred around the precincts of Rosalind Park and Menangle Park until 2030. Because the existing Menangle Park Mobile ZS (in proximity to Rosalind Park and Menangle Park) is retained in this option, the interim demand of 24.7MVA is reduced to 9.7MVA and can be serviced by three 11 kV distribution feeders, the route length of which has been determined to be 4.5 km.

A summary of these 11kV distribution requirements and the key assumptions are set out in Table 8 below.

Table 8 – Summary of the 11kV distribution feeder assumptions for Option 1

First Zone substation	Interim Demand	Number of Feeders	Distance to load centre (km)	Unit Cost ($M)	Total Cost ($M)
Moreton Park Road ZS	9.7	3	4.5	3.7	11.1

4.1.4 Summary and costs

Table 9 sets out the scope of work and the capital cost estimates for Option 1.

The capital cost in real 2024/25 dollar terms is estimated to be $51.8 million for Stage 1 and $53.7 million for Stage 2.

The total capital cost for Option 1 is estimated to be **$105.5 million**.

Annual operating and maintenance costs are estimated to be 0.4 per cent of the capital cost for all capital components other than land.

Decommissioning costs of $0.5 million in 2030/31 for the existing Menangle Park mobile substation are included as a separate operating cost. The mobile substation would be removed from the site and transported to a storage location and be ready for future use.

[6] Decommissioning costs for the mobile substation are recognised as an operating cost in the RIT-D analysis.

Table 9 – Scope of works and capital costs of Option 1

Network Component	Proposed Scope of Works	Commissioning year	Cost Estimate ($M, 2024/25)
Stage 1			
Land	Land acquisition.	2024/25	5.0
Moreton Park Road ZS	Establish an Outdoor ZS at Moreton Park Road: • 66/11kV 2 x 35MVA transformers and space for a third. • 2 x Transmission Feeder bays and space for a third. • 3 x 66kV busbars. • 2 x 11kV busbar with 6 x 11kV circuit breakers per busbar.	2027/28	29.0
66kV transmission feeders	Establish two 66kV transmission feeders connecting to the adjacent 66kV feeder 85J. Including approximately 6.0km of cable (2 x 3.0km) and 2 x UGOHs to provide the connection of the underground cables to the overhead feeder 85J.	2027/28	12.8
Distribution works	Establishment of distribution feeders to provide auxiliary supply to the new zone substation and feeder ties to the adjacent zone substations to provide load transfer and back-up capability.	2027/28	5.0
	Total Capital Cost of Stage 1		**51.8**
Stage 2			
11kV feeders	Establish three 11kV feeders from Moreton Park Road ZS to serve developments in proximity to Menangle Park and Rosalind precincts prior to Stage 2 being commissioned.	2027-2030	11.1
Menangle Park ZS	Indoor Zone Substation at Menangle Park: • 66/11kV 2 x 35MVA transformer and space for a third. • 2 x Transmission Feeder bays and space for a third. • 3 x 66kV busbars (new indoor 66kV GIS). • 2 x 11kV busbar with 6 x 11kV circuit breakers per busbar.	2030/31	29.6
66kV transmission feeders	Establish new 66kV transmission feeder from Macarthur BSP to the Menangle Park ZS location to be named 85U. Disconnect existing 66kV transmission feeder 85P from mobile substation and terminate into new Menangle Park ZS 66kV busbar via GIS.	2030/31	9.5
Distribution	Provide additional feeder ties to the adjacent zone substation service areas to enhance load transfer and back-up capability. The existing Menangle mobile substation has two 11kV distribution feeders and these would be moved from the mobile substation to be terminated into the new permanent Menangle Park Zone Substation.	2030/31	3.5
	Total Capital Cost of Stage 2		**53.7**
Total capital cost of Option 1			**105.5**

Figure 13 below presents a simplified single line diagram for Option 1. It represents the network configuration that would exist following the commissioning of Stage 1 and Stage 2.

Figure 13 – Simplified single line diagram of Option 1 including Stage 1 and Stage 2

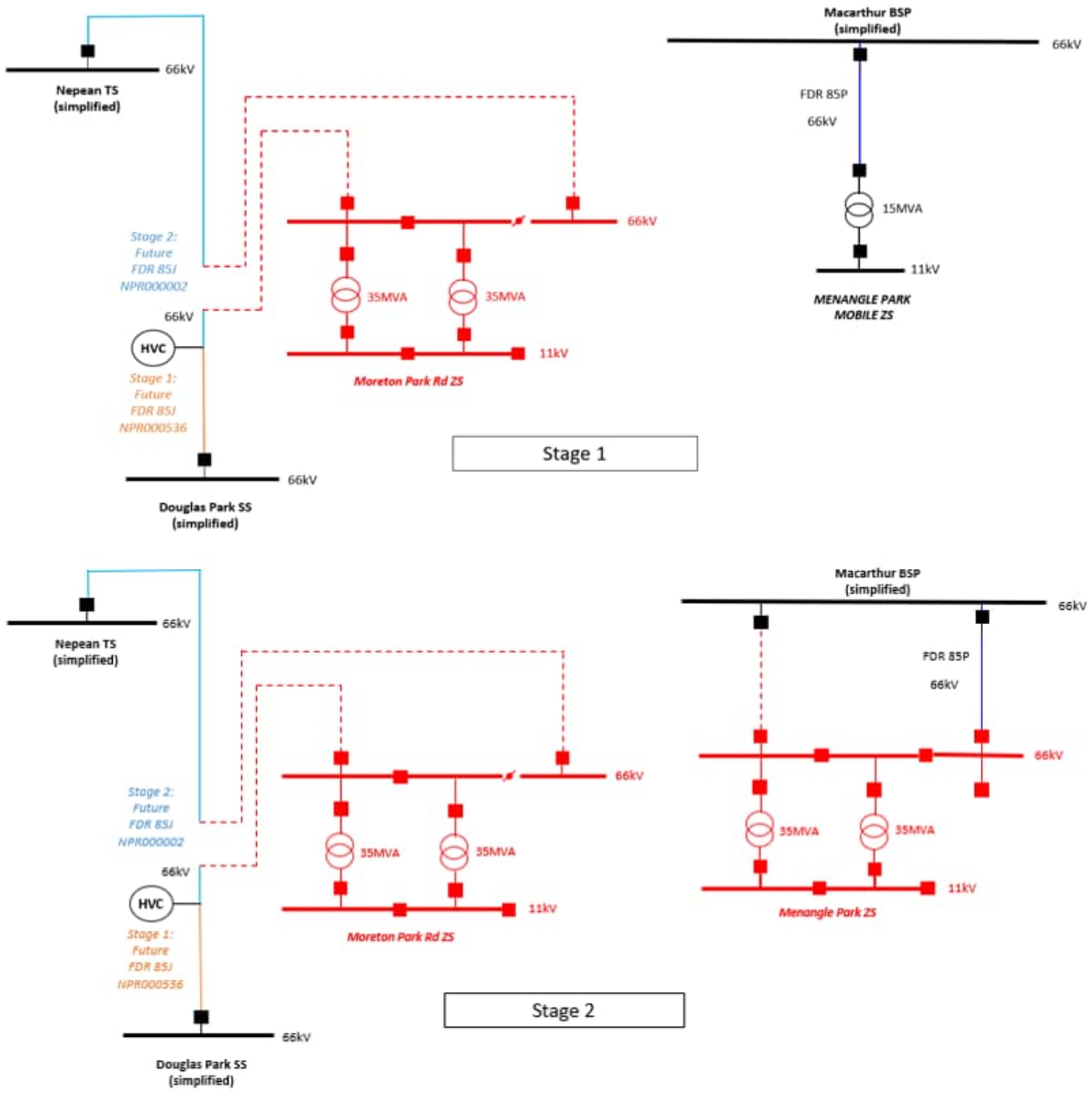
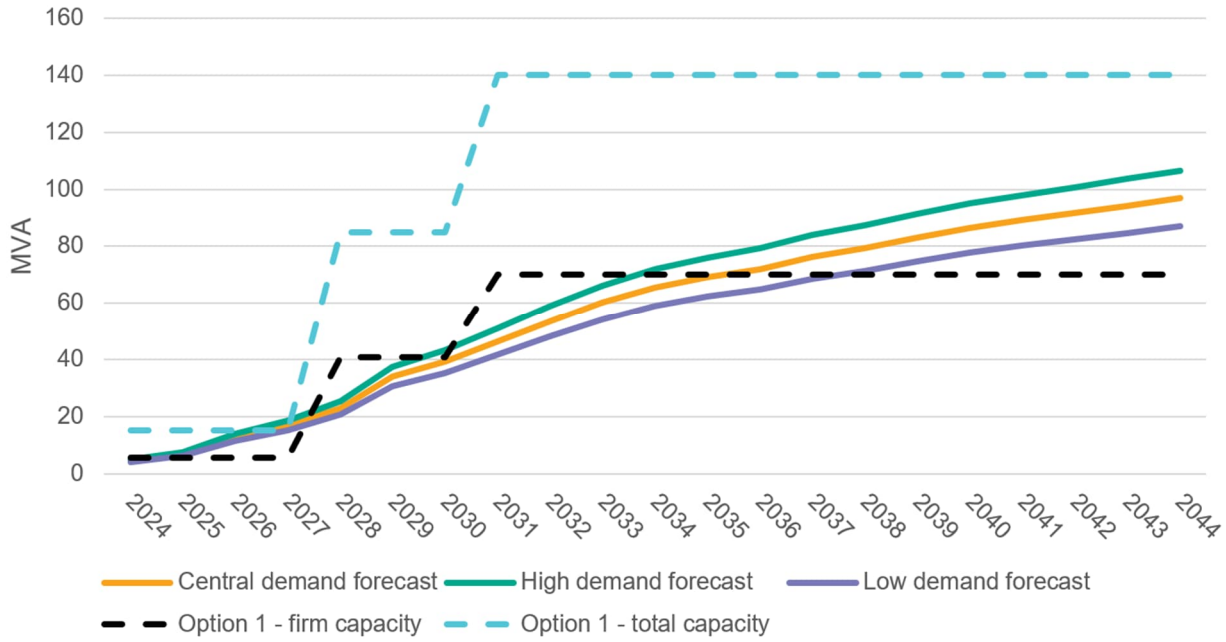


