Jemena Electricity Networks (Vic) Ltd

2026-31 Electricity Distribution Price Review Proposal

11 kV Central Area Network Development Strategy

ELE-999-PA-EL-003

Authorisation

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History

Rev No	Date	Description of changes	Author
1.0	27/05/2024	EDPR version initial release	Salvador Cantero
1.1	06/09/2024	2024 demand forecast	Rodney Bray
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Owning Functional Area

Business Function Owner:	Asset & Operations | Electricity Distribution

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Glossary

10% POE (summer)	Refers to an average daily ambient temperature of 32.9ºC, with a typical maximum ambient temperature of 42ºC and an overnight ambient temperature of 23.8ºC.
50% POE (summer)	Refers to an average daily ambient temperature of 29.4ºC, with a typical maximum ambient temperature of 38.0ºC and an overnight ambient temperature of 20.8ºC.
50% POE and 10% POE (winter)	50% POE and 10% POE condition (winter) are treated the same, referring to an average daily ambient temperature of 7ºC, with a typical maximum ambient temperature of 10ºC and an overnight ambient temperature of 4ºC.
Augmentation	An investment that increases network capacity to prudently and efficiently manage customer service levels and power quality requirements. Augmentation is usually triggered by growing customer demand in areas of the network with limitations.
Capacity	Refers to the network's capability to transfer electricity to customers.
Continuous Rating	The permissible maximum demand to which a conductor or cable may be loaded on a continuous basis.
Cyclic Rating	The permissible maximum demand to which a conductor or cable may be loaded on a cyclic basis.
Consumer Energy Resources (CER)	Solar PV, micro-generators, batteries (including electric vehicles), flexible load and other Embedded Generation connected within the distribution network.
Discount Rate	The regulated Weighted Average Cost of Capital (WACC).
Distribution Feeders	Radial 22kV, 11kV or 6.6kV powerlines that emanate from zone substations to supply Distribution Substations or HV customers.
Exit Cable	The underground cable connected to the HV distribution feeder circuit breaker that leaves the boundary of the zone substation.
Expected Unserved Energy (EUE)	Refers to an estimate of the long-term, probability weighted, average annual energy demanded (by customers) but not supplied. The EUE measure is transformed into an economic value, suitable for cost-benefit analysis, using the value of customer reliability (VCR), which reflects the economic cost per unit of unserved energy.
Jemena Electricity Networks (JEN)	One of five licensed electricity distribution networks in Victoria, the JEN is 100% owned by Jemena and services over 360,000 customers via an 11,000-kilometre distribution system covering north-west greater Melbourne.
Limitation	Refers to a limitation on a network asset's ability to transfer power due to its rating, failure rate or condition.
Maximum demand (MD)	The highest amount of electrical power delivered (or forecast to be delivered) for a particular season (summer and/or winter) and year.

Network	Refers to the physical assets required to transfer electrical energy to customers.
Non-network	Refers to anything potentially affecting the transfer of electricity to customers that does not involve the network.
Non-network alternative	A response to growing customer demand that does not involve a traditional network solution.
Open Point	An isolation device on a distribution feeder that is in a normally open state.
Operations & Maintenance expenditure (O&M)	Expenditure (ongoing) for operating and maintaining the network.
Power Factor (pf)	The ratio of active power to apparent power. A unity power factor indicates no reactive power through the element. Power factor is specified as either leading or lagging.
Present Value	The value of a cost or benefit in the future, discounted to today's value using the Discount Rate.
Probability of exceedance (PoE)	The likelihood that a given level of maximum demand forecast will be met or exceeded in any given year.
Probabilistic Planning	A planning methodology involving estimating the cost of a network limitation with consideration of demand, network capability, and the likelihood and severity of network outages and operating conditions.
Reconductor(ing)	Replacing a section of conductor with another of higher rating.
Regulatory Investment Test for Distribution (RIT-D)	A test administered by the Australian Energy Regulator (AER) that establishes consistent, clear and efficient planning processes for distribution network investments in the National Electricity Market (NEM).
Reliability	The measure of the duration or frequency of the distribution system to provide uninterrupted supply to customers over a defined time.
Sub-transmission	Overhead lines and underground cables connecting terminal stations to zone substations. These are operated at 66 kV.
System Normal	The condition where no network assets are under maintenance or forced outage, and the network is operating according to normal daily network operation practices.
Terminal Station	Sites where transmission voltages are transformed down to sub-transmission voltages. These sites and the assets within them are not owned by JEN.
Transfer Capability	The amount of capacity available for a load transfer from one substation to another.
Transmission Connection Assets	The assets within a Terminal Station that are planned by JEN and the other DNSPs that are connected to the Terminal Station.
Utilisation	The Maximum Demand expressed as a percentage of its rating.

Value of Customer Reliability (VCR)	Represents the dollar value customers place on a reliable electricity supply (and can also indicate customer willingness to pay for not having supply interrupted).
Zone Substation	Sites where sub-transmission voltages are transformed down to distribution voltages. These sites are owned by JEN. They are the upstream supply source for HV distribution feeders.

Abbreviations

A	Ampere
AAC	All Aluminium Conductor
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AW	Airport West Zone Substation
BESS	Battery Energy Storage System
BTS	Brunswick Terminal Station (owned by AusNet Services)
BY	Braybrook Zone Substation
CB	Circuit Breaker
CHP	Cable Head Pole
CIC	Customer Initiated Capital
CER	Consumer Energy Resources
DM	Demand Management
(E)	Existing
ES	Essendon Zone Substation
EUE	Expected Unserved Energy
EV	Electric Vehicle
(F)	Future
FT	Flemington Zone Substation
HV	High Voltage
JEN	Jemena Electricity Network
KTS	Keilor Terminal Station (owned by AusNet Services)
kV	kilovolts
MD	Maximum Demand
MVA	Mega Volt Ampere
MVAr	Mega Volt Ampere Reactive
MW	Mega Watt
MWh	Megawatt hour
NDS	Network Development Strategy

NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules or Neutral Earthing Resistor (depending on context)
(N)	New (or system normal - all critical plant in service, depending on context)
(N-1)	Single contingency - a single critical item of plant out service
N/O	Normally Open
NPV	Net Present Value
NS	North Essendon Zone Substation
O&M	Operations and Maintenance
OH	Overhead Line
OLTC	On-Load Tap-Changer
OOS	Out of Service
PF	Power Factor
PoE	Probability of Exceedance
PV	Pascoe Vale Zone Substation, Present Value, or Photovoltaic
PVR	Present Value Ratio
RCGS	Remote Controlled Gas-insulated Switch
REFCL	Rapid Earth Fault Current Limiter
RIT-D	Regulatory Investment Test for Distribution
RIT-T	Regulatory Investment Test for Transmission
SAPS	Standalone Power Systems
SLD	Single Line Diagram
STPIS	Service Target Performance Incentive Scheme
TCPR	Transmission Connection Planning Report
UG	Underground Cable
V2G	Vehicle to Grid
VCR	Value of Customer Reliability
VEDCOP	Victorian Electricity Distribution Code of Practice
WACC	Weighted Average Cost of Capital
WMTS	West Melbourne Terminal Station (owned by AusNet Services)

Executive Summary

Jemena Electricity Network (Vic) Ltd. (**JEN**) is the licensed electricity distributor for the northwest of Melbourne's greater metropolitan area. The service area ranges from Gisborne South, Clarkefield and Mickleham in the north, to Williamstown and Footscray in the south, and from Hillside, Sydenham and Brooklyn in the west, to Yallambie and Heidelberg in the east.

Our customers expect us to deliver and maintain a reliable electricity supply at an efficient cost over the lifecycle of our assets. To do this, we must choose the most prudent and efficient solutions that address current and emerging network limitations. In the context of the National Electricity Market (**NEM**), this means choosing an investment plan that maximises the present value of net economic benefits to all those who produce, consume and transport electricity.

This document articulates the Network Development Strategy (**NDS**) and the plans for the area of the JEN north of the Maribyrnong River and west of CityLink, south of the Western Ring Road and north of CityLink, servicing the suburbs of Kensington, Flemington, Ascot Vale, Moonee Ponds, Essendon, Aberfeldie, Niddrie, Essendon North, Strathmore, Strathmore Heights, Hadfield, Glenroy and Oak Park. This supply area is serviced by our Essendon (**ES**), North Essendon (**NS**), Flemington (**FT**), and Pascoe Vale (**PV**) zone substations by way of a network of 11 kV distribution feeders. This supply area currently comprises of over 64,072 electricity distribution customers.

This NDS presents the current and emerging limitations within this supply area over a 10-year planning horizon, and identifies solutions to address identified network needs.

Identified Needs

The population of the supply area is 135,208 and this is forecast to grow to 187,070 by 2046, an increase of 38% (or 1.6% pa). Growth in the supply area is predominantly infill and high-rise residential development with a couple of major customer developments.

Maximum electricity demand for the supply area is expected to grow on average by 2.5% per annum during the next 10-year period, driven primarily by population growth, business development and electrification. Given this growth, parts of the existing sub-transmission network, zone substations and 11 kV distribution feeders supplying the area, will not have sufficient capacity to meet this expected increase in maximum demand.

A number of existing network assets in the area are already (or forecast to be) highly utilised including three zone substations (being NS, FT and ES), one sub-transmission network (being BTS-NS), and at least eleven 11 kV distribution feeders. Staged, targeted augmentations of the network are needed, to connect new customers and maintain current levels of electricity supply reliability.

Options Considered

This NDS presents a range of credible options to meet the forecast demand for electricity over a 10-year planning horizon and maintain a safe and reliable supply to customers within the supply area. These include:

- Option 1: **Do Nothing** (base case).
- Option 2: **Flemington Plan**.
- Option 3: **Flemington and North Essendon Plan**;
- Option 4: **Flemington and Essendon Plan;**

- Option 5: **Flemington and Pascoe Vale Plan;**
- Option 6: Battery Energy Storage System (BESS) Plan; and
- Option 7: Demand Management (DM) Plan.

A summary of the 20-year economic cost-benefit analysis, assessed for each option over a 10-year investment period, is presented in Table ES-1.

Table ES-1: Summary of Cost-Benefit Analysis ($M Real 2024)

Option	Total Capital Cost	Present Value of Capital and O&M Cost	Present Value of Reliability Benefit	Net Present Value (NPV)	Ranking
Option 1 - Do Nothing	0	0.0	0.0	0.0	7
Option 2 – Flemington Plan	**21.3**	**21.8**	**92.2**	**70.5**	**1**
Option 3 - Flemington and North Essendon Plan	27.7	25.9	91.3	65.4	5
Option 4 - Flemington and Essendon Plan	26.7	24.8	94.3	69.4	2
Option 5 - Flemington and Pascoe Vale Plan	32.1	28.7	94.2	65.5	4
Option 6 – BESS Plan	0	48.1	92.2	44.1	6
Option 7 – DM Plan	0	24.0	92.2	68.2	3

Preferred Option

The assessment demonstrates that the preferred network development plan is to implement Option 2 (Flemington Plan) because this option maximises the net economic benefit to all those who produce, consume and transport electricity in the NEM. The preferred Option 2 provides a 20-year present value net market benefit of $70.4 million, with a present value of $19.0 million of investment (over 10-years, 2025 to 2034). The market benefits forecast to be delivered by the preferred solution is driven by the reduction in expected unserved energy over the analysis period.

The preferred network Option 2 to address the network limitations includes the following project components:

Table ES-2: Option 2 - Flemington Plan[1]

Timing	Projects	Cost (Real 2024)	Limitation Addressed
2026	New feeder FT0-025	[redacted]	FT22 and FT 32 overload
2026	New feeder ES0-031	[redacted]	ES 11 overload
2029	Augment feeder FT0-011	[redacted]	FT 11 overload
2029	Augment feeder FT21	[redacted]	FT 21 overload
2028	Augment BTS-NS 22kV Loop	[redacted]	BTS-NS overload
2029	3rd Transformer and 66kV Works at FT and 66kV Works	[redacted]	FT overload
2030	New feeder FT0-012	[redacted]	FT 33 overload
2030	Augment feeders at NS – NS 17	[redacted]	NS 17 overload
2031	Augment feeders at NS – NS 18	[redacted]	NS 18 overload
2033	Thermal Uprate WMTS-FT No.1 66kV	[redacted]	WMTS-FT overload
Total		**$21.3 million**	
Present Value Total		**$19.0 million**	

The estimated total capital cost of Option 2 for JEN over 10-years to address the identified network limitations is $21.3 million, of which $3.4 million is outside of the FY2027-31 regulatory control period. Table ES-3 lists the projects and their associated costs over the FY2027-31 regulatory control period.

A sensitivity analysis was carried out to assess the effect of changing the capital costs, discount rate and demand forecasts. The results showed that changing these variables can change the optimal timing of some projects in the development plan but does not change Option 2 as the preferred option.

[1] Excludes new FT feeder(s) required for a major customer connection project. Refer to Major Customer NDS.

Table ES-3: Option 2 – Flemington Plan, projects within FY2027-31 regulatory control period

Timing	Projects	Cost (Real 2024)[2]	Limitation Addressed
2026	New feeder ES0-031	[redacted]	ES 11 overload
2029	Augment feeder FT0-011	[redacted]	FT 11 overload
2029	Augment feeder FT21	[redacted]	FT 21 overload
2028	Augment BTS-NS 22kV Loop	[redacted]	BTS-NS overload
2029	3rd Transformer and 66kV Works at FT and 66kV Works	[redacted]	FT overload
2030	New feeder FT0-012	[redacted]	FT 33 overload
2030	Augment feeders at NS – NS 17	[redacted]	NS 17 overload
2031	Augment feeders at NS – NS 18	[redacted]	NS 18 overload
Total		**$17.9 million**	

[2] $3.4M of the recommended plan project costs are outside FY2027-31 regulatory control period.

1. Introduction

This chapter outlines the purpose of this NDS, provides an overview of the supply area, describes the general arrangement of the electricity network, and gives a brief overview of the network limitations in this area.

1.1 Purpose

JEN is the licensed electricity distributor for the northwest of Melbourne's greater metropolitan area. The JEN network service area ranges from Gisborne South, Clarkefield and Mickleham in the north, to Williamstown and Footscray in the south, and from Hillside, Sydenham and Brooklyn in the west, to Yallambie and Heidelberg in the east, as shown in Figure 1-1.

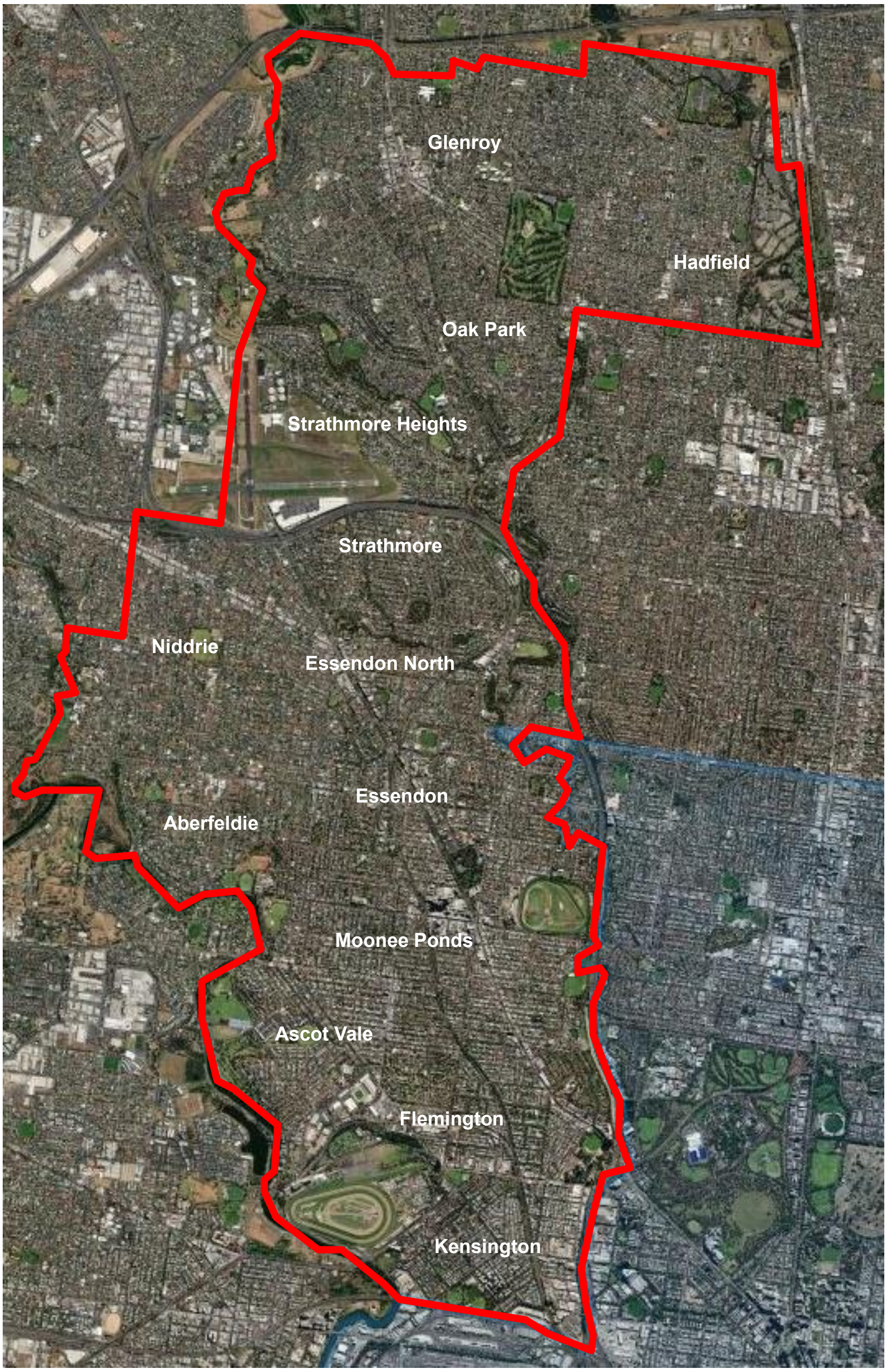
This document articulates the NDS for the electricity network north of the Maribyrnong River and west of CityLink, south of the Western Ring Road and north of CityLink, servicing the suburbs of Kensington, Flemington, Ascot Vale, Moonee Ponds, Essendon, Aberfeldie, Niddrie, Essendon North, Strathmore, Strathmore Heights, Hadfield, Glenroy and Oak Park. It presents the current and emerging limitations within this supply area over a 10-year planning horizon and identifies options to resolve these constraints.

