New Mobile Generation

Business Case

25 January 2024

Part of the Energy Queensland Group

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DOCUMENT VERSION

Version Number	Change Detail	Date	Updated by
1.0	First draft of Ergon's BC for review / comment	20/01/2023	Manager Network Performance
2.0	Second draft with Energex' BC included feedback	16/02/2023	Manager Network Performance
3.0	Amendments based on General Manager Grid Planning feedback and use of mobile generators during the Gold Coast catastrophic storms in end of December 2023 included	11/01/2024	Manager Network Performance
4.0	Approval	12/01/2024	General Manager Grid Planning

RELATED DOCUMENTS

Document Date	Document Name	Document Type
2017	Updating the costs of disasters in Australia https://knowledge.aidr.org.au/media/5506/ajem-33-2-17.pdf	Article
2018	Ergon Energy Networks and Energex Bushfire Risk Management Plan 2019-2020	Plan
2018	Ergon Energy Networks and Energex Flood Risk Management Plan 2019-2020	Plan
2020	EQL Bushfire Mitigation Strategy	Strategy
2020	Climate and Disaster Resilience, CSIRO	Report
2022	State of the Climate 2022, BoM	Strategy
2022	Ergon Energy DAPR 2022, EQL	DAPR
2022	Energex DAPR 2022, EQL	DAPR
2022	www.poweredison.com - Mobile Energy Storage | Power Edison	Web Page
Dec 2022	February – March 2022 Flood Event Cost Pass, Energex	Report
2023	Extreme weather and electricity supply factsheet, AEC and ENA	Report

1 SUMMARY

<table>
<tr><th>Title</th><th>New Mobile Generation</th></tr>
<tr><td>DNSP</td><td>Ergon Energy and Energex</td></tr>
<tr><td>Expenditure category</td><td>☐ Replacement ☒ Augmentation ☐ Connections ☐ Non-Network</td></tr>
<tr><td>Identified need
(select all applicable)</td><td>☒ Legislation ☒ Regulatory compliance
☒ Reliability ☐ CECV ☒ Safety ☐ Environment ☐ Financial
☐ Other
New program to extend Ergon Energy's and Energex's existing mobile generation capabilities to improve the supply reliability of electricity distribution network, natural disaster response and overall community recovery and support our customers during planned and unplanned outages assisting meeting Minimum Service Standards (MSS), as per the Distribution Authorities D07/98 (Energex) and D01/99 (Ergon Energy).</td></tr>
<tr><td>Summary of preferred option</td><td>Ergon Energy: Purchase 6 HV Pegasus units (mobile generators), 2 HV-CTX ("caged transformer"), 10 LV and 6 SWER mobile generators and 6 portable remotely controlled load banks
Energex: Purchase 6 HV Pegasus units (mobile generators), 2 HV-CTX ("caged transformer"), 4 LV mobile generators, 6 portable remotely controlled load banks and one HV trial mobile battery unit</td></tr>
<tr><td>Expenditure</td><td>Ergon Energy Queensland
<table>
<tr><th>Year</th><th>Previous period</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>2025-30</th></tr>
<tr><td>$, direct 2022-2023</td><td>N/A</td><td>$5,931,857</td><td>$7,712,857</td><td>$3,445,000</td><td>-</td><td>-</td><td>$17,089,714</td></tr>
</table>
Energex
<table>
<tr><th>Year</th><th>Previous period</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>2025-30</th></tr>
<tr><td>$, direct 2022-2023</td><td>N/A</td><td>$6,250,947</td><td>$5,398,096</td><td>$2,268,956</td><td>-</td><td>-</td><td>$14,458,000</td></tr>
</table></td></tr>
<tr><td>Benefits</td><td>• Restorations become more effective and efficient.
• More will see faster restoration of power supply during natural disasters and network contingency conditions.
• Communities would experience faster economic recoveries through quicker return of local services to help sustain businesses while reducing social impacts.
• Increased operational flexibility in managing networks during emergency conditions.
• Overall estimated reliability improvement of extended Mobile Generator capabilities</td></tr>
</table>

	• Increased efficiency, productivity and prudency across the business t by being better equipped in planning the future network operations, maintenance and planned program of work. • Support operation of microgrids • Supporting the strategic direction on transition to low-carbon technologies through the acquisition of the first mobile battery storage system, • Supporting Safety Net endeavours in supplying electricity to our customers • Avoided reputational risk • Improved safety benefits for the broader network under contingency, not just only for lines in bushfire and flood risk areas

2 PURPOSE AND SCOPE

The main purpose is to purchase new mobile generators and associated plant to increase capabilities of Energex and Ergon Energy networks supporting planned and unplanned works, hot-weather events, contingency plannings and disaster recovery response.

