Notice of Determination Report (Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition)

Project No. UE-RCA-N-25-001

united energy

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1. Executive Summary

1.1 Summary

United Energy (UE) is a regulated Victorian electricity distribution business. UE distributes electricity to more than 727,000 customers across Melbourne's east and south-east metropolitan area, and the Mornington Peninsula. The UE network consists of more than 215,000 poles and over 13,590 kilometres of overhead lines and underground cables. Electricity is received via 92 sub-transmission lines at 47 zone substations, where it is transformed from sub-transmission voltages down to distribution voltages.

The area of the UE network that is the subject of this Regulatory Investment Test for Distribution (RIT-D) is the Glen Waverley Zone Substation (GW) supply area (i.e. GW supply area) that supplies the area of Glen Waverley and parts of Mount Waverley, Notting Hill, and Wantirna South. GW is owned and operated by UE, providing power to approximately 19,592 customers, comprising of mainly residential with some commercial/light industrial customers.

The condition of the secondary assets[1], switchgear[2] and control building[3] at GW, necessary for the provision of a safe and reliable power supply to customers within the GW supply area, are deteriorating and technically obsolete, being unsupported by equipment suppliers with no spares.

UE has identified potential credible network options to address the asset condition risks at GW and investigated whether viable non-network or stand-alone power system (SAPS) solutions exist as alternatives to, or supplements for the network options.

Based on this report, UE has concluded on reasonable grounds, that none of the potential non-network or SAPS options investigated represent technically or commercially feasible alternatives, nor could any combination of non-network or SAPS options adequately address the identified need. Therefore, UE has determined that the publication of, and the consultation on an options screening report, is not required in this instance.

1.2 Purpose

This Notice of Determination report has been prepared by UE in accordance with the requirements of clause 5.17.4, paragraphs (c) and (d) of the National Electricity Rules (NER) version 211. UE is normally required to publish an options screening report and request stakeholder submissions, as detailed in NER clause 5.17.4(e). However, in the event that there are no potential credible non-network or SAPS options (or any combination of those options with or without a network option) that could address the identified need, UE is instead required to publish a Notice of Determination.

1.3 The Identified Need

The condition of the secondary assets at GW is deteriorating. In particular, the protection relays at GW are at end of life, have a history of failure, and are obsolete with limited spares and no manufacturer support. Furthermore, UE's fleet of 354GC 22kV outdoor circuit breaker switchgear is approaching end of life, with an increasing number of defects being found across the UE fleet. There are 18 of these circuit breakers installed at GW, with one currently not fit for service as welds on the circuit breaker mechanism have cracked and cannot be cost effectively repaired. Finally, the original asbestos fibre cement clad control building at GW has an increasing number of serious defects, which is putting at risk the safe and reliable operation of the secondary assets housed within it.

The identified need at GW is to:

i) protect power sector workers and members of the public from harm caused by equipment failure (Safety); and

ii) continue to maintain a reliable power supply to the residences and businesses that are dependent on the supply from this distribution network (Reliability).

Solutions to the identified need shall manage and mitigate the increasing risk of secondary asset failure, switchgear failure, and control building defects, to maintain safety and reliability of electricity supply to UE's customers and workforce within the GW supply area.

[1] protection, control, monitoring and communications equipment.
[2] 22kV circuit breakers and associated outdoor switchyard equipment.
[3] housing the secondary assets.

1.4 Next Steps

UE is not required to publish and consult on an options screening report in this instance, because it has been determined on reasonable grounds, that there will not be a potential credible non-network or SAPS option that is able to address the identified need, nor any that forms a significant part of a potential credible option.

The total cost of the most expensive credible network option to address the identified need, is greater than the trigger threshold of $12 million[4] for the publication of and consultation on a Draft Project Assessment Report (DPAR). On this basis, UE shall now prepare and publish a Draft Project Assessment Report (DPAR), as required under NER clause 5.17.4, paragraphs (i) to (m). UE intends to publish the DPAR by 5 July 2024.

For the purposes of referencing this RIT-D, this RIT-D is referred to as the "*Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition*" identified need.

2. Introduction

This Notice of Determination report has been prepared by United Energy (UE) in accordance with the requirements of clause 5.17.4, paragraphs (c) and (d) of the National Electricity Rules (NER) version 211, for the Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition identified need.

UE is not required to publish and consult on an options screening report in this instance, because it has been determined (on reasonable grounds) that there will not be a potential credible non-network or SAPS option that is able to address the identified need, nor any that forms a significant part of a potential credible option.

This report sets out the reasons for this determination, including the methods and assumptions used in making the determination.

The need for investment and the possible options for addressing the Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition identified need, have been foreshadowed in UE's 2023 Distribution Annual Planning Report (DAPR).[5]

This Notice of Determination report:

- Provides background information on the network limitations at Glen Waverley Zone Substation (GW), and for the GW supply area for which it services.
- Identifies the need which UE is seeking to address, together with the assumptions used in identifying that need.
- Describes the credible options that UE currently considers may address the identified need, including for each:
  - Technical definitions;
  - The risk costs associated with the option for addressing the identified need;
  - The estimated commissioning date; and
  - The total indicative cost (including capital and operating costs), with high-level cost breakdown.
- Sets out the technical characteristics that a non-network or stand-alone power system (SAPS) option would be required to deliver in order to address the identified need.