Figure 1-1 NDS Supply Area with the JEN Service Area

1.2 Supply Area Overview

The supply area covering the inner north-western Melbourne metropolitan areas is highly urbanised, with predominantly residential and commercial properties. It includes major precincts for the Moonee Valley and Flemington Racecourses and parts of Essendon Airport.

Figure 1-2 NDS Supply Area



The supply area covers parts of the Melbourne, Merri-bek and Moonee Valley city council municipal areas. In 2022, the supply area's population was 135,208. This is forecast to grow to 187,070 residents in 2046. This represents a forecast increase of 38 per cent on the current population (approximately 1.6% per annum).

Table 1-1: Supply Area Resident Population[3]

Suburb	Actual 2022	Forecast 2046	Increase	% Increase (pa)
Kensington	10,978	18,557	**7,579**	**2.9%**
Flemington	13,408	16,442	3,034	0.9%
Ascot Vale	11,134	15,521	4,387	1.6%
Moonee Ponds	15,249	26,774	**11,525**	**3.1%**
Essendon	12,285	14,200	1,915	0.6%
Aberfeldie	5,024	5,306	282	0.2%
Niddrie	8,222	10,261	2,039	1.0%
Essendon North	10,354	15,442	5,088	2.0%
Strathmore	6,993	7,995	1,002	0.6%
Strathmore Heights	4,320	5,689	1,369	1.3%
Hadfield	6,404	9,476	3,072	2.0%
Glenroy	23,992	32,488	**8,496**	1.5%
Oak Park	6,845	8,919	2,074	1.3%
TOTAL	**135,208**	**187,070**	**51,862**	**1.6%**

The largest increases in population are expected to occur in Kensington, Moonee Ponds and Glenroy, with the highest growth rate expected in Kensington and Moonee Ponds. Population growth in the supply area is predominantly being accommodated by infill and high-rise residential developments.

Development in the supply area is governed by the Melbourne[4] (southern area), Moonee Valley[5] (central area), and Merri-bek[6] (northern area) City Councils' Planning Schemes as illustrated in Figure 1–3, Figure 1–4 and Figure 1–5 respectively.

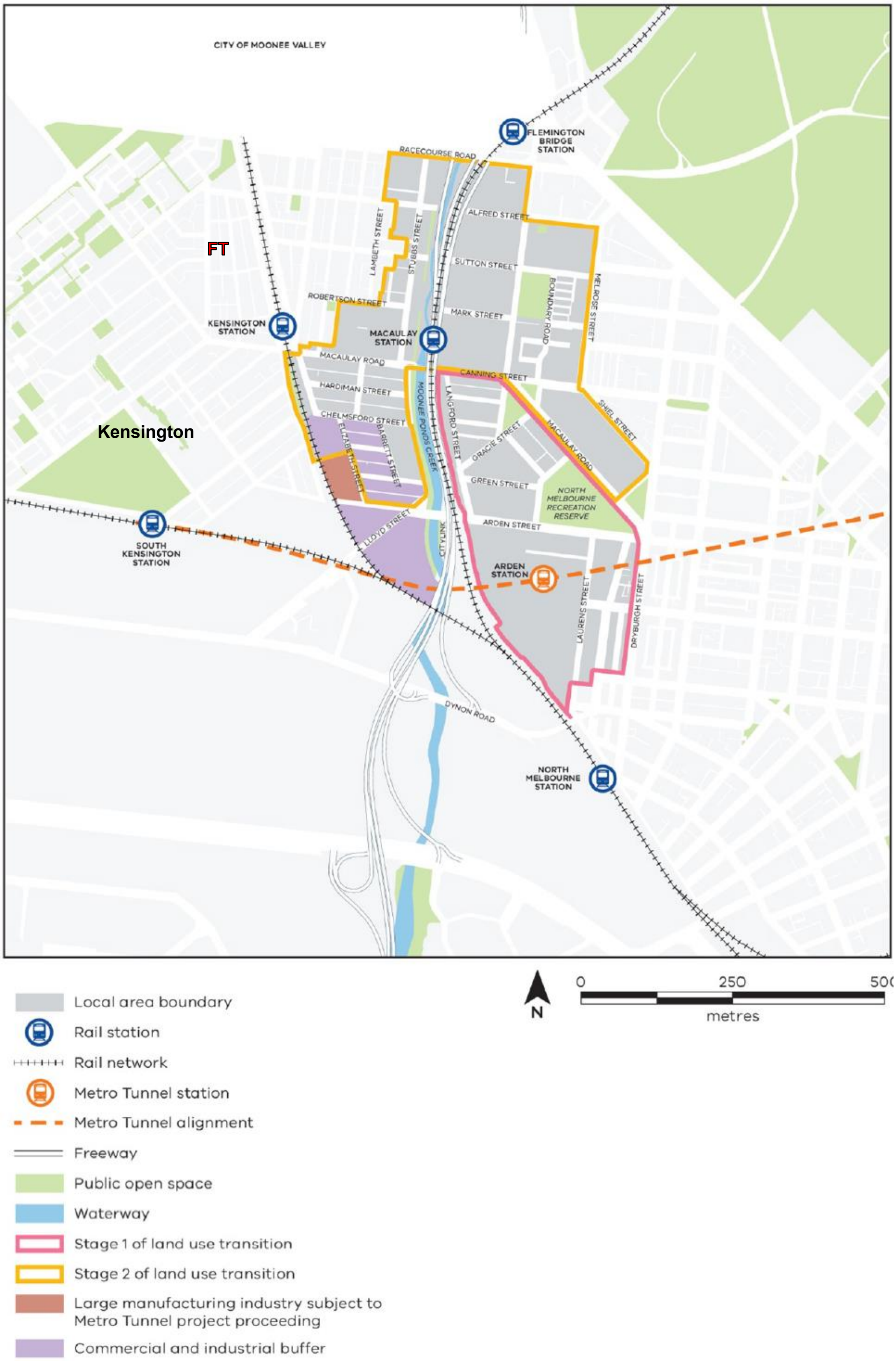
[3] See https://app.remplan.com.au/mooneevalley/forecast/population, https://profile.id.com.au/melbourne/about, and https://profile.id.com.au/merri-bek/about

[4] See https://planning-schemes.app.planning.vic.gov.au/static/1693414420249/pdf/2988764.pdf

[5] See https://planning-schemes.app.planning.vic.gov.au/static/1691948659931/pdf/2834202.pdf

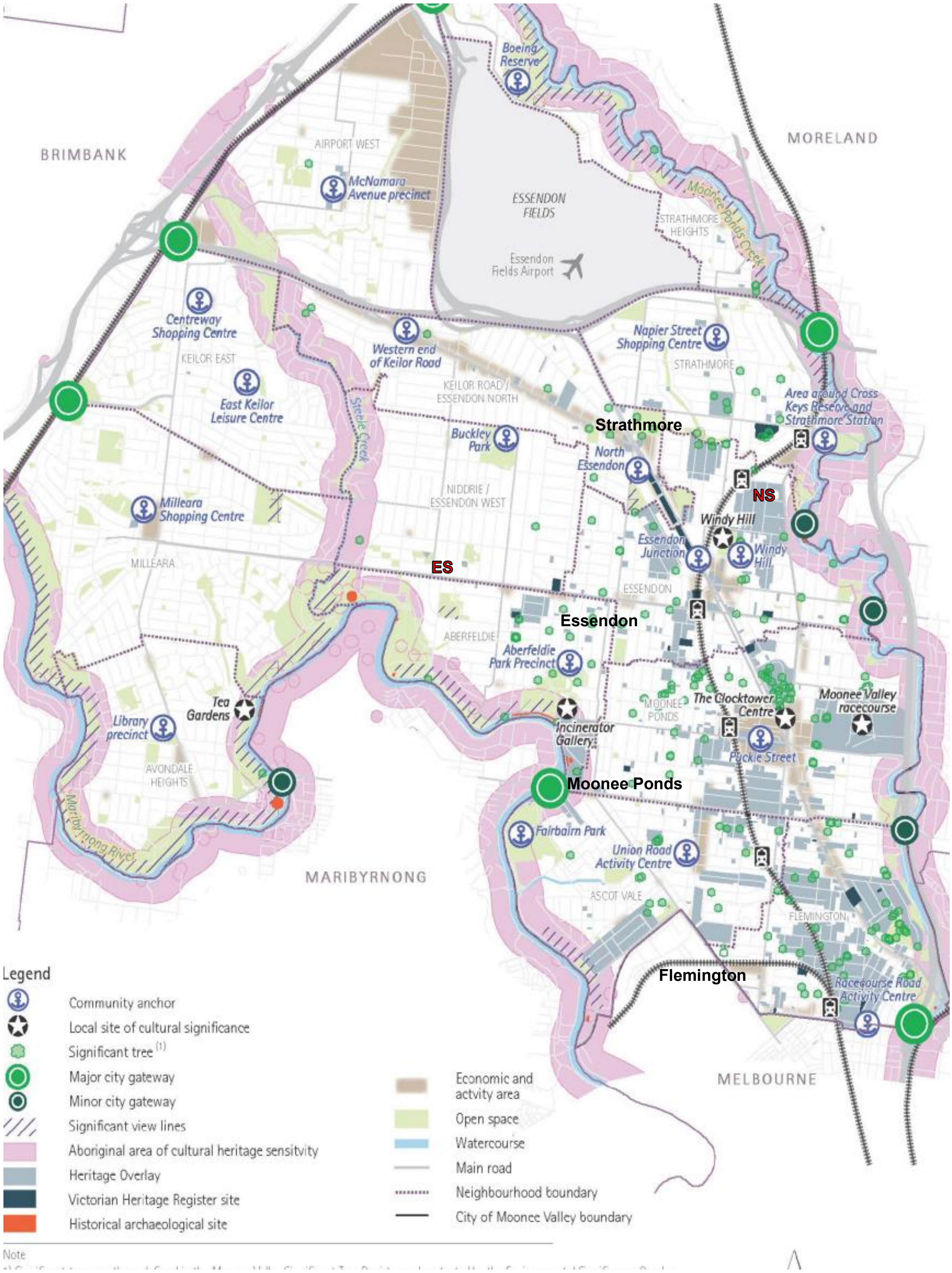
[6] See https://planning-schemes.app.planning.vic.gov.au/static/1691949277937/pdf/2989434.pdf

Figure 1–3: Melbourne Planning Scheme strategic framework plan (Kensington area)



Source: Melbourne Planning Scheme

Figure 1–4: Moonee Valley Planning Scheme strategic framework plan



Source: Moonee Valley Planning Scheme

Figure 1–5: Merri-Bek Planning Scheme strategic framework plan (Pascoe Vale and Glenroy areas)

Source: Merri-bek Planning Scheme

The supply area is serviced by our Essendon (**ES**), North Essendon (**NS**), Flemington (**FT**), and Pascoe Vale (**PV**) zone substations by a network of 11 kV distribution feeders. This supply area currently services over 64,072 electricity distribution customers.

Table 1-2: Supply Area Electricity Distribution Customers (by Zone Substation and 11 kV Feeder)[7]

Essendon (ES) Zone Substation	Actual	Flemington (FT) Zone Substation	Actual	North Essendon (NS) Zone Substation	Actual	Pascoe Vale (PV) Zone Substation	Actual
ES 11	1,235	FT 11	1,004	NS 07	1,217	PV 12	747
ES 12	1,101	FT 14	0	NS 08	1,337	PV 13	2,778
ES 13	1,902	FT 15	482	NS 09	1,161	PV 14	3,078
ES 15	2,101	FT 16	488	NS 11	883	PV 15	2,095
ES 16	1,470	FT 21	1,255	NS 12	1,249	PV 21	2,538
ES 21	1,729	FT 22	1,521	NS 14	1,499	PV 22	2,942
ES 22	2,891	FT 24	1,805	NS 15	1,653	PV 23	2,710
ES 23	490	FT 26	2,471	NS 16	872	PV 24	1,825
ES 24	1,751	FT 31	2,495	NS 17	928	PV 31	2,634
ES 25	1,204	FT 32	237	NS 18	1,401		
ES 26	1,262	FT 33	95				
		FT 35	1,536				
17,136		**13,389**		**12,200**		**21,347**	
64,072							

Growth in population and electrification of transport and gas are expected to contribute to growth in electricity demand. Further growth in electricity demand is expected from a small number of identified significant customer developments, such as the Moonee Valley Racecourse redevelopment[8].

Maximum demand for the supply area is expected to grow on average by 2.5% per annum during the next 10-year period (2025-34).

Parts of the existing sub-transmission network, zone substations and 11 kV distribution feeders supplying the area, will not have sufficient capacity to meet this expected increase in maximum demand. Several existing assets in the area are already (or forecast to be) highly utilised including

[7] Jemena Annual Regulatory Information Notice (RIN) 2021-22, tab 3.6.8.

[8] Moonee Valley Racecourse redevelopment (Racecourse infield, Grandstand and associated racecourse infrastructure) - Moonee Valley City Council (mvcc.vic.gov.au).

three zone substations (being NS, FT and ES), one sub-transmission network (being BTS-NS), and at least eleven 11 kV distribution feeders. Staged, targeted augmentations of the network are needed, to connect new customers and maintain current levels of supply reliability.

1.3 Network Overview

The NDS supply area is currently serviced by the following electricity distribution network assets:

- 4 x zone substations
  - 22/11 kV North Essendon Zone Substation (**NS**)
  - 66/11 kV Essendon Zone Substation (**ES**)
  - 66/11 kV Flemington Zone Substation (**FT**)
  - 66/11 kV Pascoe Vale Zone Substation (**PV**)
- 9 x JEN-owned 66kV sub-transmission lines forming four sub-transmission networks from three AusNet transmission terminal substations – West Melbourne (**WMTS**), Keilor (**KTS**) and Brunswick (**BTS**)
  - WMTS-FT
    - WMTS-FT No.1 (radial), WMTS-FT No.2 (radial)
  - KTS-AW-PV-NDT-KTS
    - KTS-PV, KTS-AW, KTS-NDT
    - AW-PV, AW-NDT
  - KTS-BY-ES-KTS
    - KTS-BY, KTS-ES
    - BY-ES
  - BTS-NS
    - BTS-NS1 193 (radial), BTS-NS2 176 (radial), BTS-NS3 190 (radial)
- 41 x 11 kV distribution feeders (excluding spare feeder circuit breakers)
  - 11 ex ES – ES 11, ES 12, ES 13, ES 15, ES 16, ES 21, ES 22, ES 23, ES 24, ES 25, ES 26.
  - 10 ex NS – NS 07, NS 08, NS 09, NS 11, NS 12, NS 14, NS 15, NS 16, NS 17, NS 18.
  - 12 ex FT – FT 11, FT 14, FT 15, FT 16, FT 21, FT 22, FT 24, FT 26, FT 31, FT 32, FT 33, FT 35.
  - 9 ex PV – PV 12, PV 13, PV 14, PV 15, PV 21, PV 22, PV 23, PV 24, PV 31.