Figure 14 shows the firm and total capacity of Option 1 relative to the demand forecasts discussed in section 3.5. The second stage under this option would occur during the next regulatory period. Endeavour Energy intends to undertake a separate RIT-D before committing to this second stage. Therefore, the timing of the second stage can be reviewed in the future based on the progress of the proposed development precincts.

Figure 14 – Demand forecasts and option 1 firm and total capacity



We note that demand is expected to exceed the ultimate firm rating of the two proposed zone substations between approximately 2033 and 2037, such that there would be a need for further investment to augment supply in the area.

However, because the area is still developing and land is being released and rezoned, it is not clear where the final geographic centre of load will be located between the Moreton Park Road and Menangle Park sites. Consequently, adding an additional transformer to meet customer demand after say 2035 at one of the two proposed sites is currently considered by Endeavour Energy as a future project and will be further defined at the time when the location of future demand growth at Moreton Park Road ZS and Menangle Park ZS becomes known with more certainty.

4.2 Option 2 – Establish a Permanent Menangle Park ZS as Stage 1 and then establish Moreton Park Road ZS as Stage 2

Option 2 provides increased supply capacity to the Menangle Development Area in two stages:

- Stage 1 – establish a permanent 66/11kV Menangle Park ZS with 35MVA firm capacity (70MVA installed capacity) to be commissioned in 2027/28. Including decommissioning of the existing 15MVA mobile substation which is currently on the site; and
- Stage 2 – establish a 66/11kV Moreton Park Road ZS with 35MVA firm capacity (70MVA installed capacity) to be commissioned in 2030/31.

4.2.1 Stage 1

Under Stage 1 of Option 2, the 66kV supply to the proposed permanent Menangle Park ZS would be from the existing feeder 85P and a new feeder will be installed, also from Macarthur BSP, and is proposed to be named 85U

The permanent Menangle Park ZS would be located on the site of the existing mobile substation and also connect to the existing 11kV distribution network currently supplied by the mobile substation.

The existing Menangle Park ZS location is suitable for an indoor substation arrangement and we are proposing to use a GIS unit (Gas Insulated Switchgear) that Endeavour Energy currently has in our essential spares fleet. The cost of this GIS unit is estimated to be $2.7M lower than the cost of alternate options available for the proposed permanent Menangle Park ZS.

Accordingly, the cost of developing the permanent Menangle Park ZS is expected to be $2.7M lower in Option 2 compared to Option 1 ($26.9 million compared to $29.6 million). Primarily, the reason for this is that the GIS to be utilised in Option 2 for Menangle Park ZS will not available in 2030 because the unit is also suitable for 132kV primary and is likely to be allocated to another project by that time and not be available to this project.

4.2.2 Stage 2

The scope of work and technical details of Stage 2 of Option 2 are similar to Stage 1 of Option 1, however with commissioning to occur in 2030/31.

4.2.3 Distribution Feeders

In addition to establishing two new zone substations over the two stages of work in Option 2 there is also the need to establish 11 kV distribution feeders to provide customer connections and support reticulation of electricity to customers.

Under Option 2, in which Menangle Park ZS is established first, a demand of approximately 14.6 MVA (based on the central demand forecast) will need to be serviced from Menangle Park ZS to the load centred around the precincts of the Southern Gateway Business Park, West Hume Highway Residential Precinct, and Macarthur Business Park until 2031. To service the interim demand of 14.6 MVA, three 11 kV distribution feeders will be required, the route length of these feeders have been determined to be 6km.

The higher costs of 11kV feeders for this interim supply period between the stages under Option 2 compared to Option 1 is due to this additional route length (the distance to the load centre and the route itself). In summary, the Menangle Park ZS would require longer feeders to supply southern areas than Moreton Park Road ZS does to supply northern areas.

A summary of the 11kV distribution feeder requirements and key assumptions are shown in Table 10 below.

Table 10 – Summary of 11kV distribution feeder assumptions for Option 2

First Zone Substation	Interim Demand	Number of Feeders	Approximate Distance to load centre (km)	Feeder Unit Cost Estimate ($M)	Total Cost Estimate ($M)
Menangle Park ZS	14.6	3	6.0	4.5	13.5

4.2.4 Summary and costs

Table 11 shows the scope of work and capital cost estimate for Option 2.

The capital cost in real 2024/25 dollar terms is estimated to be $39.9 million for Stage 1 and $65.3 million for Stage 2. The total capital cost for Option 2 is estimated to be $105.2 million.

Routine operating and maintenance costs are estimated to be 0.4 per cent of the capital cost for all capital components other than land.

Decommissioning costs of $0.5 million in 2027/28 for the Menangle Park mobile substation are included in the assessment framework as a separate operating cost.

Table 11 – Scope of works and costs for Option 2

Network Component	Proposed Scope of Works	Commissioning year	Cost Estimate ($M, 2024/25)
Stage 1			
Menangle Park ZS	Indoor Zone Substation at Menangle Park: • 66/11kV 2 x 35MVA transformers and space for a third. • 2 x Transmission Feeder bays and space for a third. • 3 x 66kV busbars (utilising an essential spare 66kV capable GIS board). • 2 x 11kV busbar with 6 x 11kV circuit breakers per busbar.	2027/28	26.9
66kV transmission feeders	Establish new 66kV feeder from Macarthur BSP (85U). Disconnect existing 66kV feeder 85P from mobile substation and terminate it into the permanent Menangle Park zone substation.	2027/28	9.5
Distribution	Provide additional feeder ties to the adjacent zone substation service areas to enhance load transfer and back-up capability. The existing Menangle mobile substation has two 11kV distribution feeders and these would be disconnected from the mobile substation to be terminated into the permanent Menangle Park ZS.	2027/28	3.5
	Total Capital Cost of Stage 1		**39.9**
Stage 2			
11kV feeders	Establish three 11kV feeders to serve the southern developments from Menangle Park ZS prior to Stage 2 (Moreton Park Road ZS) being commissioned.	2025-2030	13.5
Land	Land acquisition.	2027/28	5.0
Moreton Park Rd ZS	Outdoor Zone Substation at Moreton Park Road: • 66/11kV 2 x 35MVA transformer, space for a third. • 2 x Transmission Feeder bays, space for a third. • 3 x 66kV busbars • 2 x 11kV busbar with 6 x 11kV circuit breakers per busbar.	2030/31	29.0
66kV transmission feeders	Establish two 66kV transmission feeders connecting to the adjacent 66kV feeder 85J. Including approximately 6.0km of cable (2 x 3.0km) and 2 x UGOHs to provide the connection of the underground cables to the overhead feeder 85J.	2030/31	12.8
Distribution	Establishment of distribution feeders to provide auxiliary supply to the new zone substation and feeder ties to the adjacent zone substations to provide load transfer and back-up capability.	2030/31	5.0
	Total Capital Cost of Stage 2		**65.3**
Total capital costs of Option 2			**105.2**

Figure 15 below shows a high-level single line diagram for Option 2. It represents the network configuration provided following the commissioning of Stage 1 and Stage 2.