3. Referenced Documents

Table 1: Referenced Documents

Title	Document No.
UE Embedded Generation Network Access Standards	UE-ST-2008.X
UE Asset Risk Quantification Guide	UE-GU-2011

[4] https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/cost-thresholds-review-for-the-regulatory-investment-tests-2021

[5] UE: Distribution Annual Planning Report. Available at: https://dapr.unitedenergy.com.au/ue_data/UE-PL-2209%20Distribution%20Annual%20Planning%20Report%20DAPR%20-%202023.pdf

4. Definitions

Table 2: Terms and Definitions

Term	Definition
A.C.	Alternating Current
AEMO	Australian Energy Market Operator
AFAP	As Far As Practicable
DAPR	Distribution Annual Planning Report
D.C.	Direct Current
DPAR	Draft Project Assessment Report
DSED	Demand Side Engagement Document
EB	East Burwood Zone Substation
EUE	Expected Unserved Energy (MWh pa)
GW	Glen Waverley Zone Substation
MGE	Mulgrave Zone Substation
MWp	Megawatt peak
NCC	Network Control Centre
NEM	National Electricity Market
NER	National Electricity Rules
NO	Notting Hill Zone Substation
PoE	Probability of Exceedance
RIT-D	Regulatory Investment Test for Distribution
RWT	Ringwood Terminal Substation
SAPS	Standalone Power System
SCADA	Supervisory Control and Data Acquisition
UE	United Energy
VCR	Value of Customer Reliability ($/MWh)
50% PoE	The forecast maximum demand has a 50% probability of exceedance (PoE). That is, the forecast maximum demand is expected, on average, to be exceeded once in two years.
10% PoE	The forecast maximum demand has a 10% probability of exceedance (PoE). That is, the forecast maximum demand is expected, on average, to be exceeded once in ten years.
Credible option	An option that addresses the 'identified need', is commercially and technically feasible, and can be implemented in sufficient time to meet the 'identified need'.
Identified need	Any capacity, voltage, or safety limitation on the distribution system.
Limitation	Any limitations on the operation of the distribution system that will give rise to Expected Unserved Energy or safety risk consequences.

Term	Definition
Network option	A means by which an 'identified need' can be fully or partly addressed by expenditure on distribution network assets.
Non-network or SAPS option	A means by which an 'identified need' can be fully or partially addressed other than by a network option.
Non-network service provider	A party who provides a non-network or SAPS option.
Potential credible option	An option has the potential to be a credible option based on an initial assessment of its ability to address the 'identified need'.
Preferred network option	A credible network option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the NEM. The preferred network option can be a network option or do nothing (i.e. status quo).
Preferred option	A credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the NEM. The preferred option can be a network option, non-network or SAPS option, combination of both, or do nothing (status quo).

5. Identified Need

5.1 Network Overview

The area of UE's distribution network that is the subject of this Regulatory Investment Test for Distribution (RIT-D), is the Glen Waverley Zone Substation (GW) supply area, that includes the area of Glen Waverley and parts of Mount Waverley, Notting Hill, and Wantirna South.

GW is owned and operated by UE, providing power to approximately 19,592 customers, with the majority of the load at GW comprising of mainly residential with some commercial/light industrial customers.

GW is bounded in the north by adjacent 22 kV zone substations EB (East Burwood) and RWT (Ringwood), and in the south by NO (Notting Hill) and MGE (Mulgrave), providing load transfer capacity to be able to reduce load on the zone substation in the event of an emergency (such as a major asset failure, for example). The load transfer capability away from GW is 18.5 MVA.

GW zone substation is served by 66 kV sub-transmission lines from the Springvale terminal station (SVTS) and transforms electricity down to 22 kV via two 20/27 MVA transformers and one 20/30 MVA transformer.

The cyclic rating of GW with all transformers in service is 103.2 MVA, and with one transformer out of service the rating reduces to 68.8 MVA. This compares to a forecast 10% PoE maximum demand of 62.1 MVA for summer 2024/25, rising to 64.8 MVA by 2027/28.

The electrical single line diagram for GW, showing the 66 kV assets, 66/22 kV transformers, and 22 kV assets (including distribution feeder exits) is illustrated in Figure 1.

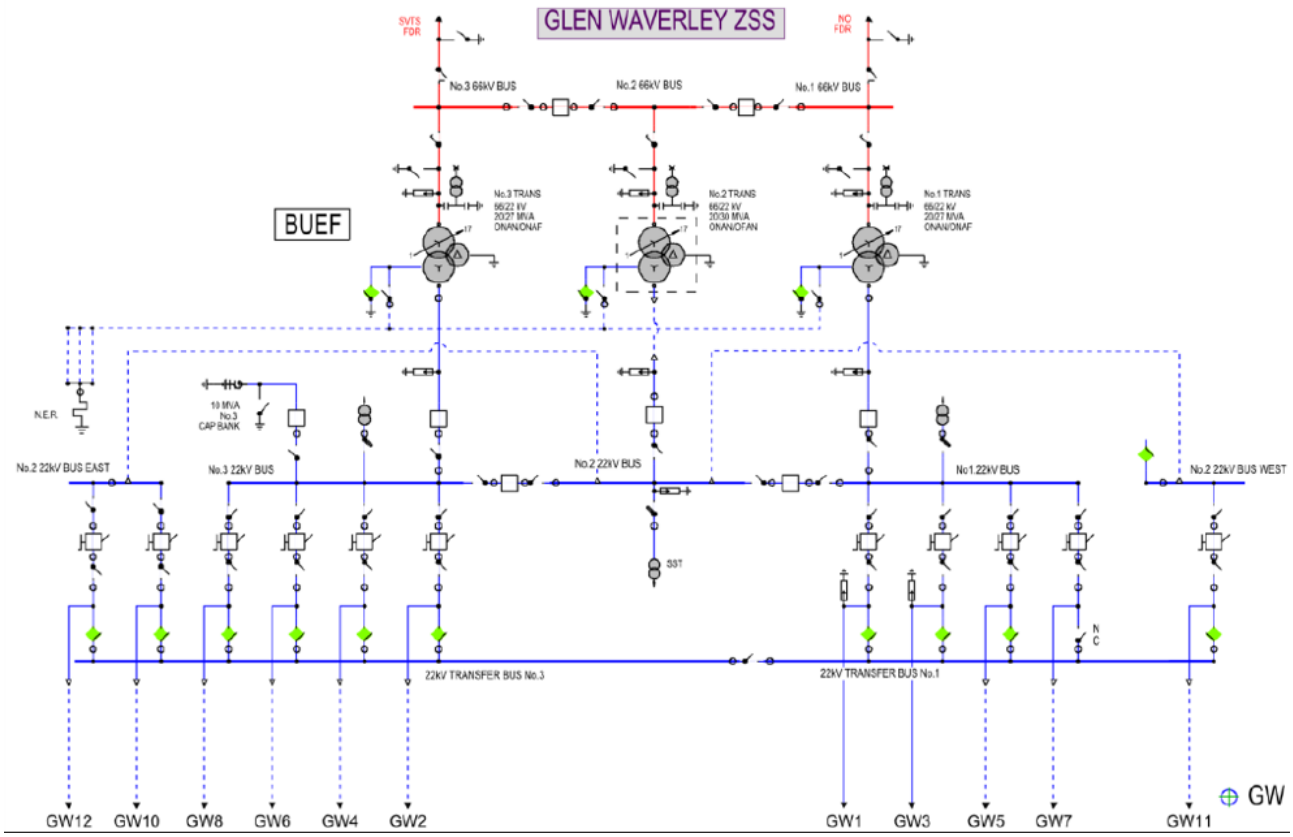

Figure 1: GW Electrical Single Line Diagram

The power supply coverage of GW is illustrated in Figure 2.

