Tarneit supply area

PAL BUS 6.03 - Tarneit supply area - Jan2020 - Public

Regulatory proposal 2021–2026

Powercor

January 2020

Contents

1 Overview

Business	Powercor
Title	Tarneit supply area
Project ID	PAL BUS 6.03 - Tarneit supply area - Jan2020 - Public
Category	Augmentation
Identified need	The identified need is to provide a reliable supply of electricity to customers in our Werribee and Truganina supply areas as the energy at risk at our existing zone substations increases with forecast residential growth and development
Recommended option	Establish the new Tarneit (**TRT**) zone substation
Proposed start date	2023
Proposed commission date	2025
Supporting documents	1. PAL MOD 6.06 - TRT supply area - Jan2020 - Public 2. PAL ATT102 - CulterMerz - Review of demand management - Feb2019 - Public 3. PAL ATT135 - MPA - Wyndham North development contributions plan - Jul2017 - Public 4. PAL RIN001 - Workbook 1 - Forecast templates - Jan2020 - Public

Source: Powercor

The western suburbs of Melbourne are growing fast, and large greenfield developments and significant residential, commercial and industrial load growth is forecast to continue. This growth includes the supply area surrounding Tarneit, which is largely serviced by our existing Werribee and Truganina zone substations.

This business case is focused on several options to ensure we continue to provide a reliable supply of electricity to these customers. For the reasons outlined in this document, our preferred network solution is to establish a new TRT zone substation.

The forecast capital and operating expenditure requirements for the 2021–2026 regulatory period, for the preferred option, are outlined in table 1. These forecasts have been developed in calendar year terms, and converted to financial years in our consolidated expenditure modelling following changes to our reporting period (as required by the Victorian Government and the Australian Energy Regulator).

Table 1 Expenditure forecasts for preferred option ($ million, 2019)

Expenditure forecast	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capital expenditure	-	0.1	4.5	9.8	5.4	19.8
Operating expenditure	-	-	0.0	0.0	0.1	0.2
Total	**-**	**0.1**	**4.5**	**9.8**	**5.5**	**19.9**

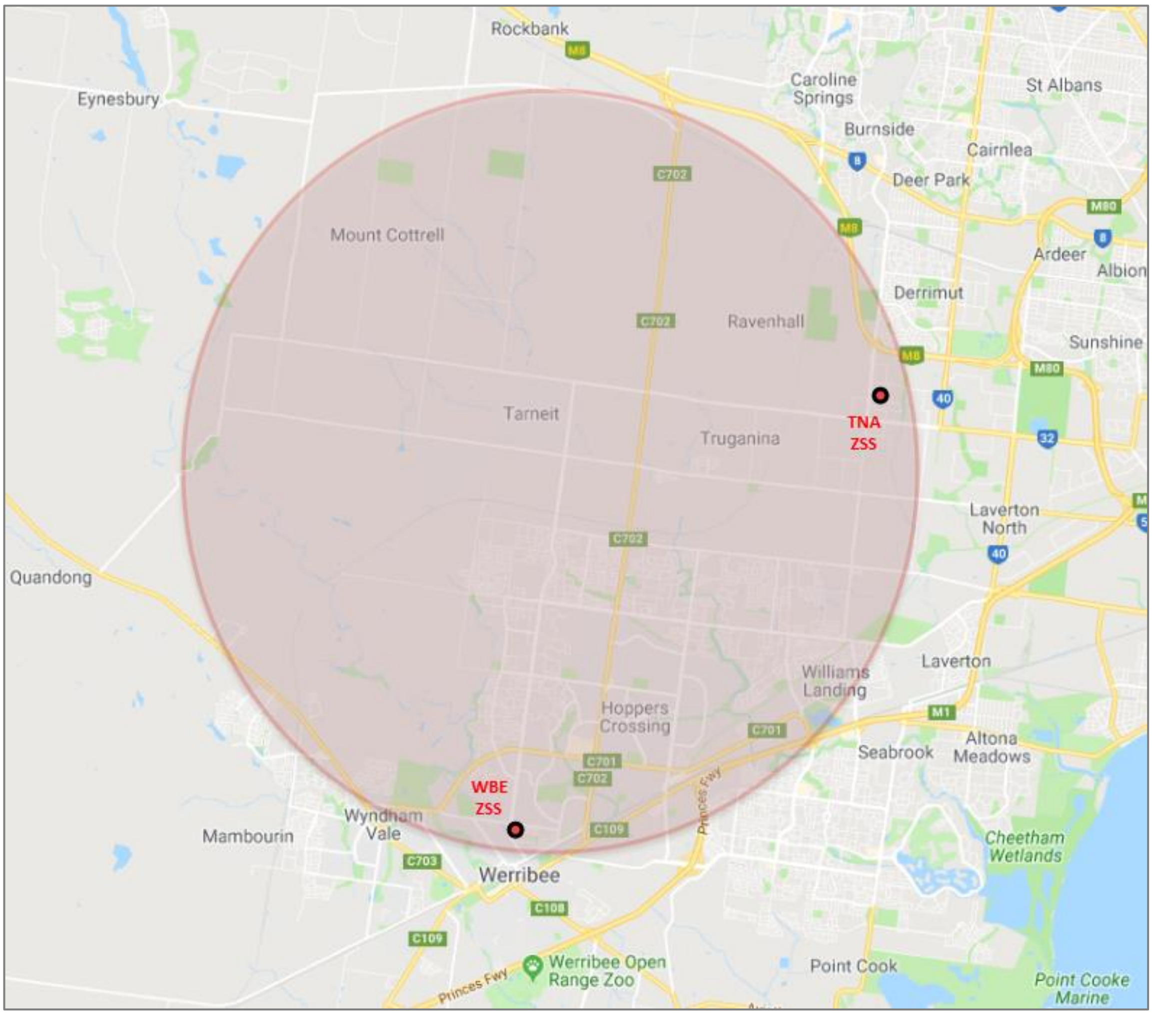
Source: Powercor

2 Background

Our network supplies the urban growth corridor to the west of Melbourne. This includes areas currently serviced by our Truganina (**TNA**) and Werribee (**WBE**) zone substations. In total, these zone substations provide electricity to over 54,803 residential, commercial and industrial customers.

A map highlighting the relevant supply area is shown in figure 1.

Figure 1 Tarneit and western growth corridor supply area



Source: Powercor

2.1 Existing network characteristics

2.1.1 Sub-transmission and zone substations

Our WBE zone substation is served by two sub-transmission lines from the Altona West terminal station (**ATS**). It supplies the area of Werribee extending into the surrounding areas of Mt Cottrell, Wyndham Vale, Tarneit, Hoppers Crossing and Point Cook. The WBE zone substation comprises two 20/33 MVA and one 25/33 MVA transformers operating at 66/22kV.

The TNA zone substation is served by sub-transmission lines from Deer Park terminal station (**DPTS**). It supplies the area of Caroline Springs, Tarneit, Truganina and Laverton North. Currently, the TNA zone substation comprises two 25/33MVA transformers operating at 66/22 kV. It is proposed to install a third 25/33MVA transformer in 2021.

2.1.2 Distribution feeders

WBE zone substation supplies twelve 22kV distribution feeders. These feeders support a mix of urban residential customers, light industry and commercial loads. Over time, these feeders have been upgraded to higher capacity feeders to meet the demand requirements and higher density of customers in a growing area of our network.