Figure 15 – High level single line diagram for Option 2

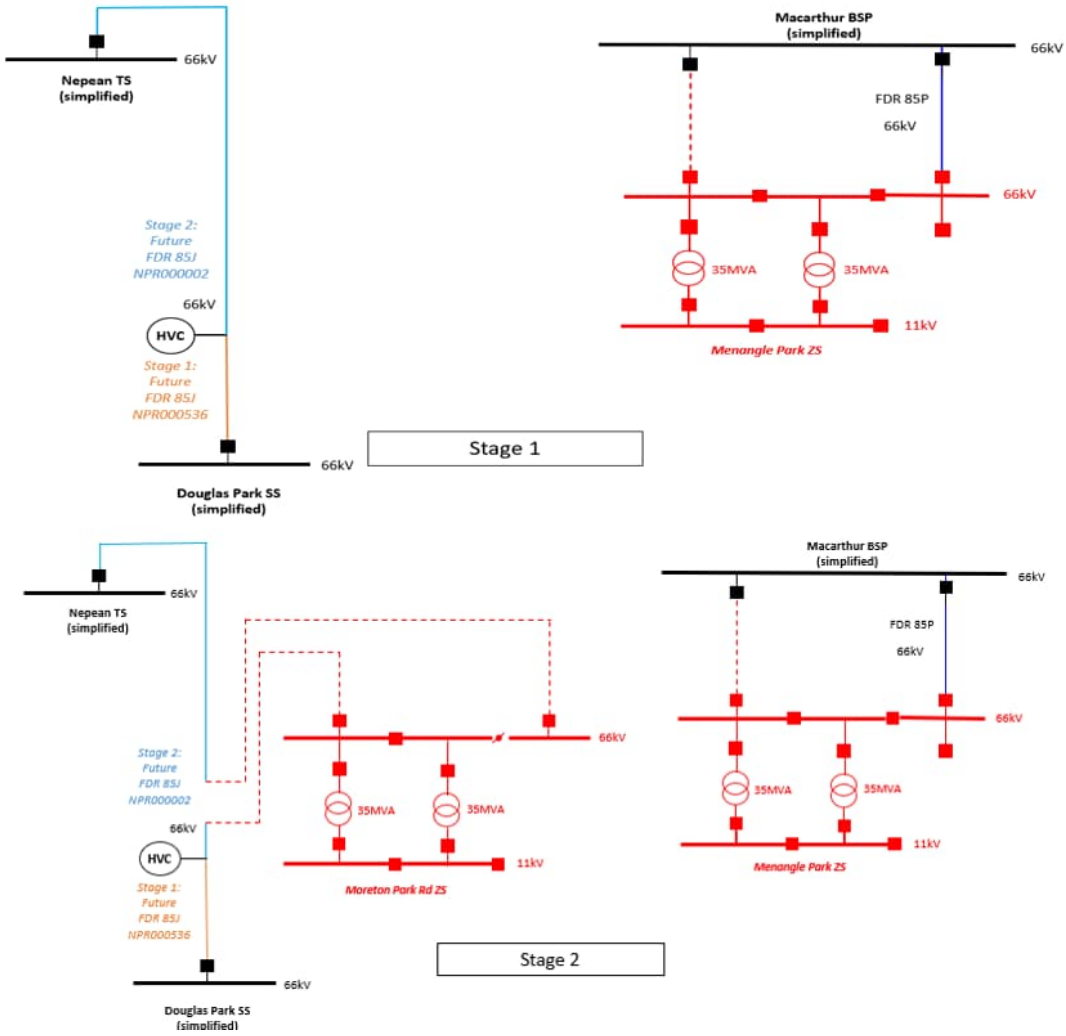
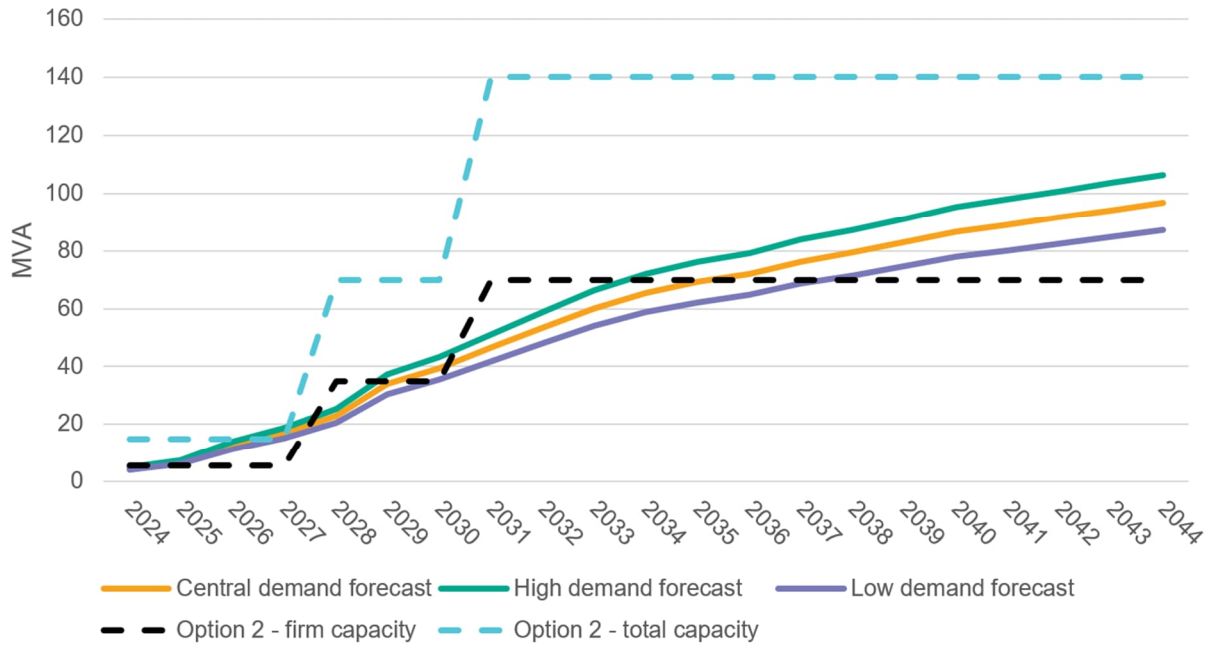


Figure 16 shows the firm and total capacity provided by Option 2 relative to the demand forecasts. The proposed staged implementation of Option 2 provides for a staged augmentation to the supply capacity to cater for the customer demand, over the three scenarios.

Figure 16 – Demand forecasts and option 2 firm and total capacity



4.3 Options considered but not progressed

Endeavour Energy has considered three additional options that we have not progressed in this DPAR. These options and our reasoning for not progressing them further are summarised in Table 12.

Table 12 – Options considered but not progressed

Option	Reason not progressed
Further staging of the network options	Endeavour Energy considered deferring the installation of the second transformer at Menangle Park ZS and Moreton Park Road ZS by two years – to ensure that the proposed investment represents the minimum network investment required to service the estimated demand and customer connection requirement. However, Endeavour Energy has determined that deferring the installation of the second transformer at either zone substation would not be a technically feasible option in this case. Given that this area is predominantly greenfield development and is supported by limited network infrastructure, the installation of the first 35MVA transformer at either Menangle Park or Moreton Park Road does not address the firm capacity limitation. As such, a staged implementation is not a credible option to address the load at risk within this area, particularly under a single contingency event, and has not been considered further as a credible option for this RIT-D.
Utilise an outdoor Zone Substation arrangement for the permanent Menangle Park ZS	The land on which the existing Menangle Park mobile substation is located was originally acquired in 2017. This is the land that will be used for the permanent Menangle Park ZS. At the time, the intent at this site was to build a future indoor substation, given its close proximity to planned residential dwellings and the lower visual amenity of an outdoor zone substation in close proximity to residential housing. Consequently, and after additional site assessment studies, it has been determined that there is not enough ground surface area to build an outdoor substation at this site. Therefore, an outdoor zone substation is not a technically feasible solution and has not been considered further in this RIT-D assessment.