For both DNSPs it is recommended to purchase six HV Pegasus (mobile generators), two HV-CTX (caged transformer) units and six portable load banks for both DNSPs. In addition, it is proposed to have 14 new LV mobile generators; ten for Ergon Energy and four for Energex.

It is also recommended to purchase six SWER mobile generators for Ergon Energy network and acquire a trial of mobile battery energy storage system (M-BESS) for Energex.

3 BACKGROUND

3.1 Asset Population

3.1.1 Ergon Energy Network

Ergon Energy distributes electricity to approximately 780,000 residential, commercial and industrial customer connections, supporting a population base of around 1.5 million in Northern and Southern Queensland.

The bulk of the electricity distributed enters Ergon Energy's distribution network through connection points from Powerlink Queensland's high voltage transmission network that brings electricity from the major conventional and renewable generation plants. However, Ergon Energy also enables connection of distributed energy resources, such as solar energy systems and other embedded generators.

The Ergon Energy's network is characterised by having:

- 70% of electricity network running through rural Queensland, making it the largest in the National Electricity Market (NEM), with the second lowest customer density per network kilometre.
- A full range of diverse end users with 84% of these customers connected to the network being residential and the remaining 16% related to small to medium industries and businesses.
- 58 connection points with Powerlink's transmission network
- One of the largest Single Wire Earth Return (SWER) networks in the world reaching 64,000km in length, supplying around 26,000 customers predominantly located in western areas of regional Queensland. This unique network operates at three voltage levels: 11kV, 12.7kV and 19.1kV in a variety of configurations such as conventional, duplex, triplex and non-isolated SWER. These systems are supplied through isolating transformers ranged in size between 50kVA and 200kVA.

In summary, Ergon Energy network area covers 1.7 million sq. km, served by 29 bulk supply substations, 259 zone substations and more than 100,000 distribution transformers via power lines with a total length of almost 160,000km consisting of 335 sub-transmission and 1283 distribution feeders.

3.1.2 Energex Network

Energex distributes electricity to over 1.6 million residential, commercial and industrial customer connections, supporting a population base of around 3.8 million in South-East Queensland.

In addition to connection points into Powerlink Queensland's high voltage transmission network, Energex distribution system also enables connection of Distributed Energy Resources (DER), such as solar energy systems and other embedded generators.

The Energex network is characterised by:

- Connection to Powerlink's transmission network via 271 connection points
- High density areas, such as the Brisbane Central Business District (CBD), and the Gold Coast and Sunshine Coast city areas, typically supplied by 110/33kV, 132/33kV,110/11kV, or 132/11kV substations.
- Urban and Rural areas with 110/33kV or 132/33kV bulk supply substations that are typically used to supply 33/11kV zone substation. 132/11kV and 110/11kV large zones substations typically supply high customer density areas such as CBDs and fringes.
- Inner Brisbane suburban areas with extensive older, meshed 33kV underground cable networks that supply zone substation.
- Outer suburbs and growth areas to the north, south and west of Brisbane, which are supplied via modern indoor substations of modular design.
- New subdivisions in urban and suburban areas supplied by underground networks with pad mount substation.

3.1.3 Ergon Energy Mobile Generation

Ergon's Energy existing mobile generator fleet has a modest capacity of approximately 14.3MVA. The current fleet includes 32 Low Voltage (LV) generators ranging in size from 60kVA, able to supply common industrial and commercial plant or as backup generation for offices buildings or homes, up to 500kVA which can supply power to a suburb or medium-to-large sized industrial site. In addition, there are five contained LV mobile 1250kVA units available for planned and unplanned works, five Pegasus 1500kVA HV injection units located in Cairns, Townsville, Mackay and Toowoomba and two 1.25MVA, so called "caged transformers" (HV-CTX) (please refer Attachment 5 to see images of these units).

The Pegasus units are capable of being directly quickly connected to either underground or overhead 11kV or 22kV networks, to supply local townships. Of this fleet, there are several generators currently committed to supplying remote areas of the network. The HV-CTX unit is well designed to support prolonged outages reliving more compact Pegasus units during extended time available for fast and more frequent planned works and natural disaster responses.

Despite a huge SWER network of approx. 800 schemes, Ergon Energy does not have SWER mobile generators.

The HV Pegasus mobile generators, manufactured in our Banyo Workshops, are also designed to support achieving compliance with the 'Safety Net' network security standards, described in Distribution Authority (Clause 10 and Schedule 4). The purpose of the Safety Net security standard is to identify and effectively mitigate the risk of 'low probability but high consequence' network

outages, to avoid unexpected customer hardship and/or significant community or economic disruption.

For the mitigation of Safety Net risks and to increase network resilience on natural disasters, more than 70 HV injection points for the connection of mobile generation into the electricity network have been established.