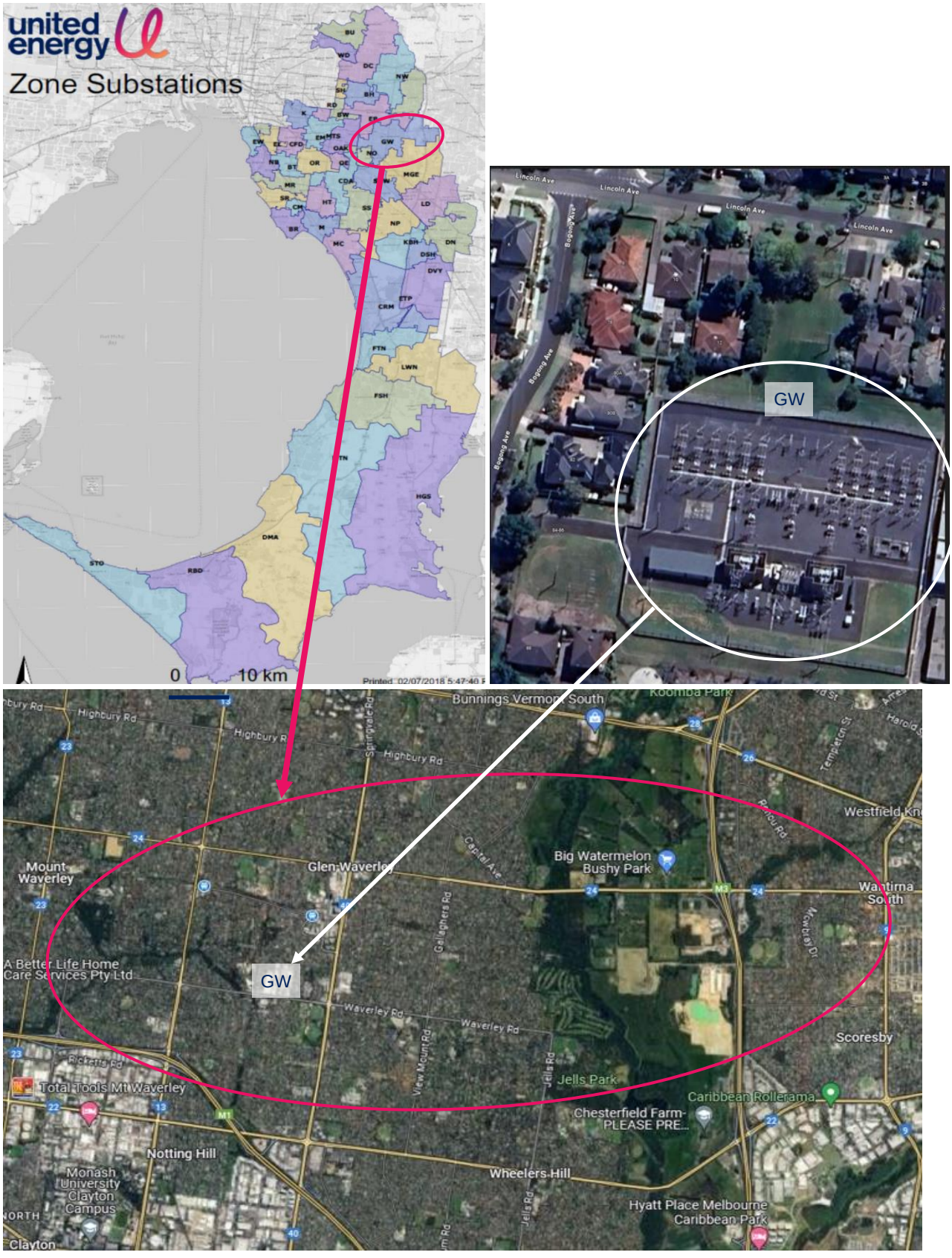

Figure 2: GW Supply Area

5.2 Description of the Identified Need

UE has prepared this report to assess whether the reliability and safety needs of GW could be realised either fully, or in part through non-network or SAPS options. To assess whether a non-network or SAPS option could be beneficial, it is important firstly to define the identified need for this location.

The condition of the secondary assets[6], switchgear[7] and control building[8] at GW, necessary for the provision of a safe and reliable power supply to customers within the GW supply area, are deteriorating, and technically obsolete, being unsupported by equipment suppliers with no spares.

The protection relays at GW are at end of life, have a history of failure, and are obsolete with limited spares and no manufacturer support.

UE's fleet of 354GC 22 kV outdoor circuit breaker switchgear is approaching end of life, with an increasing number of defects being found across the UE fleet. There are 18 of these circuit breakers installed at GW, with one currently not fit for service as the welds on the circuit breaker mechanism have cracked and cannot be cost effectively repaired.

The original asbestos fibre cement clad control building at GW installed in the 1960s, has an increasing number of serious defects, which is putting at risk the safe and reliable operation of the secondary assets housed within it.

The identified need at GW is to:

i) protect power sector workers and members of the public from harm caused by equipment failure (Safety); and

ii) continue to maintain a reliable power supply to the residences and businesses that are dependent on the supply from this distribution network (Reliability).

Solutions to the identified need shall manage and mitigate the increasing risk of secondary asset failure, switchgear failure, and control building defects, to maintain safety and reliability of electricity supply to UE's customers and workforce within the GW supply area.