Single line diagrams, network area maps and details of the existing network is provided below.

1.3.1 Zone substation network

The supply boundaries (shaded) of the zone substations contained within the NDS supply area are shown in Figure 1-6, showing the location of the zone substations and their sub-transmission lines (purple).

Figure 1-6 Zone Substation Boundaries

[redacted]

1.3.1.1 Flemington (FT) zone substation

FT is a fully indoor summer peaking zone substation with two 66/11 kV 30 MVA transformers. Under system normal conditions, the two transformers are operated in parallel as one group. Each transformer is connected to a dedicated radial 66 kV sub-transmission line from WMTS. FT has the ability to expand to three transformers in future, however it already has three 11 kV buses. FT has twelve in-service 11 kV feeders and three spare 11 kV circuit breakers for additional future feeders (FT 12, FT 25, FT 34) across the three existing 11 kV buses.

Within the NDS supply area, FT services the suburbs of Kensington, Flemington and parts of Ascot Vale, supplying 13,389 customers. The single line diagram and an aerial view of FT is shown in Figure 1-7 and Figure 1-8 respectively.

Figure 1-7 FT Single Line Diagram

[redacted]

Figure 1-8 FT Aerial View

1.3.1.2 North Essendon (NS) zone substation

NS has three 22/11 kV 18 MVA transformers and is a summer-peaking indoor zone substation. Under system normal conditions, the three transformers are operated in parallel as one group. Each transformer is connected to a dedicated radial 22 kV sub-transmission line from BTS. NS has ten in-service 11 kV feeders for JEN and two for CitiPower, and two spare 11 kV circuit breaker bays for additional future feeders (NS 06 on No.1 11 kV bus and NS 19 on No.2 11 kV bus), from the three existing 11 kV buses. NS No.1 11kV bus has the ability to accommodate a 4th 22/11 kV 18 MVA transformer.

Within the NDS supply area, NS services the suburb of Strathmore and parts of Essendon and Moonee Ponds, supplying 12,200 customers. Figure 1-9 and Figure 1-10 show the single line diagram and aerial view of NS, respectively.

Figure 1-9 NS Single Line Diagram

[redacted]

Figure 1-10 NS Aerial View

1.3.1.3 Essendon (ES) zone substation

ES has two 66/11 kV 33 MVA transformers and is a summer-peaking semi-indoor zone substation. Under system normal conditions, the two transformers are operated in parallel as one group. Each transformer is fully switched into a looped 66 kV sub-transmission network from KTS. ES has the ability to expand to three transformers in future. ES has eleven in-service 11 kV feeders and six spare 11 kV circuit breakers for additional future feeders (ES 31, ES 32, ES 33, ES 34, ES 35, ES36) across the three existing 11 kV buses (with all spares being on the No.3 11 kV bus).

Within the NDS supply area, ES services the suburbs of Aberfeldie, Niddrie, Essendon North and parts of Ascot Vale, Essendon and Moonee Ponds, supplying 17,136 customers. Figure 1-11 and Figure 1-12 show the single line diagram and aerial view of ES, respectively.

Figure 1-11 ES Single Line Diagram

[redacted]

Figure 1-12 ES Aerial View

1.3.1.4 Pascoe Vale (PV) zone substation

PV has two 66/11 kV 33 MVA transformers and one 66/11 kV 10 MVA transformer and is a summer-peaking semi-indoor zone substation. Under system normal conditions, the three transformers are operated in parallel as one group. Each transformer is fully switched into a looped 66 kV sub-transmission network from KTS. PV has the ability to expand to three 33 MVA transformers in future. PV has nine in-service 11 kV feeders and three spare 11 kV circuit breakers for additional future feeders (PV 11, PV 10, PV 25), across the three existing 11 kV buses.

Within the NDS supply area, PV services the suburbs of Strathmore Heights, Hadfield, Glenroy and Oak Park, supplying 21,347 customers. Figure 1-13 and Figure 1-14 show the single line diagram and aerial view of PV.

Figure 1-13 PV Single Line Diagram

[redacted]

Figure 1-14 PV Aerial View

1.3.2 Sub-transmission network

Four sub-transmission networks service the area, one at 66 kV from WMTS (for FT), two at 66 kV from KTS (for PV and ES), and one at 22 kV from BTS (for NS), as shown in Figure 1-15.

Figure 1-15: 66kV Sub-transmission Lines in the Supply Area - Schematic

[redacted]

1.3.2.1 BTS-NS

The BTS-NS 22 kV sub-transmission network supplies approximately 12,200 customers via the NS 22/11 kV zone substation from three radial 22 kV lines from BTS. Figure 1-16 shows the schematic diagram of this network.

Figure 1-16: BTS-NS 22 kV Sub-transmission Network

[redacted]

1.3.2.2 KTS-BY-ES-KTS

The KTS-BY-ES-KTS 66 kV sub-transmission network supplies approximately 30,330 customers via the Braybrook (**BY**) 66/22 kV and ES 66/11 kV zone substations from two 66 kV lines from KTS and a single 66 kV line connected between the two zone substations. BY is outside of the NDS supply area and is not in scope for this assessment. Figure 1-17 shows the schematic diagram of this network.

Figure 1-17: KTS-BY-ES-KTS 66kV Sub-transmission Loop

[redacted]

1.3.2.3 KTS-AW-PV-NDT-KTS

The KTS-AW-PV-NDT-KTS 66 kV sub-transmission network supplies approximately 44,440 customers via the Airport West (**AW**) 66/22 kV and PV 66/11 kV zone substations from three 66 kV lines from KTS and a single 66 kV line connected between the two zone substations. AW is outside of the NDS supply area and is not in the scope for this assessment. Figure 1-18 shows the schematic diagram of this network.

Figure 1-18: KTS-AW-PV-NDT-KTS 66kV Sub-transmission Loop

[redacted]

1.3.2.4 WMTS-FT

The WMTS-FT 66 kV sub-transmission network supplies approximately 13,389 customers via the FT 66/11 kV zone substation from two radial 66 kV lines from WMTS. Figure 1-19 shows the single line diagram of this network.

Figure 1-19: WMTS-FT 66 kV Sub-transmission Network

[redacted]

1.3.3 HV distribution feeder network

JEN's 11 kV distribution feeder network for the NDS supply area is illustrated schematically in Figure 1-20.

Multiple 11 kV inter-feeder tie points exist between NS, ES, and FT (via feeders NS 07, NS 08, NS 09, NS, 11, NS 14, NS 15, NS 16, ES 15, ES 16, ES 22, ES 23, ES 24, ES 25, ES 26, FT 14, FT 16, FT 24, FT 26).

Only a single tie to PV exists (on feeder PV 12) to each of NS (via feeder NS 14) and ES (via feeder ES 25), limiting the transfer capability to and from PV.

Figure 1-20: 11kV Distribution Feeders

[redacted]

2. Identified Need

There is one key driver for an asset management intervention within the NDS supply area. This driver relates to existing and emerging asset utilisation limitations associated with maximum demand growth, reducing the spare capacity available within the distribution network.

2.1 Network Utilisation

Maximum demand for the supply area is expected to grow on average by 2.5% per annum during the next 10-year period (2025-34) based on underlying growth within the distribution network. The expected increase in maximum demand is mainly driven by population growth from residential infill and high-rise apartment development and slow increased of electric vehicle usage and electrification of gas across the area, with some major customer developments.

Parts of the existing sub-transmission network, zone substations and 11 kV distribution feeders supplying the area, will not have sufficient capacity to meet this expected increase in maximum demand. Several existing assets in the area are already (or forecast to be) highly utilised including three zone substations (being NS, FT and ES), one sub-transmission network (being BTS-NS), and at least eleven 11 kV distribution feeders. Staged, targeted augmentations of the network are needed, to connect new customers and maintain current levels of supply reliability.

2.1.1 Network Ratings

This section details the network capacity ratings that are available for customers to use during system normal (**N**) conditions and single contingency (**N-1**) conditions with one network asset out of service (forced or planned outage), for summer (worst case) and winter (best case) seasons.

Table 2-1 present the ratings of zone substations servicing the supply area.

Table 2-1: Zone Substation Ratings (MVA)

Zone Substation	Summer (N)	Winter (N)	Summer (N-1)	Winter (N-1)
NS	54.0	54.0	36.0	40.0
FT	66.0	66.0	34.8	40.0
ES	66.0	66.0	38.0	45.0
PV	64.0	64.0	45.6	45.6

Table 2-2 present the ratings of sub-transmission lines servicing the supply area.

Table 2-2: Sub-transmission Ratings (MVA)

Sub-transmission Network	Summer	Winter	Line Section
WMTS-FT	**101.0**	**127.0**	**Overall N Rating**
	52.0	**64.0**	**Overall N-1 Rating**
	52.0	64.0	WMTS-FT1
	65.2	76.6	WMTS-FT2
KTS-AW-PV	**266.0**	**291.0**	**Overall N Rating**
	166.0	**182.0**	**Overall N-1 Rating**
	100.6	105.7	KTS-PV
	117.0	128.0	KTS-AW
	117.0	128.0	KTS-NDT
	90.3	90.3	AW-PV
	117.0	128.0	AW-NDT
KTS-BY-ES	**158.0**	**164.0**	**Overall N Rating**
	101.7	**104.6**	**Overall N-1 Rating**
	101.7	104.6	KTS-BY
	101.7	105.7	KTS-ES
	90.3	96.6	BY-ES
BTS-NS	**45.6**	**51.0**	**Overall N Rating**
	30.4	**34.0**	**Overall N-1 Rating**
	15.2	15.2	BTS-NS1 193
	15.2	15.2	BTS-NS2 176
	15.2	21.9	BTS-NS3 190

Table 2-3 presents the ratings of 11 kV distribution feeders servicing the NDS supply area.

Table 2-3: 22kV Distribution Feeder Ratings (MVA)

Feeder	Summer	Winter		Feeder	Summer	Winter
ES 11	5.8	5.8		FT 11	5.8	5.8
ES 12	5.8	5.8		FT 14	6.8	6.8
ES 13	5.8	5.8		FT 15	8.0	8.0
ES 15	5.8	5.8		FT 16	8.0	8.0
ES 16	5.4	5.4		FT 21	5.9	5.9
ES 21	5.8	5.8		FT 22	7.1	7.1
ES 22	7.1	7.1		FT 24	5.7	5.7
ES 23	7.1	7.1		FT 26	7.1	7.1
ES 24	7.1	7.1		FT 31	5.8	5.8
ES 25	5.8	5.8		FT 32	7.1	7.1
ES 26	7.1	7.1		FT 33	7.1	7.1
NS 07	5.8	5.8		FT 35	7.1	7.1
NS 08	6.6	6.6		PV 12	6.6	7.1
NS 09	7.1	7.1		PV 13	5.8	5.8
NS 11	7.1	7.1		PV 14	7.1	7.1
NS 12	5.4	5.4		PV 15	6.6	7.1
NS 14	7.1	7.1		PV 21	7.1	7.1
NS 15	5.4	5.4		PV 22	7.1	7.1
NS 16	5.8	5.8		PV 23	7.1	7.1
NS 17	3.6	3.6		PV 24	6.6	7.1
NS 18	5.8	5.8		PV 31	7.1	7.1

2.1.2 Historical Maximum Demand

Table 2-4 presents the historical actual summer maximum demand on our zone substation and sub-transmission assets in the area. Values highlighted in red exceed the (N-1) cyclic rating, noting that 2021 was a mild ambient temperature (and hence an abnormally low maximum demand) summer.

Table 2-4: Actual Historical Summer Maximum Demand (MVA)

Network Asset	N Rating	N-1 Rating	2020	2021	2022	2023
NS	**54.0**	**36.0**	39.6	31.7	33.8	38.7
BTS-NS	**45.6**	**30.4**	39.6	31.7	33.8	38.7
FT	**66.0**	**34.8**	37.6	32.3	32.3	34.1
WMTS-FT	**101.0**	**52.0**	37.6	32.3	32.3	34.1
ES	**66.0**	**38.0**	46.5	37.4	41.7	45.1
KTS-BY-ES	**158.0**	**101.7**	89.8	72.2	79.0	93.5
PV	**64.0**	**45.6**	41.8	33.8	36.0	38.8
KTS-AW-PV	**266.0**	**166.0**	112.7	100.3	103.3	108.6

This table illustrates that ES, NS and FT have historically been highly utilised zone substations, and BTS-NS a highly utilised sub-transmission network.

Table 2-5 presents the historical actual summer maximum demand on our 11 kV distribution feeder assets in the area. Values highlighted **bold red** exceed the (N) rating.

Table 2-5: Distribution Feeder Actual Historical Summer Maximum Demand (MVA)

Feeder	Rating	2020	2021	2022	2023	Feeder	Rating	2020	2021	2022	2023
ES 11	**5.8**	5.2	4.1	4.4	5.2	**FT 11**	**5.8**	5.2	5.6	5.9	5.0
ES 12	**5.8**	3.6	2.7	2.9	3.4	**FT 14**	**6.8**	0.0	0.0	0.0	2.1
ES 13	**5.8**	5.2	3.8	4.4	4.8	**FT 15**	**8.0**	3.3	3.0	2.9	2.8
ES 15	**5.8**	5.2	4.0	4.3	4.2	**FT 16**	**8.0**	3.1	2.6	2.6	2.9
ES 16	**5.4**	3.8	3.1	3.3	3.7	**FT 21**	**5.9**	4.5	4.0	4.3	4.4
ES 21	**5.8**	5.3	4.3	4.6	4.9	**FT 22**	**7.1**	4.2	3.6	3.8	3.7
ES 22	**7.1**	7.2	6.0	6.6	6.6	**FT 24**	**5.7**	4.0	3.5	3.6	3.5
ES 23	**7.1**	1.6	1.3	1.5	1.7	**FT 26**	**7.1**	4.7	3.6	3.9	4.2
ES 24	**7.1**	5.0	3.9	4.2	5.6	**FT 31**	**5.8**	4.7	3.9	3.9	2.4
ES 25	**5.8**	5.3	4.4	4.4	4.8	**FT 32**	**7.1**	1.4	1.3	1.4	1.5
ES 26	**7.1**	5.6	4.2	4.7	4.4	**FT 33**	**7.1**	3.8	3.4	3.1	3.0
NS 07	**5.8**	3.2	2.5	2.6	3.6	**FT 35**	**7.1**	4.2	3.1	3.6	4.0
NS 08	**6.6**	3.1	2.4	2.7	2.7	**PV 12**	**6.6**	2.3	2.2	2.1	2.2
NS 09	**7.1**	4.2	4.8	4.5	3.9	**PV 13**	**5.8**	4.5	3.9	3.8	4.5
NS 11	**7.1**	5.6	5.2	5.3	5.5	**PV 14**	**7.1**	6.3	5.0	5.3	5.6
NS 12	**5.4**	3.2	3.1	2.9	3.4	**PV 15**	**6.6**	4.5	3.3	3.8	4.0
NS 14	**7.1**	5.7	4.4	4.9	5.6	**PV 21**	**7.1**	4.6	3.8	4.0	4.9
NS 15	**5.4**	4.3	3.5	3.7	4.9	**PV 22**	**7.1**	6.9	5.4	6.0	6.2
NS 16	**5.8**	2.2	1.7	1.9	1.9	**PV 23**	**7.1**	5.6	4.2	4.7	4.7
NS 17	**3.6**	3.0	2.4	2.7	2.9	**PV 24**	**6.6**	4.5	4.2	4.5	4.6
NS 18	**5.8**	3.2	3.0	3.4	3.9	**PV 31**	**7.1**	4.4	4.4	4.4	4.9

2.1.3 Maximum Demand Forecast

This section presents the maximum demand forecast over the next 10-years for the NDS supply area, taking into account new loads, underlying growth and the impacts of CER. The maximum demand forecasts are developed under different ambient temperature conditions, designated by a Probability of Exceedance (**PoE**), using internally prepared bottom-up forecasts which are reconciled to externally prepared top-down econometric forecasts.

