

Notice on Screening for Non-network Options: Lake Cathie Zone Substation Supply area

Essential Energy



April 2023

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Glossary

Acronym	Full name
AEMO	Australian Energy Market Operator.
AER	Australian Energy Regulator.
Capex	Capital Expenditure.
DPAR	Draft Project Assessment Report.
EOL	End of life.
EV	Electric vehicle.
FPAR	Final Project Assessment Report.
FRMP	Financially Responsible Market Participant.
NEB	Net Economic Benefit.
NEM	National Electricity Market.
NER	National Electricity Rules.
NMI	National Metering Identifiers.
NPV / C	Net Present Value / Cost.
OPEX	Operational Expenditure.
RIT-D	Regulated Investment Test for Distribution.
STPIS	Service Target Performance Incentive Scheme.
ZS	Zone substation.

Executive summary

This document is Essential Energy's notice of its determination that there are no credible non-network options to address the identified need at Lake Cathie zone substation (LC). Essential Energy's determination is made under clause 5.17.4(c) of the National Electricity Rules and is published pursuant to clause 5.17.4(d). In accordance with those provisions, Essential Energy will not be publishing a non-network options report in relation to the proposed works at Bonny Hills zone substation to rectify the Lake Cathie zone substation constraints.

In summary, our reasons for this conclusion are:

- There is no opportunity to reduce the required assets and associated works for the Lake Cathie zone substation by partially reducing peak load through demand management.
- An embedded generation or demand response option will not be a feasible or cost-effective long-term solution.

1.1 About Essential Energy.

Essential Energy is a state-owned electricity infrastructure company which owns, maintains, and operates the electrical distribution networks for much of New South Wales, covering 95 percent of the state's geographical area. It also owns the reticulated water network in Broken Hill through Essential Water, formerly Australian Inland Energy and Water.

1.2 Identified need.

The primary driver for this investment is a significant whole of site end of life asset condition constraint. A secondary driver exists with a near term zone substation capacity constraint at the existing Lake Cathie zone substation. The investment also supports forecast growth in new connections, existing customer load and the adoption of EVs aligning with Essential Energy's corporate strategy.

The primary identified need is to rectify the Lake Cathie zone substation asset condition and to a smaller degree solve the site capacity constraint issue to achieve compliance with regulatory requirements.

We understand that where the objective is compliance rectification, it comes within the meaning of "identified need" for the RIT-D test. We also understand that work undertaken for either Network Option 1 at the proposed new Bonny Hills zone substation or Network Option 2 Rebuild Lake Cathie zone substation is for Capex, and there cannot be a disaggregation of capex costs when considering whether a RIT-D is required.

The National Electricity Rules (NER) requires that, subject to certain exclusion criteria, network business investments for meeting service standards for a distribution business are subject to a Regulatory Investment Test for Distribution (RIT-D). Essential Energy has determined that network investment is essential in this case for it to comply with the regulatory requirements as no exemptions listed in the NER clause 5.17.3(a) apply. Accordingly, Essential Energy has decided that this investment is subject to a RIT-D.

1.3 Possible solutions to address the identified need.

The possible solutions to address the identified need are:

- Establish Bonny Hills zone substation.
- Rebuild the existing Lake Cathie zone substation.

Essential Energy will now prepare and publish a Final project assessment report in relation to the Bonny Hills zone substation project.

1.4 Submissions

Any questions or submissions regarding this notice or requests for further information should be directed to:

Email: reginvestment@essentialenergy.com.au

Essential Energy
Buller Street
Port Macquarie 2444
Attention: Tim Ronan

2 Background

2.1. Location

The existing Lake Cathie zone substation is located on the main coastal road (Ocean Drive) that runs from Port Macquarie to Laurieton via Lake Cathie and Bonny Hills.

The site is situated 500m from the ocean, with a small creek adjacent to the north and a medical centre to the west. The ZS was commissioned circa early 1970's.