Further details on the condition of the secondary assets, switchgear and control building at GW, are tabulated below, and photographs of those assets are presented in Appendix A:.

5.2.1 Protection and Control Equipment Condition

Protection and control systems are critical to the safe and reliable operation of the network. These systems are designed to detect the presence of power system faults and/or other abnormal operating conditions, and to automatically isolate the faulted network by the opening of appropriate high-voltage circuit breakers. Failure to isolate power system faults will invariably result in severe damage to network assets, presenting a serious health and safety hazard to the public, and greatly increases the risk of fire-starts. Most of the protection and control relays at GW are now technically obsolete, being no longer supported by vendors, and limited to no spare parts. All of these factors increase the likelihood of a power system fault not being detected and safely isolated, or a maloperation.

Some of the recent relay failure history at GW is listed in Table 3.

Table 3: GW Protection & Control Relay Failure History

Date	Identified Issue	Identified Cause and Rectification
2016	Relay Health Alarm	GW1 Feeder Relay Failure
2016	Relay Health Alarm	GW7 Feeder Relay Failure
2019	Output contact failure	GW11 Feeder Relay Output Contact Failure
2019	Relay Health Alarm	GW4 Feeder Relay Analogue Error / Power Supply Error
2022	Relay Health Alarm	Station Master Earth Fault Relay Failure Alarm

[6] protection, control, monitoring and communications equipment.
[7] circuit breakers and associated outdoor switchyard equipment.
[8] housing the secondary assets.

5.2.2 Circuit Breaker Condition

The 22 kV Email/Westinghouse type 345GC circuit breaker failure history across the UE network. These are the same circuit breaker types used at GW. The circuit breaker type has a history of being prone to animal and bird faults. The most recent 22 kV Email/Westinghouse type 345GC circuit breaker defects at GW are tabled below.

Table 4: 345GC Circuit Breaker Defects

Date	Identified Issue	Identified Cause and Rectification
2020	Trip Coil	GW12 Feeder CB replace broken trip coil Pin
2020	Leaking	GW8 Feeder CB low oil
2021	Structural Damage	GW12 Feeder CB support structure rusted
2022	CB Earth Bond	#3 Capacitor Bank CB earthing bond performing poorly
2022	CB Earth Bond	Solenoid box bond performing poorly
2024	Structural Damage	GW12 cracked welds on contact support
2024	Bushing Defect	GW7 Feeder CB White Phase Bushing broken seal
2024	Bushing Defect	GW7 Feeder CB Blue Phase Bushing broken seal

5.2.3 Control Building Condition

The control building defect history at GW is extensive, indicative of the age of this building. The most recent defects are listed in Table 5.

Table 5: GW Control Building Defects History

Date	Identified Issue	Identified Cause and Rectification
2012	Roof, Gutter Defect	Repaired hole in the ceiling.
2012	Lighting System Defective	Control room lights not working; wiring repaired.
2012	Window Issue	Re-painting control room window.
2013	Locks Defective	Control room security.
2014	Door Defect	Door not closing, faulty latch.
2014	Roof, Gutter Defect	Repaired hole in the ceiling.
2014	Painting Deteriorated	Windows needed painting.
2015	LV Fuse/CB Problem	GPO in mess room requires replacement.
2015	Painting Deteriorated	Painted control room doors.
2015	Roof, Gutter Defect	Repair ceiling panels coming away.
2015	Roof, Gutter Defect	Control room building roof corroded; repaired/replaced.
2016	Door, Gate Defect	Control room door latch broken / replaced.
2019	Air-Conditioning / Ventilation System Defect	Air conditioner broken, replaced.
2019	Plumbing Problems	Replace cracked toilet bowl.
2019	Door, Gate Defect	Broken control room steps.
2019	Lighting System Defective	No emergency exit lights; repaired.
2019	Lighting System Defective	Control room fluorescent tubes changed.
2019	Animal Other / Vermin problem	Control room damage by fox entering.
2019	Window Issue	Window painting

Date	Identified Issue	Identified Cause and Rectification
2019	Plumbing Problems	Repair gutter and spoon drain.
2019	Painting Deteriorated	Window painting.
2020	Toilet Defect	Toilet leaking water / repaired plumbing
2021	Battery Room Fan	Battery room exhaust fan not working / replaced.
2023	Animal Other / Vermin problem	Fox den under the control building.
2024	Lighting System Defective	Fluorescent lights not working / replaced.

5.3 Quantification of the Identified Need

Table 6 summarises the forecast impact of the identified network need discussed in Section 5.2 on customers. The table shows over a 15-year forecasting period, the risk costs and hence the potential market benefits considered, including:

- Expected unserved energy (EUE) cost, which is the value of the energy at risk after taking into account the probability of asset failures or malfunctions at GW, representing the deterioration in supply reliability within the GW supply area.
- Safety risk cost, which is the cost of harm to UE's staff and the general public located within the GW supply area, as a result of anticipated safety incidents caused by asset failures or malfunctions at GW.
- Total risk which is the sum of the expected unserved energy cost and the safety risk cost.

Table 6: GW Reliability and Safety Risk Quantification ($'000, Real 2024)

Financial Year	Expected Unserved Energy Cost	Safety Risk Cost[9]	Total Risk Cost
2024	348	459	807
2025	376	483	859
2026	407	507	914
2027	438	533	970
2028	468	558	1,027
2029	500	585	1,085
2030	534	612	1,146
2031	572	639	1,210
2032	611	666	1,277
2033	651	694	1,345
2034	686	722	1,408
2035	721	750	1,470
2036	756	777	1,533
2037	792	805	1,597
2038 - 2050	792 pa	805 pa	1,597 pa

For the purposes of this RIT-D, economic evaluations are undertaken over a 25-year period.

[9] For simplicity, no AFAP disproportionate factors have been applied to the Safety Risk Cost.

6. Key Assumptions in Relation to the Identified Need

6.1 Method for Quantifying the Identified Need

UE adopts its Asset Risk Quantification Guide (UE-GU-2011) in quantifying safety and reliability risks associated with asset condition failures and their consequences. This modelling is based on Weibull distribution parameters for each asset class.

