North Camellia 132kV Switching Station Establishment

Notice on screening for non-network options
April 2022

Endeavour Energy

CONTACT

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

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Contents

1. Introduction

Based on the NSW government strategy, the Camelia-Rosehill precinct will play an important role as an industry and employment hub within the Greater Parramatta and Olympic Peninsular Economic Corridor. By 2041, it is forecast that the area will have capacity for up to 10,000 dwellings and 14,500 jobs.

Currently, Camellia precinct is an older industrial area however it is seeing many major customer connection applications from across different industries and initial plans for high density housing. Nearby customer connections include new major data centres, Sydney Metro West, Ausgrid's Lidcombe and Auburn ZS as well as the future planned high-density Camellia Town Centre.

In 2020, a major customer submitted a connection application to Endeavour Energy for 132kV supply to two separate data centres. The ultimate proposed load stated in the application is 90 MVA. Section 5.2.3 of the National Electricity Rules (NER) obliges Endeavour Energy to enable connection of customers to the distribution network. Based on the load requirements that the major customer has provided combined with the exiting load from Camellia TS, there will be a load at risk of 20.7 MVA in 2022/2023 and increasing further to 91.9 MVA by 2031.

The existing network has insufficient capacity to service the major customer and the additional load from future development in the area. Therefore, investment is required as a reliability corrective action to meet expected future load and satisfy our connection obligations under the NER.

Figure 1 – Artist impression of future potential Camelia-Rosehill Precinct[1]

While the total ultimate demand of the area will develop over the next 20 years, there is the requirement for a new 132kV switching station that will supply the two data centre connection applications and enable the

[1] Image extracted from the Draft Camellia-Rosehill Place Strategy https://pp.planningportal.nsw.gov.au/camellia-rosehill-place-strategy

support for further growth in the area. We are therefore initiating a Regulatory Investment Test for Distribution (RIT-D) for this project.

Endeavour notes that the new switching station will be a shared network asset which will become part of Endeavour's Regulatory Asset Base. As initially these prospective customers are expected to utilise a high majority of the asset, specific tariff arrangements will be established to recover the majority of the cost of the augmentation from the beneficiaries (i.e. the new customers). These customers will be charged a cost reflective network price, determined specifically from this network augmentation investment. This will ensure no cross subsidy from existing customers, but can be adjusted such that as a larger number of customers benefit from the asset, the costs can be shared accordingly.

'Identified need' for this Regulatory Investment Test for Distribution (RIT-D)

We have initiated a Regulatory Investment Test for Distribution (RIT-D) to investigate, and consult on, how to most efficiently facilitate the connection of the new major loads in the Camellia region.

Endeavour Energy is required to connect customers under section 5.2.3(d) of the 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 since 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 requiring connection will exceed the existing network capacity. This is currently anticipated to be 2023/24, based on the connection enquiries received to date.

The transmission network augmentation to support the growth in the Camelia-Rosehill precinct has been brought forward due to recent connection applications and was therefore not included as part of our regulatory proposal to the Australian Energy Regulator (AER) for the current regulatory control period. However, this network need is included in our most recent Distribution Annual Planning Report (DAPR).

This non-network screening notice sets out the reasons why we consider that there will not be a non-network option that forms a potential credible option on a standalone basis, or that forms a significant part of a potential credible option for this RIT-D project, ie, in accordance with NER clause 5.17.4(c). It represents the first formal stage of the RIT-D assessing how to facilitate the connection of the major new loads most efficiently in the Camelia-Rosehill precinct.

The second formal stage of this RIT-D is Draft Project Assessment Report (DPAR), which will include a full net present value (NPV) options assessment.

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2. Key assumptions underpinning the 'identified need' for this RIT-D

This section sets out the key assumptions and methodologies that underpin the identified need for this RIT-D. These assumptions have been used in making our determination that there will not be a non-network option that is a potential credible option on a standalone basis, or that forms a significant part of a potential credible option, ie, in accordance with NER clause 5.17.4(c).

2.1 Relevant area of our network

The Camellia-Rosehill is a large industrial area, approximately 320 hectares in size and located along the Parramatta River, 2 kilometres east of the Parramatta CBD. It is bounded by the existing established locations of Rydalmere, Rosehill, Clyde and Silverwater.

Figure 2 shows the Land Use Zoning for the Camellia precinct.

Figure 2 – Overview of future zoning as presented in the Draft Camellia-Rosehill Place Strategy

2.2 Load forecasts

Camellia precinct is an older industrial area and is seeing many major customer connection applications from across different industries.

In 2020, a major customer submitted an application for 132kV supply to two separate data centre customers within its site, with an ultimate proposed load of 90MVA. The major customer is temporarily being supplied by three twin cabled feeders from Rosehill ZS with a firm capacity of 20MVA. The customer has provided their forecast load shown in Table 1 and will have significant load at risk from 2024 if they do not switch to 132kV supply.

Furthermore, Camellia TS will need to supply a number of major customer connections:

- Sydney Metro West: requires 50MVA at 33kV supply to support major transport infrastructure
- Ausgrid's Lidcombe and Auburn ZS: requires 50MVA supply at 33kV
- Silverwater data centre: despite being in Ausgrid's network area, an enquiry was received for direct connection to Endeavour Energy's 33kV network for supply of 30MW. This is not yet confirmed but is a potential future load.

- Camellia Town Centre is a future planned high-density residential development up to 10,000 apartments near the light rail stop.

Currently, Camellia TS has two 120MVA transformers for a firm capacity of 120MVA. The forecast load for Camellia TS is based on the recent Summer Demand Forecast and as shown in Table 2, load at risk will occur from 2025. This load forecast does not include the enquiry for the Silverwater data centre.

Table 3 shows the total expected load at risk considering the combined major customer load and existing load supplied by Camellia TS. The combined load forecast and load at risk is shown graphically in Figure 3.

