Essential Energy
10.06.07 Resilience Bonalbo Network Investment Case
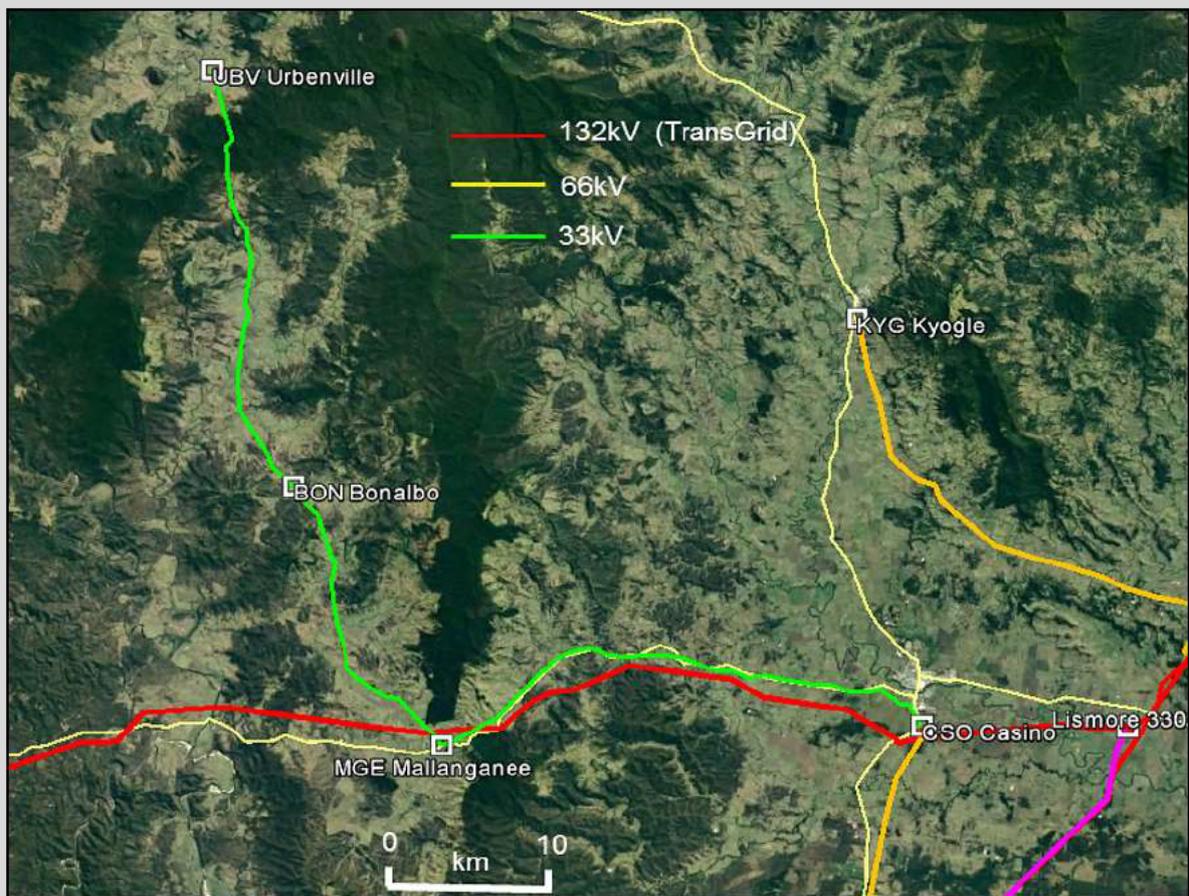
November 2022

Network Resilience Project

Project:	10.06.07 Resilience Bonalbo Network Investment Case
Date:	Nov 2022
Authors:	██████████████████████
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Approvals

	Name	Division	Title & Function	Date
1.	████████	Asset and Operations	Manager Network Planning	14/12/22

Revisions

Issue Number	Section	Details of Changes in this Revision
1.	All	Initial Issue
2.		
3.		
4.		
5.		

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1. Executive Summary

Major Project	10.06.07 Resilience Bonalbo Network Investment Case
Description	Establish back up supply to Bonalbo Zone Substation
Drivers for Investment	**Resilience:** To improve the resilience of the network for customer on the Bonalbo ZS as reliability is lower than required by applicable standards. Poor reliability performance is primarily the result of lightning and vegetation, coupled with distance from depot resulting in extended rectification timeframes. Wind and bushfire impacts are forecast to increase significantly in the future. Following subtransmission outages upstream of the zone substation large numbers of customers have been affected, including. 04/10/21: 16 hours 08/01/21: 17 hours 01/09/19: 11 hours **Reliability:** To improve reliability for those customers in the Bonalbo ZS. This will also maintain the safety, quality, and security of supply of the network as per NER 6.5.7 capital objectives. Strong customer support for proactive resilience projects including microgrids (refer 4.02 How Engagement Informed our Proposal).
Investment Options	Options considered to improve customer reliabilty included: > Diesel Generation > Network solution > Battery backup > Market Non-network solution > Lightning protection (excessive capital costs, excluded from further analysis) Due to the scale of this project an Expression of Interest (EOI) for non-network solutions will be advertised prior to project initiation to enable the private sector to submit non-network options for evaluation. The following option was investigated in detail and evaluated using Net Present Value of cost and benefit: > Diesel Generation (NPV of $5M)

Estimated Expenditure $FY24	2024/25	2025/26	2026/27	2027/28	2028/29
	$0	$0	$0	▮	$0

Note: All values are in middle of the year 2023-24 real dollar terms

2. Network

The Casino – Bonalbo 33kV feeder is a radial 33kV network (total 58km), emanating from Casino 132/66/33/11kV substation, that supplies three 33/11kV zone substations (ZS) as shown below in Figure 1. The 33kV line between Casino ZS to Mallanganee ZS is 36km radial and from Mallanganee ZS to Bonalbo ZS is 22km radial. The current load is 1.2MVA and the 5-year forecasted load for Bonalbo ZS is 1.3MVA and in total 529 customers are connected to the Bonalbo ZS.

The feeder was constructed circa 1950, consisting of a total 584 spans with single pole, predominantly delta pin pole top construction with 7/.080 copper conductor on the Casino-Mallanganee-Bonalbo sections (58km) and 6/1/.118 ACSR/GZ on the Bonalbo-Urbenville section (32km). It has 11kV underslung for 80 of the 90kms, the underslung 11kV is also mostly copper conductor of similar era. The average pole age is 39 years, with 226 of the 585 poles over 50 years old.

