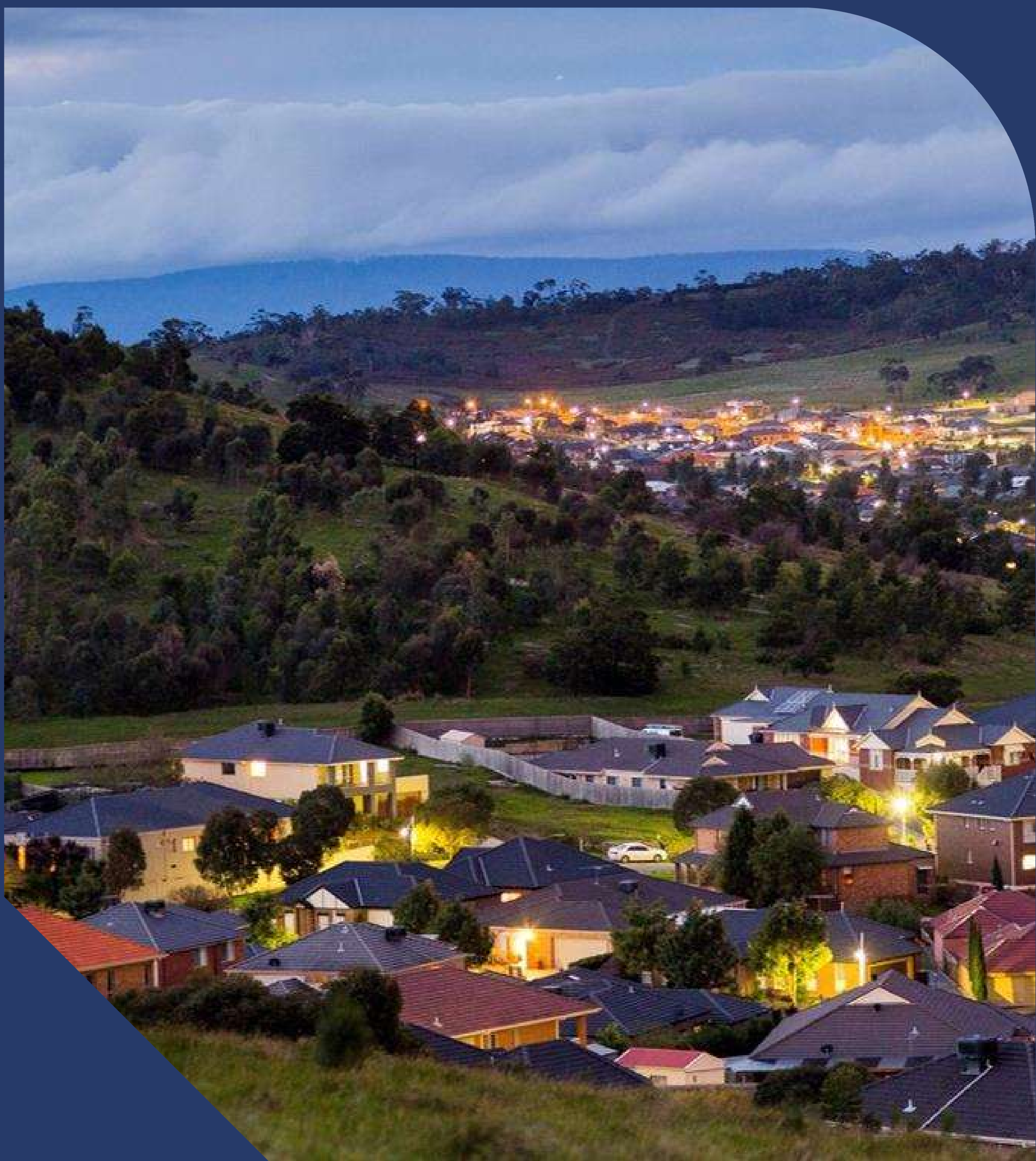
Electricity Distribution Price Review (EDPR 2026-31)

Business case: Wollert Area Upgrade

Date: 31 January 2025



AusNet

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Executive summary

AusNet Services is a regulated Victorian Distribution Network Service Provider (DNSP) that supplies electricity distribution services to more than 800,000 customers. Our electricity distribution network covers eastern and north-eastern Victoria, and Melbourne's north and east.

The forecasted increase in the population in the Wollert area has triggered the need for a strategic options evaluation to determine AusNet's ability to meet the increasing forecast load growth in the Wollert area. This business case demonstrates the need for investment to maintain reliability of power supply and undertake an assessment of the credible options to address the identified need including the comparative evaluation to identify the preferred option.

Ausnet has developed this business case to demonstrate the need for AusNet to undertake investments at Wollert to maintain the reliability of supply to customers in the area.

Identified need

There has been a significant increase in population in the Wollert area. According to the 2016 census[1], there were 9,060 people living in Wollert and by 2021[2], the corresponding figure was 24,407. This represents an average annual growth rate of approximately 22%.

It is expected that growth is likely to continue with the most recent forecast produced by Victoria's Department of Transport and Planning (VIF2023) forecasting the population of LGA Whittlesea, which contains Wollert, to grow from 231,800 to 265,970 from 2021 to 2026. This represents an overall annual growth rate for the whole LGA of 2.8% per annum. Note that some higher growth parts of the network are outside the Whittlesea LGA, and our business case relies primarily on our internal forecasts which are specific to individual zone substations.

The identified need is to efficiently maintain a reliable supply of power to the customers in the Wollert area as the forecast demand exceeds the capacity of the Kalkallo zone substation, that currently supplies the load to the Wollert area and the existing network infrastructure. The 50% Probability of Exceedance (POE) demand is expected to exceed the N rating at Kalkallo by 2027. A material level of expected unserved energy (EUE) is calculated for Kalkallo as shown in Table 1. The calculated unserved energy includes for available load transfers. The maximum demand forecast has been weighted using the industry practice of 30% of 10PoE and 70% of 50PoE.

Table 1: Maximum demand forecast in FY2031

Substation	Forecast Maximum demand (10 PoE) [MVA]	Forecast Maximum demand (50 PoE) [MVA]	N-1 [MVA]	N [MVA]	Unserved Energy (MWh)	Value of Unserved Energy ($ millions)
Kalkallo	156	131	49	98	17,950	$ 621.3
Doreen	77	69	46	89	-	$ -
South Morang	49	44	45	92	-	$ -
Epping	128	110	82	123	18	$ 0.8

Source: AusNet analysis

Across the 30-year assessment period, Expected Unserved Energy (EUE) and Value of Expected Unserved Energy are forecast to be 4,727,029 MWh and $71,328 million respectively.

Options Considered

The following credible options have been considered to mitigate the risk of expected unserved energy at Kalkallo zone substation and maintain the reliability of electricity supply to customers in the Wollert supply area:

- **Do nothing (Base Case)**: This option considers a business-as-usual approach with customers in the Wollert supply area continuing to be supplied using the existing network infrastructure. There is no capital investment and operational and maintenance investments continues as before. This option provides no mitigation to manage the energy at risk and is not considered a credible option. This option has been taken as the base case with which all other options are compared.

[1] 2016 Wollert, Census All persons QuickStats | Australian Bureau of Statistics (abs.gov.au) - https://www.abs.gov.au/census/find-census-data/quickstats/2016/209041437

[2] 2021 Wollert, Census All persons QuickStats | Australian Bureau of Statistics (abs.gov.au) - https://abs.gov.au/census/find-census-data/quickstats/2021/SAL22820

- **Build a new Zone Substation at Wollert (Option 1)**: This option involves augmenting the network by installing a new 2x33MVA 66/22kV zone substation located close to our existing dual circuit 66 kV lines on the eastern edge of the Wollert precinct. This option relieves the loading at surrounding zone substations to reduce expected unserved energy and provide sufficient capacity in Wollert to address the forecasted demand.
- **Install a third transformer at Kalkallo zone substation (Option 2)**: This option involves augmenting the capacity of the existing Kalkallo zone substation by adding a third 33MVA 66/22kV transformer and third 22kV bus section with four 22kV feeders. The additional four feeders, which would be extended into the Wollert area, are to support forecasted development in that area. This option reduces the expected unserved energy at the Kalkallo zone substation and will relieve some future load growth from other zone substations surrounding the Wollert area.
- **Install Battery Energy Storage System (BESS) at Kalkallo substation (Option 3):** This option involves adding a battery storage facility10 MW, 40 MWh to the 22kV bus at the existing Kalkallo zone substation. This will reduce the expected unserved energy at the Kalkallo zone substation by reducing the peak demand supplied from the 3x33MVA 66/22kV transformers. This is done by charging the battery during lower loading periods and discharging the stored energy during peak loading periods to reduce transformer loading.

Based on our analysis of the options the preferred option is to build a new zone substation at Wollert (**Option 1**) due the greater NPV compared to all other options across all sensitivities (see Table 2). The expected benefit from reduced EUE, compared to other options, substantially outweighs the proposed capex and opex cost of building and operating the zone substation.

Note: Whilst the establishment of the new Wollert zone substation addresses the EUE at Kalkallo zone substation, some EUE remains at Epping zone substation. The value of this remaining EUE does not justify additional investment and it is expected that these risks could be addressed through reconfiguration of the medium voltage network and transfer of loads following the establishment of Wollert zone substation. Addressing the remaining EUE will be investigated separately.

Table 2: Options summary ($m, real FY24 dollars)

	FY27 to FY31 (undiscounted)			Full assessment period (discounted)			Comments
	Capex	Opex	Total cost	Total cost	Total benefits	NPV	
Do nothing	0	0	0	0	-71,328	**-71,328**	
Option 1 – New Wollert Zone substation	40.4	1.2	41.6	44.2	67,290.3	**67,246.1**	This is the preferred option as it maximises the NPV, and services most of the EUE
Option 2 – Third transformer at Kalkallo	48.0	1.4	49.4	53.3	51,221.7	**51,168.4**	Similar design and construction to Option 1, however the EUE is larger
Option 3 – BESS at Kalkallo	25	1.5	26.5	38.8	11,056.1	**11,017.3**	Option 3 has the lowest NPV of the options, even with the lowest costs, as the option's capacity to relieve EUE is much less

Source: AusNet analysis

1. Introduction

1.1. Purpose and scope

This report outlines the existing and emerging constraints to supplying electrical power to the Wollert area which is forecasted to have significant growth over the coming years. In line with this need we assess the options that maximise the present value of net economic benefit to address the identified need at Wollert.

The scope of this report is limited to the four nearby existing zone substations that could supply the Wollert Urban Growth Area which include:

- Kalkallo (KLO)
- Doreen (DRN)
- South Morang (SMG)
- Epping (EPG)

1.2. Background

1.2.1. Increased population

Victoria in the Future (VIF2023) states that Victoria is projected to add 3.8 million people from 2021 to 2051, reaching a population of 10.3 million[3]. This represents annual average growth of 126,000 people, at a rate of 1.5 per cent per annum. The City of Whittlesea (which Wollert is a part of) is expected to grow at an average of 2.5% between 2021 and 2036 – one of the higher growth areas across the Victorian Local Government Areas.

The Victorian Planning Authority and the City of Whittlesea have published a Precinct Structure Plan for the Wollert Urban growth area[4]. The plan was published in June 2017 and amended in February 2022. The proposal calls for a total of 15,060[5] dwellings, the majority of which will be new dwellings since the precinct will transition from rural to suburban land use. A range of commercial and light industrial areas are also envisaged.

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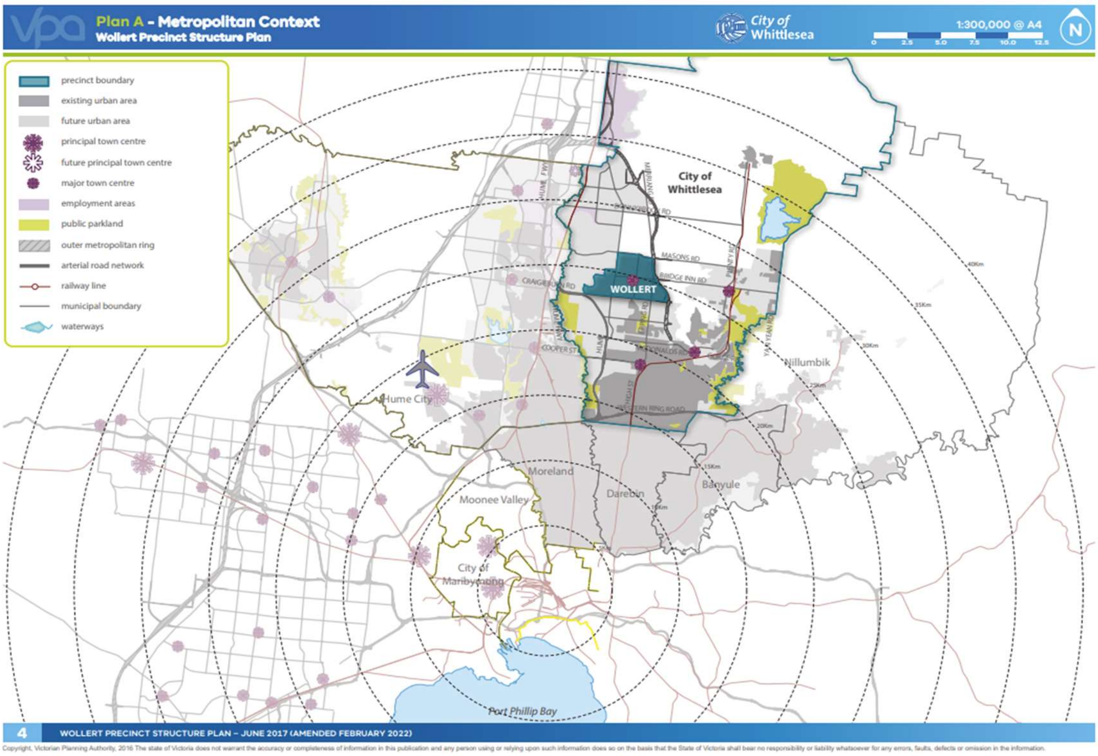
[3] Victoria in Future (planning.vic.gov.au) https://www.planning.vic.gov.au/guides-and-resources/data-and-insights/victoria-in-future

[4] Wollert Precinct Structure Plan (PSP) – June 2017 – Amended February 2022, Victorian Planning Authority. Available at https://vpa.vic.gov.au/project/wollert-precinct-structure-plan/ in July 2023.