Our TNA zone substation has the capability to supply up to twelve 22kV distribution feeders. The distribution feeders predominately supply commercial and high voltage industrial customers and are designed as high capacity feeders to meet the demand requirements of the major commercial customers.

3 Identified need

The identified need is to provide a reliable supply of electricity to customers in our Werribee and Truganina supply areas as forecast residential growth and development continue. Our load forecasts for the two existing zone substations supplying this area, and the corresponding energy at risk are discussed below.

3.1 Forecast demand

Over the years, significant residential, commercial and industrial development has occurred in our distribution territory in the western suburbs of Melbourne. This growth is expected to continue in future years. Residential and commercial growth is beginning to mature in the suburbs of Caroline Springs, Taylors Hill, Taylors Lakes, Hillside, St Albans, Sunshine, Hoppers Crossing, Laverton, Laverton North, Williams Landing, Point Cook and Werribee. However, new growth in Derrimut, Mount Cottrell, Tarneit, Ravenhall, Wyndham Vale and Truganina is creating overloading issues on existing zone substations supplying these areas.

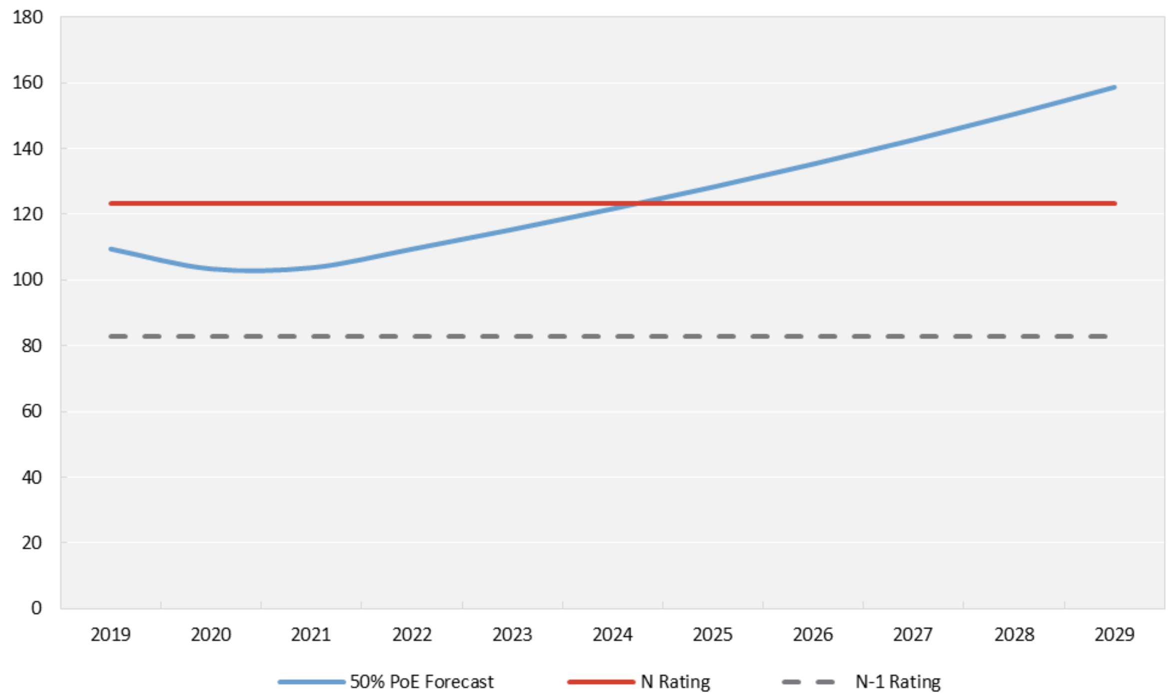
Appendix A provides more detailed information on the outlook for population growth in the western growth corridor. Appendix B outlines the strategic development plans for supplying the western growth corridor over the long term; this plan identifies the need for substantial investment in distribution infrastructure over the next 25 years.

3.1.1 Zone substation maximum demand

The section shows the maximum demand forecasts for our WBE and TNA zone substations. The emerging constraints, and the possible options for addressing these constraints, have been identified in our distribution annual planning reports (**DAPR**).

Load at our WBE zone substation currently exceeds the N-1 rating before any contingency transfers. New distribution feeders in 2019 and 2020 will transfer some of this load to our TNA zone substation, but the forecast load will still exceed the station N rating in 2024. This is shown in figure 2.

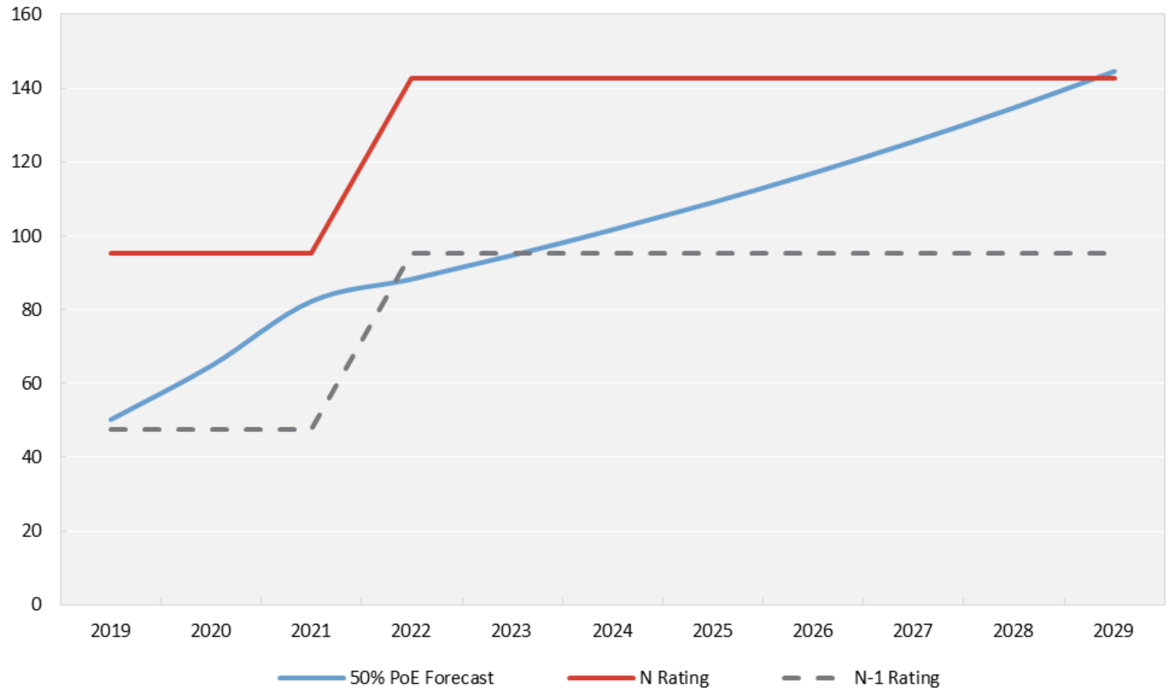
Figure 2 WBE zone substation: maximum demand at 50% probability of exceedance (MVA)



Source: Powercor

Load is also above the N-1 rating at our TNA zone substation. This follows feeder offloads from our WBE and Laverton (**LV**) zone substations in 2019 and 2020, and the planned installation of a third transformer in 2021. As shown in figure 3, forecast load growth is expected to approach the new station N rating by 2029.