8402 Mallanganee - Bonalbo is the backbone 33kV subtransmission line out of from Mallanganee ZS to Bonalbo ZS is 22km radial. A significant constraint on this feeder is its co-existence with the 11kV networks BON3B2 Old Bonalbo and BON3B3 Bottle Ck. If works, planned or unplanned, are required on the 11kV network, it will often require the 33kV network to be isolated for safety reasons, resulting in the loss of all loads at Bonalbo ZS
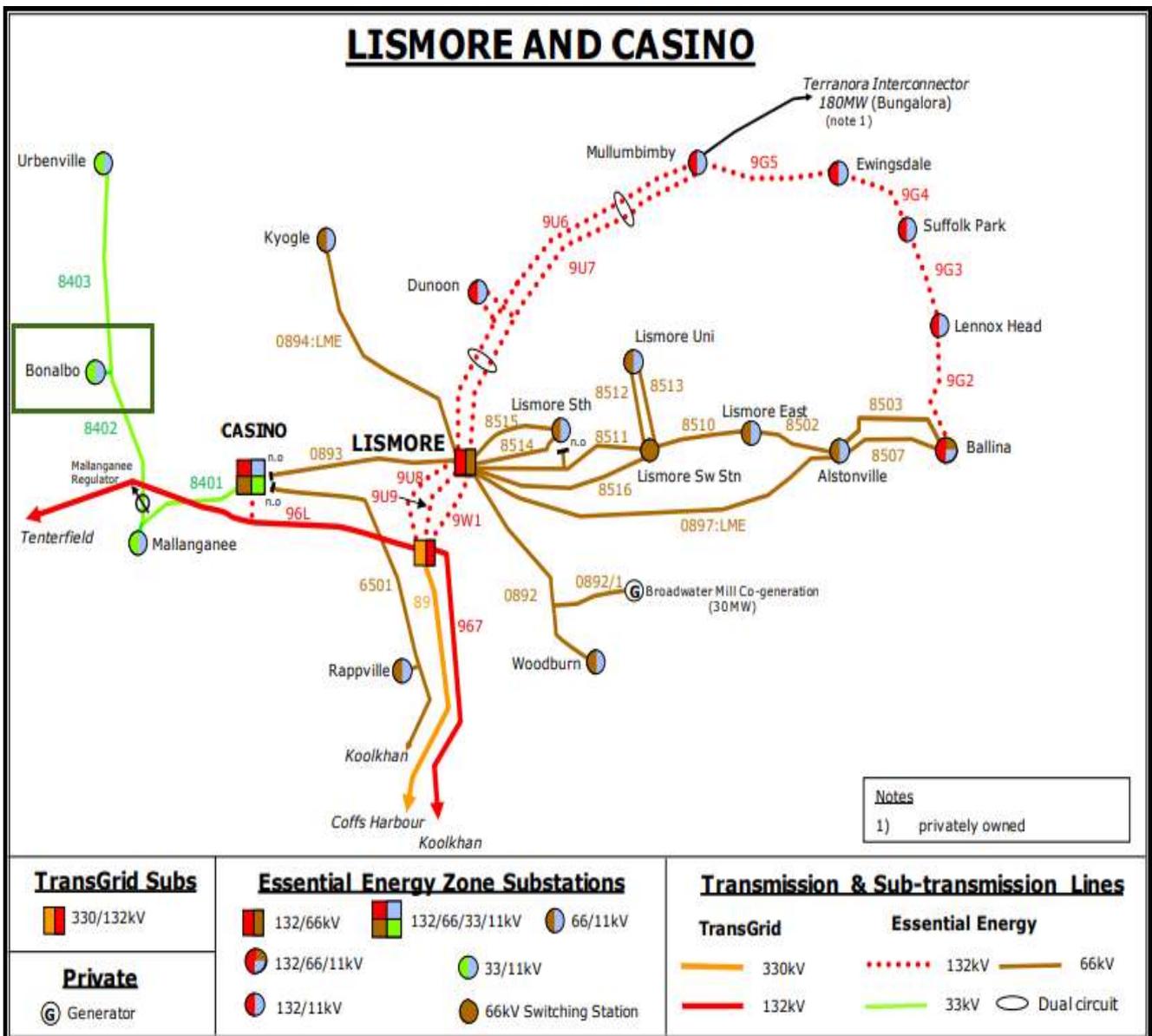

Figure 1 - Simplified Subtransmission Network

The Bonalbo ZS consists of 3 feeders that are all short rural type feeders, as shown in Figure 2:

- BON3B1 Peacock Ck has 160 customers and length of the feeder is 18km.
- BON3B2 Old Bonalbo has 312 customers and length of the feeder is 112km.
- BON3B3 Bottle Ck 57 customers 57 and length of the feeder is 39km.

Asset inspection cycles include a ground inspection every five years and aerial photo inspections (drone), also every five years. To minimise customer outages, the feeders are mostly maintained live line.
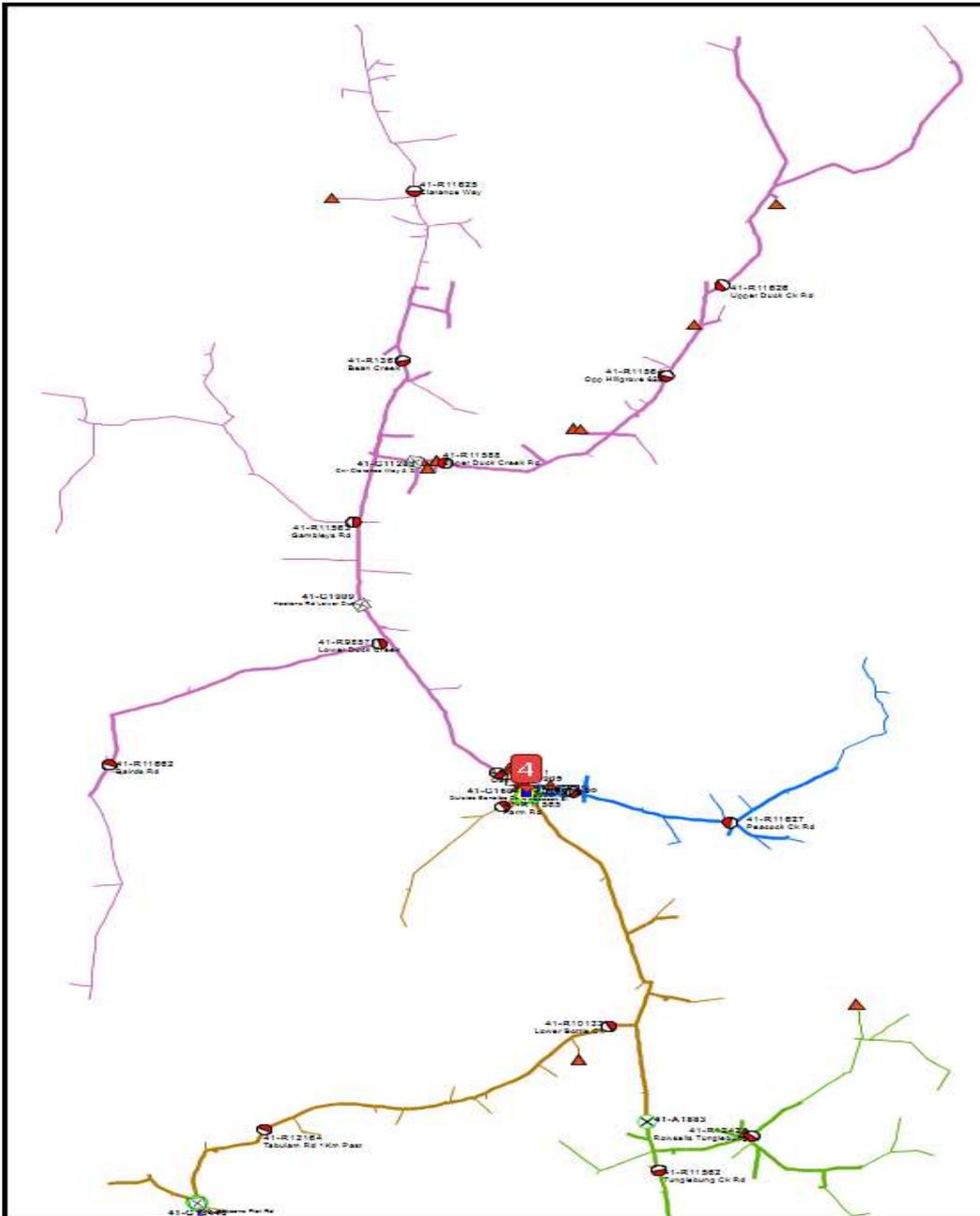

