Providing secure supply to the Berrima Junction Enterprise Growth Area

Options screening report
26 May 2023

Endeavour Energy

CONTACT

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1. Introduction

Berrima Junction is located on the southern highlands and is situated between the historic old town of Berrima to the north and Moss Vale to the south. It is named after the railway station in the area between the two towns . The area is zoned for enterprise land use and is the location for substantial development plans for major customers requiring a connection to the network and with a level of supply security to support the continuity of their business operations.

Berrima Junction is in close proximity to the major vehicle access points to the Hume Highway which is the the major road connecting Sydney-Canberra-Melbourne and will support enterprise customers with heavy vehicle operations and employees commuting to the location for work.

The major network connections in the Berrima Junction enterprise growth area include:

- An enterprise customer with a maximum demand requirement of 15 MVA and requiring a highly secure and reliable supply to support their technology based business operations.
- Two industrial subdivisions with combined estimated maximum demand of 5.4 MVA. These industrial zoned lots will likely include transport, logistics and light industry as end use customers.
- The possible anticipated connection of a major customer with an estimated maximum demand of 16.5 MVA at one of two lots.
- The continuing supply to the existing major customer engaged in a manufacturing enterprise.

The existing Berrima Junction Zone Substation was commissioned in 2010 and supplies a single major customer in close proximity to the substation site. The existing substation comprises a single power transformer and a single 33kV supply and is not capable of providing the security of supply required by the new customer connections.

We are therefore commencing this Regulatory Investment Test for Distribution (RIT-D) to determine the most economically efficient means to provide secure supply to the Berrima Junction enterprise growth area.

This identified need was included in our recent Distribution Annual Planning Report released in December 2022 and has been included in our regulatory submissions covering the periods FY2019-2024 and FY2025-2029.

This Options Screening Report (OSR) sets out the reasons for our determination that there could be a non-network option that could form a potential credible option on a standalone basis, or that could form a significant part of a credible option for the Berrima Junction RIT-D, in accordance with NER clause 5.17.4(c).

This report is the first formal stage of the RIT-D to address the supply requirements of the Berrima Junction Enterprise Growth Area and we are seeking options from non-network proponents.

The second formal stage of this RIT-D will be a Draft Project Assessment Report (DPAR), which will include a net present value (NPV) economic assessment of all credible options including potential options submitted in response to this OSR.

Endeavour Energy applies a probabilistic planning methodology to evaluate network constraints and the value of expected unserved energy in order to determine the optimal timing for network augmentation investments. This is for the benefit of all stakeholders and ensures that network investment is neither too early or too late but maximises the benefits for all stakeholders including existing customers and new customers planning a future network connection.

Network augmentation investment will commence only when there is a high degree of certainty that the anticipated customer connections and their corresponding network demand will proceed.

Furthermore, newly connecting customers will contribute to the costs of the network augmentation investment via their 'Distribution Use of System' tariffs.

1.1 Invitation for submissions

We invite submissions from any suppliers or proponents of non-network options. We are interested in exploring all potential non-network solutions that may meet the requirements of the Berrima Junction Enterprise Growth area.

We recognise that some proponents may require clarification of aspects of this report and encourage contact with us as early as possible to ensure adequate time is available for their submission.

Submissions must be lodged with us on or before 31 August 2023.

If you have any comments or enquiries regarding this report please send them to the Portfolio Management office at consultation@endeavourenergy.com.au.

1.2 Next steps

Following consideration of submissions made in response to this options screening report, we will prepare a Draft Project Assessment Report (DPAR). The DPAR will present a detailed assessment of all credible options to address the identified need at Berrima Junction and include a summary and commentary on submissions received to this report.

At this stage, we intend to publish the DPAR in October 2023.

2. Identified need

This section sets out the 'identified need' for this RIT-D and provides the detailed information to enable the development of credible options. The key assumptions that underpin the identified need are outlined including a background into the relevant geographic area of our network.

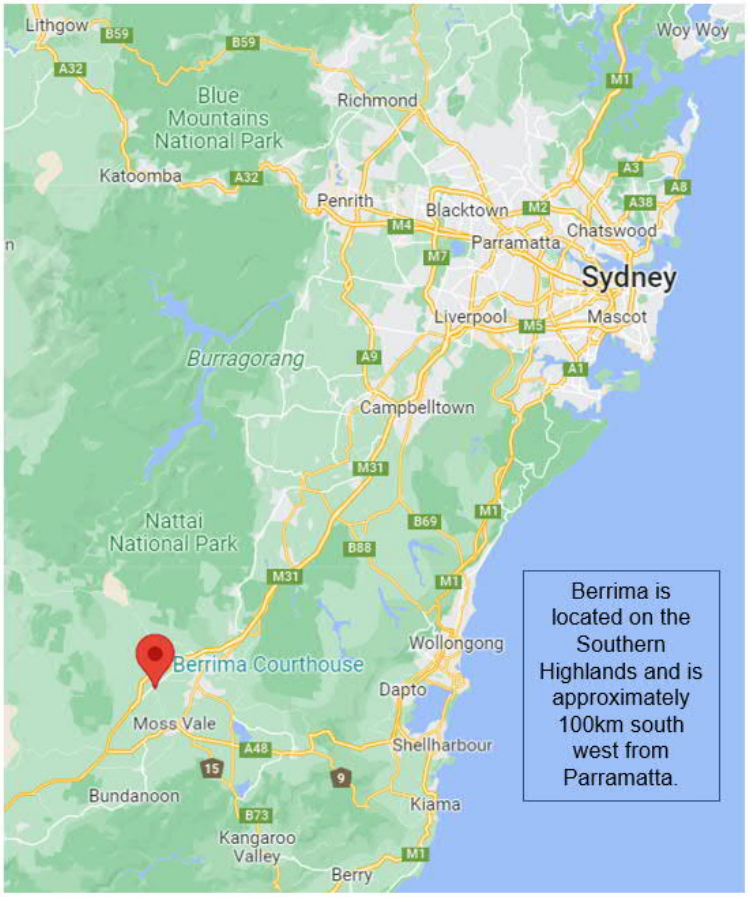
These assumptions have been used in making our determination that a non-network option could form a significant part of a potential credible option for this RIT-D and are provided to assist proponents prepare credible solutions.

2.1 Relevant area of our network

Berrima is located in the southern highlands area and is approximately 100km south west of Parramatta and approximately 3km north of Moss Vale. Endeavour Energy supplies this area and also operates a field service centre in Moss Vale.

Figure 1 below shows the geographic location of Berrima in relation to Western Sydney and Parramatta.

Figure 1 – Berrima in relation to Western Sydney and Parramatta



The area known as Berrima Junction is located between the old historic town of Berrima and Moss Vale. Berrima Junction is the name of the railway station in the area. The area is mainly zoned for enterprise land use and currently includes several large enterprises and there are several enterprises in the advanced stages of planning and development requiring network connection.

For the purpose of our network planning and alignment to the zoning of the land by local government, we have called this area the Berrima Junction Enterprise Growth Area. We note that this is not a formal place name and this area maybe renamed in the future by government authorities. Endeavour Energy currently operates the Berrima Junction Zone Substation in this area.

Figure 2 below shows the location of the area and in particular the proximity to the Hume Highway, the major road on the route Sydney-Canberra-Melbourne. The vehicle access points to the Hume Highway are suitable for heavy vehicles with major merge lanes in both directions supporting transport and logistics operations in this area. There are also no vehicle height clearance limitations from overhead bridges on the route from Berrima Junction to the Hume Highway, noting that this limitation exists closer to the town centre at Moss Vale. Figure 2 also shows the existing major substations at Moss Vale and Fairfax Lane.

Figure 2 – Location of the Berrima Junction Enterprise Growth Area in relation to the Hume Highway and Moss Vale

Figure 3 below shows a close up aerial view of the existing Berrima Junction Zone Substation and the enterprise growth that will host enterprise customers with firm and advanced plans for development on site and network connection in the near future. The area is currently largely undeveloped with one major customer in close proximity to the existing zone substation. The enterprise growth area is within 500 to 1000 metres of the existing Zone Substation. Section 2.3 provides further detail on the identified needs of major customers and the assumptions made in our network planning.

