AUGMENTATION

GREATER WESTERN MELBOURNE SUPPLY AREA

PAL BUS 3.07 – PUBLIC

2026–31 REGULATORY PROPOSAL

Table of contents

1. Overview

Melbourne's western growth corridor, including the local government areas of Melton and Wyndham is the fastest growing area across greater Melbourne. Five of the ten highest growth statistical areas in Australia are in the Melton and Wyndham local government areas, largely driven by significant net internal migration from other suburbs of greater Melbourne.

Population and economic growth is resulting in demand forecasts that exceed the rated capacity of our existing zone substations. Given the greenfield nature of the expansion with limited transfer options and the ability for assets to supply broad areas, we have assessed sites that supply the western growth corridor collectively.

Broadly, there are four augmentation options we have considered that would improve capacity in the western Melbourne growth corridor at the lowest cost per capacity added. These include:

- installing a third transformer at Mount Cottrell (MTC)
- re-building our Bacchus Marsh zone substation (BMH)
- building a new zone substation at Rockbank East (RBE)
- building a new zone substation at Point Cook (PCK), with either one or two transformers.

We also considered non-network alternatives, and will continue to do so when undertaking a regulatory investment test for distribution (RIT-D).

The preferred combination of augmentation solutions is outlined in table 1.

These investments will likely be required by the early 2030s to avoid capacity shortfalls that would impact reliability of supply for customers. However, consistent with feedback from stakeholders and to minimise short-term forecasting risk for customers, we are proposing to treat the new PCK zone substation as a contingent project in the 2026–31 regulatory period.

TABLE 1 EXPENDITURE FORECASTS FOR PREFERRED OPTION ($M 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
BMH re-build	15.1	15.1	-	-	-	30.2
New RBE zone substation	-	-	8.5	19.5	15.3	43.4
New PCK zone substation	-	-	-	6.0	26.9	32.9
Total: option	**31.0**	**15.1**	**8.5**	**25.6**	**42.2**	**122.3**
Total: proposed(1)	**31.0**	**15.1**	**8.5**	**19.5**	**15.3**	**89.4**

Note: (1) As our new PCK zone substation is being proposed as a contingent project, these costs have not been included in our regulatory proposal forecasts. They are included in the table above, and in the underlying options analysis, for completeness.

2. Background

The local government areas (LGAs) of Melton and Wyndham are located approximately 20 km west of Melbourne's central business district (CBD), on an existing rural-urban fringe. The LGAs cover a combined area of 1,070 km^2, extending as far as 50 km from the Melbourne city. We refer to these areas as the greater western Melbourne supply area.

2.1 Existing sub-transmission network

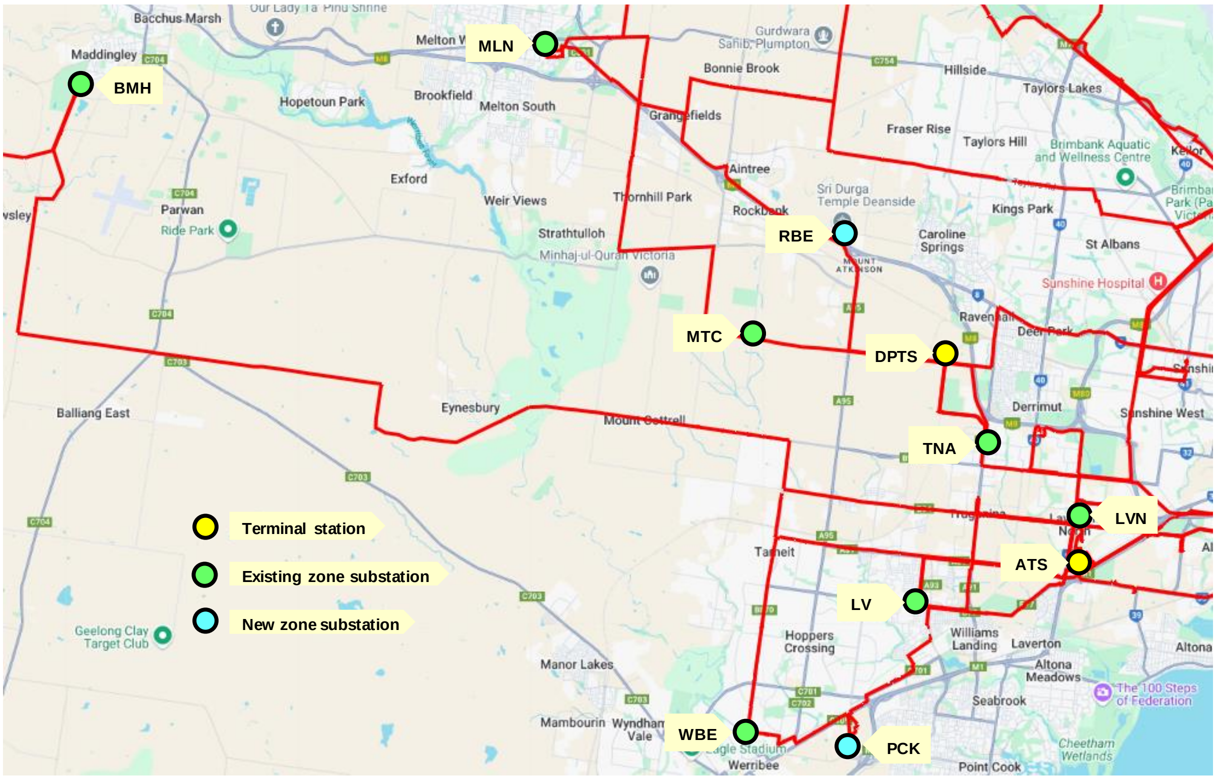
The greater western Melbourne supply area is serviced by two existing transmission connection points—Deer Park terminal station (DPTS) and Altona terminal station (ATS).[1]

DPTS supplies the 'Melton sub-transmission network', consisting of four existing zone substations—Bacchus Marsh (BMH), Melton (MLN), Truganina (TNA), and Mount Cottrell (MTC).

ATS has a split 66kV bus and supplies the ATS-West distribution network and the ATS-BLTS distribution network. The ATS-West distribution network supplies the 'Wyndham sub-transmission network', consisting of two existing zone substations—Laverton (LV) and Werribee (WBE) — and two dedicated customer substations. Together, the Melton and Wyndham sub-transmission networks are further referred to as the 'greater western Melbourne network'.

A geographical view of the greater western Melbourne networks is shown in figure 1.

FIGURE 1 GREATER WESTERN MELBOURNE NETWORK



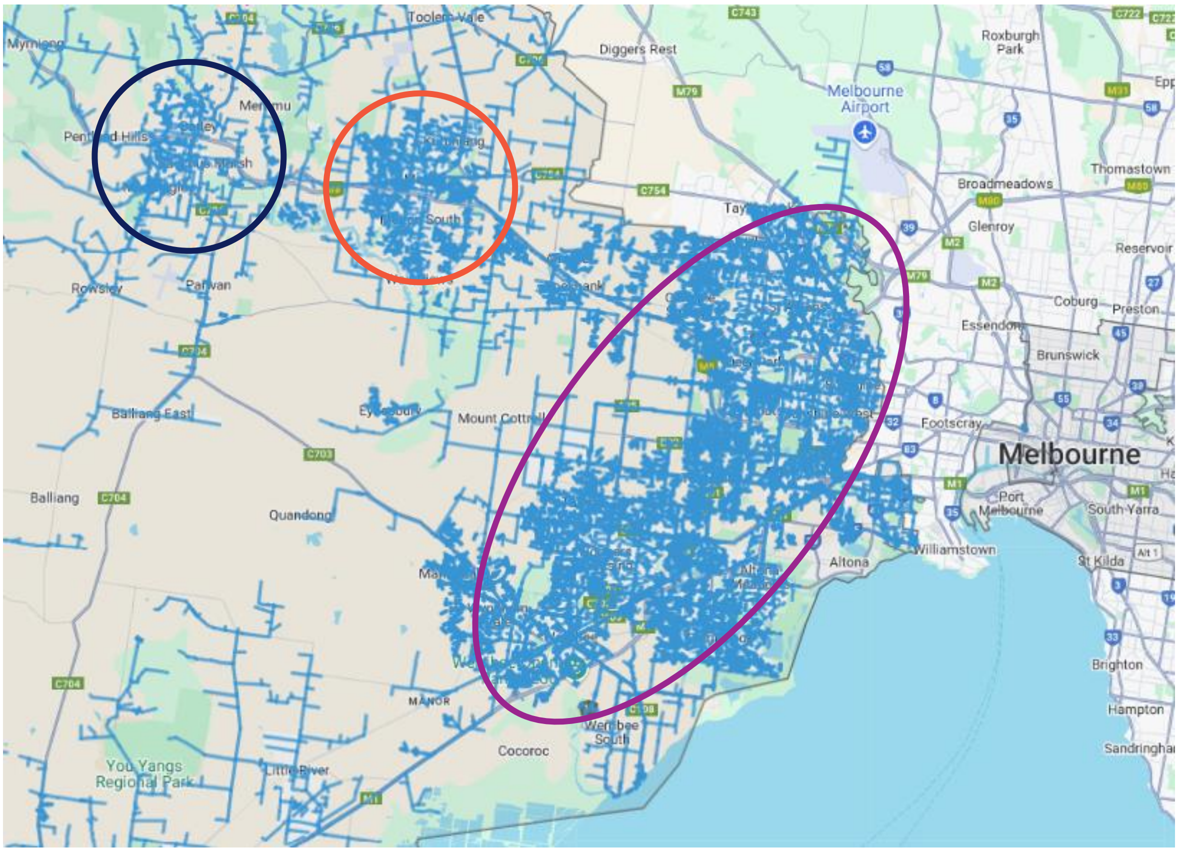
[1] DPTS and ATS are transmission-level stations and are owned and operated by TransGrid and AusNet respectively.

2.2 Existing distribution network

Figure 2 presents a snapshot of our existing 22kV distribution feeder network supplying greater western Melbourne. The eastern section of this network (purple circle) is high-density, reflecting Melbourne's expansion across the western growth corridor.

To the west, two additional high-density network segments are identified in the cities of Melton (orange circle) and Bacchus Marsh (dark blue circle). Long feeders service the predominantly undeveloped land surrounding the identified load centres.

FIGURE 2 EXISTING GREATER WESTERN MELBOURNE 22KV FEEDER COVERAGE



2.2.1 Transfer capacity

Given the interconnected nature of these assets particularly within the high-density network segments identified above in figure 2, transfers are valuable options to support load growth within the area. Additional capacity that is built within these dense load centres can take on existing demand from other nearby assets to relieve capacity constraints across an area.

Utilising available transfer capacity is a relatively low-cost approach to support demand growth across the region.

Table 2 sets out the available 22kV feeder transfers between the respective zone substations within the greater western Melbourne network. For example, 12.6 MVA of capacity can be transferred from WBE to LV.

TABLE 2 AVAILABLE TRANSFER CAPACITY BETWEEN ZONE SUBSTATIONS (MVA)

FROM/TO	MLN	WBE	LV	LVN	TNA	MTC
MLN	N/A	-	-	-	8.2	7.1
WBE	-	N/A	12.6	-	3.4	10.8
LV	-	10.9	N/A	6.8	8.6	7.5
LVN	-	-	14.9	N/A	15.9	-
TNA	12.0	-	6.2	26.7	N/A	11.7
MTC	6.2	14.6	11.0	-	22.6	N/A

3. Identified need

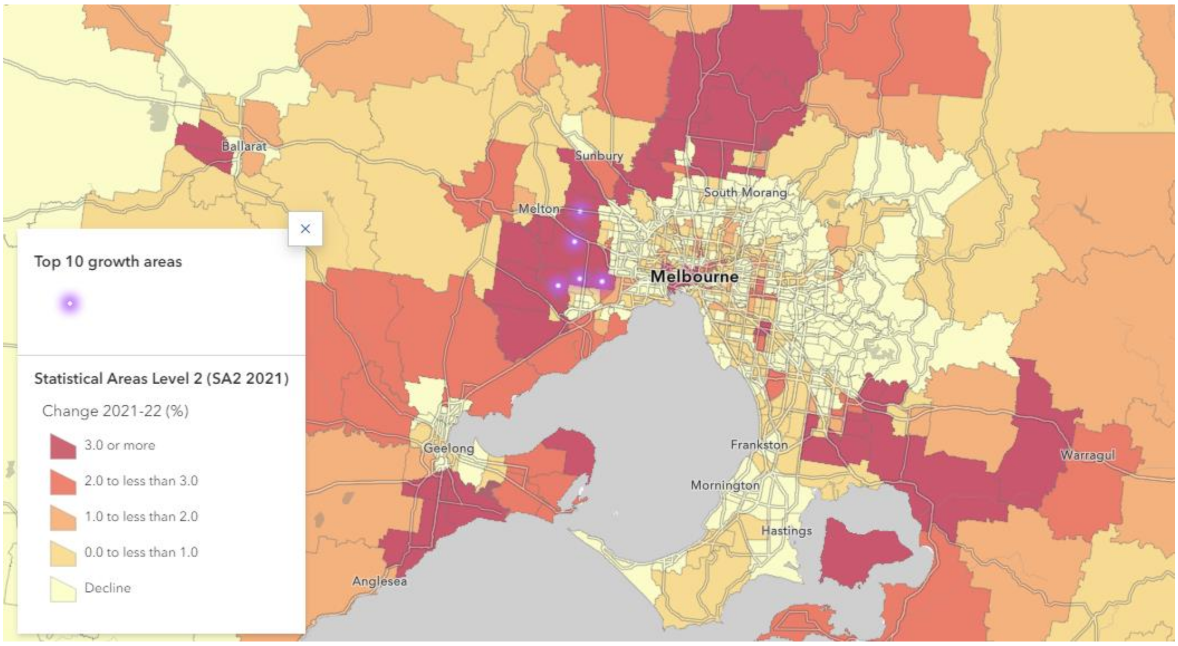
The identified need is to maintain a reliable supply of electricity to customers in the greater western Melbourne supply areas as the level of energy at risk on our existing infrastructure continues to grow over time. As outlined below, the local government areas (LGAs) of Melton and Wyndham are the fastest growing across greater Melbourne.

3.1 Melbourne growth

Due to significant year-on-year population growth, the greater Melbourne region has overtaken the greater Sydney region as the largest city in Australia. Melbourne has largely developed eastward over the past decades, however, given the excess of prime land and proximity to the city, expansion of Melbourne's west is booming.

Five of the ten highest growth statistical areas in Australia are in the Melton and Wyndham LGAs, largely driven by significant net internal migration from other suburbs of greater Melbourne. Figure 3 below depicts the 2021–22 population change per statistical area in Melbourne according to the Australian Bureau of Statistics' most recent census.

FIGURE 3 REGIONAL POPULATION CHANGE



Source: Australian Bureau of Statistics Regional Population 2021–22 Interactive Map (ABS, 2022)

The City of Melbourne's population projections provide further insights into the magnitude of growth in the Melton and Wyndham city council regions. It shows that residential population will continue to grow above three per cent per annum, higher than the greater city average.

3.2 Network utilisation and forecast capacity

Today, our customers experience some of the highest performance standards in the National Electricity Market (NEM), including the high utilisation of our existing infrastructure. When measured as the ratio of maximum demand at the zone substation to the total zone substation transformer capacity (consistent with the AER's methodology), our network utilisation is greater than any other network, and around 25 percentage points above the NEM average.

Most of our existing zone substations supplying the region already experience utilisation rates of above 70 per cent, up to 92 per cent. Table 3 below shows the actual and forecast utilisation of our zone substations under a one-in-two-year forecast (50 per cent POE).

TABLE 3 UTILISATION PRE-AUGMENTATION (SUMMER 50% POE)

STATION	2024 ACTUAL	2026 FORECAST	2031 FORECAST
Melton (MLN)	76%	84%	108%
Mount Cottrell (MTC)	-	70%	115%
Werribee (WBE)	92%	95%	95%
Bacchus Marsh (BMH)	73%	78%	92%
Laverton (LV)	86%	88%	93%
Truganina (TNA)	76%	91%	82%
Laverton North (LVN)	53%	65%	69%

In the greater western Melbourne supply area, the extent of the growth outlined above is challenging our existing network. Table 4 outlines the forecast exceedances of the N and N-1 ratings for each zone substation in the greater western Melbourne network—all sites will exceed their N-1 rating before the end of the 2026–31 regulatory period, with many also expected to exceed their N-rating.

TABLE 4 TIMING OF RATING EXCEEDANCE (SUMMER 50% POE)

STATION	N-1 RATING EXCEEDANCE	N RATING EXCEEDANCE
Melton (MLN)	Now	2028
Mount Cottrell (MTC)	2026	2029
Werribee (WBE)	Now	2031
Bacchus Marsh (BMH)	Now	2033
Laverton (LV)	Now	2034
Truganina (TNA)	Now	2035
Laverton North (LVN)	2031	Beyond reference period

3.3 Value of expected unserved energy

We apply a probabilistic approach to network planning, meaning we estimate the probability of an outage occurring within the peak loading season, and weighting the costs of such an occurrence by its probability. Probabilistic network planning aims to ensure that an economic balance is struck between:

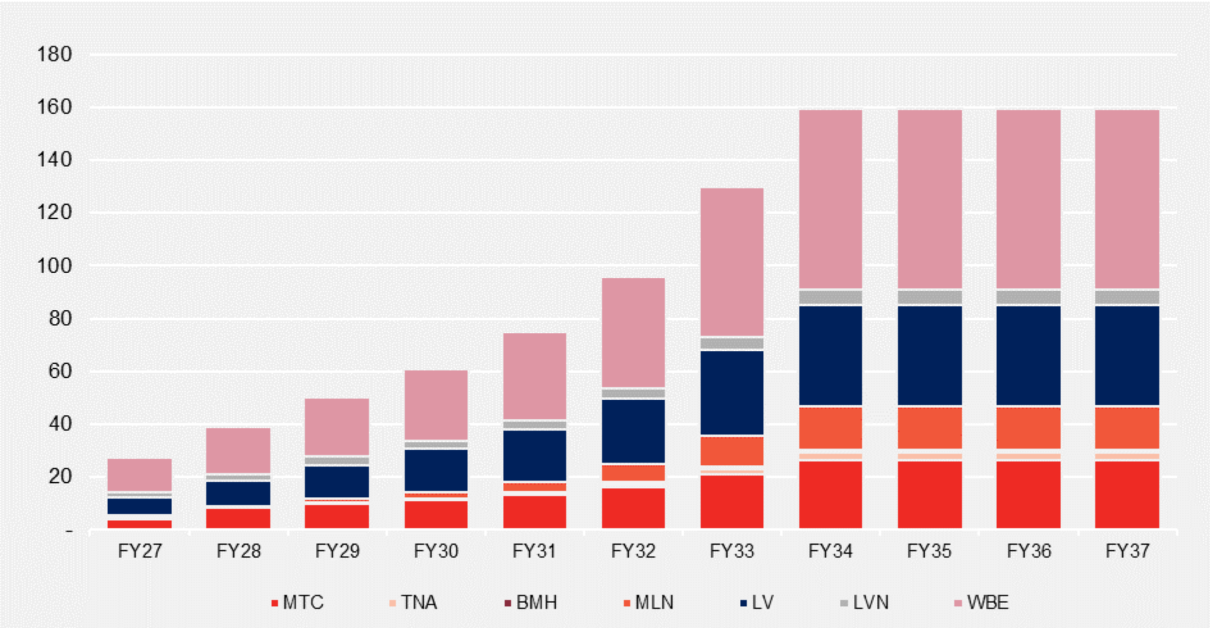
- the cost of providing additional network capacity to remove constraints
- the cost of having some exposure to loading levels beyond the network's capability.

