Addressing reliability requirements in the Garbutt network area

Notice of no non-network options

Publication Date: 13th December 2019

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1. Description of the identified need

Garbutt 132/66/11kV (T046) Substation (GARB) is a Powerlink Queensland (PLQ) / Ergon Energy (EE) shared site with outdoor 132kV and 66kV assets and indoor 11kV assets, which supplies 48,500 customers and 86MVA of load (directly and indirectly). Development of the substation commenced in 1958 with upgrades and augmentations in subsequent years. Garbutt Substation is now an integral node within the Townsville sub transmission (66kV) network with seven 66kV feeders supplying a number of zone substations. There is minimal forecast load growth at the substation however many assets are approaching or at the end of service life, with some equipment and the majority of structures 40-60 years old.

Figure 1 Aerial image of Garbutt Substation

A Civil Engineering Condition Assessment of the Garbutt Substation in 2016 made the following key observations about the pre 1980 concrete supports:

- All concrete structures supporting isolators on the low bus have a high risk of failure;
- All concrete structures supporting isolators on the high bus have a high risk of failure;
- All concrete line termination structures have a high risk of failure in the east-west direction.

The report also included the following key observations about the risk that operators switching isolators mounted on these structures are exposed to:

- There is a medium risk of failure of the structures supporting the A729, D729, B729 C729 and G729 isolators on the high bus. For the other isolators there is a low risk of failure;
- There is a medium risk of failure of the B129L line termination structure. For the other line termination structures, the risk is low.

In January 2018 a segmented porcelain insulator supporting a 66kV isolator failed catastrophically. Shards of porcelain were located up to 25m from the point of failure. This incident caused a

significant supply interruption and triggered a reactive project to replace all segmented porcelain insulators in the Garbutt Substation yard.

Subsequent to this incident a Substation Condition Assessment Report (SCAR) was completed for Garbutt Substation which identified the assets nearing or at end of life and requiring replacement. The predominant primary system assets identified for replacement were the 66kV outdoor switchgear including; circuit breakers, voltage and current transformers, insulators stacks, isolators, the strung bus, the solid bus and all their supporting structures.

The deteriorated condition of the assets at Garbutt Substation poses significant safety risks to staff working in proximity to these assets and reliability of supply risks to customers supplied from Garbutt Substation.

Ergon Energy Corporation Limited (Ergon Energy) is responsible under its Distribution Authority D01/99 for electricity supply to the Townsville area in North Queensland. A fundamental requirement of Ergon Energy's Distribution Authority is to comply with the Minimum Service Standards and Safety Net Targets that seek to effectively mitigate the risk of low probability – high consequence network outages to avoid unexpected customer hardship and / or significant community or economic disruption. Details on Ergon Energy's Minimum Service Standards and Safety Net Targets are included in Appendix B.

A condition of Ergon Energy's Distribution Authority is to comply with all applicable legislation. Accordingly, clause 42 of the *Queensland Electricity Act 1994* requires the entity to operate, maintain (including repair and replace as necessary) and protect its supply network to ensure the adequate, economic, reliable and safe connection and supply of electricity to its customers.

The identified need for investment is to remediate the safety and reliability risks currently associated with the aged assets at Garbutt Substation in order to maintain a safe, reliable supply of electricity to customers in the Townsville region. Ergon Energy's proposed preferred network option to address the identified need is to replace the aged assets at Garbutt Substation in a safe, cost-effective manner that minimises disruptions to customers.

Changes to the National Electricity Rules (NER) in July 2017[1] have meant that replacement plans for network assets are now subject to RIT-D. Accordingly, Ergon Energy has initiated a RIT-D to address the identified need associated with the aged assets at Garbutt 132/66/11kV Substation.

This notice has been prepared under cl. 5.17.4(d) of the NER and summarises Ergon Energy's determination that no non-network option is, or forms a significant part of, any potential credible option for this RIT-D. In particular, it sets out the reason for Ergon Energy's determination, including the methodologies and assumptions used.

1.1. Assumptions underpinning the identified need

The need to undertake action is predicated on the deteriorated condition of the assets at Garbutt Substation which pose significant safety risks to staff working in proximity to these assets and reliability of supply risks to customers supplied from Garbutt Substation.

[1] https://www.aemc.gov.au/rule-changes/replacement-expenditure-planning-arrangements

The consequence of not addressing the condition based risks at Garbutt Substation is that the assets will continue to deteriorate and ultimately fail presenting safety and reliability risks.

This section summarises the key assumptions underpinning the identified need for this RIT-D. It is recognised that the assumptions may prove to have various levels of correctness, and they merely represent a 'best endeavours' approach to predict the future identified need.

1.1.1. Forecast Load Growth and Daily Load Profiles

As shown in Figure 8 and Figure 9 the 50% Probability of Exceedance (50 PoE) forecast demands for the Garbutt Substation 11kV load and the Belgian Gardens Substation 11kV load are forecasting minimal load growth over the next 10 years.

The average daily profiles for the GARB and BEGA 11kV loads shown in Figure 14 and Figure 17 are not expected to change significantly over the coming years. However the load profiles could potentially be influenced by changes to customer generation or usage patterns and the uptake of electric vehicles and battery storage in the area.

1.1.2. Reduced substation operational capability

The condition of the 66kV bus isolators and supporting structures limits operational flexibility at Garbutt Substation. A majority of the isolators are in poor condition with sticky contacts and some are inoperable. The isolator structures have an increased risk of failure during operation of the isolators due to the necessary force required to open and close the isolators.

Due to the proximity of the isolators to the aerial bus there are a number of isolators that cannot have maintenance performed on them without a complete 66kV bus outage at Garbutt Substation. The 66kV bus configuration does not provide the operational flexibility to de-energise both the aerial bus and the isolators on the rigid bus without a complete bus outage.

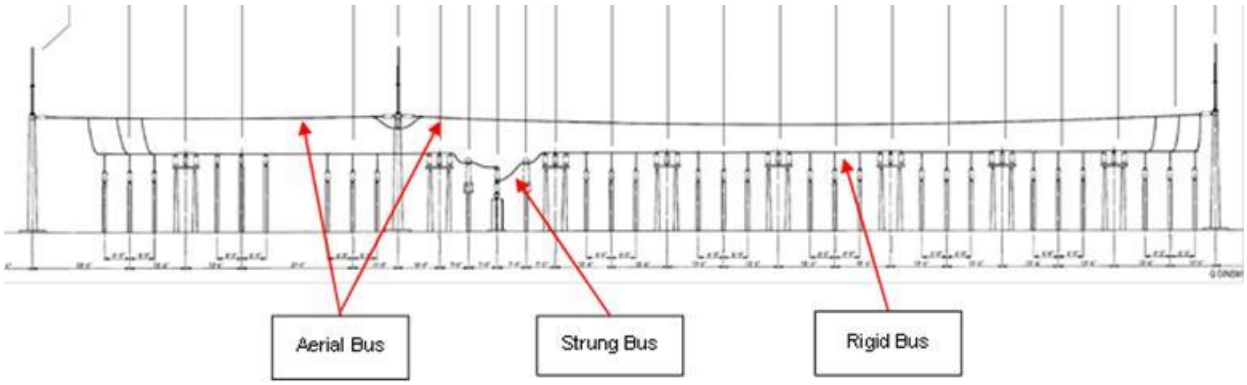


Figure 2 Garbutt Substation elevation diagram showing the 66kV bus configuration

Due to concerns associated with the integrity of the concrete support structures, switching operators assess the condition of each isolator prior to operating and consider the likelihood of structure failure or dislodgement of concrete pieces when subjected to the lateral forces during switching. The controls applied to maintain safety range from a safety observer to refusal to switch resulting in switching at adjacent devices. Switching at adjacent devices can be operationally inefficient and can result in wider network affected by the operation.

1.1.3. Increased risk of involuntary load shedding going forward

Townsville is located in a tropical environment and is subject to harsh atmospheric conditions including tropical cyclones[2]. The aged assets at Garbutt Substation, particularly the deteriorating concrete support structures, will become more susceptible to failure during periods of increased wind loading.

With the Townsville network configured in a normal state, a credible contingency at Garbutt Substation is not expected to result in loss of supply to any customers as there is generally full N-1 backup capability available up to the Garbutt and Belgian Gardens Substation 11kV busbars.

A non-credible event such as an outage to both 66kV bus sections at Garbutt Substation would result in loss of supply to at least 10,000 customers. Although considered a non-credible event (or high consequence low probability event), due to the 66kV aerial bus arrangement at Garbutt Substation an aerial bus conductor failure or supporting structure failure is likely to result in an outage to both 66kV bus sections. As the Townsville 66kV network has a meshed arrangement, an outage on both 66kV bus sections should normally only result in an outage to customers supplied from the Garbutt Substation 11kV distribution network and the Belgian Gardens 11kV distribution network.

Figure 3 Photo showing the aerial bus spanning the bus tie circuit breaker

In the event of an extended 66kV bus outage at Garbutt Substation Ergon Energy will use 'best endeavours' to partially restore supply using 11kV feeder transfers and generation support. It has been assumed that for a majority of bus faults supply can typically be fully restored within 24 hours. The restoration times would generally be dependent on a number of factors including location of staff, time of fault, severity of the fault, asset accessibility, availability of suitable spares, weather conditions and would vary under extenuating circumstances such as a natural disaster scenario.

[2] http://www.bom.gov.au/cyclone/about/

Based on the existing peak load profiles at GARB and BEGA the load at risk over a 24 hour period would be in the order of 630MWh which would reduce to around 430MWh after accounting for load transfers and generation support.

Based on Condition Based Risk Management (CBRM) analysis the probability of a 66kV primary plant or structural asset failure that would lead to a full 66kV bus outage could occur as infrequently as once in 20 years. The average annual probability of failure (PoF) is therefore 0.05 and the estimated unserved energy in the next 10 years is estimated at 215MWh.

2. Network characteristics

2.1. Geographic region

The geographic region covered by this RIT-D is Garbutt Substation and the connected substations through its 66kV Network. Garbutt Substation supplies approximately 48,500 customers and is located in the Townsville area of the Northern Region of Ergon Energy's Network.