Figure 3 – Aerial view of the Berrima Junction Enterprise Growth Area including the existing Zone Substation

2.2 Our Planning Methodology

Endeavour Energy applies a probabilistic planning methodology to evaluate the customer needs and the network constraints and the 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. The trigger for initiating network investment is based on a cost benefit analysis and compares the annualised cost of the preferred network option with the option benefits. Network augmentation is only taken further 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 analysis of the Berrima Junction Enterprise Growth Area takes into account the limited existing supply in the area and the fact that the existing zone substation has only one power transformer and is supplied from only one 33kV feeder. The probability of the failure of either one or both of these major network components has been analysed in determining the expected unserved energy, its economic value and the economic benefits of avoiding unserved energy in the area.

Our planning methodology includes a thorough and conservative analysis of the demand forecast. Including the likelihood of delays in developments and the diversity of non-coincident customer maximum demand. We use three demand forecast scenarios to cover a range of outcomes to test the robustness of the planning. The optimal timing of the implementation of solution options is important to avoid being either too early or too late in meeting customer's needs and to optimise network augmentation timing for the benefit of all stakeholders.

2.3 Key assumptions underpinning the identified need

The identified need for this RIT-D is to secure supply and connection capability for the major customer connections in the Berrima Junction area. The area is zoned for enterprise land use and major customers are well advanced in their development applications and will require secure connection in the future. The key assumptions underpinning this are below:

- Major customer connections will require a secure supply at the industry standard "N-1" (ability to maintain supply with the loss of any one major component in the network) . The existing Berrima Junction ZS is a single transformer and single 33kV feeder supply and is not capable of providing the level of supply security and reliability required for the major customers in the area.

- The timing and certainty of future major customer connections that underpin the demand forecast and the use of scenario based demand forecasts to incorporate possible delays in the timing of development.

- Endeavour Energy is required under the National Electricity Rules (NER) to connect new customers, however the existing network has insufficient capacity and redundancy to provide secure supply to the level required for the enterprise growth area and the requirements of the customer's business operations continuity.

- The existing Berrima Junction ZS contains several items of major equipment that are approaching the end of their service life and are likely to require replacement in the next 5 to 10 years. However, based on the demand forecast for the area, the need for augmenting supply in the area will occur earlier in time than the need to replace the existing network assets. This identified need is characterised as an augmentation rather than a replacement of existing assets due to the higher capacity and supply security required.

2.3.1 Demand forecasts

We have developed our demand forecast for the Berrima Junction Enterprise Growth Area by considering the existing major customer connection and the connection applications from major customers that are planned for the near future.

The major customer connections are summarised as follows:

- existing supply arrangements of 5 MVA capacity for the current major customer connections that have been in place since 2010 (peak demand has historically varied between 1.3 to 1.9 MVA); and
- new connections, including:
  - an enterprise major customer connection with a final total demand of 15 MVA, which is assumed to grow from 0 by 2.4 MVA per annum commencing in 2022/23;
  - an industrial subdivision of land with a maximum combined demand of 5.4 MVA (estimated from both the customer applications for connection and the lot size and our energy density calculations for similar industries); and
  - a further industrial facility at one of two locations near Berrima Junction with maximum demand of 16.5 MVA. This facility may be located at another location in our supply area and we have applied an appropriate confidence factor into the demand forecast scenarios to account for this uncertainty.

Drawing on the major customer connections set out above, we have developed three demand forecast scenarios, they are:

- a central demand scenario, where existing customer demand continues at current levels and the enterprise major customer connection grows its demand over **five years** and the industrial subdivision customers are connected in line with current plans;
- a low demand scenario, where existing customer demand continues and the enterprise major customer connection grows its demand over **ten years** and the industrial subdivision customers are connected in line with current plans; and
- a high demand scenario, where existing customer demand continues at current levels and the enterprise major customer connection grows its demand over **five years** and the industrial subdivision customers are connected according to current plans and the further industrial facility locates in the Berrima Junction area.

Excludes any future residential lot release in the “New Berrima” or “Medway Road” areas

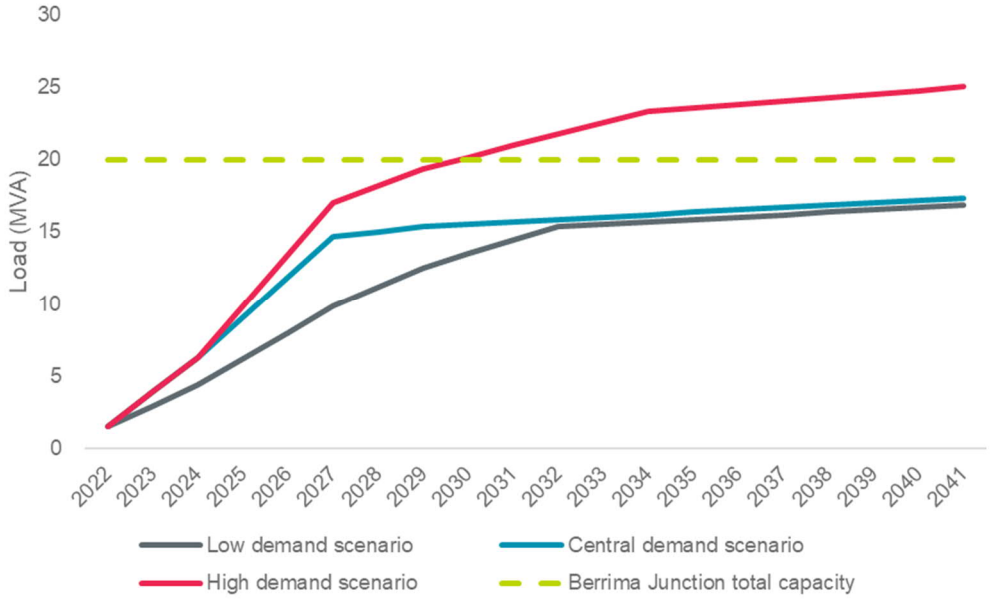
The demand forecast scenarios used in this study exclude any future residential lot release. The Berrima Junction Enterprise Growth Area will comprise only enterprise customers with no residential customers included in the scope of our forecasts.

There are long term plans with local and state government for future residential lot releases in the Medway Road area of Berrima which would include a town centre and schools with a total release of 8000 lots over the next 20 years. These plans would require a separate study including options analysis and investment testing which may proceed as further information is released, however these plans are not included in the demand forecast scenarios of this study. The future release of residential lots will increase the demand forecast in the future, particularly if they are located close to the enterprise growth area.

Figure 4 below shows our forecast demand under the central, low and high demand scenarios and the transformer capacity of the existing Berrima Junction Zone Substation.

The high demand forecast scenario will result in the supply capacity being exceeded by 2029, however the single power transformer at Berrima Junction ZS will not be capable of providing the security of supply for the customers connecting in this area.

Figure 4 – Berrima Junction Enterprise Growth Area maximum demand forecasts from 2023 to 2041 under low, central and high demand scenarios



2.3.2 Expected pattern of use

The expected pattern of use for customers to be connected to the network in the Berrima Junction Enterprise Growth Area has been forecast based on patterns of use for similar enterprise areas in our supply area including a composite load profile from the Moorebank and Smeaton Grange areas. These areas have a similar industry type customer base to that expected at Berrima Junction.

Figure 5 presents the normalised load duration curve for the Berrima Junction Enterprise Growth Area.

Figure 6 presents the forecast of the peak day profile for the area based on our assumptions of the major customer pattern of use based on our supply to similar areas of modern enterprise and light industry in Western Sydney. The figure includes the forecast peak day profiles for FY 2026,2027 and 2028 based on the central demand forecast scenario. The load profile is generally flat indicating the continuous nature of the business operations expected in the area.