4.4 Non-network solutions unlikely to be technically feasible

The NER require DNSPs to investigate non-network options by utilising a consultation process as part of planning for major network augmentations. As part of the RIT-D process, Endeavour Energy has issued an Options Screening Notice on 17 March 2025.

Our finding is that non-network options are unlikely to be technically feasible to address the identified need set out in this DPAR due to the lack of existing infrastructure in the Menangle Development Area. Although there are existing customers in the Menangle Precinct supplied from the mobile substation that was commissioned in 2021, the Menangle Development Area and the underlying planned precincts are largely undeveloped and we consider this area unsuitable for a non-network option that would avoid or defer our preferred network option. The Menangle Development Area extends over a 12km long area on both sides of the Hume Highway and is also bordered by the Nepean River and the steep terrain around the river, this results in there being no technically feasible non-network solution to meet the identified need which includes the capacity to supply the customers and provide for their connection to the network.

We have also found that a SAPS solution could not contribute to meeting the identified need because the demand requirements of the greenfield development area are significant and therefore could not be supported by a network that is not part of the interconnected national electricity system with the ability to draw on grid-connected generation sources.

We note that non-network solutions may be feasible when the proposed network infrastructure has been commissioned to defer future network investment.

5. Assessment framework

This section outlines the methodology that we have applied in assessing the market benefits and costs associated with the two credible options considered in this RIT-D.

5.1 Overview of the assessment framework

5.1.1 Base case

All costs and benefits for both credible options have been assessed in comparison to a business-as-usual base case in which there is no proactive intervention. Under this base case, Endeavour Energy would continue to rely on the existing Menangle Park mobile substation to supply the growing customer demand requirement from developments in this area.

The consequence of not proceeding with an investment option for the development area results in significant unserved energy due to the existing supply network being constrained and incapable of supplying the forecast demand for the area. The option of 'no proactive intervention' would lead to the total capacity of Menangle Park Mobile ZS capacity being exceeded by 2027/28 in the central load scenario, resulting in significant unserved energy. The firm capacity of the 11kV distribution network will be exceeded earlier in 2024/25.

The 'no proactive intervention' option is not considered credible because it will result in significant expected unserved energy in the development area which would prevent the connection of new customers, which is inconsistent with Endeavour Energy's obligations under the NER and also inconsistent with the NSW Government's plan for the Greater Macarthur Growth Area and Greater Sydney Region Plan.[7] This RIT-D has been initiated to avoid this outcome. Table 13 below shows the value of the expected unserved energy under the central demand forecast and the VCR.

Table 13 – Value of Expected Unserved Energy under the central demand forecast

Expected Unserved Energy	2025	2026	2027	2028	2029	2030	2031		2036	2041
Expected Unserved Energy (MWh)	0	4	33	411	3,860	7,137	13,102		48,748	82,119
Value of expected unserved energy ($M)	0.0	0.1	1.0	12.6	118.5	219.1	402.1		1,496.2	2,520.4

5.1.2 Key parameters

This RIT-D analysis has been undertaken over a 20-year period, from 2024/25 to 2043/44. We consider that the length of this assessment period takes into account the size, complexity and expected economic life of the relevant credible options to provide a reasonable indication of the market benefits and costs of the options.

We have adopted a central real, pre-tax discount rate of 3.27 per cent as the central assumption for the NPV analysis presented in this DPAR. We have also tested the sensitivity of the results to changes in this discount rate assumption with a lower bound real, pre-tax discount rate of 2.23 per cent and an upper bound discount rate of 4.31 per cent (i.e., a symmetrical upwards adjustment).

5.2 Market benefits are expected from reduced involuntary load shedding

We expect that the only relevant category of market benefit under the NER for this RIT-D are changes in involuntary load shedding. Our approach to valuing reduced involuntary load shedding (expected unserved energy) is outlined below.

[7] See NSW Government and Greater Sydney Commission, *Greater Sydney Region Plan 2018*; and NSW Government Department of Planning and Environment, *Guide to the Greater Macarthur Growth Area*, November 2022.

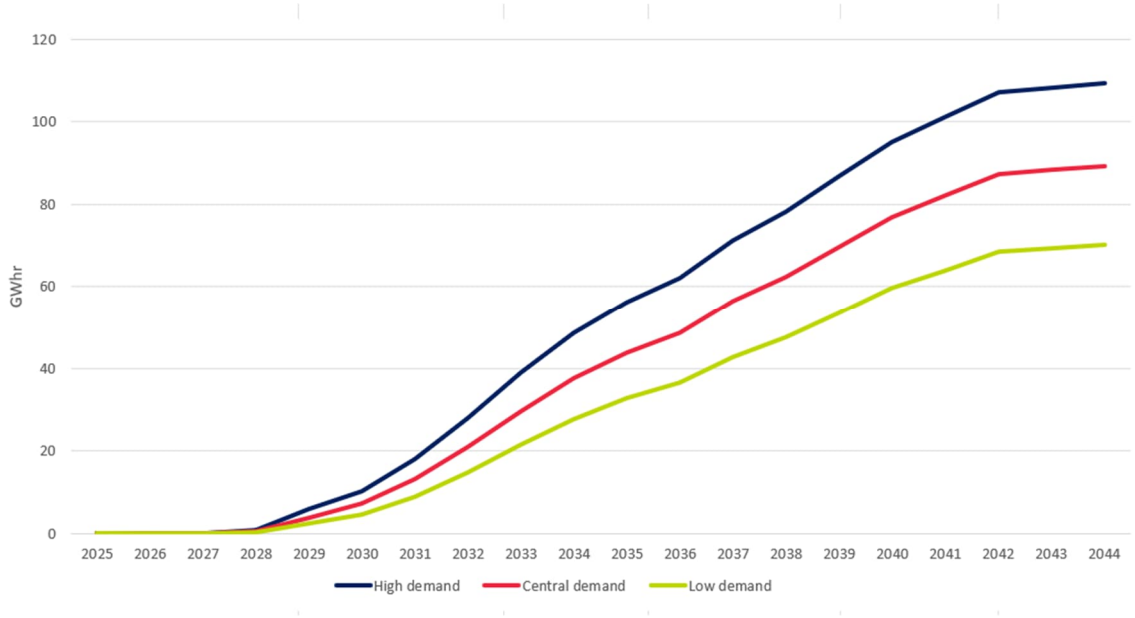
5.2.1 Reduced involuntary load shedding

Endeavour Energy has valued reduced involuntary load shedding by reference to our expected unserved energy, which is derived from the annual peak demand forecasts.

Figure 17 below shows the expected unserved energy profiles for each demand scenario.

This is identical to Figure 10 and is reproduced here to conveniently illustrate the market benefits expected by avoiding this expected unserved energy.

Figure 17 – Expected unserved energy profiles in each demand scenario



The value of expected unserved energy is calculated using the AER's estimate of the value of customer reliability (VCR). The VCR represents an estimate of the value electricity consumers place on reliable electricity supply. The VCR value (in dollars per MWh) is applied to the difference in the MWh of expected unserved energy calculated between the base case and each credible option.

The VCR is determined based on the types of customer segments expected to be served by Menangle Park ZS and Moreton Park Road ZS. In particular, we expect 82% of the customer demand to be residential and 12% per cent to be commercial with 6% to be industrial.

We have used a composite VCR value of $51,318 per MWh in the evaluation, based on the calculation provided in Table 14 below. This is based on the December 2024 VCR values published by the AER.