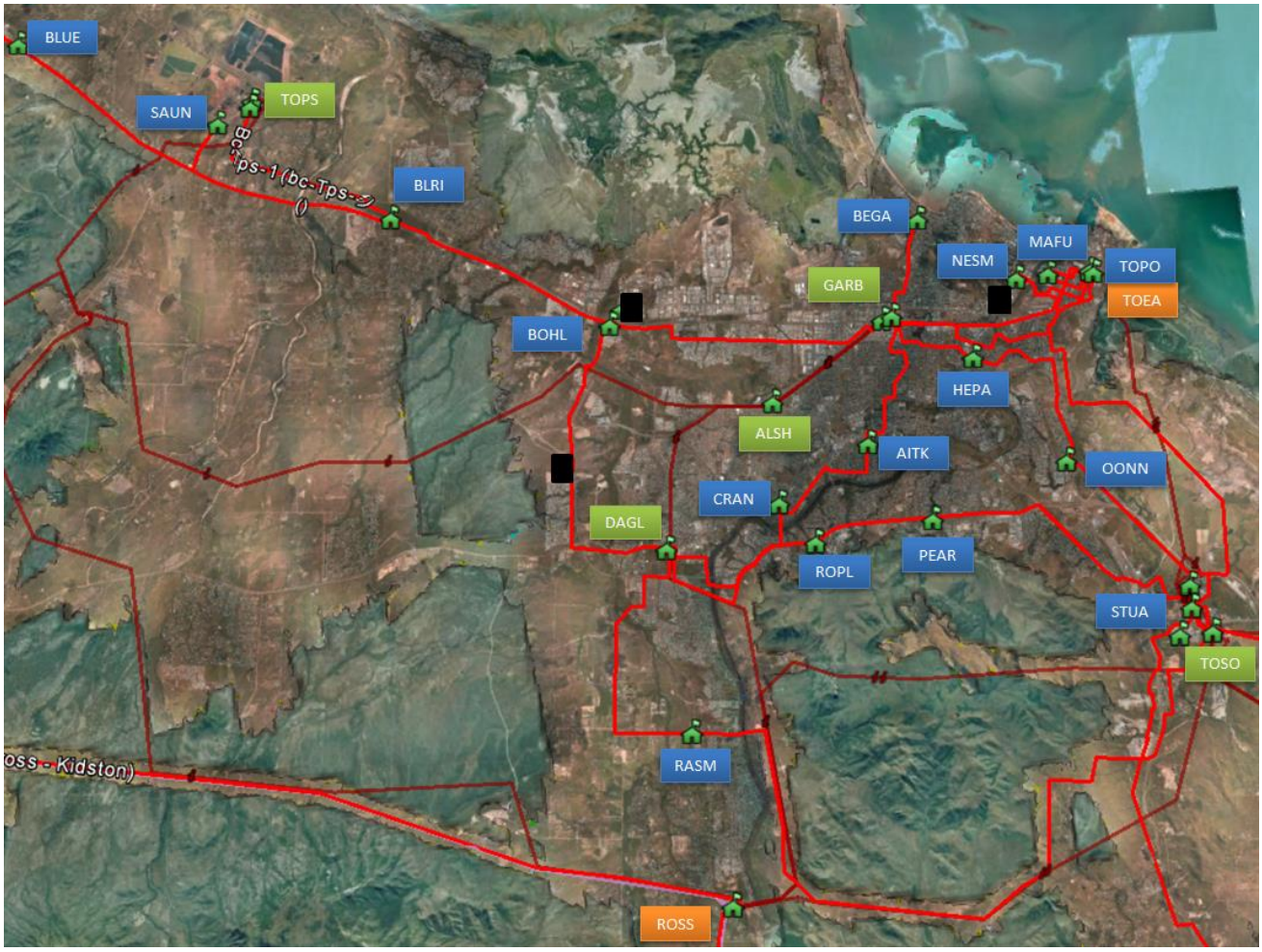


Figure 4 Townsville's 132kV transmission and 66kV sub transmission Networks

(PLQ Sites Orange, PLQ/EE Sites Green, EE sites Blue)

2.2. Existing supply system

Garbutt 132/66/11kV Substation is supplied via a Powerlink Queensland (PLQ) owned double circuit transformer ended 132kV feeder from Alan Sherriff Substation. The PLQ-EE asset boundary at Garbutt Substation is the 66kV bushings on the 132/66kV transformers. Garbutt Substation has seven 66kV feeders that supply a number of zone substations in the Townsville area. Garbutt Substation has eleven outgoing 11kV feeders that supply approximately 1472 commercial/industrial customers and 4201 domestic customers.

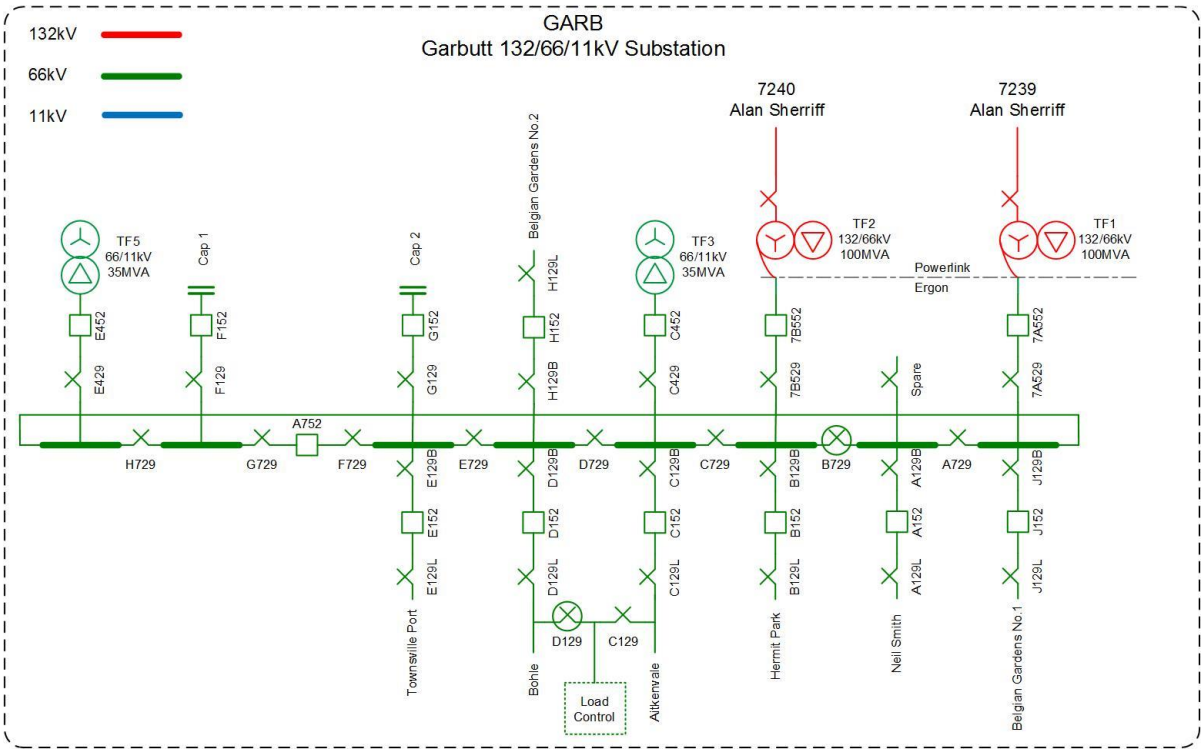


Figure 5 Single Line Diagram of the 66kV bus at Garbutt Substation

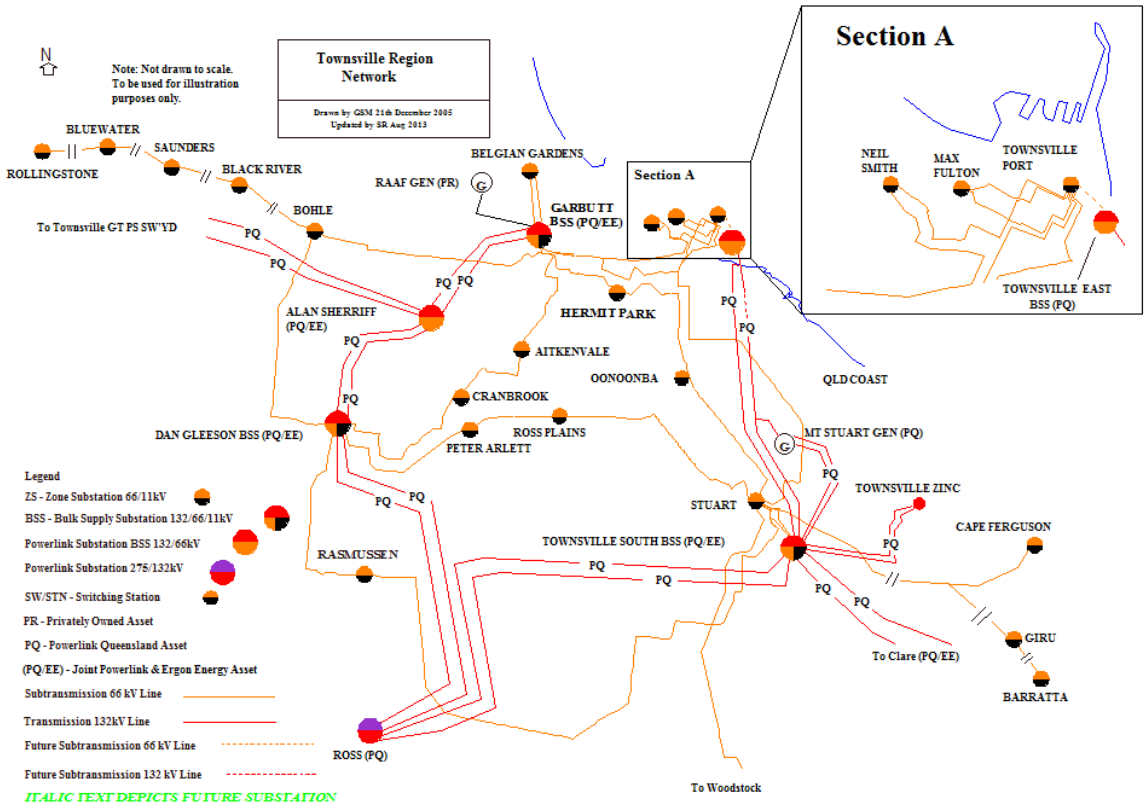


Figure 6 Existing Townsville Network Arrangement (Sub-transmission)

The Townsville 66kV network is supplied by four PLQ 132/66kV substations (T056 Townsville South, T094 Townsville East, T092 Dan Gleeson and T046 Garbutt) as shown in the diagram above. Garbutt Substation is a crucial node in the interconnected 66kV ring arrangement that supplies the 66/11kV zone substations in the Townsville urban area. The following Zone substations would be directly impacted for a Garbutt Substation 66kV bus outage:

- Garbutt 11kV network (complete outage of supply)
- Belgian Gardens (complete outage of supply)
- Bohle (supply maintained via Dan Gleeson – Bohle 66kV feeder)
- Black River (supply maintained via Dan Gleeson – Bohle 66kV feeder)
- Saunders (supply maintained via Dan Gleeson – Bohle 66kV feeder)
- Bluewater (supply maintained via Dan Gleeson – Bohle 66kV feeder)
- Rollingstone (supply maintained via Dan Gleeson – Bohle 66kV feeder)
- Neil Smith (supply maintained via Townsville Port – Neil Smith 66kV feeder)
- Aitkenvale (supply maintained via Dan Gleeson – Cranbrook 66kV feeder)
- Cranbrook (supply maintained via Dan Gleeson – Cranbrook 66kV feeder)
- Hermit Park (supply maintained via Stuart – Oonoonba 66kV feeder)
- Oonoonba (supply maintained via Stuart – Oonoonba 66kV feeder)

With the Townsville network configured in a normal state, an outage on both 66kV bus sections at Garbutt Substation should normally only result in an outage to customers supplied from the Garbutt Substation 11kV distribution network and the Belgian Gardens 11kV distribution network.

3. Forecast load and capacity

3.1. Load Forecast and Capacity

There is presently adequate capacity at Garbutt and Belgian Gardens Substations to service the forecast loads in compliance with the Safety Net Targets.

	Normal Cyclic Capacity (NCC)	Emergency Cyclic Capacity (ECC)
Garbutt Substation 66kV	180MVA[3]	90MVA[4]
Garbutt Substation 11kV	53.8MVA	29.8MVA
Belgian Gardens Substation 11kV	73.9MVA	40.9MVA

Table 1 Garbutt and Belgian Garden Substation Capacities

The plots below show the historical maximum demands and the 50% Probability of Exceedance (50 PoE) forecast demands for the Garbutt Substation 66kV load, the Garbutt Substation 11kV load and the Belgian Gardens Substation 11kV load.