[5] Wollert PSP, Table 3 page 23.

Figure 1 below shows the Wollert precinct in the overall Melbourne context.

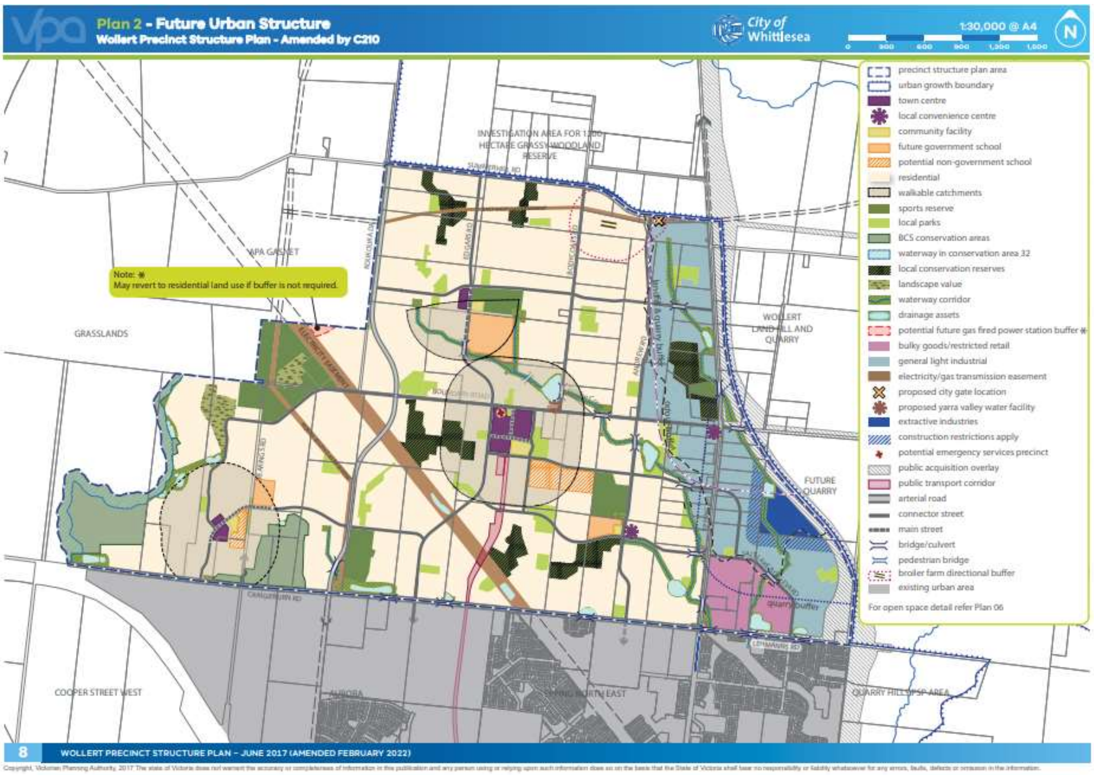
Figure 1 - Wollert Metropolitan Context[6]



Source: Victoria in the Future (VF 2023)

Figure 2 below identifies the future urban structure for the precinct with retail, commercial, education and other community facilities expected to be developed in the town of Wollert by 2051.

Figure 2 - Wollert Future Urban Structure[7]



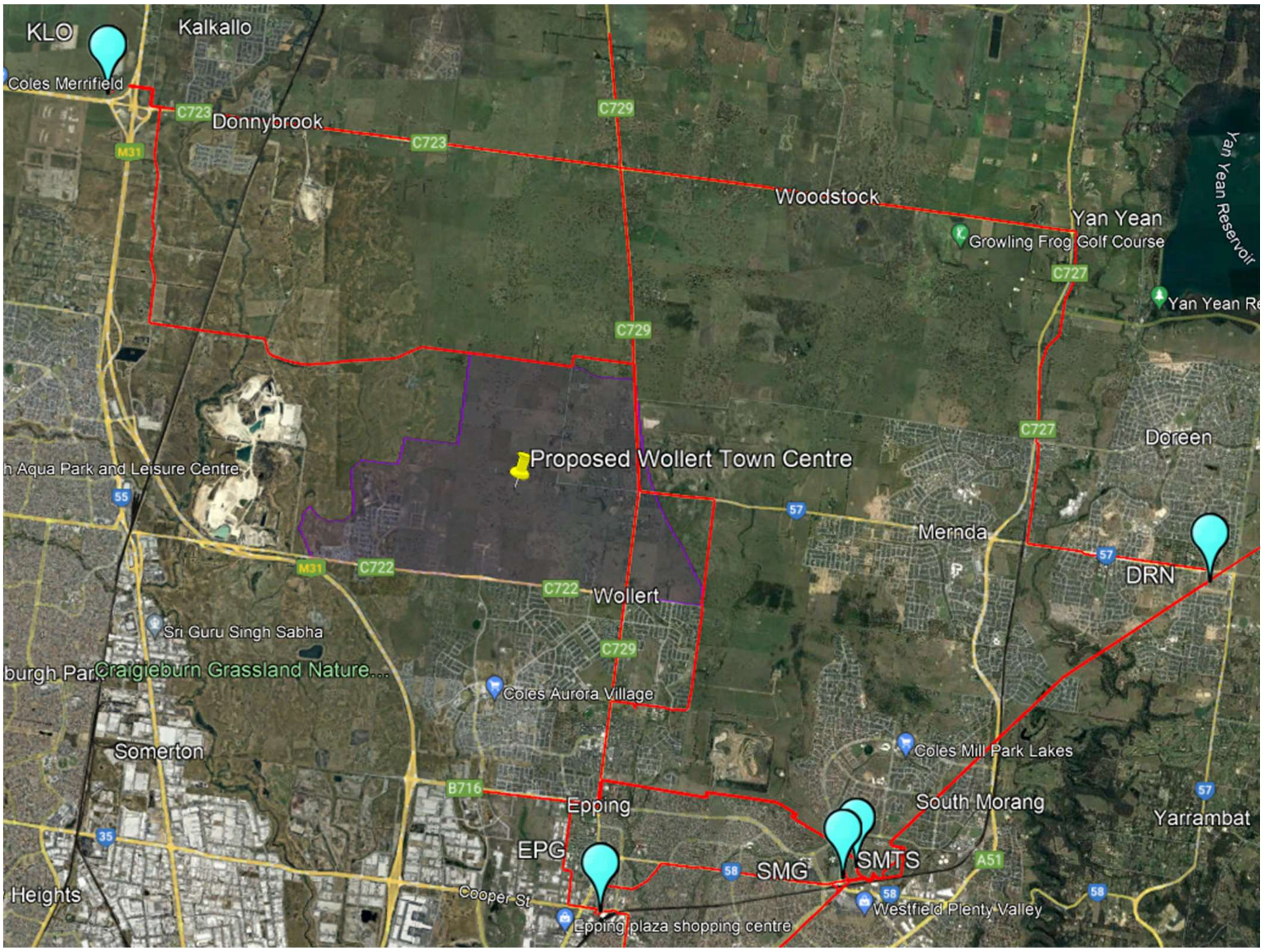
Source: Victoria in the Future (VF 2023)

[6] Wollert PSP, page 4.
[7] Wollert Precinct Structure Plan, June 2017, pg 8

1.2.2. Existing network

Figure 3 shows the development area. The Wollert precinct is highlighted in purple. Existing overhead 66 kV lines are shown in red.

Figure 3 - Wollert Precinct and Electricity Sub-transmission Network



Source: Google Earth and AusNet data

The four nearby existing zone substations that could supply the Wollert Urban Growth Area are:

- Kalkallo (KLO)
- Doreen (DRN)
- South Morang (SMG)
- Epping (EPG)

The transformation assets in Wollert region are shown in Table 3.

Table 3: Transformation assets in the Wollert region

Items	Dorreen (DRN)	Epping (EPG)	Kalkallo (KLO)	South Morang (SMG)
Voltage	66/11kV	66/11kV	66/11kV	66/11kV
Transformers (Name plate ratings)	2 x 33 MVA	3 x 33 MVA	2 x 33 MVA	2 x 33 MVA
Capacity (N-1) MVA (Cyclic rating)	46	82	49	45
Capacity (N) MVA (Cyclic rating)	89	123	98	92
Year of exceedence of (N-1)	Prior to 2024	2024	Prior 2024	2032
Forecast maximum Demand 2031 (50% PoE MVA)	68	115	167	45

All zone substations in the Wollert area are forecasted to exceed their N-1 rating by the end of the 2026-2031 regulatory control period. Kalkallo is forecast to exceed its N rating.

1.2.3. Good Electricity Industry practice

The National Electricity Rules (NER) define 'Good Electricity Industry Practice' as shown below.

> *The exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from a significant proportion of operators of facilities forming part of the power system for the generation, transmission or supply of electricity under conditions comparable to those applicable to the relevant facility consistent with applicable regulatory instruments, reliability, safety and environmental protection. The determination of comparable conditions is to take into account factors such as the relative size, duty, age and technological status of the relevant facility and the applicable regulatory instruments*[8].

In the context of a strategic investment options evaluation for the Wollert area, good industry practice is interpreted as investment in the augmentation of the network and maintaining the reliability of electricity supply to customers in the Wollert supply area amidst increasing risk of unserved energy.

Failure to provide appropriate mitigation to manage the risk of unserved energy will lead to increased supply interruptions, escalation in interruption durations, growing numbers of customers impacted, and potential asset failures as forecast demand reach and exceeds the N-1 and N ratings of the zone substation assets.

[8] National Electricity Rules, Chapter 10, Version 18

2. Identified need

Forecasted maximum demand is expected to exceed the ratings for the zone substations in Wollert area, resulting in 17,969MWh of EUE by 2031. This is equivalent to a cost of $622 million to our customers in 2031, which is a substantial amount and underpins the need for investments.

The following sections describe how we have identified the cost of $622 million to our customers, specifically:

- We have provided a discussion of our forecast maximum demand exceeding network capacity and load duration curves (LDC) that we have used to derive the cost to customers. The assumptions underpinning our demand forecasts are provided in a separate document (see AusNet's Demand forecasting methodology).
- We have compared our forecast maximum demands against existing zone substation and distribution network capacities to determine the EUE.
- We have calculated the value of expected unserved energy over each year of the study period FY27 to FY56 (inclusive).:
  - 10 PoE maximum demand at each zone substation
  - 50 PoE maximum demand at each zone substation
  - Forecast load duration curves
  - Zone Substation ratings (N and N-1)
  - Load transfer capacity between substations
  - Transformer unavailability data

2.1. Zone substation capacity

AusNet uses a probabilistic approach to network planning. Under a probabilistic network planning approach, conditions often exist where some of the load cannot be supplied (or some of the generation requires curtailment) with a network element out of service (hence the N-1 criterion is not met); however, the value of the energy not supplied is insufficient to justify additional investment whilst considering the probability of a forced outage of a particular network element. The benefit of this approach is that it results in a deferral of augmentation until it is economically justified.

Appendix A show the maximum demand forecasts and supply capacities for the Kalkallo, Doreen, Epping and South Morang zone substations. The supply capacity at a zone substation is measured by its rating. There are two types of ratings:

- **Rating (N)** is the cyclic rating of the zone substation with all transformers in service.
- **Rating (N-1)** is the cyclic rating of the zone substation with one transformer out of service.

Our analysis shows that for:

- **Doreen Zone Substation:** The 50% PoE demand is forecast to exceed the N-1 rating prior to 2024, yet we do not expect it to exceed the station's N rating over the 2026 to 2031 assessment period.
- **Epping Zone Substation:** The 50% PoE demand is forecast to exceed the N-1 rating prior to 2024, yet we do not expect it to exceed the station's N rating over the 2026 to 2031 assessment period.
- **Kalkallo Zone Substation:** The 50% PoE demand is forecast to exceed the N-1 rating prior to 2024. It is also forecast to exceed the station's N rating by 2027.
- **South Morang Zone Substation:** The 50% PoE demand is forecast to exceed the N-1 rating in 2032, yet we do not expect it to exceed the station's N rating over the 30-year assessment period.

Utilising probabilistic forecasting it is evident the 50% PoE demand values are the most likely demands to be reached. However, the 10% PoE demand values accounts for those demands that are less likely to be reached but are still possible. The 10%PoE presents the likelihood of the load exceeding the substation rating sooner than expected.