Consistent with our probabilistic planning approach, the quantity and value of expected unserved energy is a critical parameter in assessing the need for any prospective network investment or other action in response to an emerging constraint.

From the above analysis, all zone substations in the greater western Melbourne network, except for LVN, will carry energy at risk throughout the year. This is based on an average load duration curve over the previous five-years, with the AER's value of customer reliability (VCR) to value this expected unserved energy.[2]

As shown in figure 4, MTC, BMH, WBE, and MLN all have significant contributions to energy at risk throughout the period, with MTC being the largest contributor. This reflects the expected available load transfers outlined previously in section 2.2.1.

FIGURE 4 AGGREGATE ZONE SUBSTATION EXPECTED UNSERVED ENERGY (MWH)



[2] Our assessments are based on the AER's 2019 VCR study, escalated in accordance with the AER's specified methodology. In late-December 2024, the AER published its new, 2024 VCR values; we are yet to assess the impact of these changes, but will consider these through the development of our revised regulatory proposal.

4. Options analysis

The availability of load transfers to address energy at risk from interlinked zone substations means that it is prudent to consider the aggregate energy at risk from all zone substations across the greater western Melbourne supply area when assessing options to address the identified need. Adding new capacity in opportune locations means that transfers can generally be used as a cost-effective option to support load growth.

Within the 2026–31 regulatory period, 230 MVA of additional transformer capacity (or demand response) is likely required across the greater western Melbourne supply areas to alleviate future load at risk.

Given the significant growth in the Western Melbourne area, several individual augmentation projects will likely be required by the early 2030s to avoid capacity shortfalls that would impact reliability of supply for customers.

Given the scale of growth and numerous locations that could potentially be upgraded with a variety of different augmentations, we implemented an options screening process to identify the highest value augmentation options to increase transformer capacity on a cost per unit capacity basis at each location for the greater western Melbourne regions.

This screening process identified the following highest value augmentation projects, which considered transformer capacity (summer N-rating) and capital costs for each solution. The highest value augmentation projects at each site are described in table 5 below.

TABLE 5 COMPARISON OF TRANSFORMER CAPACITY SOLUTIONS

PROJECT	CAPACITY INCREASE (MVA)	CAPEX ($M, 2026)	COST PER UNIT CAPACITY ($/MVA)
MTC third transformer	47.6	15.9	334,146
New RBE zone substation	95.2	43.4	455,463
New PCK zone substation	95.2	57.5	604,287
Rebuild our BMH zone substation	41.6	30.2	725,092
Install a fourth transformer at WBE, LV or MLN	47.6	34.6	727,134
New WVL zone substation	95.2	77.7	815,980

While rebuilding our BMH zone substation is more expensive on a cost per unit capacity basis than building new RBE or PCK zone substations, rebuilding our BMH zone substation can be delivered quicker because we already own the land and have commenced potential design works. It can also more efficiently facilitate load transfers between MLN and BMH with less impact on customers.

Non-network solutions were also considered, but assessed as not being credible to address the identified need. Non-network solutions are typically preferable to network equivalents if they can defer augmentation for long periods or avoid it entirely. The speed of increasing demand in the greater western Melbourne area means that the capabilities of a reasonably sized non-network solution would only deliver short-term deferrals, limiting their value proposition.

A full description of the methodology we have used to identify the highest value augmentation projects at each site is available in appendix C.

Further information on each individual augmentation project is provided below in table 6.

TABLE 6 SUMMARY OF INDIVIDUAL AUGMENTATION PROJECTS ($M, 2026)

PROJECT	CAPEX
MTC third transformer[3] MTC is currently under construction with two transformers and will be energised in FY26 to off-load energy at risk from TNA, WBE, LV and MLN. However, a new third transformer is proposed to further support additional load in the MTC area	15.9
BMH re-build BMH is currently in service and will approach N rating within the period. BMH transformers are also a different vector group to MLN, the closest adjacent zone substation. Rebuilding BMH would provide additional capacity to support MLN and allow transfers to occur without interruption.	30.2
New RBE zone substation Construction of a RBE zone substation with two transformers would locate a new zone substation in between the existing MLN and TNA zone substation. This site would off-load energy at risk from MLN, TNA and WBE.	43.4
New PCK zone substation Construction of a PCK zone substation as a staged development a single transformer in the first stage and a deferred second transformer would locate a new zone substation to the south-east of WBE in the commercial and industrial zoned development area of Point Cook. This site would off-load energy at risk from LV and WBE and allow for additional development in the area.	57.5

4.1 Options development and summary

While we have identified the lowest cost per unit capacity added augmentation projects that are likely to deliver the highest net benefits for customers, we also need to identify the viability of the sequencing and timing of different combinations of augmentation projects.

Therefore, our options to resolve load at risk in the greater western Melbourne area assesses the relative viability of different project options and sequencing that determine whether relatively leaner investments would deliver value to customers or not. The greenfield nature of the western Melbourne growth corridor supports this flexibility in project delivery.

[3] As MTC is an ongoing project, this only includes costs that fall within the 2026–31 regulatory period

In total, four credible options were assessed relative to an existing base case (i.e. status quo), with each option comprising multiple augmentation projects.

As shown in table 7, option three has the highest net economic benefit for customers.

TABLE 7 SUMMARY OF OPTIONS ANALYSIS

OPTION	AUGMENTATIONS AND SEQUENCING	NET BENEFIT ($M, 2026)
Option one Status quo	None	-
Option two Southern capacity priority	• MTC third transformer • BMH re-build • New PCK zone substation (single) • New RBE zone substation	546.6
Option three Northern capacity priority	• MTC third transformer • BMH re-build • New RBE zone substation • New PCK zone substation (single)	546.8
Option four Lean investment; northern priority	• MTC third transformer • New RBE zone substation • New PCK zone substation (single)	528.2
Option five Lean investment; southern priority	• MTC third transformer • BMH re-build • New PCK zone substation (two)	495.8

Note: As outlined futher in this section, our new PCK zone substation is being proposed as a contingent project, consistent with strong feedback from our stakeholders (including the Customer Advisory Panel). These costs have therefore not been included in our regulatory proposal forecasts, however, PCK was included in the analysis to ensure a fulsome and holistic consideration.

Fulsome detail on our options analysis is set out in our attached net benefits model.[4] The economic benefit modelling aims to:

- quantify the present value of costs and benefits associated with each option
- identify the optimal economic timing for each augmentation which maximises net benefits.

Optimal economic timing is defined as the year in which the value of energy at risk becomes greater than the value of annualised costs of the option, resulting in positive net benefits.

In addition, the preferred option will be subject to a regulatory investment test for distribution (RIT–D), with engagement of non-network service providers. We will initiate consultation well before the economic timing of the preferred network option to maximise the chance of a viable non-network solution being identified.

4 PAL MOD 3.01 – Greater western Melbourne supply area – Jan2025 – Public

4.2 Option one: status quo

This option maintains the status-quo and provides no mitigation to manage forecast energy at risk other than through currently available operational responses such as demand management programs. Consistently growing demand in the area will lead to increased supply interruptions and a greater potential for asset failures as forecast loads exceed the capacity of our assets.

Figure 4 above sets out the collated value of expected unserved energy across the greater western Melbourne supply area under this status quo option.

Early in the 2026–31 regulatory period, MTC is the largest contributor to expected unserved energy. Following completion of the MTC zone substation in FY26 it immediately faces N-1 energy at risk due to supporting load growth at other zone substations by making use of relatively low-cost transfers. These transfers off-load demand on the MLN, TNA and WBE zone substations to reduce energy at risk in the current regulatory period.

Late into the period, MTC and MLN account for the majority of energy at risk in the region due to high demand growth and a lack of transformer capacity. The value of expected unserved energy is described above in figure 4.

4.3 Option two: southern capacity priority

Option two proposes four separate augmentation projects to address energy at risk in the greater western Melbourne networks, including third transformer upgrades, rebuilding a zone substation and constructing new zone substations.

Specifically, the augmentations under this option in sequential order are:

- the immediate construction of a third transformer at MTC
- the re-build and transformer upgrade of at BMH, including the construction of a new 22kV feeder enabling the offload of near-term risk at MLN
- the construction of a new PCK zone substation with a single transformer
- the construction of a new RBE zone substation with two installed transformers.

This option collectively prioritises the early development of additional capacity in the southern region of the greater western Melbourne supply area, and leads to more alleviation of energy at risk from southern areas first.

The third transformer at MTC would support near-term risk from the central regions of the greater western Melbourne supply area.

Early benefits for customers in the southern Wyndham and Melton region would then be prioritised by alleviating energy at risk for customers supplied by BMH. Load transfers would then support alleviation of energy at risk from MLN.

The construction of PCK zone substation would then support growth of the southern region, supporting WBE and LV. Finally, RBE would support growth in the northern region.

Further detail on each project is provided below, with project costs and timing shown in table 8.

TABLE 8 OPTION TWO: CAPITAL EXPENDITURE FORECAST ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
Re-build BMH	15.1	15.1	-	-	-	30.2
New PCK zone substation (single)	-	6.0	26.9	24.6	-	57.5
New RBE zone substation	-	-	5.9	19.5	17.9	43.4
Total	**31.0**	**21.1**	**32.8**	**44.2**	**17.9**	**147.0**

4.3.1 MTC third transformer

Based on optimal economic timing, the MTC third transformer project should be online FY28 to address near-term energy at risk. The third transformer at MTC provides an approximate 50 per cent increase in transformer capacity at the substation. This directly reduces the forecast energy at risk at MTC, whilst also providing excess capacity to facilitate a 16 MVA transfer from TNA to MTC in FY28.

4.3.2 BMH re-build

The BMH re-build project and associated transformer upgrades effectively doubles the transformer capacity at BMH. The proposed feeder upgrades enable a 15 MVA equivalent load transfer from the constrained MLN zone substation to the newly rebuilt BMH, without re-allocating risk to distribution feeders. The works for this project are expected to commence in FY27 with the project completed in FY28.

4.3.3 PCK new zone substation

The new PCK zone substation would be commissioned in FY31, and provide additional capacity with a single 25/33 MVA transformer. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 9.

TABLE 9 OPTION TWO: OFFLOADS TO NEW PCK ZONE SUBSTATION (MVA)

OFFLOADS	MTC	LV	TNA	WBE	MLN	LVN	TOTAL
To new PCK zone substation	5.1	6.7	5.1	24.7	-	-	41.6

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed PCK supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.3.4 RBE new zone substation

The new RBE zone substation would be commissioned in FY32, and provide additional capacity with two 25/33 MVA transformers. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 10.

TABLE 10 OPTION TWO: OFFLOADS TO NEW RBE ZONE SUBSTATION (MVA)

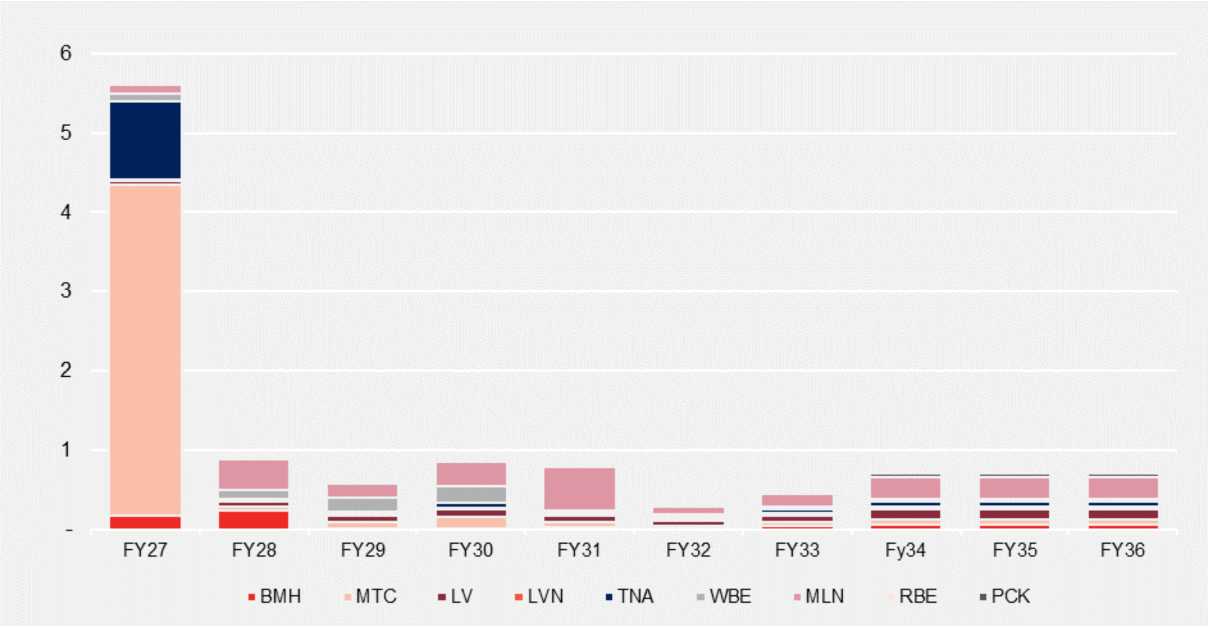
OFFLOADS	MTC	LV	TNA	WBE	MLN	PCK	TOTAL
To new RBE zone substation	9.1	2.8	7.2	2.9	19.9	-	41.9

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed RBE supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.3.5 Net economic benefits under option two

As a result of the above transfers to new transformer assets, energy at risk is removed from zone substations and feeders that would otherwise exceed their rated capacities. Figure 5 presents the total energy at risk and value of expected unserved energy after the option two augmentations.

FIGURE 5 OPTION TWO: REMAINING VALUE OF UNSERVED ENERGY ($M, 2026)



A summary of the results of the economic benefit analysis, relative to the existing status quo, are shown in table 11.

TABLE 11 OPTION TWO: NET ECONOMIC BENEFIT ($M, 2026)

DESCRIPTION	PV COSTS	PV BENEFITS	NET ECONOMIC BENEFIT
Option two: southern capacity priority	-78.4	625.1	546.6

4.4 Option three: northern capacity priority

Option three proposes the same four augmentation projects as option two except with changes to the sequencing of projects. RBE is constructed before PCK, which prioritises improving network capacity in the northern region first and alleviating more energy at risk from northern areas earlier.

Specifically, the augmentations under this option in sequential order are:

- the immediate construction of a third transformer at MTC
- the re-build and transformer upgrade of at BMH, including the construction of a new 22kV feeder enabling the offload of near-term risk at MLN
- the construction of a new RBE zone substation with two installed transformers
- the construction of a new PCK zone substation with a single transformer.

Option three differs from option two only in the order of delivery of RBE and PCK. Relatively, developing RBE prior to PCK will alleviate more energy at risk from norther areas prior to southern areas.

Further detail on each project is provided below, with project costs and timing shown in table 8.

TABLE 12 OPTION THREE: CAPITAL EXPENDITURE FORECAST ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
BMH rebuild	15.1	15.1	-	-	-	30.2
New RBE zone substation	-	5.9	19.5	17.9	-	43.4
New PCK zone substation (single)	-	-	-	6.0	26.9	32.9
Total	**31.0**	**21.0**	**19.5**	**23.9**	**26.9**	**122.3**

The costs, benefits and timing of the third transformer at MTC and BMH rebuild are the same as option two, described in sections 4.3.1 and 4.3.2 above.

4.4.1 RBE benefits

The new RBE zone substation would be commissioned in FY31, and provide additional capacity with two 25/33 MVA transformers. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 13.

TABLE 13 OPTION THREE OFFLOADS TO RBE

	MTC	LV	TNA	WBE	MLN	LVN	TOTAL
To new RBE zone substation	9.1	1.3	10.4	6.8	19.9	0	47.5

The distribution feeders constructed alongside the new zone substation alleviate all thermal constraints from the longest feeders that currently service the proposed RBE supply area. The risk savings associated with the removal of feeder constraints were excluded from the project's net economic benefit.

4.4.2 PCK Benefits

The new PCK zone substation would be commissioned in FY32, and provide additional capacity with a single 25/33 MVA transformer. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 14.