Table 1 – Major Customer Load Forecast

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Equinix Demand (MVA)	14.3	28.7	41.6	41.6	53.1	64.6	76.1	79.2	79.2	79.2
Load At Risk (MVA)	-	8.7	21.6	21.6	33.1	44.6	56.1	59.2	59.2	59.2

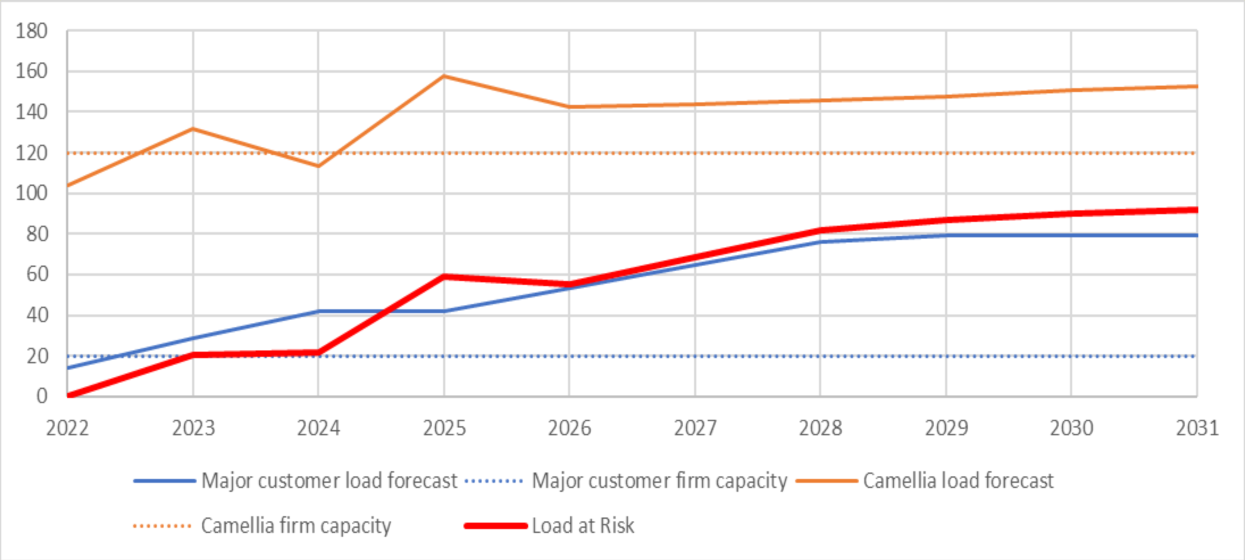
Table 2 – Camellia TS Load Forecast

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Camellia TS Demand 50% POE (MVA)	104.0	132.0	113.5	157.7	142.3	144.0	145.7	147.8	150.6	152.7
Load At Risk (MVA)	-	12.0	-	37.7	22.3	24	25.7	27.8	30.6	32.7

Table 3 – Total Load At Risk

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Total Demand (MVA)	118.3	160.7	155.1	199.3	195.4	208.6	221.8	227	229.8	231.9
Load At Risk (MVA)	-	20.7	21.6	59.3	55.4	68.6	81.8	87	89.8	91.9

Figure 3 - Combined Load Forecast and Load at Risk for Camellia TS and major customer



2.3 Expected pattern of use

Since the forecast loads are yet to connect, we have assessed the identified need using the demand profile of an alternate data centre customer which we believe will be representative of the North Camellia data centres.

The representative data centre customer receives supply at 132kV similar to the North Camellia data centres. The demand profile over a full year, from 1-Oct-2020 to 30-Sep-2021, has been extracted and Figure 4 presents the normalised Load Duration Curve (LDC).

Similarly, Figure 5 presents the peak load profile for summer based on the representative customer demand profile.

Figure 4 – Normalised LDC assumed for the major customer

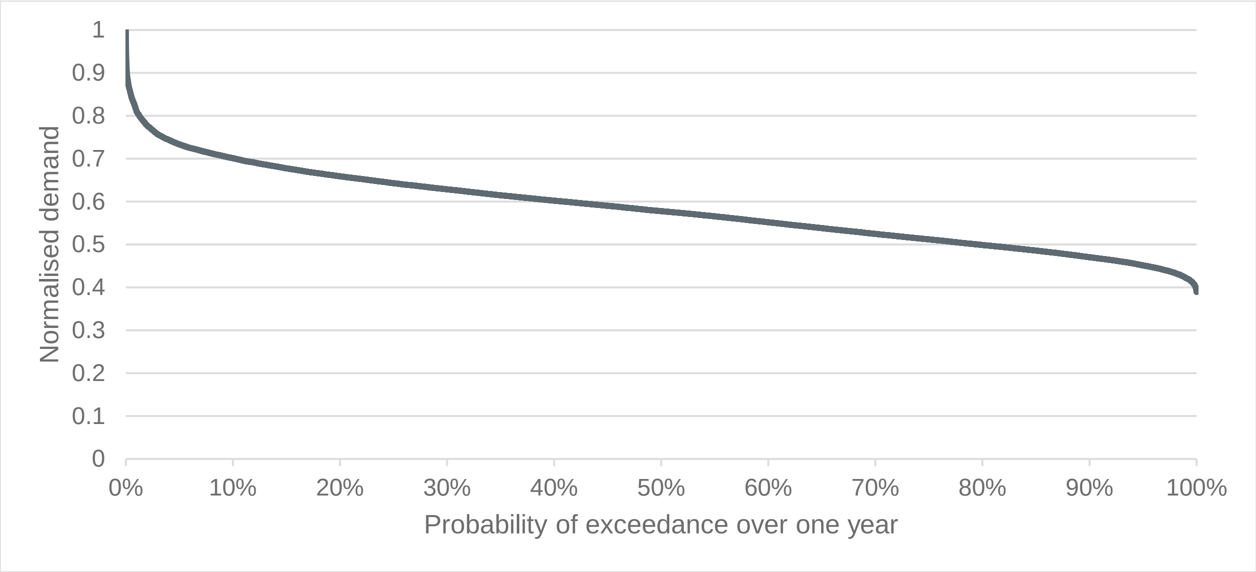
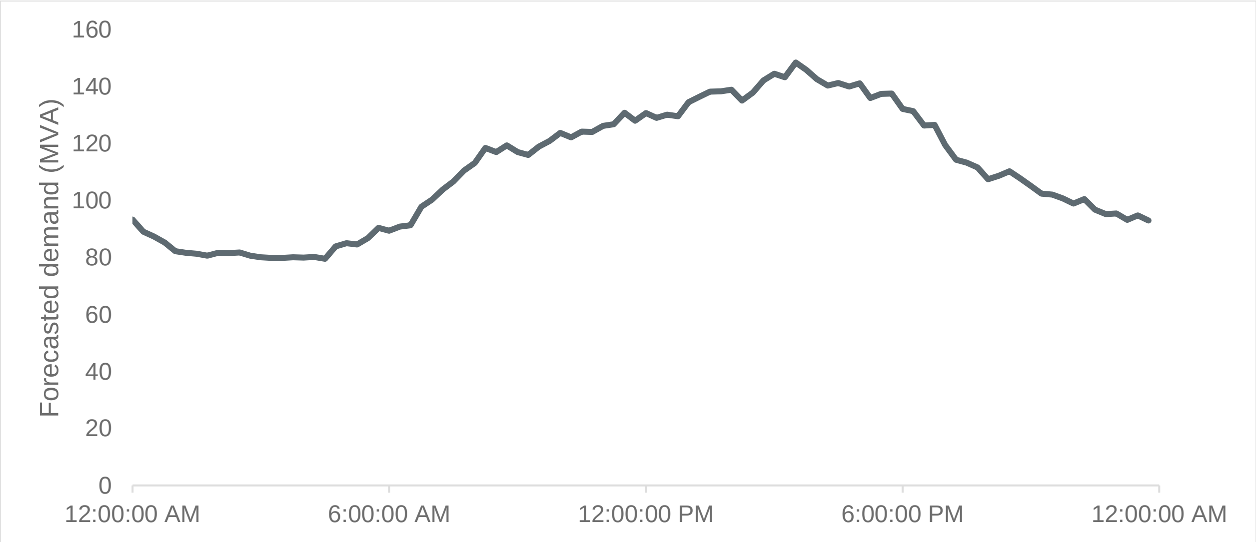