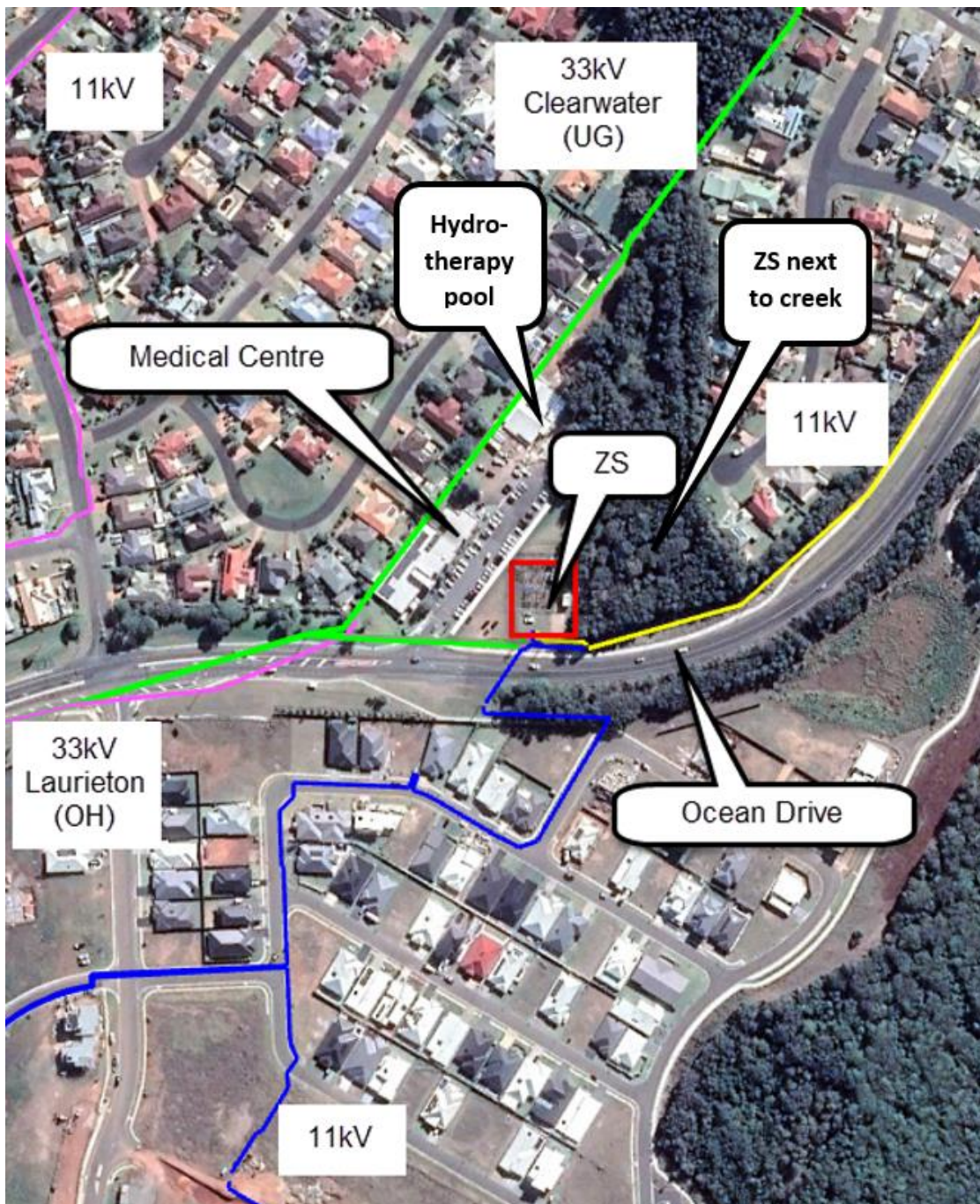


Figure 1: Lake Cathie zone substation location.

2.2. Configuration

Lake Cathie zone substation has two 33/11kV transformers (No.1 8MVA and No.2 10/16MVA), along with three outgoing 11kV feeders as shown in Figure 1.

The 33kV and 11kV infrastructure is outdoor, with two 33kV reclosers protecting the transformers and three 11kV reclosers protecting the feeders. A small shed contains protection and control equipment.

The normal 33kV supply into Lake Cathie ZS comes from Clearwater Crescent 33/11kV ZS in Port Macquarie via 17km of 33kV feeder that is all overhead, except for 1km of underground cable at both ends.

The backup 33kV supply into Lake Cathie ZS originates from Laurieton 66/33/11kV ZS via 14km of overhead conductor. There are limitations with utilising this backup arrangement from Laurieton due to complexities with feeding from the incoming 66kV onto the 11kV bus, then back up through the 33/11kV transformer (step up) and then onto the 33kV line to Lake Cathie.

Both the 33kV normal and backup supplies are connected to form a 'tee' arrangement 200m away from Lake Cathie ZS, and a single section of line enters the ZS. The backup 33kV supply is normally open via a 33kV circuit breaker at Laurieton ZS. This network configuration makes faults in the ZS, or the 33kV lines between Port Macquarie, Lake Cathie, and Laurieton difficult to identify and find.