Figure 3 TNA zone substation: maximum demand at 50% probability of exceedance (MVA)



Source: Powercor

3.2 Energy at risk

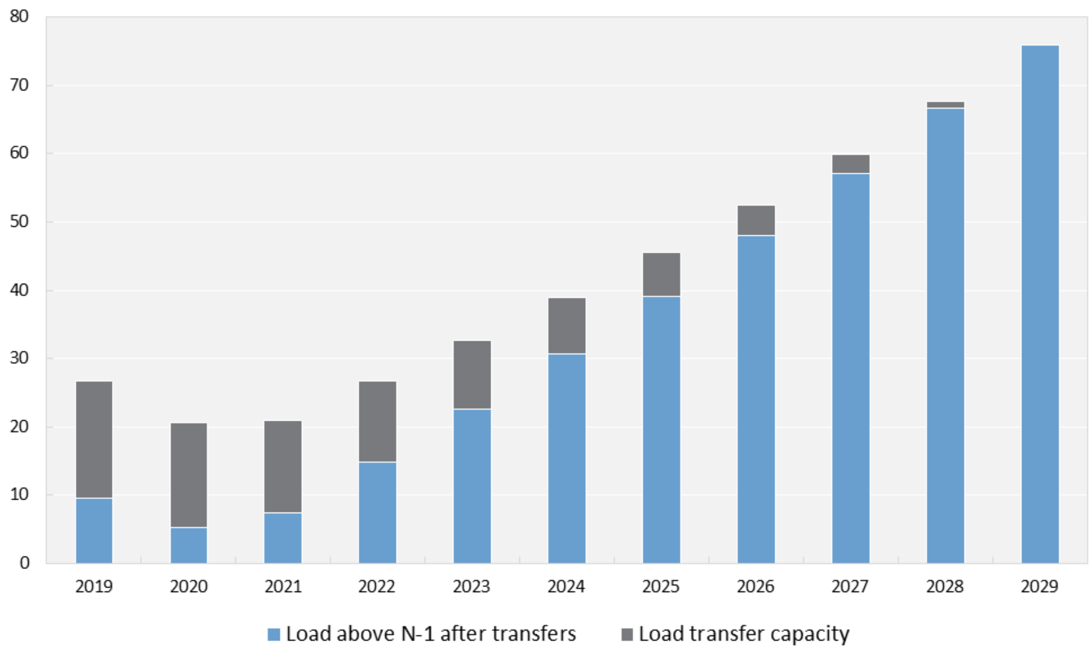
Consistent with our probabilistic planning approach, the quantity and value of energy at risk is a critical parameter in assessing prospective network investment or other action in response to an emerging constraint.

3.2.1 Load transfer capacity

The expected load above N-1 after transfers following a major outage of one of the transformers at WBE zone substation during peak demand conditions is shown in figure 4. Available load transfers are shown in the attached business case model.[1] After load transfers are established, a shortfall in capacity of approximately 48MVA is forecast in 2026 (or loss of supply for approximately 15,000 customers).

[1] PAL MOD 6.06 - TRT supply area - Jan2020 - Public

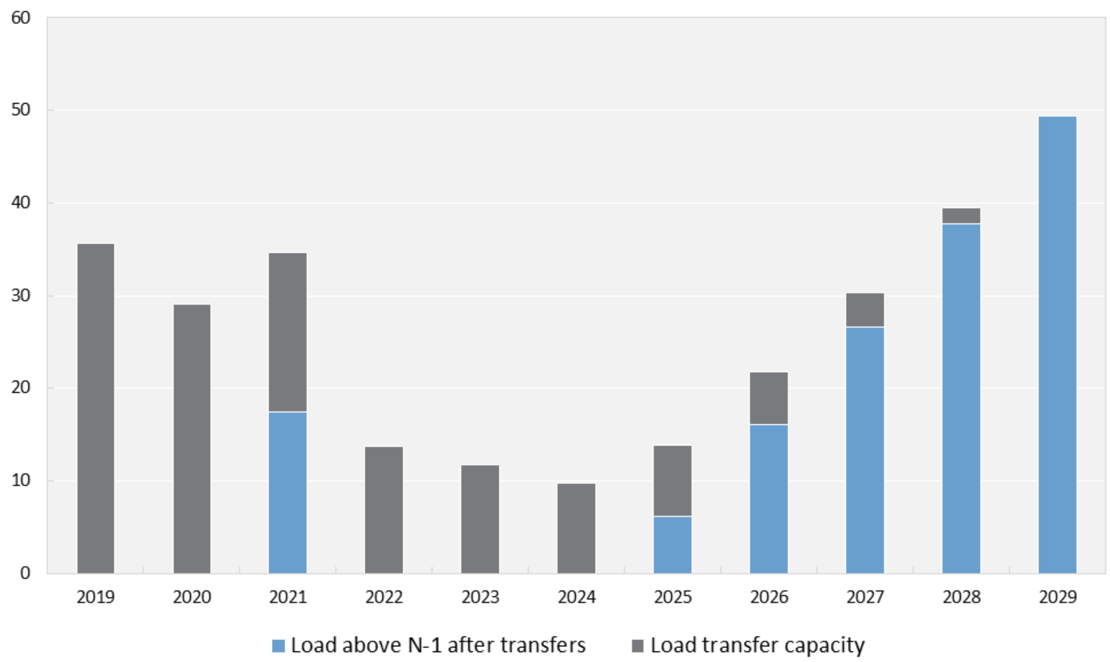
Figure 4 Forecast WBE load above N-1 after transfers (MVA)



Source: Powercor

For our TNA zone substation, the expected load above N-1 after transfers following a major outage of one of its transformers during peak demand conditions is shown in figure 5. After load transfers are established, a shortfall in capacity of approximately 16MVA is forecast in 2026 (or loss of supply for approximately 5,600 customers).

Figure 5 Forecast TNA load above N-1 after transfers (MVA)