Figure 5 – Peak summer day profile for the major customer



2.4 Existing network

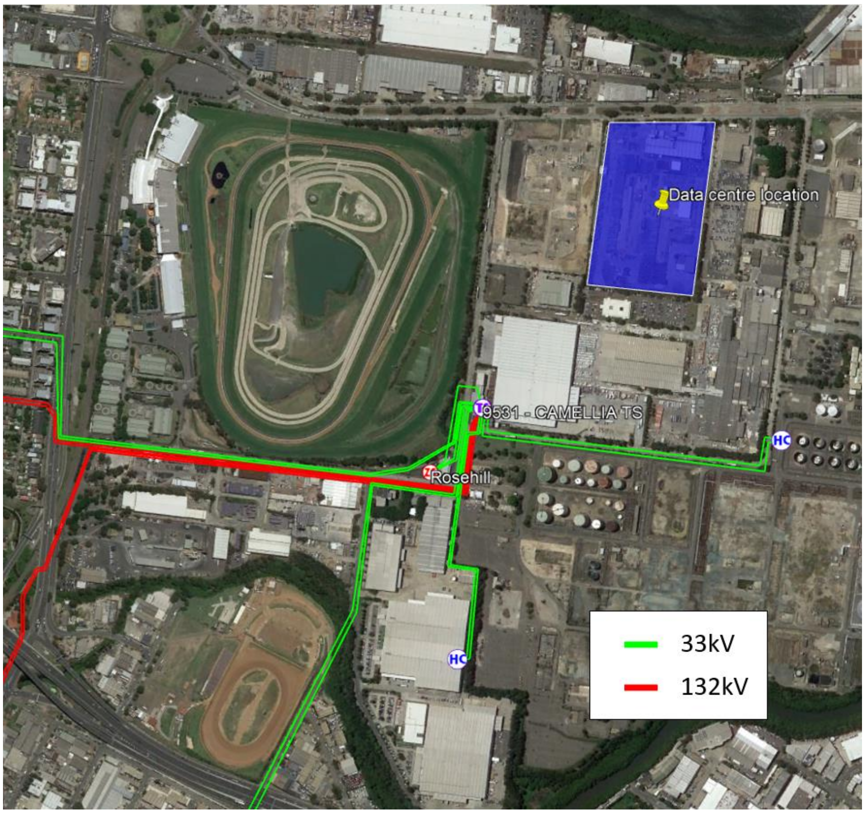
Within the Camellia-Rosehill precinct is Camellia 132kV/33kV TS, Rosehill 33kV/11kV ZS, an underground sub-transmission network at voltages of 132kV and 33kV, and an 11kV distribution network. The location of the sub-transmission assets is shown in Figure 6. It can be seen that the sub-transmission network is primarily towards the south of the precinct and there are no existing sub-transmission assets towards the north, where the North Camellia data centres and future development are located. It is also noted that all four of the 132kV cables are oil-filled cables that will eventually require replacement based on end-of-life or capacity constraints.

The existing area is largely non-residential and primarily supplied by the 11kV network and only two high voltage customers with 33kV supply. Additionally, Sydney Metro West will have its stabling yard within the Camellia-Rosehill precinct to be supplied at 33kV.

The NSW Department of Planning and Environment (DPE) has released the Camellia-Rosehill Place Strategy which aims to revitalise the precinct through significant growth in dense residential dwellings and commercial loads, in particular the planned Camellia Town Centre towards the North-West of the precinct around the Parramatta Light Rail and Sydney Metro West stations. High-level estimates based on this growth strategy have shown that both Camellia TS and Rosehill ZS will have insufficient capacity to maintain security of supply to the Camellia-Rosehill precinct from 2023.

Camellia TS, which supplies Rosehill ZS, is able to be augmented to address capacity constraints at 33kV. However, Rosehill ZS has insufficient space for augmentation and additional loads above its firm rating will need to be addressed via 11kV feeders from adjacent zone substations or from a new zone substation within the precinct.