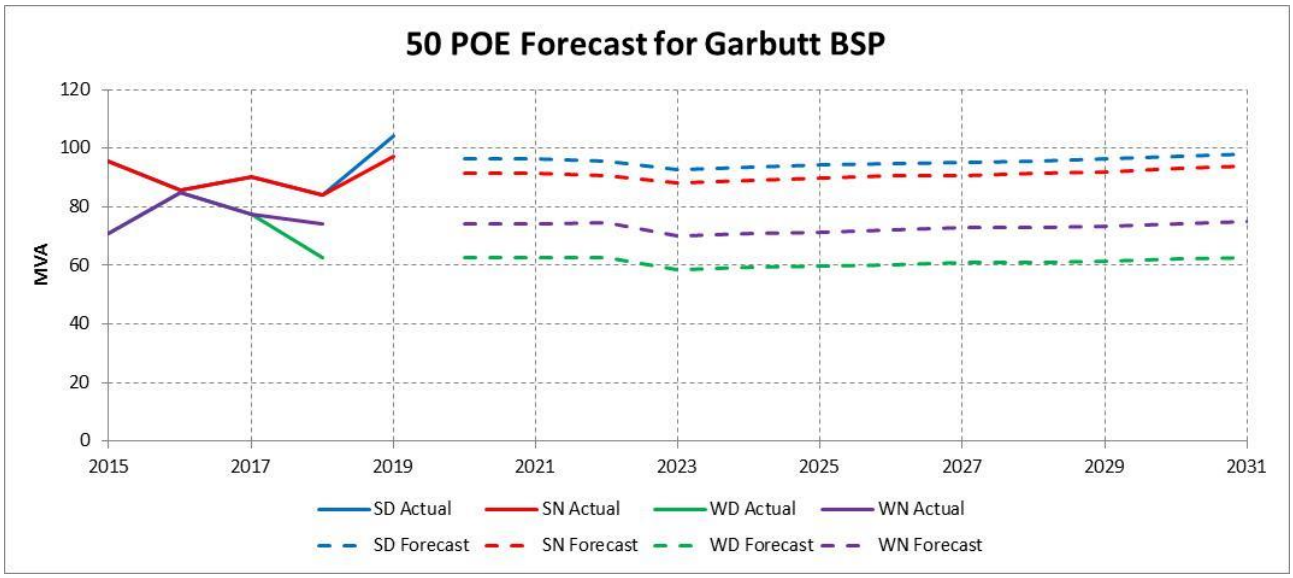


Figure 7 50 PoE Demand Forecast for the Garbutt Substation 66kV load

The 66kV network is highly meshed around Townsville and an outage to one of the 132/66kV transformers does not result in all 66kV load being carried on the remaining 132/66kV transformer due to the impedance change at Garbutt Substation. Therefore the loading shown in the forecast for Garbutt Substation 66kV load would normally not be applicable with one 132/66kV transformer out of service as some of this load would shift, based on the impedance changes, to adjacent bulk supply points in the Townsville 66kV network.

[3] Limited by the 66kV 800A isolators. Also dependant on the split of power flow through the 66kV rigid and aerial bus sections. The aerial bus section has a rating of approximately 485A.
[4] Dependant on the split of contingent power flows through the 66kV rigid and aerial bus sections. The aerial bus section has a rating of approximately 485A.

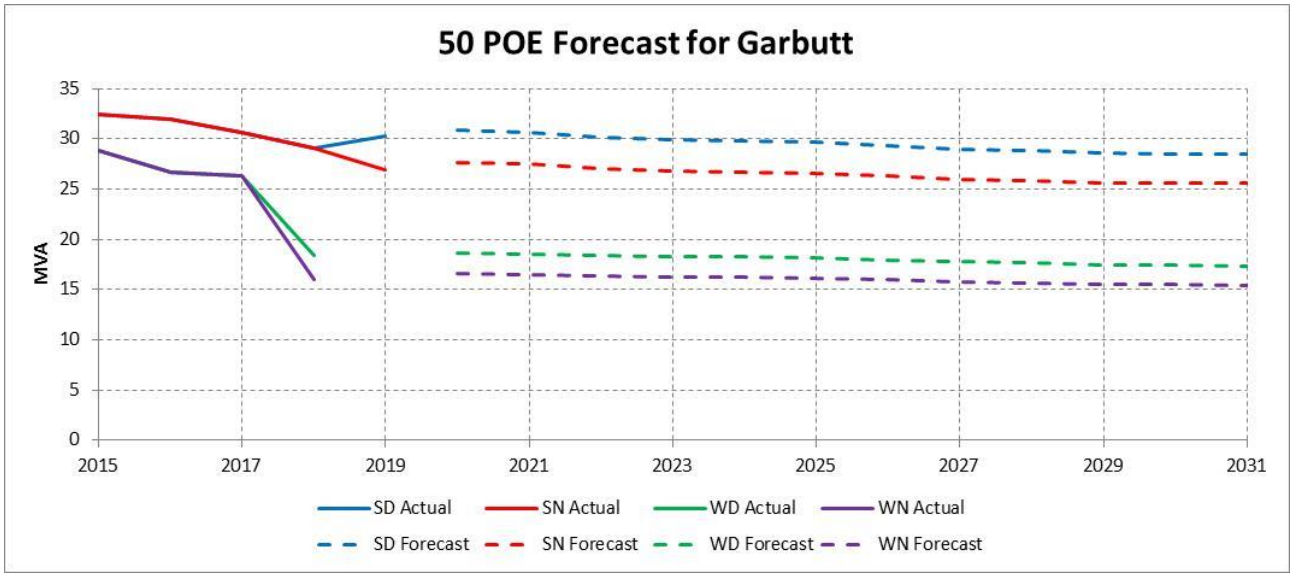


Figure 8 50 PoE Demand Forecast for the Garbutt Substation 11kV load

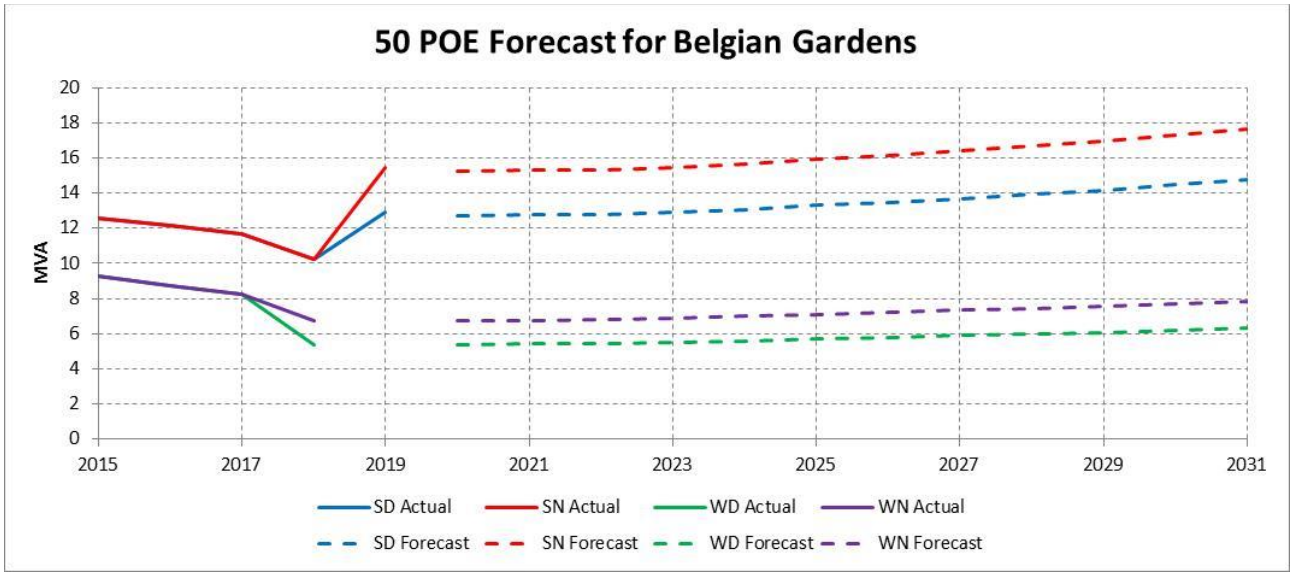


Figure 9 50 PoE Demand Forecast for the Belgian Gardens Substation 11kV load

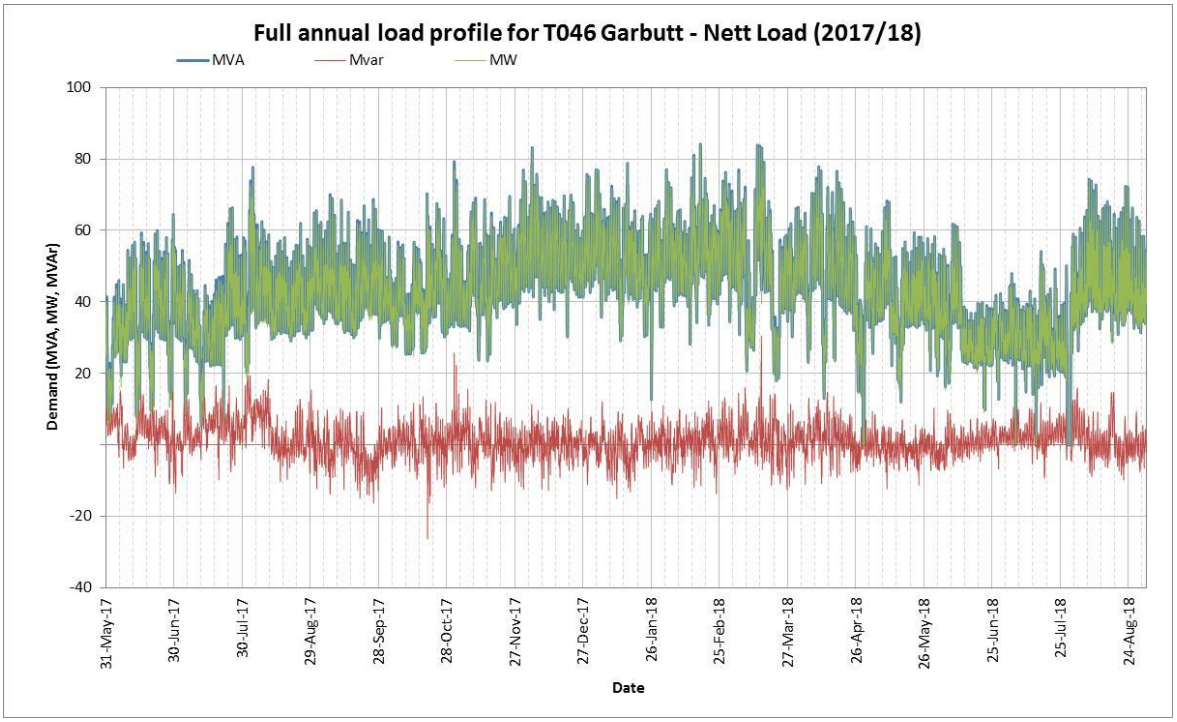


Figure 10 GARB 66kV load profile (2017/18)

The plot above shows the half hourly average daily load profile for Garbutt Substation 66kV load for the 2017/18 period. The plot shows that the Garbutt Substation 66kV load peaks during the summer period. Note that the configuration of the Townsville 66kV network and the status of local generation can influence the 66kV loading at Garbutt Substation.