TABLE 14 OPTION THREE OFFLOADS TO PCK (MVA)

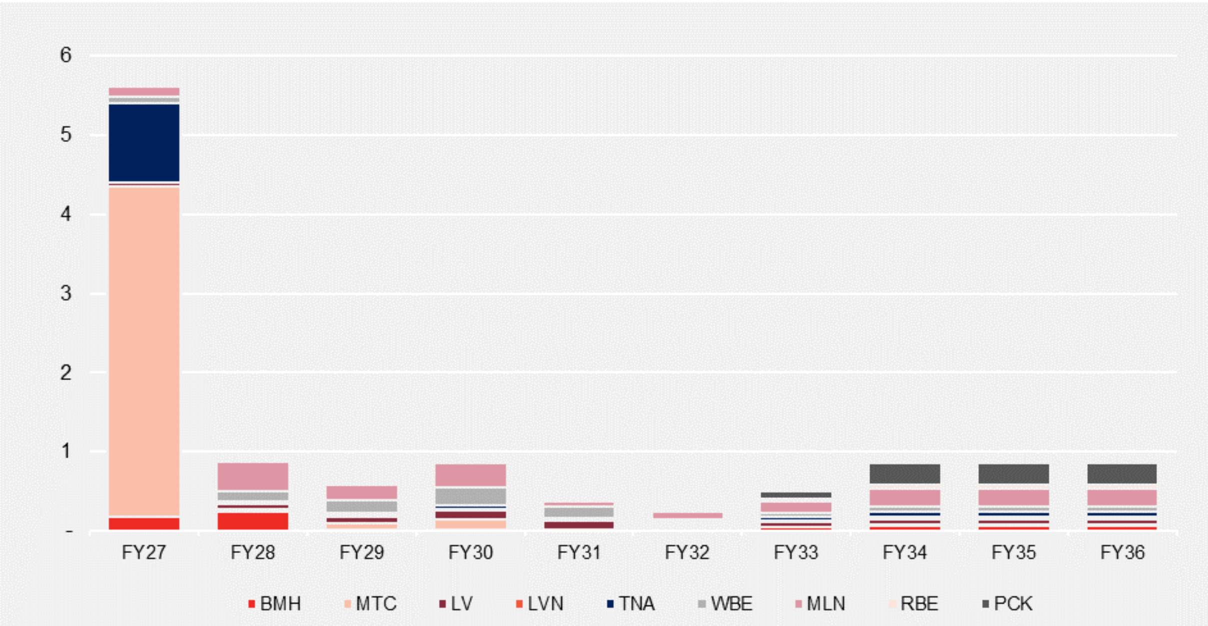
	MTC	LV	LVN	TNA	WBE	RBE	TOTAL
To new PCK zone substation	10.5	12.1	2.1	0.9	18.0	0.0	43.6

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed PCK supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.4.3 Net economic benefits under option 3

As a result of the above transfers to new transformer assets, energy at risk is removed from zone substations and feeders that would otherwise exceed their rated capacities. Figure 6 presents the total energy at risk and value of expected unserved energy after the option three augmentations.

FIGURE 6 OPTION THREE: REMAINING VALUE OF UNSERVED ENERGY ($M, 2026)



A summary of the results of the economic benefit analysis, relative to the existing status quo, are shown in table 15.

TABLE 15 OPTION THREE: NET ECONOMIC BENEFIT ($M, 2026)

DESCRIPTION	PV COSTS	PV BENEFITS	NET ECONOMIC BENEFIT
Option three: northern capacity priority	-73.0	619.8	546.8

4.5 Option four: lean investment, northern capacity priority

Option four tests the economic viability of excluding the BMH rebuild project from the combination of solutions to test whether leaner investment delivers more value for customers than under option two or three.

Specifically, the augmentations under this option in sequential order are:

- the immediate construction of a third transformer at MTC
- the construction of a new RBE zone substation with two installed transformers
- the construction of a new PCK zone substation with a single transformer.

This options tests whether there are overall customer benefits from delivering fewer augmentations compared with option two while still prioritising northern development first. This option leads to more energy at risk for customers but lower costs than option two.

Further detail on each project is provided below, with project costs and timing shown in table 16.

TABLE 16 OPTION FOUR CAPITAL EXPENDITURE FORECAST ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
New RBE zone substation	5.9	19.5	17.9	-	-	43.4
New PCK zone substation (single)	-	6.0	26.9	24.6	-	57.5
Total	**21.8**	**25.6**	**44.8**	**24.6**	**-**	**116.8**

The costs, benefits and timing of the third transformer at MTC are the same as previous options described above. Under this option, BMH is not rebuilt.

4.5.1 RBE benefits

The new RBE zone substation would be commissioned earlier than other options in FY30, and provide additional capacity with two 25/33 MVA transformers. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 17.

TABLE 17 OPTION FOUR OFFLOADS TO RBE (MVA)

	MTC	LV	TNA	WBE	MLN	LVN	TOTAL
To new RBE zone substation	3.3	1.0	14.5	6.8	19.9	0.0	45.5

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed RBE supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.5.2 PCK benefits

The new PCK zone substation would also be commissioned earlier than in other options in FY31, and provide additional capacity with a single 25/33 MVA transformer. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 18.

TABLE 18 OPTION FOUR OFFLOADS TO PCK (MVA)

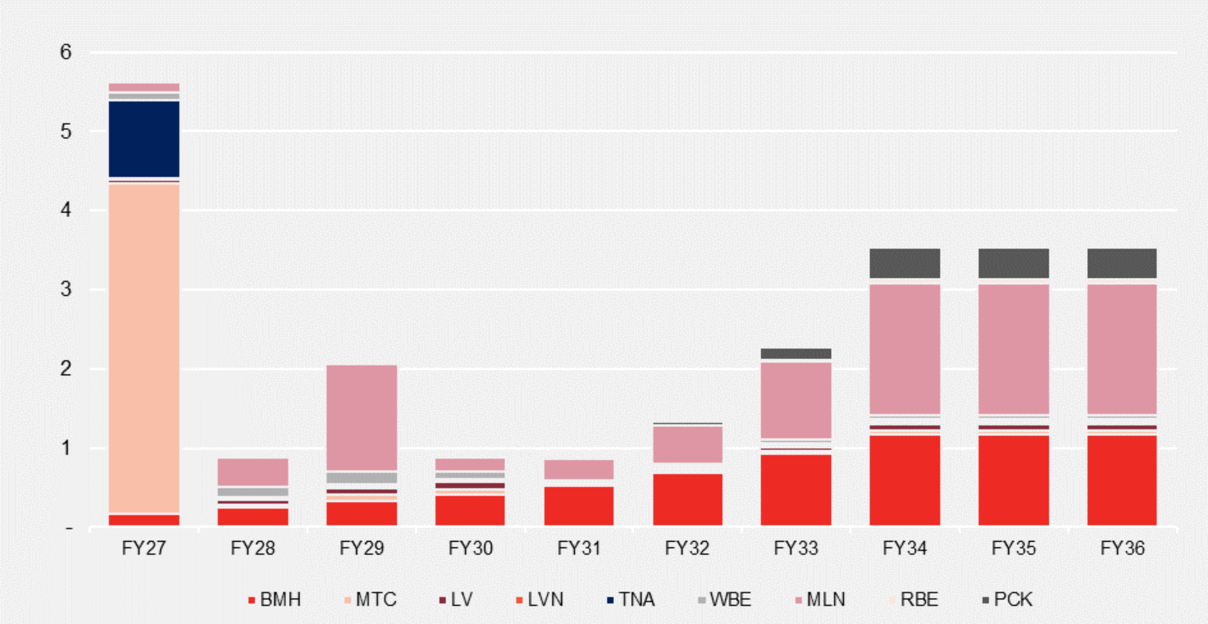
	MTC	LV	LVN	TNA	WBE	RBE	TOTAL
To new PCK zone substation	11.0	12.8	1.9	0.9	17.6	0.0	44.1

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed PCK supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.5.3 Net economic benefit of option four

As a result of the above transfers to new transformer assets, energy at risk is removed from zone substations and feeders that would otherwise exceed their rated capacities. Figure 7 presents the total energy at risk and value of expected unserved energy after the option four augmentations.

FIGURE 7 OPTION FOUR: REMAINING VALUE OF UNSERVED ENERGY ($M, 2026)



A summary of the results of the economic benefit analysis, relative to the existing status quo, are shown in table 19.

TABLE 19 OPTION FOUR: NET ECONOMIC BENEFIT ($M, 2026)

DESCRIPTION	PV COSTS	PV BENEFITS	NET ECONOMIC BENEFIT
Option four: lean investment, northern capacity priority	-62.6	590.8	528.2

4.6 Option five: lean investment, southern capacity priority

Option five tests the economic viability of excluding the construction of RBE from the combination of solutions to test whether leaner investment delivers more value for customers than under other options.

Specifically, the augmentations under this option in sequential order are:

- the immediate construction of a third transformer at MTC
- the re-build and transformer upgrade of at BMH, including the construction of a new 22kV feeder enabling the offload of near-term risk at MLN
- the construction of a new PCK zone substation with a single transformer.

This options tests whether there are overall customer benefits from delivering fewer augmentations compared with option three while still prioritising southern development first. This option leads to more energy at risk for customers but lower costs than option three.

Further detail on each project is provided below, with project costs and timing shown in table 20 below.

TABLE 20 OPTION FIVE CAPITAL EXPENDITURE FORECAST ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
BMH rebuild	15.1	15.1	-	-	-	30.2
New PCK zone substation	-	6.1	32.9	30.2	-	69.1
Total	**31.0**	**21.2**	**32.9**	**30.2**	**-**	**115.2**

The costs, benefits and timing of the third transformer at MTC are the same as previous options described above.

4.6.1 BMH re-build

The BMH re-build project and associated transformer upgrades effectively doubles the transformer capacity at BMH. The proposed feeder upgrades enable a 15 MVA equivalent load transfer from the constrained MLN zone substation to the newly rebuilt BMH, without re-allocating risk to distribution feeders. The works for this project are expected to commence in FY27 with the project completed in FY28.

4.6.2 PCK benefits

The new PCK zone substation would also be commissioned earlier than in other options in FY31, and provide additional capacity with a single 25/33 MVA transformer. This will enable offloads from surrounding zone substations that are facing rating exceedances, as shown in table 21 below.

TABLE 21 OPTION FIVE OFFLOADS TO PCK (MVA)

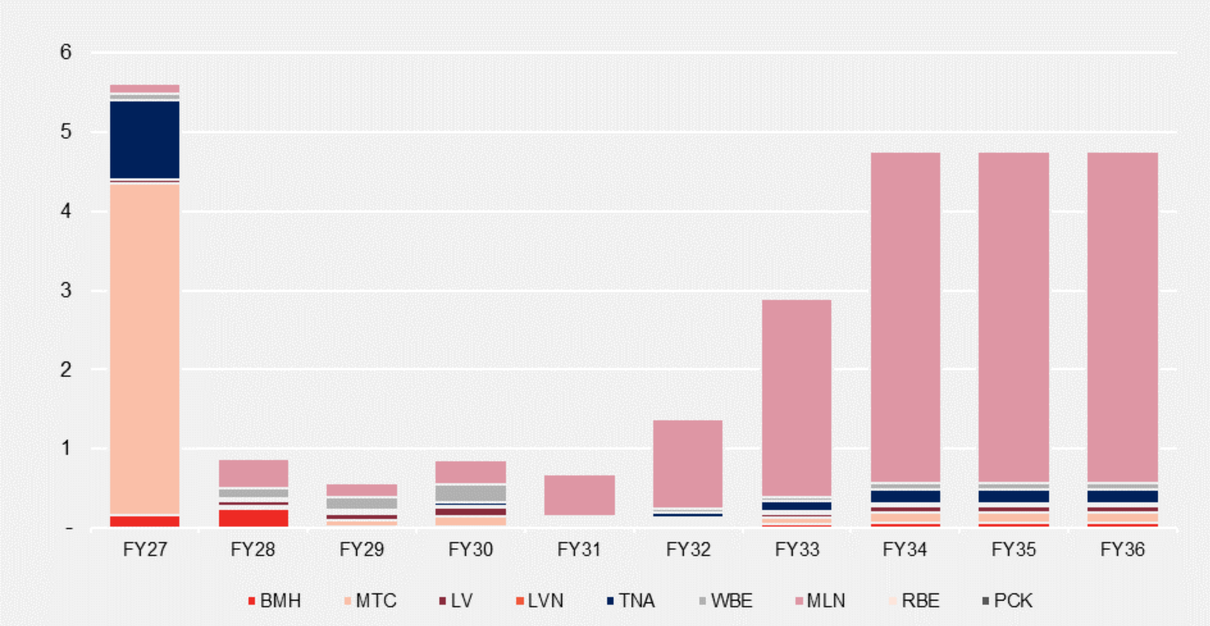
	MTC	LV	LVN	TNA	WBE	RBE	TOTAL
To new PCK zone substation	11.0	14.2	0.1	5.0	22.5	0.0	52.8

The distribution feeders constructed alongside the new zone substation would alleviate all thermal constraints from the longest feeders that currently service the proposed PCK supply area. The risk savings associated with the removal of feeder constraints were excluded from the net economic benefits analysis.

4.6.3 Net economic benefit of option five

As a result of the above transfers to new transformer assets, energy at risk is removed from zone substations and feeders that would otherwise exceed their rated capacities. Figure 8 presents the total energy at risk and value of expected unserved energy after the option five augmentations.

FIGURE 8 OPTION FIVE: REMAINING VALUE OF UNSERVED ENERGY ($M, 2026)



A summary of the results of the economic benefit analysis, relative to the existing status quo, are shown in table 22.

TABLE 22 OPTION FIVE NET ECONOMIC BENEFIT ($M, 2026)

DESCRIPTION	PV COSTS	PV BENEFITS	NET ECONOMIC BENEFIT
Option five: lean investment, southern capacity priority	-59.2	555.0	495.8

5. Preferred option

Option three is the preferred option because its combination of augmentations minimises the expected unserved energy in the greater western Melbourne network areas and maximises net benefits for customers.

The forecast capital expenditure to deliver the preferred option and the optimal timing of each project is described in table 23 below. Further information supporting the optimal delivery timing of each project within option three is described in appendix B.

Given the material demand growth in the area and the increases in capital expenditure required to manage this demand growth, we are proposing to treat the construction of PCK with one transformer as a contingent project.[5] This approach is consistent with strong feedback from our stakeholders (including the Customer Advisory Panel) to only invest when necessary. These costs have therefore not been included in our regulatory proposal forecasts.[6]

This approach effectively manages uncertainty surrounding forecast demand growth in the greater western Melbourne supply area and minimises costs for customers through the 2026–31 regulatory period.

TABLE 23 EXPENDITURE FORECAST FOR PREFERRED OPTION ($M 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
MTC third transformer	15.9	-	-	-	-	15.9
BMH re-build	15.1	15.1	-	-	-	30.2
New RBE zone substation	-	-	8.5	19.5	15.3	43.4
New PCK zone substation	-	-	-	6.0	26.9	32.9
Total: option	**31.0**	**15.1**	**8.5**	**25.6**	**42.2**	**122.3**
Total: proposed(1)	**31.0**	**15.1**	**8.5**	**19.5**	**15.3**	**89.4**

Note: (1) As our new PCK zone substation is being proposed as a contingent project, these costs have not been included in our regulatory proposal forecasts. They are included in the table above, and in the underlying options analysis, for completeness.

As a result of the preferred option, figure 9 and figure 10 show the re-distribution of service areas for each zone substation in the greater western Melbourne supply area (excluding BMH, which services from the north-west and LVN because it's served by a different terminal station), noting the reduced coverage of the MLN, MTC, TNA, LV and WBE zone substations.

5 See PAL ATT 11.01 – Managing uncertainty – Jan2025 – Public for further details
6 Note that PCK was included in the options analysis to ensure a fulsome and holistic consideration of economic benefits.

FIGURE 9 EXISTING NETWORK COVERAGE

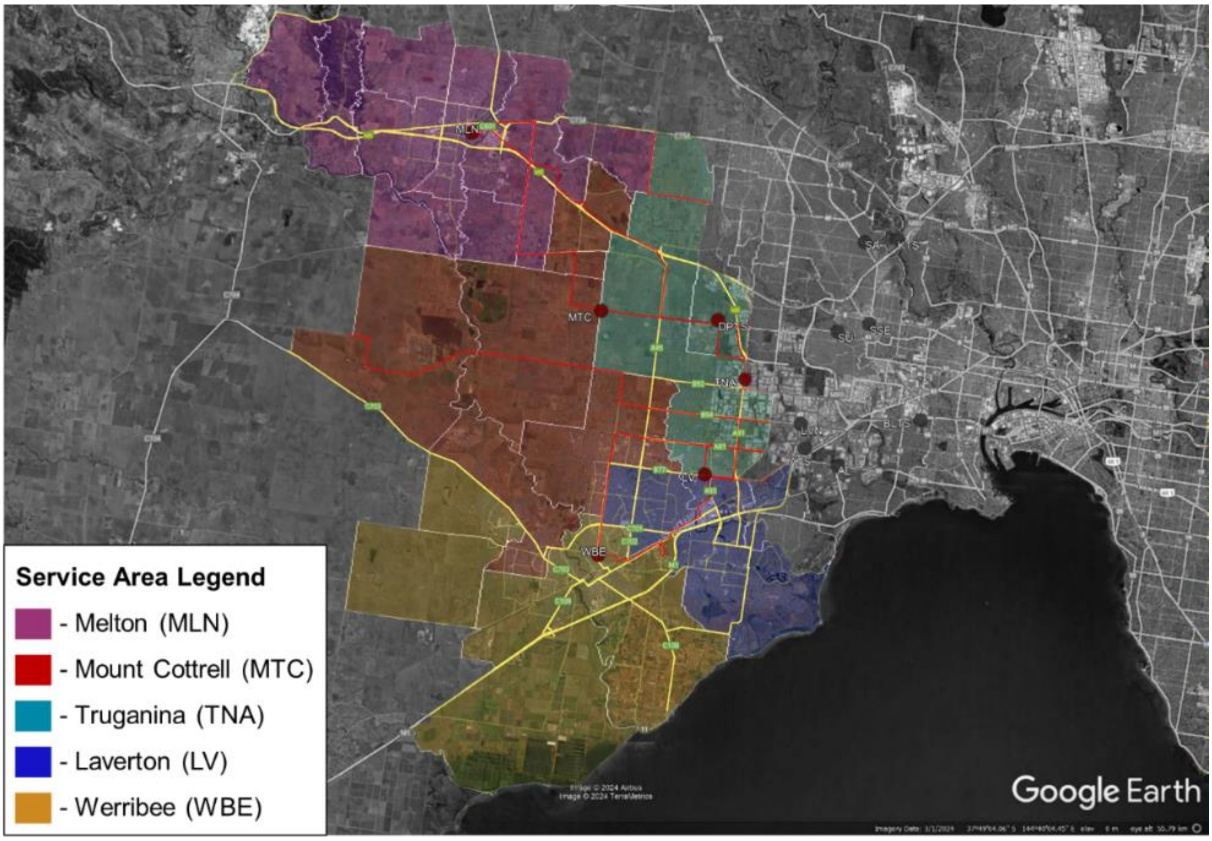
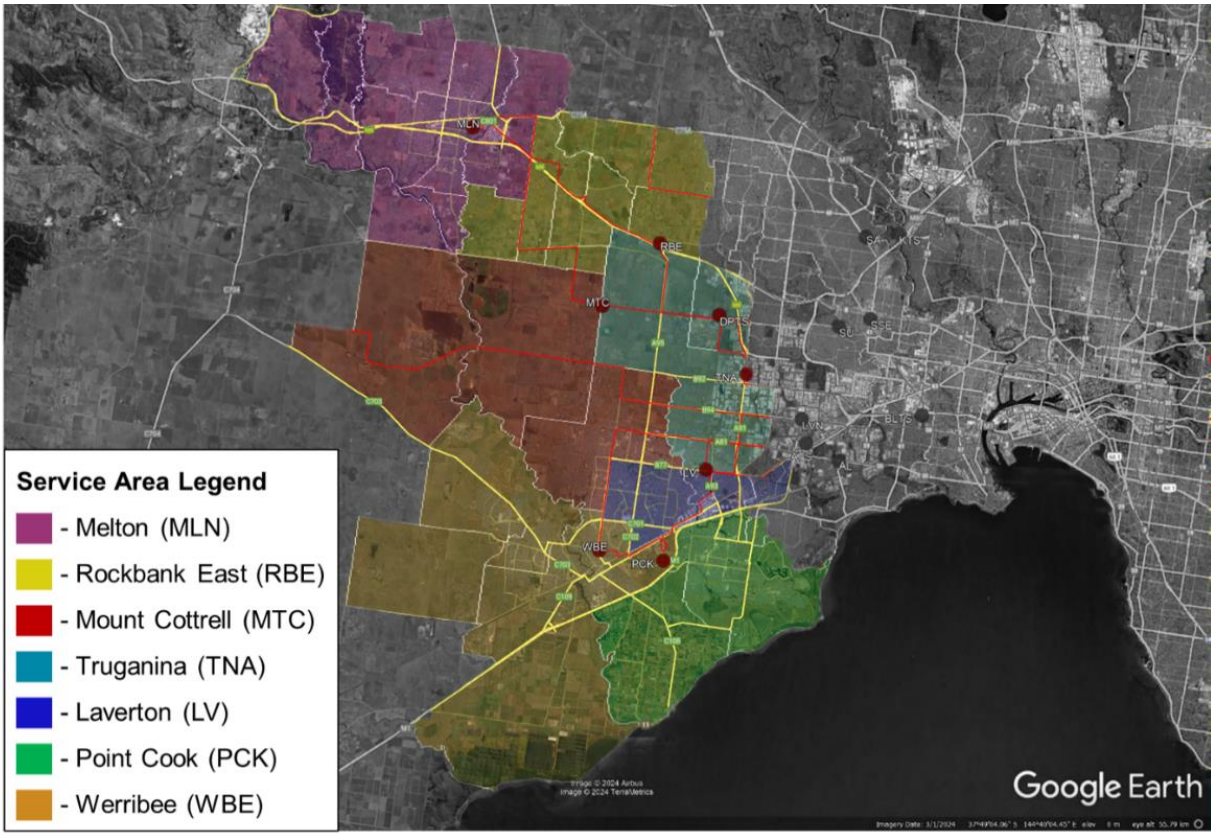