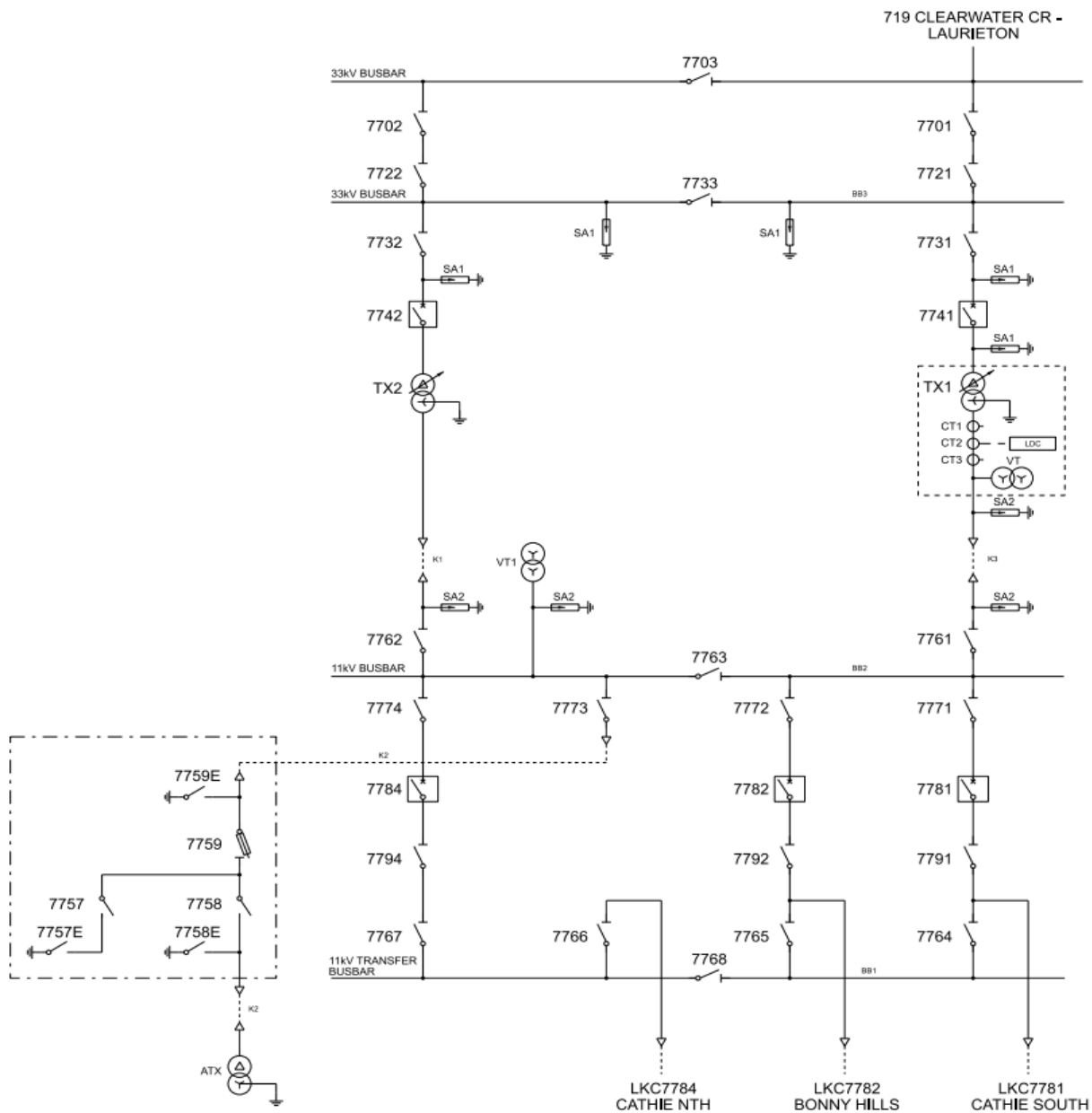


Figure 2: Lake Cathie zone substation single line diagram.

2.3. Asset condition and capacity issues

Lake Cathie ZS has the following asset condition and capacity issues:

- The structures supporting the outdoor busbar equipment and reclosers are heavily corroded.
- Corrosion is occurring on the upper and lower sections of the 33kV and 11kV insulators fitted to isolators. This increases the risk of the units failing whilst an Essential Energy employee is operating the device.
- The insulators are subjected to regular heavy salt build up which causes tracking and increases likelihood of failure.
- There are reduced phase-to-phase safety clearances between outgoing feeders. ZS technicians need to isolate two feeders to allow safe access to maintain one feeder recloser.
- The ZS has a chain wire mesh fence that provides a lower standard of security than required and is in poor condition. A formal risk assessment has raised concerns with its ability to prevent unauthorised access to the ZS. It is in an area of expanding residential and commercial development with increased foot and vehicle traffic nearby and is in a highly visible location. It also does not meet Essential Energy's CECP7029 Physical Security Framework.
- The transformers are protected by 33kV reclosers, not circuit breakers, and the protection scheme does not meet the requirements of Essential Energy's protection policy CEOP 8002.01 which recommends that transformers with a rating >8MVA to have differential protection.
- Transformer bunds and oil containment are not to standard or sufficiently sized, creating an environmental risk of transformer oil leaking into an adjacent creek.
- The outgoing 11kV feeders cannot provide adequate 11kV redundancy for ultimate demand.
- 33/11kV transformers (No.1 8MVA and No.2 10/16MVA) cannot provide N-1 capacity for the forecast growth.
- No. 1 and No. 2 transformers cannot be paralleled due to voltage tap incompatibility.
- The normally in service No.1 transformer is forecast to have its cyclic capacity exceeded in four years.
- No.2 transformer has a non-standard secondary nominal voltage and limited tapping range that results in high customer voltages, so it is not normally used. It has an 11.66kV nominal voltage with limited buck taps, so it regularly sits on top tap and cannot maintain the distribution voltage within the required acceptable range and is rarely put into service.
- The existing incoming 33kV tee arrangement and present protection systems require a manual changeover to the backup 33kV supply which takes time as line and ZS patrols are also needed.