Figure 5 – Normalised Load Duration Curve (LDC) for the Berrima Junction Enterprise Growth Area

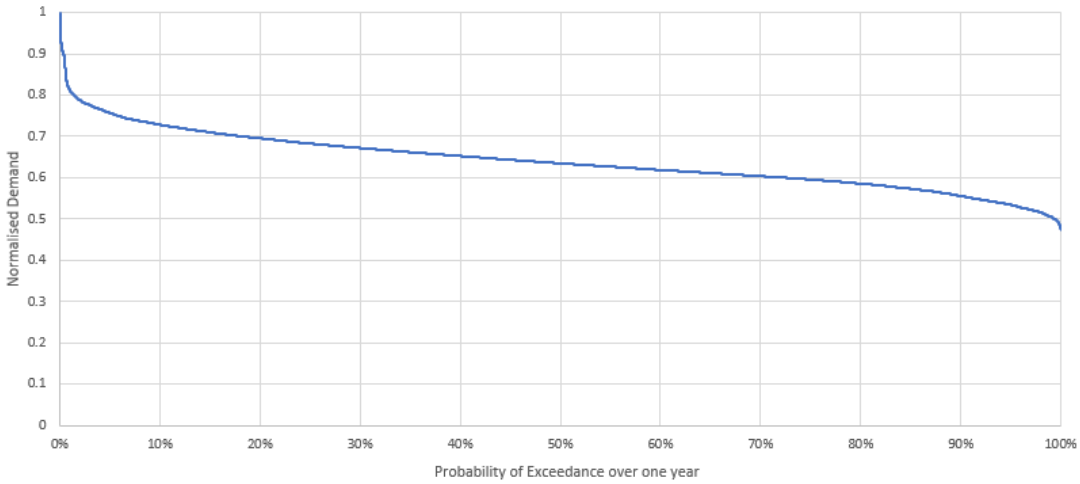
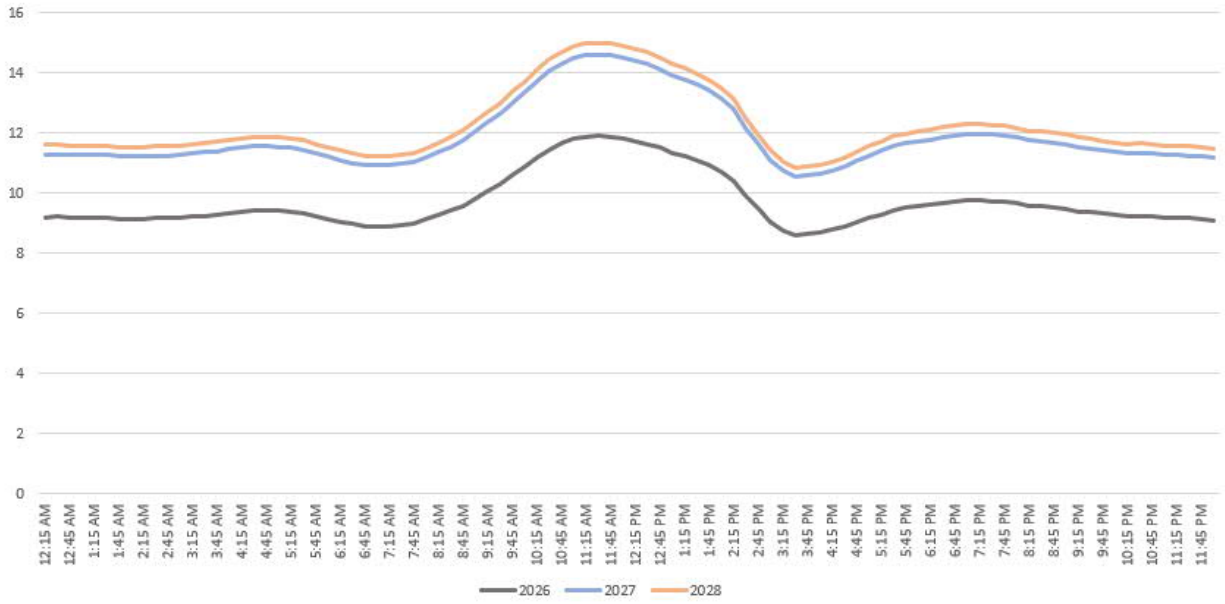


Figure 6 – Peak day profile forecast for the Berrima Junction Enterprise Growth Area



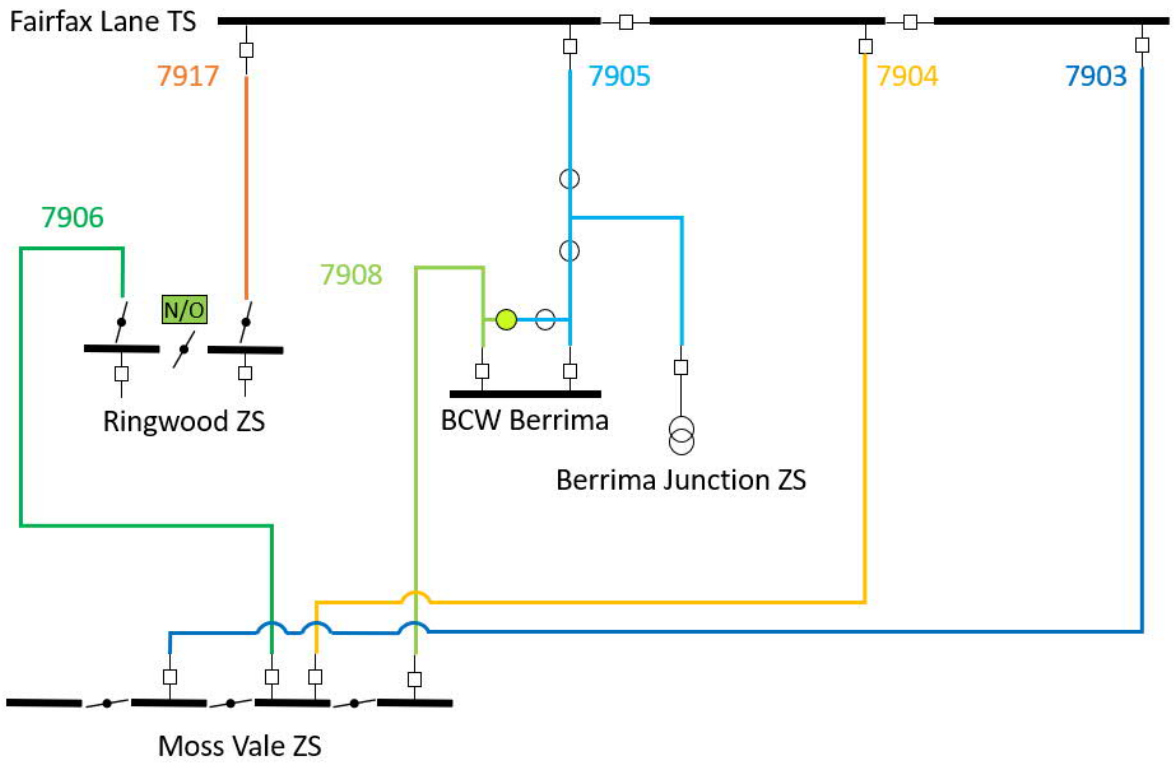
2.3.3 Existing network

The southern highlands area of the Endeavour Energy network uses a 33kV subtransmission network.

The existing Berrima Junction Zone Substation has a single 20 MVA 33/11kV transformer and is supplied via a tee-connection from the Fairfax Lane 33kV feeder 7905. Feeder 7905 also partly supplies the BCW Berrima High Voltage Customer (HVC). The area is an overhead supply network with the feeder routes being adjacent to local roads.

Figure 7 below shows a simplified diagram of the existing 33kV supply network and the supply to the Berrima Junction ZS.

Figure 7 – Simplified line diagram of the Southern Highlands 33kV network and the Berrima Junction Zone Substation



Key facts in relation to the existing Berrima Junction ZS:

- Commissioned in 2010 to supply a single major customer in close proximity.
- The 33/11kV 20MVA power transformer was manufactured in 1965 and is approaching the end of its service life after served in various locations in Western Sydney prior to being commissioned at Berrima Junction. The transformer is functional, however it has an elevated risk of potential oil leaks as it continues to age.
- Endeavour Energy has suitable replacement transformers in the event of a major failure of the existing transformer, however this would require transport to Berrima and a likely replacement period of one to two months to allow for oil filling and testing and depending on the exact size of the replacement transformer may require small scale reconstruction to allow for connection on site at Berrima.

- The control room in service at Berrima Junction ZS had previously served at Tahmoor ZS and Smithfield ZS is approaching the end of its expected service life. It will not be suitable for the next generation digital substation protection and control systems.
- The land parcel is 80m x 60m with the existing zone substation transformer and control room occupying a relatively small portion of the available land.

2.3.4 Expected unserved energy if action is not taken

The existing network supplying the Berrima Junction Enterprise Growth Area is insufficient to meet the supply needs of the major customers in advanced stages of their future network connection.

The existing Berrima Junction ZS has only a single 33/11kV transformer and although it has sufficient capacity to supply significant growth above the current level of customer demand in the area, it lacks a standby transformer. The potential loss of the single transformer in either a planned or unplanned outage would interrupt supply to the major customers who will connect in the area.

The 33kV supply to the existing Berrima Junction ZS is a single overhead line and is exposed to potential unplanned outages in the event of storms, lightning strikes or vehicle impacts on pole structures. The single supply cannot be backup in a significant manner to avoid potentially long outage periods.