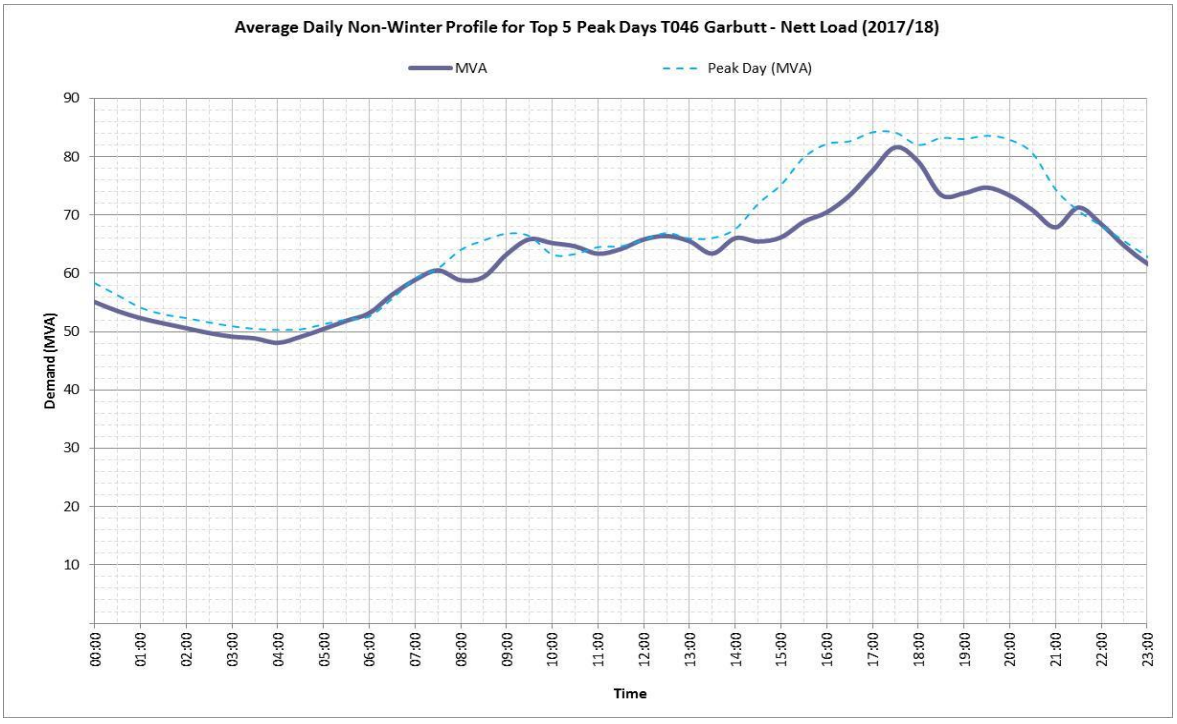


Figure 11 GARB 66kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the Garbutt Substation 66kV load typically occurs in the late afternoon early evening as shown in the plot above.

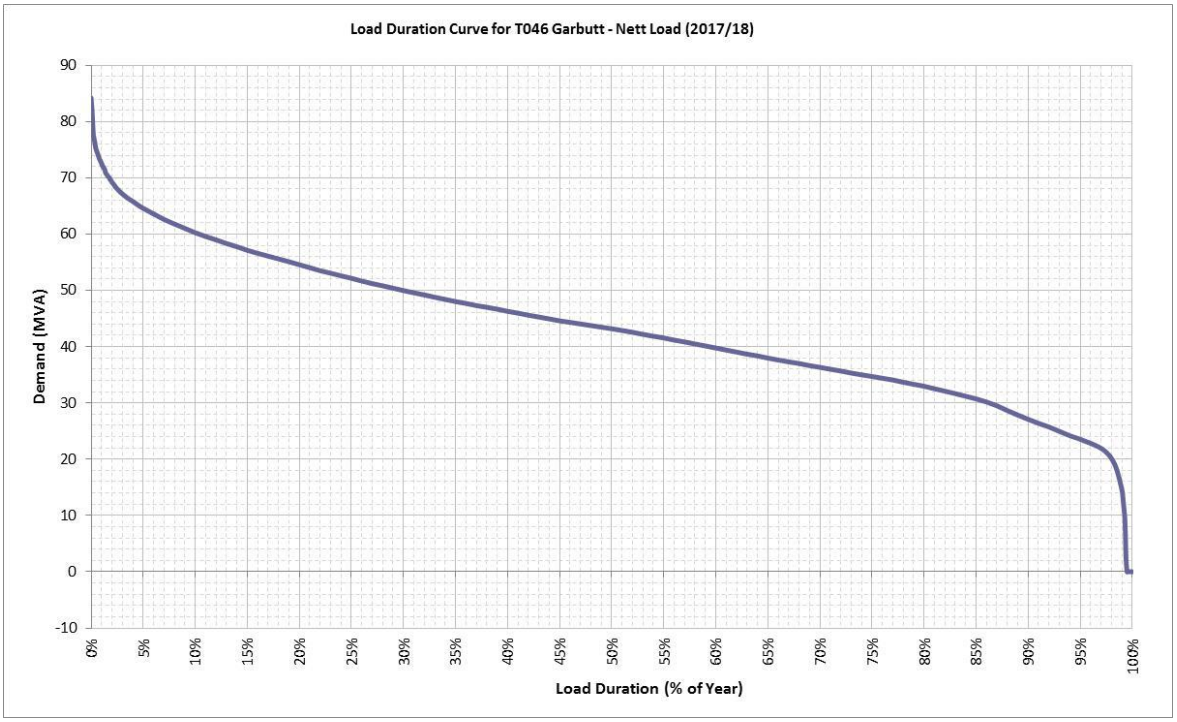


Figure 12 GARB 66kV Load Duration Curve (2017/18)

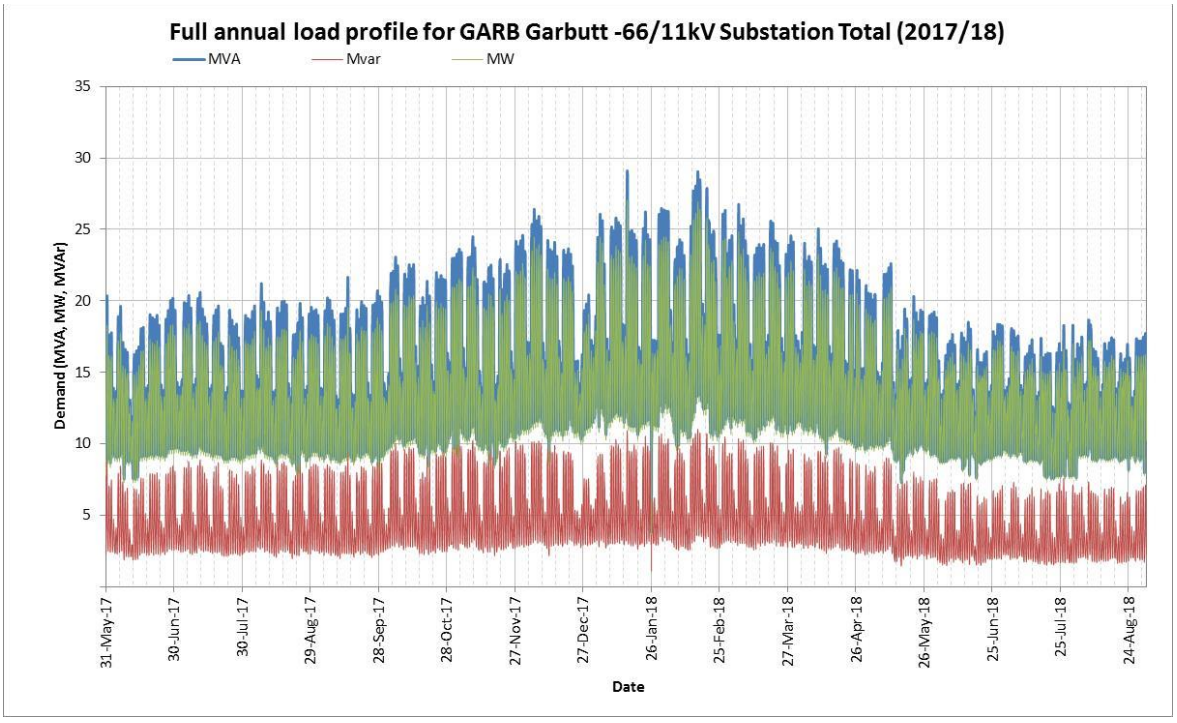


Figure 13 GARB 11kV load profile (2017/18)

The plot above shows the half hourly average daily load profile for Garbutt Substation 11kV load for the 2017/18 period. The plot shows that the Garbutt Substation 11kV load peaks during the summer period.

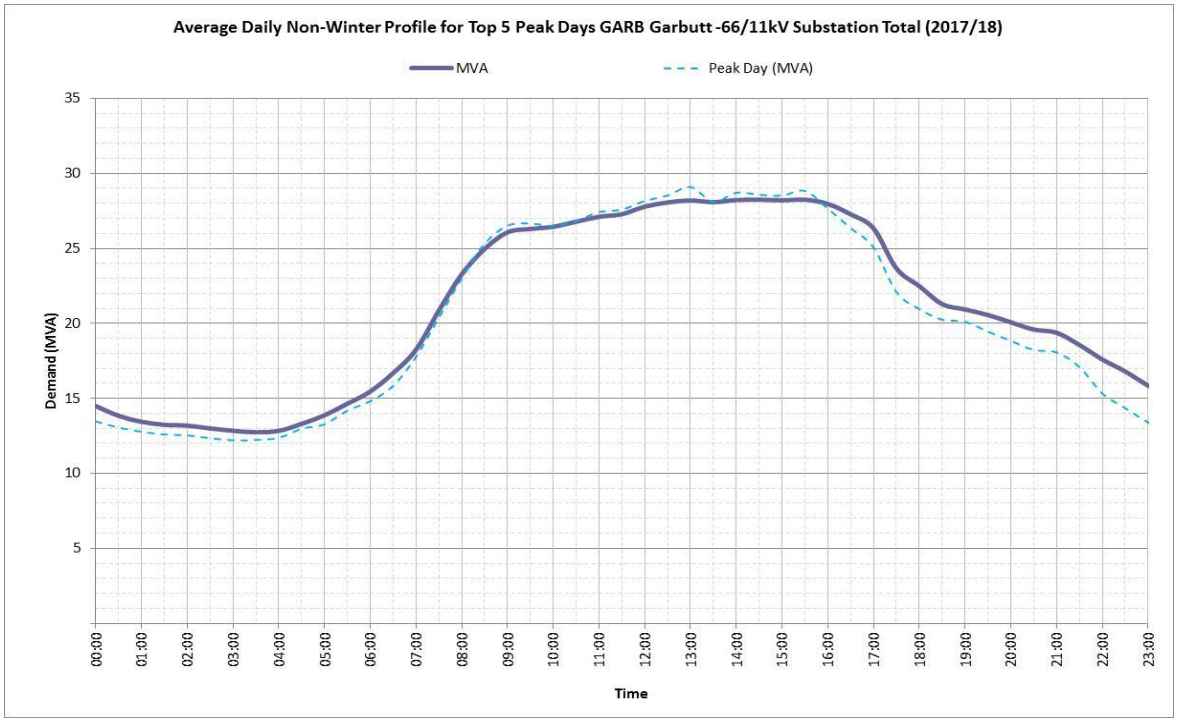


Figure 14 GARB 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the Garbutt Substation 11kV load typically occurs during the day as shown in the plot above. The Garbutt Substation 11kV distribution network supplies a large proportion of industrial / commercial customers that predominantly operate during normal business hours.