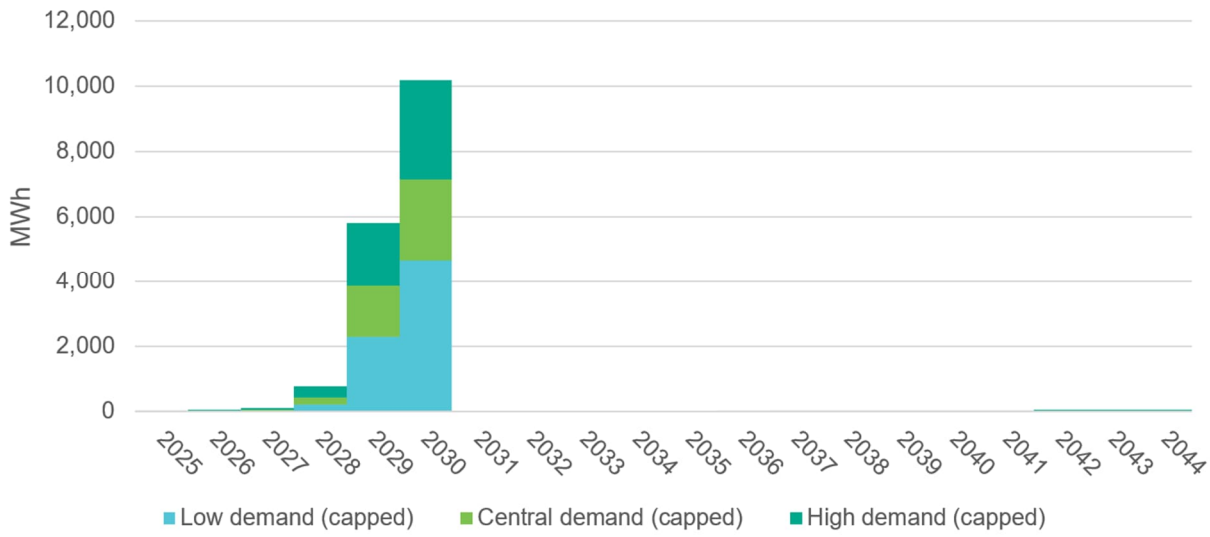
Table 14 – Composite VCR used in evaluation

Parameter	Residential (Climate Zone 6 CBD and Suburban)	Commercial	Industrial
Demand composition of the Menangle Development Area	82%	12%	6%
AER VCR (Dec 2024)	$55.10/kWh	$34.39/kWh	$33.49/kWh
Demand weighted VCR	$51.32/kWh		
Demand weighted VCR (MWh)	**$51,318.20/MWh**		

We have elected to cap the unserved energy used in the NPV assessment at zero from 2031 onwards. This decision has been made so that the difference between the credible options can be seen more clearly than if all avoided unserved energy benefits through to 2043/44 were included. Given that both credible options avoid the same amount of unserved energy from 2031 onwards, this does not affect the ranking of the options nor the absolute difference between the net benefits of each option. However, as avoided unserved energy amounts from 2031 onwards are very large, including them would distract from the analysis such that the difference between the options would be more difficult to observe than under the capping approach that we have taken. The approach of capping expected unserved energy in the base case is aligned with other RIT-Ds (and RIT-Ts).

The capped unserved energy approach taken in this RIT-D is shown in Figure 18 below with the values used in the economic analysis shown for the three demand forecast scenarios.

Figure 18 – Capped expected unserved energy values used in the economic analysis



We provide the NPV results on the basis of uncapped expected unserved energy in Appendix A.

5.3 No other categories of market benefit are expected to be material

This section provides a brief overview of the categories of market benefit that Endeavour Energy considers will not materially affect the outcome of this RIT-D assessment. These are:

- changes in voluntary load curtailment;
- option value;
- changes in load transfer capability;
- changes in costs to other parties;
- changes in electrical losses;
- changes in the timing of unrelated expenditure; and
- avoided greenhouse gas emissions.

5.3.1 Changes in voluntary load curtailment

Voluntary load curtailment is when customers agree to reduce their demand (load) to address a network limitation in return for a payment. A credible demand side option to enlist such customers to voluntarily reduce their demand could lead to a reduction in voluntary load curtailment.

Endeavour Energy has not estimated any market benefits associated with changes in voluntary load curtailment. Although, generally, customers are now more capable of providing greater levels of voluntary load curtailment, the greenfield nature of this investment is such that the area does not have the capability to deliver sufficient voluntary demand reduction.

5.3.2 Option value

Endeavour Energy notes the AER's view that option value is likely to 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 by the RIT-D proponent are sufficiently flexible to respond to that change.

Although we have not explicitly quantified option value for this assessment, it is implicitly captured in the staged structure of our credible options each of which have flexibility for future investment and could be accelerated or deferred to respond to customer demand over time.

5.3.3 Changes in load transfer capability

Distribution investments can improve load transfer capacity where a credible option allows customers to gain access to an alternate back-up power supply via the meshed 11kV network. This is a market benefit because the alternate supply can service customers in the event of loss of primary supply.

The main objective of this project is to establish a secure connection for new customers in the Menangle Development Area. An analysis of the Ambarvale ZS and Nepean ZS feeders indicate the limited load transfer capability via the 11kV network. However, establishing Moreton Park Road ZS and the 66kV connection from 85J introduces possible load transfer capability via the 66kV network by providing an alternate path of supply from Nepean TS and Transgrid's Macarthur BSP.

While establishing Moreton Park Road ZS will improve load transfer capability, we have not included this category of benefits in the economic evaluation as changes in load transfer capability will be similar between the credible options given that Stage 1 and Stage 2 are only three years apart, and the magnitude of load transfer capability is unlikely to be material.

5.3.4 Changes in costs to other parties

Endeavour Energy has not identified any changes in costs to other parties from developing the credible options identified in this document.

5.3.5 Changes in electrical losses

Endeavour Energy recognises that there would be small changes in the loss profiles for customers across the network due to these changes in the network. We do not expect these changes to be material to any particular customer or group of customers.

These changes are captured as part of the annual review of distribution loss factors when more information about customer usage patterns is available.

5.3.6 Changes in the timing of unrelated expenditure

Differences in the timing of expenditure relates to the potential for a credible option to change the timing (or configuration) of other future investments to be made by or for the RIT-D proponent. Importantly, this relates to distribution investments that address identified needs other than those addressed by the credible option. Given that this investment is concerned with establishing the first stage of supply in the greenfield development area of the Menangle Development Area, we do not consider differences in the timing of unrelated expenditure to be material for this RIT-D.

5.3.7 Avoided greenhouse gas emissions

Following the change to the National Electricity Objective (NEO) in September 2023 to include changes in Australia's greenhouse gas emissions, and the subsequent change to the NER on 1 February 2024, NSPs are required to include a new benefit category to cater for changes in emissions in RIT assessments (where material).

Endeavour Energy recognises the importance of considering changes in greenhouse case emissions in light of the changes made to the NEO. However, neither of the options considered in this RIT-D 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.

In particular, the similarities between option components in this RIT-D mean that differences in avoided greenhouse gas emissions are unlikely to be material.

5.4 Endeavour Energy's approach to estimating project costs

Endeavour Energy's design teams have estimated capital costs by considering the scope of works of each of the credible options and utilised unit costs discovered from recent major projects including:

- Aerotropolis Backbone Feeder 132kV from South Erskine Park ZS to Bringelly ZS
- Western Sydney Airport Transmission Substation
- North Bradfield ZS
- Box Hill ZS
- South Erskine Park ZS.

These major projects are in various stages of completion ranging from detailed design to approaching commissioning and we have monitored the increase in cost over the previous four years.

We have observed significant increases in the cost of major equipment including cable and transformers, civil and building works (including bulk earthworks) and the civil works for trenching for cable installation works. The costs of third-party contractors who support the delivery of major projects have increased substantially.

Our cost estimates for the credible options in this DPAR are based on the best cost estimate information that we have available at the time of publishing. We have also included real cost increases in our cost estimates to cover the future delivery of staged works as far into the future as 2031.

Endeavour Energy does not generally apply the 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.

We estimate that actual costs will be within +/- 25 per cent of the central capital cost estimate. While we have not explicitly applied the AACE cost estimate classification system, we note that an accuracy of +/- 25 per cent for cost estimates is consistent with industry best practice and aligns with the accuracy range of a 'Class 4' estimate, as defined in the AACE classification system.

No specific contingency allowance has been included in the cost estimates.

All cost estimates are prepared in real 2024/25 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.

Routine operating and maintenance costs are based on a network level assessment of assets. These costs are included for each year in the assessment period commencing from when the options are planned to be commissioned.