Figure 2 – The 3 feeders of Bonalbo ZS

The geographical spread of the 3 distribution feeders from Bonalbo ZS is as shown in Figure 2.

3. Reliability

Reliability of the 33kV subtransmission network is mostly affected by weather and the area is area susceptible to lightning strikes as shown the Appendix A.

For faults on this feeder, resources patrol the feeder visually via adjacent roads and other access. Depending on weather and night/daytime, patrols may take several hours. Once the fault is found, emergency repairs are usually completed straight away. Typical storm/lightning faults impact the pole top; crossarm or insulators, conductor or pole faults are less common.

Historical outage data indicates there is an average of 3.8 unplanned outages per annum. Due to the conditions and patrol requirements the average outage timeframe is approximately six hours.

Maintaining a reliable supply is a key investment driver in determining network augmentation expenditure. Examples of some of the longer outages that have occurred are detailed below:

04/10/21: 16 hours, total customer affected 522. The cause was environment and equipment deterioration. The equipment damage was broken crossarm of the underslung 11kV and the 33kV had to be isolated to restore the 11kV line back up onto the pole.
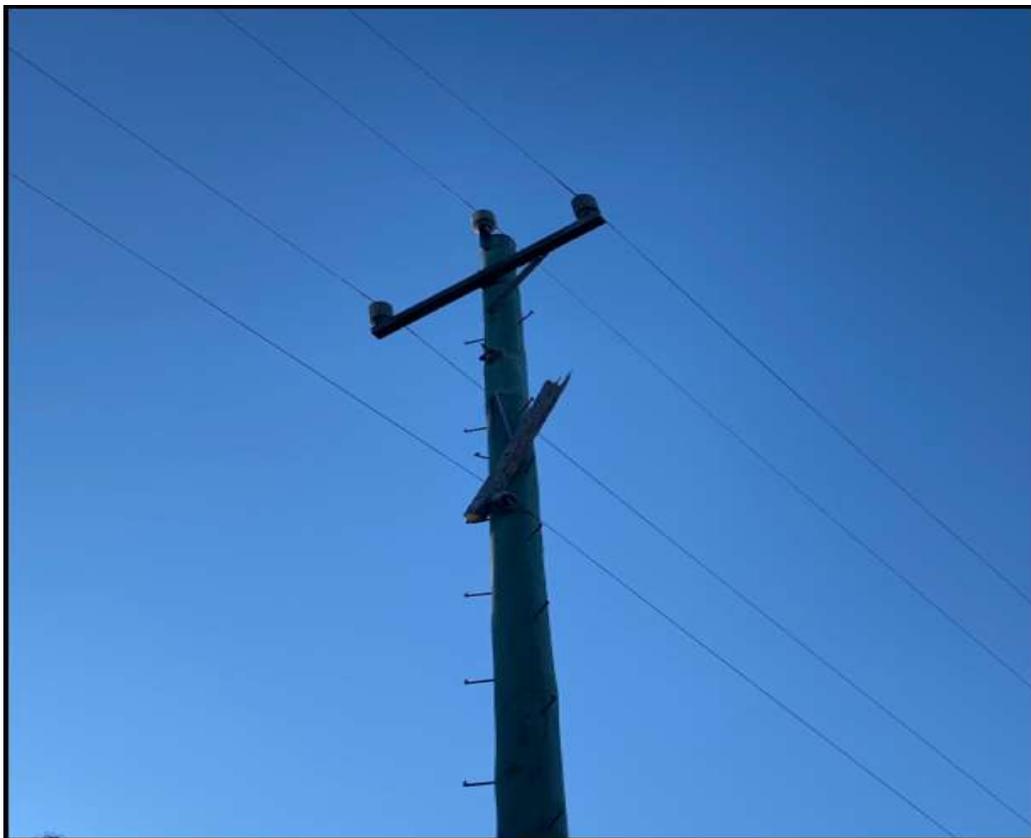
Figure 3 – Cross arm Failure INCD-87715-q

08/01/21: 17 hours, total customer affected 516; The cause was related to weather and lightning. The equipment damaged was the 33kV earth wire 100m outside casino zone. The incident no. INCD-58471-q.

31/05/2022: 7 hours, total customer affected 529. The cause was extreme wind. The equipment was HV wire down. The incident no. INCD-124427-q.

Further historical reliability data for these feeders can be found in Appendix A.

The SAIDI and SAIFI of the 3 feeders is as shown in Figure 4. Out of the 3 feeders the longest feeder is 112km in length and the feeder with the highest number of customers is 312.