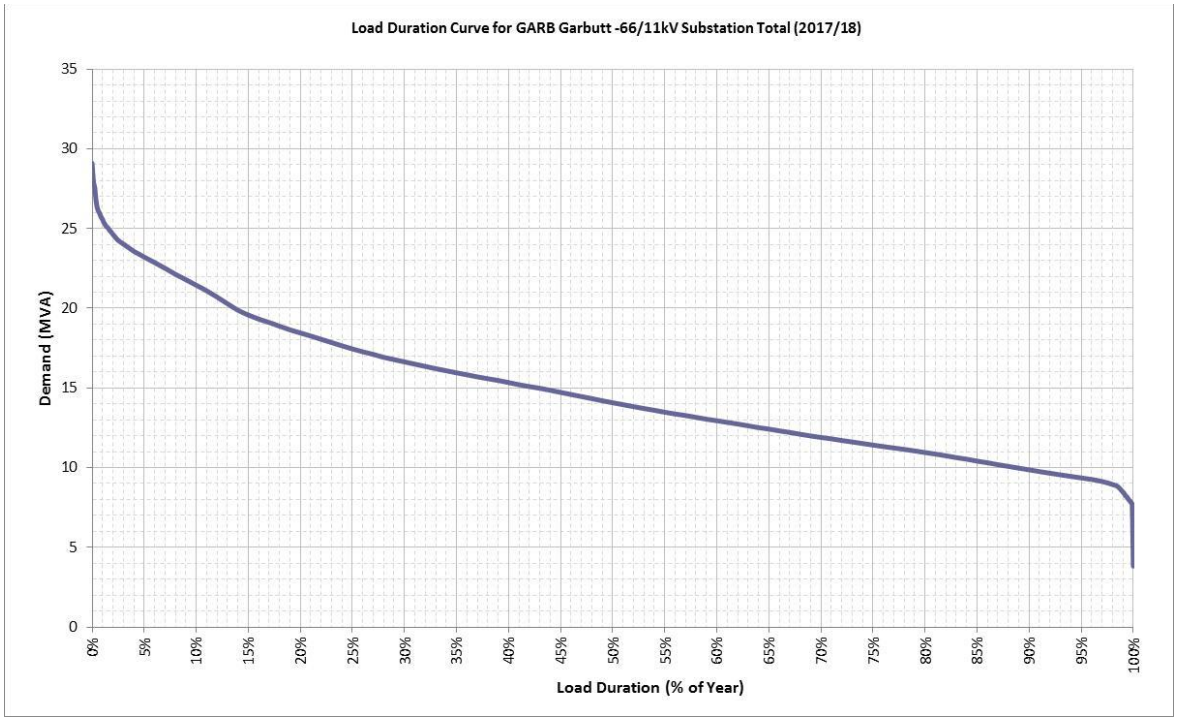


Figure 15 GARB 11kV Load Duration Curve (2017/18)

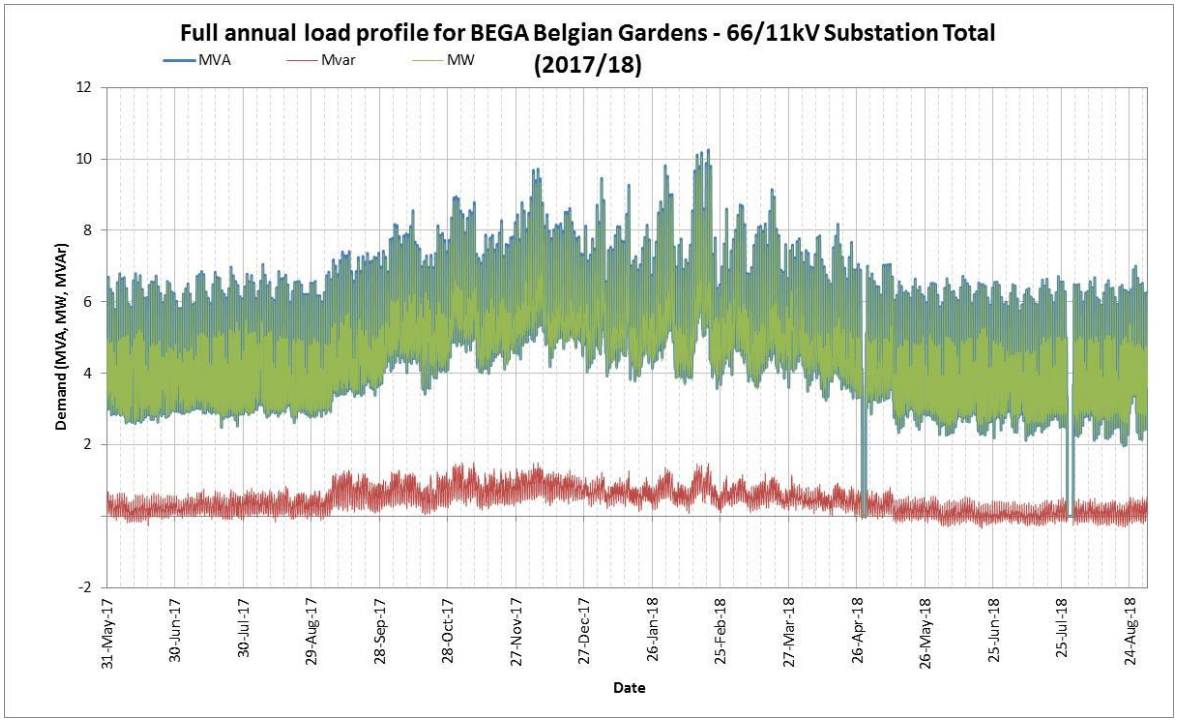


Figure 16 BEGA 11kV load profile (2017/18)

The plot above shows the half hourly average daily load profile for Belgian Gardens Substation 11kV load for the 2017/18 period. The plot shows that this substation load peaks during the summer period.

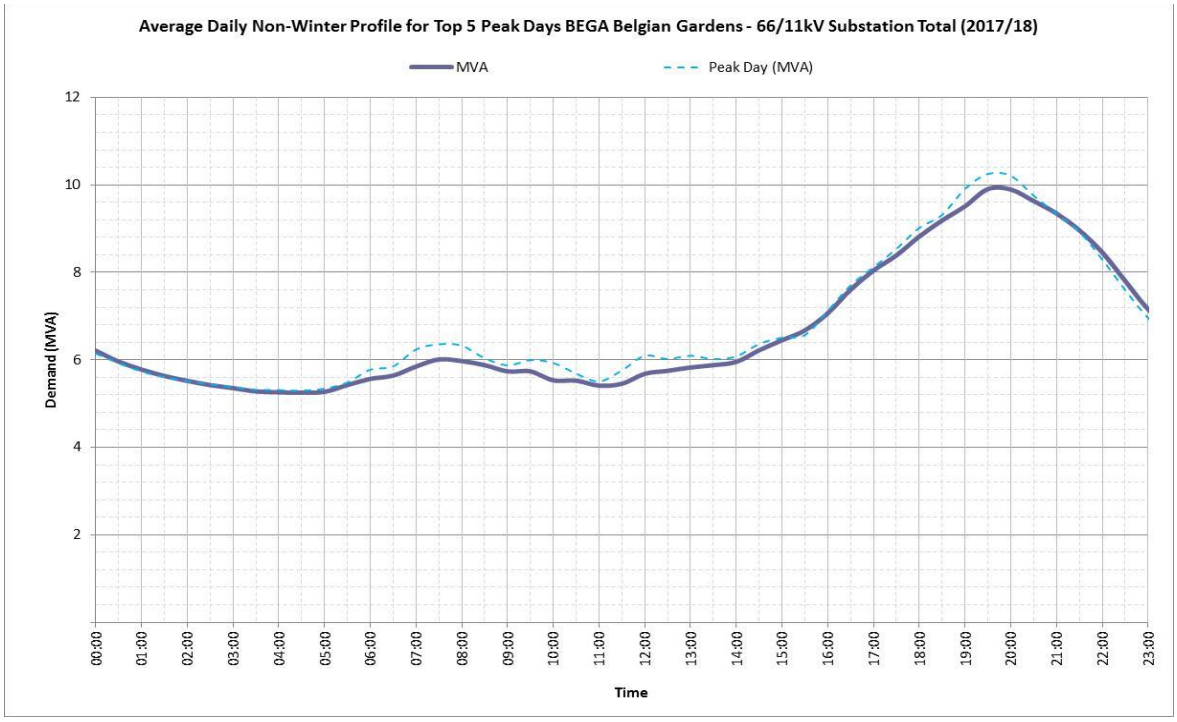


Figure 17 BEGA 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the Belgian Gardens Substation 11kV load typically occurs in the early evening as shown in the plot above. The Belgian Gardens Substation 11kV distribution network supplies a large proportion of residential customers resulting in an evening peak.

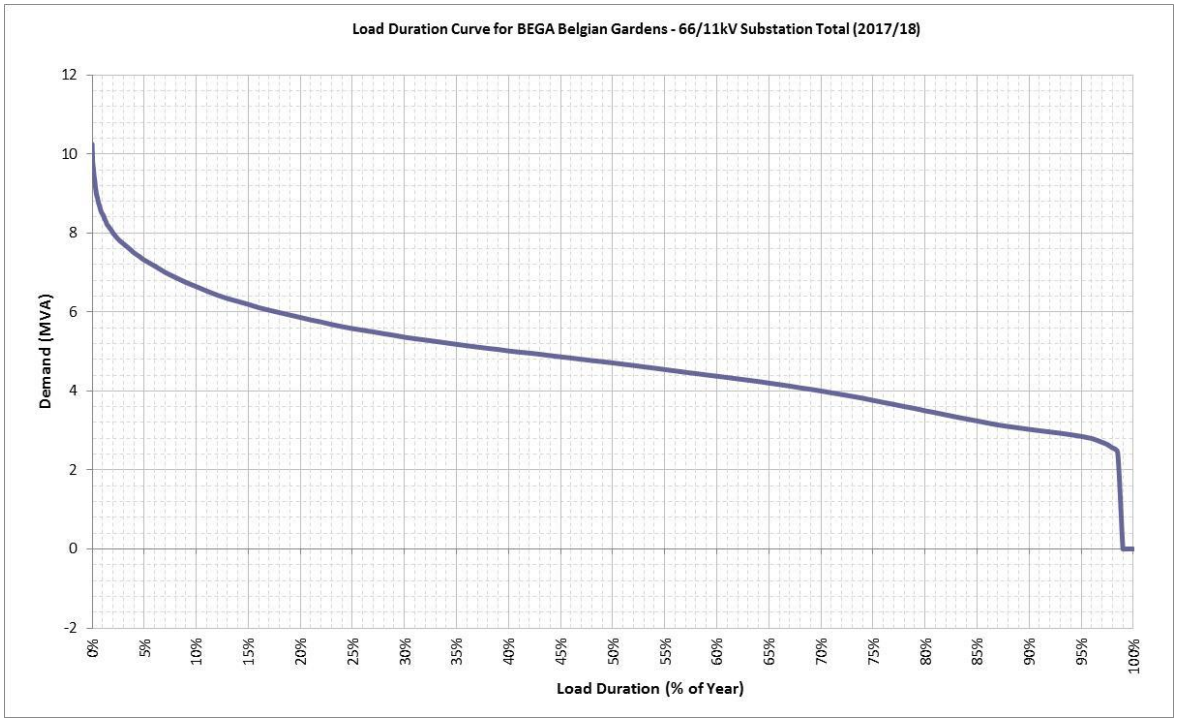


Figure 18 BEGA 11kV Load Duration Curve (2017/18)

3.2. Customer Statistics

Approximately 11,597 customers are directly supplied from Garbutt and Belgian Gardens substations via the 11kV distribution network. 1,509 of these customers have inverter energy systems installed.

	Garbutt Substation 11kV network	Belgian Gardens Substation 11kV network
Total Customers	5673	5924
Residential	4201	5475
Non-Residential	1472	449
Annual Energy (kWh)	141,379,824	55,597,707
Energy Residential (kWh)	32,174,858	33,615,309
Energy Non-Residential (kWh)	109,204,967	21,982,399
Inverter Energy Systems		
IES Count Residential	615	715
IES Count Non-Residential	134	45
IES Capacity Residential	2544kVA	3224kVA
IES Capacity Non-Residential	2439kVA	736kVA

Table 2 Customer Statistics for the 2018/19 period

4. Proposed preferred network option

Ergon Energy investigated a number of network options to address the identified need at Garbutt Substation. Construction works carried out in a live substation yard in proximity to the deteriorated structures presents an intolerable risk to staff safety and network supply interruption and therefore the option to replace like for like in-situ was not considered a feasible option.

Due to these risks and the limited space available, the proposed preferred network option is the replacement of the aged 66kV assets at Garbutt Substation with 66kV Gas Insulated Switchgear (GIS) located within the existing Garbutt Substation boundary.