5.5 Three different demand scenarios have been modelled to address uncertainty

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

We have assessed three alternative future scenarios as part of the DPAR NPV assessment, namely:

- a central demand scenario – consisting of assumptions that reflect the central demand forecast in MVA terms. This scenario represents the best estimate of demand based on estimates from network connection applications, developers, local councils and government;
- a high demand scenario – reflecting higher demand forecasts above the central demand scenario in MVA terms. This scenario has been included in the assessment to test the impact of a higher demand forecast on the ranking of the credible options; and
- a low demand scenario – reflecting lower demand forecasts below the central demand scenario in MVA terms. This scenario has been included in the assessment to test the impact of a lower demand forecast on the ranking of the credible options.

Other parameters, including capital expenditure, VCR and discount rate are held constant across the scenarios, with variations considered as part of the sensitivity analysis.

A summary of the key variables used for each scenario is provided in Table 15 below.

Table 15 – Scenario used in the RIT-D NPV assessment

Parameter / Scenario	Central scenario	High demand	Low demand
Demand	Central demand forecast	High demand forecast (+10% MVA)	Low demand forecast (-10% MVA)
Capex	Central estimates	Central estimates	Central estimates
VCR	Load-weighted AER VCR of $51,318/MWh	Load-weighted AER VCR of $51,318/MWh	Load-weighted AER VCR of $51,318/MWh
Discount rate	3.27%	3.27%	3.27%
Scenario weighting	33%	33%	33%

Endeavour Energy considers that all scenarios are equally likely on the basis that there is no information that would indicate each individual scenario being more likely than other scenarios, and as such they have all been given equal weighting of one third for the assessment of credible options.

6. Assessment of credible options

This section summarises the results of the NPV analysis, including the sensitivity analysis undertaken. All credible options have been assessed in comparison to the business-as-usual (no proactive intervention) base case.

6.1 Gross market benefits estimated for each credible option

Table 16 below summarises the gross market benefit of each credible option relative to the base case in present value terms. The gross market benefit has been calculated for each of the scenarios.

Table 16 – Present value of gross market benefits of each credible option relative to the base case ($M, PV)

Option	Central scenario	High benefits	Low benefits	Weighted
Scenario weighting	33%	33%	33%	
Option 1	448	642	286	459
Option 2	**489**	**719**	**306**	**505**

Option 2 provides higher market benefits primarily due to it being able to avoid more of the expected unserved energy due to it providing network supply capacity closer to the expected load centre. The development in the early years of the assessment period is centred closer to the Menangle Park area and in the later years of the assessment period, the development is more centred to the south and towards the proposed location of the Moreton Park Road ZS. The locating of augmented network capacity to locations close to the customer need results in a lower expected unserved energy, although we expect this area to be served by a very high reliability underground reticulated electricity supply.

6.2 Estimated costs for each credible option

Table 17 below summarises the costs of each credible option relative to the base case in present value terms. The cost is the sum of the project capital costs and the estimated annual operating and maintenance costs.

The capital cost of each option does not vary across the three demand scenarios.

Table 17 – Present value of costs of each credible option under each scenario ($M, PV)

Option	Central scenario	High benefits	Low benefits	Weighted
Scenario weighting	33%	33%	33%	
Option 1	57.2	57.2	57.2	57.2
Option 2	**56.3**	**56.3**	**56.3**	**56.3**

6.3 Net present value assessment outcomes

Table 18 below summarises the net market benefit in NPV terms for each credible option under each scenario. The net market benefit is the gross market benefit (as set out in Table 16) minus the cost of each option (as set out in Table 17).

Table 18 – Present value of net market benefit of each credible option relative to the base case ($M, PV)

Option	Central scenario	High benefits	Low benefits	Weighted	Rank
Scenario weighting	33%	33%	33%		
Option 1	391	585	229	402	2
Option 2	**433**	**662**	**250**	**448**	**1**

Under the NER, the preferred option is the credible option that maximises the present value of the net economic benefit to all those who produce, consume or transport electricity in the NEM, as well as that arising from changes in Australia's greenhouse gas emissions.

Applying this criteria, Option 2 is the preferred option at this draft stage because it has the highest net benefits. Option 2 has the highest net benefits on a weighted basis and in each scenario.

The following section demonstrates that the sensitivity analysis we have undertaken confirms our view that Option 2 is preferred at this draft stage.

6.4 Sensitivity and boundary analysis

6.4.1 Sensitivity analysis results

We have undertaken a thorough sensitivity testing analysis to test the robustness of the RIT-D assessment to underlying assumptions about key variables. Our sensitivity analysis has focused on testing the sensitivity of the total NPV benefit associated with the investment proceeding consistent with the timeframes for customer connection and customer demand. We have assessed the sensitivity of the net benefits of each option to:

- changes in the discount rate;
- changes in the capital costs; and
- changes in the VCR.

The figures below demonstrate that these sensitivities confirm the selection of the preliminary preferred option.

Figure 19 – Impact of varying the discount rate on the net market benefits of each credible option

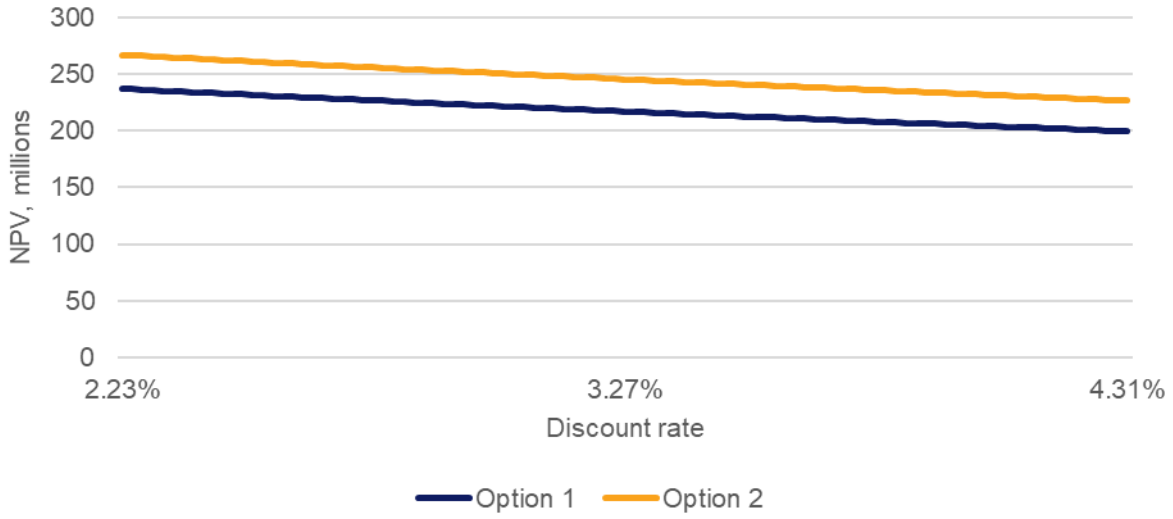


Figure 20 – Impact of varying capital costs on the net market benefits of each credible option