Figure 6 – Geographic location of the existing network

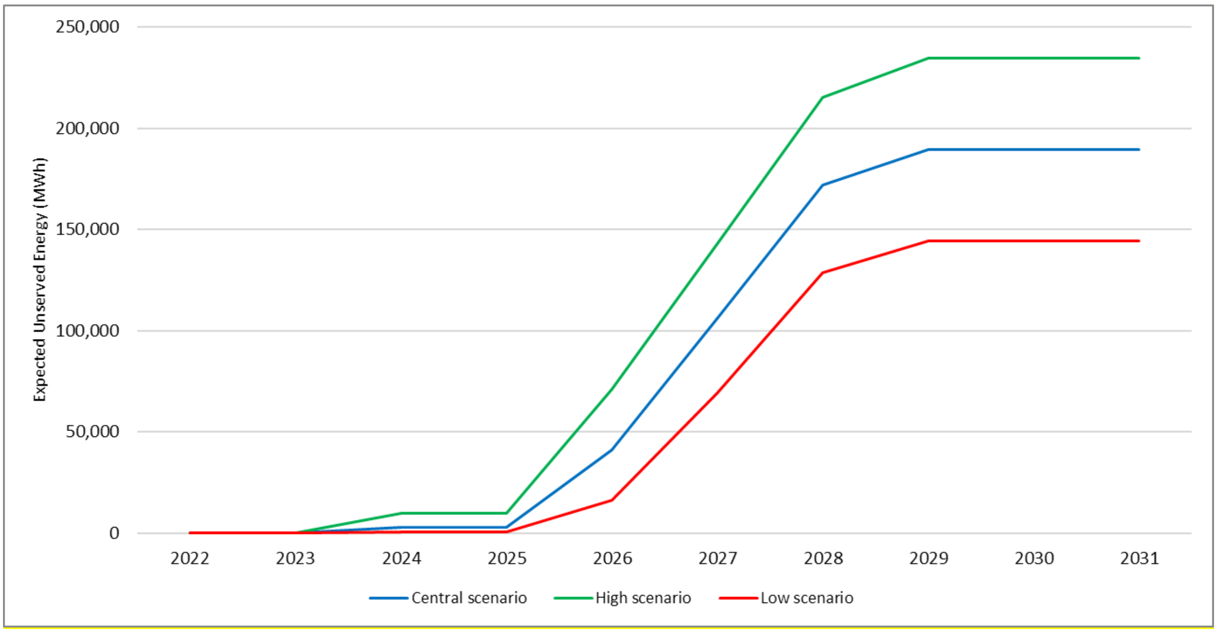


2.5 Expected unserved energy if action is not taken

If network augmentation is not undertaken, there will be significant unserved energy in the area from 2023 onwards.

Figure 7 below presents the estimated unserved energy if no action is taken under each of the three demand scenarios. We have only presented the next ten years to enable the differences to be clearly seen in the initial years (but we note that the unserved energy forecasts are expected to increase significantly after 2031).

Figure 7 – Expected unserved energy under the base case scenario (ie, with no investment)



2.6 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 with respect to the potential market benefits that could be realised under each credible option.

A summary of the key variables/framework expected to be used for each scenario is provided in Table 4 below.

Table 4 – Proposed scenarios for the forthcoming RIT-D NPV assessment

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

We propose to assess all credible options across a 20-year assessment period.

3. Proposed network options to meet the identified need

We have identified three credible network options to meet the identified need. This section provides more information on the scope and cost of these options. It also outlines options considered but that we do not propose to progress further.

3.1 Option 1: Establish a new 132kV switching station

This option is to establish a new 132kV switching station on Grand Avenue. The scope of works includes the installation of two new 132kV GIS circuit breakers at Camellia transmission substation and establishment of two new 132kV feeders with 180 MVA rating from Camellia TS to the new switching station on Grand Avenue.

The estimated route is 1 kilometre and is to be underground for its entire route, along Colquhoun St and Grand Avenue. A geographic view of the transmission route is shown in Figure 10.

The switching station will provide a connection point for two data centre customers with each customer utilising one feeder bay. Additionally, provision will be made for two spare feeder bays in the switching station to facilitate a most likely scenario of connecting a new zone substation to service future customers in the precinct, including Camellia Town Centre comprising of approximately 10,000 apartments. Thus, the switching station has been designed with a total of 4x feeder bays. Should the need arise to build a new 132/11kV transmission substation in the future, it will subject to a separate RIT-D.

It is proposed that the new 132kV switching station be commissioned in FY24 with a total project cost (including all associated works) of $13.3M. A contingency amount (approximately 10% of the project cost) has been built into the cost estimates to cover unforeseen costs related to site conditions which may arise during construction. For this option, the construction expenditure will occur from FY23 to FY24.