This option includes:

- A structure for the GIS Switchgear and new control building for the protection and control equipment.
    - 66kV bus protection
    - 66kV feeder protection
    - Transformer 3 & 5 protection
- 15 x GIS Modular CB/Isolator/CT/VT (As required):
    - 4 x 66kV Transformer Bays (2 x Plink 132/66kV, 2 x EQ 66/11kV)
    - 8 x 66kV Feeder Bays (7 x existing feeders and 1 x Load control / Future Feeder)
    - 2 x 66kV Capacitor Bank Bays
    - 1 x 66kV Bus Tie Bay
- Connection of existing plant to the new GIS switchgear:
    - 66kV UG cables between the GIS switchgear and the transformers (x4), cap banks (x2), feeders (x7) and AFLC (x1).
    - 7 x 66kV Feeder Terminations
    - 2 x 66kV cable term poles (Aitkenvale and Bohle Feeders)
    - 5 x 66kV cable connections (Belgian Gardens 1 & 2, Neil Smith, Hermit Park, Townsville Port)
- Replacement of aged AFLC components; controller, transmitter and coupling cell
- Replacement of the pilot wire protection schemes on the Hermit Park and Townsville Port 66kV feeders including removal of the redundant pilot wires.
- Removal of all aged and redundant 66kV AIS bays and associated plant

The estimated preferred project cost is $30,867,660 with an estimated average annual maintenance cost of $154,340 (assumed to be 0.5 percent of the capital cost). The estimated project delivery timeframe has design commencing in late 2019 and construction completed by late 2022.

5. Assessment of non-network solutions

A viable non-network solution to address the safety and reliability risks currently associated with the aged assets at Garbutt Substation would need to replicate the capacity, reliability and functionality of the Garbutt Substation 66kV bus on an enduring basis.

To be considered a feasible option, any non-network solution must be technically and commercially feasible and able to be implemented in sufficient time to satisfy the identified need in 2022 in order to avoid network investment.

5.1. Required demand management characteristics

A viable demand management solution that replaces the functionality of the Garbutt 66kV bus must be capable of supplying the entire 11kV load at both Garbutt and Belgian Gardens substations.

The 11kV load profiles for Garbutt and Belgian Gardens substations from the 2017/18 period are shown in section 3.1. The demand management solution would be required to supply the forecast peak loading and the estimated annual energy at Garbutt and Belgian Gardens substations as shown in Table 3 below:

Substation Load	Required Peak Load support MW[5]	Required Annual GWh	Days/Year
Garbutt 11kV	28.64	141.4	365
Belgian Gardens 11kV	17.45	55.6	365

Table 3 Network support required for the GARB and BEGA 11kV load

The figures provided in the Table 3 are those applicable for a normal 11kV network configuration and have not considered the requirement for any additional transfer capacity for contingency support to feeders from adjacent substations.

Without the alternate 66kV supply path from Garbutt the demand management solution must also be capable of reducing the unsupplied load at Bohle, Black River, Aitkenvale, Cranbrook, Hermit Park, Oonoonba and Neil Smith substations to the levels required to meet Ergon Energy's Safety Net Targets in the event of an unplanned 66kV outage to the feeders supplying these substations.

The magnitude and timing of load reduction required under a peak load scenario in order to support substation outages due to credible contingency events, without an alternate supply path from Garbutt 66kV bus, is shown in Table 4.

The restoration times shown in the table are typical response times and are generally dependant on a number of factors including location of staff, time of fault, severity of the fault, asset accessibility, availability of suitable spares, weather conditions and would vary under extenuating circumstances such as a natural disaster scenario.

[5] Based on 50PoE Forecast Peak MW for the 2020-2031 period

Outage Scenario	Substations Impacted	Peak Load Reduction Required within 1 hour (MVA)	Peak Load Reduction Required within 6 hours (MVA)	Peak Load Reduction Required within 12 hours (MVA)	Estimated Restoration Time for typical fault scenario
Dan Gleeson – Bohle 66kV overhead feeder outage	Black River Bohle[6]	18.5	23.5	33.5	5 – 19 hrs
Dan Gleeson – Cranbook 66kV overhead feeder outage	Aitkenvale Cranbrook	17	22	32	5 – 19 hrs
Stuart – Oonoonba 66kV overhead feeder outage	Hermit Park Oonoonba	13.5	18.5	28.5	5 – 19 hrs
Townsville Port – Neil Smith 66kV underground feeder outage	Neil Smith	0	1	11	5 – 24 hrs[7]

Table 4 Network support required at various locations in Townsville to address safety net compliance

Table 3 and Table 4 show the magnitudes of support required from a demand management solution for permanent support for the Garbutt and Belgian Gardens 11kV load and the contingent support for a number of other substation 11kV loads within the Townsville area. We consider that a combination of permanent and temporary demand reductions would offer the most plausible scenario for a possible cost effective non-network alternative.

The 11kV load profiles from the 2017/18 period are shown below for the substations that would be impacted by 66kV feeder outages without the alternate supply path from Garbutt.

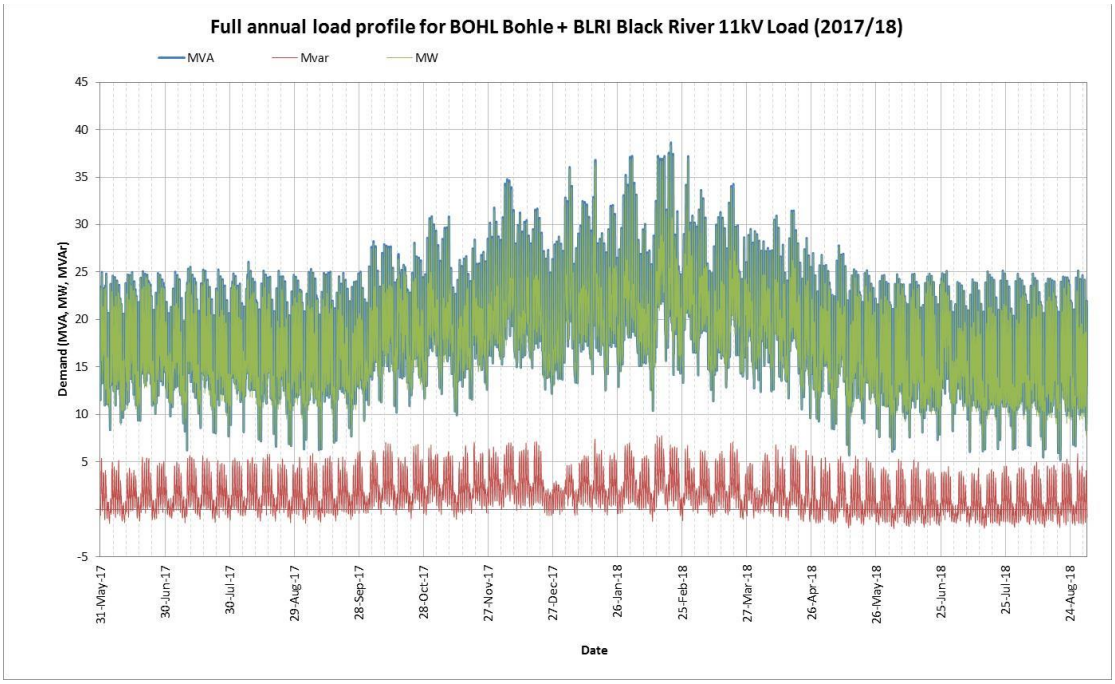


Figure 19 Summated BOHL + BLRI 11kV load profiles (2017/18)

[6] The Saunders, Bluewater and Rollingstone substations will generally be supplied via the Ingham 66kV feeder in the event of an extended outage from the Black River supply path.
[7] Restoration time may exceed this depending on cable fault location

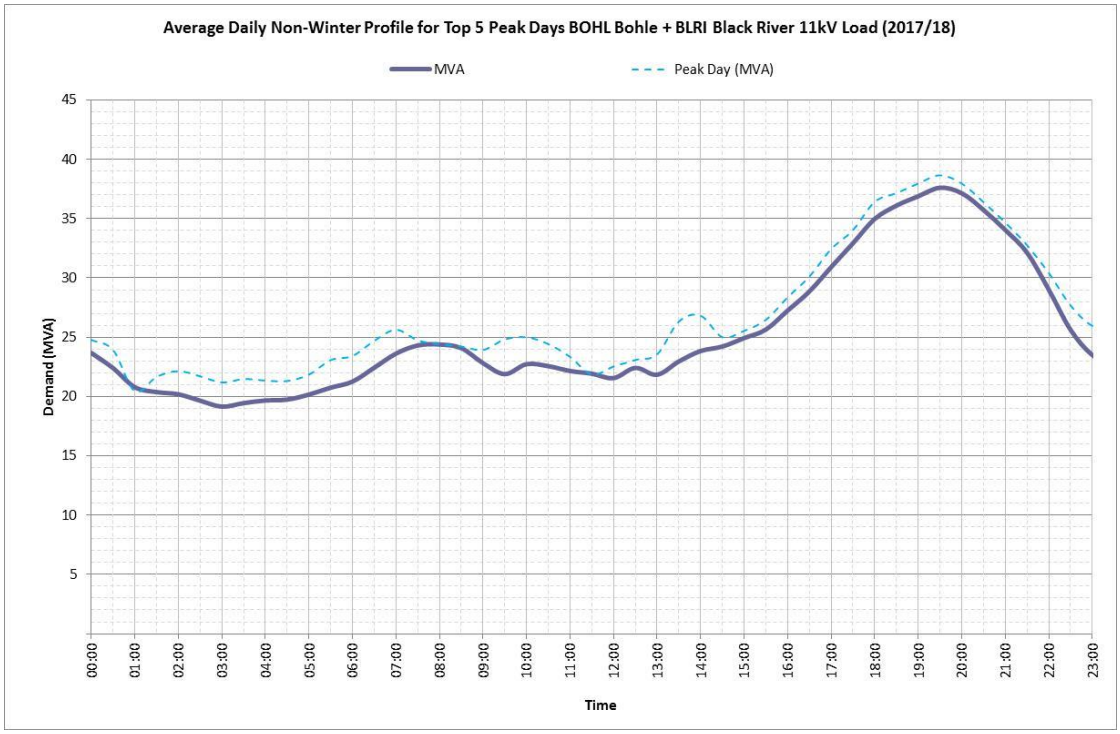


Figure 20 Summated BOHL + BLRI 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the summation of the Bohle and Black River substation 11kV loads typically occurs in the early evening as shown in the plot above.