Lake Cathie ZS presents significant asset condition, safety, capacity, and operational issues that need to be addressed.

2.4. Development area population growth

Area 14 is one of three key development areas within the Port Macquarie Hastings Council area and is currently supplied from the existing Lake Cathie zone substation. The development areas are Area 13 – Thrumster / Sovereign Hills, Area 14 - Lake Cathie/Bonny Hills and Area 15 - Camden Haven.

The three development areas were endorsed by the NSW Dept of Urban Affairs and Planning in 2001 via Council's 'Hastings Urban Growth Strategy'. The Council's strategy has been further reinforced in the 2011 and 2017 'Urban Growth Management Strategy'.

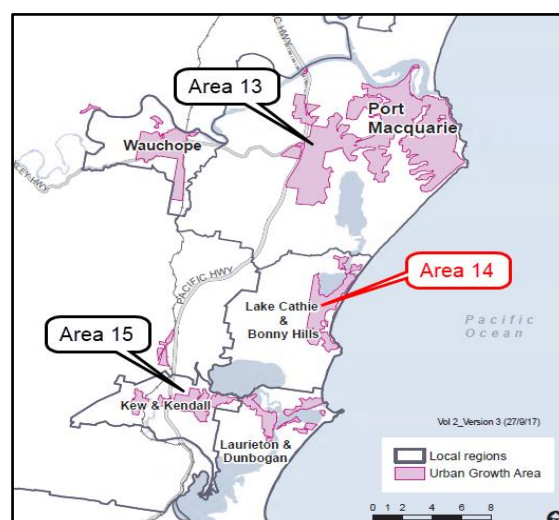


Figure 3: Port Macquarie Hastings Council development areas

Area 14 population is anticipated to increase from the current 6,000 to 9,000 residents by 2036. Significant portions of the future development will be located along the coast between Lake Cathie and Bonny Hills, including the master planned Rainbow Beach area, which has capacity for 1,300 dwellings, primary schools, playing fields and village centre providing retail and community facilities. The ultimate long-term peak demand in the area is expected to exceed 14MVA (approx. 2037). The medium-term demand forecast is shown below in Figure 4 and Table 1.

In conjunction with the Hastings Urban Growth Strategy, Hastings Council have a committed plan to establish a new water treatment plant at Cowarra Dam (2027 completion) and provide N-1 security for the WTP. The preferred option is to provide primary supply for the Cowarra Dam WTP from Bonny Hills zone substation with backup available from Rocks Ferry Zone Substation. The POE50 forecast below includes a step change in 2026/2027 that includes the new WTP load. There is also an opportunity to place conduits for the future 66kV ring alongside the new Cowarra Dam 11kV supply conduits and Lake Cathie Bonny Hills pipeline being constructed along Houston Mitchell Drive over the next 4 years.

2.5. Forecast demand.

Lake Cathie ZS is forecast to remain a winter peaking zone substation. The load is significantly residential with over 80% of customers in this category and most of the remaining demand is from commercial customers being the next largest category at 18%.

It has been identified that by the end of 2026 there will be 2.3 MVA of load at risk and there are 216 hours for which it will not be able to supply all customers from the zone substation if there is a failure of the normally in service No.1 transformer at Lake Cathie ZS. That is, it would not be able to supply all customers during high load periods following the loss of transformer 1. No.2 transformer has a non-standard nominal voltage and limited tapping range that results in high customer voltages, so it is not normally used. It has a 11.6kV nominal secondary voltage with limited buck taps, so it regularly sits on top tap and cannot maintain the distribution voltage within the required acceptable range and is rarely put into service due to it delivering voltage outside the acceptable range that may cause power quality issues for Essential Energy customers.