Appendix A provides charts showing the maximum demand for the zone substations in the Wollert region.

We also note that we have an existing contract with a gas fired generator at a waste disposal facility to provide network support. This contract expires in 2024 and therefore we have not considered this network support in our analysis.

2.2. Feeder capacity

The forecasted demand in the Wollert study area shows that there is limited capacity in the network by 2031. The total load of all feeders in the study area is slightly below their combined rating, as detailed in Table 4. Due to this constraint, feeder reconfiguration works will have limited effectiveness in addressing the forecasted demand requirements in the Wollert region, as discussed in Section 2.1. The feeders with available capacity are primarily located in areas with little growth, whereas those serving high-growth areas are approaching their capacity limits. Feeders KLO14 and KLO24, which supply the Wollert area, reached their capacity in Winter 2024.

Table 4: Total load and rated capacity at each zone substation in the Wollert region by 2031

	Total load on all feeders (MVA)	Total capacity of all feeders (MVA)	Difference (MVA)
KLO	83	42	-41
DRN	83	102	19
EPG	183	179	-5
SMG	55	89	34
Total	**405**	**412**	**7**

Appendix B tabulates the full list of feeder ratings and forecast demand for the four zone substations in the Wollert region.

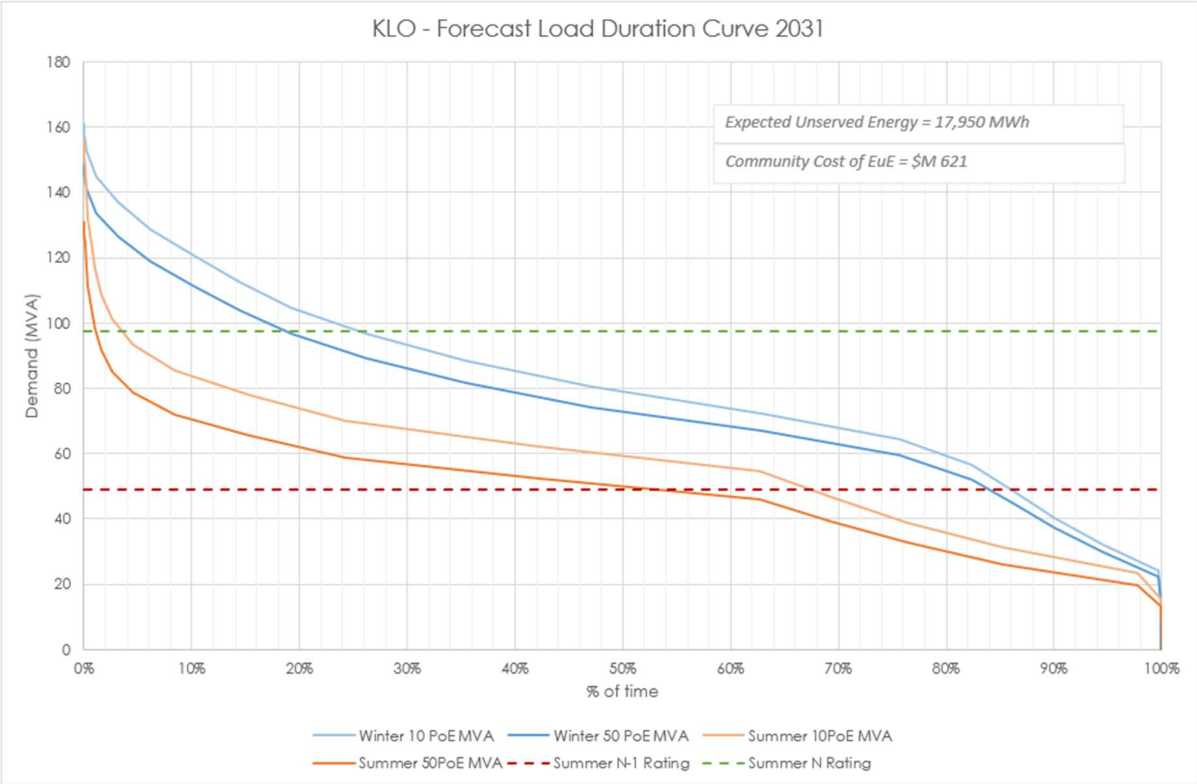
2.3. Load Duration Curves

Load Duration Curves (LDC) illustrate the relationship between forecast electrical load and network capacity in a particular year. The curve plots the load forecast for each hour of the year against percentage of time. The load values are plotted in the order of decreasing magnitude; this means that the highest load is at the left, lower loads are towards the right, and the lowest loads are at the extreme right. Any point on the load duration curve represents the total duration when load is expected to be greater than or equal to that load value. The area under the curve which is higher than the rating represents the expected unserved energy.

The load duration curves below have been derived using SCADA data from each of the substations and the demand forecasts developed by AusNet. Specifically, we used SCADA to derive the shape of the LDC and our own internal maximum demand forecasts to determine the scale of the curve.

Figure 4 shows the 10% PoE load duration curve and 50% PoE load duration curve forecasts for Kalkallo in 2031. The chart shows that the forecast demand at Kalkallo is expected to exceed the system normal (N) rating of the substation at the 10% PoE forecast for both summer and winter and at the 50% PoE forecast for winter, for more than 30% of the year. This means that the maximum demand will not be able to be supplied when all elements of the network are in service. This expected unserved energy is likely to continue to grow as the load increases over time. LDC curves for the other substations in the Wollert region are provided in Appendix C.

Figure 4 - Kalkallo 2031 Load Duration Curve



Source: AusNet forecasts June 2024

2.4. Value of the expected unserved energy

Under a Do-Nothing approach, the key cost to the community relates to the Value of Unserved Energy, where it is defined in section 5.4.6 of the Planning Guidelines as:

Value of Unserved Energy = VCR x EUE

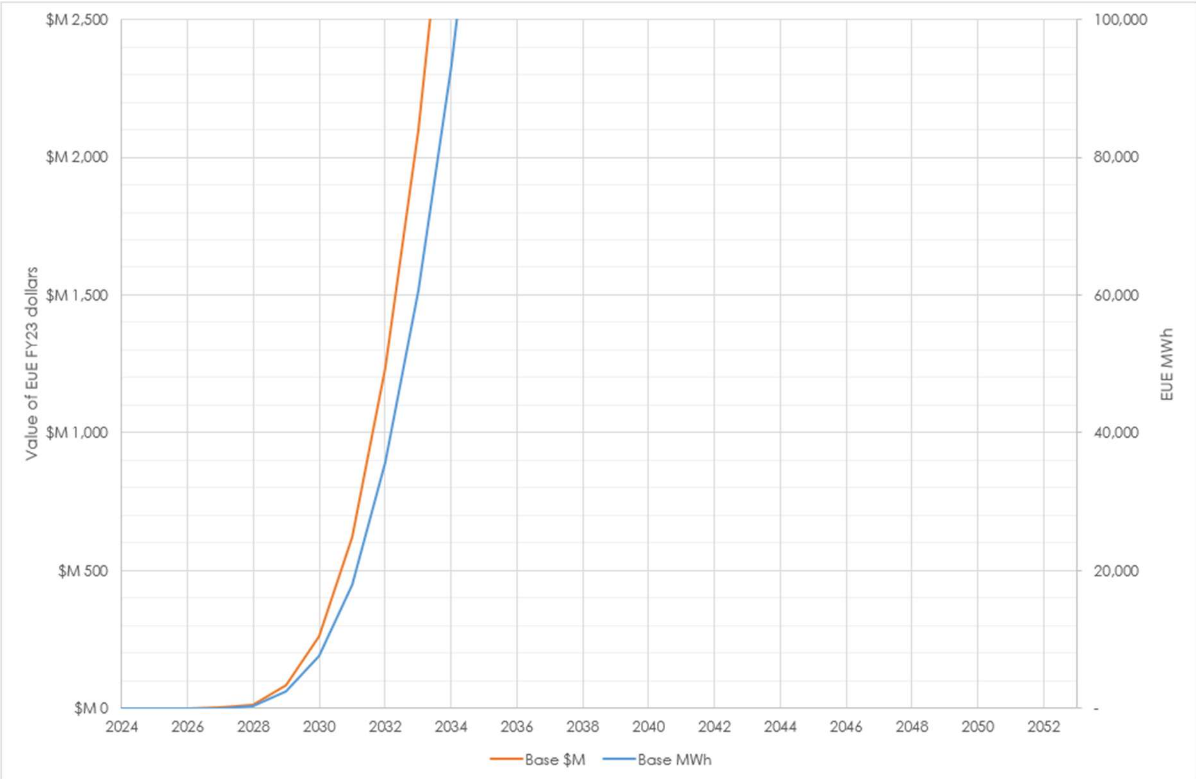
We have calculated the Expected Unserved Energy (EUE) by determining the amount of energy that would not be able to be supplied at the zone substations in the Wollert area. This accounts for breaches in both the N and N-1 ratings at the relevant zone substations.

We have calculated the expected unserved energy by using the load forecast at the substation and multiplying it by the load duration curve at the zone substation to determine the amount of time that the forecast load is above the rating of the transformers and load transfers, and the probability of a failure of a transformer.

We have calculated the value of unserved energy by applying a weighted average of the AER's Value of Customer Reliability (VCR). This is based on adopting the AER's 2023 VCRs for different customer groups and then weighting it by the mix of customers in the Wollert area.

Figure 5 shows the forecast value of unserved energy of outages in the distribution network in the Wollert area. From 2029 onwards, this cost is calculated as greater than $100m per annum; almost entirely underpinned by the expected unserved energy at Kalkallo. The chart's vertical axis is fixed to allow for comparison with other charts in this document.

Figure 5 – Value of Expected Unserved Energy



The inputs and assumptions that underpin the identified need for Wollert are shown in the table below.

Table 5: Key assumptions underpinning the Wollert model.

Parameter	Value	Source
Wollert Total Dwellings growth	9.8% pa average 2016-2036	Victoria in Future 2019[9].
WACC	5.56%	The average of 4.11% and AEMO's IASR central discount rate of 7%.
Value of Customer Reliability	Value as specified by the AER	AER 2023 Values of Customer Reliability Annual Adjustment
Power transformer failure rate	Various depending on the transformer age and condition	AusNet Asset Management Data
Weightings of the PoE curves	10% PoE - 0.3 50% PoE – 0.7 90% PoE – 0.0	Victorian Electricity Planning Approach[10]

[9] Analysis based on data downloaded from Victoria in Future website. Note that population figures are not directly part of the analysis documented here. Justifications for expenditure are rather based on forecasts derived by AusNet's load forecasting team.
[10] victorian-electricity-planning-approach.pdf (aemo.com.au)

3. Options assessed

This section outlines the credible options that have been considered to address the identified need at the Wollert area. The following options were considered in detail:

- **Do nothing (Base Case)** - This option has been used to demonstrate 'business as usual' which captures existing activities and EUE that would exist in the absence of making additional asset investments.
- **Build new Wollert Zone substation (Option 1)** - This option involves augmenting the network by installing a new 2x33MVA 66/22kV zone substation located close to existing dual circuit 66 kV lines on the eastern edge of the Wollert precinct. This option relieves the loading at surrounding zone substations by eliminating the energy at risk at Kalkallo substation and providing capacity in Wollert to address future development.
- **Install a third transformer at Kalkallo substation (Option 2)** - This option involves augmenting the capacity of the existing Kalkallo substation by adding a third 33MVA 66/22kV transformer and third 22kV bus section. This will provide an additional four 22kV feeders which would be extended into the Wollert area to support forecast development in that area. This option reduces the energy at risk at the Kalkallo substation and will relieve some future load growth from other zone substations surrounding the Wollert area.
- **Install Battery Energy Storage System (BESS) at Kalkallo substation (Option 3)** - This option involves adding a battery storage facility to the 22kV bus at the existing Kalkallo zone substation. This will reduce the energy at risk at the Kalkallo zone substation by reducing the peak demand supplied from the 3x33MVA 66/22kV transformers. This is done by charging the battery during lower loading periods and discharging the stored energy during peak loading periods to reduce transformer loading.

Given the significant and rapid load growth in the Wollert area, we did not consider demand side options as being feasible.

3.1. Assessment approach

We have assessed the Do-Nothing option against the three other network options as noted above, where we have quantified the costs and benefits of each option in comparison to the base case, to determine the option that will address the identified need at the highest NPV. We have estimated high level capital costs, and annual operating cost for each option.

The capital cost estimates for the three assessed options have been against recent AusNet cost estimates for similar proposed investments[11]. The capex development and implementation for all options is expected to take two years commencing in FY27 with completion by the end of FY28.

Operating costs per annum for the three assessed options have been calculated at 1.0% of the capital investment, consistent with the approach considered reasonable for other similar investment considerations by AusNet[12]. Our experience from high level values used by the industry is between 1% - 1.5% and we consider this value reasonable for our high-level assessment. Commencement of operating costs has been assumed to be after the completion of capex works.

We have also estimated the benefits for each option. Our approach follows the framework laid out by the AER in the RIT-D guidelines document[13], where the only material market benefit to be quantified in this business case relates to the reduction in the value of expected unserved energy. This involved:

- Determining the total EUE (MWh) and the value of the EUE under the base case.
- Calculating the total EUE that is forecast to remain following the investment under different options.
- Valuing the benefits for each option which is calculated as the difference between the base case EUE and the residual EUE multiplied by the Value of Customer Reliability (VCR).