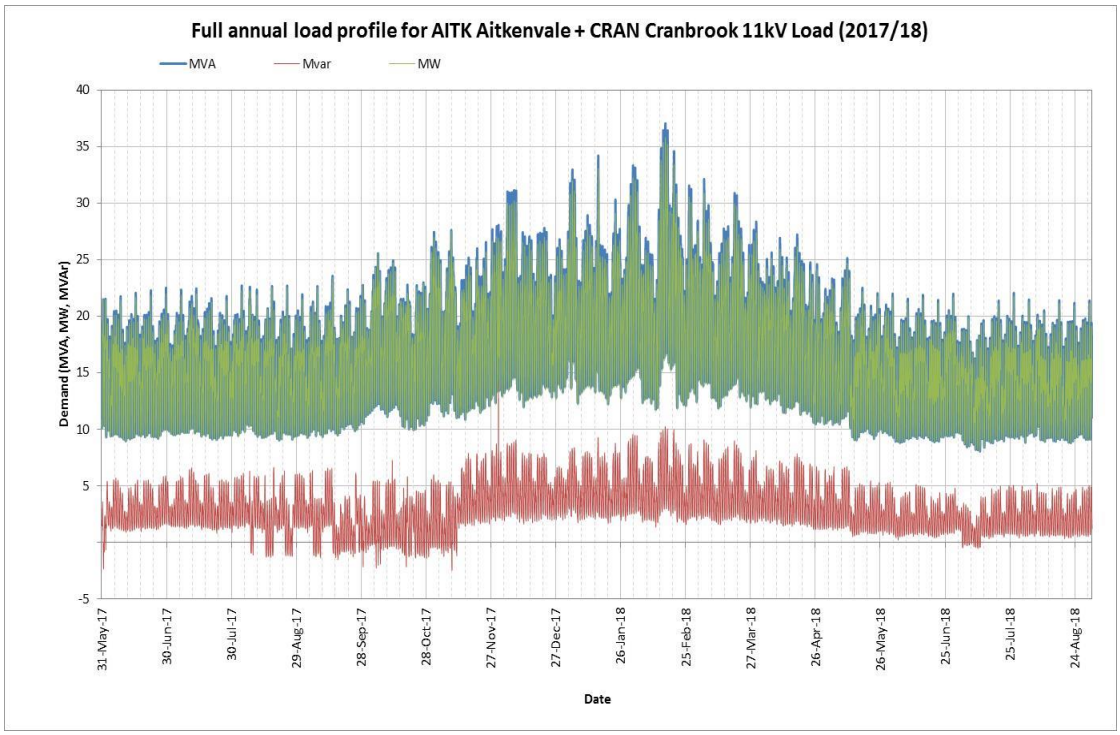


Figure 21 Summated AITK + CRAN 11kV load profiles (2017/18)

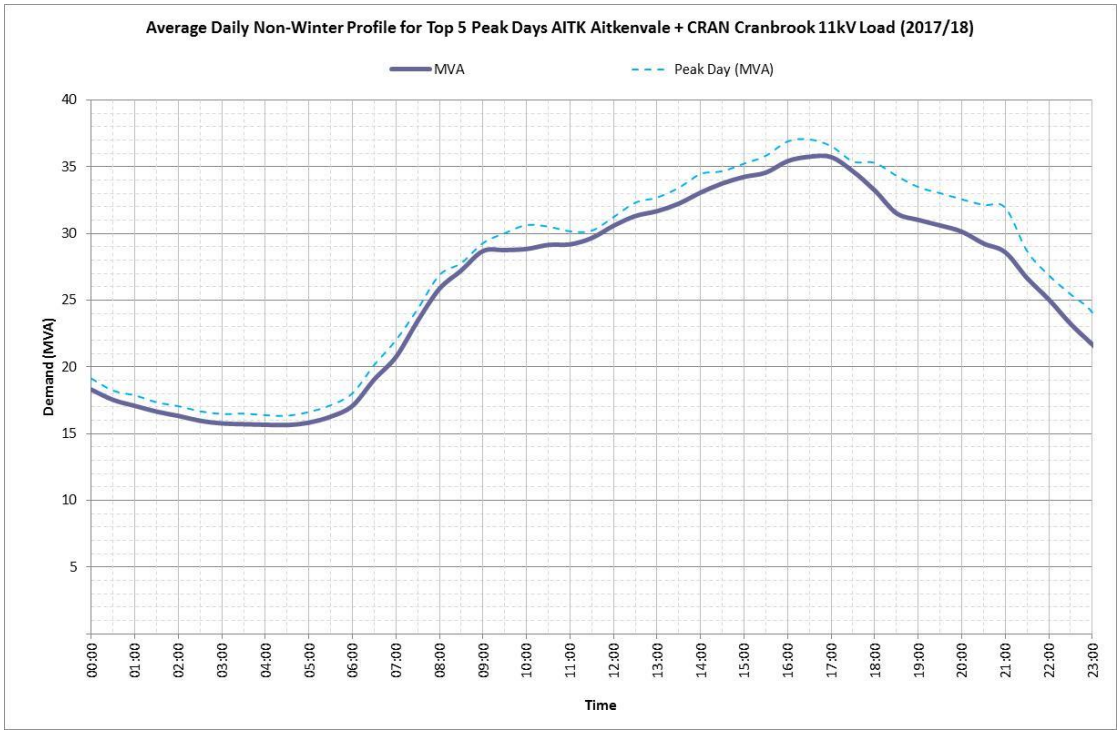


Figure 22 Summated AITK + CRAN 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the summation of the Aitkenvale and Cranbrook substation 11kV loads typically occurs in the late afternoon as shown in the plot above.

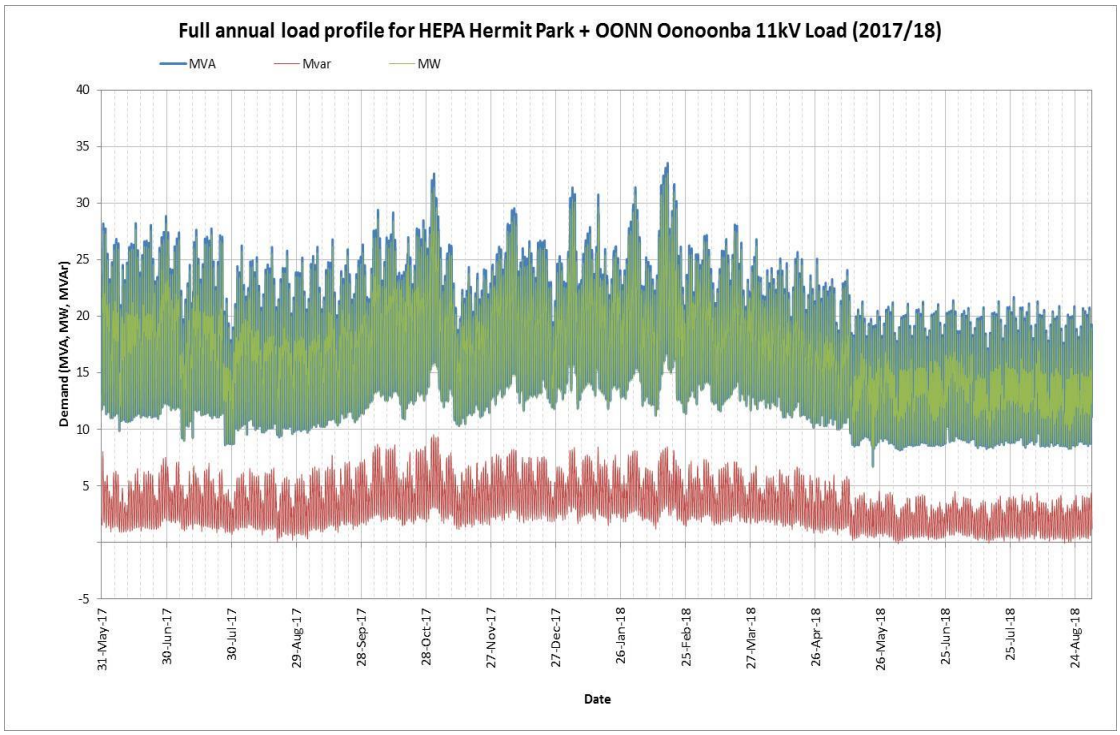


Figure 23 Summated HEPA + OONO 11kV load profiles (2017/18)

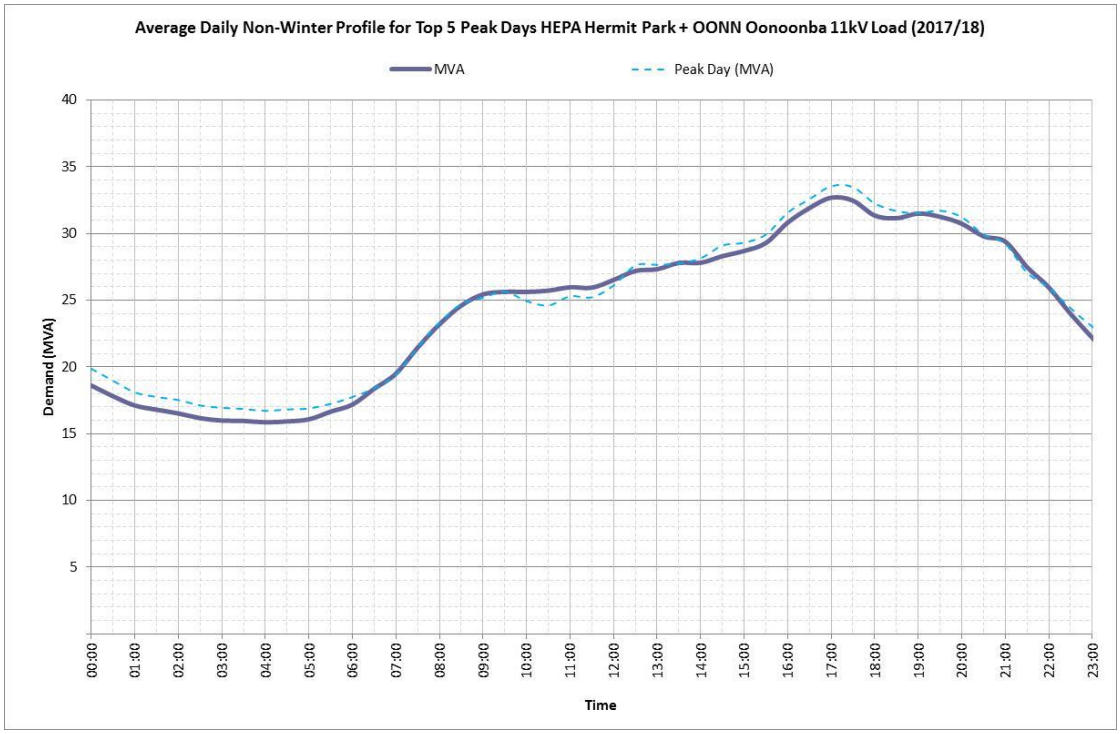


Figure 24 Summated HEPA + OONO 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the summation of the Hermit Park and Oonoonba substation 11kV loads typically occurs in the late afternoon as shown in the plot above.

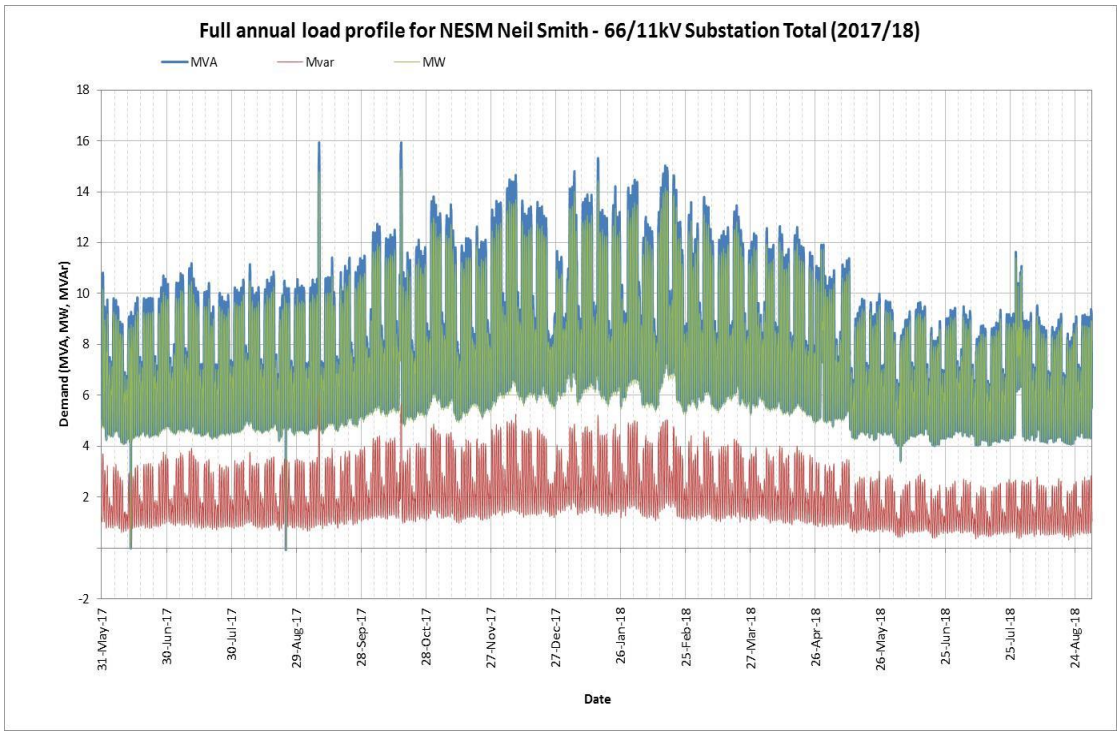


Figure 25 NESM 11kV load profile (2017/18)