6.1.1 Safety

The safety risk to UE employees and the general public, arising from potential failure or malfunction of network assets is quantified by UE using a safety risk cost, based on the asset conditions. The ability to maintain a safe network for the GW supply area is increasingly difficult due to the poor and deteriorating condition of the GW secondary system and switchgear assets, and the condition of the control building.

UE's approach to safety risk is based on the As Far As Practicable (AFAP) principle. The AFAP principle recommends safety risk reduction measures be implemented unless the cost, time or form of the risk reduction measure is grossly disproportionate to the benefit gained from the reduced risk. A "Do Nothing" (or run to failure) approach would result in the poor condition assets remaining in service, deteriorating further, and completely failing to address any safety concerns.

6.1.2 Reliability

UE's reliability planning standard for its zone substation assets is based on a probabilistic planning approach which quantifies Expected Unserved Energy (EUE) defined in terms of megawatt hours (MWh) per annum of energy not supplied, taking into account the unavailability of an asset due to a failure or malfunction, and expresses this financially by applying a Value of Customer Reliability (VCR) ($/MWh).

6.2 Forecast Maximum Demand

GW provides power to approximately 19,592 customers to parts of the suburbs of Glen Waverley, Mount Waverley, Notting Hill, and Wantirna South, with the majority of the load at GW comprising of mainly residential customers with some light industrial and commercial customers.

A credible network, non-network or SAPS solution should consider the forecast maximum demand for the GW supply area shown in Table 7. Forecasts of the 10% PoE and 50% PoE summer maximum demand and power factor at GW are presented. These forecasts are based on an expected economic growth scenario.

Table 7: GW Maximum Demand Forecast

Time Period	Power Factor	10% PoE (MVA)	50% PoE (MVA)
2024-25	1.00	62.1	57.4
2025-26	1.00	63.0	58.0
2026-27	1.00	64.3	58.7
2027-28	1.00	64.8	59.5
2028-29	1.00	65.5	60.1

6.3 Forecast Annual Energy

A credible network, non-network or SAPS solution should consider the annual energy requirements of customers within the GW supply area as shown in Table 8.

Table 8: GW Annual Energy Forecast

Time Period	Energy (GWh pa)
2024-25	200
2025-26	202
2026-27	205
2027-28	208
2028-29	210

6.4 Characteristic of Load Profile

A credible network, non-network or SAPS solution should be able to support the load profiles below.

UE has prepared load profiles that are characterised by the use of profiles from the most recent 50% PoE year. Based on this approach, the 2022/23 historical demand profile has been prepared and presented herein.

The coincident maximum demand of the customers within the GW supply area occurs during days of extreme ambient temperature. The annual demand profile at GW expressed as a percentage of the 50% PoE maximum demand listed in Table 7, is illustrated in Figure 3.

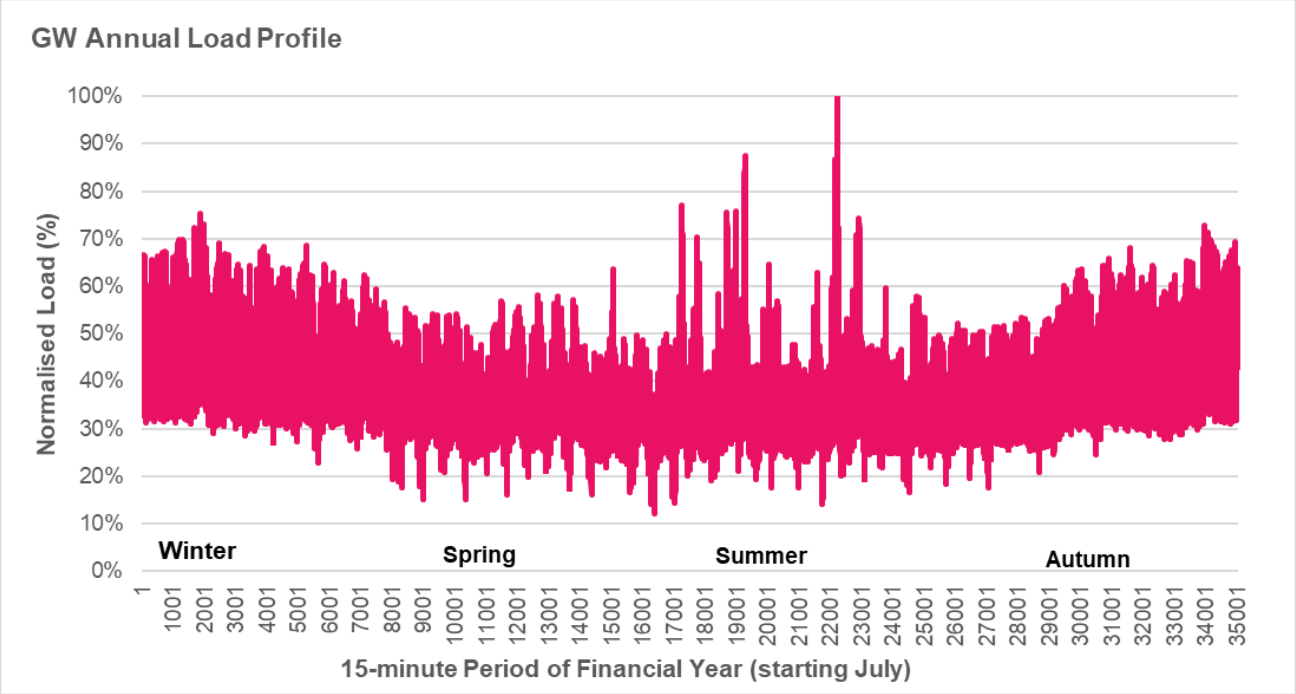

Figure 3: Annual Load Profile at GW

The load profile on the day of a 50% PoE summer maximum demand is illustrated in Figure 4. The prominence of air-conditioning load within the GW supply area, results in a maximum demand occurring during the early evening as the solar PV output subsides.