Other market benefits including a reduction in electrical energy losses are considered immaterial and have not been included.

The assessment period is from FY27 to FY56 (inclusive). Our analysis is based on forecasts from FY24 till FY38 beyond which we have flatlined the forecasts.

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[11] DD-0011571 – CLN 3rd Transformer and Switch Room – Business Case, Ausnet Services Electricity (D) 2021-22 – Category Analysis – RIN Response
[12] DD-0011571 – CLN 3rd Transformer and Switch Room – Business Case
[13] Australian Energy Regulator. Application guidelines - Regulatory investment test for distribution. August 2022.

Both costs and benefits were estimated in FY24 dollars and any values from previous financial years were adjusted to FY24 dollars using Reserve Bank Consumer Price Index forecasts[14].

3.2. Base Case: Do-Nothing

The Do-Nothing option assumes that AusNet would not undertake any investment outside of the normal operation and maintenance process to manage the forecast demand on the Wollert network. While the cost of the Do-Nothing option is zero, the NPV value of expected unserved energy is $71,328 million aggregated over a 30-year period from 2023 to 2056.

The EuE and value of EuE over the assessed period is provided in the Figure 6 and shows an exponential increase after 2027 when the 50% PoE demand forecast at Kalkallo substation breaches the station's N rating.

Figure 6 – Base case expected unserved energy

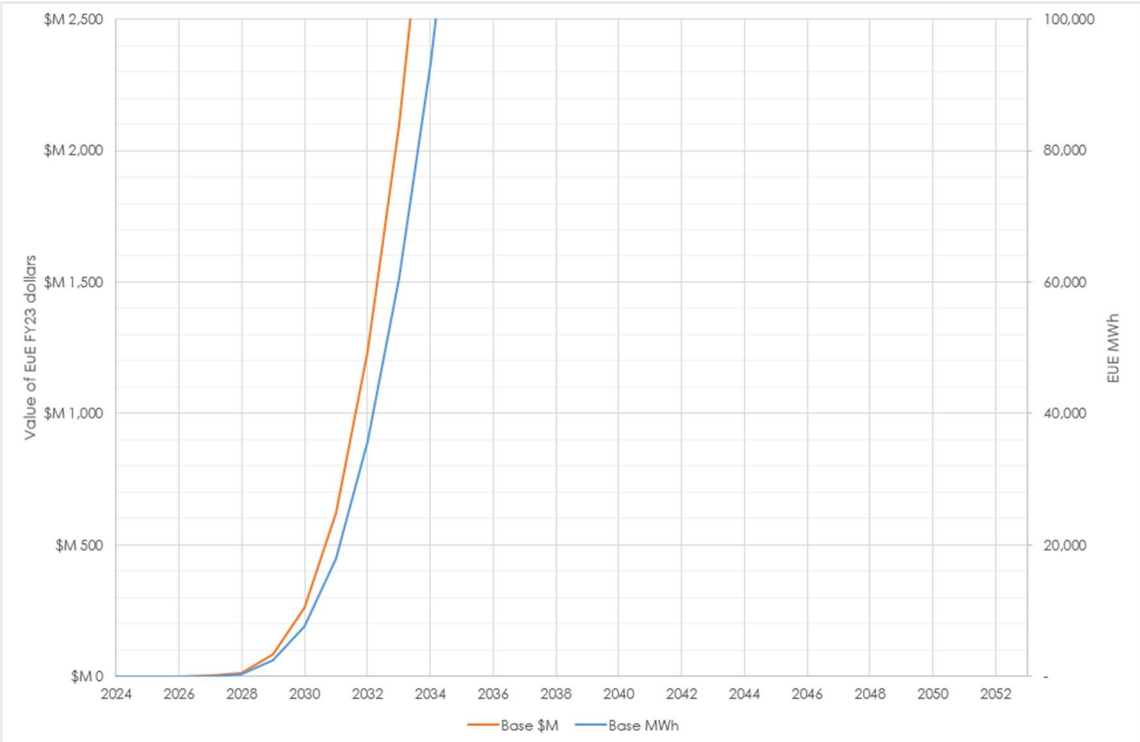


Table 6: Do-Nothing Summary ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Full assessment period FY27-56
Cost	-	-	-	-	-	-
Value of EuE ($M)	-0.7	-10.4	-73.3	-222.4	-501	**-71,328**
EuE [MWh]	21	317	2,359	7,556	17,969	**5,469,117**
NPV	**-71,328**					

Source: AusNet analysis

[14] Forecast table – May 2023 | RBA (14 July 2023)

3.3. Option 1 New Wollert zone substation

This option is to install a new 2 x 33 MVA 66/22 kV zone substation with eight 22 kV feeders exits, located close to the existing dual circuit 66 kV lines on the eastern edge of the Wollert precinct. The substation installed would be to AusNet's standard design with provision for a third transformer in the future. We expect commissioning of the substation can be completed by the end of FY28 based on an immediate start of the design and construct activities at the start of the upcoming regulatory period.

This proposed option addresses the identified need by ensuring that the growing load in the Wollert precinct is not connected to the existing surrounding substations, in particular Kalkallo. This option would allow the amount of expected energy at risk to be reduced significantly.

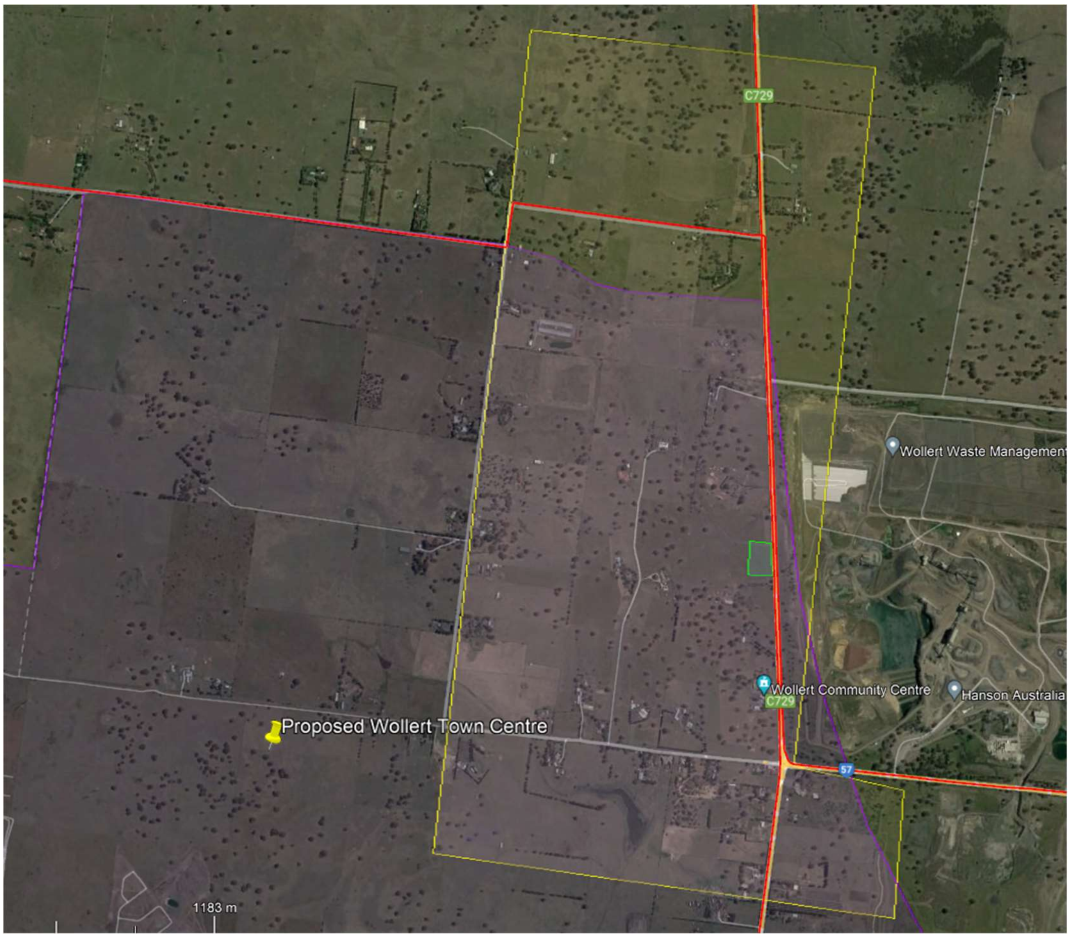
Figure 7 below shows a possible Wollert zone substation site of approximately 10,000 m^2 highlighted with a green outline. It is in a planned light industrial area on the eastern edge of the Wollert precinct and is adjacent to the existing dual circuit 66 kV lines, meaning the cost of connecting the proposed zone substation will be minimised. Further detailed site investigation will be required before an exact site is selected.

The expected scope of this option at a high level has been assumed to include:

Table 7 – Scope of capital work for Option 1 ($m, undiscounted, FY24 dollars)

Asset items	Estimated Cost
Design	C-I-C
Internal Labour	C-I-C
Materials (excludes 22KV Lines)	C-I-C
Plant and Equipment (excludes 22KV Lines)	C-I-C
Contracts (excludes 22KV Lines)	C-I-C
Risk allowance	C-I-C
Total capex	**40.4**

Figure 7 - Possible Wollert Zone Substation Site



Overall, this option will allow for the forecast demand at Wollert to be met and will reduce the cost of unserved energy by $67,290.3M (FY27-56) to the community relative to if nothing was done.

3.3.1. Cost

3.3.1.1. Capex

The following table provides the capital costs associated with this option. It assumes an immediate investment at the start of the upcoming regulatory period with practical completion by the end of FY28.

Table 8: Option 1, Capital Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Capex	24.2	15.3		-	-	**39.5**	**39.5**

Source: AusNet analysis

3.3.1.2. Opex

The following table provides the operating costs associated with this option. Operating costs are assumed to start at practical completion allowing for potential early expenditure associated with the connection of the new plant into the network.

Table 9: Option 1, Operating Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Opex	-	-	0.4	0.3	0.3	**1.0**	**4.7**

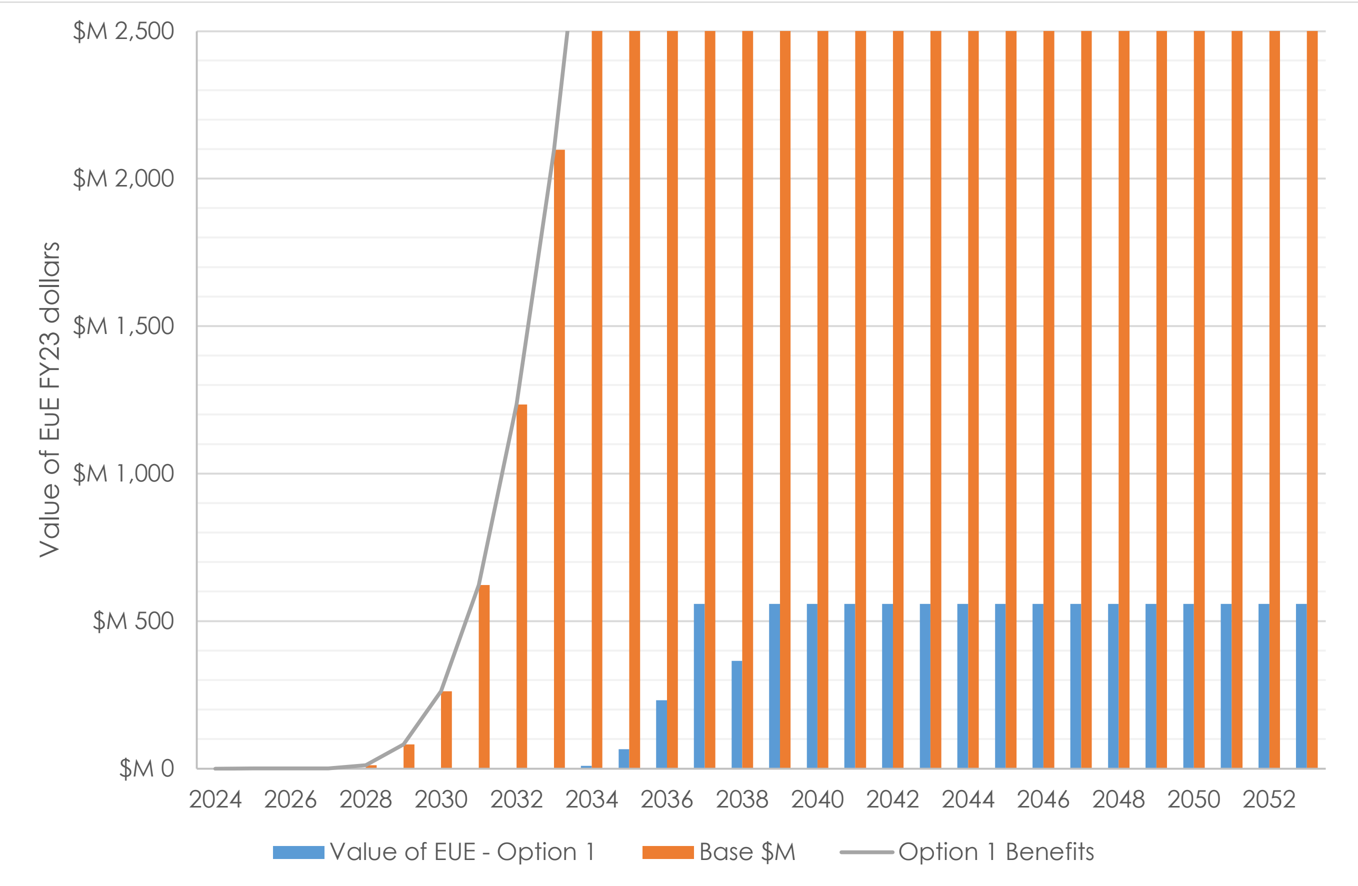
Source: AusNet analysis

3.3.2. Benefits

The installation of a new zone substation at Wollert will result in $67,290.3M of benefits[15] by meeting nearly all EuE. While the value may seem high, it is important to recognise the scale and frequency of the EuE. Under BAU, the existing substation will be progressively overloaded above N until it is almost continuous. The scale of the benefits demonstrate that a timely solution is warranted. The benefits of Option 1 compared with the base case costs and remaining value of EUE is provided below.