Table 2-6 presents the 10% PoE summer maximum demand forecast for the forward 10-year planning period. Values highlighted and are an identified network limitation with red exceeding the (N-1) rating and **bold red** exceeding the (N) rating. BTS-NS is at risk of overload with all assets in service from 2027.

Table 2-6: 10% PoE Summer Maximum Demand Forecast (MVA) - Do Nothing

Network Asset	N Rating	N-1 Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
NS	**54.0**	**36.0**	40.9	41.2	42.6	44.4	46.0	47.4	48.9	50.3	51.7	52.9
BTS-NS	**45.6**	**30.4**	40.9	41.2	42.6	44.4	**46.0**	**47.4**	**48.9**	**50.3**	**51.7**	**52.9**
FT	**66.0**	**34.8**	42.0	44.2	47.0	49.4	51.3	52.6	54.1	55.7	57.2	58.6
WMTS-FT	**101.0**	**52.0**	42.0	44.2	47.0	49.4	51.3	52.6	54.1	55.7	57.2	58.6
ES	**66.0**	**38.0**	47.3	47.4	47.9	48.5	49.0	49.9	51.0	52.0	53.1	53.9
KTS-BY-ES	**158.0**	**101.7**	95.9	96.6	98.1	99.6	100.8	102.7	105.0	107.3	109.6	111.4
PV	**64.0**	**45.6**	42.0	42.0	42.3	42.8	43.3	43.8	44.4	44.6	45.2	45.6
KTS-AW-PV	**266.0**	**166.0**	167.0	168.7	171.3	173.8	174.2	175.8	177.9	179.5	181.4	182.9

Table 2-7 presents the 10% PoE winter maximum demand forecast for the forward 10-year planning period. Values highlighted and are an identified network limitation with red exceeding the (N-1) rating and **bold red** exceeding the (N) rating. FT is at risk of overload with all assets in service from 2032

Table 2-7: 10% PoE Winter Maximum Demand Forecast (MVA) - Do Nothing

Network Asset	N Rating	N-1 Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
NS	**54.0**	**40.0**	30.4	31.5	33.4	35.4	37.1	38.5	39.8	40.9	42.1	43.2
BTS-NS	**51.0**	**34.0**	30.4	31.5	33.4	35.4	37.1	38.5	39.8	40.9	42.1	43.2
FT	**66.0**	**40.0**	38.8	41.7	45.4	48.3	51.0	53.3	55.1	56.8	58.5	60.1
WMTS-FT	**127.0**	**64.0**	38.8	41.7	45.4	48.3	51.0	53.3	55.1	56.8	58.5	60.1
ES	**66.0**	**45.0**	36.0	37.1	38.3	39.4	40.3	41.2	42.2	43.1	44.1	45.1

KTS-BY-ES	**164.0**	**104.6**	70.4	73.1	75.9	78.0	79.9	82.0	83.9	85.8	87.7	89.6
PV	**64.0**	**45.6**	33.9	34.9	36.0	37.0	37.9	38.7	39.4	40.0	40.7	41.3
KTS-AW-PV	**291.0**	**182.0**	134.7	138.8	143.0	146.4	148.3	150.3	152.1	153.8	155.5	157.3

Table 2-8 presents the distribution feeder 10% PoE summer maximum demand forecast for the forward 10-year planning period. Values highlighted **bold red** exceed 100% of the rating (i.e., exceed the N rating) and are an identified network limitation. Several distribution feeders are at risk of overload over the planning horizon.

Table 2-8: Distribution Feeder 10% PoE Summer Maximum Demand Forecast (MVA) - Do Nothing

Feeder	Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
ES 11	**5.8**	5.7	**6.0**	**6.3**	**6.5**	**6.6**	**6.8**	**6.9**	**7.0**	**7.2**	**7.3**
ES 12	**5.8**	3.9	3.9	4.0	4.0	4.0	4.1	4.2	4.3	4.4	4.4
ES 13	**5.8**	5.0	5.0	5.1	5.1	5.2	5.3	5.4	5.5	5.6	5.7
ES 15	**5.8**	4.1	4.4	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3
ES 16	**5.4**	4.0	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6
ES 21	**5.8**	5.1	5.1	5.1	5.1	5.1	5.2	5.3	5.5	5.6	5.6
ES 22	**7.1**	5.4	5.4	5.4	5.4	5.5	5.6	5.7	5.8	5.9	6.0
ES 23	**7.1**	4.0	4.1	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.0
ES 24	**7.1**	5.6	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3
ES 25	**5.8**	5.2	5.2	5.2	5.3	5.3	5.4	5.5	5.6	5.7	5.8
ES 26	**7.1**	4.8	4.7	4.7	4.8	4.8	4.9	5.0	5.1	5.2	5.3
NS 07	**5.8**	3.5	3.5	3.6	3.6	3.7	3.8	3.9	4.0	4.1	4.2
NS 08	**6.6**	2.8	2.8	2.8	2.8	2.9	2.9	3.0	3.1	3.2	3.3
NS 09	**7.1**	2.6	2.6	2.7	3.0	3.4	3.8	4.3	4.8	5.1	5.2
NS 11	**7.1**	5.5	5.5	5.5	5.5	5.6	5.7	5.9	6.1	6.2	6.4
NS 12	**5.4**	3.1	3.2	4.6	**6.6**	**8.2**	**8.4**	**8.6**	**8.8**	**9.1**	**9.3**
NS 14	**7.1**	5.7	5.7	5.9	6.0	6.1	6.2	6.4	6.6	6.8	6.9
NS 15	**5.4**	3.9	4.5	5.0	5.3	5.4	**5.6**	**5.8**	**5.9**	**6.1**	**6.2**
NS 16	**5.8**	2.2	2.3	2.3	2.3	2.3	2.4	2.4	2.5	2.6	2.6
NS 17	**3.6**	3.2	3.3	3.3	3.3	3.4	3.4	3.5	3.6	**3.7**	**3.8**
NS 18	**5.8**	4.3	4.6	4.8	4.8	4.9	5.1	5.2	5.4	5.5	5.7
FT 11	**5.8**	4.9	4.8	4.8	4.9	5.0	5.0	5.1	5.2	5.3	5.4

Feeder	Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
FT 14	**6.8**	5.0	5.6	6.3	**7.1**	**7.9**	**8.9**	**9.9**	**11.1**	**11.9**	**12.2**
FT 15	**8.0**	2.8	3.1	3.4	3.8	4.1	4.3	4.4	4.5	4.7	4.8
FT 16	**8.0**	4.4	4.4	4.4	4.5	4.5	4.6	4.8	4.9	5.0	5.2
FT 21	**5.9**	4.5	4.8	4.8	4.8	4.9	5.0	5.1	5.3	5.4	5.5
FT 22	**7.1**	4.9	4.4	5.4	6.1	6.5	6.7	6.9	7.1	**7.3**	**7.4**
FT 24	**5.7**	4.0	4.1	4.2	4.2	4.2	4.3	4.5	4.6	4.7	4.8
FT 26	**7.1**	5.0	5.1	5.1	5.1	5.2	5.3	5.5	5.6	5.8	5.9
FT 31	**5.8**	2.6	4.1	4.1	4.1	4.1	4.2	4.4	4.5	4.6	4.7
FT 32	**7.1**	2.5	4.1	6.1	**7.6**	**8.5**	**9.0**	**9.4**	**9.6**	**9.9**	**10.1**
FT 33	**7.1**	3.5	4.0	5.0	5.4	5.8	6.0	6.1	6.3	6.5	6.6
FT 35	**7.1**	4.7	4.7	4.7	4.7	4.8	4.9	5.0	5.2	5.3	5.5
PV 12	**6.6**	2.5	2.5	2.6	2.7	2.8	2.8	2.8	2.9	2.9	2.9
PV 13	**5.8**	4.7	4.8	5.0	5.0	5.1	5.1	5.2	5.3	5.3	5.4
PV 14	**7.1**	6.1	6.0	6.0	6.0	6.0	6.1	6.2	6.3	6.4	6.4
PV 15	**6.6**	4.0	4.1	4.3	4.5	4.6	4.6	4.7	4.8	4.8	4.9
PV 21	**7.1**	4.9	4.9	4.9	5.0	5.0	5.0	5.1	5.2	5.2	5.3
PV 22	**7.1**	6.9	6.8	6.8	6.8	6.9	6.9	7.0	7.1	**7.2**	**7.3**
PV 23	**7.1**	4.7	4.6	4.6	4.6	4.6	4.7	4.8	4.8	4.9	4.9
PV 24	**6.6**	4.8	5.0	5.3	5.6	5.9	6.1	6.3	6.5	6.6	6.6
PV 31	**7.1**	4.9	4.9	5.0	5.0	5.1	5.2	5.2	5.3	5.4	5.4

Table 2-9 presents the distribution feeder 10% PoE winter maximum demand forecast for the forward 10-year planning period. Values highlighted in **bold red** exceed 100% of the rating (i.e., exceed the N rating) and are an identified network limitation. Several distribution feeders are at risk of overload over the planning horizon.

Table 2-9: Distribution Feeder 10% PoE Winter Maximum Demand Forecast (MVA) - Do Nothing

Feeder	Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
ES 11	**5.8**	4.7	5.1	5.4	5.7	5.8	**6.0**	**6.1**	**6.3**	**6.4**	**6.6**
ES 12	**5.8**	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.5	3.6
ES 13	**5.8**	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
ES 15	**5.8**	3.2	3.5	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.6
ES 16	**5.4**	3.1	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9

Feeder	Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
ES 21	**5.8**	3.9	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.6	4.7
ES 22	**7.1**	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.5	5.6
ES 23	**7.1**	2.9	3.0	3.2	3.4	3.5	3.6	3.7	3.8	3.9	4.0
ES 24	**7.1**	4.3	4.4	4.5	4.6	4.8	4.9	5.0	5.1	5.2	5.3
ES 25	**5.8**	3.7	3.8	3.8	3.9	3.9	4.0	4.1	4.2	4.2	4.3
ES 26	**7.1**	3.9	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.6	4.7
NS 07	**5.8**	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.9	4.0
NS 08	**6.6**	2.6	2.7	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.2
NS 09	**7.1**	2.1	2.2	2.3	2.6	3.0	3.4	3.8	4.2	4.5	4.7
NS 11	**7.1**	4.7	4.8	4.9	4.9	5.0	5.2	5.3	5.4	5.6	5.7
NS 12	**5.4**	1.8	1.9	2.9	4.3	**5.5**	**5.7**	**5.9**	**6.1**	**6.3**	**6.4**
NS 14	**7.1**	3.9	4.1	4.3	4.5	4.6	4.8	5.0	5.1	5.3	5.4
NS 15	**5.4**	3.0	3.6	4.1	4.4	4.5	4.7	4.9	5.0	5.2	5.3
NS 16	**5.8**	1.7	1.8	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.1
NS 17	**3.6**	2.5	2.6	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.2
NS 18	**5.8**	3.9	4.2	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.3
FT 11	**5.8**	**6.0**	**6.0**	**6.0**	**6.1**	**6.1**	**6.2**	**6.2**	**6.2**	**6.2**	**6.3**
FT 14	**6.8**	4.5	5.0	5.8	6.6	**7.4**	**8.4**	**9.4**	**10.5**	**11.3**	**11.6**
FT 15	**8.0**	2.2	2.6	2.9	3.3	3.6	3.8	3.9	4.1	4.2	4.3
FT 16	**8.0**	4.0	4.1	4.2	4.3	4.4	4.6	4.7	4.8	5.0	5.1
FT 21	**5.9**	5.0	5.4	5.5	5.6	5.7	5.9	**6.1**	**6.3**	**6.5**	**6.7**
FT 22	**7.1**	4.7	4.4	5.4	6.2	6.8	7.1	**7.3**	**7.6**	**7.8**	**8.0**
FT 24	**5.7**	4.1	4.3	4.5	4.6	4.7	4.8	5.0	5.1	5.3	5.4
FT 26	**7.1**	5.0	5.2	5.4	5.5	5.6	5.8	6.0	6.2	6.4	6.5
FT 31	**5.8**	3.1	4.8	4.9	5.0	5.1	5.3	5.4	5.6	5.8	**6.0**
FT 32	**7.1**	2.2	3.8	5.8	**7.3**	**8.3**	**8.9**	**9.4**	**9.7**	**10.0**	**10.2**
FT 33	**7.1**	4.0	4.7	6.0	6.6	**7.3**	**7.6**	**7.9**	**8.1**	**8.3**	**8.6**
FT 35	**7.1**	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3	4.5	4.6
PV 12	**7.1**	2.0	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.7	2.7
PV 13	**5.8**	4.4	4.7	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6
PV 14	**7.1**	5.2	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0

Feeder	Rating	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
PV 15	**7.1**	3.4	3.5	3.8	4.0	4.2	4.3	4.4	4.4	4.5	4.6
PV 21	**7.1**	4.4	4.5	4.6	4.7	4.7	4.8	4.9	5.0	5.1	5.2
PV 22	**7.1**	5.5	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.5
PV 23	**7.1**	4.2	4.3	4.4	4.4	4.5	4.6	4.7	4.7	4.8	4.9
PV 24	**7.1**	4.3	4.6	5.0	5.4	5.7	5.9	6.1	6.3	6.4	6.6
PV 31	**7.1**	4.5	4.6	4.7	4.8	5.0	5.1	5.1	5.2	5.3	5.4

2.2 Summary of Network Limitations

This NDS will assess the technical and economic viability of solutions to alleviate the network utilisation issues identified above.

A summary of credible solutions is presented in Table 2-10 that could address each of the identified limitations. Further details and diagrams of the scope of the solutions is provided in the Appendices.

Table 2-10: Summary of identified network limitations and possible options

Network Asset	Limitation	From	Possible screening of network options to address the need[9]
NS	N-1 capacity	Existing	4th 22/11 kV transformer at NS & Augment feeders at NS (all) 3rd 66/11 kV transformer at PV & New feeder PV 11 & New feeder PV 25 3rd 66/11 kV transformer at ES & New feeder ES 32 & New feeder ES 33 Load transfers to FT, PV and/or ES BESS and/or demand management in NS 11 kV distribution network
BTS-NS	N-1 capacity N capacity	Existing 2029	Thermal Uprate BTS-NS3 190 22kV Augment BTS-NS 22kV Loop New BTS-NS4 22kV line BESS and/or demand management in NS 11 kV distribution network
FT	N-1 capacity	Existing	3rd Transformer and 66kV Works at FT 4th 22/11 kV transformer at NS and new BTS-NS4 22kV line 3rd 66/11 kV transformer at ES and new ES feeder 3rd 66/11kV transformer at PV and new PV feeder

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Network Asset	Limitation	From	Possible screening of network options to address the need[9]
			BESS and/or demand management in FT 11 kV distribution network
WMTS-FT	N-1 capacity	2030	No nothing - risk is not material for some options before end of next regulator control period. Thermal Uprate WMTS-FT No.1 66kV Thermal Uprate WMTS-FT No.1 and No. 2 66kV Reconductor WMTS-FT No.1 and WMTS-FT No.2 66kV lines BESS and/or demand management in FT 11 kV distribution network
ES	N-1 capacity	Existing	3rd 66/11 kV transformer at ES 3rd 66/11 kV transformer at PV & New feeder PV 11 New feeder PV 25 Load transfers to PV and/or NS BESS and/or demand management in ES 11 kV distribution network
KTS-BY-ES	N-1 capacity	2030	No nothing - upgrading KTS-BY-ES is an expensive option, so is not considered a viable option compared to the value of the risk. Demand management in ES 11 kV or BY 22 kV distribution network
PV	N-1 capacity	2035	No nothing - risk is not material for some options before end of next regulator control period. 3rd 66/11 kV transformer at PV (to replace smaller unit) Demand management in PV 11 kV distribution network
KTS-AW-PV	N-1 capacity	2025	No nothing - upgrading KTS-PV does not increase the N-1 rating of the sub-transmission network, so is not considered a viable option. Augmentation need driven only by major customer connections – Refer to Major Customers NDS.
ES 11	N capacity	2026	Augment feeder ES 11 New feeder ES0-031 BESS and/or demand management in ES 11 11 kV distribution network
NS 12	N capacity	2028	No nothing - risk is not material before end of next regulator control period.