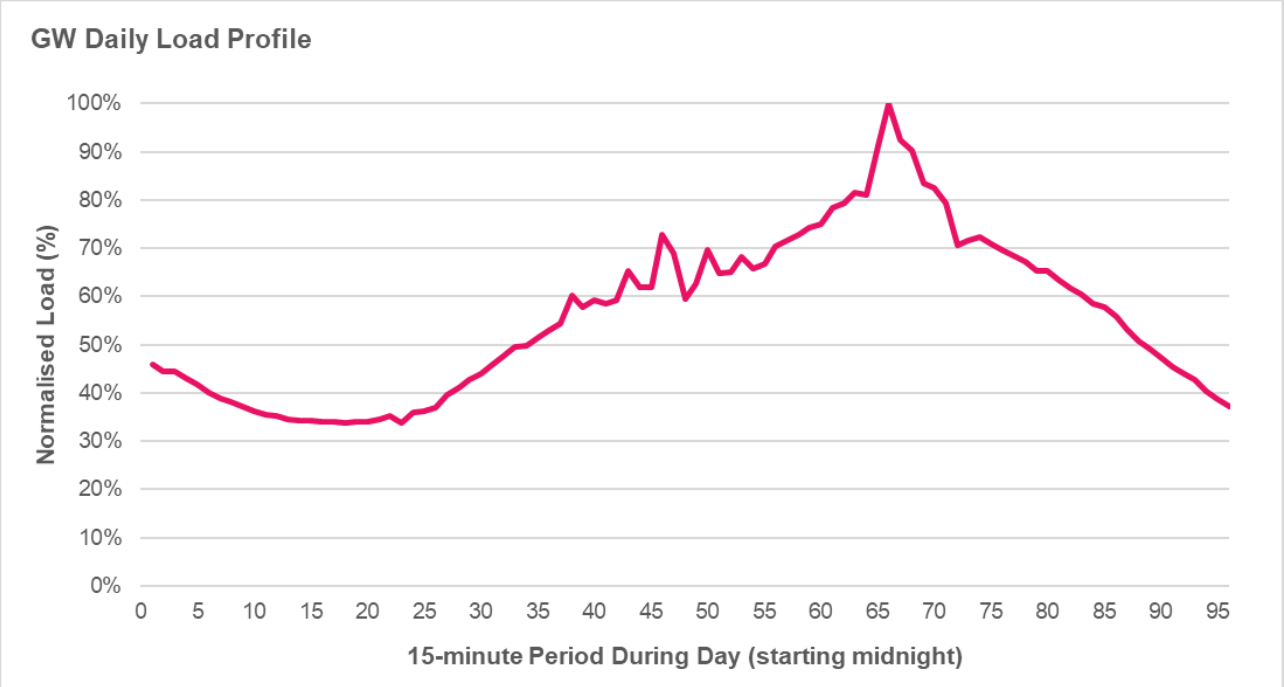

Figure 4: Load Profile on Day of Summer Maximum Demand at GW

Figure 5 shows the normalised annual load-duration curve at GW for a 50% PoE summer maximum demand year.

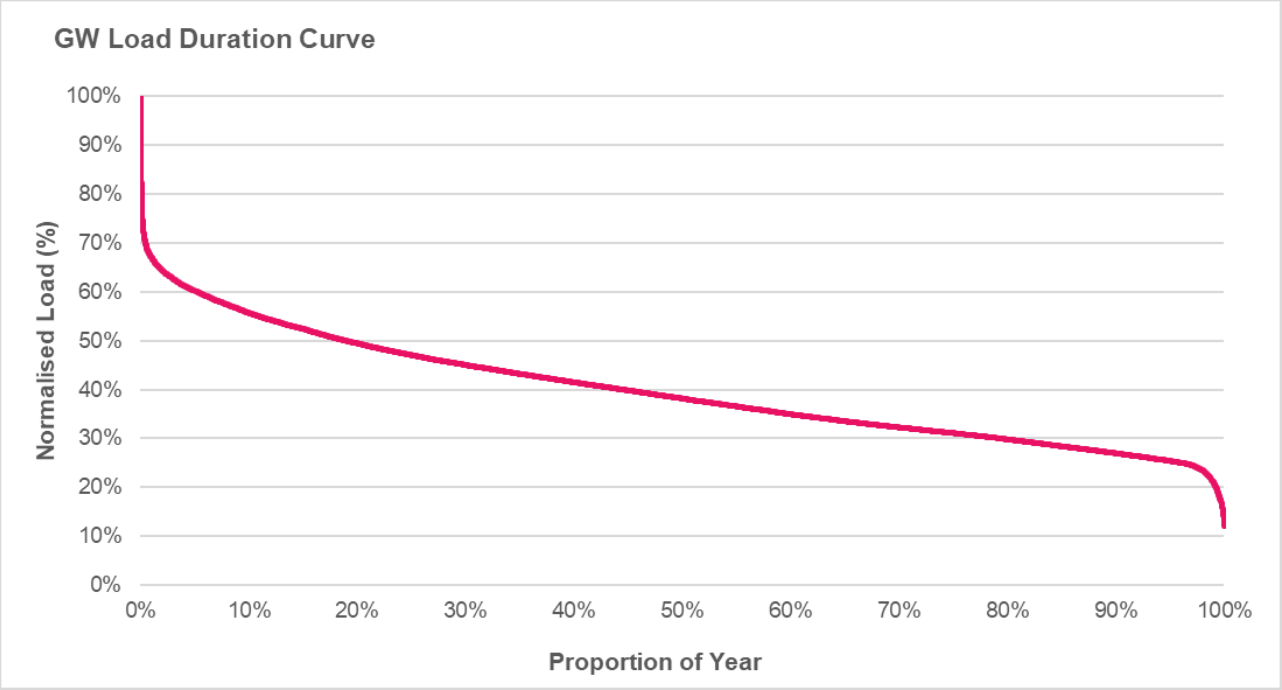

Figure 5: Annual Load-Duration Curve at GW

The load characteristics can vary marginally from year to year due to changes in weather, solar generation systems growth, and underlying changes in the customers' load usage. Figure 5 shows that load in excess of 80% of the maximum demand lasts for less than 1% of the year. It also shows that GW has a higher penetration of air conditioning which operates for a very small fraction of the year.

6.5 Load Transfer Capacity and Supply Restoration Times

A credible network, non-network or SAPS solution can assume the load transfer capability between GW and the neighbouring networks of RWT, EB, MGE and NO (among others) to be 18.5 MVA for summer 2024/25.