There is minimal load transfer capability from adjacent zone substations and feeders. The only feasible load transfer is via the 11kV distribution network and is limited to 3MVA by using a Moss Vale ZS distribution feeder.

Table 1 below is a summary of the network contingency analysis conducted to determine the expected unserved energy if no action is taken in the Berrima Junction Enterprise Growth Area. It provides an overview of the main contingencies that if they were to occur then they would cause interruption to supply and an expected unserved energy value incurred with the major customers with connections planned in the area.

Table 1 – Network contingency analysis for the Berrima Junction Enterprise Growth Area for determining expected unserved energy

Contingency Scenario	Identified Asset	Description
1	Loss of the single Berrima Junction ZS transformer	The loss of the existing single transformer at Berrima Junction ZS in either a planned or unplanned outage would result in loss of supply to all customers supplied from Berrima Junction ZS. There is a limited small load transfer capability available from a distribution feeder from Moss Vale ZS. This would provide a maximum of 3MVA back up supply. This supply would require manual switching in the field which would take some time to complete, although we have a field service centre at Moss Vale. The available capacity for load transfer would depend on the time of day and the demand on the Moss Vale feeder such that the transfer capacity is likely to be less than 3MVA. In the event of a failure of the transformer due to an electrical fault within the transformer this could require an extended period of time for a replacement, potentially weeks or months.
2	Loss of 33kV Feeder 7905	The loss of feeder 7905 would result in loss of supply to all customers supplied from Berrima Junction. This feeder also supplies the HVC BCW Berrima. This is an overhead feeder and is subject to potential storm damage including lightning strikes or vehicle impact damage to any of the poles on the route of the feeder. Depending on the exact location of a fault on feeder 7905, supply may be restored from feeder 7908 via Moss Vale ZS instead of the normal supply from 7905 via Fairfax Lane TS. This would require manual field switching via our staff having to attend the site of the air break switches in the area. Feeder 7905 and 7908 are rated at 33MVA (and operated at 33kV), the loss of either feeder requires the other feeder for backup and the 33MVA capacity is a limitation in providing backup to both BCW Berrima and Berrima Junction .
3	Loss of 33kV Feeder 7908	The loss of feeder 7908 would result in 7905 having to supply BCW Berrima and Berrima Junction ZS and it is rated at 33MVA. This limitation is included in the expected unserved energy values with the corresponding probability of failure.

Figure 8 and figure 9 show the Load at Risk resulting from the two main contingencies of a loss of the single Berrima Junction ZS transformer and the loss of the single 33kV supply feeder 7905.

The NPV analysis that will be presented in the Draft Project Assessment Report will be underpinned by these contingencies and the corresponding expected unserved energy values. It is the expected unserved energy that we are seeking to avoid with the credible options being considered in this RIT-D.

Figure 8 – Load at risk due to the loss of the single Berrima Junction ZS Transformer

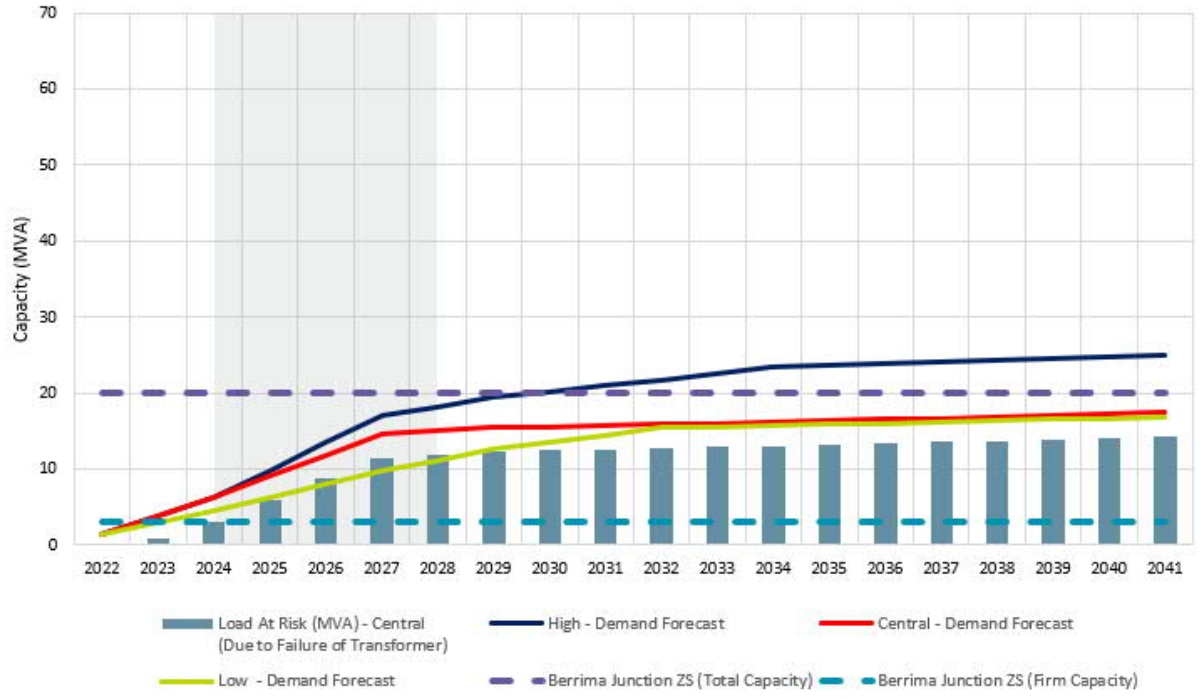
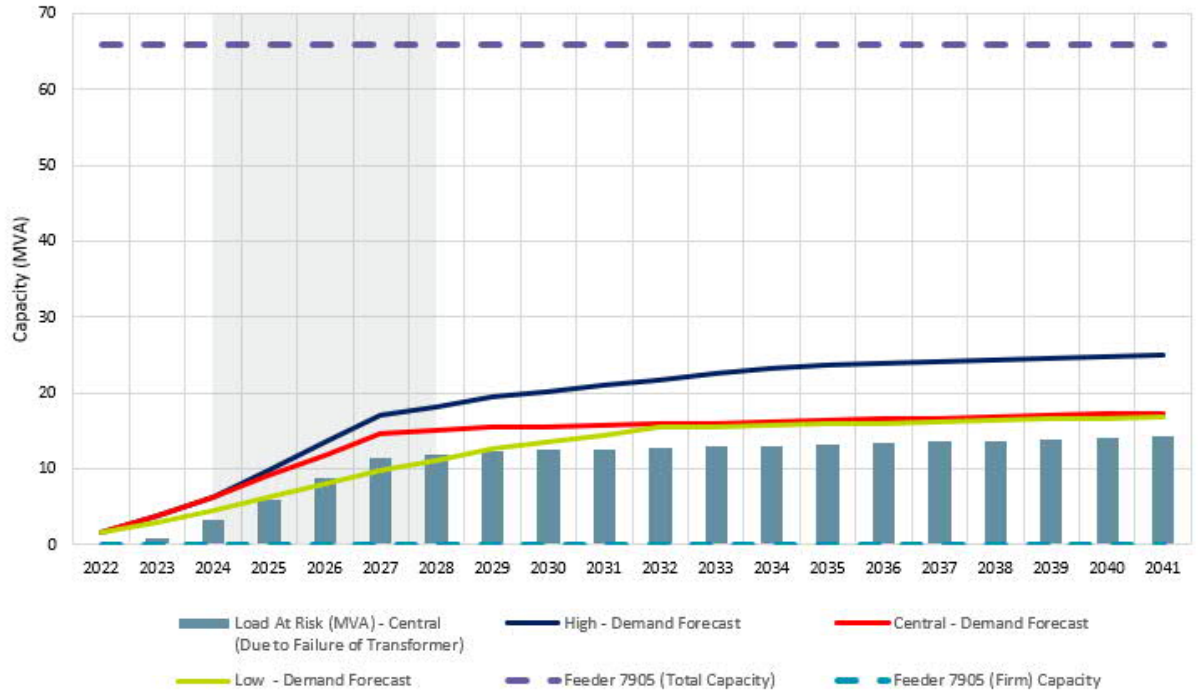


Figure 9 – Load at risk due to the loss of the 33kV Feeder 7905



2.3.5 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
- 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.

A summary of the key parameters expected to be used for each scenario is provide in table 2 below.