The breach of Licence Conditions reliability standards has occurred primarily due to SAIDI thresholds being exceeded. The feeder BON3B1 and BON3B3 has been non-compliant since Dec 2019 qtr. And the feeder BON3B2 has not had 4 consecutive qtrs. of compliance since Dec 2013.
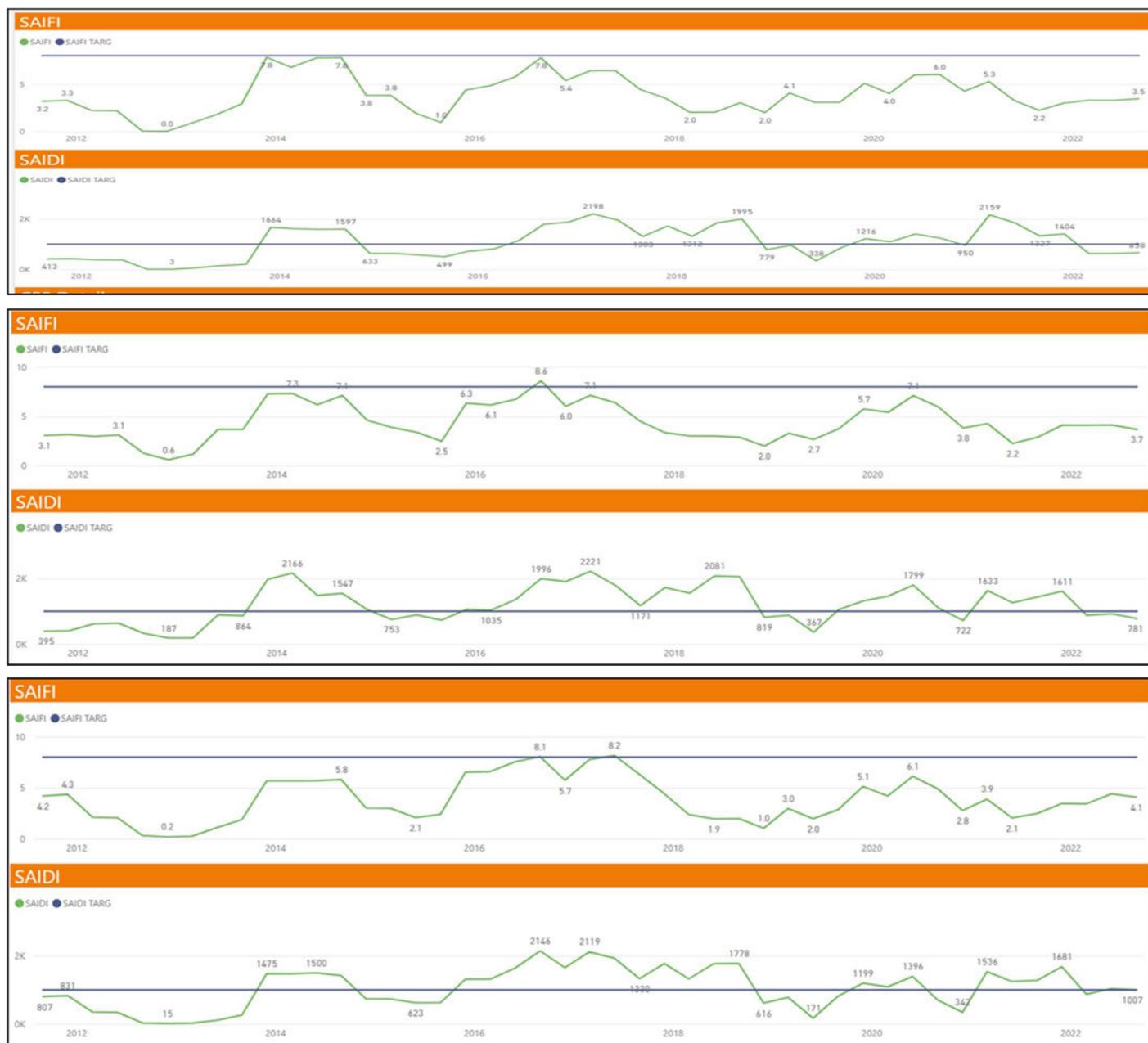

Figure 4 - SAIDI/SAIFI Performance of the 3 feeders

The 3 feeders in the past 5 years have been affected by a significant amount of subtransmission faults as shown below.
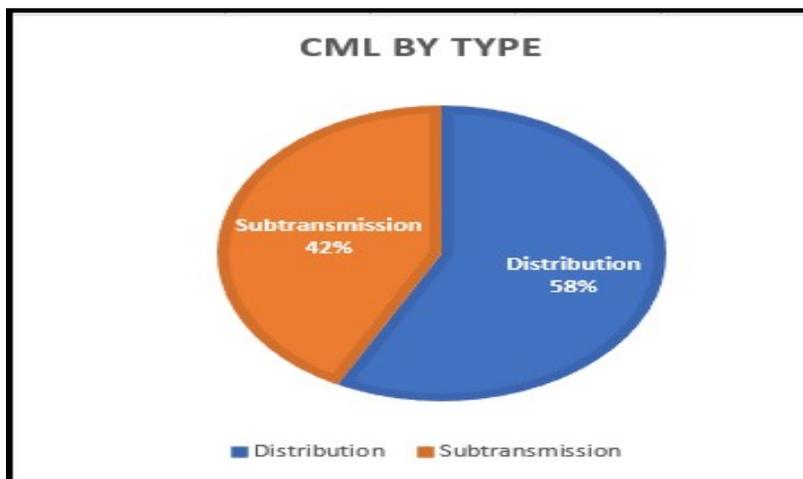
Figure 5 - Customer Minutes Lost by Network Level

By Cause, the majority of the unplanned outages affecting the 33kV subtransmission have been weather related.
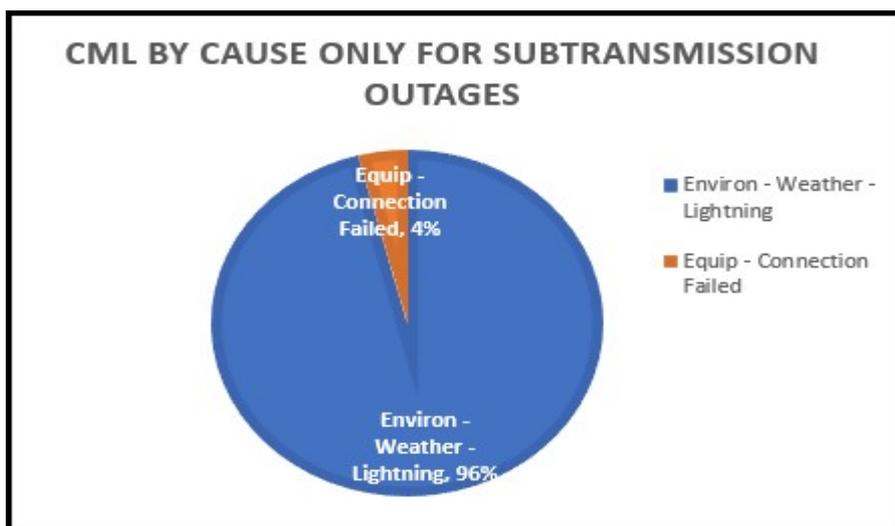
Figure 6 - Customer Minutes Lost Primary Cause for Subtransmission outages only

To date a reconductor of 15km section of the line which traverses the higher areas towards Mallanganee as Stage 1 has been completed.

3.1   Climate Impact Assessment

This project forms part of our **Resilience Plan (Attachment 6.02)** and strengthening the resilience of the network. Whether planned work or unplanned outages on the subtransmission network, a permanent backup generator will reduce the exposure on the distribution feeder and improve the experience of the commercial and residential customers in the area.

From **Attachment 6.01 Climate Impact Assessment**, it is forecast by 2070 that the impact on asset failures of combined bushfire, flood and wind will increase by approximately 20% using RCP4.5 as shown in Figure 7 below.

