Addressing reliability requirements in the Bundaberg network area

Notice on screening for non-network options

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Notice on screening for non-network options; Addressing reliability requirements in the Bundaberg network area.

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1. Addressing reliability requirements in the Bundaberg network area

The Bundaberg region consists of approximately 45,000 customers and is located in the Wide Bay-Burnett area of the Southern Region of Ergon Energy’s Network. The region is supplied by the T20 Bundaberg Substation and its 66kV ring-feed. The West Bundaberg, Bundaberg Central, East Bundaberg and South Bundaberg substations are connected directly onto the 66kV ring-feed. The Bargara, Meadowvale and Gooburrum zone substations are supplied via radial lines connected to the 66kV ring-feed.

A fundamental requirement of Ergon Energy’s Distribution Authority D01/99 is to comply with 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. Bundaberg T020 in its current state will not meet the safety net outage restoration times should a 132kV OR 66kV bus outage occur. Bundaberg T020 bulk supply point supplies 112MVA at peak load to the wider Bundaberg region and hence a bus outage will have a significant impact.

Bundaberg T020 bulk supply point supplies between 30 – 112 MVA to the wider Bundaberg region throughout the year. The expected restoration time for a 132kV or 66kV bus outage at T020 Bundaberg is two hours while the maximum time for unserved load above 20MVA allowable under safety net is one hour. Therefore regardless of the time of the event, it is expected that Ergon Energy will breach the Safety Net regulatory requirement should a 132kV or 66kV bus outage occur at T020 Bundaberg if no investment is made.

Installation of 2 bus section circuit breakers and associated equipment will allow restoration to comply with Safety Net by lowering the restoration time to under 1 hour for the up to 92MVA of unserved load should a 132kV or 66kV bus outage occur at T020.

Changes to the National Electricity Rules (NER) in July 2017 have meant that the installation of the bus circuit breaker and associated infrastructure is now subject to a RIT-D. This notice of no credible non-network option has been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(d) of the National Electricity Rules (NER).

A full discussion of loading and the identified need can be found in the Final Project Assessment Report (FPAR) for addressing reliability requirements in the Bundaberg network area.

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 thereasons for Ergon Energy’s determination, including the methodologies and assumptions used.
2. Forecast load, capacity, and network characteristics at Bundaberg substation

2.1. Restoration timeframes and safety net

The primary component of the identified need is an inability to meet safety net requirements in the event of a bus fault at T020 Bundaberg.

2.1.1. Safety net requirements

A fundamental requirement of Ergon Energy’s Distribution Authority D01/99 is to comply with 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. Bundaberg T020 in its current state will not meet the safety net outage restoration times should a 132kV OR 66kV bus outage occur.

Under the reliability standards, Ergon Energy is no longer required to provide full N-1 security of supply on the 66kV network that supplies Bundaberg. Instead, a set of supply restoration targets, known as the ‘Service Safety Net Targets’ apply. The Safety Net targets seek to limit the severity (and thus the hardship experienced by Ergon Energy customers) following a “credible contingency” for loads up to the 50% PoE forecast.

Under the Safety Net, Bundaberg is classified as a “Regional Centre” and has the following restoration targets. The load unserved must be:

1. Less than 20 MVA after 1 hour
2. Less than 15 MVA after 6 hours
3. Less than 5 MVA after 12 hours
4. Fully restored within 24 hours
2.1.2. Safety net analysis

![Ergon Safety Net Analysis for: T020 Bundaberg - 66kV Total Load](image)

**Figure 1 – Bundaberg T020 substation safety net analysis.**

As the only supply point into the region, an outage on either the 66kV or 132kV bus will result in loss of supply to the Bundaberg region.

"Expected" vs "Target" supply restoration following bus contingency at T020 Bundaberg on a peak day is shown in Figure 1. If an outage was to occur at any time, as shown in Figure 5, Ergon Energy would be unable to meet the Safety Net restoration targets. However, it should be noted that consideration needs to be given to the credibility of such an event occurring (i.e. both the permanent fault and the timing) before making decisions about the appropriate level of mitigation (including the option of none).

2.2. Network characteristics

2.2.1. Geographic region

The geographic region covered by this RIT-D is the Bundaberg region which consist of approximately 45 000 customers and is located in the Wide Bay-Burnett area of the Southern Region of Ergon Energy’s Network.
2.2.2. Existing supply system

The Bundaberg region is supplied by the T20 Bundaberg Substation. The West Bundaberg, Bundaberg Central, East Bundaberg and South Bundaberg substations are connected directly onto the 66kV ring-feed. The Bargara, Meadowvale and Gooburrum zone substations are supplied via radial lines connected to the 66kV ring-feed.