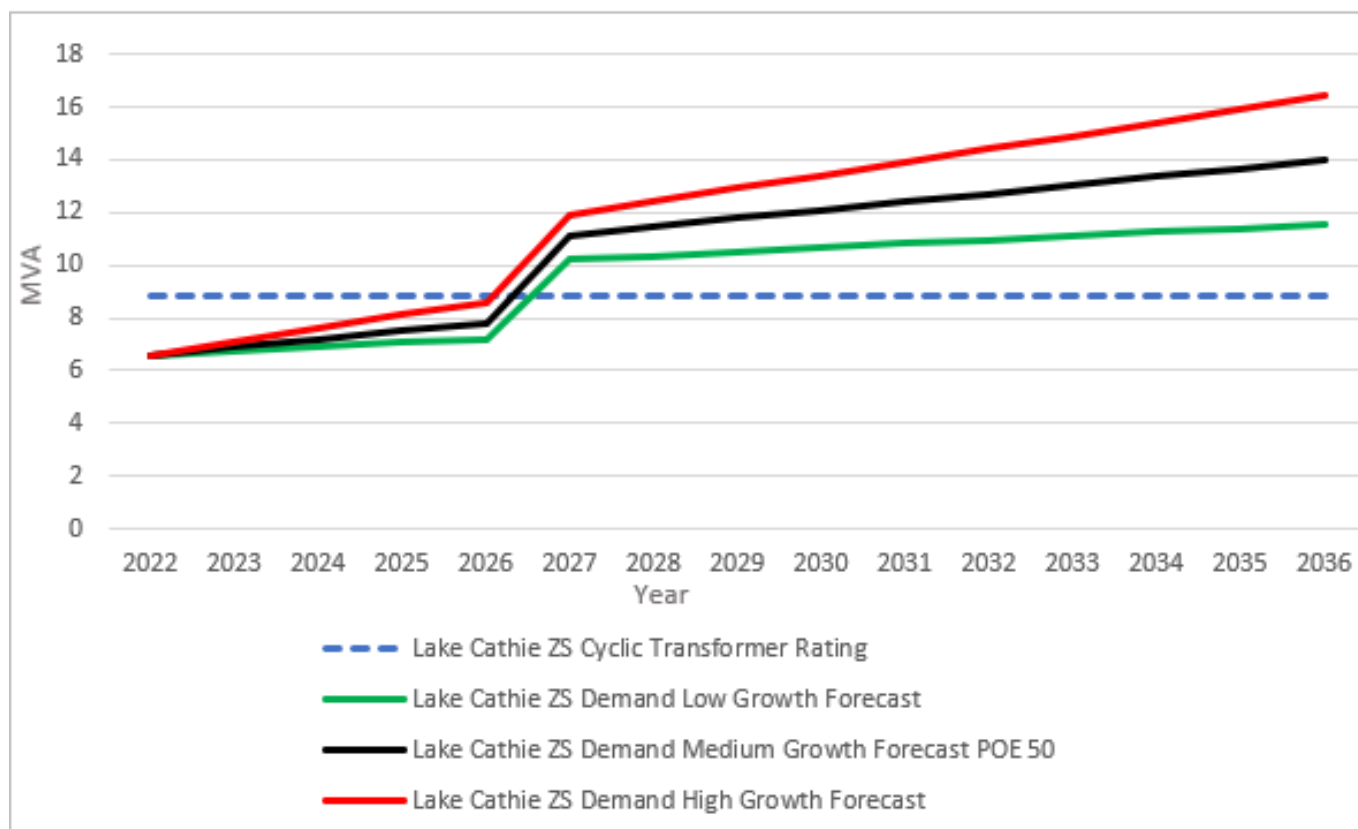


Figure 4: Lake Cathie zone substation demand forecast & N-1 cyclic transformer rating.

LAKE CATHIE ZS FORECAST PEAK MVA #															
Forecast Scenario	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Low Growth	6.6	6.8	6.9	7.1	7.2	10.2	10.4	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6
Medium Growth #	6.6	6.9	7.2	7.5	7.8	11.1	11.4	11.8	12.1	12.4	12.7	13.0	13.4	13.7	14.0
High Growth	6.6	7.1	7.6	8.1	8.6	11.6	12.1	12.6	13.1	13.6	14.1	14.6	15.1	15.6	16.1