Change in expected number of replaced assets due to the combined impact of bushfire, flood, and windstorm from 2022 to RCP4.5 2070
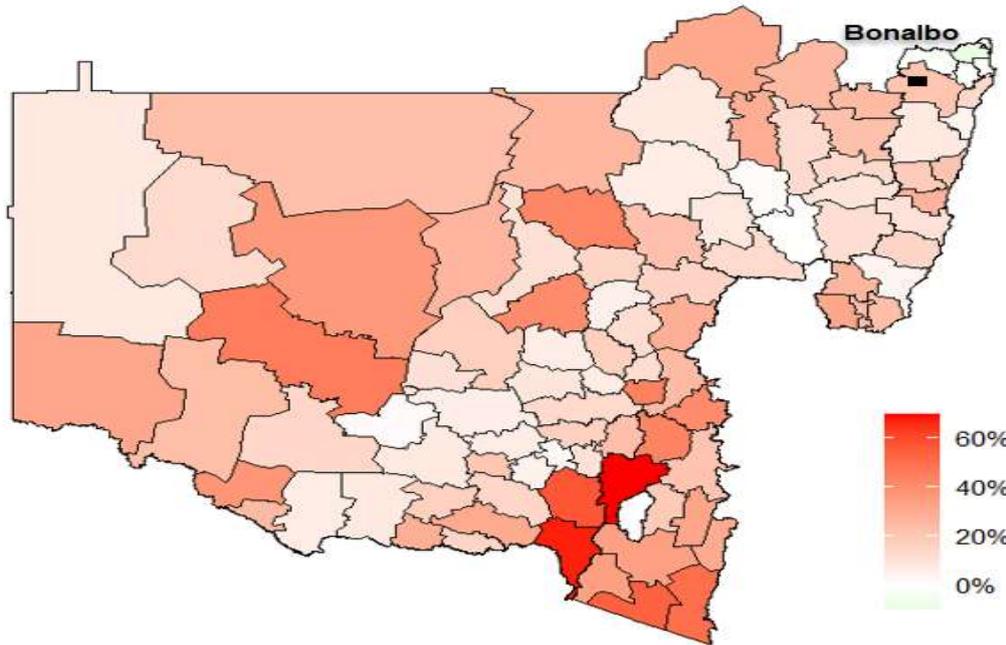
Figure 7 – Expected increase in asset replacement due of climate impact (Attachment 6.01 Climate Impact Assessment)

Modelling of impact of bushfire and wind in the Casino depot area is forecast to increase by 11% and 7% respectively (Figure 8).
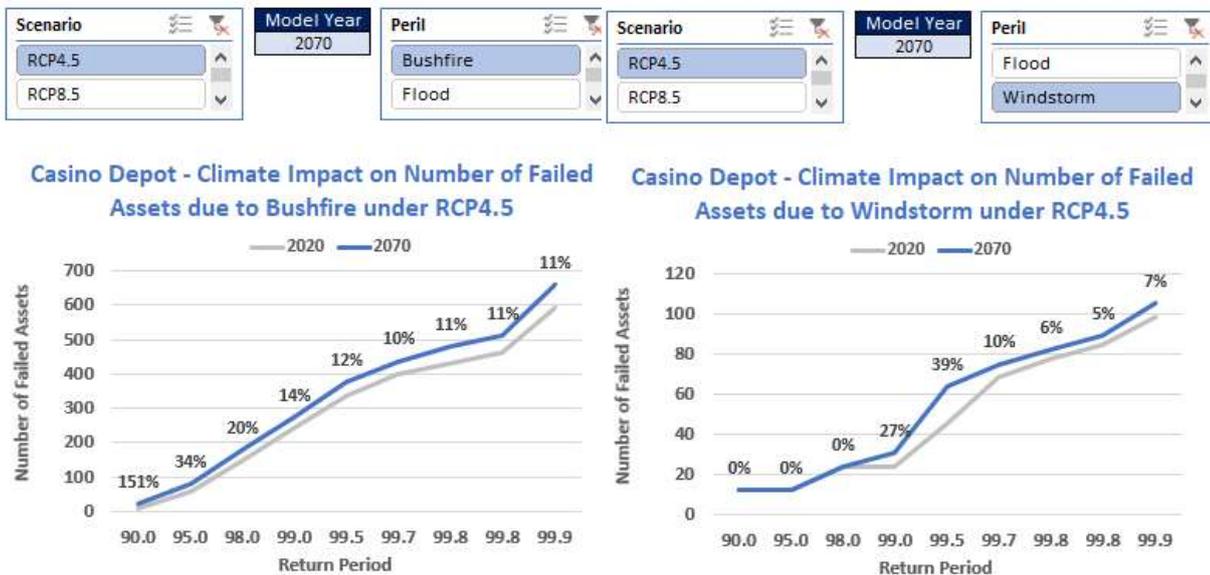
Figure 8 - Current and forecasted analysis of climate impact (Attachment 6.01.01 Climate Summary Line Graph)

Climate impact modelling has not been included in the NPV analysis for this project but does offer additional qualitative benefits.

4. Options Analysis

Several options were investigated to improve reliability in the Bonalbo ZS. The following three options below were compared via Net Present Value (NPV) analysis. NPV analysis considers both costs and benefits over typical life of asset (40 years). Costs include both capital and operating. The key benefit in this case is the Value of Customer Reliability (VCR).

Beyond reliability benefit other risk value benefits were considered as per Appraisal Value Framework (**Attachment 6.03.03**). The benefit of alleviating specific network risks such as safety, environment (bushfire), financial, reputation and compliance were also considered. A summary of the risk framework assessment is detailed below in Section 5.

Table 1 includes the primary variable assumptions to calculate the Baseline risk of the overhead network supplying the Bonalbo ZS.

Table 1 - Variables for Baseline Risk

| Variable	Value	Source
Discount Rate	3.54%	Current internal rate for standard control CAPEX
Failure Rate of OH Line	3.8	Historical performance over the past seven years
Load Impacted	1.3MVA	Average customer load in ZS Bonalbo
Outage Timeframe	5.6hrs	Historical performance over the past ten years
NPV Period	40yrs	Current internal common modelling window

4.1 Option 1 - Diesel Generation- Bonalbo ZS

This option has a capital cost of ██████ and would require a diesel powered generator unit to be installed at the Bonalbo ZS. The unit would be semi containerised standard 415V output and connect to the 11kV busbars at the zone substation via a 415V/11kV step-up transformer. Considering peak demand, optimised generator protection and operation, one 1.5MVA unit would be installed at Bonalbo ZS to supply the three distribution feeders. The unit would have fuel storage for at least eight hours of running. The NPV analysis assumes the life of the generator to be 20 years, thus for the 40 year NPV analysis the cost of a replacement of the generator at 20 years has been considered. For the purpose of residual risk a conservative assumed failure rate of 1 in 10 years has been included for the diesel generator in the event that the generator fails to supply the ZS.

Benefits of a generator also extend to the Essential Energy field staff that are not quantified in the value calculator. The benefits include being able to complete work without an excessive time constraint for both planned and unplanned outages. Issues of access and remoteness of the fault can be better planned due to the availability of an alternate supply.

On loss of the 33kV supply, the 11kV transformer circuit breakers would open, and the generator start-up would occur within minutes.

Option 1 has estimated capital cost of ██████████████████████ and a Net Present Value of $5M and an impact to STPIS targets included in Service Target Performance Incentive Scheme (STPIS) Approach (Attachment 8.04).