Note: Whilst this option addresses all the EuE at Kalkallo substation, some EuE remains at the Epping substation. The value of the remaining EuE is immaterial and is expected to be addressed through the reconfiguration of the medium voltage networks and transfer of loads following the establishment of the new Wollert substation. Investigation of options to address the remaining EuE will be the subject of a separate assessment and business case.

Figure 8 - Change in EUE outcome - Option 1



3.3.3. NPV analysis

This section summarises the costs and benefits of implementing this option with all prices in FY24 dollars using our approach for NPV which is described in Section 3.1. Costs remain stable on a real, undiscounted basis, with avoided EUE increasing almost exponentially from 2029. Benefits from the investment accrue from the first year of expected operation of the new Wollert substation as shown in Table 10.

[15] Benefits are discounted and approach is described in Section 3.1

Table 10: Option 1, New Wollert Substation - Summary ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Cost ($M)	24.2	15.3	0.4	0.3	0.3	40.5	**44.2**
Avoided EUE relative to Do-Nothing ($M)	0.7	10.4	73.3	222.4	501.0	807.9	**$67,290**
NPV ($M)	**$67,246**						

Source: AusNet analysis

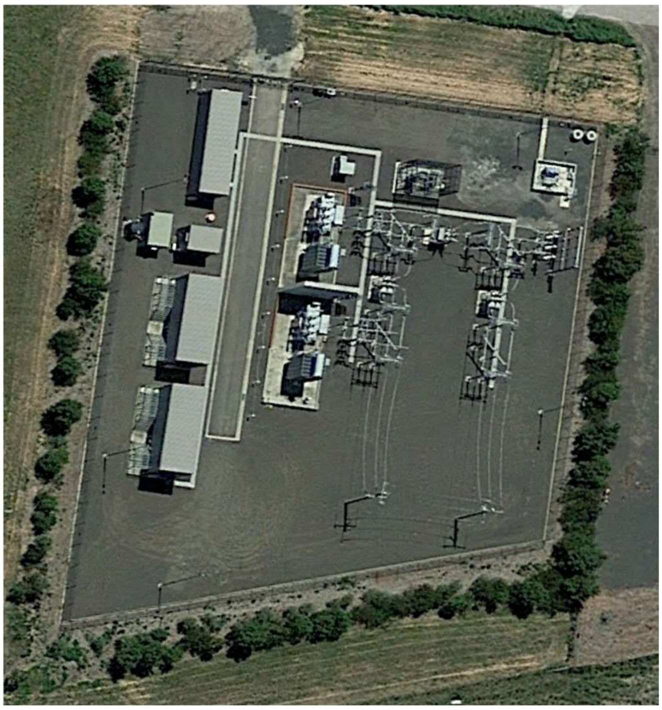
3.4. Option 2 Install third transformer and bus section at Kalkallo Zone substation

This option involves installing a third 66/22kV 33 MVA Transformer at Kalkallo.

This option addresses the need by expanding the existing Kalkallo zone substation to its full capacity by adding a third 33 MVA 66/22 kV transformer and switchroom. Figure 9 shows a satellite view of Kalkallo zone substation with the available space for a third transformer. Four new 22kV feeders from the new bus section will be utilised to provide supply to the Wollert precinct.

The additional 22kV feeders are needed in this option as the Kalkallo substation is located approximately 8 km from the Wollert precinct. This is significantly longer than the average feeder length which will be required from the Wollert substation proposed in Option 1.

Figure 9 - Kalkallo Zone substation site



The expected scope of this option at a high level has been assumed to be:

Table 11 – Scope of capital work for Option 2 ($m, undiscounted, FY24 dollars)

Asset items	Estimated Cost
Design	C-I-C
Internal Labour	C-I-C
Materials (excludes 22KV Lines)	C-I-C
Plant and Equipment (excludes 22KV Lines)	C-I-C
22KV Lines inc materials & plants	C-I-C
Contracts (excludes 22KV Lines)	C-I-C
Risk allowance	C-I-C
Total capex	**48**

3.4.1. Cost

3.4.1.1. Capex

The following table provides the capital costs associated with this option. It assumes an immediate investment at the start of the upcoming regulatory period with practical completion by the end of FY28 to offset the expected unserved energy.

Table 12: Option 2, Capital Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Capex	28.8	18.2	-	-	-	47.0	**47.0**

Source: AusNet analysis

3.4.1.2. Opex

The following table provides the operating costs associated with this option. Operating costs are assumed to start at practical completion allowing for potential early expenditure associated with the connection of the new plant into the network.

Table 13: Option 2, Operating Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Opex	-	-	0.0	0.4	0.4	1.2	**6.4**

Source: AusNet analysis

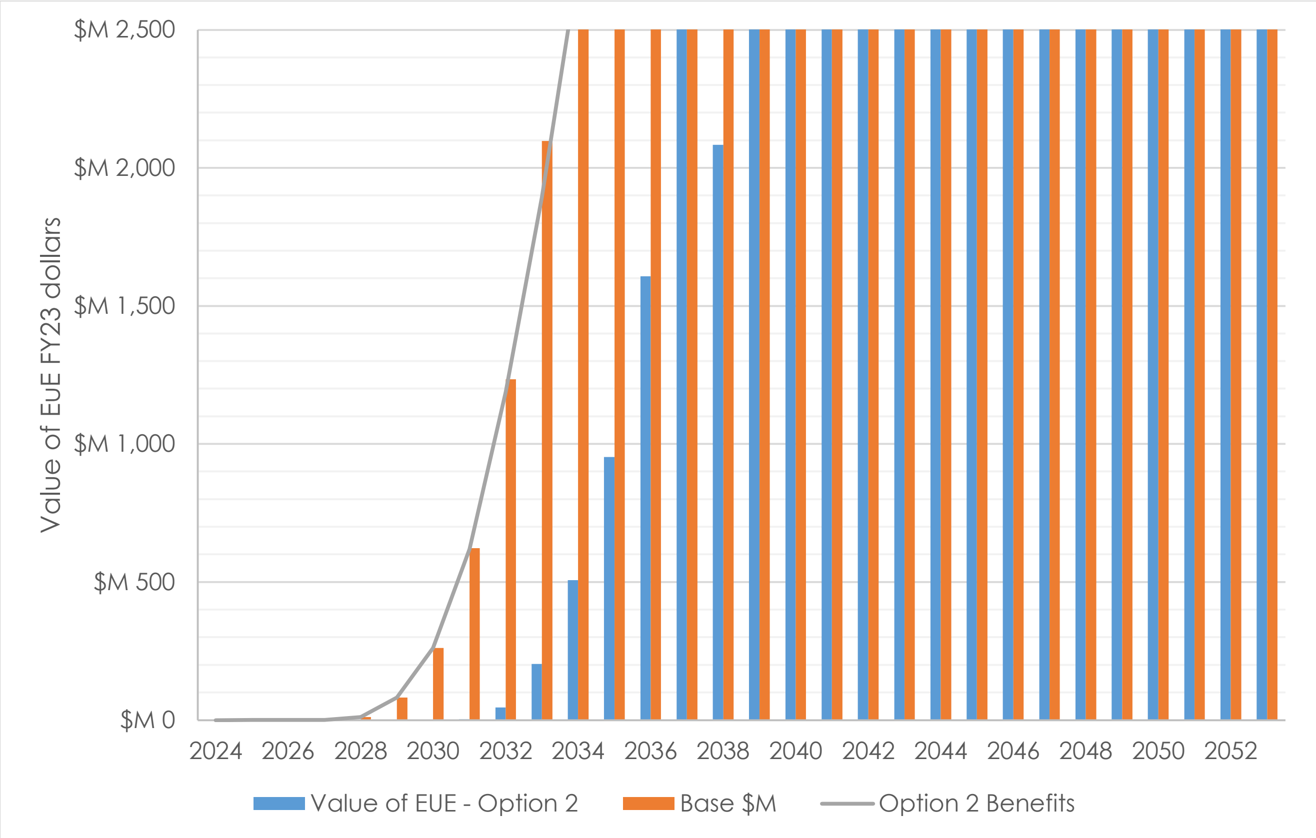
3.4.2. Benefits

The installation of a third transformer at KLO is projected to result in $51,221.7m of benefits[16] from a significant reduction of community cost of expected unserved energy. The benefits of Option 2 compared with the base case costs and remaining value of EUE are graphically represented in Figure 10.

The benefits increase exponentially from 2029 and seems high. However, it is important to recognise the scale and frequency of the EUE. Under BAU the existing substation will be progressively overloaded above N until it is almost continuous. The scale of the benefits demonstrate that a timely solution is warranted.

[16] Benefits are discounted and approach is described in Section 3.1

Figure 10 - Change in EUE outcome - Option 2



3.4.3. NPV analysis

This section summarises the costs and benefits of implementing this option with all prices in FY24 dollars using our approach for NPV assessment which is described in Section 3.1. Costs remain stable on a real, undiscounted basis, with avoided EUE increasing almost exponentially from 2029.

The NPV is smaller compared to option 1 as there is considerable value of EUE remaining due to the capacity limitations associated with installing a third transformer at Kalkallo.

Similar to option 1 benefits from the investment accrue from the first year of expected operation of the third transformer at KLO as shown in Table 11.

Table 14: Option 2, Third transformer at KLO - Summary ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-36
Cost ($M)	28.8	18.2	0.4	0.4	0.4	48.2	53.3
Avoided EUE relative to Do-Nothing ($M)	0.7	10.4	73.3	222.2	498.4	805.0	51,221.7
NPV ($M)	51,168.4						

Source: AusNet analysis

3.5. Option 3 BESS at KLO

This option involves installing a 22 kV connected 10 MW, 40 MWh Battery Energy Storage System (BESS) at Kalkallo.

This option addresses the need by reducing the peak demand at the Kalkallo Zone substation through storing energy during lightly loaded periods and releasing it during peak demand periods so that the peak demands are not supplied from the existing 66/22kV transformers. In doing so this reduces the expected energy at risk by decreasing the peak demand. This option would require the existing Kalkallo zone substation site to be expanded to accommodate the construction of a suitable battery.

The expected scope of this option at a high level have been noted in Table 15.

Table 15 – Scope of capital work for Option 3 ($m, undiscounted, FY24 dollars)

Asset items	Estimated Cost
1 MW/ 4 MWh Battery connected at 22kV	C-I-C
BESS connection costs $M/MW	C-I-C
Regional adjustment factor (Vic Med)	C-I-C
Total capex	**25.45**

3.5.1. Cost

3.5.1.1. Capex

The following table provides the capital costs associated with this option. It assumes an immediate investment at the start of the upcoming regulatory period with practical completion by the end of FY28.

Table 16: Option 3, Capital Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Capex	15.0	9.5	0.0	0.0	0.0	**24.5**	**32.3**

Source: AusNet analysis

3.5.1.2. Opex

The following table provides the operational costs associated with this option. Operational Cost assumptions were taken from AEMO's 2023 Inputs and Assumptions Workbook. In this case, there is only a fixed operating cost assumption provided as 17.84 $/kW/y expressed in FY24 dollars.

Operating cost shown below are based on plant site operations and maintenance and does not include economic consideration of charging and discharging the battery including battery losses. As a general observation, given that the battery is discharging during periods of high system load, the net economic impact of the trading is unlikely to be negative.