FIGURE 10 NETWORK COVERAGE AFTER PREFERRED OPTION



5.1 Sensitivity analysis

Sensitivity analysis was undertaken to understand the impact of increasing costs and decreasing the value of energy at risk mitigated on the net economic benefits of each option in different scenarios. Option three provides the highest net economic benefit under all scenarios and remains the preferred option. Further information on our sensitivity analysis can be found in our attached cost benefit modelling.[7]

In addition to our sensitivity modelling, we also investigated the impact that our augmentation would have on forecast utilisation rates across the region. Even under our preferred augmentation solution, utilisation rates at most of our zone substations are expected to remain above 70 per cent, with three zone substations above 90 per cent utilisation under a one-in-two-year forecast.

Table 24 below shows forecast utilisation under our preferred augmentation solution.

TABLE 24 UTILISATION AFTER PREFERRED AUGMENTATION (SUMMER 50% POE)

STATION	2024 ACTUAL	2026 FORECAST	2031 FORECAST
Melton (MLN)	76%	84%	91%
Mount Cottrell (MTC)	0%	47%	70%
Werribee (WBE)	92%	95%	90%
Bacchus Marsh (BMH)	31%	33%	39%
Rockbank East	-	-	53%
Laverton (LV)	86%	88%	92%
Truganina (TNA)	76%	91%	75%
Laverton North (LVN)	53%	65%	69%

7 PAL MOD 3.01 – Greater western Melbourne supply area – Jan2025 – Public

A

APPENDIX

ZONE SUBSTATION ASSESSMENTS

A Zone substation assessments

This appendix sets out the individual assessment of forecast demand and capacity for each zone substation under the base case. Forecasts take into account known new asset constructions and offloads between zone substations.

A.1 Mount Cottrell (MTC) zone substation

MTC, once commissioned in FY26, will be the most central substation to the existing greenfield between the City of Melton and the western Melbourne rural-urban fringe. The substation will be comprised of two 25/33MVA transformers operating at 66/22kV.

MTC is planned to alleviate energy at risk across both the Melton and Wyndham sub-transmission networks via load transfers from Melton (MLN), Truganina (TNA), Laverton (LV) and Werribee (WBE). The substation has been designed to allow for future installation of a third transformer.

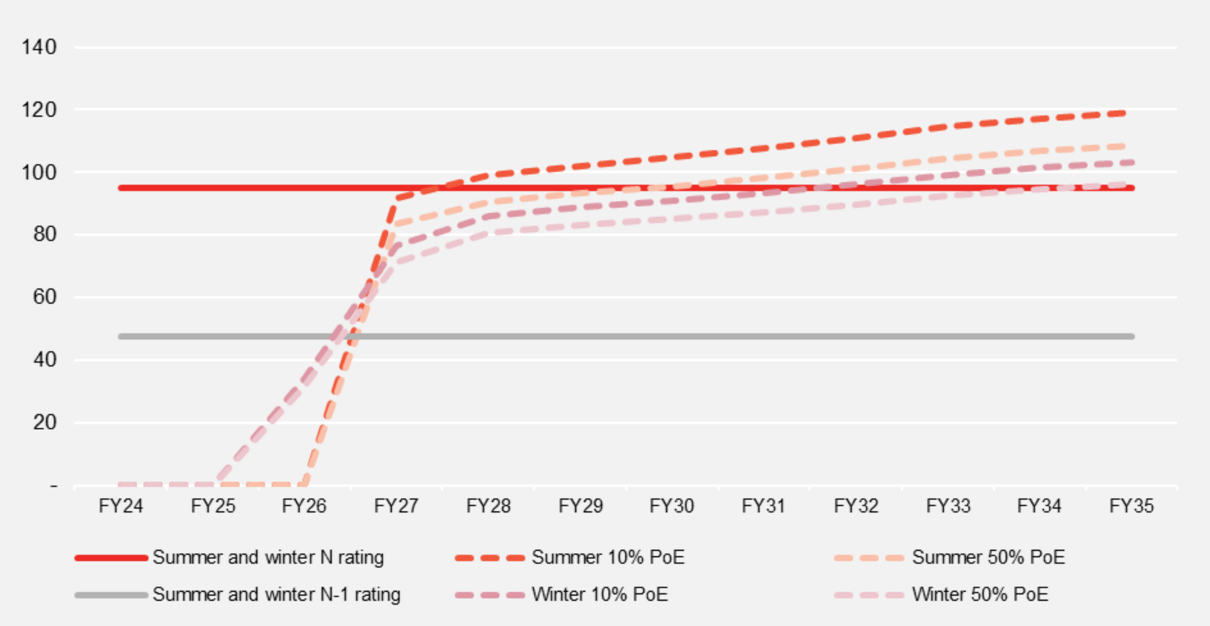
FIGURE 11 MTC ZONE SUBSTATION SITE AERIAL VIEW

A.1.1 MTC forecast demand and energy at risk

MTC, currently under construction, will be energised in FY26 to defer energy at risk from TNA, WBE, LV and MLN. The balance of transferred load from neighbouring substations results in MTC exceeding its N-1 rating (a single transformer at 47.6 MVA) immediately, once online. It is forecast that MTC will breach its summer N rating at a 10 per cent probability of exceedance (PoE) in FY29, with the 50 per cent PoE following in late FY31.

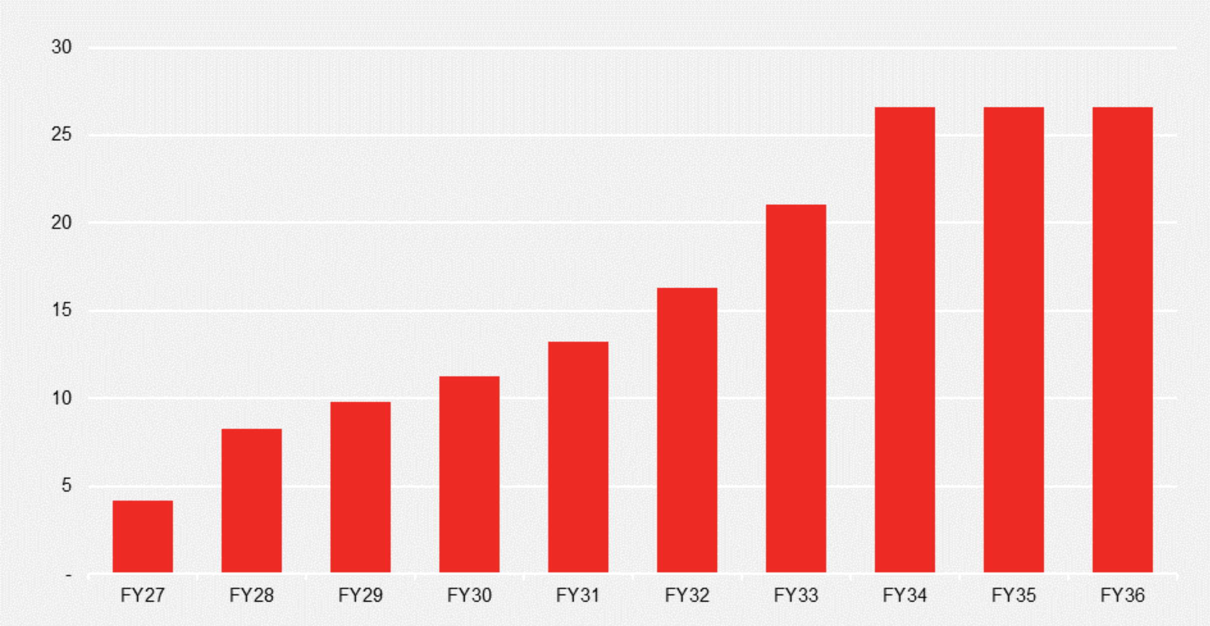
Figure 12 plots the zone substation's historical and forecasted demand.

FIGURE 12 MTC ZONE SUBSTATION DEMAND FORECAST



As seen in figure 13, MTC is one of the greatest contributors of energy at risk in the greater western Melbourne network, reaching just under $40,000,000 of expected unserved energy per year toward the end of the planning period.

FIGURE 13 MTC EXPECTED UNSERVED ENERGY (MWH)

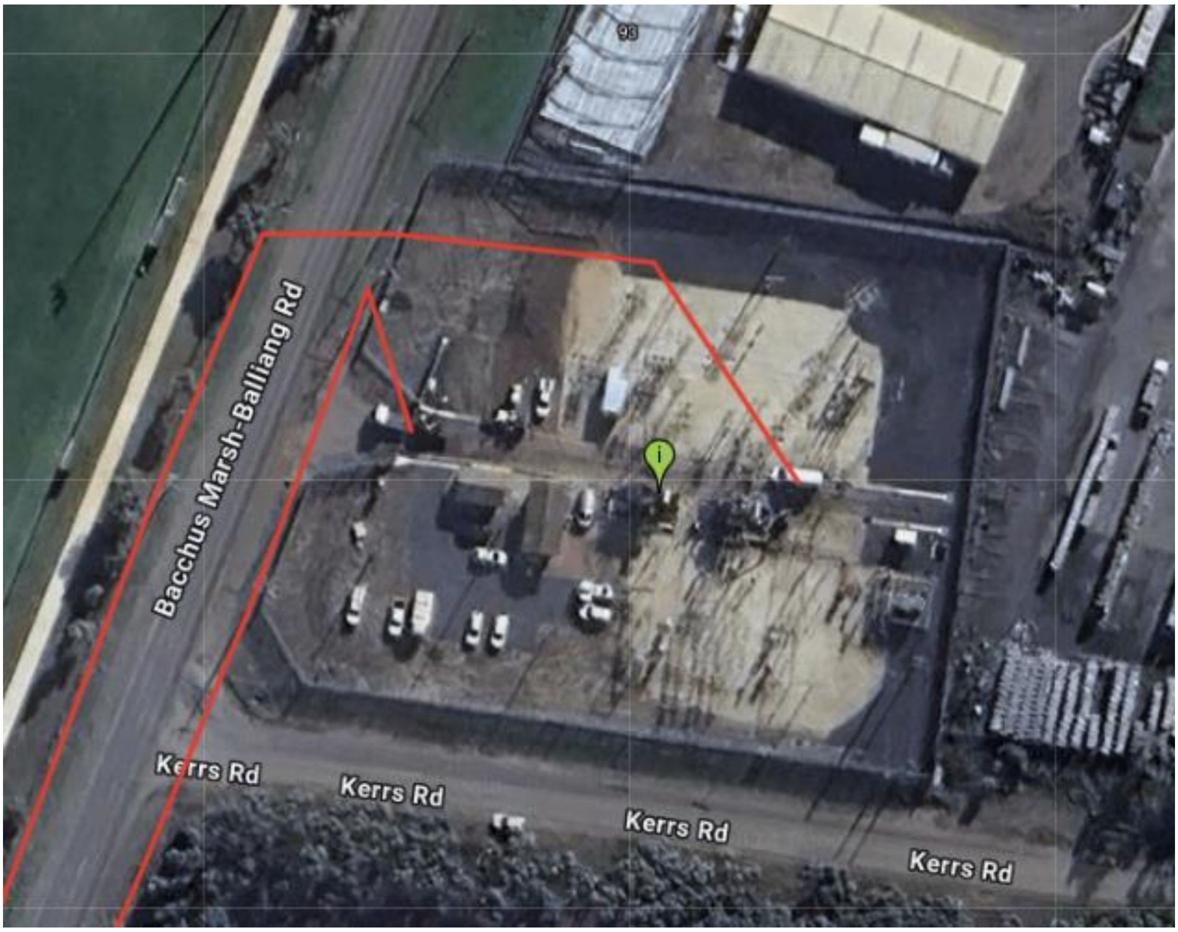


A.2 Bacchus Marsh (BMH) zone substation

BMH is most rural zone substation of this business case, located west of the MLN zone substation. Historically, load at risk has been managed between BMH and MLN as they face load at risk and subsequent augmentations. BMH comprises two 10/13.5 MVA transformers supplying the 22 kV buses.

Capacity expansion of BMH would require a full rebuild of the site to upgrade the 10/13.5 MVA transformers to 25/33 MVA, along with compatible switchgear, the replacement of switchboards, and demolition and reconstruction of the switchroom to accommodate the new equipment. The substation is independently served via two 66kV sub-transmission lines, BLTSBMH from the Brooklyn Terminal Station (BLTS) and YSWBMH from the Ballarat Terminal Station (BATS) via the Yaloak South Wind Farm (YSW). A layout of the substation can be seen in figure 14.

FIGURE 14 BMH ZONE SUBSTATION AERIAL VIEW

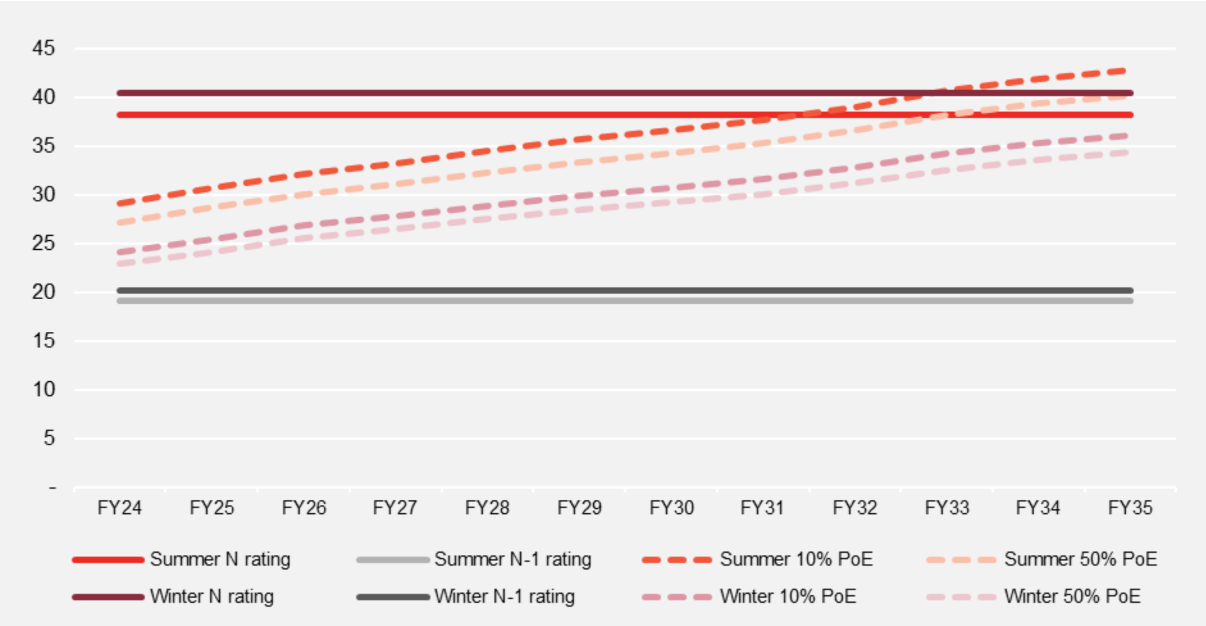


A.2.1 BMH Forecast Demand and Energy at Risk

BMH is currently suffering from a breached summer N-1 thermal rating of 20 MVA (one of two transformer failures), resulting in current and persisting energy at risk. Whilst a steady population rise is expected, the BMH zone substation does not exceed its summer N rating until FY33 within the reference period.