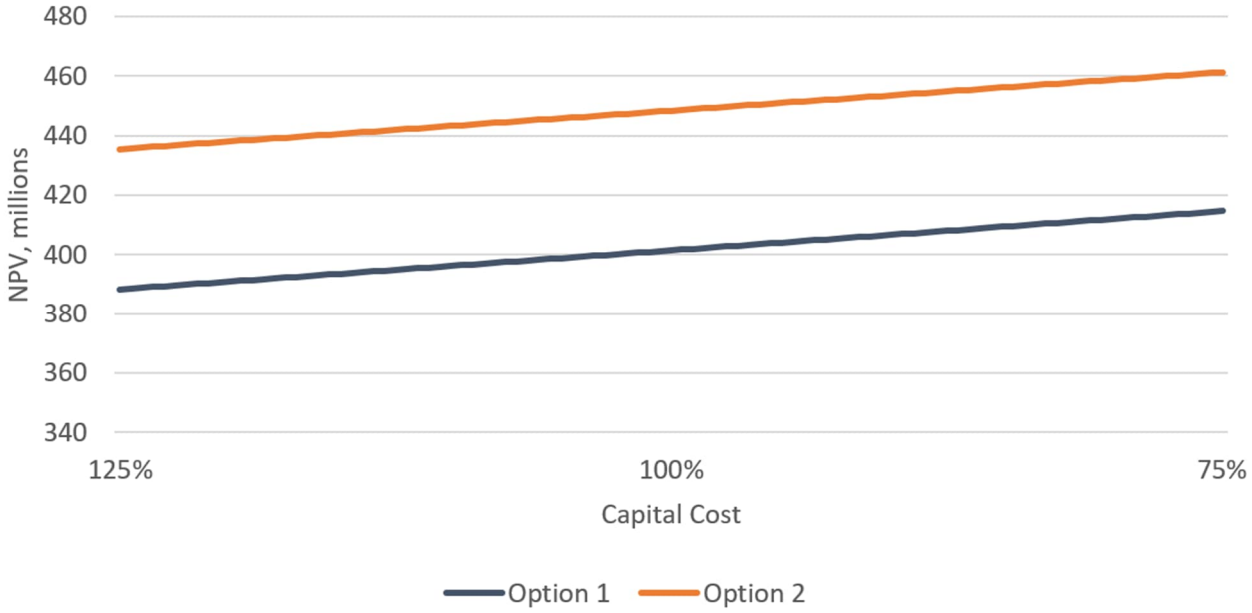
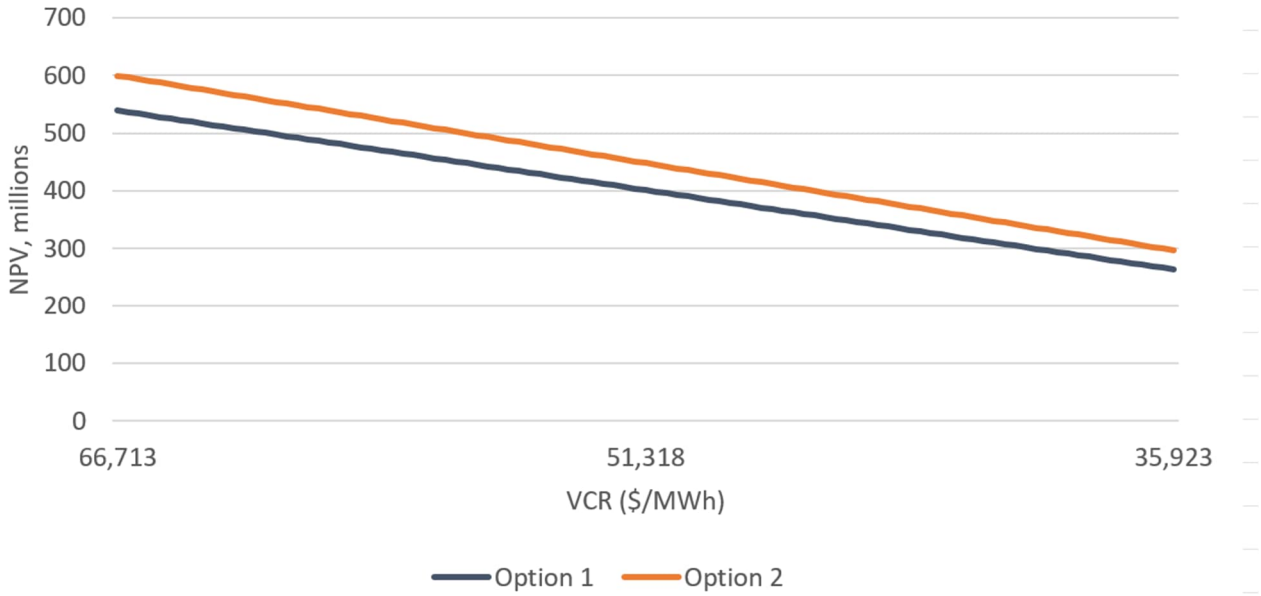


Figure 21 – Impact of varying the VCR on the net market benefits of each credible option



6.4.2 Boundary analysis results

In addition to the sensitivity testing, we have undertaken boundary testing to understand the bounds of discount rates, capital costs, and VCR parameters where the preferred option can continue to exhibit the highest net benefit and maintain a positive net benefit. Table 19 below shows the results of the Boundary testing conducted for our analysis of the Menangle Development Area.

Table 19 – Boundary testing

Parameter	For Option 2 to no longer be the preferred option	For Option 2 to no longer exhibit net market benefits
Discount rate	No realistic value.	99 per cent
Capital cost	No realistic value.	476 per cent increase
VCR	No realistic value.	$5,726/MWh

Furthermore, while this RIT-D is considered a reliability corrective action under section 5.10 of the NER, we note that there are no realistic parameter values for the discount rate, capital cost or VCR that would cause Option 2 to no longer exhibit positive net benefits.

There are also no realistic values for discount rate, capital cost or VCR that would result in a change of the preferred option.

7. Conclusion

The Menangle Development Area is located within the south-west of Sydney. It is approximately 40km south-west of Parramatta and 20km south-east of the Western Sydney Airport.

The area consists of five precincts that will include new residential dwellings and enterprise based business parks that will be employment hubs and be strategically located near the vehicle access points to the Hume Highway. The area is part of the Greater Macarthur Growth Area that the New South Wales government plans to support Sydney's growing population through the development of new communities in land release areas.

The residential precincts within the Menangle Development Area are planned to contain 10,200 new residential dwellings and there will be complementary development of town centres, schools and community facilities for sporting and recreation. There will also be a shopping centre and small commercial developments in support of the communities that will be established in the area. The business parks planned for the area are expected to be among the largest in the Sydney area and will also require major road works which are currently underway and provide us with confidence in the progress of development and our demand forecast for the area.

The Menangle Development Area is forecast to require approximately 46MVA of electricity supply capacity by 2031 and 92MVA by 2042 based on our central demand forecast.

The current temporary Menangle Park mobile substation and the supporting 11kV network provides a limited 5.7MVA of firm capacity and 15MVA of total supply capacity. This does not provide sufficient supply capacity to meet the forecast demand requirements from the new developments proposed in the Menangle area. The new developments will also require significant connection points for 11kV feeders that we expect will be developed to supply the relatively large geographical footprint of the area.

Through the analysis presented in the Options Screening Notice, Endeavour Energy is of the view that no non-network solution or SAPS solution is feasible to form a credible option on a standalone basis, or form a significant part of a potential credible option for the Menangle Development Area RIT-D.

This DPAR identified two credible network options that can provide increased supply capacity to the Menangle Development area to meet the forecast customer demand requirements.

The two credible network options are:

- **Option 1** – Establish Moreton Park Road ZS in Stage 1 (2027/28) and the permanent Menangle Park ZS under Stage 2 (2030/31);
- **Option 2** – Establish the permanent Menangle Park ZS under Stage 1 (2027/28) and Moreton Park Road ZS in Stage 2 (2030/31).

The two options effectively deliver the identical network assets in two different sequences. The order of delivery of the network assets over the two options give rise to differences in costs and benefits that are examined in the economic assessment of the two options.

Each of the two options were considered in an economic evaluation and Option 2 has been identified as the preferred option because it is estimated to generate higher net benefits on a weighted basis (and in each scenario), mainly due to avoiding more involuntary load shedding than Option 1 after commissioning of Stage 1.

The capital cost in real 2024/25 dollar terms for Option 2 is estimated to be $39.9 million for Stage 1 and $65.3 million for Stage 2. The total capital cost is expected to be $105.1 million.

The construction of Stage 1 of the preferred option would commence with establishment of 11kV distribution feeders in 2024/25, with the permanent Menangle Park ZS to commence construction in 2025/26 and be commissioned during 2027/28.

Stage 2 would involve the construction of the Moreton Park Road ZS, for which construction would commence in 2028/29 and be commissioned during 2030/31. Endeavour Energy will apply a new RIT-D ahead of a future decision to proceed with Stage 2 as there maybe material changes to the customer demand forecast and potentially the cost estimates over the time period prior to commencing Stage 2.

Table 20 – Option 2 – Preferred Option – Staging and estimates

Stage	Deliverable	Commissioning	Added Supply Capacity (MVA)	Cost Estimate ($M)
1	Establishment of the permanent Menangle Park ZS on the location of the existing temporary substation. Decommissioning of the existing mobile substation and transportation to an appropriate storage facility for future use.	2027/28	70	39.9
2	Establishment of the Moreton Park Road ZS including land acquisition.	2030/31	70	65.3
			140	**105.2**

Proposed 're-opening triggers' for this RIT-D

Under the updated NER relating to a Material Change in Circumstance (MCC), Endeavour Energy is required to set out in the DPAR (for consultation and confirmation in the FPAR), re-opening triggers for this RIT-D.