Table 1: Forecast demand # Winter POE50

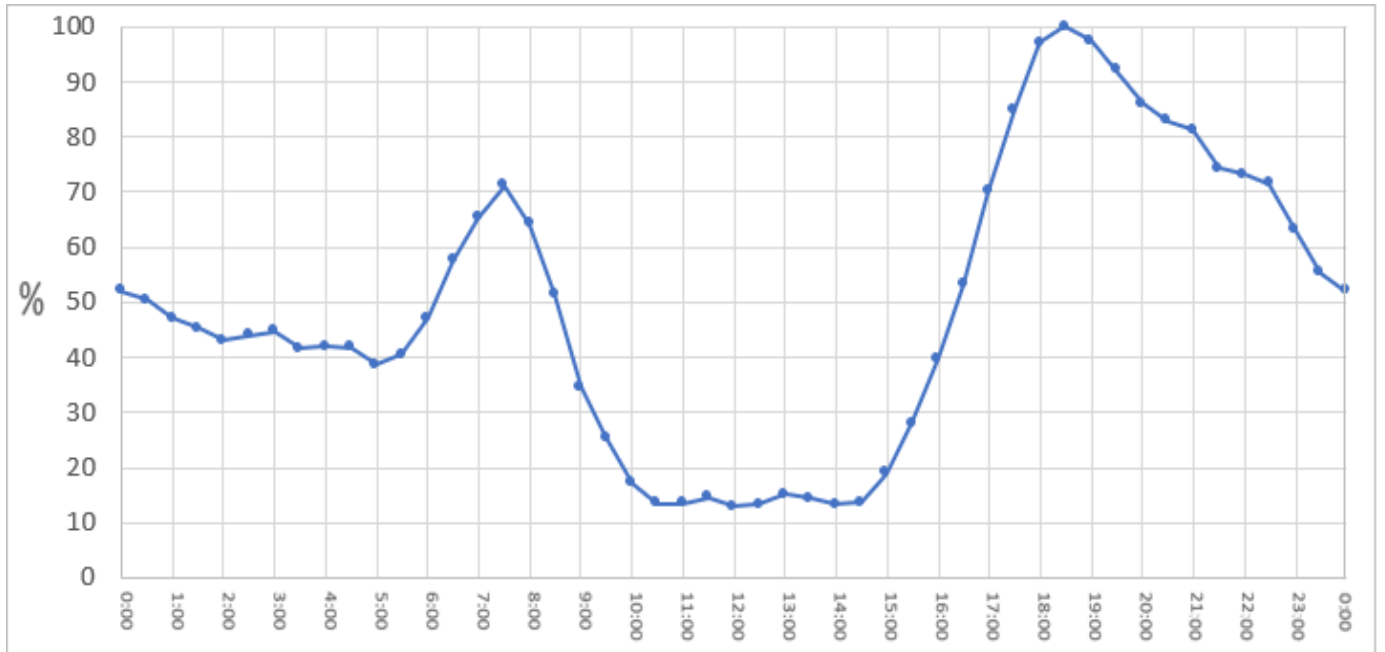


Figure 5: Lake Cathie zone substation peak winter load cycle

2.6 Load transfer capacity from the adjacent zone substations

There is limited transfer capacity available to the existing 11 kV network. During peak demand an estimated maximum transfer capacity of 0.7 MVA is available from the adjacent 11kV network supplied from Laurieton ZS via 11kV Feeder LRN3B1 Alma Street located south of the Bonny Hills / Lake Cathie supply area with no 11kV network link available from Port Macquarie. Due to voltage and thermal constraints the available transfer capacity can only supply a small section of the network in the Bonny Hills area.

3 Identified Need

3.1 Description of the Identified need.

Essential Energy has prepared this non-network options screening notice to assess whether the safety, reliability and demand requirements of the Lake Cathie Zone Substation could be achieved either fully, or in part through non-network options. To assess whether the non-network options could be beneficial, it is important firstly to define the identified need for this location. Lake Cathie zone substation asset condition and near-term capacity issues require rectification because:

- Lake Cathie zone substation was installed in the 1970s and is in poor condition. If the identified poor asset condition zone substation components (Full list in background), remain in service, there is an increased likelihood that a number of these assets will fail in future years, which could result in fires and oil spills that present a high risk to those in the immediate vicinity, and potentially the wider area which includes a medical centre and environmentally sensitive creek located next to the zone substation.
- The zone substation is at near capacity with existing in-service transformer 1 unable to carry the forecast future load within 5 years without thermal overload. Alternate Transformer 2 has a secondary nominal tap of 11.6kV and is only used as an emergency backup due to lack of buck taps creating power quality issues. Essential Energy has identified the Lake Cathie Zone Substation as a priority for investment based on two key needs:
 - Firstly, the need to protect power sector workers and members of the public from harm caused by equipment failure (Safety); and,
 - Secondly, the need to maintain a reliable power supply to the residences and businesses that are dependent on the supply from this distribution network (Reliability).

3.2 Quantification of the identified need.

3.2.1 Condition of plant, safety / operational clearances, and security fencing.

The investment is driven by the deteriorating condition of the busbar structures, switchgear insulators, transformer insulators, unacceptable busbar safety clearances, transformer bunding and security fencing which are at risk of failure and pose a serious safety risk.

- The structures supporting the outdoor busbar equipment and reclosers are heavily corroded and ZS technicians have made several ad-hoc repairs over the years without fully completing substantive repairs.
- The switchgear and transformer insulators are subjected to regular heavy salt build up which causes tracking.
- Corrosion is occurring on the upper and lower sections of the 33kV and 11kV insulators fitted to isolators. This increases the risk of the units failing whilst an Essential Energy employee is operating the device.
- There are reduced phase-to-phase safety clearances between outgoing feeders. ZS technicians need to isolate two feeders to allow safe access to maintain one feeder recloser with a loss of reliability as a result.
- Transformer bunds and oil containment are not to standard or sufficiently sized, creating an environmental risk of transformer oil leaking into the adjacent creek.
- The ZS has a chain wire mesh fence that provides a lower standard of security than required for an urban area and is in poor condition. A formal risk assessment has raised concerns with its ability to prevent unauthorised access to the ZS. It is in an area of expanding residential development with increased foot and vehicle traffic nearby and is in a highly visible location. It also does not meet Essential Energy's CECP7029 Physical Security Framework.
- There is an increased likelihood that a number of these assets will fail in future years, which could result in projectiles, fires and oil spills that present an intolerable risk to those in the immediate vicinity, and potentially the wider area.