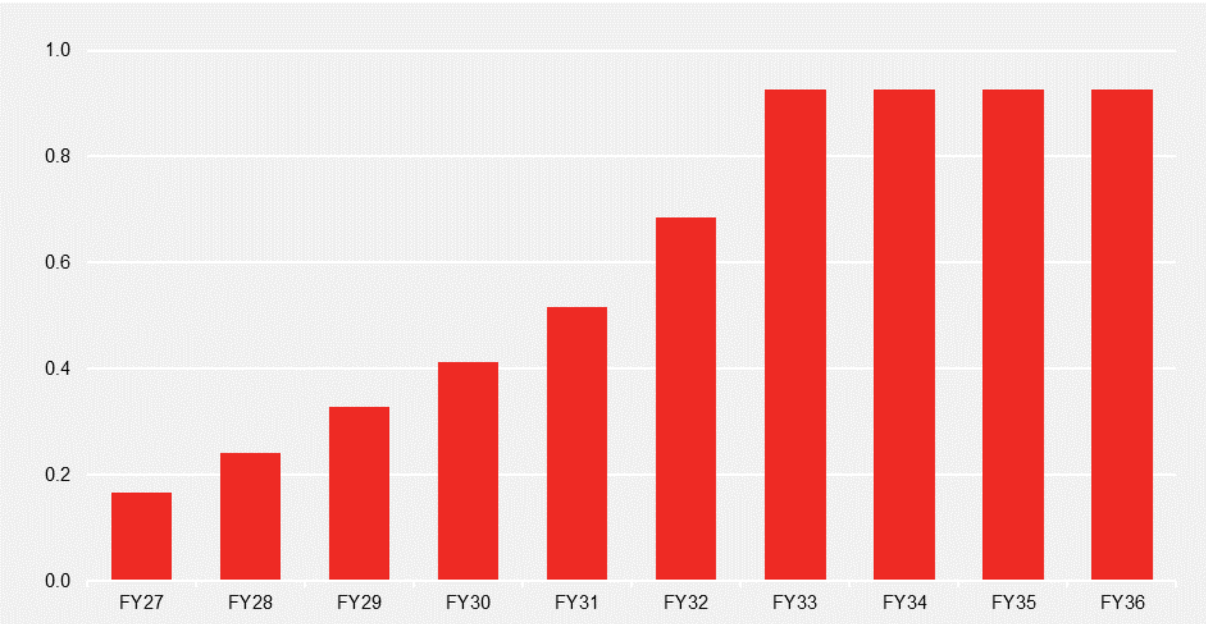
Figure 15 shows the demand forecast at BMH between FY24 and FY35.

FIGURE 15 BMH ZONE SUBSTATION DEMAND FORECAST



Without augmentation, BMH will remain exposed to the risk of unsupplied energy in the N-1 instance. Figure 16 shows the quantity and value of expected unserved energy at BMH.

FIGURE 16 BMH EXPECTED UNSERVED ENERGY (MWH)



A.3 Melton (MLN) zone substation

MLN is located near to the city centre of Melton and is one of the highest growth zone substations within this business case. MLN supplies the domestic, industrial and commercial area of Melton extending into surrounding urban areas of Mt Cottrell, Deer Park, Tarneit and Caroline Springs.

MLN comprises two 33 MVA 66/22kV transformers and one 25/33 MVA transformer supplying the 22 kV buses. Capacity expansion of MLN is considered unviable due to a combination of equipment ratings and space constraints.

The substation is independently served via two 66kV sub-transmission lines, DPTSMLN1 and DPTSMLN2, which both terminate at MLN. A layout of the substation can be seen in figure 17.

FIGURE 17 MLN ZONE SUBSTATION AERIAL VIEW

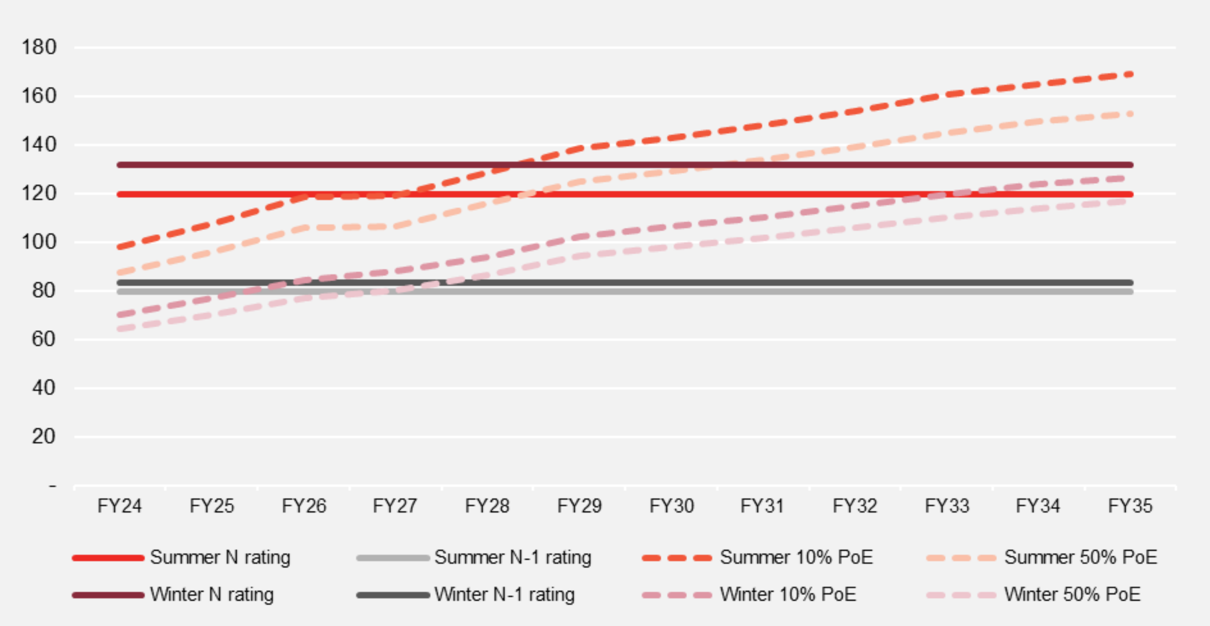
A.3.1 MLN forecast demand and energy at risk

MLN had breached its summer N-1 thermal rating of 80 MVA (one of three transformer failures) in FY24, resulting in current and persisting energy at risk. Given the sharp population projections for the Melton region, it is forecast that MLN will breach its N rating at a 10 per cent probability of exceedance (PoE) in FY29, with the 50 per cent PoE shortly following in FY30.

Given MLN is an ongoing constraint, it was included in our 2023 Distribution Annual Planning Report (DAPR). The N-1 capacity exceedance at MLN was identified and a preferred augmentation proposed; to build a new Mount Cottrell (MTC) zone substation as early as possible and transfer load at risk away from MLN.

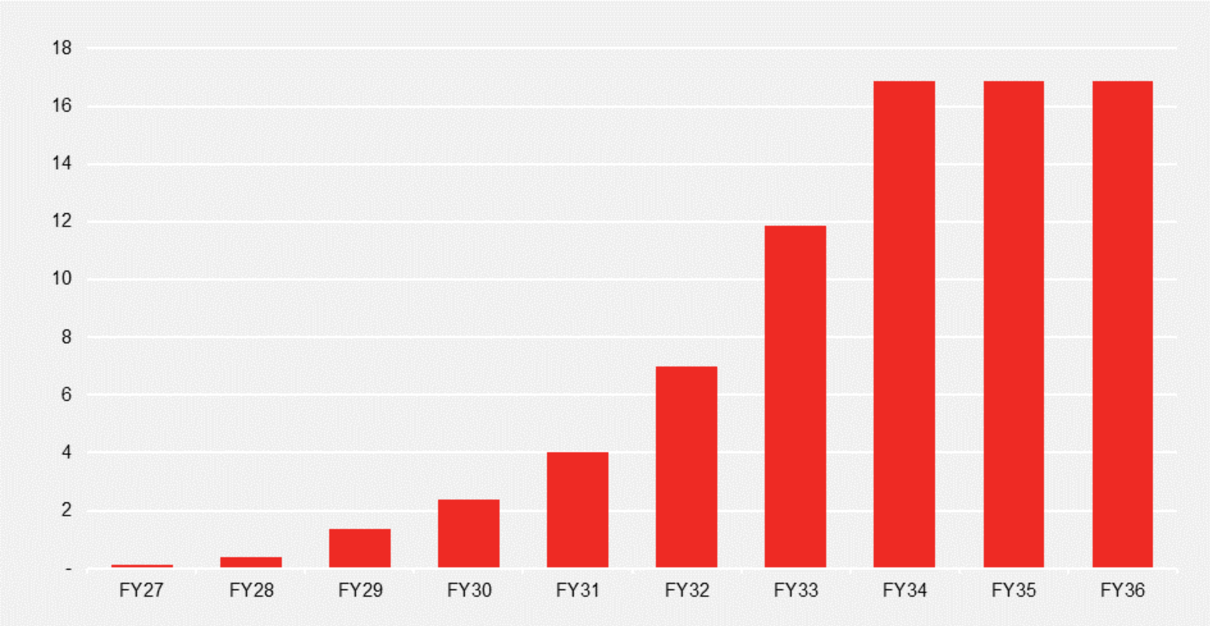
The demand forecasts shown in figure 18 below includes MLN load transfers to the newly constructed MTC before Mount Cottrell reaches capacity and can no longer offload further MLN load growth.

FIGURE 18 MLN ZONE SUBSTATION DEMAND FORECAST



Without augmentation, MLN will remain exposed to the risk of unsupplied energy in the N-1 instance. Figure 19 shows the quantity and value of expected unserved energy at MLN.

FIGURE 19 MLN EXPECTED UNSERVED ENERGY (MWH)



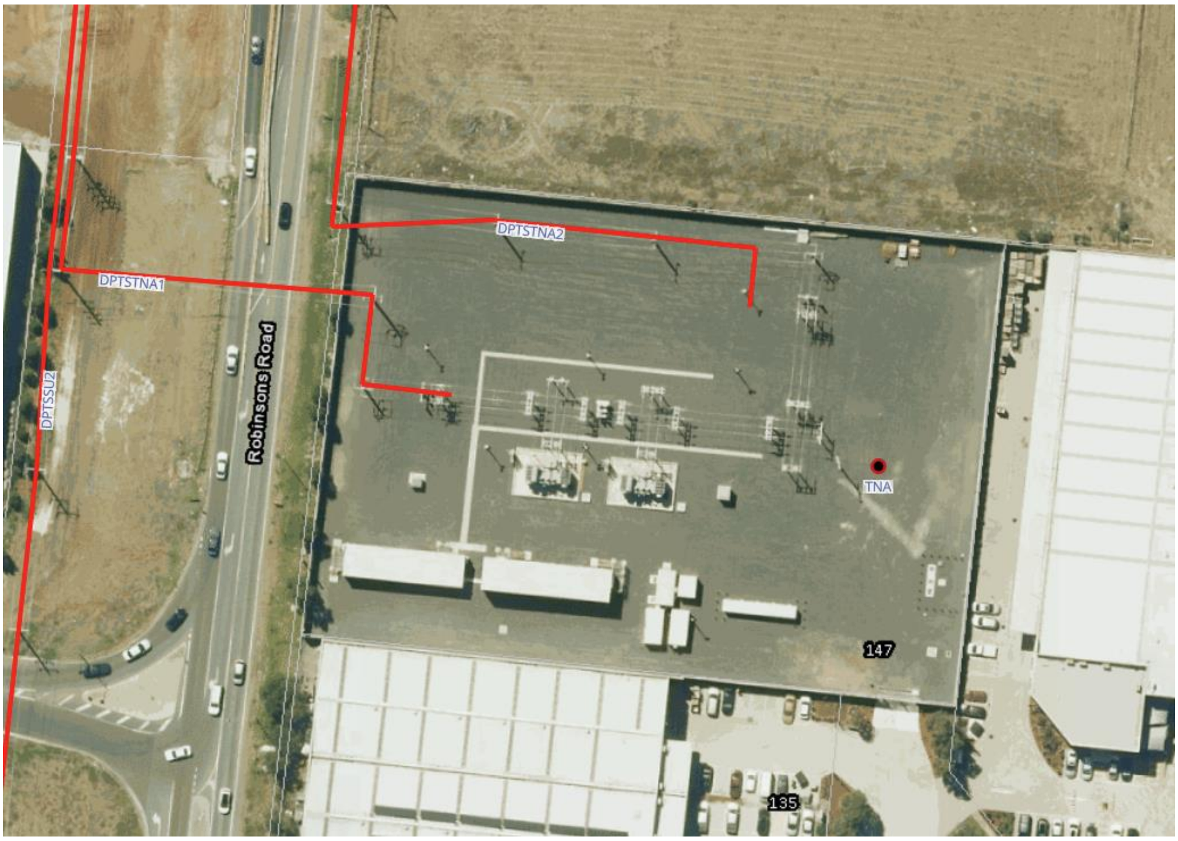
A.4 Truganina (TNA) zone substation

TNA is located within an existing industrial precinct just within the rural-urban fringe of far west Melbourne. TNA largely serves the surrounding industrial activities and the residential suburbs of Derrimut and Deer Park with its three 25/33 MVA transformers.

Capacity expansion of TNA is considered unviable due to technical challenges and land constraints which are expected to exaggerate project costs.

The substation is independently served via two 66kV sub-transmission lines, DPTSTNA1 and DPTSTNA2, which both terminate at TNA. A layout of the substation can be seen in figure 20.

FIGURE 20 TNA ZONE SUBSTATION AERIAL VIEW

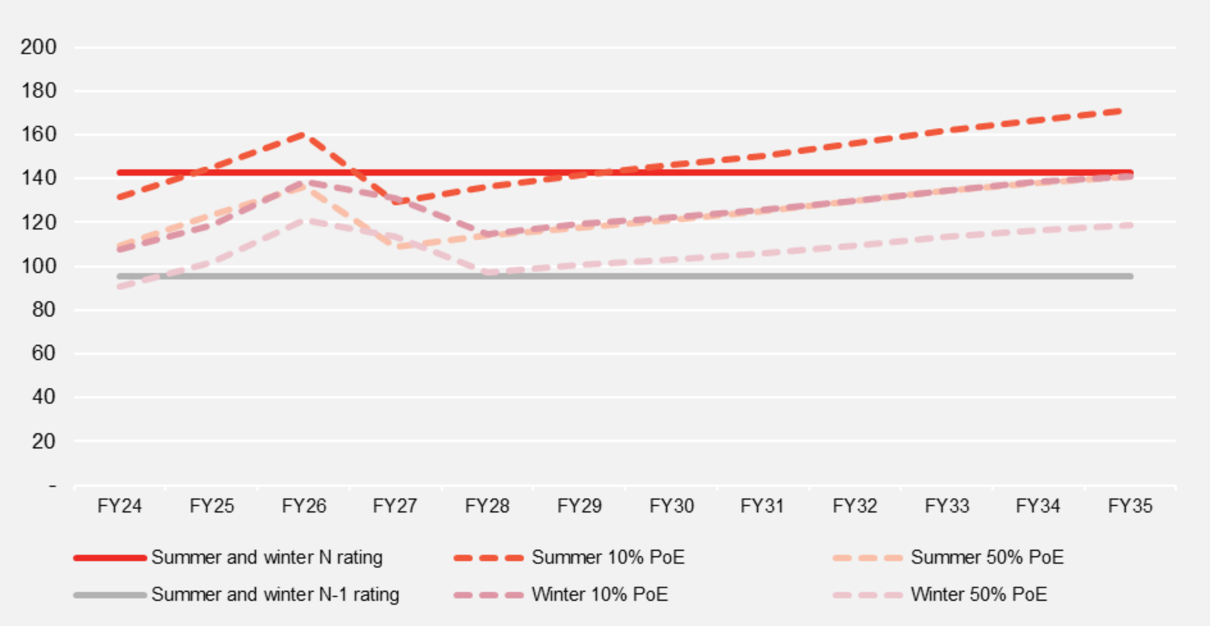


A.4.1 TNA forecast demand and energy at risk

TNA has breached the N-1 thermal rating of 95 MVA (one of three transformer failures) prior to the reference period, resulting in significant current and enduring energy at risk. It is forecast that TNA will breach its summer N rating at the beginning of the regulatory period; 10 per cent probability of exceedance (PoE) in FY27.

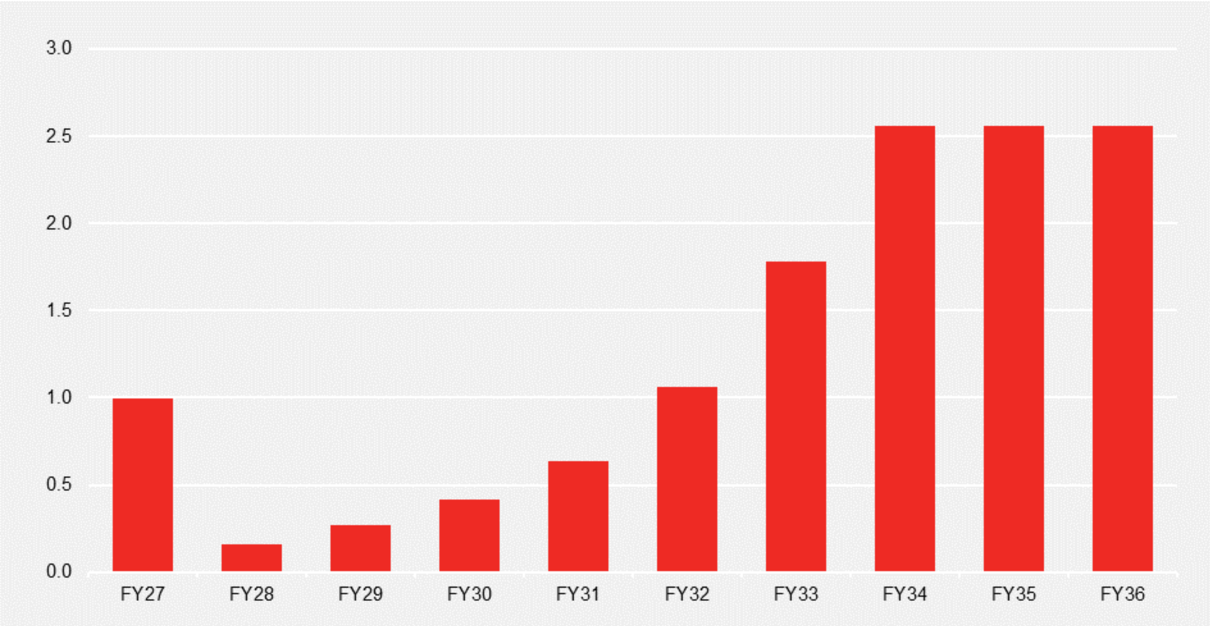
The demand forecast shown in Figure A-8 below includes significant load transfers from TNA to the newly constructed MTC in FY28; hence, TNA's reduced demand levels after FY28. The zone substation is exposed to energy at risk above the N-1 rating even after MTC transfers in FY28, indicating the new MTC zone substation alone does not address all energy at risk in the network.