At this stage, we have not identified any re-opening triggers applicable to this RIT-D that would constitute a material change to the identified need, the underlying assumptions underpinning the identified need, or the identification of the preferred option, in relation to Stage 1 of the preferred option.

Importantly, based on the sensitivity assessment included in this DPAR and given the fact that this RIT-D is a 'reliability corrective action', Endeavour Energy does not consider the following will constitute re-opening triggers for this RIT-D:

- real cost increases compared to those used in the RIT-D analysis;
- variations to the AER estimated VCR; or
- credible changes to the commercial discount rate.

Specifically, the finding that Option 2 is the preferred option is not found to be sensitive to changes in these variables. This is driven by the fact that Option 2 leads to greater avoided unserved energy and slightly lower capital costs on an NPV basis compared to Option 1, and that the identified need for this RIT-D is a 'reliability corrective action' (and so the preferred option is permitted to have negative net market benefits).

With respect to Stage 2 of the investment, while we note that future changes in demand in the Menangle Development Area have the potential to affect the need or timing for Stage 2 of the investment, Endeavour Energy intends to undertake a separate RIT-D process to confirm that Stage 2 remains required and continues be the preferred option to address the identified need ahead of committing to that future stage of the investment. It follows that re-opening triggers for Stage 2 are not required.

8. Compliance to the National Electricity Rules

This section sets out a compliance checklist to demonstrate the compliance of the DPAR to the NER and the related Application Guidelines. Table 21 below shows a checklist of requirements and the relevant section of the DPAR addressing the requirement.

Table 21 – Draft Project Assessment Report Compliance Checklist

NER Clause or Application Guidelines	Summary of Requirements	Relevant Section of DPAR
5.17.4 j (1)	A description of the identified need for investment.	3
5.17.4 j (2)	The assumptions used in identifying the identified need including whether a reliability corrective action is necessary.	3
5.17.4 j (4)	A description of each credible option assessed.	4
5.17.4 j (6)	A quantification of the cost for each credible option.	4
5.17.4 j (7)	A description of the methodology used in quantifying each class of cost and market benefit.	5
5.17.4 j (8)	Any reasons why a class of market benefits do not apply to a credible option.	5.3
5.17.4 j (9)	The results of the net present value analysis for each option.	6
5.17.4 j (10)	Identification of the proposed preferred option.	6.3
5.17.4 j (11)	Details of the preferred option.	4.2
5.17.4 j (12)	Contact details for queries in relation to the DPAR.	2.2
RIT-D - Application Guidelines - November 2024	Characterisation of the base case.	5.1.1
RIT-D - Application Guidelines - November 2024	Re-application of regulatory investment test for distribution for material change in circumstances (MCC).	7
RIT-D - Application Guidelines - November 2024	Details of the Cost Estimation Accuracy.	5.4
RIT-D - Application Guidelines - November 2024	Details of the treatment of Greenhouse Gas Emissions in the investment test.	5.3.7
RIT-D - Application Guidelines - November 2024	Assessment of non-network options.	4.4
RIT-D - Application Guidelines - November 2024	Testing sensitivities to select reasonable scenarios.	6.4

Appendix A – Uncapped avoided unserved energy benefits

We discuss our approach to capping avoided unserved energy benefits and the rationale for this approach in the Assessment Framework. The NPV results presented in the DPAR are based on the capped avoided unserved energy benefits.

In this appendix, for completeness, we present values based on the uncapped avoided unserved energy and the associated present value of net market benefits.

Table 22 below shows the NPV results if the full avoided unserved energy amounts based on the demand forecasts through to 2043/44 are included in the assessment.

Option 2 is the highest ranked option and delivers significant net benefits to consumers. Option 2 is the highest ranked option across all three scenarios and the weighted scenario.

Table 22 – Present value of net market benefit of each credible option relative to the base case with uncapped avoided unserved energy benefits ($M, PV)

Option	Central scenario	High benefits	Low benefits	Weighted	Rank
Scenario weighting	33%	33%	33%		
Option 1	25,898	32,597	19,726	26,074	2
Option 2	**25,940**	**32,675**	**19,747**	**26,121**	**1**

Appendix B – Further Technical Details on the Proposed Preferred Option

Both of the credible options considered and examined in the DPAR include 66kV connections for both the permanent Menangle Park ZS and the proposed establishment of the Moreton Park Road ZS. In this appendix we provide further details of the proposed 66kV connections that will support the increase in supply capacity and customer connection capability in the Menangle Development Area.

Figure 22 shows the proposed new 66kV feeder 85U (we have named the feeder to allow for preliminary designs and cost estimated to be developed) from Transgrid's Macarthur BSP to the existing site of the temporary Menangle Park ZS which utilises a mobile substation and this will be the location of the proposed permanent Menangle Park ZS included in both of the network options.

The existing 66kV supply via 85P is shown in Figure 22. The existing temporary Menangle Park ZS based on the mobile substation is currently supplied this 66kV feeder.

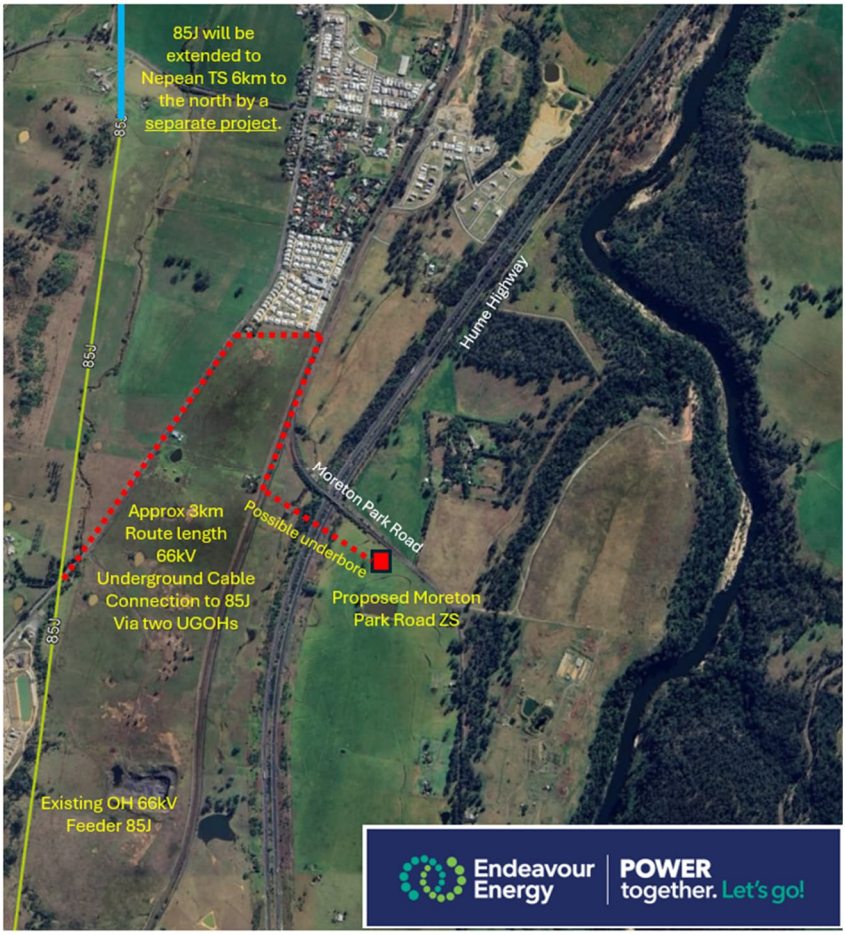
Figure 22 - Proposed new 66kV feeder 85U to the Menangle Park ZS location

Figure 23 below shows the proposed 66kV supply to the proposed Moreton Park Road ZS which is included in both of the network options examined in the DPAR.

At this stage, it is proposed to connect the Moreton Park Road ZS to the existing overhead 66kV feeder 85J via two UGOHs (Underground to Overhead connections). There will be two cables of approximate route length of 3.0km from the UGOHs to the proposed location of the Moreton Park Road ZS.

Our preferred option in this RIT-D has the establishment of Moreton Park Road ZS as the second stage and it will be subject to a separate RIT-D.

Figure 23 - Location of the proposed Moreton Park Road ZS and the 66kV supply via 85J



CONTACT

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Endeavour Energy

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