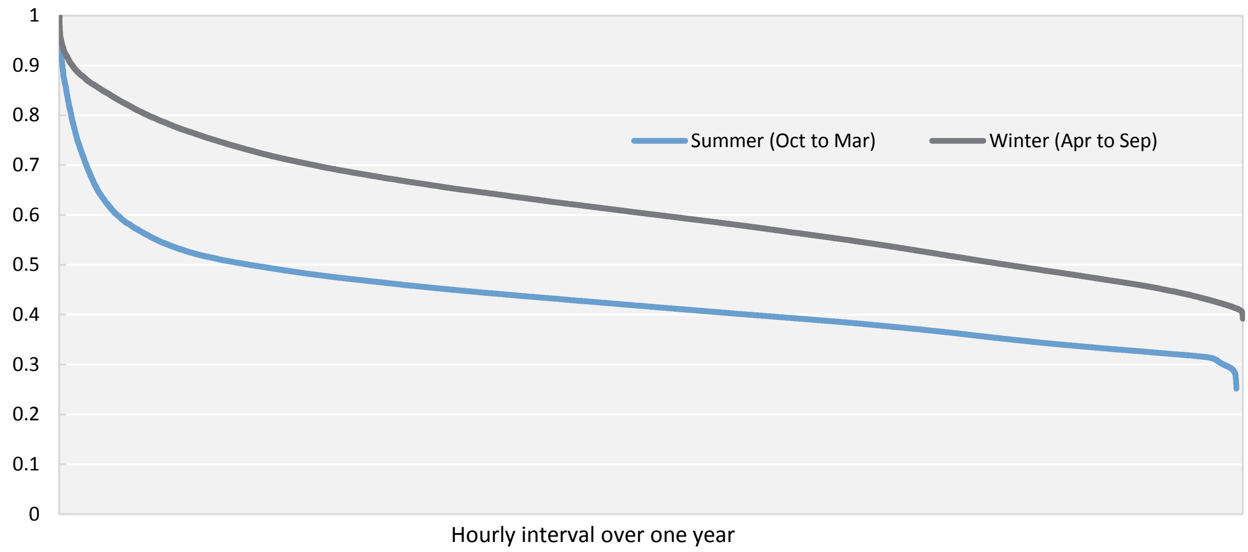


Source: Powercor

3.2.2 Energy at risk after load transfers

A load-duration curve, based on historical load data, is used to determine the amount of energy at risk over the N and N-1 ratings each year. The load duration curve is disaggregated into summer and winter curves, with each representing the duration that demand reaches a given percentage of the summer and winter maximum demands respectively.[2] The load-duration curves for our WBE zone substation is shown in figure 6.

Figure 6 Load-duration curve for WBE zone substation (percentage of maximum demand)

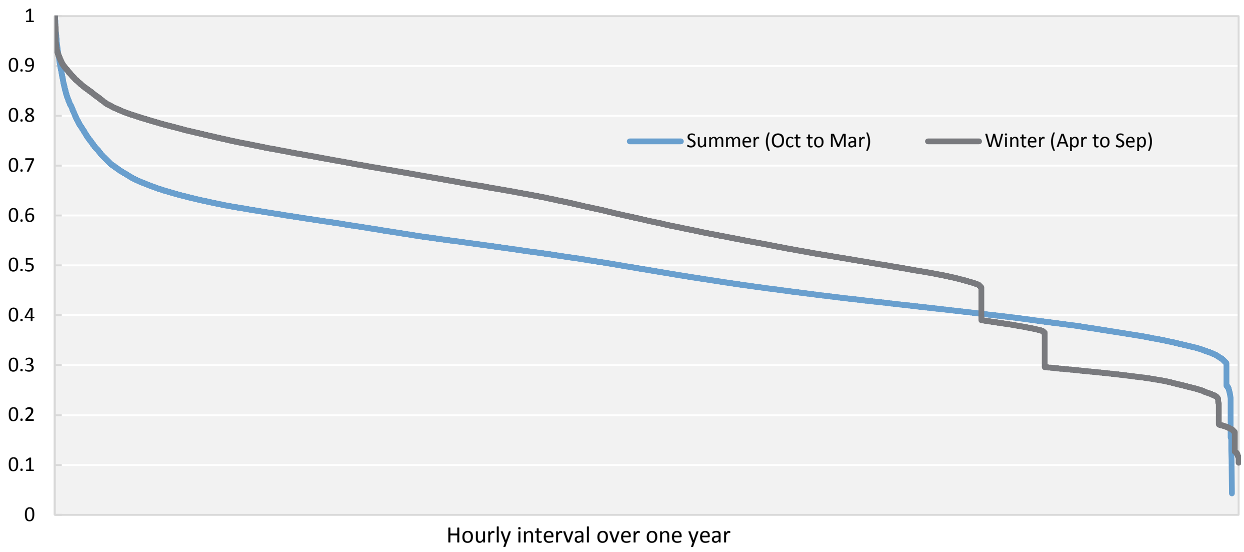


Source: Powercor

The load-duration curves for our TNA zone substation is shown in figure 7.

[2] Typically zone substations in our network are summer peaking. Winter load duration curves are often higher than summer curves because the maximum demand in winter is lower.

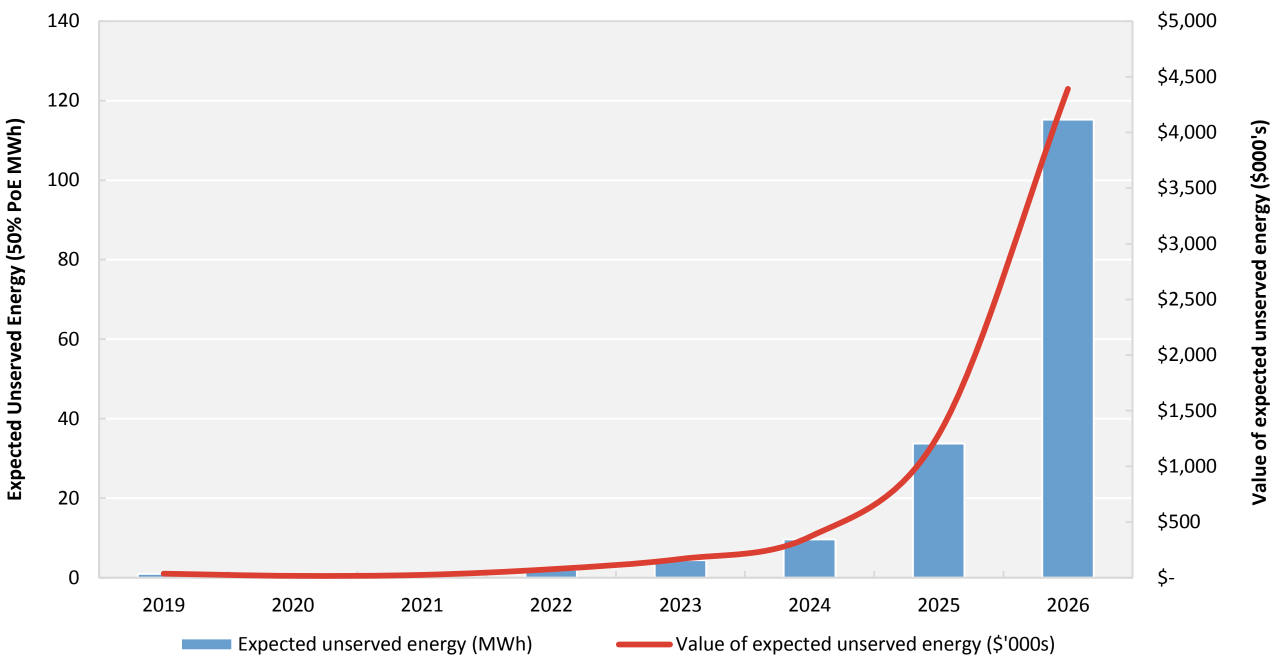
Figure 7 Load-duration curve for TNA zone substation (percentage of maximum demand)



Source: Powercor

The energy at risk is weighted by the probability of an outage to determine the expected unserved energy. The expected unserved energy is estimated using a 30:70 weighting of the 10% PoE and 50% PoE. The expected unserved energy of the combined energy at risk at WBE and TNA zone substations (under a 'do-nothing' scenario) is shown in figure 8.