FIGURE 21 TNA ZONE SUBSTATION DEMAND FORECAST



Without augmentation, TNA will remain exposed to the risk of unsupplied energy in the N-1 instance, breached throughout the entirety of the reference period. Figure 22 depicts the weighted energy at risk and total value of expected unserved energy at TNA.

FIGURE 22 TNA EXPECTED UNSERVED ENERGY (MWH)



A.5 Laverton (LV) zone substation

LV is located within an existing, large residential zoning in the northeast of the Wyndham LGA. LV largely serves the surrounding suburbs of Laverton, Williams Landing, Altona, Seabrook and Point Cook with its three 25/33 MVA transformers.

Capacity expansion of LV is considered unviable due to land constraints (see Photo B-5).

The substation is independently served via two 66kV sub-transmission lines, ATSLV (directly from ATS) and LVAWT (from ATS, through AWT switching station), which both terminate at LV.

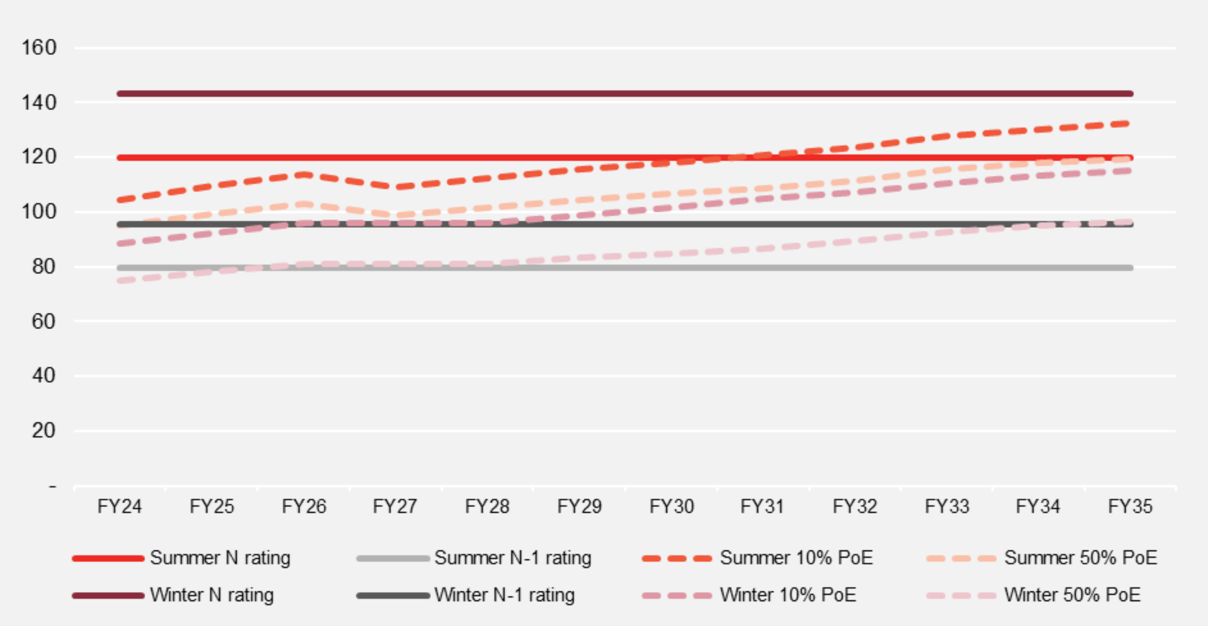
FIGURE 23 LV ZONE SUBSTATION AERIAL VIEW

A.5.1 LV forecast demand and energy at risk

LV has breached the N-1 thermal rating of 80 MVA (one of three transformer failures) prior to the reference period, resulting in significant current and enduring energy at risk. It is forecast that LV will breach its N rating after the regulatory period; 10 per cent probability of exceedance (PoE) in FY32, with the 50 per cent PoE following in FY35.

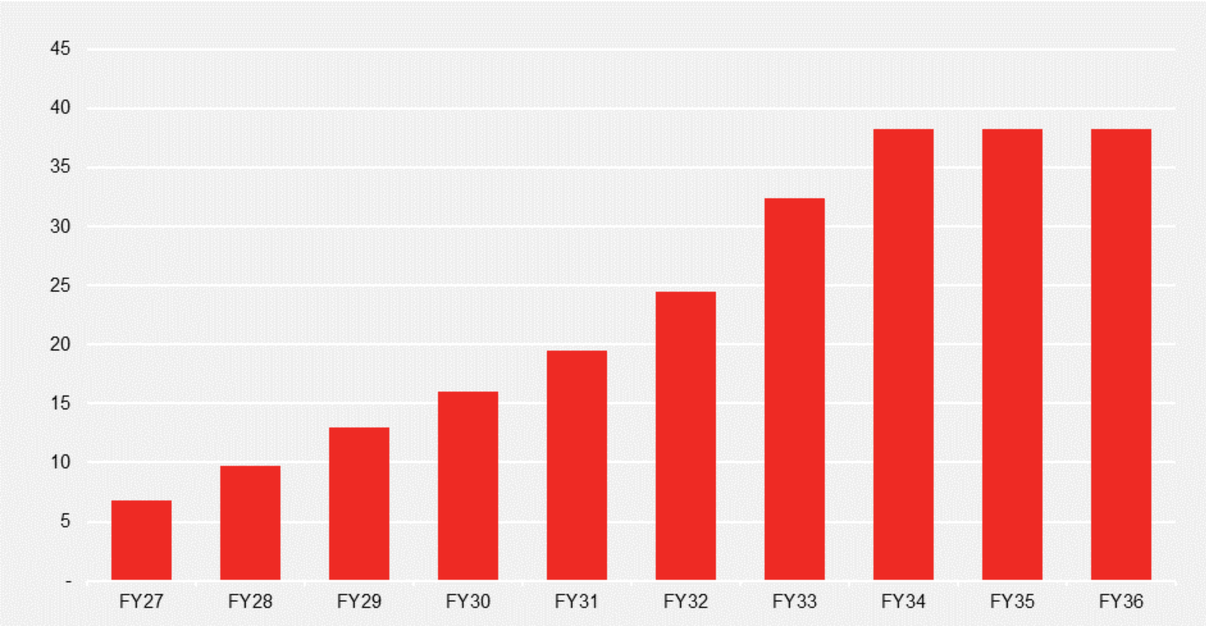
The demand forecast shown in figure 24 below includes significant load transfers from LV to the newly constructed MTC in FY28; hence, LV's reduced demand levels after FY28. Whilst the demand forecast does not breach the N rating of LV during the reference period graphed, the zone substation is exposed to energy at risk above the N-1 rating even after MTC transfers in FY28, indicating the new MTC zone substation alone does not address all energy at risk in the network.

FIGURE 24 LV ZONE SUBSTATION DEMAND FORECAST



Without augmentation, LV will remain exposed to the risk of unsupplied energy in the N-1 instance, breached in FY23. figure 25 depicts the weighted energy at risk and total value of expected unserved energy at LV.

FIGURE 25 LV EXPECTED UNSERVED ENERGY (MWH)

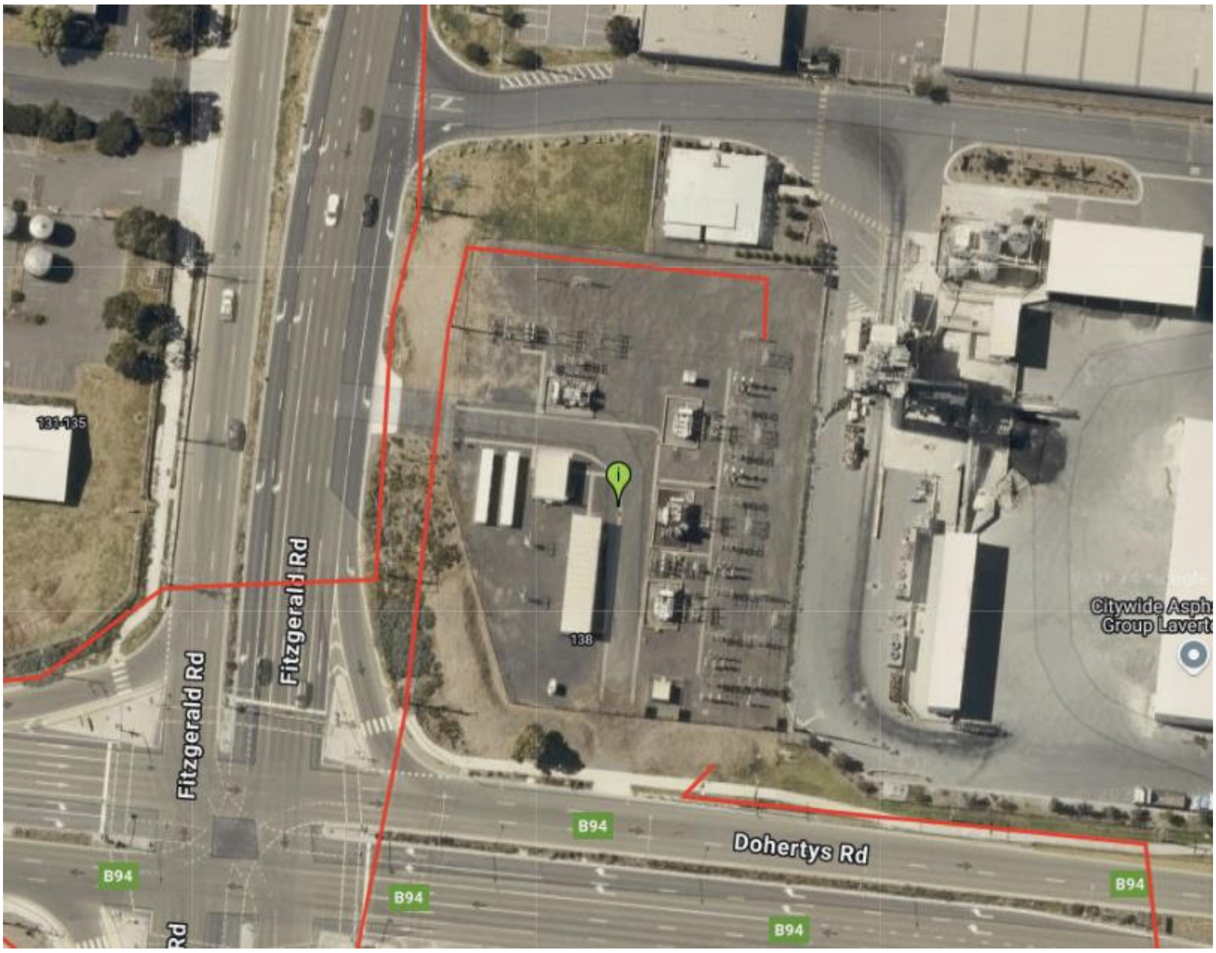


A.6 Laverton North (LVN) zone substation

LVN is located just north of LV, within an existing, large industrial/commercial zoning in the eastern boarder of the Melton and Wyndham LGAs. LVN largely serves the surrounding suburbs of Laverton North, Laverton, Truganina, and Altona North with its three 25/33 MVA transformers and one 20/30 MVA transformer supplying an industrial customer at 11kV.

The substation is independently served via two 66kV sub-transmission lines, LVNATS (directly from ATS) and BLTSLVN (directly from BLTS), which both terminate at LVN.

FIGURE 26 LVN ZONE SUBSTATION AERIAL VIEW

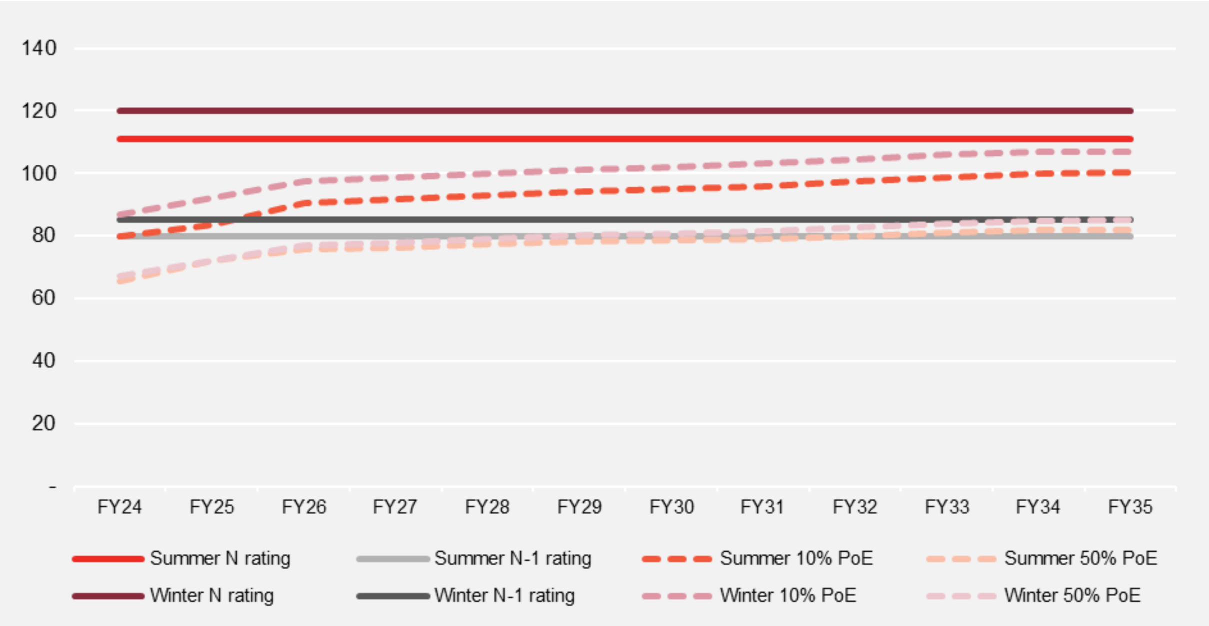


A.1.1 LVN forecast demand and energy at risk

LVN breaches its winter N-1 thermal rating of 85 MVA (one of three transformer failures) at the beginning of FY25, resulting in significant current and enduring energy at risk throughout the reference period. Whilst LVN is not expected to exceed its N ratings during the reference period, customer demand gradually increases over the reference period.

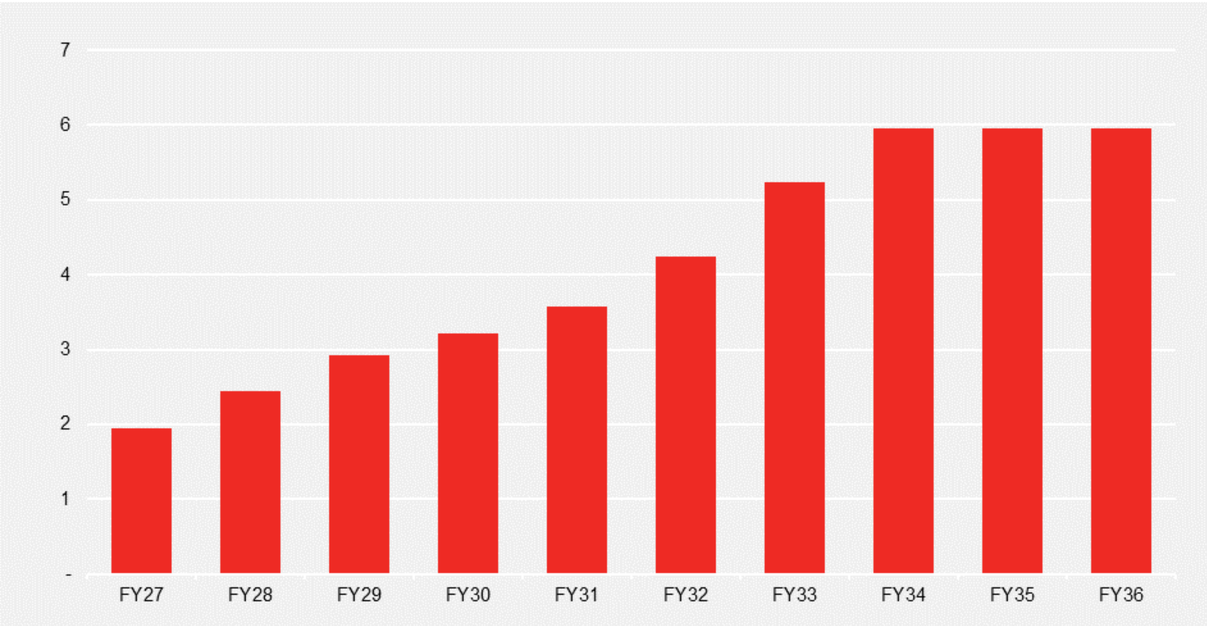
The demand forecast shown in figure 27 shows the substation's exposure to energy at risk above the N-1 rating throughout the reference period.

FIGURE 27 LVN ZONE SUBSTATION DEMAND FORECAST



Without augmentation, LVN will remain exposed to the risk of unsupplied energy in the N-1 instance, breached in FY25. Figure 28 depicts the weighted energy at risk and total value of expected unserved energy at LVN.

FIGURE 28 LVN EXPECTED UNSERVED ENERGY (MWH)



A.7 Werribee (WBE) zone substation

WBE is located within an existing, large residential precinct in central Wyndham. WBE largely serves the surrounding suburbs of Werribee, Werribee South, Wyndham Vale, Point Cook, and Hoppers Crossing with its two 20/33 MVA and one 25/33 MVA transformers operating at 66/22kV.

Capacity expansion of WBE is considered unviable due to a combination of limited equipment ratings and land constraints.

The substation is independently served via two 66kV sub-transmission lines, ATSWBE (directly from ATS) and HCPWBE (from ATS, through HCP switching station), both of which terminate at WBE.

In 2022, Wyndham City Council announced development plans for new industrial precincts including:

- the Werribee South and Wyndham Vale industrial precincts, which are identified as future industrial land in the West Growth Corridor Plan
- the Southwest Quarries that contain Mambourin East and Werribee Junction industrial precincts and identified as future industrial land in the West Growth Corridor Plan.