Future load transfer capability levels between GW and the neighbouring network can be assumed to remain relatively constant.

A credible network, non-network or SAPS solution should provide for supply to be restored within 60 minutes (on average) following the loss of a plant item causing an outage.

6.6 Discount Rates

To compare cash flows of options with different time profiles, it is necessary to use a discount rate to express future costs and benefits in present value terms. The choice of discount rate will impact on the estimated present value of net market benefits and may affect the ranking of alternative options. A discount rate of 4.43 per cent is used.

6.7 Asset Ratings

The existing capabilities of GW zone substation for summer and winter are presented in Table 9 for all transformers in service (N), and for one transformer out of service (N-1).

Table 9: Summary of GW Ratings (MVA)

Zone Substation	Summer Cyclic Rating at 40°C		Winter Cyclic Rating at 10°C	
	N	N-1	N	N-1
GW Import[10]	103.2	68.8	119.2	79.5
GW Export[11]	-84.0	-54.0	-84.0	-54.0

6.8 Value of Customer Reliability

Location-specific Value of Customer Reliability (VCR) is used to value reliability of supply. The locational VCR for the GW supply area was derived from the sector VCR estimates provided by the AER, weighted in accordance with the composition of the load, by sector, and escalated by CPI. This is summarised in Table 10.

Table 10: Summary of Location Specific VCR

Zone Substation	VCR ($ per MWh, Real 2024)
GW	42,020

6.9 Potential Credible Options to Address the Identified Need

UE has developed a set of potential credible options to address the identified need relating to the Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition.

To address the safety need, credible network, non-network or SAPS options would be required to have characteristics that would allow the safe decommissioning or rectification of the GW secondary systems, switchgear and control building. Furthermore, to address the reliability need in anticipation of the safe decommissioning of GW, credible options would need to be capable of supplying the annual energy requirements of customers supplied by GW, and the forecast maximum demand at GW over the planning horizon, taking into account the available load transfer capacity.

Table 11 provides a summary of the base case option, using the risk costs presented earlier in Table 6.

[10] Power flow towards customer load.
[11] Power flow towards the transmission network.

Table 11: Base Case

Option	Description
Do Nothing (status quo)	This base case option involves running the GW secondary systems, circuit breakers and control building to failure. That is, continue with existing maintenance of this equipment, coupled with replacement upon failure. This option does not address the identified need as it does not address the growing network reliability and safety risks. The present value of all costs (EUE and safety risk) is $21.12 million (Real, 2024).

Table 12 provides a summary of credible options that could address the identified need.

Table 12: Credible Options Under Consideration

Option	Description
1 - Proactive Relay, Control Building and Switchyard Replacement. (i.e. Indoor switchboard).	This option involves a renewal of secondary systems and the 22 kV switchyard in a new control and switchgear building. This option is the most economically viable option. It addresses network reliability and safety risks to AFAP. It realises synergies and economies of scale by combining secondary system and 22 kV switchyard replacement works and provides a reduction in commissioning risk. The total capital cost of this option is $14.80 million (Real, 2024). The present value of all costs (capital, O&M, EUE and safety risk) is $16.24 million (Real, 2024).
2 - Proactive Relay and Control Building Replacement. (i.e. Switchyard status-quo).	This option involves a renewal of the secondary systems only in a new control room. This option addresses secondary systems and control building risks only. The total capital cost of this option is $11.58 million (Real, 2024). The present value of all costs (capital, O&M, EUE and safety risk) is $16.84 million (Real, 2024).

A credible option needs to be technically and economically feasible, and able to be implemented within a reasonable timeframe to address the identified need. Table 13 describes the options that have been considered by UE and are regarded as not being credible for the reasons set out below. These include all remaining network, non-network and SAPS options.

Table 13: Options Regarded as Being Not Credible

Option	Description
Decommission GW and transfer all load to EB or RWT, and NO or MGE.	This option allows for the decommissioning of GW by transferring all of its load to the adjacent zone substations EB, RWT, NO and MGE. Referring to Table 14, 47 MVA of new feeder capacity (at least 6 new high voltage 22 kV feeders) would need to be established to transfer GW's entire load base to these zone substations. Either EB or RWT, and NO or MGE would each need to be augmented with an additional 20/33 MVA transformer and 22 kV switchboard. Given the scale of the works required to achieve this outcome would be in excess of $30 million, this option is not regarded as credible.
Power factor correction	The power factor at GW is currently unity at times of maximum demand, and there is no further opportunity to reduce demand at the network or customer level as seen by GW. Therefore, this option is not credible, because it cannot technically address the identified need in relation to reliability or safety risks associated with deteriorating asset condition.
Demand response programmes	Demand response programs are generally designed for peak demand management. The ability of all customers to be self-sufficient in their electricity demand at all times and for all year round to meet the identified need, is considered to be unfeasible, as it effectively requires all customers within the GW supply area to disconnect from the network. Hence this option is not credible.