Figure 8 Do-nothing scenario: expected energy at risk (MWh) and expected value of unserved energy ($'000s)



Source: Powercor

Figure 8 demonstrates that the expected unserved energy levels for the supply area will increase significantly from current levels. This will result in deteriorating reliability of supply for the customers in this area, particularly during hot summer days. This business case demonstrates there is an identified need and an economic case to invest in the area to maintain reliability of supply at current levels.

4 Options analysis

Several options were considered to address the identified need of maintaining a reliable supply of electricity and catering for new residential growth and development in the Tarneit supply area. These options address the identified need to varying extents, and as such, the preferred option is that which maximises the net economic benefits. This assessment of net economic benefits is presented relative to a 'do-nothing' scenario.

As shown in table 2, the preferred network solution is option one—establish a new Tarneit (**TRT**) zone substation in 2025.

Table 2 Summary of net economic benefits ($ million, 2019)

	Option	Net economic benefits
Do-nothing	Maintain the status-quo	-
1	Establish TRT zone substation in 2025	744.0
2	Establish new feeder to offload WBE, and build TRT zone substation in 2026	742.4
3	Non-network solution to defer preferred network option	742.3

Source: Powercor

The options considered are discussed in further detail below. The analysis supporting our assessment of alternative options, including relevant assumptions, is included in the attached model.[3]

This project will also be subject to a regulatory investment test for distribution (**RIT–D**). Engagement of non-network service providers to seek alternative solutions to defer investment is a major part of the RIT-D consultation. 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.

4.1 Assessment of credible options

4.1.1 Option zero: maintain the status-quo

The 'maintain status-quo' option does not involve any capital expenditure. Under this option, we would continue to supply customers by our WBE and TNA zone substations without any intervention to manage the existing and forecast energy at risk, other than through currently available operational responses such as limited load transfers. As a result, this option will lead to significant supply interruptions and potential asset failures as forecast loads reach or exceed the thermal ratings of distribution assets.

This option, therefore, fails to address the identified need (as set out in section 3).

4.1.2 Option one: establish TRT zone substation in 2025

This option involves building the new TRT zone substation with two 66kV lines, two 66kV circuit breakers, two transformers, three 22kV busses, six 22kV feeders and a 12MVAr capacitor bank. Construction would commence in 2023 and the zone substation would be commissioned in 2025. A breakdown of the costs for this option is provided in our attached reset Regulatory Information Notice (**RIN**).[4]

3 PAL MOD 6.06 - TRT supply area - Jan2020 - Public

4 PAL RIN001: Powercor, Reset RIN, template 2.3(a).

This option reduces load at risk in the area and provides capacity for future growth with the least long-term cost. Without the TRT project, WBE is forecast to exceed its N rating in 2025 and there are significant hours of energy at risk.

This option addresses the identified need, and has higher net economic benefits than the other credible options. A summary of the market benefits and costs of this option relative to the do-nothing option is shown in table 3.

Table 3 Option one: benefits assessment ($ million, 2019)

Option	NPV costs	NPV benefits	Net economic benefits
Establish TRT zone substation in 2025	-8.4	752.4	744.0

Source: Powercor

4.1.3 Option two: establish new feeder to offload WBE, and build TRT zone substation in 2026

This option involves establishing a new TNA feeder to offload WBE zone substation in 2023. The transfer of load from WBE to TNA zone substation will reduce the overall demand on WBE. However, these transfers will result in the forecast demand exceeding the TNA zone substation N-1 rating and hence, increases its energy at risk (i.e. the new feeder does not address the underlying capacity constraints in the supply area, rather, it shifts load between zone substations).

Under this option, the new TRT zone substation is deferred by one year (i.e. it would be commissioned in 2026).

This option addresses the identified need, but has a lower net economic benefit than option one. A summary of the market benefits and costs of this option relative to the do-nothing option is shown in table 4.

Table 4 Option two: benefits assessment ($ million, 2019)

Option	NPV costs	NPV benefits	Net economic benefits
Establish new feeder to offload WBE, and build TRT zone substation in 2026	-8.6	751.0	742.4

Source: Powercor

4.1.4 Option three: non-network solution to defer preferred network option

This option considers the ability of a non-network solution to defer the preferred network option. For this assessment, we have estimated the cost of a non-network solution that would result in the energy at risk remaining at the same level as that forecast in the year immediately prior to the commissioning date of the preferred solution.

We have based the cost of a non-network solution on a benchmark rate of $87,000 per MW per annum. This rate is based on observed rates, and is supported by comparative analysis of other distributors experience provided by CutlerMerz.[5]

[5] PAL ATT102: CutlerMerz, *Review of demand management unit rates*, February 2019,

The estimated non-network support requirements are summarised in table 5. For example, an 18.8MW non-network solution would bring the combined station load at risk back to the previous year's level and defer by one year the preferred network solution. The magnitude of the required non-network support increases over time so that the expected energy at risk remains constant.

Table 5 Non-network support requirements (MW)

Year	2025	2026	2027	2028	2029
Demand at risk after load transfers	45.3	64.0	83.8	104.5	125.3
Non-network support	-	18.8	38.5	59.3	80.0

Source: Powercor

Based on the above, the full cost of a demand management solution is equal to the required network support multiplied by the benchmark rate, plus the annual costs of any residual unserved energy. In this case, the net economic benefits of the demand management option are not as great as the preferred option, due in part to the lower residual unserved energy in the preferred option.

A summary of the market benefits and costs of this option relative to the do-nothing option is shown in table 6.

Table 6 Option three: benefits assessment summary ($million, 2019)

Option	NPV costs	NPV benefits	Net economic benefits
Non-network solution to defer preferred network option	-9.0	751.3	742.3

Source: Powercor

Irrespective of this high-level assessment, this project will be subject to assessment as required under the RIT-D. 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.

4.1.5 Other options considered, but not costed

Several other options were considered in preliminary planning investigations, but have not been costed due to their inability to address the identified needs. These options include the following:

- increasing the transformer capacity of LV, TNA and WBE zone substations is not an option as they are fully developed to their maximum station design capacity
- increasing the thermal backbone capacity of the existing 22kV distribution feeders to supply new development areas is not an option as they are already designed and operating at their maximum thermal design capacity.

4.2 Sensitivity analysis

Sensitivity assessment was performed to assess the impact on the ranking of the options from varying the demand and capital expenditure forecasts. Two scenarios were applied (equal to ±2% for demand forecasts, and ±10% for capital expenditure forecasts), reflecting best and worst-case scenarios.