Network Asset	Limitation	From	Possible screening of network options to address the need[9]
			Augmentation need driven only by major customer connections. New MVRC customer feeder from FT to offload NS 12
NS 15	N capacity	2030	Transfer load to FT 14
NS 17	N capacity	2033	Augment feeders at NS (NS 17 part) New feeder PV 25 BESS and/or demand management in NS 17 11 kV distribution network
NS 18	N capacity	2035	Augment feeders at NS (NS 18 part) BESS and/or demand management in NS 18 11 kV distribution network
FT 11	N capacity	2025	Augment feeder FT0-011 to FT 15 BESS and/or demand management in FT 11 11 kV distribution network
FT 14	N capacity	2028	Augmentation need driven only by major customer connections. New MVRC customer feeder from FT to offload FT 14
FT 21	N capacity	2031	Augment feeder FT 21 BESS and/or demand management in FT 21 11 kV distribution network
FT22 FT32	N capacity	2031 2028	New feeder FT0-025 BESS and/or demand management in FT 22 & FT 32 11 kV distribution networks
FT 31	N capacity	2034	Load transfers to adjacent feeders.
FT 33	N capacity	2029	New feeder FT0-012 BESS and/or demand management in FT 33 11 kV distribution network
PV 22	N capacity	2033	No nothing - risk is not material before end of next regulator control period.
PV 24	N capacity	2035	Transfer load to PV 23

The effectiveness of each solution to address an identified need is evaluated within this NDS by comparing its costs and benefits against the status quo (do nothing), used as a reference base case.

Where multiple potential solutions are indicated above to address an identified limitation, those solutions are separated into different options in this NDS for further comparative technical and economic evaluation.

2.3 Non-network Alternatives

The NER requires us to consider non-network and standalone power systems (SAPS) solutions for addressing identified limitations on our network. In developing this NDS, we have considered the possibility of credible non-network or SAPS solutions, for meeting each of the existing and emerging network capacity limitations identified within the supply area.

Non-network and SAPS solutions could be delivered through embedded generation, storage, or demand-side management programs (or combination thereof), to defer or reduce in scope, traditional network augmentation solutions. Such solutions need to have a sufficient number of proponents participating, to provide the aggregate level of dispatchable capacity needed, to defer an augmentation by at least one year. This could then address the identified capacity limitations and avoid supply interruptions or asset overload damage which may otherwise result without adequate network support.

Demand management solutions are targeted at reducing the peak demand by reducing customer load. This includes solutions such as direct load control (including for example, air-conditioning, pool pumps and electric vehicle charging), or customer behavioural demand response programs. By comparison, embedded generation and/or storage solutions are targeted at supplying the peak demand by offsetting part of the customers' load using local generation sources. This includes dispatchable blocks of embedded generators and/or energy storage systems (including for example, virtual power plants, community storage, standby/grid connected generation).

The aim when defining potential credible non-network and SAPS options, is to test whether non-network or SAPS solutions (or combination of) is a viable way to avoid or reduce the scale of a network investment, in a way that efficiently addresses the identified need. The criteria we use to assess the potential credibility of non-network or SAPS solutions includes:

- **Addressing the identified need**: being able to reduce or eliminate the supply reliability risk (EUE) associated with the identified need.
- **Technically feasible**: there being no constraints or barriers that prevent an option from being delivered to address the identified need.
- **Economically feasible**: the economic viability is commensurate or potentially better than the preferred network option.
- **Timely**: can be delivered in a timescale that is consistent with the timing of the identified need.

We intend to pursue a blend of prudent, targeted investments in network and non-network solutions to reduce EUE within the NDS supply area, consistent with NER clause 6.5.7. This approach provides us with greater option value (in some cases) to manage uncertainty in our forecasts of maximum demand growth. As such, for each of the major solutions identified in the preferred network development plan of this NDS, we intend to consult the market (through the RIT-D process) to identify credible non-network or SAPS solutions.

Given the needs for non-network solutions for this NDS are known, we are yet to identify (from the market) credible non-network solutions for each limitation. We intend to fund any identified preferred option non-network solutions through capex to opex substitution during the regulatory control period, rather than request step changes to our operational expenditure regulatory allowance.

Notwithstanding our approach to seeking efficient solutions to project augmentation, we have undertaken a high-level assessment of non-network options by considering the benefits of deferring expenditure by one year against a plausible alternative of procuring capacity from the market.

Applying this methodology to distributed storage, we determined that the installed costs of $48.1 million is greater than the $21.8 million installed costs of the preferred network option. By comparison, for a demand response solution, we determined that the costs of $1.2 million pa is comparable to the network augmentation deferral benefit of $1.1 million pa. Whilst this not the preferred approach for storage, demand response could be a preferred approach for some of the projects in the network development program, only if all four credibility criteria are met - this has yet to be tested with the market and will need to go through the RIT-D process to have it tested.

2.4 Consumer Energy Resources

Decentralisation, digitisation, decarbonisation and electrification are fundamentally changing the structure and function of the electricity system. Our network will need to continue to evolve from a network which provides one-directional flow to the crucial platform which underpins energy use in our network area.

Given the expanded role of our network – in terms of scale, function and criticality – we are keen ensure we also take advantage of the available opportunities to make the most of our existing network before building more.

A key aspect of this is our Consumer Energy Resources (CER) Strategy which includes:

- **Modernising the grid** – enable and support the uptake of CER on the network, including flexible services using Dynamic Operating Envelopes (**DOE**) to remove static export and import limits, reduce CER curtailment, improve CER exports, and improve voltage, supply quality and system security compliance.
- **Seeding the market** – stimulate growth in the efficient use of CER to support the broader market, including data visibility for customers, enhanced tariffs such as for solar soak and EV charging, and use common communication protocols to support CER aggregation by market service providers.

Our demand forecast is premised on the roll-out of our CER strategy. For example, it takes into account the continued impact of solar in reducing peak demand (until the peak demand shifts later in the evening) and moderates the impact of EV charging overtime, based on expected roll-out of cost-reflective tariffs and consumers who opt-into forms of managed charging. Or put another way, the network constraints identified already incorporate the impact of our CER strategy.

This strategy also considers a sensitivity where our CER strategy is more effective than anticipated (all EV charging load is removed from our demand forecast). This sensitivity shows the impact of what could occur if all EV charging was subject to dynamic operating envelopes, considered as part of our CER strategy.

3. Assessment Methodology and Assumptions

This section outlines the method that we apply in assessing its network risks and limitations for each credible solution and of the feasible options. It presents key assumptions and input information applied to the assessments in this document.

3.1 Probabilistic Planning

In accordance with clause 5.17.1(b) of the National Electricity Rules, our augmentation investment decisions are aligned with the Regulatory Investment Test for Distribution (RIT-D). This test aims to maximise the present value of the net economic benefit to all those who produce, consume and transport electricity in the NEM.

To achieve this objective, JEN applies a probabilistic planning method that considers the likelihood and severity of critical network conditions and outages and their duration. The method compares the forecast cost to consumers of a loss of energy supply due to a network limitation, against the proposed augmentation cost to mitigate the energy supply risk.

The annual cost to consumers is calculated by multiplying the expected unserved energy (**EUE**) (the expected energy not supplied based on the probability and duration of the supply capacity limitation occurring in a year - a proxy for supply reliability) by the Value of Customer Reliability (**VCR**).

The present value of this expected benefit is then compared with the costs of the feasible solutions and options. In essence, the total lifecycle cost for each credible solution and option includes the project capital cost, the annual on-going operating and maintenance expenditure (**O&M**), and the annual cost of the EUE.

3.2 Assessment Assumptions

In evaluating net economic benefits, the following assumptions are used to calculate the annualised value of EUE for all the solutions and options analysed in this document:

- Value of Customer Reliability (VCR) of $47,905 per MWh (Real 2024).
- Average feeder outage rate is calculated based on recent years of JEN's actual historic reliability data.
- Sub-transmission line outage frequency, which is 0.09 outages per kilometre of line length per year.
- Sub-transmission line outage average duration of 4 hours per outage.
- Power transformer outage frequency, which is 0.01 outages per year.
- Power transformer outage average duration of 2.65 months per outage.
- Regulatory Discount rate of 5.18%
- Economic analysis period for cost-benefit analysis set at 20 years.
- Distribution feeder EUE based on 6-year demand forecast, held constant thereafter.
- Zone substation and sub-transmission EUE based on 10-year demand forecast, held constant thereafter; and

- 70% weighting on 50% PoE, and 30% weighting on 10% PoE for calculation of the EUE.

4. Base Case

The base case Option 1 (do nothing) assumes no additional investment into the network to address the existing and forecast network limitations identified in section 2.2.

Table 4-1 details the zone substation and sub-transmission EUE for Option 1 (do nothing) over the planning horizon for the identified network limitations.

Table 4-1: Zone Substation and Sub-transmission Expected Unserved Energy (MWh pa) – Option 1

Asset	FT	ES	NS	WMTS-FT	BTS-NS	Total
2025	0.8	0.4	0.1	0.0	1.1	**2.5**
2026	2.2	0.5	0.3	0.0	1.3	**4.2**
2027	5.1	0.6	0.5	0.0	1.8	**7.9**
2028	9.8	0.6	0.8	0.0	2.6	**13.9**
2029	15.8	0.8	1.1	0.0	3.8	**21.5**
2030	22.7	0.9	1.5	0.0	5.4	**30.6**
2031	31.5	1.1	2.0	0.0	7.9	**42.5**
2032	42.1	1.3	2.6	0.0	10.9	**56.9**
2033	54.6	1.5	3.2	0.0	14.7	**74.1**
2034	69.3	1.8	4.0	0.1	19.5	**94.7**

Table 4-2 details the distribution feeder EUE for Option 1 (do nothing) over the planning horizon for the identified network limitations.

Table 4-2: Distribution Feeder Expected Unserved Energy (MWh pa) – Option 1

Asset	FT 11	FT 21	FT 22	FT 31	FT32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	4.7	0.0	0.3	0.0	0.0	0.0	3.1	0.1	0.0	0.0	**8.2**
2026	4.8	0.0	1.7	0.0	0.0	0.1	4.0	0.1	0.1	0.0	**10.8**
2027	4.9	0.0	5.0	0.1	1.1	0.9	5.6	0.2	0.4	0.0	**18.1**
2028	5.1	0.1	7.4	0.1	3.9	1.7	8.1	0.2	0.8	0.1	**27.4**
2029	5.5	0.6	8.3	0.1	47.5	2.0	9.4	0.2	1.2	0.2	**75.0**
2030	5.9	1.1	8.7	0.1	183	3.6	12.0	0.3	1.8	0.3	**216.5**

A number of feeders are forecast to exceed their 'N' rating over the forecast period as was presented in Table 2-8 and Table 2-9, accounting for the rapid increase in the value of EUE.

Applying the VCR, gives the values of the expected EUE over the forecast period.

Table 4-3 details the zone substation and sub-transmission EUE financial value for Option 1 (do nothing) over the planning horizon for the identified network limitations.

Table 4-3: Zone Substation and Sub-transmission Value of Expected Unserved Energy ($k, Real 2024) – Option 1

Asset	FT	ES	NS	BTS-NS	WMTS-FT	Total
2025	40	21	7	55	0	**122**
2026	106	23	13	60	0	**202**
2027	245	27	24	84	0	**381**
2028	470	30	38	127	0	**664**
2029	757	36	53	181	0	**1,028**
2030	1,085	44	74	260	0	**1,464**
2031	1,508	54	97	378	0	**2,037**
2032	2,019	64	123	521	1	**2,728**
2033	2,618	74	154	702	2	**3,550**
2034	3322	84	190	935	4	**4,536**

Table 4-4 details the distribution feeder EUE financial value for Option 1 (do nothing) over the planning horizon for the identified network limitations.

Table 4-4: Distribution Feeder Value of Expected Unserved Energy ($k, Real 2024) – Option 1

Asset	FT 11	FT 21	FT 22	FT 31	FT 32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	223	0	17	1	0	0	148	5	1	0	**395**
2026	229	0	81	2	0	3	192	6	4	1	**517**
2027	235	0	238	2	53	42	268	8	18	1	**865**
2028	246	6	357	3	186	79	388	10	37	4	**1,314**
2029	263	27	397	4	2,277	94	451	12	56	10	**3,591**
2030	281	53	419	6	8749	172	573	16	85	16	**10,370**

5. Options Analysis

5.1 Options Description and Scope

This section provides a summary of the solutions which combine to form the projects for each network development option that are designed to address the identified needs.

Table 5-1 provides a broad description of the scope of each option and their ability to address the identified network need, assuming all solution components are implemented in full.

Table 5-1: Options to address the identified need and their solution descriptions

Option	High Level Description	Ability to address identified network need
Option 1 Do Nothing	This is the base case, assuming no additional expenditure in the NDS supply area.	Nil
Option 2 Flemington Plan	FT 3rd 66/11 kV 33 MVA transformer and 66 kV line uprate NS 22 kV line uprates HV feeder augmentations	Fully addresses overload risk at FT. No change in overload risk on ES and NS. No change in overload risk on KTS-BY-ES and KTS-AW-PV 66 kV sub-transmission loops. Addresses almost all overload risk on BTS-NS lines. Fully addresses all HV feeders overload risk.
Option 3 Flemington and North Essendon Plan	FT 3rd 66/11 kV 33 MVA transformer and 66 kV line uprate NS 4th 22/11 kV 18 MVA transformer and 4th 22 kV line HV feeder augmentations	Fully addresses overload risk at FT. Partially addresses overload risk at NS and ES. Partially addresses overload risk on KTS-BY-ES loop. No change in overload risk on KTS-AW-PV loop. Partially addresses overload risk on BTS-NS lines. Fully addresses all HV feeders overload risk.
Option 4 Flemington and Essendon Plan	FT 3rd 66/11 kV 33 MVA transformer and 66 kV line uprate ES 3rd 66/11 kV 33 MVA transformer NS 22 kV line uprates HV feeder augmentations	Fully addresses overload risk at FT and ES. Partially addresses overload risk at NS. Marginal increase in overload risk on KTS-BY-ES loop. No change in overload risk on KTS-AW-PV loop. Fully addresses overload risk on BTS-NS lines.

		Fully addresses all HV feeders overload risk.
Option 5 Flemington and Pascoe Vale Plan	FT 3rd 66/11 kV 33 MVA transformer and 66 kV line uprate PV 3rd 66/11 kV 33 MVA transformer (replacing smaller) NS 22 kV line uprates HV feeder augmentations	Fully addresses overload risk at FT and PV. Partially addresses overload risk at NS and ES. Partially addresses overload risk on KTS-BY-ES loop. Marginal increase in overload risk on KTS-AW-PV loop. Fully addresses overload risk on BTS-NS lines. Fully addresses all HV feeders overload risk.
Option 6 BESS Plan	40 MW / 100 MWh BESS ramp up over 10 years, distributed across FT 11 kV and NS 11 kV feeders.	Fully addresses overload risk at FT. No change in overload risk on ES No change in overload risk on KTS-BY-ES and KTS-AW-PV 66 kV sub-transmission loops. Addresses almost all overload risk on NS and BTS-NS lines. Fully addresses all HV feeders overload risk.
Option 7 DM Plan	40 MW / 100 MWh DM ramp up over 10 years, distributed across FT 11 kV and NS 11 kV feeders.	

Table 5-2 itemises the credible solutions within each of the network development options assessed in this NDS.

Table 5-2: Summary of credible solutions comprising each network option.

Asset Limitation	Option 1 Do Nothing	Option 2 FT	Option 3 FT, NS	Option 4 FT, ES	Option 5 FT, PV
FT		8.1.1 3rd Transformer and 66kV Works at FT			
NS		Nil.	8.2.1 4th 22/11 kV transformer at NS	8.3.1 3rd 66/11 kV transformer at ES, 8.3.2 New feeder ES 32	8.4.1 3rd 66/11 kV transformer at PV, 8.4.2 New feeder PV 11 8.4.2 New feeder PV 25

				Load transfer from NS to ES (12 MVA)[10]	Load transfer from NS to PV (8 MVA)[11]
ES	Nil.	Nil.	8.2.5 Augment feeders at NS (18, 06, 07, 17) Load transfer from ES to NS (10 MVA)[12]	8.3.1 3rd 66/11 kV transformer at ES.	Load transfer from ES to PV (4 MVA)[13]
PV		Nil. (Risk not material)			
BTS-NS		8.2.4 (Refer right)	8.2.2 New BTS-NS4 22kV line	8.2.4 Augment BTS-NS 22kV Loop	
WMTS-FT		8.1.2 Thermal Uprate WMTS-FT No.1 66kV			
KTS-BY-ES		Nil. (Risk not material)			
KTS-AW-PV		Nil. (Refer Major Customer NDS)			
ES 11		8.5.6 New feeder ES0-031, Load transfer to ES 31 (4 MVA)			
NS 12		Nil. (Refer Major Customer NDS)			
NS 15		Load transfer to FT 14 (2 MVA)			
NS 17		8.2.5 Augment feeders at NS (NS 17 part)			8.4.2 New feeder PV 25
NS 18		8.2.5 Augment feeders at NS (NS 18 part)			
FT 11		8.5.4 Augment feeder FT0-011, Load transfer to FT 15 (1 MVA)			
FT 14		Nil. (Refer Major Customer NDS)			
FT 21		8.5.1 Augment feeder FT21			
FT 22		8.5.2 New feeder FT0-025			
FT 32		8.5.2 New feeder FT0-025			
FT 33		8.5.3 New feeder FT0-012			
PV 22		Nil. (Risk not material)			
PV 24		Load transfer to PV 23 (1 MVA)			

5.2 Options Project and On-going Operational Costs

Table 5-4 summarises the credible network solution costs and scope of work, and the identified optimum economic timing of each solution based on the EUE risk of the associated network limitation.