Table 17: Option 3, Operational Costs ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Opex	0.0	0.0	0.4	0.4	0.4	1.2	**6.5**

Source: AusNet analysis

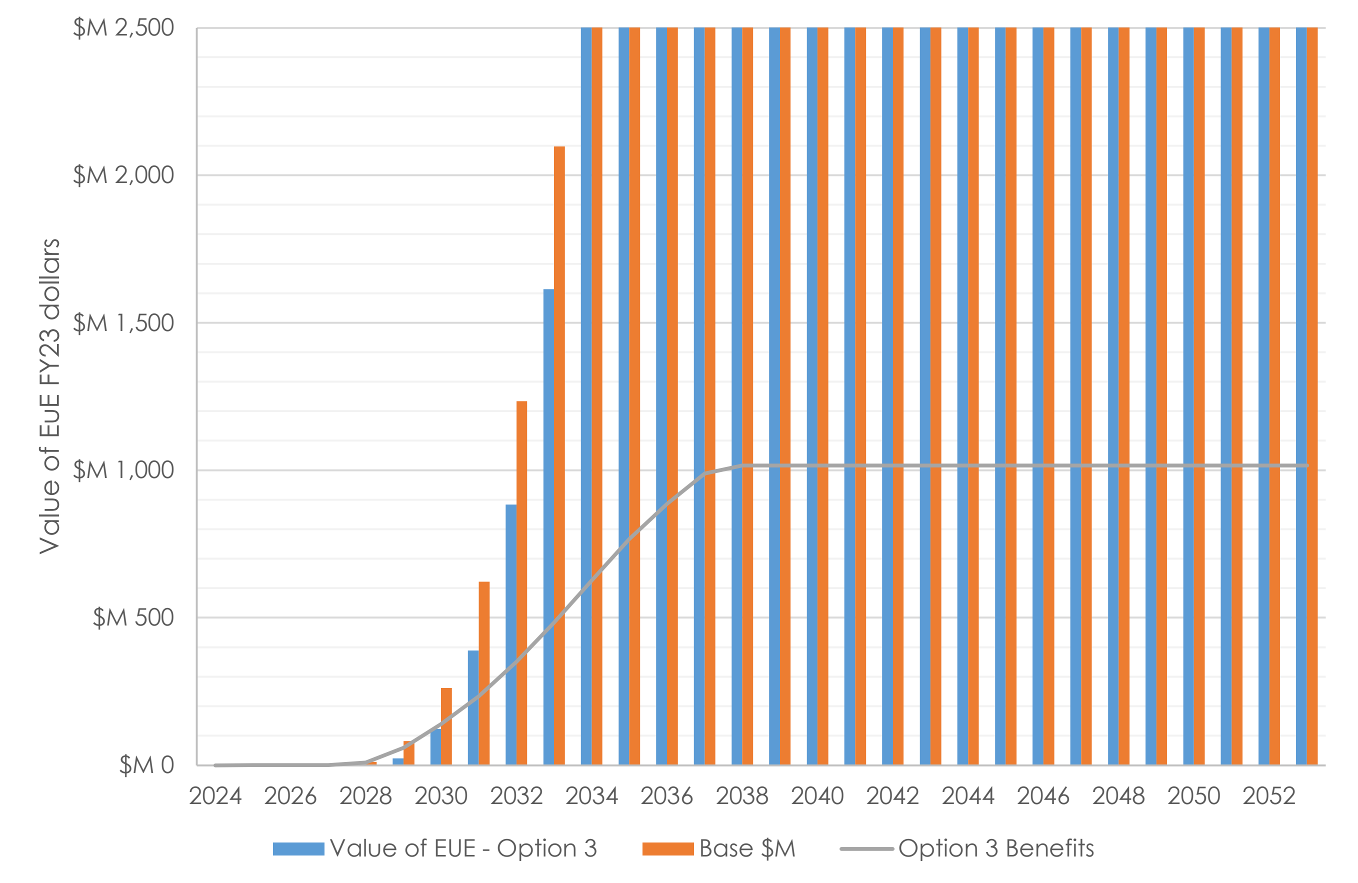
3.5.2. Benefits

The installation of a new battery at Wollert will result in **11,056.1M** of benefits[17] by meeting nearly all EUE until 2028. After that date, capacity constraints emerge for the battery.

While the value may seem high, it is important to recognise the scale and frequency of the EUE. Under BAU the existing substation will be progressively overloaded above N until it is almost continuous. A BESS curtails almost all EUE until 2032 when the unserved demand increases beyond the capacity of the BESS at higher rates each year which is represented by the blue bars in Figure 11 below.

[17] Benefits are discounted and approach is described in Section 3.1

Figure 11 - Change in EUE outcome - Option 3



3.5.3. NPV analysis

This section summarises the costs and benefits of implementing this option with all prices in FY24 dollars using our approach for NPV as described in Section 3.1. Costs remain stable on a real, undiscounted basis and contribute only a small part to the NPV with avoided EUE increasing linearly from 2029.

Similar to option 1 and option 2 benefits from the investment accrue from the first year of expected operation of the BESS at KLO as shown in Table 18. However, the present value is smaller compared to option 1 and 2 as there is considerable value of EUE remaining due to land constraints limiting the size of the battery that can be installed.

Table 18: Option 3, BESS at KLO - Summary ($m, discounted, FY24 dollars)

	FY27	FY28	FY29	FY30	FY31	Total FY27-31	Full assessment period FY27-56
Cost ($M)	15.0	9.5	0.4	0.4	0.4	**25.7**	27.8
Avoided EUE relative to Do-Nothing ($M)	0.4	8.9	53.1	118.3	188.2	**368.9**	**11,056.1**
NPV ($M)	**11,017.3**						

Source: AusNet analysis

4. Preferred option and sensitivity testing

4.1. NPV comparison

Option 1 has the highest NPV and is the preferred option due to meeting more of the value of EUE and with costs being a lower proportion of benefits (see Table 19).

Table 19 - NPV comparisons

	NPV ($M)	Rank
Base case	-71,328.0	4
Option 1	67,290.3	1
Option 2	51,168.4	2
Option 3	11,017.3	3

4.2. Sensitivity analysis

Table 20 presents the NPV (Real $2024) under a variety of sensitivities. The net economic benefit assessment takes account of each option's total capital, operating and maintenance costs, compared to the reduction in service level risk cost that option is expected to deliver.

The robustness of the economic assessment is tested for the following sensitivities:

- Asset failure rates, varied at ±50% of the base failure rates;
- Maximum demand forecasts, varied to ±5% of the base forecast;
- Community cost of EUE, varied to $53.42/kWh for residential, and keeping the same AER VCR values for the remaining customer types and $53.42/kWh for residential and $32.10/kWh for commercial, industrial and agricultural
- Proposed option costs, varied to ±15% of the base option costs;
- Real discount rate of 5.56%, varied to 7.00% and 4.11% per annum;

The preferred option under each sensitivity is highlighted, and the option that maximises net benefits under majority of sensitivities is considered the preferred option.

The sensitivity analysis indicates the preferred option is Option 1, as it has the highest net benefit under all sensitivities tested.

Table 20: NPV under sensitivity testing

Scenario	Option 1 ($M)	Option 2 ($M)	Option 3 ($M)
Base Case	$ 67,246	$ 51,168	$ 11,017
High Asset Failure Rate	$ 67,364	$ 51,251	$ 11,047
Low Asset Failure Rate	$ 67,141	$ 51,095	$ 10,992
High Demand	$ 89,335	$ 65,751	$ 13,928
Low Demand	$ 46,753	$ 36,802	$ 7,999
VCR Option 2	$ 103,338	$ 78,632	$ 16,940

Scenario	Option 1 ($M)	Option 2 ($M)	Option 3 ($M)
VCR Option 3	$ 89,535	$ 68,122	$ 14,669
High Option Cost	$ 67,235	$ 51,155	$ 11,008
Low Option Cost	$ 67,257	$ 51,182	$ 11,027
High Discount Rate	$ 54,476	$ 41,577	$ 8,545
Low Discount Rate	$ 84,044	$ 63,771	$ 14,504

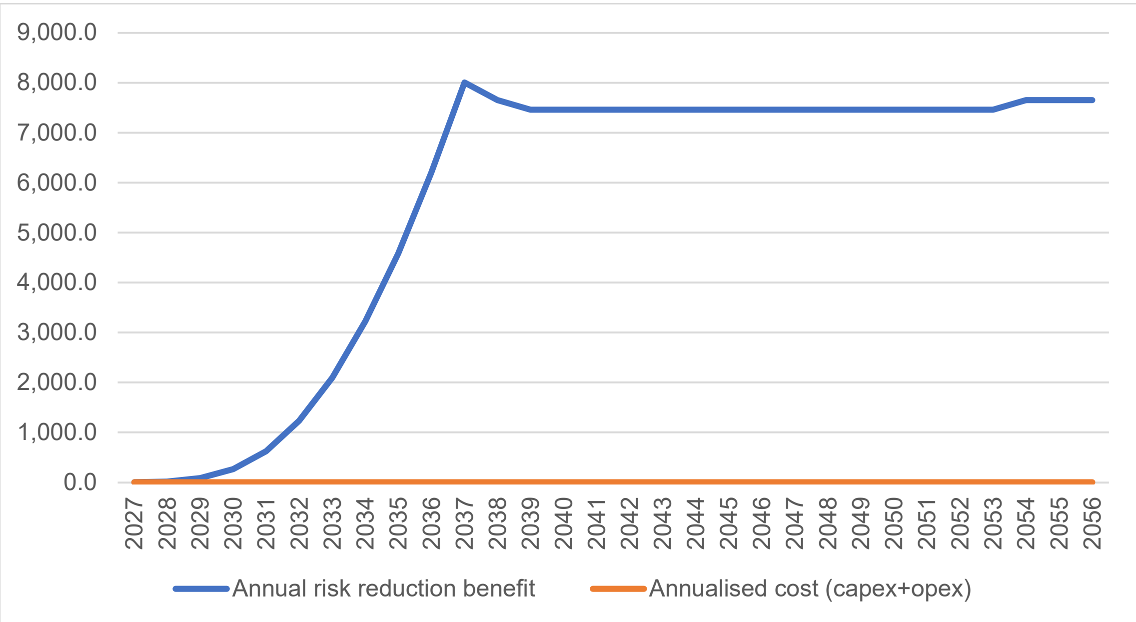
4.3. Optimal economic timing of the preferred option

The optimal economic timing of the preferred option is the point in time when the annual risk reduction benefit exceeds the annualised cost to implement the option, specifically:

- The **annual risk reduction benefit** of implementing the preferred option compared to the Do-Nothing scenario is the difference between the Do-Nothing risk costs for that year minus the preferred option residual risk costs for that year. Also known as the benefits and described further in section 3.1.
- The **annualised cost** is the preferred option's capex and opex converted into equivalent annual payments over the life of the asset at a specified discount rate.

The point in time in which the annualised risk reduction benefit exceeds the annualised cost is FY29 as presented in Figure 12.

Figure 12 Optimal timing analysis



5. Conclusion

5.1.1. Recommendation

The need for augmentation in the Wollert Area as described in section 2 is material, driven by the high projected growth rates in the area it is expected that most augmentations will show a significant benefit in reduced community cost of expected unserved energy.

This report outlined options to address this need and based on the analysis presented in section 3 and 4, the preferred option is Option 1, a new zone substation at Wollert. The addition of a 3rd transformer at Kalkallo has smaller NPV results in the analysis due to the third transformer providing the additional capacity of only one transformer, while the proposed new substation will include two transformers.

The battery option has some compelling aspects as a short-term solution and may have flexibility to provide services not considered in this analysis. However, it too has only a short-term impact in meeting the energy demand requirements of such a rapidly growing area.

From these considerations, in addition to the best NPV performance in our analysis, Option 1, a new zone substation at Wollert is the preferred option. Developing a new substation in this area has the following advantages:

- It is the correct strategic decision because in the long term, a new substation will be required in the area to supply the increasing loads.
- It will allow a suitable substation site to be obtained prior to development of the Wollert area.

5.1.2. Next Steps

This business case outlines the need for mitigating expected unserved energy in the Wollert Area during the 2026-31 regulatory period, the proposed investment is subject to the regulatory investment test for distribution (RIT-D).

As such, the proposed investment will be confirmed via the formal RIT-D process which includes a formal consultation process where interested parties can make submissions that help identify the optimal solution.

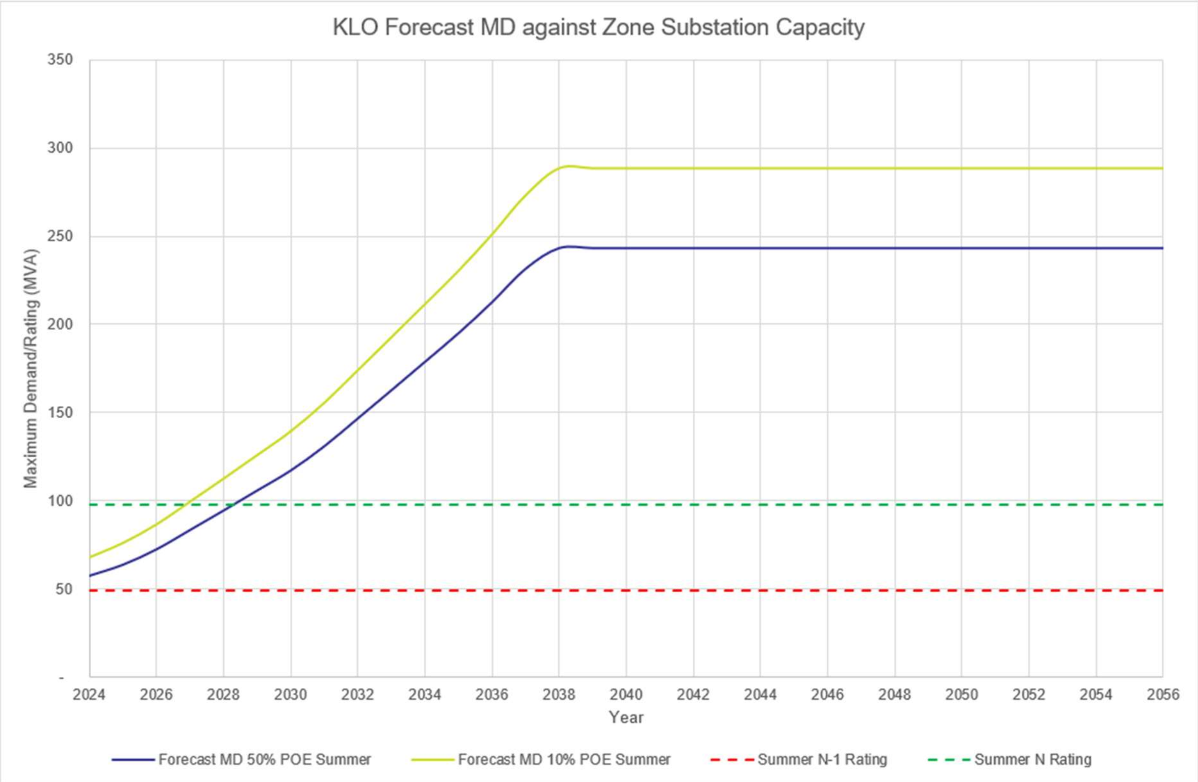
AusNet Services intends to commence the RIT-D process in 2025.