4.2 Option 2 - Network Reconductor

This option would require 22km of the 33kV conductor to be replaced. This option is to undergo refurbishment beyond just the conductor being replaced with aging poles and pole top constructions to be replaced as required based on

condition assessments. The 11kV conductor which is mostly copper and is underslung the 33kV conductor for most of the 22km length will also be replaced. This will cost an estimated ███.

Unplanned outages due to weather will still be an ongoing issue. This network solution option was deemed economically unfeasible.

Option 2 has a capital cost estimated in excess of ██ and is deemed uneconomical.

4.3   Option 3 Battery Back-up Storage for Bonalbo ZS

Battery storage would require installation of containerised battery banks at Bonalbo ZS.

The battery banks would be connected directly to the 11kV network in the Bonalbo ZS. On loss of the 33kV supply, auto-changeover to the battery banks would occur. With a peak demand of 1MVA, the battery banks would need significant capacity to provide backup supply over the extended unplanned outage periods, which is anticipated to be at least 24 hours.

The advantages of battery storage are they are fast acting sources of supply, they are relatively quick to install, can be extended readily and have low running cost. They can provide benefits beyond backup supply: stabilise the grid in frequency events and sale of spare capacity into the grid at high wholesale price points. Neither of these benefits can be considered as Essential Energy is not in a regulated position to do so. Disadvantages of batteries are they are relatively costly, and at this stage the battery life is expected to be less than 20 years. In comparison to other network options with typical asset life of 40 years, it is assumed the battery would be replaced after 20 years.

It is estimated that the average power consumption is 1.5MVA, for 24 hours requires a battery bank of 36MWh. This option has been ruled out of further analysis due to an estimated capital cost of ██████ with an expected cost of ████ per MWh based on energy storage costs received from Essential Energy network battery trial project in 2022.

Option 3 has a capital cost estimated in excess of ██████ and is deemed not economical without subsidies or grants.

4.4   Option 4 Market led Non-Network Solution

The requirements to improve resilience and reliability to the Bonalbo ZS may be advertised via an EOI process to enable the market to respond with alternative non-network solutions. The response from the market could include another option not previously investigated by Essential Energy and could include other market benefits driven from 3rd party owned solutions. The basis of the EOI will be to request alternative energy storage and backup power solutions under any business model and operational conditions to ensure all new solutions can be assessed. Because of this approach, submissions may need to be reviewed against any applicable regulatory rules and if a solution is deemed to be economically viable, engagement with regulators may be required. Solutions from this market exercise will then be assessed against network solutions.

As such, Option 4 does not have NPV analysis at this stage but will be considered as part of the project development.

4.5   Recommended Option

In recommending a preferred option, the initial capital costs are considered along with the NPV analysis of overall 40-year benefit which is primarily based on improved reliability.

Option 2 has a capital cost estimated in excess of ████ and is deemed not economical.

Option 3 has been evaluated as not being economically viable solution due to the high initial and cyclical capex cost.

Option 4 will be evaluated prior to Essential Energy commencing the project to ensure up to date market pricing and solutions are used in the final evaluation.

Option 1 diesel generation is currently the recommended option due to lower capital cost, and positive NPV benefit over a 40 year period.

5. Risk Framework

Essential Energy's Corporate Risk Management Procedure (**Attachment 6.03.01**) and Network Risk Management Manual (**Attachment 6.03.02**) underpins network investments in line with the risk Appraisal Value Framework (**Attachment 6.03.03**) and provide a consistent approach to network asset risk management and augmentation evaluation. The purpose of the procedures is to estimate the level of risk via probability of failure, likelihood of consequence and evaluate cost of consequence for network investments. The framework looks at overall network risk across six key areas: Safety, Network (Reliability), Environment, Compliance, Reputation and Financial.

5.1 Safety

Safety consequence considers the risk to both public and Essential Energy personnel. The existing risk in this case is live conductor dropping to the ground mostly from storm activity or possible vehicular contact with pole, leading to possible injury or fatality. The protection equipment which opens the feeder when conductor drops to the ground is fast acting and reinforced by secondary backup equipment if primary equipment fails. Although the consequence is severe, the probability of failure and likelihood of consequence deems the risk to public and personnel safety to be acceptable. Options 1 and 3 offer reliability and resilience to the network and will allow repair/maintenances work to be done as best as possible as without a negative impact on the customers in the ZS. Option 2 solution will reduce the outage for the ZS caused by equipment failure only. Unplanned outages due to weather and subtransmission failures will still be an ongoing issue, hence, the network solution may not be the ideal solution. Due to the low probability and likelihood of consequence a value for Safety has been deemed negligible and excluded from the NPV for all options.

5.2 Network (Reliability)

Network risk captures the consequences associated with loss of supply. As noted above in Section 3 Reliability, the existing reliability to customers supplied by Bonalbo ZS is the main risk that is addressed in this network investment evaluation. The probability of failure and the consequence associated with loss of supply are relatively straight forward and readily valued, via average unplanned outages rates and VCR. Loss of supply is assessed utilising the historic failure rate and length projected forward utilising a Value of Customer Reliability (VCR) [1] based on 6.03.03 Appraisal Value Framework.

5.3 Environmental

The prevalent environmental risk is bushfire. As a pole top/conductor fails and live conductor touches the ground, it may, dependant on conditions and environment ignite fire, causing property damage. Essential Energy uses the Phoenix Rapid Fire system and internal modelling to determine a fire risk per pole. The area between Casino ZS and Bonalbo ZS is deemed to be a low bushfire risk. All three proposed augmentation options have the existing feeder remain in service. Although the consequence is moderate, the probability of failure and likelihood of consequence deems the risk to be acceptable. Other environmental risks would be transformer oil and diesel fuel spillage. Essential Energy complies to all relevant standards with oil containment and fuel storage. The risk and consequences associated with transformer oil and diesel fuel is negligible and acceptable. Due to a lack of difference between baseline and residual risks environmental risk has been excluded from the NPV.

5.4 Compliance

Compliance risk is assessed for issues that may arise because of not complying to relevant Standards, Acts or Guidelines. Essential Energy complies to all relevant Standards and Acts. There is no compliance risk that needs to be addressed.

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[1] AER Values of Customer Reliability Final report on VCR values Dec 2019

5.5   Reputation

Reputational consequences are categorised as those risks associated with the tarnishing of the company's reputation as the result of mostly, in this case, ongoing loss of supply due to overhead asset failure. This investment will address some of the risk associated with Bonalbo ZS having long outage durations.

5.6   Financial

Financial consequences, in this case, are generally those costs associated with fault and emergency work, over-and-above typical planned maintenance costs. Ongoing asset failure has a consequence of ongoing fault and emergency work, which could be costly if the annual probability of failure was significant and increasing exponentially. The existing 33kV network will remain in service. The addition of new assets (Diesel Generator, switchgear, control, and communication devices) will require maintenance. The generator will require regular maintenance to ensure that it will be able to perform as expected. The life of the generator is expected to be 20 years.