Figure 8 – Simplified single line diagram for Option 1

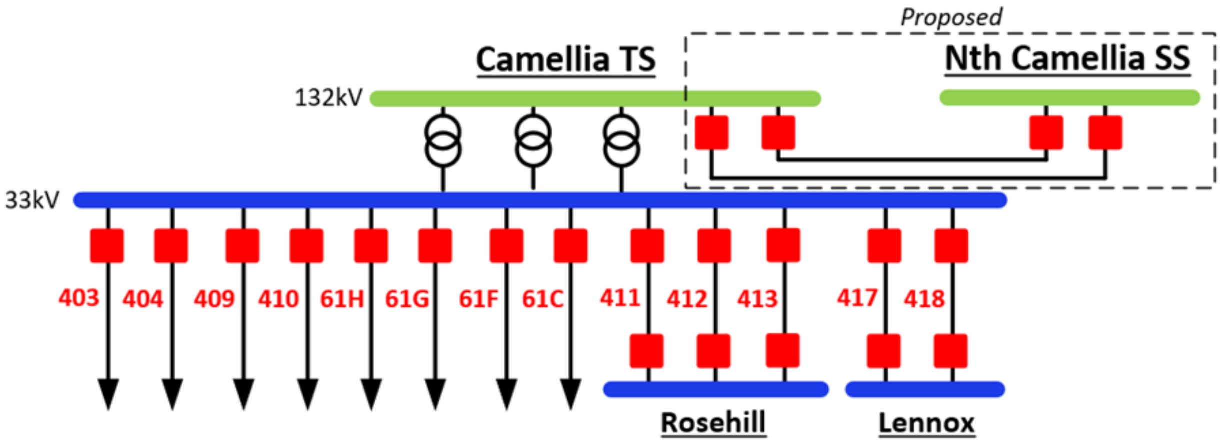


Figure 9 – Simplified transmission single line diagram for Option 1

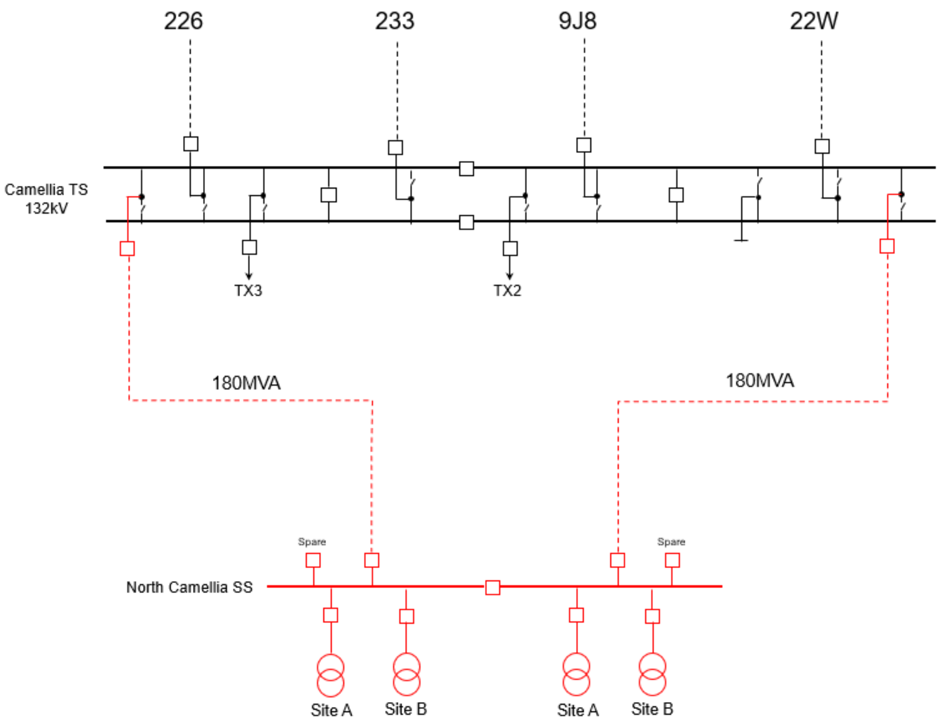
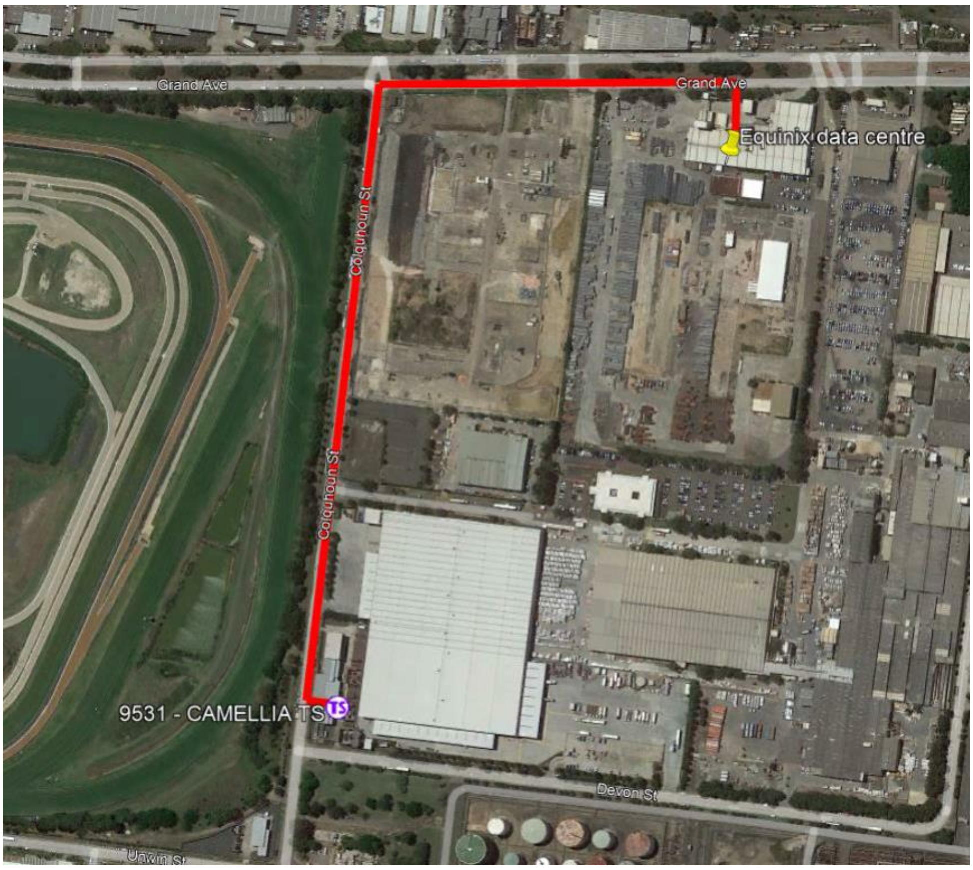


Figure 10 – Proposed feeder route from Camellia TS to the new switching station



3.2 Option 2: Establish a new 120MVA 132/33kV transmission substation

This option proposes establishment of a new transmission substation with 120MVA (non-firm) capacity within the development area. The scope of works for this option includes land acquisition for the new transmission substation, establishment of the new transmission substation and two 132kV feeders from the new transmission substation to Grand Avenue.