A. Appendix A

A.1. Maximum demand

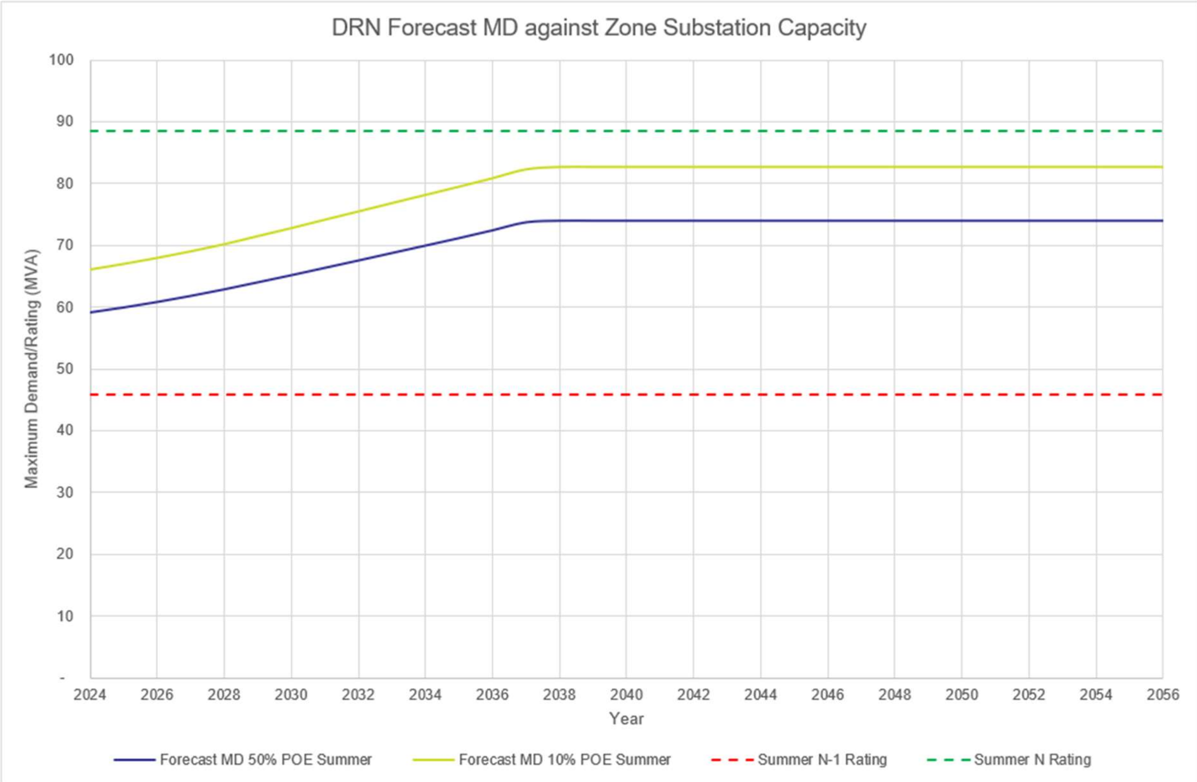
The following charts provides the maximum demand at the Wollert substations.

Figure 13 – Kalkallo Zone Substation Forecast Maximum Demand



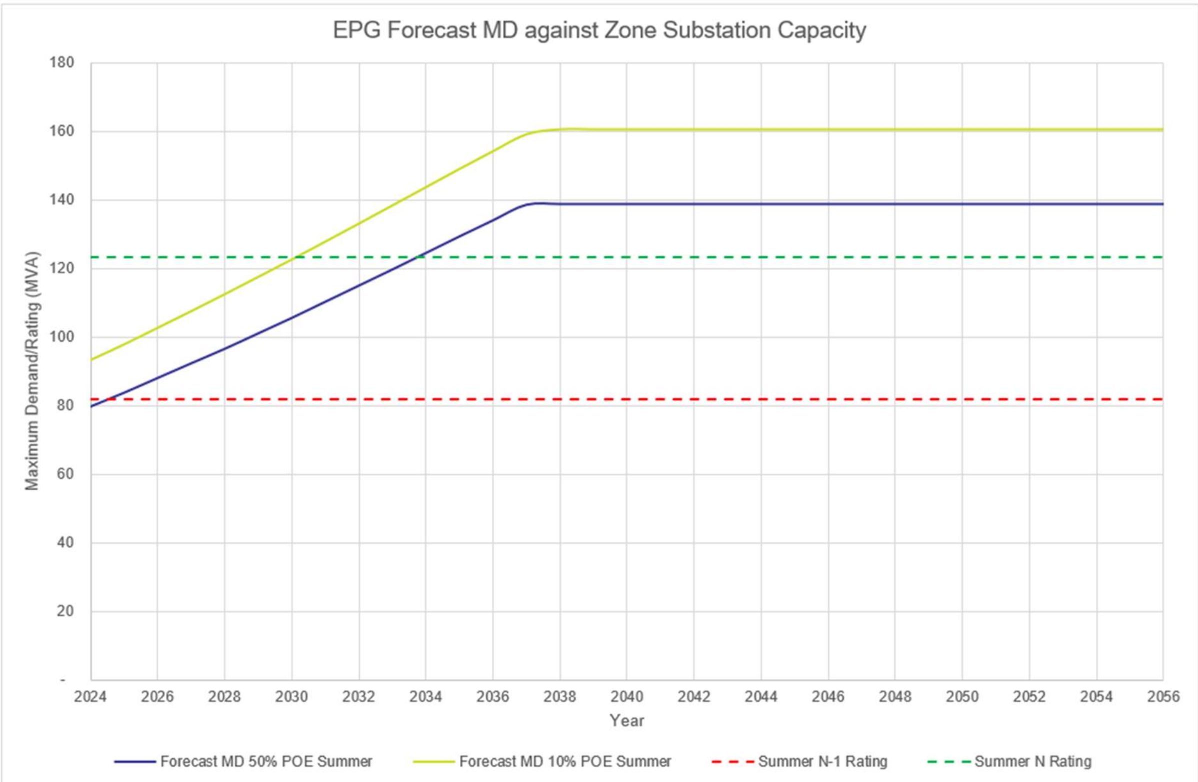
Source: AusNet Forecasts 2024

Figure 14 – Doreen Zone Substation Forecast Maximum Demand



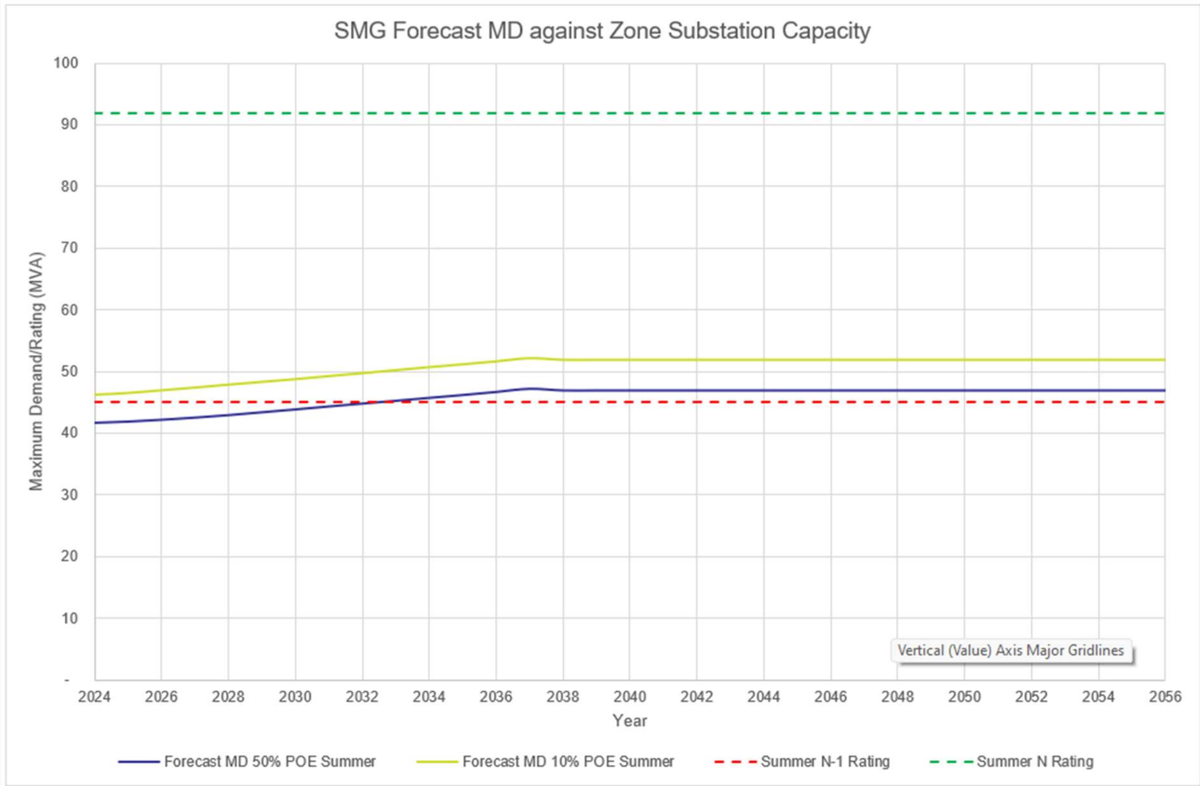
Source: AusNet Forecasts 2024

Figure 15 – Epping Zone Substation Forecast Maximum Demand



Source: AusNet Forecasts 2024

Figure 16 – South Morang Zone Substation Forecast Maximum Demand



Source: AusNet Forecasts 2024

B. Appendix B

This appendix provides the feeder load growth for the Doreen, Epping, Kalkallo and South Morang substations in the Wollert region.

Table 21 shows that forecast demand is expected to be exceeded by 2031:

- Kalkallo – 2 of 4 feeders will be overloaded.
- Doreen – 1 of 8 feeders will be overloaded.
- Epping – 5 of 13 feeders will be overloaded.
- South Morang – no feeders will be overloaded.

Feeder ratings were sourced from AusNet RIN Sub-Transmission and Feeder Ratings for 2022 and load forecasts were sourced from the EDPR forecasts.

Table 21: Feeder demand at Doreen (DRN), Epping (EPG), Kalkallo (KLO) and South Morang (SMG) substations

		FORECAST LOAD (MVA)					
Feeder ID	**Rating (MVA)**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
KLO11	14.56	0.9	1.0	1.1	1.2	1.3	1.3
KLO12	13.72	4.3	4.3	5.2	5.2	5.2	6.1
KLO14	13.72	25.8	29.4	33.0	36.5	40.1	43.7
KLO24	13.72	21.6	23.7	25.8	28.0	30.1	32.3
DRN11	12.42	11.3	11.5	11.7	11.9	12.2	12.4
DRN12	12.99	11.4	11.6	11.7	11.9	12.1	12.3
DRN13	13.15	7.9	8.0	8.1	8.3	8.4	8.5
DRN14	13.15	12.3	12.4	12.5	12.6	12.8	12.9
DRN21	12.00	7.8	8.1	8.5	8.8	9.2	9.5
DRN22	12.38	8.8	9.0	9.3	9.5	9.8	10.0
DRN23	13.72	9.0	9.1	9.2	9.2	9.3	9.4
DRN24	12.38	7.9	7.9	8.0	8.1	8.2	8.3
EPG11	13.34	3.0	3.0	3.1	3.1	3.1	3.1
EPG12	12.96	13.2	13.8	14.4	15.1	15.8	16.5
EPG13	13.91	20.5	22.0	23.6	25.2	26.8	28.4
EPG14	13.03	4.7	4.7	4.8	4.8	4.8	4.8
EPG21	14.75	8.7	9.6	10.5	11.4	12.3	13.0
EPG22	11.43	7.1	7.2	7.3	7.3	7.3	7.4
EPG23	13.72	9.9	10.3	10.7	11.1	11.5	11.9
EPG24	16.84	9.9	9.9	9.9	9.9	9.9	9.9
EPG31	9.53	6.9	7.0	7.1	7.2	7.3	7.4
EPG32	10.86	11.8	12.6	13.3	14.1	14.8	15.4
EPG33	14.75	18.5	20.5	22.5	24.4	26.3	28.2
EPG34	21.72	7.3	7.3	7.4	7.5	7.6	7.7
EPG35	12.00	18.8	21.5	23.6	25.7	27.7	29.5