The identified need, therefore, is to address the increasing risks to safety, reliability of supply associated with the deterioration and capacity of the assets at Lake Cathie zone substation. This ensures we continue to comply with our obligations in the following regulations:

- Electricity Supply (Safety and Network Management) Regulation 2014 ¹
- The Reliability And Performance Licence Conditions For Electricity Distributors.²

1. Section 5 Network operators to ensure safety of distribution and transmission systems.

A network operator must take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of its network (or any part of its network) is safe.

2. Section 15. Network overall reliability standards

15.1 A licence holder must not, when excluded interruptions are disregarded, exceed in a financial year the SAIDI average standards that apply to its feeder types.

15.2 A licence holder must not, when excluded interruptions are disregarded, exceed in a financial year the SAIFI average standards that apply to its feeder types.

3.2.2. Creditable solution requirements

Credible solutions would be required to allow the decommissioning of the Lake Cathie Zone Substation to ensure the safety of staff and the public and enable supply for the load detailed in Table 2 and Figure 5.

3.3 Assumptions in relation to identified need.

In accordance with the NER requirements, we also noted this reasoning is not dependent on any assumptions or methodologies.

4 Potential Credible Options

Table 2 provides a description of the credible network options that address the identified need. These options are compared to a 'business as usual' (BAU) option, where the existing assets at Lake Cathie zone substation remain in service and maintenance is undertaken consistent with the condition and age of the assets. Minor capital works will also occur as is essential to keep the substation operational on a 'like for like' basis.

Option	Description	Notes	Opex	Capex	Net Economic Benefit (\$M)	Ranking
BAU	Business as usual “Do Nothing” option.	<ul style="list-style-type: none"> Increased safety risk of EOL plant failure over time Compromised level of Reliability. Ongoing operational Safety Risk. Increased operating and maintenance costs including ongoing repair. Compromised protection not meeting current standards. Compromised power quality when Txr 2 is in service. 	\$0.282M	\$0.0M	-\$5.28*	3*
1	Establish Bonny Hills zone substation.	<ul style="list-style-type: none"> Lower cost. Simple construction. Site well located/hidden. Improved Reliability. 	\$0.1M	\$10.69M	\$1.45	1
2	Rebuild the existing Lake Cathie zone substation.	<ul style="list-style-type: none"> Brownfield site. Increased customer outages during construction. Construction safety. Poor location/public presence. Elevated corrosion due to location. 	\$0.1M	\$10.94M	\$1.17	2

Table 2: Network options

*Full detail is in the FPAR Section 6 Economic Analysis including Market Benefit analysis that provides Ranking.

4.1 Preferred option

The preferred option is Network Option 1: Establish Bonny Hills zone substation. This option has an NEB of \$1.45M positive and includes the establishment of a new 33/11kV zone substation at an existing site (Bonny Hills) on Houston Mitchel Drive, 2km southwest of the existing Lake Cathie ZS.

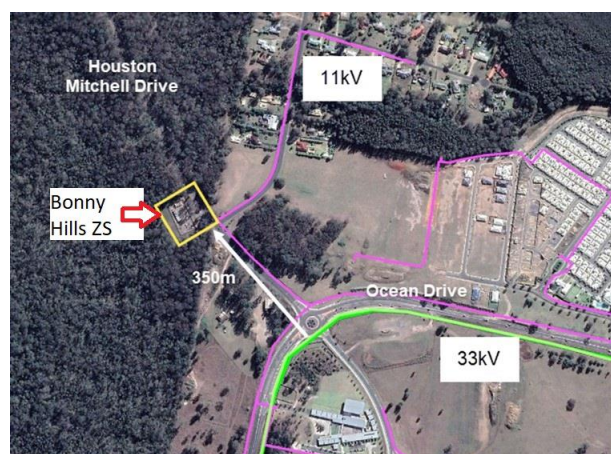


Figure 6: Bonny Hills zone substation site

The site is 2.5km from the ocean in an area that is screened and buffered by State Forest which will provide more salt corrosion protection than the existing Lake Cathie ZS site. The surrounding State Forrest ensures that dwellings and other developments cannot be built around the ZS. The site was cleared some time ago and it is presently used as a storage area.

The site is well located with respect to connecting into Essential Energy electrical infrastructure, being only 350m from the 33kV line and adjacent to the 11kV network. The overall location is ideal to service the existing loads back to the north towards Lake Cathie township and the developing areas directly east and south of the ZS site.

The new ZS would have a control / switch room containing a 12 panel 11kV switchboard (10 x feeders), two new 33/11kV 16/20MVA transformers, 66kV outdoor switchyard and equipment to allow for future conversion to 66kV (except for 33kV VTs).

Construction of the new ZS will be straight forward as it is on a greenfield site. The 33kV and 11kV connections along Houston Mitchell Drive will be mostly underground. The existing 11kV feeder along Houston Mitchell Drive will be rebuilt with compact 66kV overhead construction, and the other 33kV connection will be underground.