Table 2 – Proposed scenarios for the forthcoming RIT-D NPV assessment

Parameter	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%
Maintenance costs	Central estimates	-25%	+25%

The proposed scenarios have been developed to comprehensively test the range of net benefits that can be expected from the credible options. We will use a central estimate maintenance cost assumption of 0.4% of the capex value as a recurring annual operating cost in the NPV.

We continue to review the reasonableness of values used in the scenario analysis.

The DPAR will include a sensitivity analysis on the parameters in isolation to further test the robustness of the assessment.

We consider that the central scenario is the most likely because it is based primarily on a set of expected central assumptions. We propose to 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 using a 30-year assessment period.

3. Summary of potential credible network options

We have identified three credible network options for providing secure supply to the Berrima Junction Enterprise Growth Area. All three options involve the augmentation of the existing Berrima Junction Zone Substation. The network options are:

- Option 1 – Augment Berrima Junction Zone Substation with the installation of 2 x 35MVA transformers and use the existing 33kV supply;
- Option 2 – Augment Berrima Junction Zone Substation with the installation of 2 x 35MVA transformers and establish a new 33kV feeder supply from Moss Vale Zone Substation; and
- Option 3 – Augment Berrima Junction Zone Substation with the installation of 2 x 35MVA transformers and establish a new 33kV feeder supply from a connection to an existing feeder 7906.

A high level summary description is provided below for each of the options.

3.1 Option 1 – Augment Berrima Junction ZS with existing 33kV supply

Option 1 would involve augmenting the existing Berrima Junction Zone Substation by installing two 35 MVA transformers. The new transformers would be installed on the available land at the site. Following commissioning of the new transformers, supply to the area would be transferred from the existing single transformer to the newly installed transformers and the existing transformer would be decommissioned.

Construction would commence in 2023/24 and be completed in two years with commissioning in 2025/26. The decommissioning works could extend shortly beyond this period.

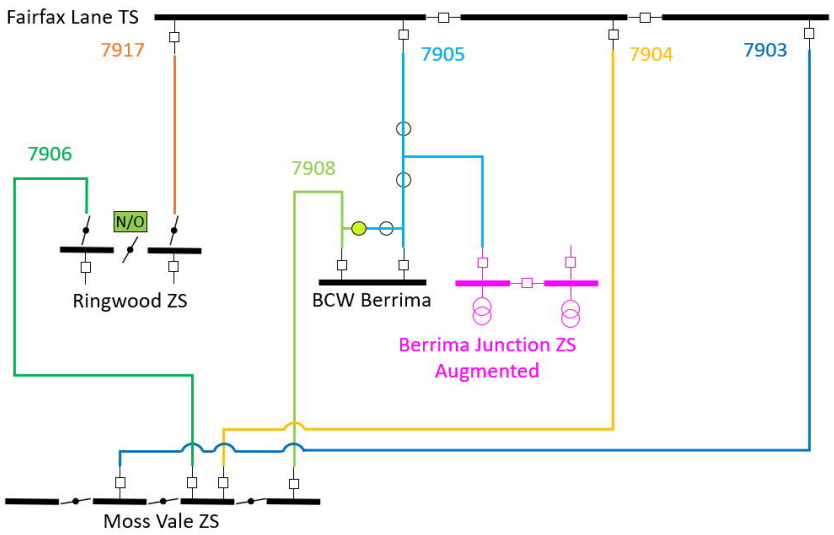
Table 3 shows the scope of work and cost estimates for Option 1.

Table 3 – Scope of works and costs for Option 1

Network Component	Proposed Scope of Works	Cost Estimate ($M)
Substation	Augment the existing Berrima Junction Zone Substation: • Install major equipment: o 2 x 33/11kV 35MVA transformers. o 2 x 33kV feeder bays o 2 x 33kV bus sections o 2 x 11kV bus sections o 2 x 11kV switchboards o Control Building and amenities • Changeover 33kV supply and 11kV cables to the new major equipment. • Decommission the existing 20MVA 33/11kV transformer, switchgear and control room. Salvage value to be credited to the project as a cost reduction.	14.0
Mains	Divert 33kV feeder 7905 to the new 33kV feeder bay.	0.1
Distribution	Divert 11kV feeders to the new 11kV bus sections.	0.5
	Option 1 (Present Value) Total Cost.	**14.6**

Figure 10 below shows a simplified single line diagram for Option 1. The total cost of this option is expected to be $14.6 million with annual operating costs estimated to be 0.4 per cent of the capital expenditure.

Figure 10 – Simplified line diagram of Option 1



This option addresses the network constraint associated with having a single transformer at the zone substation however it does not address the network constraint associated with the failure of feeder 7905.

3.2 Option 2 – Augment Berrima Junction ZS and establish a new 33kV feeder from Moss Vale ZS

Option 2 would involve augmenting the existing Berrima Junction Zone Substation by installing two 35 MVA transformers and establishing a new 33kV feeder supply from Moss Vale ZS. The new transformers would be installed on the available land at the site. Following commissioning of the new transformers, supply to the area would be transferred from the existing single transformer to the newly installed transformers and the existing transformer would be decommissioned.

Construction would commence in 2023/24 and be completed in two years with commissioning in 2025/26. The decommissioning works could extend shortly beyond this period.

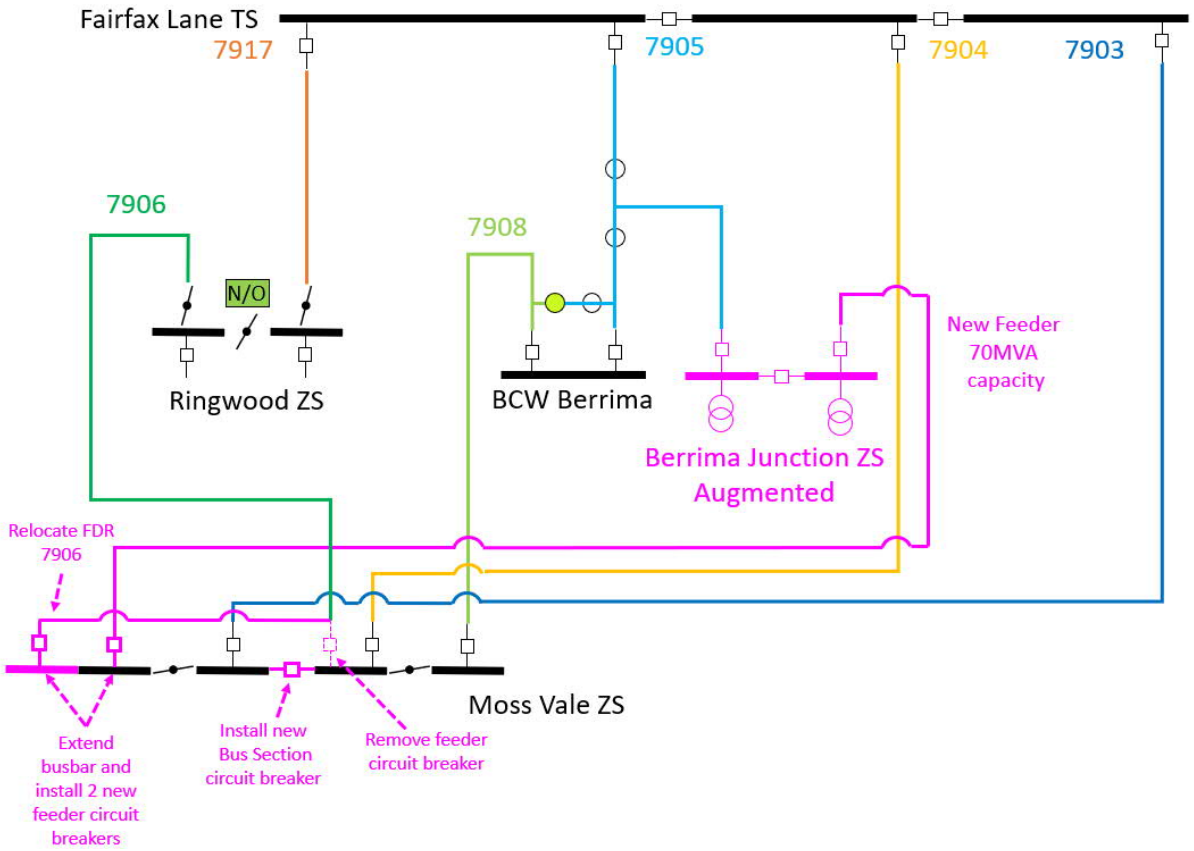
Table 4 below shows the scope of works and the cost estimate for Option 2.