[10] NS 07 to ES 32 (3 MVA); NS 11 to ES 33 (4 MVA); NS 16 to ES 26 (2 MVA); NS 15 to ES 33 (3 MVA).

[11] NS 14 to PV 11 (5.5 MVA); NS 17 to PV 25 (3 MVA).

[12] ES 16 to NS 08 (4 MVA); ES 15 to NS 07 (3 MVA); ES 26 to NS 16 (3 MVA).

[13] ES 25 to PV 12 (3.5 MVA).

Table 5-3: Summary of Credible Network Solution Capital and Annualised Costs (Real 2024)

Credible Network Solutions	Scope of Work Section	Option	Capital Cost ($M)	Annual Cost ($k pa)[14]	Network Limitation	Optimum Timing[15]
3rd Transformer and 66kV Works at FT	8.1.1	2,3,4,5	[redacted]	[redacted]	FT	2029
Thermal Uprate WMTS-FT No.1 66kV	8.1.2	2,3,4,5	[redacted]	[redacted]	WMTS-FT	2033
Thermal Uprate WMTS-FT No.1 and No. 2 66kV	8.1.3	Nil	[redacted]	[redacted]	WMTS-FT	N/A
Reconductor WMTS-FT No.1 and WMTS-FT No.2 66kV lines	8.1.4	Nil	[redacted]	[redacted]	WMTS-FT	N/A
4th 22/11 kV transformer at NS	8.2.1	3	[redacted]	[redacted]	NS, BTS-NS	> 2035
New BTS-NS4 22kV line	8.2.2		[redacted]			
Thermal Uprate BTS-NS3 190 22kV	8.2.3	Nil	[redacted]	[redacted]	BTS-NS	N/A
Augment BTS-NS 22kV Loop	8.2.4	2,4,5	[redacted]	[redacted]	BTS-NS	2028
Augment feeders at NS – NS 18	8.2.5	2,3,4,5	[redacted]	[redacted]	NS 18	2031
Augment feeders at NS – NS 08	8.2.5	3	[redacted]	[redacted]	ES	2027
Augment feeders at NS – NS 07	8.2.5	3	[redacted]	[redacted]	ES	2027
Augment feeders at NS – NS 17	8.2.5	2,3,4	[redacted]	[redacted]	NS 17	2030
3rd 66/11 kV transformer at ES	8.3.1	4	[redacted]	[redacted]	NS, ES	> 2035
New feeder ES 32	8.3.2		[redacted]			
New feeder ES 33	8.3.2	Nil	[redacted]	[redacted]	ES 24	N/A
3rd 66/11 kV transformer at PV	8.4.1	5	[redacted]	[redacted]	NS, ES	> 2035
New feeder PV 11	8.4.2		[redacted]			
New feeder PV 25	8.4.2	5	[redacted]	[redacted]	NS 17	> 2035
Augment feeder FT21	8.5.1	2,3,4,5	[redacted]	[redacted]	FT 21	2029
New feeder FT0-025	8.5.2	2,3,4,5	[redacted]	[redacted]	FT 32, FT 22	2026
New feeder FT0-012	8.5.3	2,3,4,5	[redacted]	[redacted]	FT 33	2030
Augment feeder FT0-011	8.5.4	2,3,4,5	[redacted]	[redacted]	FT 11	2029
Augment feeder ES 11	8.5.5	Nil	[redacted]	[redacted]	ES 11	N/A
New feeder ES0-031	8.5.6	2,3,4,5	[redacted]	[redacted]	ES 11	2026
Augment feeder PV 24	8.5.7	Nil	[redacted]	[redacted]	PV 24	N/A

Based on an aggregation of the cost of the various solutions above that make up each option, and their optimum timing based on a comparison of their annualised costs with the do-nothing value of EUE, the costs for each option are summarised in Table 5-4 below. Present values are calculated over an economic analysis period of 20 years.

[14] Based on a regulated discount rate.

[15] Year in which the value of EUE exceeds the annualised cost of the solution.

Table 5-4: Summary of Option Costs ($M Real 2024)

Capital Cost	Option 1	Option 2	Option 3	Option 4	Option 5
Option total capital cost	0.0	21.3	27.7	26.7	32.1
PV of total capital cost	0.0	19.0	22.7	21.7	25.2
PV of O&M cost	0.0	2.8	3.3	3.1	3.6
PV of option total capital and O&M cost	0.0	21.8	26.0	24.9	28.7

5.3 Options Ability to Address the Need

This section presents the maximum demand forecast and asset utilisations over the next 10-years for the supply area, taking into account the impact of each option and its ability to address the forecast overloads on the network as was tabulated in Table 2-6, Table 2-7, Table 2-8 and Table 2-9.

This assessment supports us in determining the option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the NEM, and which is therefore consistent with the long-term interests of our customers.

The “do nothing” option presents the forecast EUE for the NDS supply area, assuming none of the identified network development options are implemented. It is used as a base case against which all of the credible network development options are compared and shows the comparative benefits of each credible option.

The risks associated with the “do nothing” option are:

- Inability to connect new customer load.
- Increased risk of breaching statutory clearances (green book) on bare overhead conductors.
- Increased risk of failure of equipment (e.g., cables, joints, etc.) when equipment operated above limits.
- Inability to restore all lost supplies in the event of loss of a critical asset during peak demand period.
- Deterioration of supply reliability due to capacity shortfall; and
- Intangible costs to JEN arising from negative publicity due to longer supply restoration time during and following hot weather events.

Table 5-5 presents the new ratings of the credible solutions applied for each option. Asset not listed in this table have no change to their ratings, and therefore the Option 1 ratings presented in section 2.1.1 apply to those assets.

Table 5-5: Ratings Before and After Solutions Applied (MVA)[16]

Asset	Option	Summer Before	Summer After	Winter Before	Winter After	Solution Applied
FT	2, 3, 4, 5	34.8	69.6	40.0	80.0	8.1.1
WMTS-FT	2, 3, 4, 5	52.0	63.0	64.0	76.6	8.1.2
FT 12	2, 3, 4, 5	-	7.1	-	7.1	8.5.3
FT 21	2, 3 ,4, 5	5.9	6.7	5.9	6.7	8.5.1
FT 25	2, 3, 4, 5		7.1		7.1	8.5.2
NS	3	36.0	54.0	40.0	60.0	8.2.1
BTS-NS	2, 4, 5	30.4	38.8	34.0	38.8	8.2.4
BTS-NS	3	30.4	45.6	34.0	51.0	8.2.2
NS 08	3	6.6	8.1	6.6	8.1	8.2.5
NS 07	3	5.8	7.1	5.8	7.1	8.2.5
NS 17	2, 3, 4, 5	3.6	7.1	3.6	7.1	8.2.5
NS 18	2, 3, 4, 5	5.8	7.8	5.8	7.8	8.2.5
ES	4	38.0	76.0	45.0	90.0	8.3.1
ES 31	2, 3, 4, 5	-	7.1	-	7.1	8.5.6
ES 32	4	-	7.1	-	7.1	8.3.2
ES 33	2, 3, 4, 5	-	7.1	-	7.1	8.3.2
PV	5	45.6	76.0	45.6	90.0	8.4.1
PV 11	5	-	7.1	-	7.1	8.4.2
PV 25	5	-	7.1	-	7.1	8.4.2

[16] (N-1) ratings for sub-transmission and zone substations. (N) rating for 11 kV feeders.

Table 5-6 presents the 10% PoE summer maximum demand zone substation and sub-transmission network forecast for the forward 10-year planning period following the proposed works for each option, assuming all of the solution components of each option are implemented now. Assets not listed have the same forecast as Option 1 detailed in Table 2-6. Values highlighted are an identified network limitation with red exceeding the (N-1) rating and **bold** exceeding the (N) rating.

Table 5-6: 10% PoE Summer Maximum Demand Forecast and Ratings (MVA) After Proposed Works

Asset	Option	New Rating	2026	2027	2028	2029	2030	2031	2032	2033	2034
FT	2,3,4,5	69.6	47.0	50.5	53.5	55.4	56.8	58.3	59.8	61.4	62.7
WMTS-FT	2,3,4,5	63.0	47.0	50.5	53.5	55.4	56.8	58.3	59.8	61.4	62.7
NS	2	36.0	38.4	39.2	40.3	41.8	43.2	44.8	46.1	47.5	48.7
NS	3	54.0	48.4	49.2	50.3	51.8	53.2	54.8	56.1	57.5	58.7
NS	4	36.0	26.4	27.2	28.3	29.8	31.2	32.8	34.1	35.5	36.7
NS	5	36.0	30.4	31.2	32.3	33.8	35.2	36.8	38.1	39.5	40.7
BTS-NS	2	38.8	38.4	39.2	40.3	41.8	43.2	44.8	46.1	47.5	48.7
BTS-NS	3	45.6	48.4	49.2	50.3	51.8	53.2	54.8	56.1	57.5	58.7
BTS-NS	4	38.8	26.4	27.2	28.3	29.8	31.2	32.8	34.1	35.5	36.7
BTS-NS	5	38.8	30.4	31.2	32.3	33.8	35.2	36.8	38.1	39.5	40.7
ES	2	38.0	47.4	47.9	48.5	49.0	49.9	51.0	52.0	53.1	53.9
ES	3	38.0	37.4	37.9	38.5	39.0	39.9	41.0	42.0	43.1	43.9
ES	4	76.0	59.4	59.9	60.5	61.0	61.9	63.0	64.0	65.1	65.9
ES	5	38.0	43.4	43.9	44.5	45.0	45.9	47.0	48.0	49.1	49.9
KTS-BY-ES	3	101.7	86.6	88.1	89.6	90.8	92.7	95.0	97.3	99.6	101.4
KTS-BY-ES	4	101.7	108.6	110.1	111.6	112.8	114.7	117.0	119.3	121.6	123.4
KTS-BY-ES	5	101.7	92.6	94.1	95.6	96.8	98.7	101.0	103.3	105.6	107.4

PV	**5**	**76.0**	54.0	54.3	54.8	55.3	55.8	56.4	56.6	57.2	57.6
KTS-AW-PV	**5**	**166.0**	180.7	183.3	185.8	186.2	187.8	189.9	191.5	193.4	194.9

Table 5-7 presents the 10% PoE winter maximum demand zone substation and sub-transmission network forecast for the forward 10-year planning period following the proposed works for each option, assuming all of the solution components of each option are implemented now. Assets not listed have the same forecast as Option 1 detailed in Table 2-7. Values highlighted are an identified network limitation with red exceeding the (N-1) rating and **bold** exceeding the (N) rating.

Table 5-7: 10% PoE Winter Maximum Demand Forecast and Ratings (MVA) After Proposed Works

Asset	Option	New Rating	2026	2027	2028	2029	2030	2031	2032	2033	2034
FT	**2,3,4,5**	**80.0**	44.6	48.8	52.5	55.2	57.5	59.2	60.9	62.6	64.3
WMTS-FT	**2,3,4,5**	**76.6**	44.6	48.8	52.5	55.2	57.5	59.2	60.9	62.6	64.3
NS	**2**	**40.0**	28.7	29.9	31.2	33.0	34.4	35.7	36.8	37.9	39.0
NS	**3**	**60.0**	38.7	39.9	41.2	43.0	44.4	45.7	46.8	47.9	49.0
NS	**4**	**40.0**	16.7	17.9	19.2	21.0	22.4	23.7	24.8	25.9	27.0
NS	**5**	**40.0**	20.7	21.9	23.2	25.0	26.4	27.7	28.8	29.9	31.0
BTS-NS	**2**	**38.8**	28.7	29.9	31.2	33.0	34.4	35.7	36.8	37.9	39.0
BTS-NS	**3**	**51.0**	38.7	39.9	41.2	43.0	44.4	45.7	46.8	47.9	49.0
BTS-NS	**4**	**38.8**	16.7	17.9	19.2	21.0	22.4	23.7	24.8	25.9	27.0
BTS-NS	**5**	**38.8**	20.7	21.9	23.2	25.0	26.4	27.7	28.8	29.9	31.0
ES	**2**	**45.0**	37.1	38.3	39.4	40.3	41.2	42.2	43.1	44.1	45.1
ES	**3**	**45.0**	27.1	28.3	29.4	30.3	31.2	32.2	33.1	34.1	35.1
ES	**4**	**90.0**	49.1	50.3	51.4	52.3	53.2	54.2	55.1	56.1	57.1
ES	**5**	**45.0**	33.1	34.3	35.4	36.3	37.2	38.2	39.1	40.1	41.1
KTS-BY-ES	**3**	**104.6**	63.1	65.9	68.0	69.9	72.0	73.9	75.8	77.7	79.6
KTS-BY-ES	**4**	**104.6**	85.1	87.9	90.0	91.9	94.0	95.9	97.8	99.7	101.6
KTS-BY-ES	**5**	**104.6**	69.1	71.9	74.0	75.9	78.0	79.9	81.8	83.7	85.6

PV	**5**	**90.0**	46.9	48.0	49.0	49.9	50.7	51.4	52.0	52.7	53.3
KTS-AW-PV	**5**	**182.0**	150.8	155.0	158.4	160.3	162.3	164.1	165.8	167.5	169.3

Table 5-8 presents the 10% PoE summer maximum demand distribution feeder forecast for the forward 10-year planning period following the proposed works for each option, assuming all of the solution components of each option are implemented now. Assets not listed have the same forecast as Option 1 detailed in Table 2-8.

Table 5-8: Distribution Feeder 10% PoE Summer Maximum Demand Forecast (A) After Planned Works

Feeder	Option	New Rating	2026	2027	2028	2029	2030	2031	2032	2033	2034	Transfers
FT 11	**2,3,4, 5**	**5.8**	3.8	3.8	3.9	4.0	4.0	4.1	4.2	4.3	4.4	1 MVA to FT 15
FT 14	**2,3,4, 5**	**6.8**	3.9	4.1	4.4	4.9	5.6	6.4	6.1	5.4	4.2	MVRC to FT feeder[17] 2 MVA from NS 15
FT 15	**2,3,4, 5**	**8.0**	4.1	4.4	4.8	5.1	5.3	5.4	5.5	5.7	5.8	1 MVA from FT 11
FT 21	**2,3,4, 5**	**6.7**	3.8	3.8	3.8	3.9	4.0	4.1	4.3	4.4	4.5	1 MVA to FT 35
FT 22	**2,3,4, 5**	**7.1**	-0.6	0.4	1.1	1.5	1.7	1.9	2.1	2.3	2.4	5 MVA to FT 12
FT 12	**2,3,4, 5**	**7.1**	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	7 MVA from FT 32 & 33
FT 35	**2,3,4, 5**	**7.1**	5.7	5.7	5.7	5.8	5.9	6.0	6.2	6.3	6.5	1 MVA from FT 21
NS 07	**3**	**7.1**	5.8	5.9	5.9	6.0	6.1	6.2	6.3	6.4	6.5	2.3 MVA from ES
NS 08	**3**	**8.1**	7.5	7.5	7.5	7.6	7.6	7.7	7.8	7.9	8.0	4.7 MVA from ES
NS 09	**2,3,4, 5**	**7.1**	2.3	2.1	2.0	2.4	2.8	3.2	3.8	4.1	4.2	MVRC to FT[17]
NS 12	**2,3,4, 5**	**5.4**	2.7	3.8	4.6	5.2	5.4	4.6	4.8	5.1	5.3	MVRC to FT[17]
NS 14	**2,3,4**	**7.1**	4.7	4.9	5.0	5.1	5.2	5.4	5.6	5.8	5.9	1 MVA to NS 17
NS 14	**5**	**7.1**	0.2	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.4	5.5 MVA to PV 11
NS 15	**2,3,4, 5**	**5.4**	2.5	3.0	3.3	3.4	3.6	3.8	3.9	4.1	4.2	2 MVA to FT 14
NS 17	**2,3,4**	**7.1**	4.3	4.3	4.3	4.4	4.4	4.5	4.6	4.7	4.8	1 MVA from NS 14
NS 17	**5**	**3.6**	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	3 MVA to PV 25
NS 18	**2,3,4, 5**	**7.8**	4.6	4.8	4.8	4.9	5.1	5.2	5.4	5.5	5.7	No transfers

[17] New feeder(s) dedicated for major customer MVRC. Refer to Major Customers NDS.