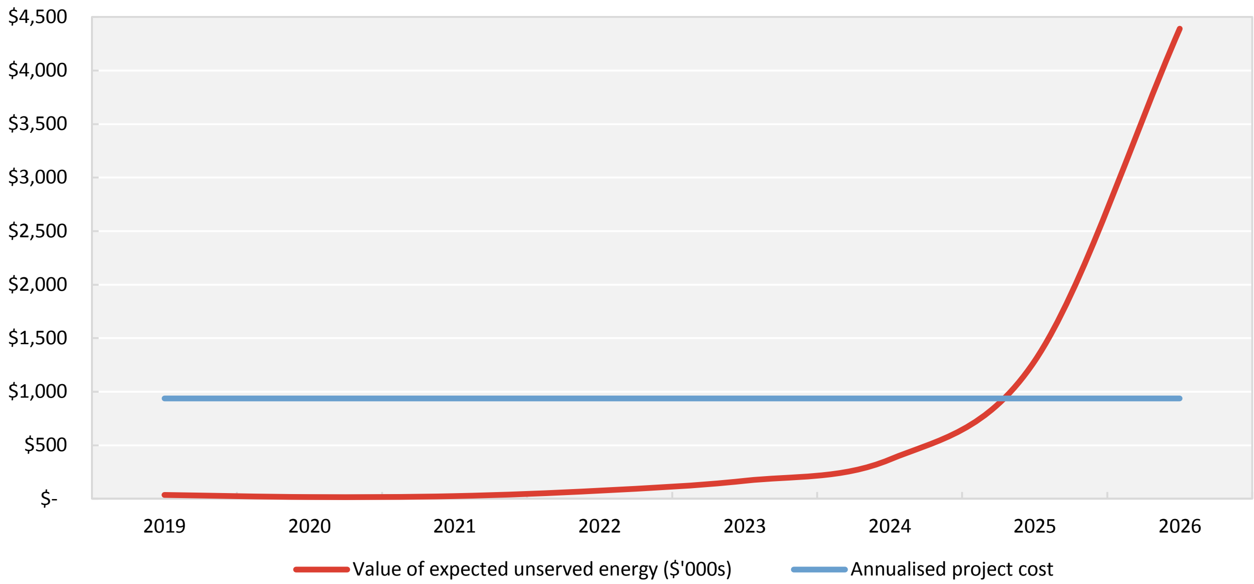
The results found the ranking of the preferred network option remains unchanged in all sensitivity scenarios.

5 Recommendation

The preferred option, as set out in section 4, is to establish a new TRT zone substation, with two 66kV lines, two 66kV circuit breakers, two transformers, three 22kV busses, six 22kV feeders and a 12MVAr capacitor bank. Construction would commence in 2023 and the zone substation would be commissioned in 2025. The proposed design of the new TRT zone substation and distribution feeder network is shown in appendix C and appendix D.

A detailed economic assessment was performed to evaluate the optimum timing of the preferred network option. As shown in figure 9, the net market benefits of establishing a new zone substation at TRT are maximised if the asset is commissioned no earlier than 2025.

Figure 9 Timing of preferred option ($million, 2019)



Source: Powercor

The forecast capital and operating expenditure requirements for the establishment of TRT zone substation over the 2021–2026 regulatory control period are outlined in table 7. These forecasts have been developed in calendar year terms, and converted to financial years in our consolidated expenditure modelling following changes to our reporting period (as required by the Victorian Government and the Australian Energy Regulator).

Table 7 Expenditure forecasts for preferred option ($ million, 2019)

Expenditure forecast	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capital expenditure	-	0.1	4.5	9.8	5.4	19.8
Operating expenditure	-	-	0.0	0.0	0.1	0.2
Total	**-**	**0.1**	**4.5**	**9.8**	**5.5**	**19.9**

Source: Powercor
Notes: May not add due to rounding

A Tarneit locality forecast population

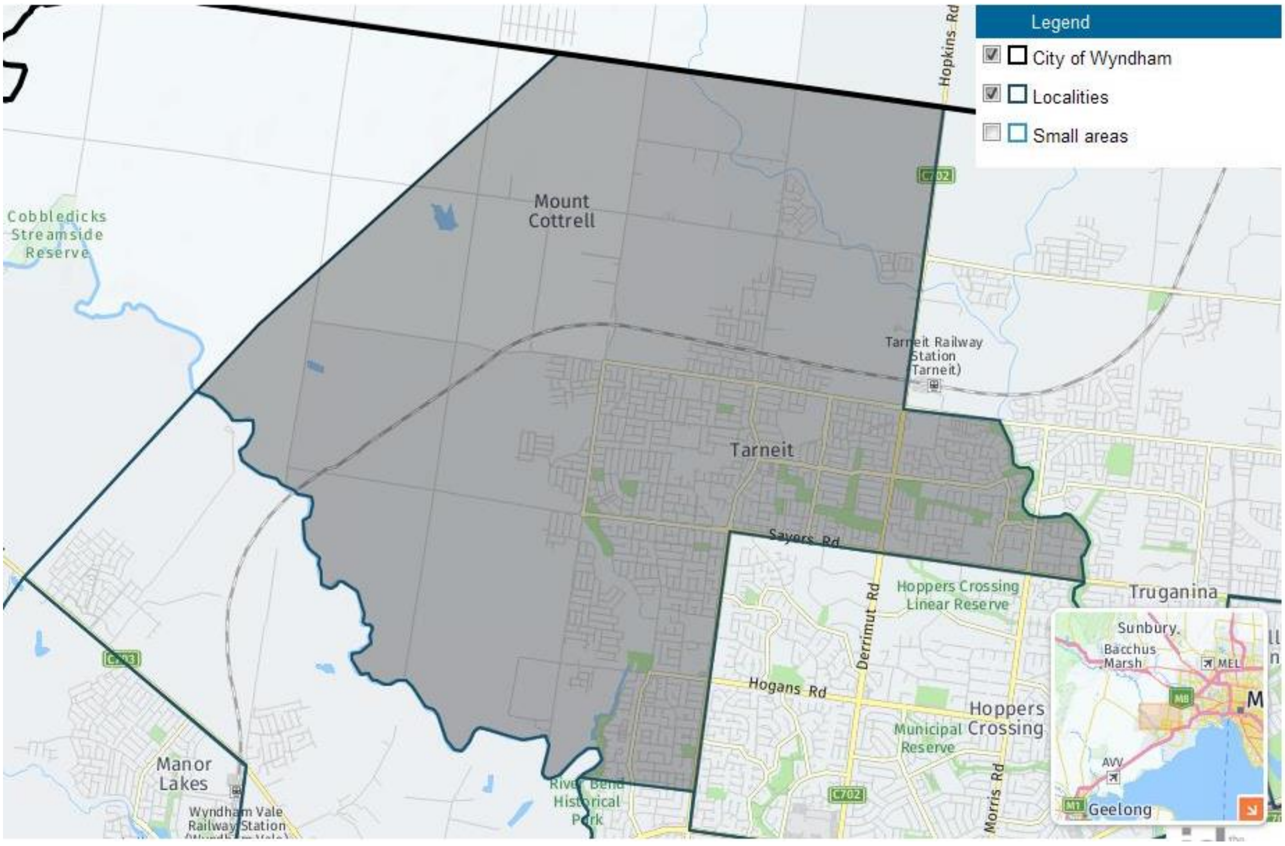
Table 8 shows the forecasts for population, households and dwellings in the City of Wyndham for the period 2016–2041. This highlights the expected strong growth in the Tarneit locality in the short and medium term. The corresponding area is shown in figure 10.