References

Doc No.	Document Name	Relevance
1	Bonalbo ZS Generator NPV.xlsx	NPV Option Analysis
2	Bonalbo ZS outages 01-10-17 to 23-10-22.xlsx	Outages analysis on 33kV subtransmission network
3	Casino-Mallanganee Gate 2 Approval July 18	Background of the network
4	4.02 How engagement informed our Proposal	Reference material, justification
5	6.01 Climate impact assessment	Reference material
6	6.01.01 Climate summary line graphs	Reference material
7	6.02 Resilience Plan	Reference material
8	6.03.01 Corporate Risk Management Procedure	Reference material
9	6.03.02 Network Risk Management Manual	Reference material
10	6.03.03 Appraisal Value Framework	Reference material, risk evaluation
11	8.04 Service Target Performance Incentive Scheme (STPIS) Approach	STPIS target adjustment

Key Terms and Definitions

Term	Definition
$M	Dollars expressed in millions
CML	Customer Minutes Lost
DNSP	Distribution Network Service Provider
FY	Financial Year
MW	MegaWatt
NPB	Net Present Benefit (Benefits over 40-year expressed in present value)
NPC	Net Present Cost (Capital and operation costs over 40-year expressed in present value)
NPV	Net Present Value
NPVM	Net Present Value to Market (NPB subtract NPC)
VCR	Value of Customer Reliability
VUE	Value of Unserved Energy