ES 11	**2,3,4, 5**	**5.8**	2.0	2.3	2.5	2.6	2.8	2.9	3.0	3.2	3.3	4 MVA to ES 31
ES 24	**2,3,4, 5**	**7.1**	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	1 MVA to ES 33
ES 31	**2,3,4, 5**	**7.1**	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4 MVA from ES 11
ES 32	**4**	**7.1**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6 MVA from NS
ES 33	**4**	**7.1**	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	1 MVA from ES 24 6 MVA from NS
ES 33	**2,3,5**	**7.1**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1 MVA from ES 24
PV 11	**5**	**7.1**	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5 MVA from NS 14
PV 12	**5**	**6.6**	6.0	6.1	6.2	6.3	6.3	6.3	6.4	6.4	6.4	3.5 MVA from ES 25
PV 23	**2,3,4, 5**	**7.1**	5.6	5.6	5.6	5.6	5.7	5.8	5.8	5.9	5.9	1 MVA from PV 24
PV 24	**2,3,4, 5**	**6.6**	4.0	4.3	4.6	4.9	5.1	5.3	5.5	5.6	5.6	1 MVA to PV 23
PV 25	**5**	**7.1**	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3 MVA from NS 17

Table 5-9 presents the 10% PoE winter maximum demand distribution feeder forecast for the forward 10-year planning period following the proposed works for each Option, assuming all of the solution components of each option are implemented now. Assets not listed have the same forecast as Option 1 detailed in Table 2-9.

Table 5-9: Distribution Feeder 10% PoE Winter Maximum Demand Forecast (A) After Planned Works

Feeder	Option	New Rating	2026	2027	2028	2029	2030	2031	2032	2033	2034	Transfers
FT 11	**2,3,4, 5**	**5.8**	5.0	5.0	5.1	5.1	5.2	5.2	5.2	5.2	5.3	1 MVA to FT 15
FT 12	**2,3,4, 5**	**7.1**	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5 MVA from FT 22
FT 14	**2,3,4, 5**	**6.8**	3.3	3.6	3.9	4.4	5.1	5.9	5.5	4.8	3.6	MVRC to FT feeder[18] 2 MVA from NS 15
FT 15	**2,3,4, 5**	**8.0**	3.6	3.9	4.3	4.6	4.8	4.9	5.1	5.2	5.3	1 MVA from FT 11

[18] New feeder dedicated for major customer MVRC. Refer to Major Customers NDS.

FT 21	**2,3,4, 5**	**6.7**	4.4	4.5	4.6	4.7	4.9	5.1	5.3	5.5	5.7	1 MVA to FT 35
FT 22	**2,3,4, 5**	**7.1**	0.0	0.0	0.0	0.0	0.1	0.3	0.6	0.8	1.0	5 MVA to FT 12
FT 25	**2,3,4, 5**	**7.1**	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7 MVA from FT 32 & 33
FT 35	**2,3,4, 5**	**7.1**	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.5	5.6	1 MVA from FT 21
NS 07	**3**	**7.1**	5.6	5.7	5.8	5.8	5.9	6.0	6.1	6.2	6.3	2.3 MVA from ES
NS 08	**3**	**8.1**	7.4	7.4	7.4	7.5	7.6	7.6	7.7	7.8	7.9	4.7 MVA from ES
NS 09	**2,3,4, 5**	**7.1**	1.9	1.7	1.6	2.0	2.4	2.8	3.2	3.5	3.7	MVRC to FT[18]
NS 12	**2,3,4, 5**	**5.4**	1.4	2.1	2.3	2.5	2.7	1.9	2.1	2.3	2.4	MVRC to FT[18]
NS 14	**2,3,4**	**7.1**	3.1	3.3	3.5	3.6	3.8	4.0	4.1	4.3	4.4	1 MVA to NS 17
NS 14	**5**	**7.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5 MVA to PV 11
NS 15	**2,3,4, 5**	**5.4**	1.6	2.1	2.4	2.5	2.7	2.9	3.0	3.2	3.3	2 MVA to FT 14
NS 17	**2,3,4**	**7.1**	3.6	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.2	1 MVA from NS 14
NS 17	**5**	**3.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	3 MVA to PV 25
NS 18	**2,3,4, 5**	**7.8**	4.2	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.3	No transfers
ES 11	**2,3,4, 5**	**5.8**	1.1	1.4	1.7	1.8	2.0	2.1	2.3	2.4	2.6	4 MVA to ES 31
ES 24	**2,3,4, 5**	**7.1**	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.2	4.3	1 MVA to ES 33
ES 31	**2,3,4, 5**	**7.1**	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4 MVA from ES 11
ES 32	**4**	**7.1**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6 MVA from NS
ES 33	**4**	**7.1**	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	1 MVA from ES 24 6 MVA from NS
ES 33	**2,3,5**	**7.1**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1 MVA from ES 24
PV 11	**5**	**7.1**	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5 MVA from NS 14
PV 12	**5**	**7.1**	5.7	5.8	5.9	6.0	6.1	6.1	6.1	6.2	6.2	3.5 MVA from ES 25
PV 23	**2,3,4, 5**	**7.1**	5.3	5.4	5.4	5.5	5.6	5.7	5.7	5.8	5.9	1 MVA from PV 24
PV 24	**2,3,4, 5**	**7.1**	3.6	4.0	4.4	4.7	4.9	5.1	5.3	5.4	5.6	1 MVA to PV 23
PV 25	**5**	**7.1**	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3 MVA from NS 17

5.4 Options Reliability Assessment

The following tables detail the annualised EUE for each option, assuming all solutions are in service based on their optimal timing as identified in Table 5-3.

5.4.1 Option 2 – Flemington Plan

Table 5-10 details the zone substation and sub-transmission EUE for Option 2 over the planning horizon for the identified network limitations.

Table 5-10: Zone Substation and Sub-transmission Expected Unserved Energy (MWh pa) – Option 2

Asset	FT	ES	NS	WMTS-FT	BTS-NS	Total
2025	0.8	0.4	0.1	0.0	1.1	**2.5**
2026	2.2	0.5	0.3	0.0	1.3	**4.2**
2027	5.1	0.6	0.5	0.0	1.8	**7.9**
2028	9.8	0.6	0.8	0.0	2.6	**13.9**
2029	0.0	0.8	0.1	0.0	0.7	**1.6**
2030	0.0	0.9	0.2	0.0	1.3	**2.4**
2031	0.0	1.1	0.5	0.0	1.9	**3.5**
2032	0.0	1.3	0.8	0.2	2.9	**5.2**
2033	0.0	1.5	1.2	0.0	4.3	**7.1**
2034	0.0	1.8	1.8	0.0	6.8	**10.4**

Table 5-11 details the distribution feeder EUE for Option 2 over the planning horizon for the identified network limitations.

Table 5-11: Distribution Feeder Expected Unserved Energy (MWh pa) – Option 2

Asset	FT 11	FT 21	FT 22	FT 31	FT 32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	4.7	0.0	0.3	0.0	0.0	0.0	3.1	0.1	0.0	0.0	**8.2**
2026	0.2	0.0	0.0	0.0	0.0	0.1	4.0	0.1	0.1	0.0	**4.6**
2027	0.4	0.0	0.0	0.1	1.1	0.9	0.0	0.2	0.4	0.0	**3.0**
2028	0.7	0.0	0.0	0.1	3.9	1.7	0.0	0.2	0.8	0.1	**7.4**
2029	1.0	0.0	0.3	0.1	0.0	2.0	0.0	0.2	1.2	0.2	**5.0**

2030	1.2	0.2	0.9	0.1	0.0	3.6	0.0	0.3	1.8	0.2	**8.4**

5.4.2 Option 3 – Flemington and North Essendon Plan

Table 5-12 details the zone substation and sub-transmission EUE for Option 3 over the planning horizon for the identified network limitations.

Table 5-12: Zone Substation and Sub-transmission Expected Unserved Energy (MWh pa) – Option 3

Asset	FT	ES	NS	WMTS-FT	BTS-NS	Total
2025	0.8	0.4	0.1	0.0	1.1	**2.5**
2026	2.2	0.5	0.3	0.0	1.3	**4.2**
2027	5.1	0.6	0.5	0.0	1.8	**7.9**
2028	9.8	0.6	0.8	0.0	2.6	**13.9**
2029	0.0	0.8	0.1	0.0	0.7	**1.6**
2030	0.0	0.9	0.2	0.0	5.4	**6.6**
2031	0.0	1.1	0.5	0.0	7.9	**9.5**
2032	0.0	1.3	0.8	0.2	10.9	**13.2**
2033	0.0	1.5	1.2	0.0	14.7	**17.5**
2034	0.0	1.8	1.8	0.0	19.5	**23.1**

Table 5-13 details the distribution feeder EUE for Option 3 over the planning horizon for the identified network limitations.

Table 5-13: Distribution Feeder Expected Unserved Energy (MWh pa) – Option 3

Asset	FT 11	FT 21	FT 22	FT 31	FT 32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	4.7	0.0	0.3	0.0	0.0	0.0	3.1	0.1	0.0	0.0	**8.2**
2026	0.2	0.0	0.0	0.0	0.0	0.1	4.0	0.1	0.1	0.0	**4.6**
2027	0.4	0.0	0.0	0.1	1.1	0.9	0.0	0.2	0.4	0.0	**3.0**
2028	0.7	0.0	0.0	0.1	3.9	1.7	0.0	0.2	0.8	0.1	**7.4**
2029	1.0	0.0	0.3	0.1	0.0	2.0	0.0	0.2	1.2	0.2	**5.0**
2030	1.2	0.2	0.9	0.1	0.0	3.6	0.0	0.3	1.8	0.2	**8.4**

Zone substation solutions at NS to alleviate the residual value of EUE are not economically viable prior to 2034, hence this option resembles Option 2 over the 10-year outlook period.

5.4.3 Option 4 – Flemington and Essendon Plan

Table 5-14 details the zone substation and sub-transmission EUE for Option 4 over the planning horizon for the identified network limitations.

Table 5-14: Zone Substation and Sub-transmission Expected Unserved Energy (MWh pa) – Option 4

Asset	FT	ES	NS	WMTS-FT	BTS-NS	Total
2025	0.8	0.4	0.1	0.0	1.1	**2.5**
2026	2.2	0.5	0.3	0.0	1.3	**4.2**
2027	5.1	0.6	0.5	0.0	1.8	**7.9**
2028	9.8	0.6	0.8	0.0	2.6	**13.9**
2029	0.0	0.8	0.1	0.0	0.7	**1.6**
2030	0.0	0.9	0.2	0.0	1.3	**2.4**
2031	0.0	1.1	0.5	0.0	1.9	**3.5**
2032	0.0	1.3	0.8	0.2	2.9	**5.2**
2033	0.0	1.5	1.2	0.0	4.3	**7.1**
2034	0.0	1.8	1.8	0.0	6.8	**10.4**

Table 5-15 details the distribution feeder EUE for Option 4 over the planning horizon for the identified network limitations.

Table 5-15: Distribution Feeder Expected Unserved Energy (MWh pa) – Option 4

Asset	FT 11	FT 21	FT 22	FT 31	FT 32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	4.7	0.0	0.3	0.0	0.0	0.0	3.1	0.1	0.0	0.0	**8.2**
2026	0.2	0.0	0.0	0.0	0.0	0.1	4.0	0.1	0.1	0.0	**4.6**
2027	0.4	0.0	0.0	0.1	1.1	0.9	0.0	0.2	0.4	0.0	**3.0**
2028	0.7	0.0	0.0	0.1	3.9	1.7	0.0	0.2	0.8	0.1	**7.4**
2029	1.0	0.0	0.3	0.1	0.0	2.0	0.0	0.2	1.2	0.2	**5.0**
2030	1.2	0.2	0.9	0.1	0.0	3.6	0.0	0.3	1.8	0.2	**8.4**

Zone substation solutions at ES to alleviate the residual value of EUE are not economically viable prior to 2034, hence this option resembles Option 2 over the 10-year outlook period.

5.4.4 Option 5 – Flemington and Pascoe Vale Plan

Table 5-16 details the zone substation and sub-transmission EUE for Option 5 over the planning horizon for the identified network limitations.

Table 5-16: Zone Substation and Sub-transmission Expected Unserved Energy (MWh pa) – Option 5

Asset	FT	ES	NS	WMTS-FT	BTS-NS	Total
2025	0.8	0.4	0.1	0.0	1.1	**2.5**
2026	2.2	0.5	0.3	0.0	1.3	**4.2**
2027	5.1	0.6	0.5	0.0	1.8	**7.9**
2028	9.8	0.6	0.8	0.0	2.6	**13.9**
2029	0.0	0.8	0.1	0.0	0.7	**1.6**
2030	0.0	0.9	0.2	0.0	1.3	**2.4**
2031	0.0	1.1	0.5	0.0	1.9	**3.5**
2032	0.0	1.3	0.8	0.2	2.9	**5.2**
2033	0.0	1.5	1.2	0.0	4.3	**7.1**
2034	0.0	1.8	1.8	0.0	6.8	**10.4**

Table 5-17 details the distribution feeder EUE for Option 5 over the planning horizon for the identified network limitations.

Table 5-17: Distribution Feeder Expected Unserved Energy (MWh pa) – Option 5

Asset	FT 11	FT 21	FT 22	FT 31	FT 32	FT 33	ES 11	NS 17	NS 18	PV 24	Total
2025	4.7	0.0	0.3	0.0	0.0	0.0	3.1	0.1	0.0	0.0	**8.2**
2026	0.2	0.0	0.0	0.0	0.0	0.1	4.0	0.1	0.1	0.0	**4.6**
2027	0.4	0.0	0.0	0.1	1.1	0.9	0.0	0.2	0.4	0.0	**3.0**
2028	0.7	0.0	0.0	0.1	3.9	1.7	0.0	0.2	0.8	0.1	**7.4**
2029	1.0	0.0	0.3	0.1	0.0	2.0	0.0	0.2	1.2	0.2	**5.0**
2030	1.2	0.2	0.9	0.1	0.0	3.6	0.0	0.3	1.8	0.2	**8.4**

Zone substation solutions at PV to alleviate the residual value of EUE are not economically viable prior to 2034, hence this option resembles Option 2 over the 10-year outlook period.

6. Economic Evaluation

This section presents the results of an economic cost-benefit analysis undertaken on each option. It takes into account the present value of capital and additional operating costs, and the present value of the EUE over an analysis period of 20-years. Capital costs over the 10-year planning horizon are included which address all of the identified network needs over the same period.

6.1 Cost-Benefit Analysis

A summary of the cost-benefit analysis assessed for each option is present in Table 6-1. Option 2 maximises the NPV, relative to all other options assessed.

Table 6-1: Summary of NPV Cost-Benefit Analysis ($M Real 2024)

Option	Total Capital Cost	Present Value of Capital and O&M Cost	Present Value of Reliability Benefit	Net Present Value (NPV)	Ranking
Option 1 - Do Nothing	0	0.0	0.0	0.0	7
Option 2 – Flemington Plan	**21.3**	**21.8**	**92.2**	**70.4**	**1**
Option 3 - Flemington and North Essendon Plan	27.7	26.0	91.3	65.4	5
Option 4 - Flemington and Essendon Plan	26.7	24.9	94.3	69.4	2
Option 5 - Flemington and Pascoe Vale Plan	32.1	28.7	94.2	65.5	4
Option 6 – BESS Plan	0	48.1	92.2	44.1	6
Option 7 – DM Plan	0	24.0	92.2	68.2	3

6.2 Sensitivity Analysis

A sensitivity analysis has been undertaken to test the robustness of the preferred network development option to credible pessimistic changes in key input assumptions. These changes are applied individually to each option as follows:

- Reducing VCR by 10%, thereby reducing customer benefits by 10%.
- Increasing VCR by 10%, thereby increasing customer benefits by 10%.
- Raising the discount rate by 1%, thereby reducing the attractiveness of capex investments.
- Lowering the discount rate by 1%, thereby improving the attractiveness of capex investments.