The new transmission substation will be commissioned by FY24. The estimated cost of this option is estimated to be $34M.

There are major challenges associated with this option including scarcity of available land suitable for the size of a transmission substation and difficulties associated with connecting a new transmission substation into the existing 132kV oil-filled cable network.

Figure 11 – Simplified single line diagram for Option 2

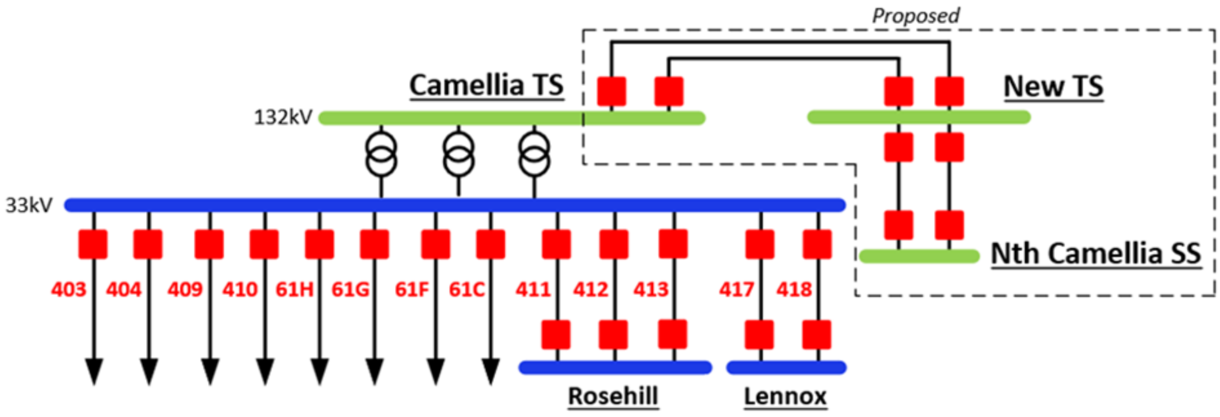
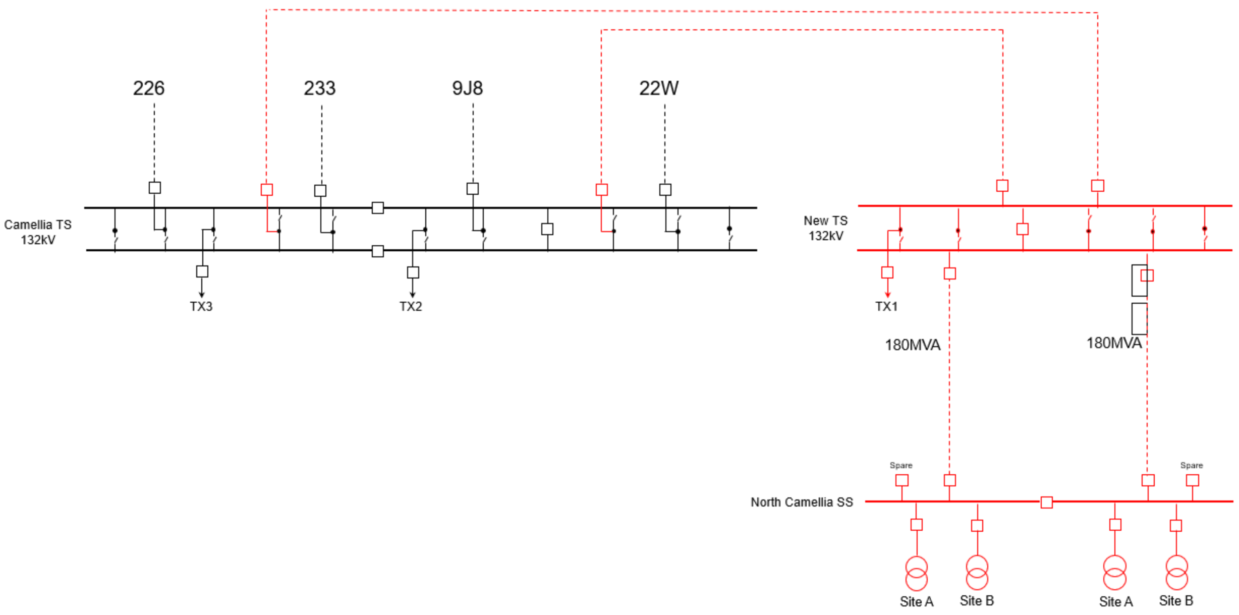


Figure 12 – Simplified transmission single line diagram for Option 2



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

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

4. Assessment of non-network solutions

Following a review of the expected future load demands in the area and the nature of the existing load and network capability, Endeavour Energy has determined that there is unlikely to 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 potential credible option, for this RIT-D.

This section sets out the assessment behind this determination, which draws on the assumptions outlined in the sections above, and considers the required technical characteristics that a non-network option would need to meet to meet the identified need.

4.1 Requirements that a non-network option would need to satisfy

We have considered the requirement that a non-network option would need:

- to be able to form a credible stand-alone option, or
- to defer the network investment.

Table 5 below sets out the requirements that a non-network option would need to satisfy in order to form a stand-alone credible option (i.e. without being combined with a network solution).

A viable non-network option must be capable of reducing the estimated shortfall to retain supply to all customers. Under the central scenario, by the end of 2023/24, a shortfall is estimated to exist for 122 days in the year and is at a maximum of about 77 MWh per day in the summer period. By 2024/25, a shortfall is estimated to exist for the full year. The requirement for non-network solutions is therefore substantive in both the number of days expected to be required and the magnitude of the support needed.

In addition, we note that for any non-network solution to be effective it would need to locate near, and essentially connect to, the new load connection points. We consider that any such co-location would be extremely difficult at the required capacity given the requirement for network itself, large land requirements, the planning approvals and these being in addition and competition to those developments expected in these areas.

Table 5 below summarises the expected network support requirements out to 2025/26 for any non-network solutions to form standalone options under the central scenario. We note that the requirements would increase further beyond 2026/27 as the area develops and more load connects.