Table 8 City of Wyndham, Tarneit locality population forecast

Tarneit (locality)	2016	2021	2026	2031	2036	2041
Population	28,811	45,619	60,706	75,465	91,032	115,763
Change in population (5yrs)	-	16,808	15,087	14,758	15,567	24,731
Average annual change (%)	-	9.6	5.9	4.5	3.8	4.9
Households	8,314	13,527	18,609	23,718	29,268	37,859
Average household size	3.47	3.37	3.26	3.18	3.11	3.05
Dwellings	8,517	13,895	19,159	24,440	30,199	39,104
Dwelling occupancy rate (%)	97.6	97.4	97.1	97.1	96.9	96.8

Source: City of Wyndham, *Population and household forecasts, 2016 to 2041*, May 2018

Figure 10 City of Wyndham, Tarneit locality forecast area

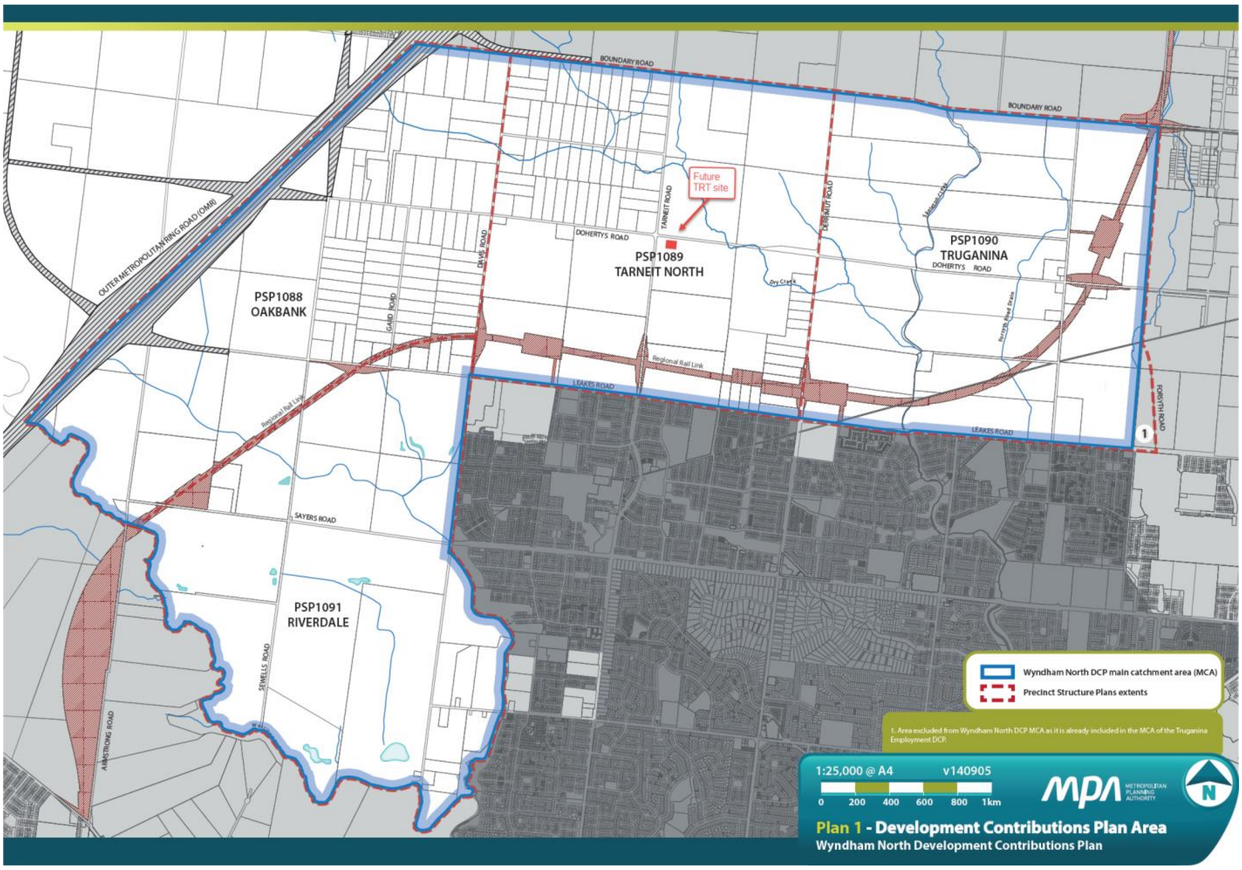


Source: City of Wyndham, *Population and household forecasts, 2016 to 2041*, May 2018

B Wyndham North development plan

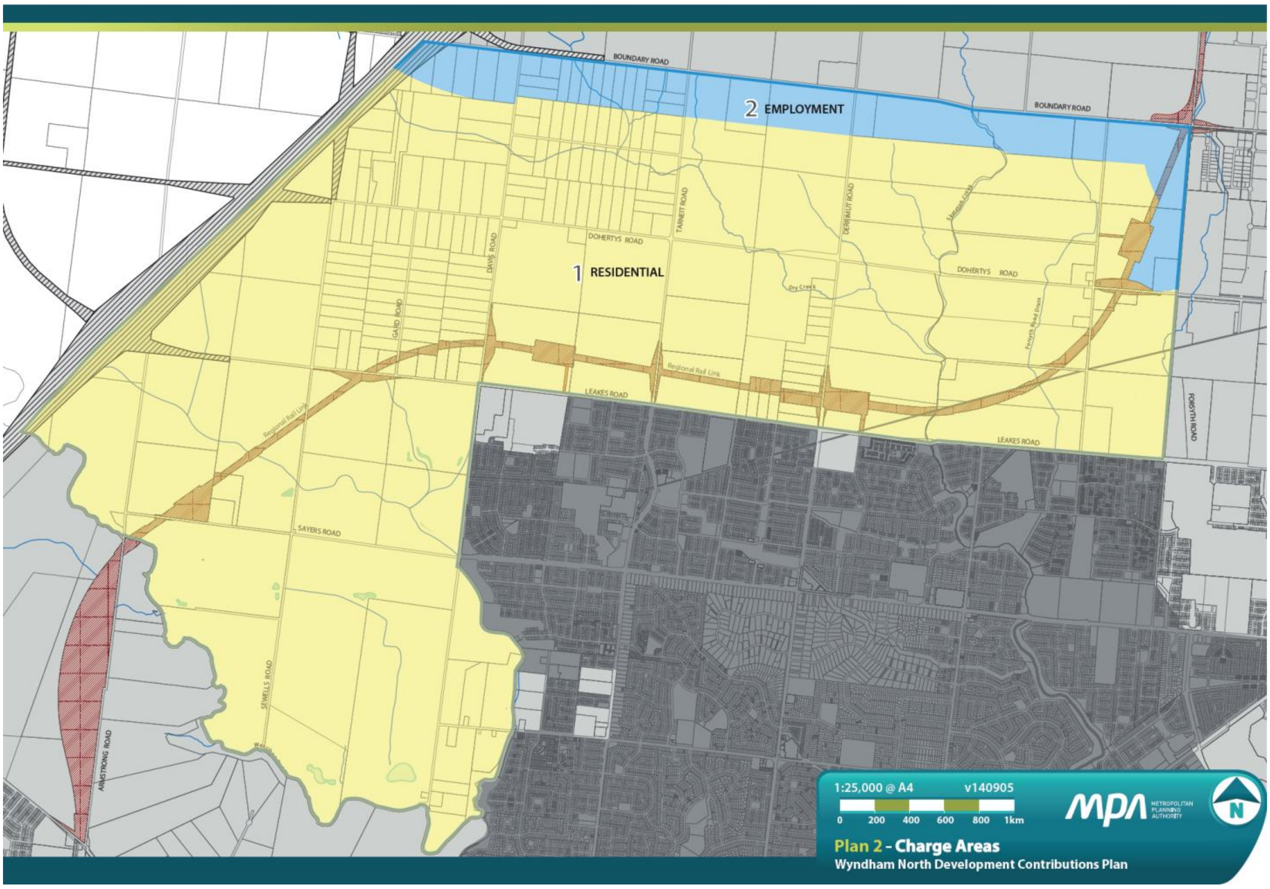
Figure 11 and figure 12 outlines the strategic development plans for supplying the Wyndham North development area, and the proposed TRT zone substation.