Table 4 – Scope of works and costs for Option 2

Network Component	Proposed Scope of Works	Cost Estimate ($M)
Substation	Augment the existing **Berrima Junction Zone Substation**: • Install major equipment: o 2 x 33/11kV 35MVA transformers o 2 x 33kV feeder bays o 2 x 33kV bus sections o 2 x 11kV bus sections o 2 x 11kV switchboards o Control Room and Amenities • Changeover 33kV supply and 11kV cables to the new major equipment. • Decommission the existing 20MVA 33/11kV transformer, switchgear and control room. Salvage value to be credited to the project as a cost reduction. Enabling works at **Moss Vale Zone Substation** to provide connection of the new 33kV feeder to Berrima Junction ZS: • Extend 33kV bus section • 1 x 33kV bus section circuit breaker • 2 x 33kV feeder bays • Relocate existing 33 kV feeder 7906 to one of the new feeder bays on the new bus section.	16.0
Mains	Establish a 33kV feeder from Berrima Junction ZS to Moss Vale ZS (3.2km).	1.8
Distribution	Divert 11kV feeders to the new 11kV bus sections.	0.5
	Option 2 (Present Value) Total Cost.	**18.3**

Figure 11 below shows an overview of Option 2. The total cost of this option is estimated to be $18.3 million with annual operating costs estimated to be 0.4 per cent of the capital expenditure.

Figure 11 – Simplified line diagram of Option 2



Option 2 would provide two power transformers with one operating as a standby back-up and 33kV supply feeder to the growth area and also include enabling works at Moss Vale ZS to support the connection of the new feeder and also enhance the operational flexibility at Moss Vale ZS. The market benefits of this will be included in the NPV assessment of this option in the Project Assessment Reports including any feasible non network options that may be combined with Option 2 to provide a possible deferral of the network investment.

3.3 Option 3 – Augment Berrima Junction ZS and establish a new 33kV feeder with a tee connection to feeder 7906

Option 3 would involve augmenting the existing Berrima Junction Zone Substation by installing two 35 MVA transformers and establishing a new 33kV feeder supply using a tee connection to the existing feeder 7906 which has a line route from Moss Vale ZS to Ringwood ZS. The new transformers would be installed on the available land at the site. Following commissioning of the new transformers, supply to the area would be transferred from the existing single transformer to the newly installed transformers and the existing transformer would be decommissioned.

Construction would commence in 2023/24 and be completed in two years with commissioning in 2025/26. The decommissioning works could extend shortly beyond this period.

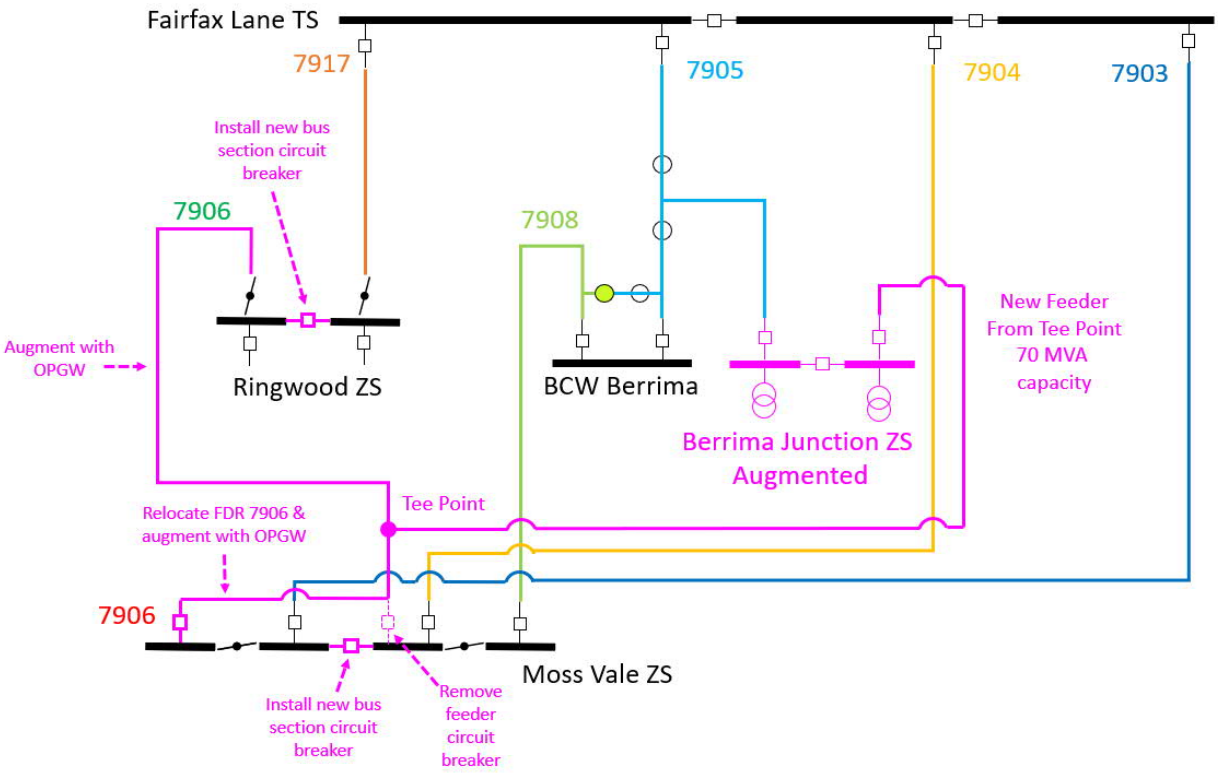
Table 5 below shows the scope of works and the cost estimate for Option 3.

Table 5 – Scope of works and costs for Option 3

Network Component	Proposed Scope of Works	Cost Estimate ($M)
Substation	Augment the existing **Berrima Junction Zone Substation**: • Install major equipment: o 2 x 33/11kV 35MVA transformers. o 2 x 33kV feeder bays o 2 x 33kV bus sections o 2 x 11kV bus sections o 2 x 11kV switchboards o Control Room and Amenities Building • Divert 33kV and 11kV cables from the existing substation to the new major equipment. • Decommission the existing 20MVA 33/11kV transformer, switchgear and control room. Salvage value to offset the decommissioning costs. Enabling works at **Moss Vale Zone Substation** : • 1 x 33kV bus section circuit breaker • 1 x 33kV feeder bays • Relocate existing 33 kV feeder 7906 to the new feeder bay. Enabling works at **Ringwood Zone Substation**: • 1 x 33kV bus section circuit breaker	18.0
Mains	Establish a tee connection to 33kV feeder 7906 Ringwood ZS to Moss Vale ZS to supply Berrima Junction ZS. (Route Length of approximately 3.0km).	1.7
Distribution	Divert 11kV feeders to the new 11kV bus sections.	0.5
	Option 3 (Present Value) Total Cost.	**20.2**

Figure 12 below shows an overview of Option 3. The total cost of this option is estimated to be $20.2 million with annual operating costs estimated to be 0.4 per cent of the capital expenditure.

Figure 12 – Simplified line diagram of Option 3



Option 3 would provide two power transformers and 33kV supply feeder to the growth area and also include enabling works at Moss Vale ZS and Ringwood ZS to support the tee connection of the new feeder and also enhance the operational flexibility at Moss Vale ZS. The option would also provide a bus section circuit breaker at Ringwood ZS and replace the existing manually operated isolators which would improve the operational flexibility at Ringwood ZS and provide a small improvement in response times to certain unplanned outages. The higher cost of this option reflects the works required across the three existing zone substation sites, however this option would also provide widespread benefits by improving operational flexibility and fault & emergency response times.

3.4 Options considered but not proposed to be progressed in the DPAR

In addition to the credible options that are summarised above and have been presented with their high level scope and cost estimates we also considered the following network options in our planning process that we evaluate as not credible in their ability to meet the identified need.

The reasons these options are proposed not to be progressed to the DPAR are summarised in table 6.