Table 5 – Network support required for a standalone option under the central scenario

Year	Peak load reduction required (MW)	Days required	Hours required	Total MWh required
FY23	8.7	122	1882	3,097
FY24	21.6	365	8754	62,387
FY25	21.6	365	8754	62,387
FY26	33.1	365	875	128,042

Table 6 below sets out the requirements for non-network options in order to cost effectively defer network expenditure, ie, to be coupled with a network option in order to form a combined credible option.

Given that the comprehensive NPV assessment of the network options is yet to be undertaken (and will be part of the forthcoming DPAR), the deferral assessment has been undertaken in this screening report using the preliminarily preferred network option, Option 1 (which is the lowest cost and meets the connection and load growth requirements of the area).

Table 6 – Network support required to defer a network option under the central scenario

Deferral period	Deferral year	Peak load reduction required (MW)	Days required	Hours required	Total MWh required	Deferral value
1 year	FY25	8.7	122	1882	77	$0.43M
2 years	FY25	8.7	122	1882	77	$0.87M
	FY26	21.6	365	8754	320	
	Total	21.6	365	10,635	397	

The required characteristics for non-network solutions set out above demonstrates that the amount of demand reduction and/or local storage/generation that would be required to be provided in order to represent a credible option for this RIT-D is of an order of magnitude which does not appear realistic, given the existing load in the area. We therefore do not consider it technically feasible that non-network technologies can form standalone credible options that meet the entire identified need.

Similarly, the amount of load reduction that would be required in order to enable a deferral of network augmentation by one year is also reasonably high, particularly when considering the low deferral value. We therefore also do not consider it commercially feasible that non-network technologies can be coupled with a network option to form a credible option.

4.2 Assessment of specific non-network technologies

In addition to our general assessment of whether non-network options are likely able to form a potential credible option on a standalone basis, or form a significant part of a potential credible option, we have individually considered both demand management and new generation/storage below.

4.2.1 Demand management

The existing demand in the area of interest is based on the existing industrial areas served by the Camelia zone substations.

We consider that traditional coordinated demand management programs targeting residential and commercial/industrial customers who currently consume energy in the area cannot produce sufficient reductions to meet the demand requirements of the area, even for a one year deferral of network investment under the central scenario (as shown above).

Recent experience in demand management programs and discussions with industrial customers in the area shows that many of the major demand management initiatives have already been implemented, e.g. LED lighting and improved motors and drives. While there is capability and interest by some major customers in our network to participate in demand response programs aligned to opportunities in the wholesale energy market, this relates to large scale industrial customers with building and process management systems that support a co-ordinated and controlled demand response. The existing brownfield sites in the area generally lack the existing capability to support a demand response program of this type.

The magnitude of demand reduction required to achieve a one-year deferral of network investment (as outlined in Table 6 above), given the limited capacity of existing load to reduce demand, makes the use of demand management impractical as part of a combined option.

By way of a recent example in our network, we implemented the Oakdale Energy Saver Program in late 2019 with the objective to achieve demand reduction to defer the construction of a new zone substation by one year. The program involved providing complimentary energy audits to customers in the Oakdale

Industrial Park, comprised of mainly logistics and warehouse sites, and an incentive of $142/kVA for implementing permanent demand reduction initiatives was offered to participants. Around 2 MVA of potential demand reduction was identified from the twelve sites audited, which is insufficient to meet the 8.1 MVA target reduction and, while the program ends on 31 March 2022, so far only one site has implemented an initiative which is a 175kW upgrade to their existing solar capacity.

We therefore consider demand management programs to not be technically feasible under the RIT-D.

4.2.2 Generation and/or storage

Any potential non-network options such as grid-scale battery storage or large scale solar PV would require a large network capacity augmentation themselves to enable connection to the NEM and commercial operation. This augmentation would have a similar cost to the network options outlined in section 3 above.

We note that all existing solar PV is already captured in the analysis. For summer demand, we expect to see dedicated solar PV provide benefit in reducing the duration of peak demand events (i.e. before sunset) but we forecast that this will have a marginal impact on the remaining peak demand that will occur after sunset. Solar PV is not expected to be able to provide the firm dispatchable capacity required in high demand days.

Energy storage could contribute to peak demand after sunset, but this would involve a significant cost (and would also require comparable network augmentation to operate). For example, for a BESS to meet the worst day in 2022/23 under the central demand forecasts it would need to be at least 9MVA/88MWh (not including any additional margin for if that year ended up being a higher POE year), which we consider would cost at least $45 million, depending on the forecast assumptions.

Moreover, new generation/storage would also likely need to acquire land to situate on and a source of fuel to be able to provide network support as frequently as is required, which would further add to the cost and practical difficulties associated with these solutions.

We therefore consider that these technologies are not commercially feasible under the RIT-D for this particular network need.

4.2.3 Other non-network technologies

We consider it highly unlikely that power factor corrections can assist since most lighting in the area has already changed to LED. We typically find that it is electric motors in brownfields area that provide this saving.

Control schemes and automation in a smart-grid require new buildings and building management systems and we do not consider there to be the magnitude of these to meet, or help meet, the identified need for this RIT-D.

5. Conclusion

The Camellia-Rosehill precinct is an older industrial area currently seeing many major customer connection applications from across different industries and initial plans for high density housing. Based on the NSW government strategy, the precinct will play an important role as an industry and employment hub within the Greater Parramatta and Olympic Peninsular Economic Corridor. The NSW Department of Planning and Environment (DPE) has released the Camellia-Rosehill Place Strategy which aims to revitalise the precinct through significant growth in dense residential dwellings and commercial loads, in particular the planned Camellia Town Centre towards the North-West of the precinct around the Parramatta Light Rail and Sydney Metro West stations. By 2041, it is forecast that the area will have capacity for up to 10,000 dwellings and 14,500 jobs.