	FORECAST LOAD (MVA)						
SMG21	12.00	9.1	9.2	9.3	9.4	9.6	9.7
SMG22	13.53	7.4	7.4	7.5	7.5	7.6	7.7
SMG23	12.00	8.7	8.8	8.9	9.0	9.2	9.3
SMG31	12.00	9.2	9.3	9.3	9.4	9.5	9.5
SMG32	13.72	5.1	5.2	5.2	5.3	5.3	5.3
SMG33	12.00	5.1	5.1	5.2	5.2	5.3	5.3
SMG34	13.72	7.6	7.6	7.6	7.6	7.6	7.6

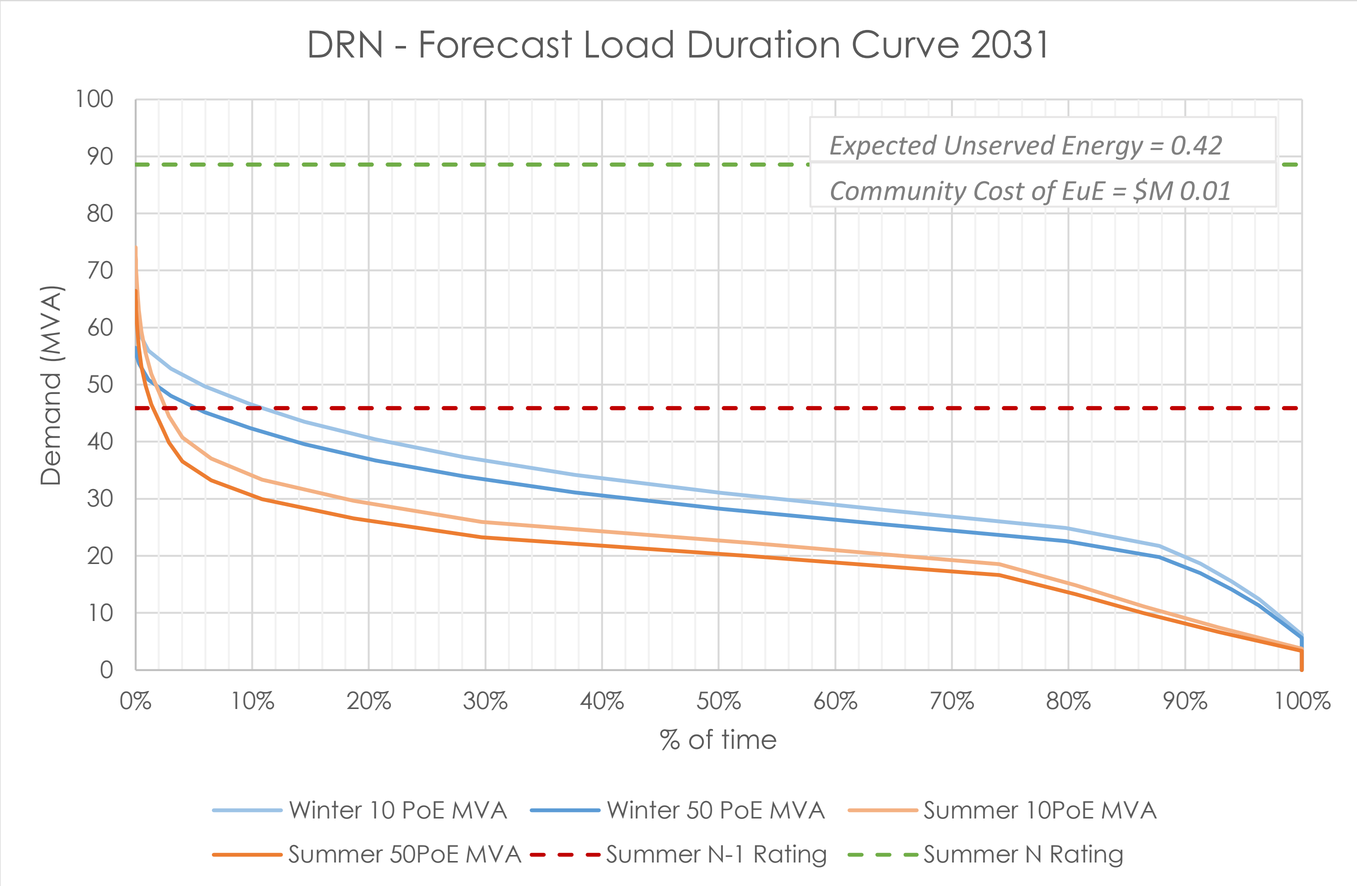
Source: AusNet Forecasts 2023

C. Appendix C

This appendix provides the LDC curves for the Doreen, Epping and South Morang substations in the Wollert region.

The chart in Figure 17 below shows that the forecast demand at Doreen is expected to be higher than the N-1 rating of the substation for the 50% PoE forecast for approximately 2% of the summer and approximately 6% of the winter in 2031. Higher percentages apply for the 10% PoE forecasts. The expected unserved energy grows as the load increases over time.

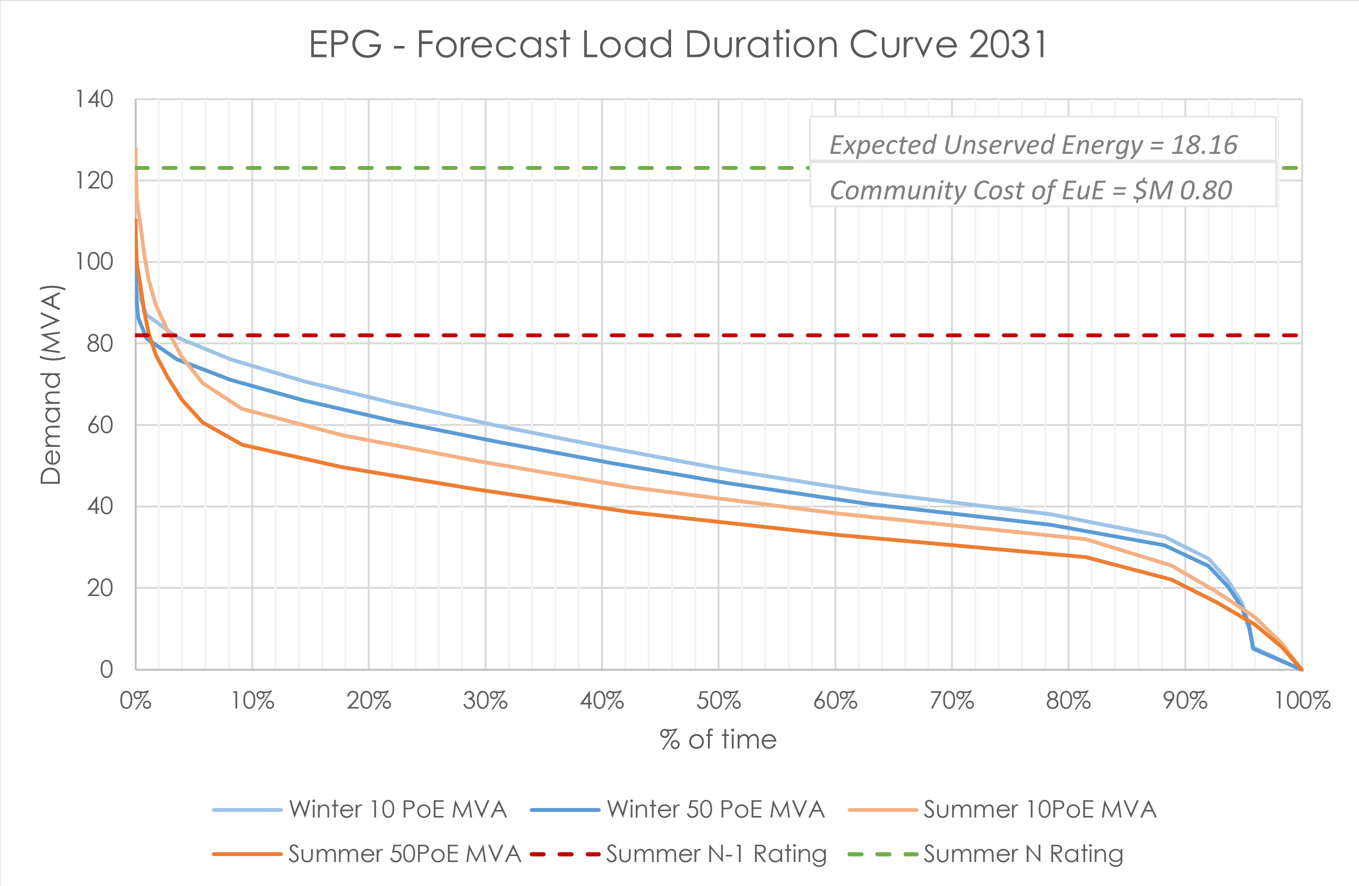
Figure 17 - Doreen 2031 Load Duration Curve



Source: AusNet forecasts 2024

The chart in Figure 18 below shows that the demand at Epping in 2031 is forecast to be higher than the N-1 rating of the substation for the 50% PoE forecast for approximately 2% of the year and a higher percentage for the 10% PoE forecasts. The expected unserved energy grows as the load increases over time.

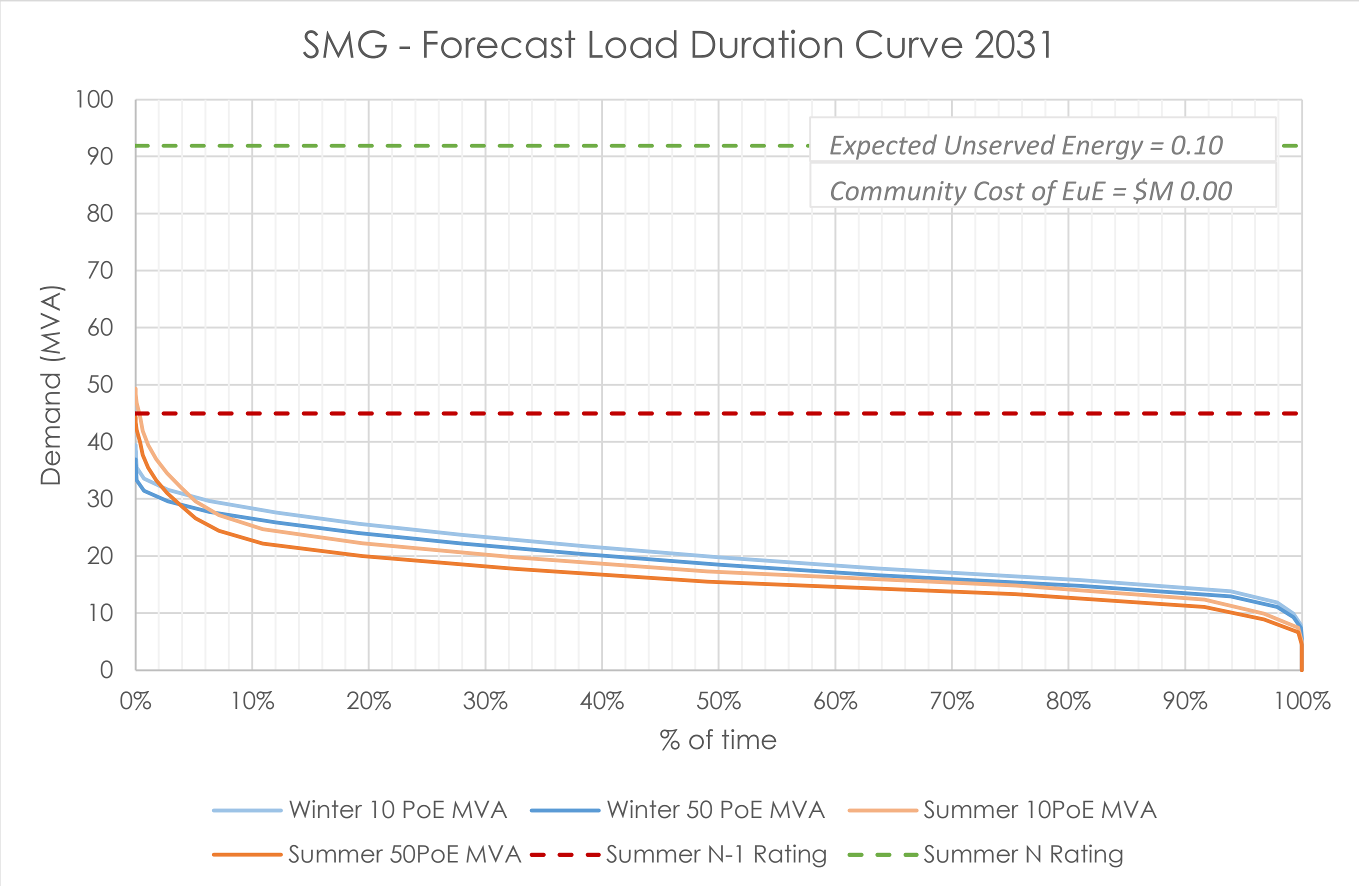
Figure 18 - Epping 2031 Load Duration Curve



Source: AusNet Forecasts 2024

The chart in Figure 19 below shows that the expected demand at South Morang is forecast to exceed the N-1 rating of the substation in 2031 for less than 1 % of the time.

Figure 19 - South Morang 2031 Load Duration Curve



Source: AusNet Forecasts 2024

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