Table 6 – Options considered but not proposed to be progressed further

Option	Reasons for not progressing further
Augment Berrima Junction Zone Substation by installing two 25MVA transformers.	Not proposed to be progressed because the alternative of installing 35 MVA transformers provides increased capacity at minimal additional cost compared to 25 MVA transformers. The spatial requirement for 25MVA transformers is only marginally less than 35MVA transformers and the option of using 25MVA transformers on this site location would not optimise the land available in comparison to 35MVA transformers. The use of 35MVA transformers and the space to potentially install a third transformer in the future with 105MVA of installed transformer capacity is preferred. The use of 25MVA transformers may require an additional zone substation to supply the enterprise growth area for the time period after 2040. The proposed future residential development plans for New Berrima or Medway Road would eventually require an additional zone substation and the capacity provided by 35MVA transformers will be preferred. Particularly, if there is a requirement to support a load transfer from Moss Vale ZS to support the residential development.
Augment Berrima Junction Zone Substation with two 35 MVA transformers with new feeder from Fairfax Lane transmission substation.	Not proposed to be progressed because it is significantly higher cost compared to the alternative feeder options from Moss Vale Zone Substation and does not provide significant additional benefits. A new feeder from Fairfax Lane TS would have a longer route length to Berrima Junction ZS compared to from Moss Vale ZS and this would result in a higher cost feeder.
Augment Berrima Junction Zone Substation in stages using the existing transformer with a new feeder from Moss Vale Zone Substation.	Not proposed to be progressed because the existing transformer and associated electrical switchgear is approaching the end of service life. The transformer has been in service for over 55 years, in various locations in our network, and is at an elevated risk of oil leakage in the future. Furthermore, there would be operational constraints associated with the impedance mismatch between the old and new transformers limiting the potential supply capacity and operational flexibility of the augmented zone substation. Based on our current technical analysis of the existing transformer including examining the oil within the transformer our plan would be disposal of the existing transformer with the salvage value credited to the augmentation of the Berrima Junction Zone Substation.

3.5 Preliminary preferred network option annual deferred augmentation value

At this stage and based on our early internal economic assessment, the preliminary preferred network option is Option 2 - augmenting the existing Berrima Junction Zone Substation to include 2 x 35MVA transformers and establishing a new 33kV feeder supply from the Moss Vale Zone Substation.

The estimated **annual deferred augmentation value** associated with this network option to meet the identified need is **$0.6M**.

This value assumes a one year deferral and uses the central discount rate and the central capital cost estimate.

4. Required technical characteristics of non-network options and SAPS

This section sets out the technical characteristics that a non-network option would be required to provide to assist with meeting the identified need.[1] This information is provided to enable proponents of non-network solutions to understand the identified need and to tailor their proposals accordingly. It also sets out the reasons that we consider a SAPS option could not form a potential credible option on a standalone basis, or could form a significant part of a potential credible option.

Endeavour Energy intends to explore all possible non-network options with proponents to ensure that the most efficient option is selected to satisfy the identified need.

Based on our screening of non-network options for the Berrima Junction Enterprise Growth Area we consider the following options may be both technically and commercially feasible:

- Grid Connected Battery Energy Storage Systems.
- Direct Load Control at existing enterprise customer premises.
- Use of existing back-up embedded generation that may already be installed at customer premises.
- Behavioural demand response for both enterprise and potentially residential and rural customers using aggregation services.

We note that these non-network options may require critical input factors for their technical feasibility including but not limited to: land for locating any new embedded generation including battery and related approvals from authorities, establishing new network connections for any new embedded generation or energy storage solutions, agreements with customers including obtaining contact details and network technical details including customer demand profiles.

We have determined that a stand alone power system (SAPS) would not be feasible due to the requirement of major customers in the area to have an N-1 fully redundant back up supply and any SAPS would be required to provide this level of supply security and we do not believe that this is commercially feasible based on any current technology. Although, the relative close proximity of the major customer connections may result in a technically feasible microgrid, a stand alone power system would require independent operation from the network and we do not believe that this will provide the level of supply security required from the customers intending to be supplied in the area.

Endeavour Energy welcomes submissions from proponents able to offer a credible non-network solution that is both commercially and technically feasible under the RIT-D.

[1] In accordance with clause 5.17.4(e)(4) of the NER.

4.1 The size of demand reduction required to support the Berrima Junction Enterprise Growth Area

Table 7 below presents the annual load at risk for the Berrima Junction Enterprise Growth Area using the central demand forecast and the two most severe contingencies in the existing supply system: the transformer failure at the existing zone substation and a failure of the 33kV supply feeder 7905.

The demand reduction requirement for a non-network solution is the worst case of the contingencies and this is the 33kV feeder which has a greater load at risk than the transformer due to the feeder also having to supply BCW Berrima in addition to the existing Berrima Junction Zone Substation. This arises because of the physical nature of the tee connection in the feeder 7905 to supply the Berrima Junction ZS.

Table 7 – Estimated Berrima Junction Enterprise Growth Area Load at Risk

Load at Risk (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031
Transformer failure	0.8	3.2	5.9	8.7	11.5	11.9	12.3	12.4	12.6
Feeder failure	3.9	6.3	9.1	11.9	14.6	15.0	15.4	15.6	15.7
Load at Risk	**3.9**	**6.3**	**9.1**	**11.9**	**14.6**	**15.0**	**15.4**	**15.6**	**15.7**
Our Risk based Assessment	*Monitor this level of load at risk.*				*Endeavour Energy deems this load at risk level to be such that network augmentation or non-network options are required.*				

Table 8 below shows the level of demand reduction required to produce certain deferrals of our preliminary preferred network option. This table is intended to provide clarity on the investment deferral and demand reduction dynamics for this particular growth location.

Table 8 – Deferral periods of our Berrima Junction Enterprise Growth Area Network Option achieved in combination with a Non Network Option

Years of Deferral	Deferred Commissioning of network option	Demand Reduction Required
1 year	2027	14.6
2 years	2028	15.0
3 years	2029	15.4

We expect, at this early stage, that non-network options may be able to credibly defer the commissioning of a network option by one to three years. This is based on our current central demand forecast.

4.2 Location

We are seeking non-network options for the Berrima Junction Enterprise Growth Area located in the geographic area shown below in the red box in Figure 13.

The geographic area is defined by the service area of the 33kV feeders 7905 and 7908. These are the constrained assets that cause the load at risk and the expected unserved energy for the Berrima Junction Enterprise Growth Area. The existing Berrima Junction ZS and the BCW Berrima major customer are within the target area.

To help proponents understand the locational requirement, we provide the following indicative examples of possible technically feasible non-network options:

Example 1 : a grid connected battery energy storage system capable of providing embedded generation in a battery discharge cycle with a network connection point in the target area.

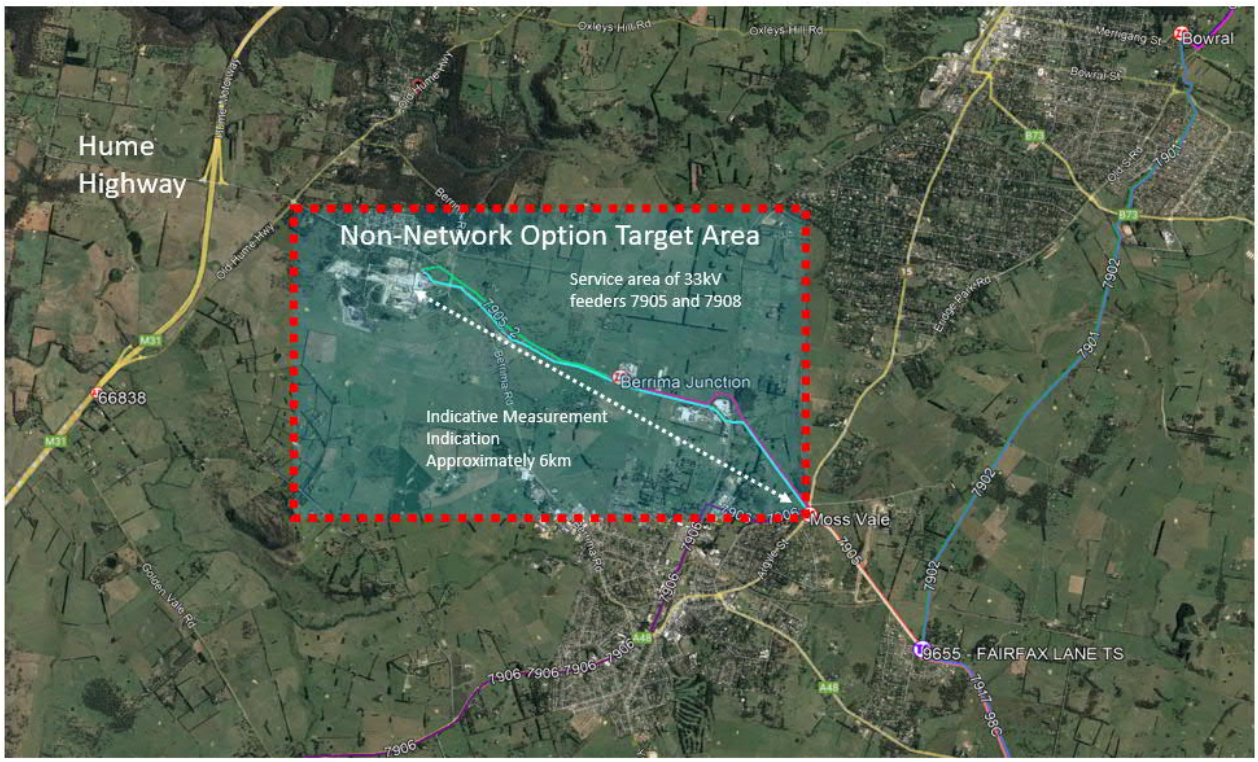
Example 2: a direct load control scheme capable of reducing the demand with a major customer connection in the target area.