Bundaberg T020 bulk supply point supplies 112MVA at peak load to the wider Bundaberg region and hence a bus outage is of significant impact. The following Zone substation would be directly impacted for a 132kV or 66kV bus outage:

- Gooburrum
- Meadowvale
- West Bundaberg
- East Bundaberg
- Central Bundaberg
- South Bundaberg
- Bargara
- Woongarra
- Givelda
- South Kolan
- Bullyard
- Monduran
- Wallaville
2.2.3. Loading - historical and forecast

Figure 4 and Figure 5 below show the historical actual demand for T020 Bundaberg with Figure 4 showing the average daily non-winter profile for the top 5 peak days at T020 Bundaberg and Figure 5 showing the load duration curve at T020 Bundaberg.

Figure 6 shows the 50% probability of exceedance level (50 POE) forecast annual maximum demand for T020 Bundaberg. Figure 10 shows little load growth forecast out to 2028 and also displays the maximum allowable unsupplied load for a 2 hour outage window (20 MVA).
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Figure 4 – Bundaberg T020 Load Profile and Capability.

Figure 5 – Bundaberg T020 66kV Load Duration Curve.
3. **Proposed preferred network option is to establish bus section breakers**

The sole credible network option is the establishment of a bus section breaker in the 66kV bus and 132kV bus at Bundaberg Substation and reconfiguring the 66kV bus.

This option includes:

**132kV Works including:**
- Installation of a new 132kV Bus Section Bay;
- Installation of a new 132kV CB and CT; and
- Installation of supporting structures for CB and CT.

**66kV Works including:**
- Building a new 66kV Feeder bay behind the AFLC bay;
- Rearrange the 66kV feeders so that West Bundaberg, Sth Kolan, & Sth Bundaberg feeders split across the two buses;
- Demolish the existing West Bundaberg No.2 feeder bay (retain CB and CTs for bus section bay);
- Relocate the two (2) bus VTs so these no longer require a bus outage to access;
- Installation of a new 66kV Bus Section Bay;
- Replacing the 66kV galvanised waterpipe with aluminium bus and removal of all aged bus isolators;
- Removing the existing 66kV overhead strung bu;
- Installation of supporting foundations, conduits and structures for a new 66kV Feeder Bay (New Isis feeder opposite the AFLC bay);
- Installation of new VT footings, conduits and structures on Bus 2 at the end of the bus;
- Installation of new 66kV CB and CT footings, conduits and structures for the 66kB Bus Tie bay;
- Removal of structures and demolishing footing of plant in the existing West Bundaberg No.2 feeder bay; and
- Installation of new VT footings, conduits and structures on Bus 1 in the spare bay adjacent to the Farnsfield feeder bay.

<table>
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<tr>
<th></th>
<th>T020</th>
<th>Actual</th>
<th>POE50 Forecast</th>
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<td>112.9</td>
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<td>121.2</td>
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<tr>
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<td>372.0</td>
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**Figure 6 – Bundaberg substation load forecast.**
This option will increase sectionalising and restoration flexibility that will enable restoration to occur within the 1 hour safety net limit as prescribed in our Distribution Authority. The estimated capital cost of the preferred option is $7.3 million. Annual operating costs associated with this new capex are estimated to be around $36,500 per annum (assumed to be 0.5 per cent of the capital cost).

Ergon Energy estimates that the construction timeline for Option 1 is 17 months, with assumed commissioning during 2020/21. Ergon Energy intends to commence work on delivering the preferred option 1 in 2019 (in particular, we intend to commence design in mid-2018 and commence construction in April 2019).

Overall, this finding confirms the earlier planning assessment exercises undertaken by Ergon Energy in 2017 that concluded that new bus section circuit breakers at Bundaberg substation is the most efficient option for replacing addressing the safety net requirements at the Bundaberg zone substation.

![Figure 7 – Bundaberg 132kV proposed CB location](image-url)
4. **Assessment of non-network solutions**

4.1. **Required demand management characteristics**

A viable demand management solution must be capable of reducing the unsupplied load at T020 Bundaberg to <20 MVA for the 2 hours required for restoration of supply in the event of an unplanned substation outage due to a bus outage to be considered a viable alternative solution. Current loading at T020 Bundaberg is between approximately 26 MVA and 116 MVA and is 60 MVA, 50% of the time. This equates to support in the event of a substation outage due to a credible contingency event of between 6 MVA and 96 MVA for 2 hours until restoration is completed. This reduction in unsupplied load, may be temporary or permanent, however, it must offer support in both summer and winter, and be cost effective in comparison with the preferred network alternative.

Due to the scale of the shortfall in electricity supply (Refer to 2.2.3 for details on the load profiles, and demand forecasts), 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. A graphical representation of the unsupplied load reduction required is below in Figure 9.
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Figure 9 – Bundaberg substation forecast and required loading to meet safety net requirements for a 2 hour restoration.

As load growth is forecast to be relatively flat and there are no load transfer options in the event of a T020 Bundaberg outage, the shortfall in supply required to meet safety net requirements is significant with more detail shown below.