- Incurring 30% higher capital costs across all projects with an associated rise in the O&M.
- Achieving 30% lower capital costs across all projects with an associated reduction in the O&M; and
- No EV charging during peak electricity demand periods.

Table 6-2 presents the results for the sensitivity analysis.

Table 6-2: Sensitivity of NPV to Changes in Input Assumptions ($M Real 2024)

Option	Baseline	VCR 10% Lower	VCR 10% Higher	Discount Rate 1% Higher	Discount Rate 1% Lower	Capital Costs 30% Higher	Capital Costs 30% Lower	No EV Charging at Peak Demand
Option 1 - Do Nothing	0	0	0	0	0	0	0	0
Option 2 – Flemington Plan	**70**	**61**	**80**	**66**	**75**	**64**	**77**	**46**
Option 3 - Flemington and North Essendon Plan	65	56	75	62	69	58	73	42
Option 4 - Flemington and Essendon Plan	69	60	79	65	73	62	77	45
Option 5 - Flemington and Pascoe Vale Plan	65	56	75	62	69	57	74	41

Option 2 remains the preferred network development option, retaining the highest positive NPV for all credible pessimistic sensitivities. Table 6-3 lists the project deferrals that would be triggered if all EV charging avoided peak electricity demand periods. Two deferrals were identified.

Table 6-3: Deferrals for Option 2 with no EV Charging at Peak Electricity Demand

Projects	Revised Timing	Years Deferred
New feeder FT0-025	2026	0
New feeder ES0-031	2027	0
Augment feeder FT0-011	2029	0

Augment feeder FT21	2029	0
Augment BTS-NS 22kV Loop	2029	1
3rd Transformer and 66kV Works at FT and 66kV Works	2029	0
New feeder FT0-012	2031	1
Augment feeders at NS - NS 17	2030	0
Augment feeders at NS - NS 18	2031	0
Thermal Uprate WMTS-FT No.1 66kV	2033	0

7. Recommendation and Next Steps

The assessment demonstrates that the preferred network development plan is to implement Option 2 (Flemington Plan) because this option maximises the net economic benefit to all those who produce, consume and transport electricity in the NEMs. The preferred Option 2 provides a 20-year present value net market benefit of $70.4 million, with a present value of $19.0 million of investment (over 10 years, 2025 to 2034). The market benefits forecast to be delivered by the preferred solution are driven by a reduction in the amount of expected unserved energy over the planning period.

7.1 Recommended Development Plan

The preferred network development plan (Option 2) to address the identified network limitations include the following**:**

Table 7-1: Option 2 - Flemington Plan[19]

Timing	Projects	Cost (Real 2024)	Limitation Addressed
2026	New feeder FT0-025	[redacted]	FT22 and FT 32 overload
2026	New feeder ES0-031	[redacted]	ES 11 overload
2029	Augment feeder FT0-011	[redacted]	FT 11 overload
2029	Augment feeder FT21	[redacted]	FT 21 overload
2028	Augment BTS-NS 22kV Loop	[redacted]	BTS-NS overload
2029	3rd Transformer and 66kV Works at FT and 66kV Works	[redacted]	FT overload
2030	New feeder FT0-012	[redacted]	FT 33 overload
2030	Augment feeders at NS – NS 17	[redacted]	NS 17 overload
2031	Augment feeders at NS – NS 18	[redacted]	NS 18 overload
2033	Thermal Uprate WMTS-FT No.1 66kV	[redacted]	WMTS-FT overload
Total		**$21.3 million**	

[19] Excludes new FT feeder(s) required for a major customer connection project. Refer to Major Customer NDS.

Present Value Total	$19.0 million	

The estimated total capital cost of Option 2 for JEN over 10-years to address the identified network limitations is $21.3 million, of which $3.4 million is outside of the FY2027-31 regulatory control period.

Table 7-2 lists the projects and their associated costs over the FY2027-31 regulatory control period.

Table 7-2: Option 2 - Flemington Plan, projects within FY2027-31 regulatory control period

Timing	Projects	Cost (Real 2024)[20]	Limitation Addressed
2026	New feeder ES0-031	[redacted]	ES 11 overload
2029	Augment feeder FT0-011	[redacted]	FT 11 overload
2029	Augment feeder FT21	[redacted]	FT 21 overload
2028	Augment BTS-NS 22kV Loop	[redacted]	BTS-NS overload
2029	3rd Transformer and 66kV Works at FT and 66kV Works	[redacted]	FT overload
2030	New feeder FT0-012	[redacted]	FT 33 overload
2030	Augment feeders at NS – NS 17	[redacted]	NS 17 overload
2031	Augment feeders at NS – NS 18	[redacted]	NS 18 overload
Total		**$17.9 million**	

[20] $3.4M of the recommended plan project costs are outside FY2027-31 regulatory control period.

8. Appendix A – High Level Scopes of Work

8.1 Flemington Zone Substation

8.1.1 3rd Transformer and 66kV Works at FT

Install a 3rd 66/11 kV 33 MVA transformer at FT (No.3) and connect into the spare CB on No.2 11kV bus. Relocated the Tx No.2 cables and install No. 1-2 and 2-3 Bus tie CBs.

[redacted]

[redacted]

8.1.2 Thermal Uprate WMTS-FT No.1 66kV line.

[redacted]

Thermal uprate 0.9km of 19/0.128 AAC conductor on WMTS-FT No.1 to 100°C/75°C.

This will increase the rating of WMTS-FT No.1 from 455A to 551A (63 MVA) and increase the (N-1) rating of the network from 52 MVA to 63 MVA.

8.1.3 Thermal Uprate WMTS-FT No.1 and No. 2 66kV lines.

[redacted]

Reconductor 0.9km of 19/0.128 AAC conductor on WMTS-FT No.1 to 37/3.75AAC. Thermal uprate 0.1km of 19/0.183 AAC conductor on WMTS-FT No.2 to 100°C/75°C.

This will increase the rating of WMTS-FT No.1 from 455A to 695A (79 MVA), WMTS-FT

8.1.4 Reconductor WMTS-FT No.1 and WMTS-FT No.2 66kV lines

[redacted]

Reconductor 0.9km of 19/0.128 AAC on WMTS-FT No.1 and 0.9km of 19/0.116 Cu on WMTS-FT No.2 to 37/3.75AAC 100°C/75°C. Thermal uprate 0.8km of 19/0.183 AAC conductor on WMTS-FT No.1 and No.2 to 100°C/75°C. Replace droppers on No.2 line at WMTS.

This will increase the rating of WMTS-FT No.1 from 455A to 860A (98 MVA), WMTS-FT No.2 from 570A to 860A (98 MVA)

8.2 North Essendon Zone Substation

8.2.1 4th 22/11 kV transformer at NS

Install a 4th 22/11 kV 18 MVA transformer at NS (designated No.4) and connect into the spare CB bay on No.1 11kV bus. This option requires the installation of a 4th 22 kV line to NS (refer 8.2.2), considering the limited space available in NS zone substation.

[redacted]

[redacted]

8.2.2 New BTS-NS4 22kV line

This option requires the installation of a 4^{th} 22/11 kV 18 MVA transformer at NS (refer 8.2.1).

Install 7.3km of 19/3.25AAC 100ºC/75ºC 22 kV overhead line from BTS to the new NS No.4 transformer along Glenlyon Rd and Dean St (rebuilding the existing 66 kV line as double circuit construction), and along the east side of Pascoe Vale Rd and north side of Moreland Rd to Johnson St, following and rebuilding existing 11kV/LV lines (as 22 kV and 11 kV/LV subsidiary).

Install 0.2km cabling at BTS using 2x3/c $300mm^2$ Al 22kV XLPE, and a 0.5km section of 2x3/c $300mm^2$ Al 22kV XLPE underground cable will be required in the vicinity of Sydney Rd, west of David St. Also install 0.1km cabling at NS using 2x3/c $300mm^2$ Al 22kV XLPE.

This new 22 kV line shall be constructed to provide an end-to-end rating of this section of the new 22 kV feeder from BTS of at least 500A (20 MVA).

This will increase the (N-1) rating of the network from 30.4 MVA to 45.6 MVA.

[redacted]

If this option is undertaken with the option in 8.2.3, then the (N-1) rating of the network will increase from 30.4 MVA to 48.0 MVA.

If this option is undertaken with the option in 8.2.4, then the (N-1) rating of the network will increase from 30.4 MVA to 58.2 MVA.

8.2.3 Thermal Uprate BTS-NS3 190 22kV line.

Thermal uprate 0.3km of 19/0.149 AAC conductor and up to 1.4km of 19/0.101 Cu conductor on BTS-NS190 to 100ºC/75ºC. Replace existing 300mm Al U/G cable with 300mm Cu U/G cable at NS end for each feeder. This will increase the rating of BTS-NS190 from 400A to 508A (20 MVA) and increase the (N-1) rating of the network from 30.4 MVA to 32.0 MVA.

[redacted]

8.2.4 Augment BTS-NS 22kV Loop

Thermal uprate 0.3km of 19/0.149 AAC conductor and up to 1.4km of 19/0.101 Cu conductor on BTS-NS190 to 100ºC/75ºC. Reconductor 2.2km of 19/0.083 Cu conductor on BTS-NS193 to 19/3.25 AAC 100oC/75oC. Thermal uprate 0.6km of 19/0.101 Cu conductor on BTS-NS193 to 100oC/75oC. Thermal uprate 0.6km of 19/0.101 Cu conductor on BTS-NS176 to 100oC/75oC. Replace existing 300mm Al U/G cable with 300mm Cu U/G cable at NS end for each feeder. This will increase the rating of BTS-NS190 from 400A to 508A (20 MVA), BTS-NS193 from 420A to 508A (20 MVA), BTS-NS176 from 445A to 508A (20 MVA) and increase the (N-1) rating of the network from 30.4 MVA to 38.8 MVA.

[redacted]

8.2.5 Augment feeders at NS

This option is required if a 4th 18 MVA transformer is installed at NS to enable load to be transferred from surrounding zone substations to NS. Its aim is to increase the capacity of NS feeders to pick up load off ES and to address the overload issues on NS feeders.

NS 18 - Replace 0.5km NS 18 feeder exit cable to pole A137963 using 300mm^2 Cu XLPE to increase NS 18 feeder rating from 305A to 410A.

NS 08 - Replace 0.1km NS 08 feeder exit cable to pole A001116 using 300mm^2 Cu XLPE to increase NS 08 feeder rating from 345A to 425A.

NS 07 - Replace 0.1km NS 07 feeder exit cable to pole A001121 using 300mm^2 Cu XLPE to increase NS 07 feeder rating from 305A to 375A.

NS 17 – Thermally upgrade 1.1km NS 17 19/0.083 Cu section to increase NS 17 feeder rating from 190A to 305A.

[redacted]

[redacted]

8.3 Essendon Zone Substation

8.3.1 3rd 66/11 kV transformer at ES

Install a 3rd 66/11 kV 33 MVA transformer at ES (No.1) and connect into the spare CB bay on No.2 11kV bus.

[redacted]

[redacted]

8.3.2 New feeder ES 32 & New feeder ES 33

These options are required if a 3rd transformer is installed at ES to enable load to be transferred from surrounding zone substations to ES. Its aim is to use ES 32 and ES 33 to split ES 15 into three feeders to pick up load off NS 07 and NS 11. ES 33 is also required to offload ES 24.

Install 1.6km and 1.8km of 300mm^2 Al XLPE cables in two parallel conduits from ES along Buckley St to Violet St and Leslie Rd respectively, connecting on to the existing overhead line of ES 15 (in Buckley St and south of sw 25149 respectively). At ES, connect cables to ES 32 and ES 33 CBs on Bus No.3 and provide protection schemes.

[redacted]

[redacted]

Set up open points for the two new feeders including:

- Install a new normally open RCGS adjacent to Violet-Buckley substation
- Open sw 25149.
- Close sw 24105, Open sw 29911.

Make the following open point changes to offload NS 07 and NS 11 to ES:

- Close sw 25543, Open sw 24695 on NS 07.
- Close sw 44036, Open sw 20238 (replacing this switch with a normally open RCGS) on NS 07.
- Close sw 21522, Open sw 12189 on NS 11.

[redacted]

[redacted]

ES 32 and ES 33 are each rated at 375A.

8.4 Pascoe Vale Zone Substation

8.4.1 3rd 66/11 kV transformer at PV

Install a 3rd 66/11 kV 33 MVA transformer at PV (No.4) to replace the existing No.3 10 MVA transformer (keeping this 10 MVA transformer as a spare on site).

[redacted]

[redacted]

8.4.2 New feeder PV 11 & New feeder PV 25

These options are required if a 3rd 33 MVA transformer is installed at PV to enable load to be transferred from surrounding zone substations to PV. Its aim is to establish two new feeders (PV 11 and PV 25) each rated at 375A, to pick up load off ES 25, NS 14 and NS 17.

Install 2 x 1.9km of 300mm^2 Al XLPE cables in two parallel conduits from PV along Northumberland Rd and Gaffney St to just south of Lind St, connecting the cables to either side of sw 25510 on to the existing overhead line of NS 14, and opening this switch. At PV, connect cables to PV 11 and PV 25 CBs and provide protection schemes. Bond NS 14 and NS 17 overhead circuits together in Woodland Drive. Replace sw 24673 with a RCGS. Close sw 21002 and open sw 24673. Open NS 14 CB and NS 17 CB to be used as spares.

[redacted]

8.5 11kV Feeders

8.5.1 Augment feeder FT21

FT 21 is the feeder that supplies the southern tip of the NDS supply area, an area which is experiencing growth in high-density residential developments in Kensington. The existing network arrangement is shown below.

[redacted]

To upgrade the rating of FT 21 involves thermal uprating to 65ºC a section of 0.5km of 19/.183AAC between Pole A030290 and Pole A028331, and a section of 0.15km of 19/3.25AAC between Pole A028331 and Pole A028320 as shown below.

[redacted]

- Undertake load transfers to rebalance the loading between FT 21 and FT 33.
- The rating of FT 21 will increase to 350A.

8.5.2 New feeder FT0-025

Install a new FT 25 feeder with a rating of 375A to offload FT 32 and FT 22.

[redacted]

Install a new 0.62km underground feeder exit cable for FT 25 using 300mm^2 Cu XLPE from FT along Barnet St and Macaulay Rd up to HV SW 48638 at MACAULAY-346 STUBBS substation. Install a RCGS on Pole A026961 and transfer load from FT22 to new FT25.

8.5.3 New feeder FT0-012

This option is aimed at installing a new feeder to address the longer-term growth within the Kensington area.

Install a new FT 12 feeder with a rating of 375A to offload FT 33.

[redacted]

Install a new 0.6km underground feeder exit cable for FT 12 using $300mm^2$ Cu XLPE from FT along Rankins Road to Macaulay Rd up to new HV SW at a new ELIZABETH 20-HELMFORD substation (to be installed as part of a future CIC project). Configure the substations to allow load balancing across FT 12 and FT 33.

8.5.4 Augment feeder FT0-011

This option is aimed at reducing the load on FT 11 to address its high utilisation, by transferring 1MVA load to FT 15.

[redacted]

- Replace switch 20609 with a RCGS.
- Close switch 21040, Open switch 20609.
- The ratings of FT 11 and FT 15 remain the same.

8.5.5 Augment feeder ES 11

This augmentation increases the rating of heavily loaded feeder ES 11 from 305A to 375A. Replace 0.2km of the ES 11 feeder exit cable with 300mm^2 Cu XLPE cable. Reconductor 1.3km from sw 21242 to corner of Ogilivie St and Market St with 19/3.25 AAC.

[redacted]

8.5.6 New feeder ES0-031

This augmentation involves the installation of a new feeder ES 31 with a rating of 375A to address the heavily loaded feeders ES 11, and ES 21.

[redacted]

Utilise the existing 280m of conduit from ES to Forrester St and new conduit to install new 300mm^2 Al exit cable for 1.2km up to pole A064259. Upgrade to 19/3.25 0.7km section between poles A064259 and A123895. Install new RGCS on pole A064259 (normally open). Close sw 23100 and open sw 27508 at KEILOR 294-BIRDWOOD substation (new normally open).

8.5.7 Augment feeder PV 24

This augmentation increases the rating of heavily loaded feeder PV 24 from 345A to 375A. Replace 0.25 km of the PV 24 feeder exit cable with 300mm^2 Al XLPE cable.

[redacted]