Figure 11 Wyndham North development plan



Source: Metropolitan Planning Authority, Wyndham North development contributions plan, amended September 2017

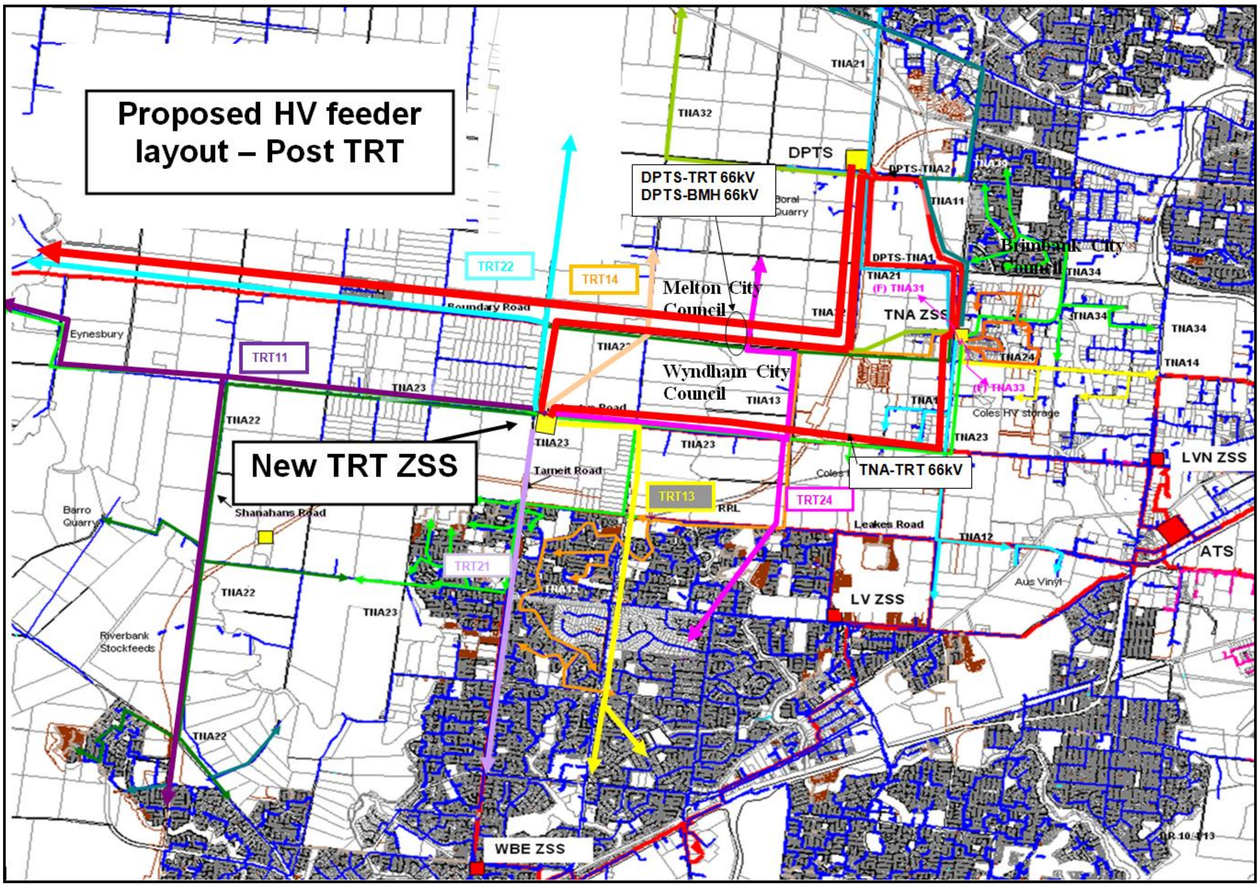
Figure 12 North Development plan



Source: Metropolitan Planning Authority, Wyndham North development contributions plan, amended September 2017

C TRT zone substation feeders

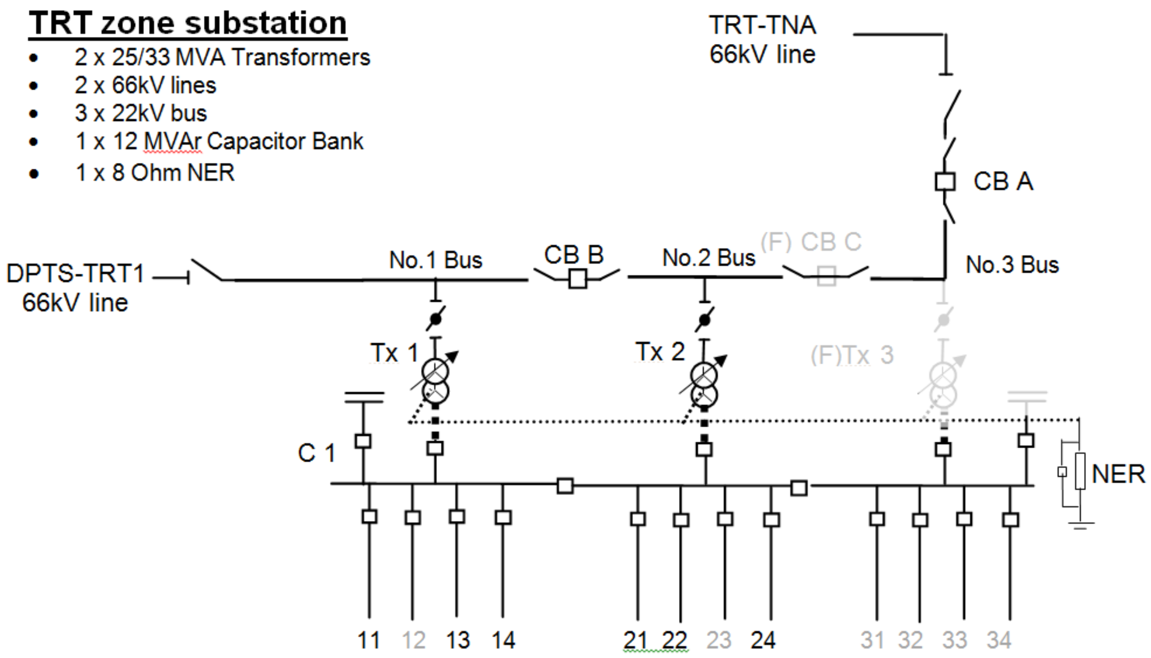
Figure 13 Proposed TRT zone substation feeder layout



Source: Powercor

D TRT zone substation diagram

Figure 14 Schematic: TRT zone substation



Source: Powercor