Required commissioning date to meet the identified need is December 2026.

Network Option 1 has NPC of \$10.69M an NPMB of \$12.14M and is NEB positive \$1.45M.

4.2 Other network options considered.

Network Option 2 – Rebuild Lake Cathie ZS

This option requires rebuilding Lake Cathie ZS at its present location. The Lake Cathie ZS site is 50m x 50m and the ZS footprint is 30 x 30m. The ZS is in the northwest corner of the site, away from Ocean Drive to the south and the creek to the east.

A new control/switch room would be constructed in the only available area, which is to the south of the existing footprint, close to Ocean Drive and away from the creek. The new building would contain an 11kV indoor switchboard and control/protection equipment. Temporary 11kV connections would be made from the new switchboard to the existing 33/11kV transformers to allow staged connections of the 11kV feeders. Existing 11kV outdoor infrastructure would then be dismantled to allow for construction of two new transformer bunds for the new 16/20MVA transformers.

The primary side of the ZS would be built to 66kV standards, including all equipment except for 33kV VTs, in preparation for the long-term future network conversion to 66kV.

To build the new outdoor yard, temporary 33kV connections would be needed to the new transformers. This would then allow removal of the existing transformer bunds and 33kV outdoor equipment. A new high security fence and earthing grid would be installed, and existing oil containment system upgraded.

The existing 33kV tee connection outside of the ZS would be removed by rearranging the 33kV line from Clearwater Crescent to enter UG into the ZS and connect to the new outdoor switchgear.

Rebuilding on a brownfield site is normally more expensive and complex than a greenfield site. There are additional safety risks related to working around live high voltage that is not present with a greenfield build. Retaining this site would have negative community and reputational impacts.

The adjacent medical centre and therapy aquatic centre have expressed concerns with their proximity to the ZS. There are environmental concerns related to the ZS's oil filled transformers not meeting today's design standard and being adjacent to a creek. The location of the site will continue to be in a highly visible residential and commercial area, subject to nearby vehicle and foot traffic, and salt corrosion from the nearby ocean.

As per Network Option 1 the required commissioning date to meet the identified need is December 2026.

Network Option 2 has NPC of \$10.94M an NPMB of \$12.14M and is NEB positive \$1.17M.

5 Consideration of Non-Network Options

In the case of the identified need at the Lake Cathie zone substation, we have concluded that there are no credible non-network options for the following reasons:

- there is no opportunity to reduce the required assets and associated works to replace the EOL Lake Cathie zone substation by partially reducing peak load through demand management.
- embedded generation incorporating the use of batteries would not be cost effective in this location given the estimated capital cost and amount of land purchase required to cater for the December 2026 peak load requirement with connection of the committed Water Treatment Plant at Cowarra Dam.
- the cost of embedded generation exceeds the cost of the preferred network option, and there is in any event, limited space for implementing a local generation option large enough to meet current and forecast demand within the area.

In considering the feasibility of generation and storage options, Essential Energy investigated an indicative estimate for the non-network options listed in Table 3 that would provide a level of supply reliability comparable to the network options. It was found that:

- the high-level annualised capital cost of a stand-alone gas fired generation option was higher.
- There is no gas pipeline to supply the standalone gas generator in the area.
- the high-level annualised capital cost of a stand-alone renewable generation / battery option was higher.

These non-network options are unfavourable when compared to the network options. A non-network solution within the lake Cathie area would be cost prohibitive and not be able to meet all the criteria to satisfy the identified need.

Table 3 below is a summary of the non-network options considered with respect to meeting the identified need, technical, commercial, and timing to enable full consideration of these non-network options as credible.

Rating	Colour Coding
Does not meet the criterion	
Does not fully meet the criterion (or uncertain)	
Clearly meets the criterion	

Options	Assessment against Criteria			
	Meets Need	Technical	Commercial	Timing
1.0 Generation and Storage				
1.1 Gas turbine power station				
1.2a Generation (Solar) including battery storage				
1.2b Generation (Wind) including battery storage				
1.3 Dispatchable generation (large customer)				
1.4 Large customer energy storage				
1.5 Community Battery				
2.0 Demand management				
2.1 Customer power factor correction				
2.2 Customer solar power systems				
2.3 Customer energy efficiency				
2.4 Demand response (curtailment of load)				

Table 3: Non-network options summary

6 Determination

For the reasons set out in this notice, pursuant to clause 5.17.4(c) of the Rules Essential Energy has determined that there are no credible non-network options to address the identified need for the Lake Cathie zone substation.

Therefore, in accordance with clauses 5.17.4(c) and (d) of the Rules, Essential Energy will not be publishing a non-network options report in relation to the proposed works associated with the establishment of Bonny Hills zone substation to replace the EOL Lake Cathie zone substation.

Essential Energy will prepare and publish a Final project assessment report in relation to the Bonny Hills zone substation project, in accordance with clause 5.17.4(i) of the Rules.