Option	Description
Customer and/or community intermittent renewable generation and energy storage	Referring to Table 14, distributed generation of up to 47 MW using solar PV is likely to require more than 47 hectares of land[12]. Devoting this amount of land to energy production in a dense, urban environment is unlikely to be feasible. Nevertheless, coupling this with customer solar PV installations in the GW supply area, particularly with the availability of commercial and residential roof-space, could reduce the amount of additional generation required at a competitive cost. The challenge however lies in the provision of storage to back-up the solar PV panels when they are not operating (including during the evenings). A viable storage option that meets the maximum demand at GW and reliably meets customer requirements requires 'N' batteries (where 'N' ≥ 2) each able to supply (47 ÷ N) MWp, each with an energy to power ratio of around 9.5[13]. This would enable the system to meet maximum demand and coupled with solar PV, supply the annual energy needs. The costs of the storage alone is likely to exceed those of the preferred network option. For example, the fully installed capex cost of storage is approximately $0.9 million per MWh[14], totalling $404 million[15] (excluding land). Adding generation, demand management or efficiency measures to this option would reduce the battery requirements stated above. This option would lead to a much higher marginal cost to the customer compared to a network solution cost, and the gap is unlikely to be covered from other market-based revenues. The planning process required for this type of investment, also means this is unlikely to be completed in time to meet the identified need. The storage resources owned by individual customers indicates that no potential existing customer-owned storage would be large enough to meet the identified need. Therefore, this option is not considered to be credible.
Dispatchable generation and/or Customer standby generation	Referring to Table 14, a viable generation option that meets the maximum demand at GW and reliably meets customer requirements requires at least two generators to allow maintenance on one generator during off-peak times, each able to supply up to (47 ÷ N) MWp, where 'N' is the number of generators. This would enable the system to meet maximum demand and supply the annual energy needs. The costs of this are likely to exceed those of the preferred network option. For example, the capex cost of small gas-fired generator is approximately $1.25 million per MW[16]. For 47 MW of generation, the cost will be over $59 million[17], excluding land, connection and operating costs. Adding storage, demand management or efficiency measures to this option would reduce the generation requirements stated above, and potentially the costs. This option would lead to a much higher marginal cost to the customer compared to a network solution cost, and the gap is unlikely to be covered from other market-based revenues. The planning process required for this type of investment, also means this is unlikely to be completed in time to meet the identified need. The maximum demands of individual customers indicate that no potential existing customer-owned generation (standby or otherwise) would be large enough to meet the identified need. Therefore, this option is not considered to be credible.

[12] https://www.quora.com/How-much-land-is-required-to-setup-a-1MW-solar-power-generation-Unit-1
[13] 164,000 MWh pa / 365 days pa / 47 MW = 9.5.
[14] https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2022/2023-inputs-assumptions-and-scenarios-consultation/supporting-materials-for-2023/aurecon-2022-cost-and-technical-parameter-review.pdf
[15] 47 x 9.5 x 0.9 = $404 million.
[16] https://aemo.com.au/-/media/files/electricity/%E2%80%8Cnem/%E2%80%8Cplanning_and_%E2%80%8Cforecasting/%E2%80%8Cinputs-assumptions-methodologies/%E2%80%8C2021/Aurecon-Cost-and-Technical-Parameters-Review-2020.pdf
[17] 47 x 1.25 = $59 million.

7. Technical Characteristics of Non-Network Options

This section describes the minimum technical characteristics that a non-network or SAPS option would be required to deliver to address the identified need.

Like the network options, credible non-network and SAPS options would be required to have characteristics that would allow the safe decommissioning of GW and would need to be capable of supplying the annual energy requirements of all customers supplied by GW, and the maximum demand at GW over the planning horizon.

A credible non-network or SAPS option, or any combination of those (including with a network option) must satisfy timing, operational and the minimum technical requirements stipulated below.

7.1 Size of Support

Table 14 outlines the estimated amount of load reduction, or additional generation needed to be supplied by a credible non-network or SAPS solution within the GW supply area to address the identified need. These are the minimum requirements, because the values reflect the reduced requirement needed due to the availability of load transfer capability away from GW to its surrounding zone substations.

Table 14: Minimum Peak Demand and Annual Energy Offsets Required from Non-Network or SAPS Solutions

Year	Load at Risk (MVA)	Hours at Risk (Hours)	Minimum Non-Network or SAPS Support Required	
			Expected GWh pa	Expected MWp
2024-25	43.6	8760	152	43.6
2025-26	44.5	8760	155	44.5
2026-27[18]	45.8	8760	160	45.8
2027-28	46.3	8760	161	46.3
2028-29	47.0	8760	164	47.0

7.2 Time of Year, Duration and Location of Support

Proposed non-network or SAPS options, at a minimum, must be capable of supplying the entirety of the GW supply area maximum demand and annual energy, utilising the available transfer capability. This service is required no later than by the end of calendar year 2026.

7.3 Reliability of Support

Proposed non-network and SAPS options must be capable of reliably meeting electricity demand under a range of conditions and be able to maintain reliability and quality of supply levels for customers supplied within the GW supply area.

As such, redundancy may need to be built into a non-network or SAPS solution in order to maintain reliability of supply.

If the non-network option is a generator operating in parallel with UE's network, the generator must comply with the requirements set out in UE's Embedded Generation Network Access Standards (Document No. UE-ST-2008.X).

[18] Year of preferred network option.

8. Conclusion and Next Steps

8.1 Conclusion

Given the size of the support needed from a non-network or SAPS solution, and it being required at all times of the year to maintain supply reliability within the GW supply area (following the safe decommissioning of GW), it is unlikely that a non-network or SAPS option could be technically and economically viable to address the identified need.

In conclusion, this Notice of Determination report demonstrates that none of the non-network or SAPS options are potentially feasible in this instance. The analysis demonstrates that there are no combinations of non-network or SAPS options, or in combination with network options, that are likely to adequately meet the criteria that would require the publishing of, and consultation on a RIT-D options screening report.

8.2 Next Steps

The total cost of the most expensive credible network option to address the Glen Waverley Zone Substation Secondary Assets, Switchgear and Control Building Condition identified need, is higher than the trigger threshold of $12 million[19] for the publication of and consultation on a Draft Project Assessment Report (DPAR).

Therefore, UE shall now prepare and publish a Draft Project Assessment Report (DPAR), as required under NER clause 5.17.4, paragraphs (i) to (m), which will present a detailed economic assessment of all credible network options that address the identified will identify the preferred option and its optimum timing.

The DPAR shall provide information required under NER clause 5.17.4, paragraph (j), and will apply the latest available information on reliability and safety risk costs associated with the identified need, and the project cost estimates, in evaluating the economic viability of the preferred option against the alternative options considered.

UE intends to publish the DPAR by 5th July 2024.

[19] https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/cost-thresholds-review-for-the-regulatory-investment-tests-2021

Appendix A: Secondary Assets, Switchgear and Control Building Photos

A significant proportion of the secondary systems, 22 kV outdoor circuit breakers and the control building within GW are in a poor condition and technically obsolete (with no vendor support and limited to no spares). UE has assessed there is now an unacceptable risk of asset failure, with significant consequences for safety, and for the reliability of electricity supply to UE's customers within the GW supply area.



Figure 6: In-Service Secondary Systems, 22 kV Circuit Breakers & Control Building at GW