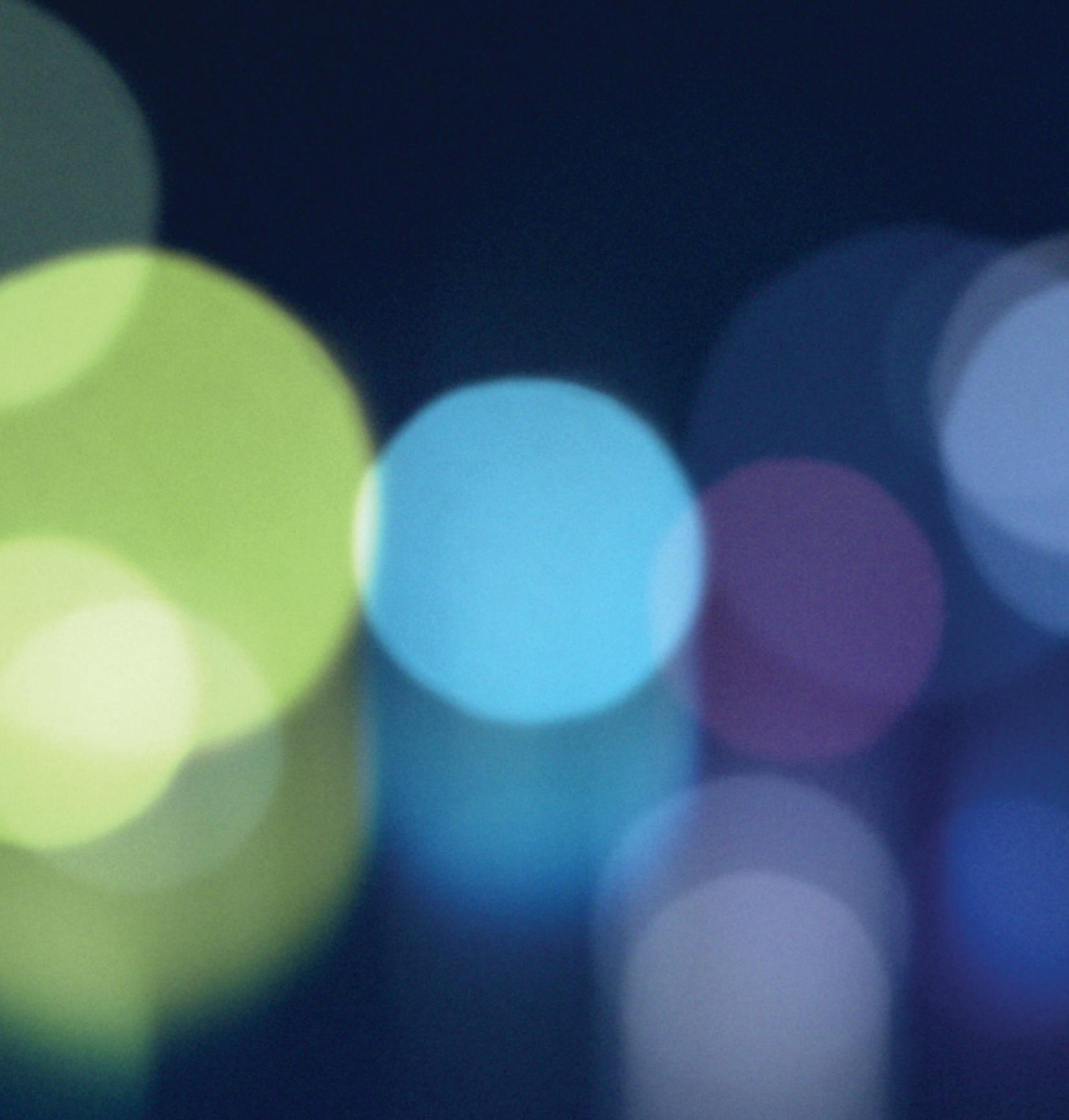
High-level estimates based on this Strategy have shown that both Camellia TS and Rosehill ZS will have insufficient capacity to maintain security of supply to the Camellia-Rosehill precinct from 2023. Furthermore, a major customer submitted a connection application to Endeavour Energy for 132kV supply to two separate data centres. The ultimate proposed load stated in the application is 90 MVA. Based on the load requirements that the major customer has provided combined with the exiting load served by Camellia TS, there will be a load at risk of 20.7 MVA in 2022/2023 and increasing further to 91.9 MVA by 2031.

Based on the extent of forecast load for the major customer and the Camellia-Rosehill development area, the expected cost of network options and the capacity of the existing network to facilitate non-network technologies, it is not considered feasible that a non-network solution will form a potential credible option on a standalone basis, or form a significant part of a potential credible option for this RIT-D. Consequently, a Non-Network Options Report is not intended to be prepared for this RIT-D in accordance with clause 5.17.4(c) of the NER.

We consider that non-network solutions maybe more likely to be feasible for future developments in the area as the cost of large scale battery storage continues to decrease, the widespread inclusion of solar PV in new commercial and industrial developments continues to increase, and the uptake of electric vehicles, including electric buses, begins to offer opportunities in the vehicle-to-grid capability for network support. These developments will be closely monitored as the Camellia-Rosehill precinct develops over the next decade.

The proposed switching station will provide a connection point for two data centre customers. Additionally, provision will be made for two spare feeder bays in the switching station to facilitate a most likely scenario of connecting a new zone substation to service the future customers in the precinct, including Camellia Town Centre comprising of approximately 10,000 apartments. Thus, the switching station has been designed with a total of 4x feeder bays. Should the need arise to build a new 132/11kV transmission substation in the future, it will subject to a separate RIT-D.

Endeavour notes that the new switching station will be a shared network asset which will become part of Endeavour's Regulatory Asset Base. As initially the connecting customers are expected to utilise a high majority of the asset, specific tariff arrangements will be established to recover the majority of the cost of the augmentation from the beneficiaries (i.e. the new customers). These customers will be charged a cost reflective network price, determined specifically from this network augmentation investment. This will ensure no cross subsidy from existing customers, but can be adjusted such that as a larger number of customers benefit from the asset, the costs can be shared accordingly.



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