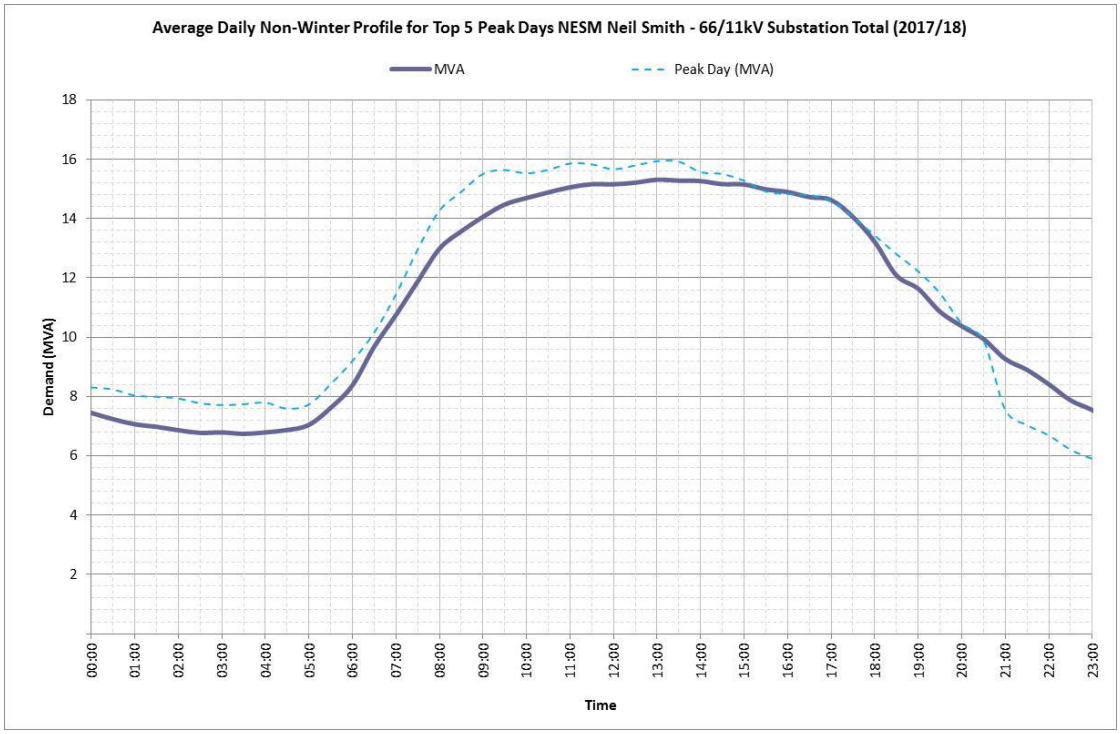


Figure 26 NESM 11kV load profile – Average of Top 5 Peak Days (2017/18)

The summer peak for the Neil Smith Substation 11kV load typically occurs during the day as shown in the plot above.

5.2. Demand management options considered

Ergon Energy considered a number of demand management technologies to determine their commercial and technical feasibility to assist with the identified need in the Garbutt network area.

5.2.1. Customer Energy efficiency and power factor correction

Energy efficiency and power factor correction while offering permanent reductions has been assessed as not technically viable as this would only contribute to a fraction of the support required for the Garbutt and Belgian Gardens substations 11kV load.

5.2.2. Demand Response (curtailment of load)

Customer curtailment of load is an effective technique for network support where the need is for a short time period but is generally not viable for extended periods of time.

A small portion of the Garbutt and Belgian Gardens substations residential load such as hot water systems, pool pumps and air conditioning is controllable load that can be switched off for short periods of time.

In the Townsville region large customer demand response is valued at $40-100 per kVA (excluding acquisition costs). Ergon Energy has identified a small number of large customers in the Garbutt area with a total call off load of around 1400kVA that could potentially be suitable for network support for short periods of time.

These options have been assessed as technically not viable as they would not provide the identified demand reduction required at Garbutt and Belgian Gardens substations and the load reduction would only be available for short periods of time.

Similarly, these options would not be able to provide the identified demand reduction at the other substations in the wider Townsville area that require support for 66kV feeder contingencies.

5.2.3. Customer Solar Power / Energy Storage Systems

Business customers with large solar arrays are deemed to present a significant opportunity for targeted load control or load curtailment if coupled with a Battery Energy Storage System (BESS).

There are currently around 1509 customers connected to the Garbutt and Belgian Gardens substation 11kV network with inverter energy systems installed with a combined capacity of approximately 8950kVA.

At present, only a very small percentage of customer solar power systems are coupled with a BESS. Solar customers without a BESS will not meet the technical needs of the demand reduction as their solar contribution may not be available when network support is required.

This option has been assessed as technically not viable as it would not provide the identified demand reduction required to support the Garbutt and Belgian Gardens substation loads, would only provide support during daylight hours and the majority of these systems cease to operate during a network outage.

Similarly, this option would not be able to provide the identified demand reduction at the other substations in the wider Townsville area that require support for 66kV feeder contingencies.

5.2.4. Large Scale Customer Generation / Energy Storage

Large scale customer generation or energy storage is an effective technique for network support where the need is for a short time period but is generally not viable for extended periods of time.

In the Townsville region large customer generation support is valued at $40-100 per kVA (excluding acquisition costs). Ergon Energy has identified approximately 5 sites that have existing diesel generation that could potentially be used for network support in the Garbutt and Belgian Gardens areas with a combined capacity of around 8000kVA. These generators are typically operated as backup generators in parallel with the network or separated from the network in an islanded arrangement to supply the customer's facility.

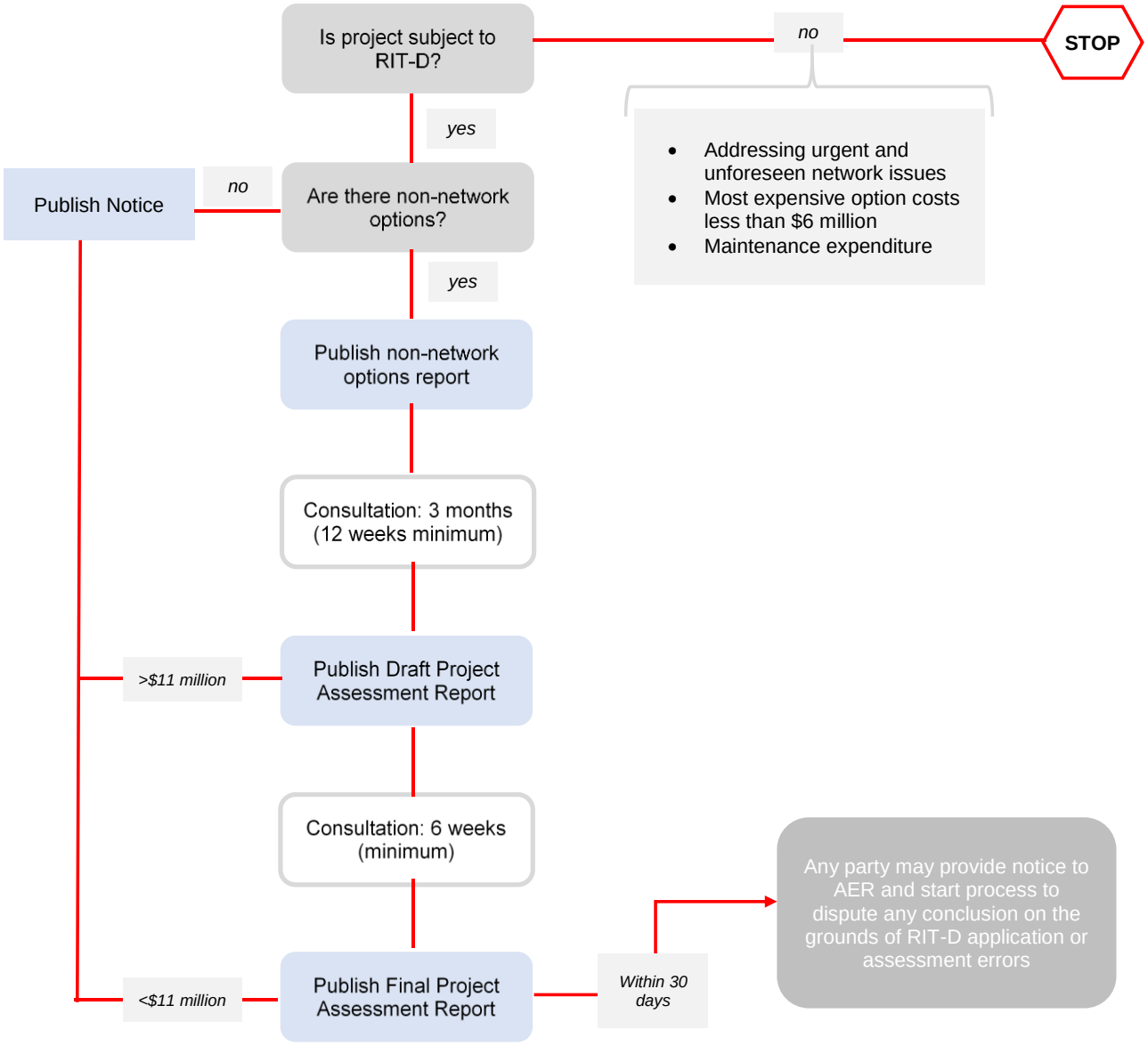
This option has been assessed as technically not viable as it would only support around 18% of the identified capacity required to support the Garbutt and Belgian Gardens substation loads.

Apart from the Bohle and Black River substations which could potentially be supplied from the Townsville Power Station, the levels of generation support at the other substations in the wider Townsville area requiring support for 66kV feeder contingencies would not be sufficient to meet the safety net requirements from Table 4.

6. Conclusion

The internal investigations undertaken on the feasibility of the non-network solutions revealed that it is unlikely to find a complete non-network solution or a hybrid (combined network and non-network) solution to provide the magnitude of network support required in the Townsville area to address the identified need. This notice of no non-network options is therefore published in accordance with rule 5.17.4(d) of the National Electricity Rules.

Appendix A. RIT-D Process



Appendix B. Ergon Energy's Minimum Service Standards and Safety Net Targets

The legislated System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) limits from Ergon Energy's Distribution Authority are detailed in Table 5.

Feeder Category	SAIDI MSS Limits	SAIFI MSS Limits
Urban	149	1.98
Short Rural	424	3.95
Long Rural	964	7.40

Table 5 SAIDI (minutes per customer) and SAIFI (interruptions per customer) limits

The legislated Safety Net Targets from Ergon Energy's Distribution Authority are provided in Table 6. Townsville is considered a 'Regional Centre'.

Area	Targets (for restoration of supply following an N-1 Event)
Regional Centre	Following an N-1 event, load not supplied must be: ○ Less than 20MVA after 1 hour; ○ Less than 15MVA after 6 hours; ○ Less than 5MVA after 12 hours; and ○ Fully restored within 24 hours.
Rural Areas	Following an N-1 event, load not supplied must be: ○ Less than 20MVA after 1 hour; ○ Less than 15MVA after 8 hours; ○ Less than 5MVA after 18 hours; and ○ Fully restored within 48 hours.
Note: All modelling and analysis will be benchmarked against 50 PoE loads and based on credible contingencies. 'Regional Centre' relates to larger centres with predominantly urban feeders. 'Rural Areas' relates to areas that are not Regional Centres.	

Table 6 Ergon Energy Service Safety Net Targets