Example 3: an aggregation service capable of providing a demand reduction from multiple customers within the target area.

For any clarification on the applicable location, please contact us at:

consultation@endeavourenergy.com.au

Figure 13 – Berrima Junction Non Network Option Target Area



4.3 Operating profile

To support the Berrima Junction enterprise growth area with reliable and secure supply a non network option would be required to provide network support over the period FY27 to FY29 and during the peak demand days over the summer period. Based on our analysis of the area and the customer connections, we have determined that it is days with a maximum temperature exceeding 30 degrees Celsius that define a key technical requirement. The nearest Bureau of Meteorology automatic weather station is situated at Moss Vale and could be used as a reference point for any network support agreement in relation to this requirement.

Table 9 sets out the key expected technical characteristics that a network support solution would need to exhibit.

Table 9 – Non-network option technical characteristics

Objective	Target
Time of year	1 November 2026 to 31 March 2027 1 November 2027 to 31 March 2028 1 November 2028 to 31 March 2029
Time of Day	11am to 5pm (Summer period)
Season	Summer 2026/27, 27/28 and 2028/29.
Day type	Any day of the week with maximum air temperature forecast to be above 30^{o}C. Weekdays and weekends excluding public holidays.
Demand reduction required	Refer to Table 7 – Estimated Berrima Junction Enterprise Growth Area Load at Risk

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 NER requirements related to grid connection (if this is required as part of the solution).

Endeavour Energy has obligations under the NER, its distributor's licence and connection agreements to ensure supply reliability is maintained to customers. Failure to meet these obligations may give rise to liability. Proponents of non-network solutions 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 10.

Table 10 – Applicable reliability standards

Feeder/network type	Average reliability duration standards (minutes per customer)	Average reliability interruption duration standards (numbers 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.

4.6 Consideration of SAPS options

Recent changes to the NER, RIT-D and RIT-D application guidelines require Endeavour Energy to consider whether a SAPS option can fully or partly address an identified need. In practice, this relates to consideration of whether an identified need could be fully or partly addressed by converting part of our distribution network forming part of the interconnected national electricity system to a regulated SAPS.[2] Regulated SAPS are set out in section 6B of the National Electricity Law (NEL), which defines a SAPS as a system that:[3]

- generates and distributes electricity; and
- does not form part of the interconnected national electricity system.

We consider that there is not a SAPS option that could form a potential credible option on a standalone basis, or that could form a significant part of the credible option, in this RIT-D. In particular, the demand

[2] See definition of 'SAPS option' in the NER.

[3] Section 6B(6) of the NEL.

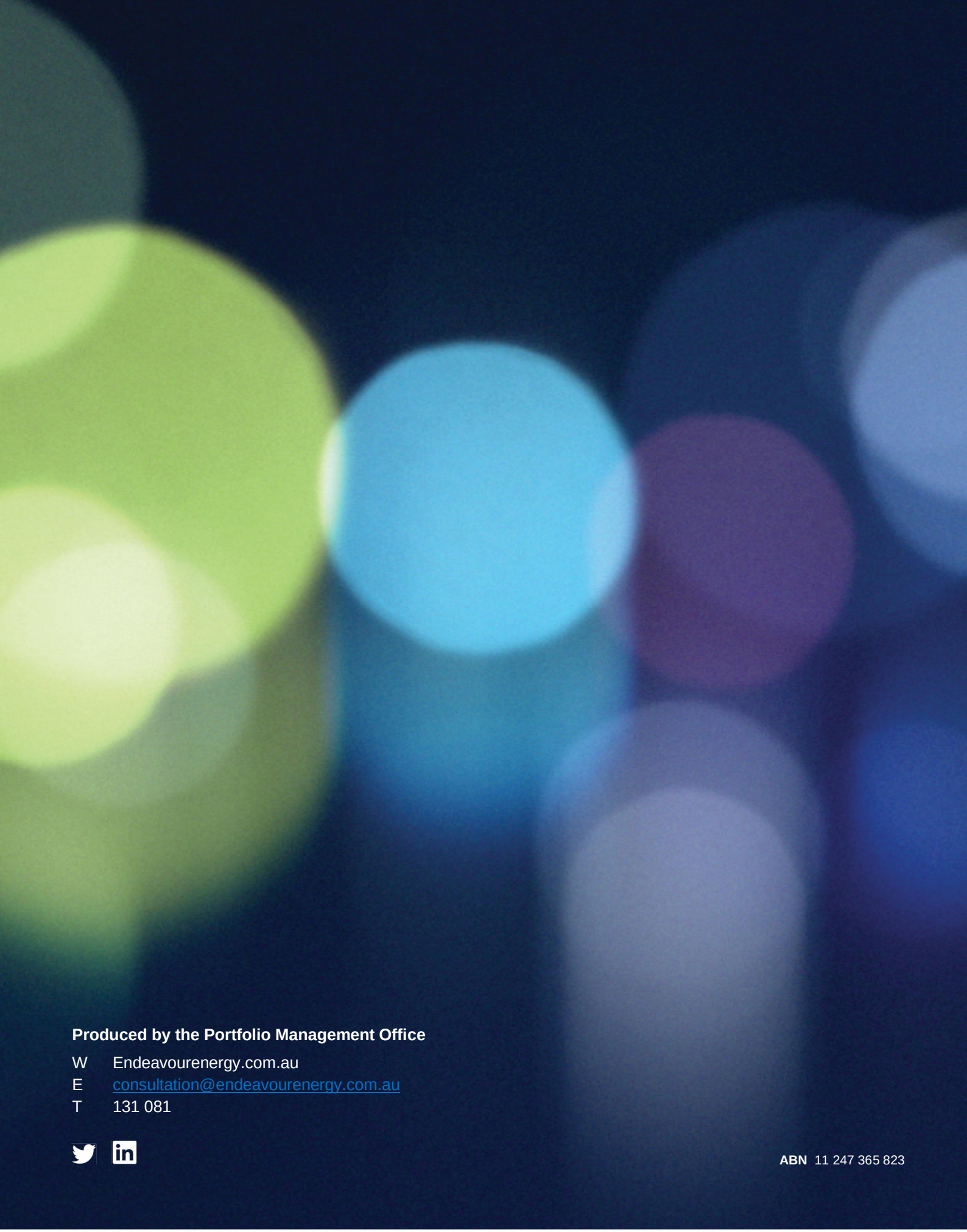
requirements (including back-up as required by the customers) of the enterprise development area are significant and therefore could not be supported by a network that is not part of the interconnected national electricity system with the ability to draw on grid-connected generation sources. In forming this conclusion, we have considered both the potential to convert part of our distribution network to a regulated SAPS as well as the potential to build a new SAPS (given the greenfield nature of the network development in this area).

We note that this conclusion does not preclude the development of embedded generation and storage by specific customers or other proponents to meet part of their supply needs and/or as back-up to their grid connections. Such developments fall outside of the definition of a SAPS and are coupled with those customer connections continuing to also require their full demand to be able to be met from the grid.

Appendix A – Checklist of compliance clauses

This section sets out a compliance checklist that demonstrates compliance of this OSR with the requirements of clause 5.17.4(e) of the NER version 187.

Clause 5.17.4(e) requirement	Section of this OSR
1. Description of the identified need.	2
2. Assumptions used in identifying the identified need.	2.3
3. Relevant annual deferred augmentation charge associated with the identified need.	3.5
4. The technical characteristics of the identified need that a non-network option or SAPS 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. Summary of potential credible options to address the identified need, as identified by the RIT-D proponent, including network options and non-network 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).	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.	4



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