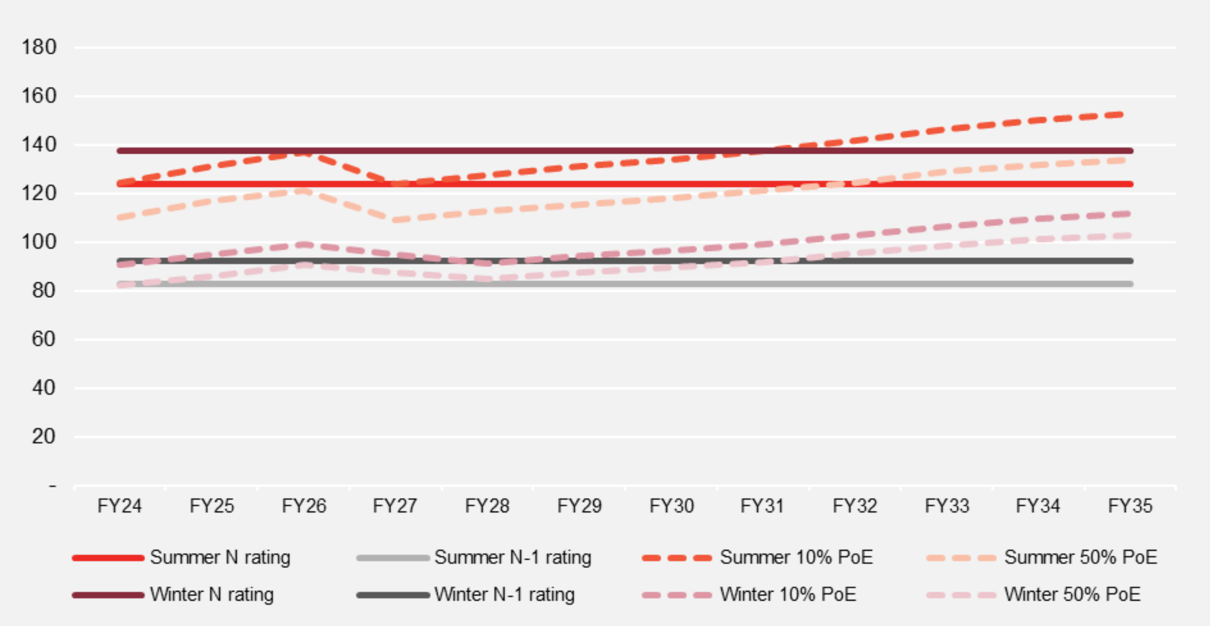
Due to the unconfirmed nature and delayed progress of these developments, current energy demand forecasts do not account for prospective loads that may result from these precincts. A layout of the substation can be seen in figure 29 below

FIGURE 29 WBE ZONE SUBSTATION AERIAL VIEW

A.7.1 WBE forecast demand and energy at risk

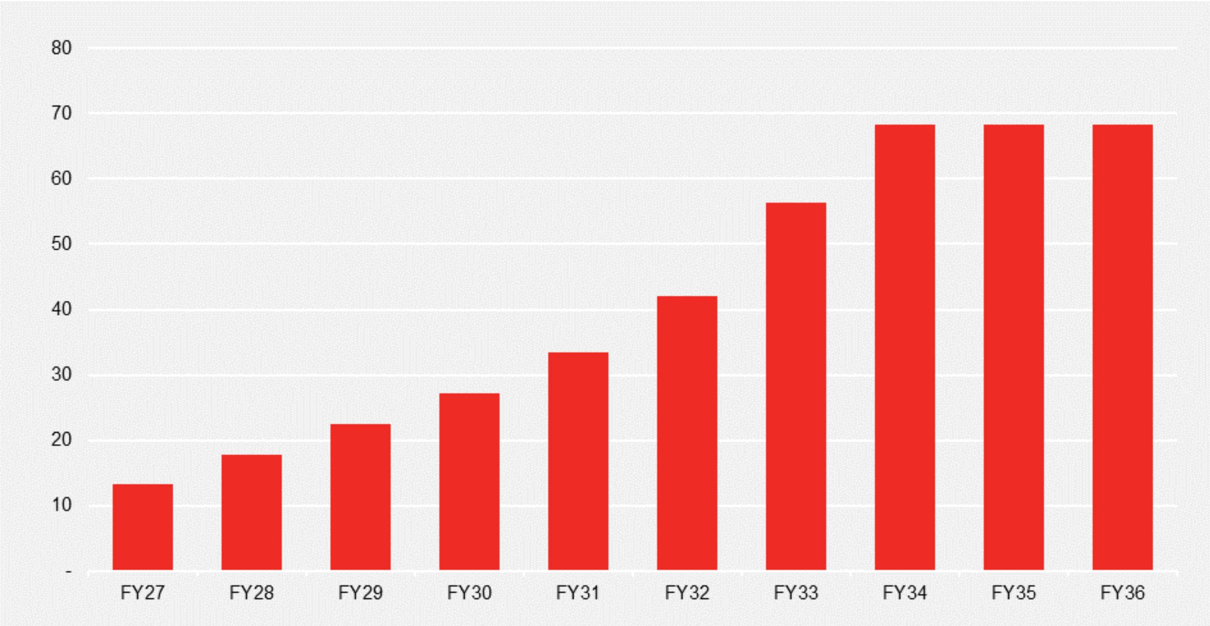
WBE has breached the N-1 thermal rating of 83 MVA (one of three transformer failures) prior to the reference period, resulting in current and enduring energy at risk. It is forecast that WBE will breach its N rating, in the first instance, by 10 per cent PoE in FY25 (slightly alleviated by offloading to MTC in FY28) and then rising above the N rating again throughout the remainder of the reference period.

FIGURE 30 WBE ZONE SUBSTATION DEMAND FORECAST



Without augmentation, WBE will remain exposed to the risk of unsupplied energy in both the N-1 an N rating instances. Figure 31 depicts the weighted energy at risk and total value of expected unserved energy at WBE.

FIGURE 31 WBE EXPECTED UNSERVED ENERGY (MWH)



B

APPENDIX

INDIVIDUAL PROJECT RISK AND TIMING

B Individual project risk and timing of preferred option

This appendix sets out further detail about the economic timing of each project within our preferred option.

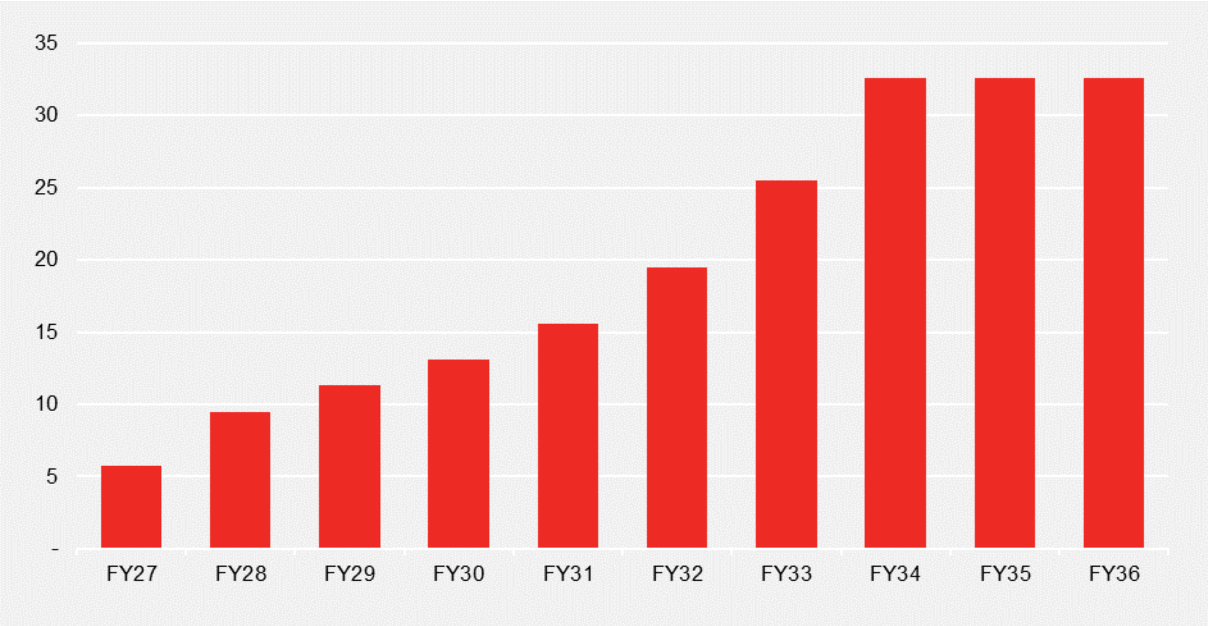
The aggregate energy at risk prior to each individual augmentation project is used to justify the project's economic timing. As one project is completed, this changes the energy at risk profile of the following project. This leads to sequential energy at risk assessments to determine the optimal timing of each project.

Sequential energy at risk assessments are undertaken prior to each augmentation, which consider the impacts of prior augmentations. These sequential energy at risk assessments are then used to determine the optimal timing of each sequenced project.

B.1 MTC third transformer

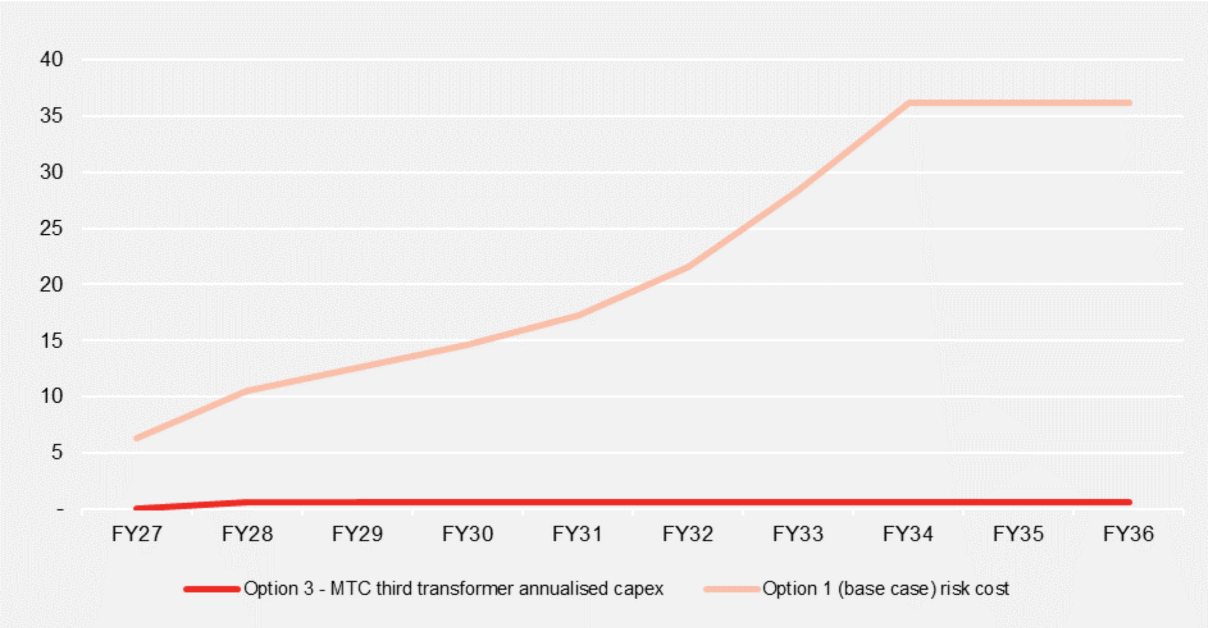
The first augmentation under our preferred option is building a third transformer at MTC. Figure 32 shows the aggregate value of expected unserved energy prior to any augmentation.

FIGURE 32 OPTION THREE: AGGREGATE VALUE OF EXPECTED UNSERVED ENERGY WITH NO AUGMENTATION ($M, 2026)



The optimal timing for the third transformer at MTC is to be operational in FY27, as described in figure 33 below.

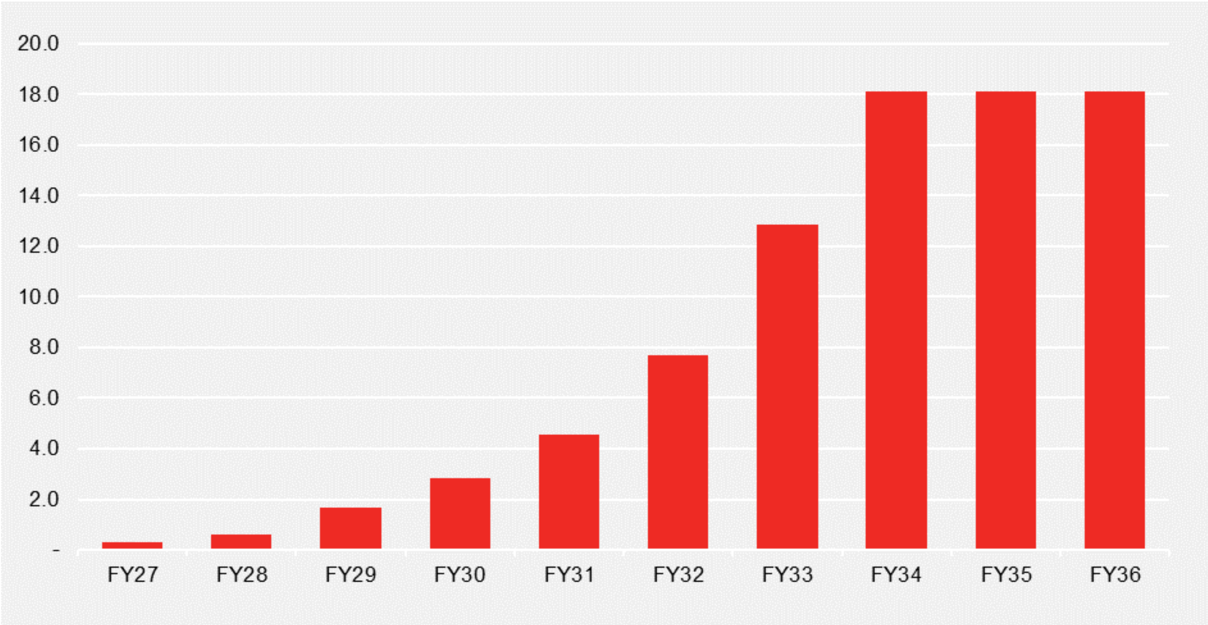
FIGURE 33 TIMING OF MTC THIRD TRANSFORMER ($M, 2026)



B.2 BMH rebuild

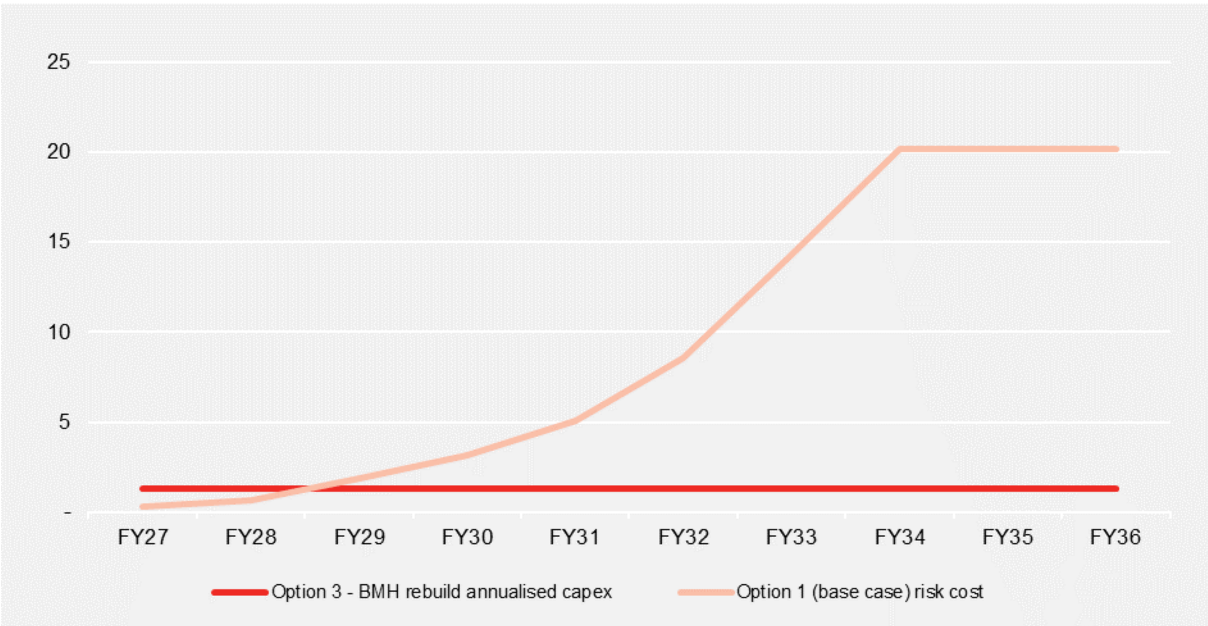
The second augmentation under our preferred option is rebuilding our BMH zone substation. Figure 34 shows the aggregate value of expected unserved energy prior to any augmentation.

FIGURE 34 OPTION THREE: AGGREGATE VALUE OF EXPECTED UNSERVED ENERGY AFTER MTC THIRD TRANSFORMER (MWH)



The optimal timing for rebuilding our BMH zone substation is to be operational by in FY29, as described in figure 35 below.