Appendix A – Historic unplanned outages for 3 feeders at Bonalbo ZS

Interruption_Num	Segment	CML	Total CA	Total CML	Supply Lost	Supply Restored	Subtrans	Equip	Cause	WEATHER
INCD-58471-q	1	121878	1940	1880107	1/8/2021 9 53:46 PM	1/9/2021 3:18:26 PM	Y	Conductor - HV Failed	Environ - Weather - Lightning	Lightning/ storm
INCD-66213-q	1	32818	1943	388248	3/2/2021 6:16 04 PM	3/2/2021 10:55:24 PM	Y	Conductor - HV Failed	Environ - Weather - Lightning	Lightning/ storm
INCD-43219-r	1	19065	1126	173926	1/12/2022 10:10:49 AM	1/12/2022 12:45:44 PM	N	Conductor - HV Failed	NF - Likely Animals - Bird	Fine conditions
INCD-116075-q	1	35793	522	151902	3/28/2022 2 54:33 PM	3/28/2022 7:45:15 PM	Y	Conductor - HV Failed	Equip - Connection Failed	Rain
INCD-87715-q	1	17958	1125	91851	10/4/2021 4 58:22 PM	10/5/2021 9 07:17 AM	N	Conductor - HV Failed	Veg - Trees Blown into Cond.	Fine conditions
INCD-41708-q	1	50296	158	80320	9/16/2020 11 02 50 PM	9/17/2020 1:08:00 PM	N	Pole - HV Failed	Unauth Contact - Road Vehicle	Fine conditions
INCD-87222-q	41-R1013	23569	200	55260	9/30/2021 11:25 00 PM	10/1/2021 7:01:25 AM	N	Conductor - HV Failed	Environ - Weather - High Winds	Lightning/ storm
INCD-105887-q	41-R11625	6682	35	17968	1/16/2022 1:15:03 AM	1/16/2022 9:49:33 AM	N	Transformer - Distrib Failed	Environ - Weather - Lightning	Lightning/ storm
INCD-116703-q	41-R11662	14716	13	14716	4/1/2022 7:25:29 PM	4/2/2022 2:17:26 PM	N	Joint / Connection - HV	NF - Likely Weather - Wind	Wind
INCD-18503-u	41-R10132	3344	36	10944	12/5/2020 6 53:22 PM	12/5/2020 11 57 06 PM	N	Joint / Connection - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-120644-q	1	3936	55	8359	5/18/2022 11:55:59 AM	5/18/2022 3:18:47 PM	N	Sectionaliser / Recloser	Equip - Internal Fault	Fine conditions
INCD-132453-q	41-R12164	90	445	7440	8/28/2022 7:55:10 AM	8/28/2022 8 13 57 AM	N	Unknown - No Fault Found	NF - Specify in comments	Fine conditions
INCD-91989-q	41-R11564	1107	52	6720	11/12/2021 5 54:10 PM	11/12/2021 9:45:40 PM	N	Conductor - LV Failed	Equip - Connection Failed	Fine conditions
INCD-129354-q	41-R1013	6142	37	6142	7/21/2022 6:55:18 AM	7/21/2022 9:41:25 AM	N	Fuse - LV	Other - Specify in comments	Fine conditions
INCD-19794-u	1	5994	74	5994	2/10/2021 5:57 00 PM	2/10/2021 7:18:49 PM	N	Fuse - HV	Animal - Bird	Fine conditions
INCD-101789-q	41-R10132	2197	36	4972	1/1/2022 3:15:56 PM	1/1/2022 9:10:42 PM	N	Cross-arm - Failed	Equip - Fatigue	Fine conditions
INCD-128206-q	41-R11626	4356	22	4356	7/7/2022 1:41:24 PM	7/7/2022 4 59:48 PM	N	Conductor - LV Failed	Environ - Weather - High Winds	Wind
INCD-53458-r	41-R1162	4075	25	4075	7/20/2022 4:22 06 PM	7/20/2022 7 05 50 PM	N	Conductor - HV	Equip - Fatigue	Fine conditions
INCD-113381-q	41-R11588	3240	3	3240	3/6/2022 2:23:53 PM	3/7/2022 8:23 06 AM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-95097-q	41-R11626	2646	18	2646	12/5/2021 12:22:18 PM	12/5/2021 2:49:45 PM	N	Cross-arm - Failed	Equip - Decay or Rot	Lightning/ storm
INCD-112957-q	41-R1363	2139	7	2139	3/3/2022 1:17:13 PM	3/3/2022 6 50 00 PM	N	Fuse - HV	Equip - Fatigue	Flood
INCD-44052-r	1	1836	12	1836	1/29/2022 12:06 59 PM	1/29/2022 2:39:48 PM	N	Conductor - LV	Equip - Connection Failed	Fine conditions
INCD-104912-q	41-R1013	1416	12	1416	1/12/2022 11:28 59 PM	1/13/2022 1:26 02 AM	N	Fuse - HV	Animal - Frog	Fine conditions
INCD-117839-q	41-R10133	1052	1	1052	4/13/2022 7:20 00 PM	4/14/2022 12 52:33 PM	N	Transformer - Distrib Failed	Environ - Weather - Lightning	Previous Storm
INCD-69735-q	41-R12164	1020	3	1020	3/22/2021 6:06:40 AM	3/22/2021 11:47:13 AM	N	Transformer Dropper - HV	Equip - Connection Failed	Fine conditions
INCD-84580-q	41-R10133	748	23	1012	8/26/2021 10:38:27 PM	8/26/2021 11:22:35 PM	N	Conductor - HV Failed	Equip - Fatigue	Fine conditions
INCD-63761-q	41-R10132	968	4	968	2/14/2021 7:19:03 AM	2/14/2021 11:21 56 AM	N	Fuse - HV	NF - Likely Animals - Frog	Rain
INCD-84576-q	41-R10133	939	1	939	8/26/2021 7:35:33 AM	8/27/2021 11:34:44 AM	N	Conductor - HV Failed	Equip - Fatigue	Fine conditions
INCD-110312-q	41-R1013	891	9	891	2/16/2022 10:12:22 PM	2/16/2022 11 51 57 PM	N	Fuse - HV	Animal - Frog	Fine conditions
INCD-19618-t	41-R1363	600	3	600	3/1/2021 9:11:32 AM	3/1/2021 12:31 09 PM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-9706-t	41-R10132	564	4	564	9/23/2020 3:42:16 PM	9/23/2020 6 43:15 PM	N	Fuse - LV	Equip - Overload	Fine conditions
INCD-22277-t	41-R11662	473	1	473	4/2/2021 12:09:16 AM	4/2/2021 8:02:15 AM	N	Fuse - HV	Animal - Bird	Fine conditions
INCD-24015-r	41-R1363	414	3	414	8/15/2020 8:23:33 AM	8/15/2020 10:41:22 AM	N	Unknown - No Fault Found	NF - Likely Weather - Lightning	Previous Storm
INCD-66862-q	41-R1363	345	3	345	3/8/2021 5:00:56 PM	3/8/2021 6 55:34 PM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-15411-t	41-R1013	276	2	276	1/5/2021 10:15:21 AM	1/5/2021 12:33:36 PM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-114968-q	41-R1013	270	1	270	3/18/2022 7:01:12 AM	3/18/2022 11:31:17 AM	N	Conductor - LV Service	Veg - Trees in Service	Fine conditions
INCD-14286-t	41-R11588	256	1	256	12/20/2020 7 50:37 PM	12/21/2020 12:06:42 AM	N	Fuse - HV	Animal - Other in comments	Lightning/ storm
INCD-70279-q	41-R1013	253	1	253	3/24/2021 5:48:34 AM	3/24/2021 10:01 09 AM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-45009-r	41-R10132	251	1	251	2/18/2022 6 56 58 PM	2/18/2022 11 07:14 PM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-24152-r	41-R10132	244	4	244	8/22/2020 8:53:57 AM	8/22/2020 9:54:34 AM	N	Cross-arm - Failed	Equip - Decay or Rot	Fine conditions
INCD-59613-q	41-R11626	227	1	227	1/16/2021 11:17:19 AM	1/16/2021 3 04 00 PM	N	Fuse - LV	Environ - Weather - Lightning	Lightning/ storm
INCD-34317-t	1	209	1	209	2/17/2022 8:02:56 AM	2/17/2022 11:31:18 AM	N	Fuse - HV	Animal - Frog	Fine conditions
INCD-1896-y	41-R11588	206	1	206	11/25/2020 6:19:48 AM	11/25/2020 9:45:35 AM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-54113-q	41-R11564	182	1	182	12/15/2020 8:24:47 PM	12/15/2020 11:26:45 PM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-24235-u	41-R10133	175	1	175	11/12/2021 5:47:28 AM	11/12/2021 8:42 09 AM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-33188-t	41-R10133	170	1	170	1/3/2022 5:50:23 AM	1/3/2022 8:40 52 AM	N	Unknown - No Fault Found	NF - Likely Animals - Frog	Fine conditions
INCD-127741-q	41-R1013	152	1	152	7/2/2022 8:00:00 AM	7/2/2022 10:32 00 AM	N	Conductor - LV Service Failed	Equip - Weathered/Decayed	Rain
INCD-134420-q	41-R1013	140	1	140	9/22/2022 5:26:46 PM	9/22/2022 7:46 52 PM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-21276-u	41-R1162	136	1	136	5/15/2021 4 07:20 PM	5/15/2021 6:23:43 PM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-23291-u	41-R11588	133	1	133	9/17/2021 6 57:26 PM	9/17/2021 9:10:36 PM	N	Fuse - LV	Equip - Fatigue	Fine conditions
INCD-63009-q	41-R10133	129	1	129	2/7/2021 6:34:12 AM	2/7/2021 8:43:46 AM	N	Fuse - HV	NF - Likely Animals - Frog	Fine conditions
INCD-38049-r	41-R11565	128	1	128	10/15/2021 7:02:05 AM	10/15/2021 9:10:27 AM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-30047-t	41-R11588	127	1	127	11/21/2021 5:55:26 AM	11/21/2021 8:02 59 AM	N	Unknown - No Fault Found	NF - Likely Weather - Lightning	Previous Storm
INCD-35944-t	41-R1013	118	1	118	3/6/2022 7:17:33 AM	3/6/2022 9:15:26 AM	N	Fuse - HV	Animal - Frog	Flood
INCD-20824-u	41-R1013	116	1	116	4/12/2021 2:35 01 PM	4/12/2021 4:31:20 PM	N	Unknown - No Fault Found	NF - Likely Weather - Lightning	Previous Storm
INCD-19990-t	41-R10133	113	1	113	3/5/2021 4:14:08 PM	3/5/2021 6 07:31 PM	N	Unknown - No Fault Found	NF - Likely Weather - Lightning	Previous Storm
INCD-35180-r	41-R11564	110	2	110	8/17/2021 10:17:00 AM	8/17/2021 11:12 00 AM	N	Cross-arm - Failed	Equip - Decay or Rot	Fine conditions
INCD-41323-r	41-R10133	107	1	107	12/5/2021 11:44 07 PM	12/6/2021 1:31 09 AM	N	Fuse - HV	Animal - Possum	Rain
INCD-7259-y	41-R10133	104	1	104	1/30/2022 6:15:29 AM	1/30/2022 7:59:23 AM	N	Transformer - Distribution	Animal - Frog	Fine conditions
INCD-28583-r	41-R12164	102	2	102	12/9/2020 5:46:32 PM	12/9/2020 6:37 06 PM	N	Fuse - HV	Equip - Fatigue	Fine conditions
INCD-36899-r	41-R11588	99	3	99	10/1/2021 8:34:29 AM	10/1/2021 10:35 04 AM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-30836-t	41-R11625	96	1	96	12/6/2021 4:38 58 PM	12/6/2021 6:14:21 PM	N	Fuse - HV	Environ - Weather - Lightning	Lightning/ storm
INCD-40752-t	41-R10132	83	1	83	4/11/2022 6 50 03 PM	4/11/2022 8:13:44 PM	N	Fuse - HV	NF - Likely Animals - Frog	Fine conditions
INCD-34416-t	41-R1013	25	1	25	2/18/2022 12:10:46 PM	2/18/2022 12:35:49 PM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-31663-r	41-R1013	10	1	10	3/24/2021 10:09:00 AM	3/24/2021 10:19:14 AM	N	Fuse - HV	Environ - Weather - Lightning	Previous Storm
INCD-59299-q	1	0	9024	0	1/15/2021 8:08:34 AM	1/15/2021 8:08:42 AM	N			
INCD-71336-s	41-R12164	0	1	0	1/19/2022 6 04:39 PM	1/19/2022 6:04:40 PM	N			