<table>
<thead>
<tr>
<th>MW of support required</th>
<th>MWh of support required</th>
<th>% of year risk exists</th>
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<td>55</td>
<td>110</td>
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<td>876</td>
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</table>

Figure 10 – Bundaberg substation shortfall to meet safety net requirements

To be considered a feasible option, any unsupplied load reduction must be technically feasible, and commercially feasible.

Ergon Energy estimates that the construction timeline for the preferred option is 17 months, with assumed commissioning during 2020/21. Ergon Energy intends to commence work on delivering the preferred option 1 in 2019 (in particular, we intend to commence design in mid-2018 and commence construction in April 2019). The feasible option must also be able to be implemented in sufficient time to satisfy the identified reduction need from 2020/21 for deferral of the network investment.
4.2. Demand management value

Ergon Energy’s Intelligent Grid Systems Customer Interactions (IGSCI) Team has assessed the potential demand management options required to defer the network option and to ensure that the solution is technically and commercially viable, and delivered within the required timeframe. The amount of demand management support identified to satisfy the reduction need is as per Figure 11 Ergon Energy considered a number of demand management technologies (discussed under sections 4.2.1 to 4.2.3 of this Report) to determine their commercial and technical feasibility to assist with the identified need at Bundaberg T20 Bulk Supply Point (BSP).

4.2.1. Demand Management (Demand Reduction)

Energy efficiency and other demand reduction measures such as power factor correction, lighting etc. have been assessed as not technically viable as a loss of supply at Bundaberg T20 BSP will result in a loss of power to the whole system. Therefore, reductions in demand will not help to increase restoration times for the large number of unmet load hours.

4.2.2. Demand response

Four methods utilising demand response technology for deferring network investment for the short hours of network support required for the network issue at Bundaberg T20 BSP are: call off load (COL), customers embedded generation (CEG), large scale customer generation (LSG) and customer solar power systems.

4.2.2.1. Customer Call off load (COL)

COL is an effective technique for deferring network investment where the need is for a short time period as is the case at Bundaberg T20 BSP where a 1 hour reduction of unserved load is required.

There are a small number of Large Customers in the Bundaberg area with businesses suited to call off load. Large customer demand response is valued at $250 per kVA /P.A (excluding acquisition costs). The potential maximum demand reduction 3MW would have a total cost of $750,000 P.A including fuel, customer recruitment and establishment costs.

This option has been assessed as technically not viable as it will only defer 5.5% of the identified capacity requirement.

4.2.2.2. Customer embedded generation (CEG)

CEG is an effective technique for deferring network investment where the need is for a short time period as is the case at Bundaberg T20 BSP where a 1 hour reduction of unserved load is required.
In the Bundaberg region CEG large customer demand response is valued at $50-150 per kVA. P.A. IGSCI has recorded 14 sites that have existing diesel generation. To acquire an estimated potential maximum demand reduction value of 6.5MW would have a total cost of $493,000 P.A including fuel, customer recruitment and establishment costs.

This option has been assessed as technically not viable as it will only defer 30% of the identified capacity requirement.

4.2.2.3. Large scale customer generation (LSG)

Millaquin Sugar Mill - 5MW Bagasse generator export demand is 2.5MW P.A
Bingera Sugar Mill - 5MW Bagasse generator export demand is 0.75 MW P.A

In the Bundaberg region LSG demand response is valued at $75/kVA P.A. The sugar mills in this area have a combined maximum generation demand capacity of 3.25MW that could be contracted at a total cost of $356,000 P.A, including customer recruitment and establishment costs. Operationally the sugar mills are only seasonally available, the crushing and subsequent availability of the generators occurring between May and December.

This option could potentially defer 20% of the requirement but has been assessed as technically not viable as the generation is not available all year and therefore may not contribute to satisfy the identified reduction need for unsupplied load at Bundaberg T20 BSP.

4.2.2.4. Customer solar power 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). Contracting such customers is attractive as they represent a larger load across a fewer customers and therefore are cheaper and easier to engage and contract.

There are 40 Large Standard Asset Customers (SAC) connected to Bundaberg T20 with approximately 900kW of export limited PV systems. These systems present a future portfolio opportunity for potential demand response but currently only a very small percentage of solar power systems have 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 the Network un-met need is required.

Ergon Energy has not as yet contracted for this type of Demand Response so the maximum CEG dollar figure of $150/kVA has been used. Maximum estimated potential reduction value available would be 900kW P.A at a total cost of $135,000 P.A. plus customer recruitment and establishment costs.

In terms of the unsupplied load at Bundaberg T20 as a load curtailment opportunity this option is not technically feasible, the T20 outage failure would lead to the majority of these systems to cease operating and therefore not contribute to resolving a shortfall in grid supply.
Based on the demand management options considered in Section 4, it is not considered possible that sufficient demand management measures could be feasibly implemented to achieve the required demand reduction to make the project deferral technically and economically viable. Consequently, a Non-Network Options Report has not been prepared in accordance with rule 5.17.4(c) of the National Electricity Rules.