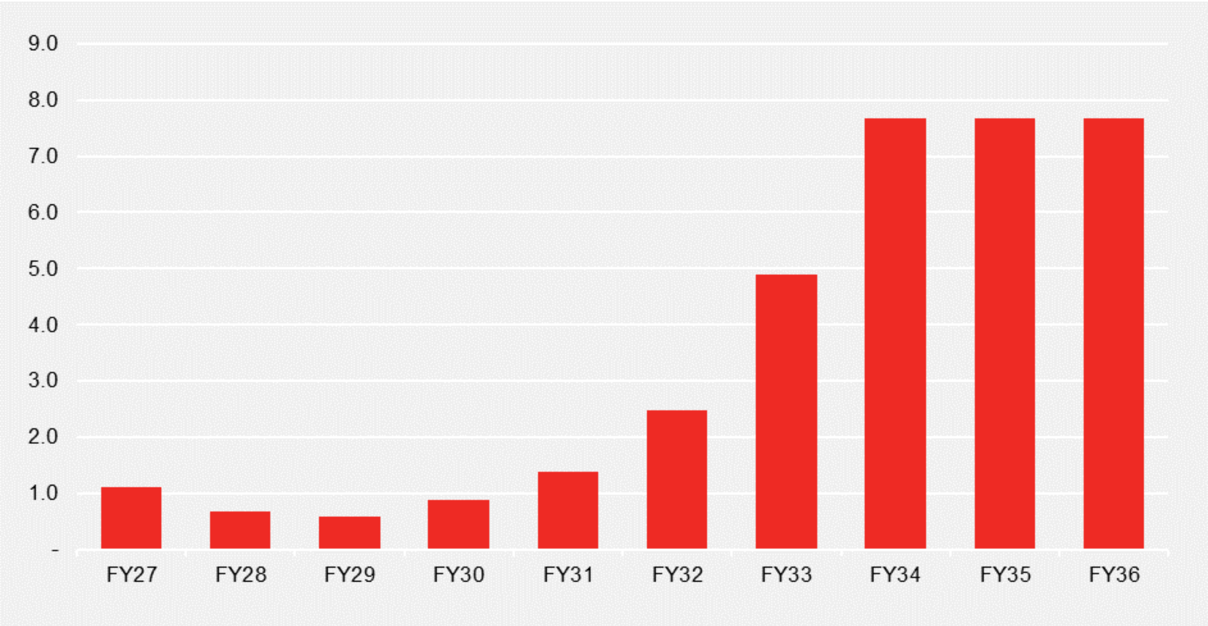
FIGURE 35 TIMING OF BMH REBUILD ($M, 2026)



B.3 RBE zone substation

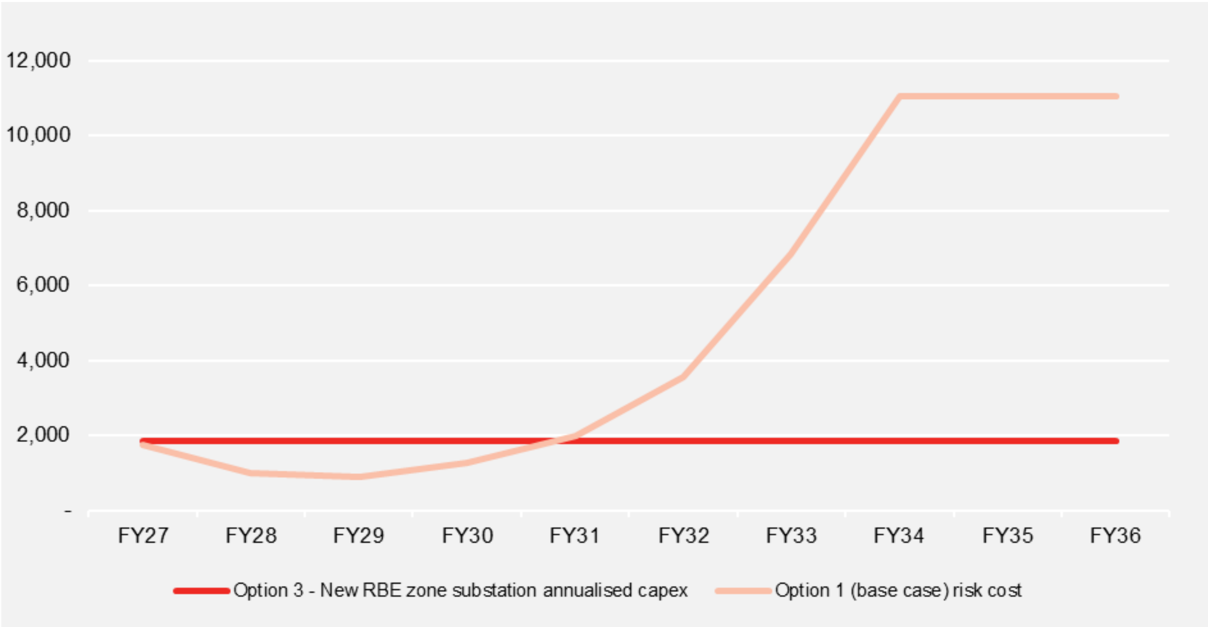
The third augmentation under our preferred option is building our new RBE zone substation. Figure 36 shows the aggregate value of expected unserved energy prior to any augmentation.

FIGURE 36 OPTION THREE: AGGREGATE VALUE OF EXPECTED UNSERVED ENERGY AFTER BMH REBUILD (MWH)



The optimal timing for building our RBE zone substation is to be operational by FY31, as described in figure 37 below.

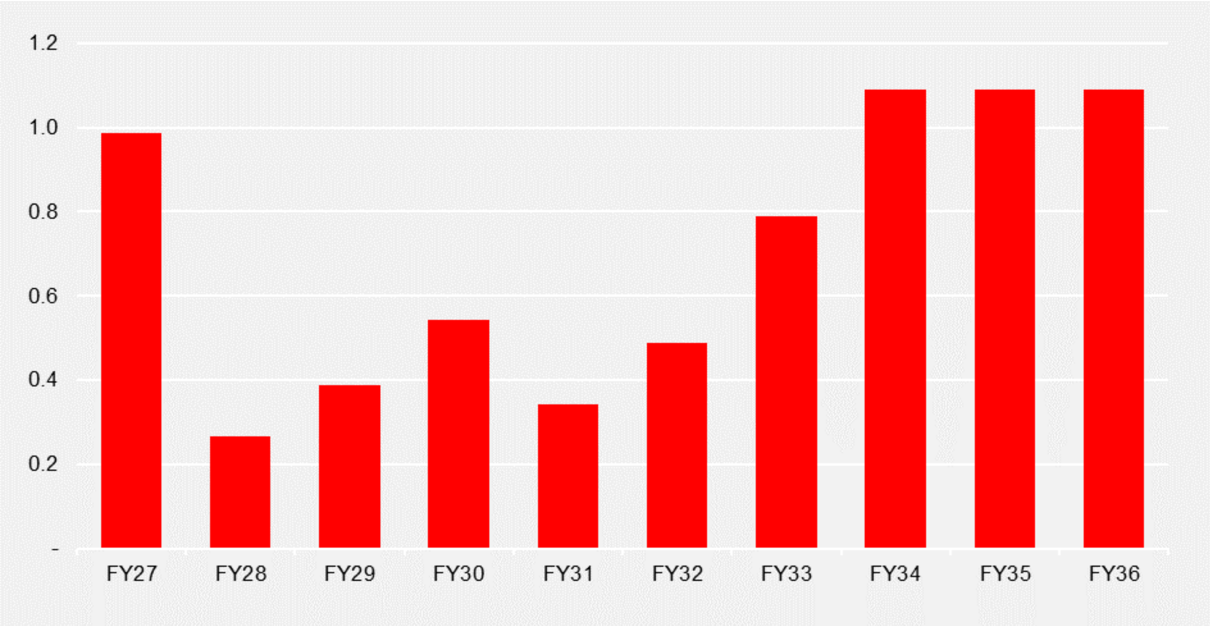
FIGURE 37 TIMING OF RBE ZONE SUBSTATION ($M, 2026)



B.4 PCK zone substation

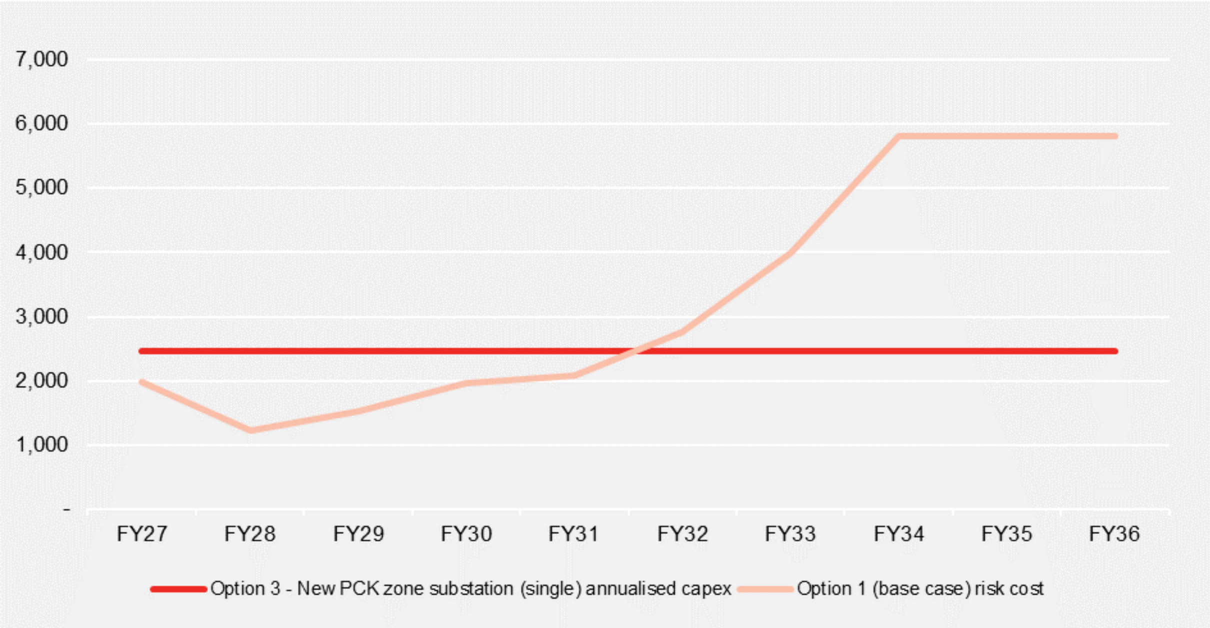
The fourth augmentation under our preferred option is building our new PCK zone substation. Figure 38 shows the aggregate value of expected unserved energy prior to any augmentation.

FIGURE 38 OPTION THREE: AGGREGATE VALUE OF EXPECTED UNSERVED ENERGY AFTER RBE ZONE SUBSTATION (MWH)



The optimal timing for building our PCK zone substation is to be operational FY32, as described in figure 39 below.

FIGURE 39 TIMING OF PCK ZONE SUBSTATION ($M, 2026)



C
APPENDIX
ANALYSIS METHODOLOGY

C Analysis methodology

The project need primarily focuses on balancing customer demands and regional transformer capacity; as such, the criteria for assessing project need is dependent on:

- the load characteristics of zone substations
- the growth in demand forecasts leading to equipment rating exceedances
- the value of any resulting expected unserved energy.

The methodologies of these criteria are described below.

C.1 Load characteristics and demand forecasts

Zone substations and terminal stations can be categorised by:

- a nameplate and cyclic rating for when all components are in service in a normal operating configuration (N-1). Exceedance of N-1 ratings removes operational redundancy and is a constraint when the rating is exceeded, and network needs are such that maintenance or switching for other reasons cannot be carried out as a result of the constraint. N-1 constraints also increase the likelihood of impacts to customers in the event of a fault on a constrained system. In terminal stations and zone substations, this is typically constrained by the reliability of transformers where N-1 represents a single transformer being inactive and lowering the transformer capacity of a site
- a nameplate and cyclic rating for when the operating configuration of a substation where no more primary equipment can be taken out of service, intentionally or otherwise, without causing an interruption of supply to connected customers (N). In terminal stations and zone substations, this is defined as the normal operating configuration where all transformers are active.

In determining the need, the demand forecasts consider the weather conditions and integrate the impact of new technologies (solar PV, batteries, electric vehicles). Historical demand is based on actual maximum and minimum and demand values recorded across the distribution network. Historical feeder demands are trended forward using the underlying feeder growth rate including known or predicted loads that are forecast for connection.

The demand forecast provides both the 50 per cent and the 10 per cent PoE demand. The 50 per cent PoE demand presents the peak demand based on a one-in-two-season (summer and winter). The actual demand in any given year has a 50 per cent probability of being higher than the 50 per cent demand forecast. The 50 per cent percentile forecast is therefore considered the 'most-likely' level of demand, bearing in mind that actual demand will vary depending on temperature and other factors. It is often referred to as 50 per cent PoE. Similarly, the 10 per cent PoE demand forecast relates to maximum demand corresponding to an extreme maximum temperature that will be exceeded, on average, once every ten years.

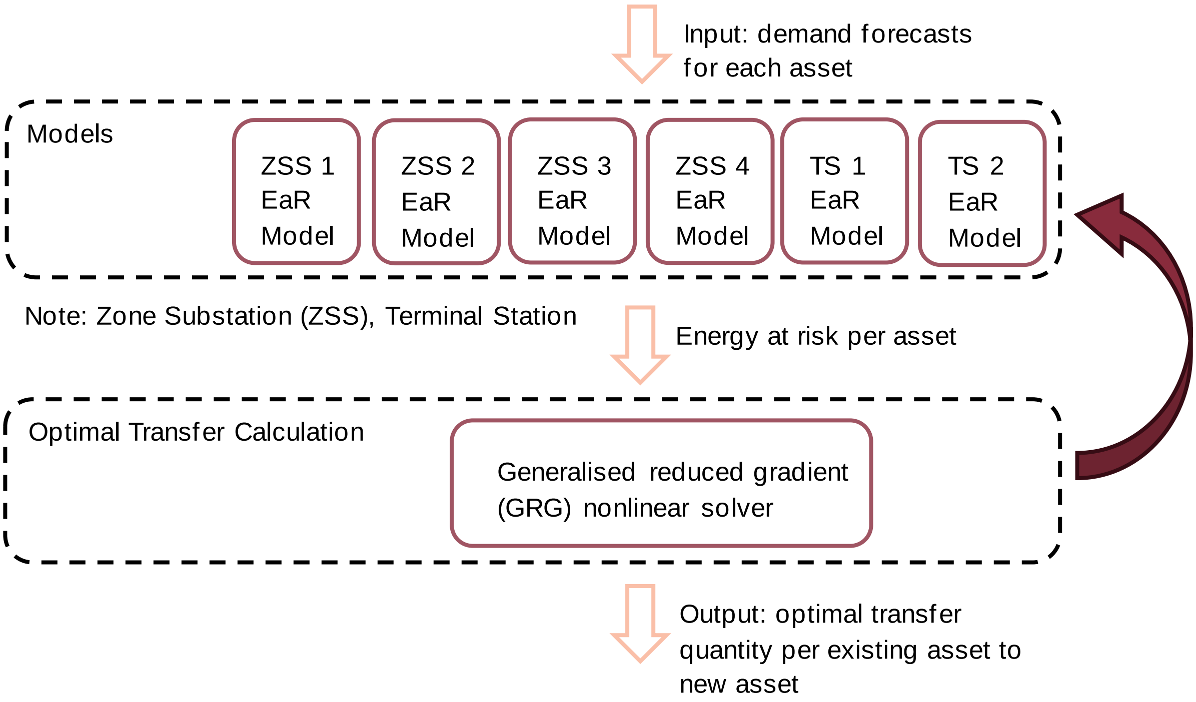
We apply a 30:70 weighting of the 10 per cent PoE and 50 per cent PoE demand forecast in the assessment of investment requirements.

C.2 Modelling methodology

C.2.1 Energy at risk

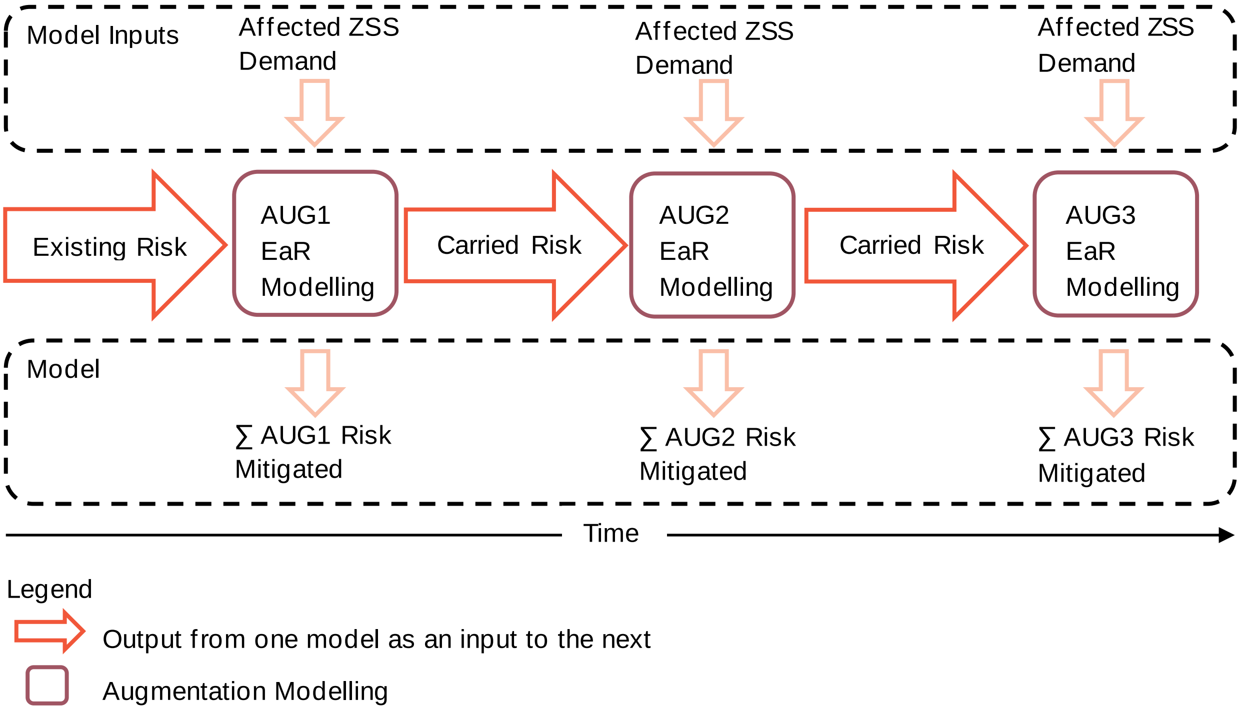
This business case takes an iterative approach to energy at risk modelling to more precisely account for progressive regional development. A particular augmentation solution will accept a variety of transfers from all other zone substations with load at risk. To calculate the optimal quantity of each transfer, a nonlinear solver is used which is linked to each energy at risk model. Figure 40Figure 40 visualises this model method.

FIGURE 40 OPTIMAL TRANSFER MODELLING



The optimal transfers, once devised, are reinputted into the energy at risk models for the augmentation solution in question and the total risk mitigated is taken as an output. The balance of energy at risk resulting from the first augmentation (in this case, augmentation 1 (AUG1)), is taken as the new status quo for the proceeding augmentation (AUG2). This process is repeated for any following augmentation projects. Figure 41 visualises this process.

FIGURE 41 ENERGY AT RISK MODELLING METHODOLOGY



A separate energy at risk model is created for each zone substation which would be affected by any given augmentation. A balance of transfers is performed between each asset and the resulting energy at risk is summed to produce a total risk mitigated attributable to the augmentation.

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