The lack of available mobile generators is a serious problem in Ergon Energy. During their extended use, for example when providing contingency supply for zone substations, supporting natural disaster recoveries or multiple deployments for planned works, there are no available units either regionally, or across entire network. With the increase of safety driven defect works in Ergon's networks and more severe storm and flood events, in the last few years we have witnessed concerns from Operations field teams in getting mobile generation when needed.

Delivery times largely depends on location of generators and connection site. In terms of mobile plant deployment timing, Pegasus set requires two hours set up and three hours connection, with two hours for disconnection.

3.1.4 Energex Mobile Generation

The current Energex' fleet includes 51 mobile generators, with a total capacity of 23.8MVA. This includes five HV generators of 1250kVA capacity (11kV connection), as the range of remining 46 LV units varies between 60kVA and 500kVA. Majority of 500kVA LV units are located in Brisbane, three 150kVA units are in Geebung, as smaller 60kVA units are located in other SEQ locations.

Note that the LV generators are directly connected to the network via connected straight onto the overhead or pad-mount/ground transformer (busbars). The HV generators are connected to the overhead HV networks or HV EDO's (Expulsion Drop Out fuses). Underground connections are through a spare switch on a RMU. Both LV and HV generators are positioned at a maximum of 25 metres from the connection points (maximum length of the cables).

Generally, generators are kept at the towing service providers' yards for faster dispatch. Delivery time for metro areas is typically one hour and 2-3 hours to non-metro areas.

Figure 1 – Deployment of LV mobile generator

Figure 2 – Pegasus mobile generator at the site

3.2 Asset Management Overview

In managing its current and future assets, Energex and Ergon Energy must balance between regulatory obligations for safety, customer power quality, customer reliability and security. At the same time, Energex and Ergon Energy are managing risk mitigation associated with personnel and customer safety, bushfire, flood and asset condition. In addition, our DNSPs are preparing the network for the unprecedented adoption of new and disruptive technology by customers.

The National Electricity Objective (NEO) as stated in the National Electricity Law (NEL) is:

> "to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to:
>
> - price, quality, safety and reliability and security of supply of electricity
> - the reliability, safety and security of the national electricity system."

In accordance with the NEO, as well as the Best Practices and Asset Management Policy, Strategic Asset Management Plan and Investment Processes, to maximise value from assets, Energex' and Ergon Energy's primary investment objective is to prudently and efficiently plan and deliver long-term operational and capital expenditure, keeping pressure off customer prices and achieving balanced commercial outcomes for a sustainable future.

The main purpose of mobile generators is to increase disaster response capabilities of Ergon Energy and Energex. In addition, existing generators are used to support variety of planned works across large network, unplanned interventions, hot weather events and contingency plans. These HV Pegasus units are in very high demand, especially to support planned safety driven defect rectification works on networks. In the 2017-2022 period, Energex' and Ergon's generators have been deployed 12,099 times. Since 2020 the demand is increasing due to extensive works on the networks and supporting communities during severe weather events impacted by La Nina cyclic atmospheric phenomena.

With extensive planned works in the future, it is expected that existing modest fleet of mobile generation will be extensively utilised. Given the extensive deployment and utilisation of these units, it is recommended to increase the number of HV and LV mobile generators and HV-CTX units, and also add alternative solutions utilising new technologies in our networks, such as SWER mobile generators, portable remotely controlled load banks and the trail of mobile battery energy storage system.

4 IDENTIFIED NEED

4.1 Problem Statement

The main problem that the investment is trying to solve is related to the lack of mobile generators to provide timely support across Ergon and Energex networks to planned works, unplanned outages, disaster response (cyclone, flood and bushfire), hot weather events and contingency plans.

By purchasing first portable remotely controlled load banks, the investment will help improving stability of generator operations in the areas with high penetration of PV systems.

As there are no SWER mobile generators, Ergon's proposal will assist in supporting customers connected to weak rural networks.

With additional mobile plants, this investment will release opportunity to reduce duration of power supply interruptions during planned (network and customer connection projects) and unplanned events, during network outages in the areas impacted by natural disasters and support Energex and Ergon networks during contingency conditions and the shortfall of capacity.

4.2 Compliance

The two main legislative compliances related to this Program are specified in Ergon Energy Distribution Authority No. D01/99 (amended in November 2018). Clause 9 sets principles of Minimum Service Standards (MSS), as Clause 10 specifies criteria for application of Safety Net targets.

4.2.1 Minimum Service Standards

The purpose of MSS is to provide a standard against which the distribution entity's performance, by feeder type, will be assessed across its supply network, as per:

> (a) the distribution entity must use all reasonable endeavours to ensure that it does not exceed in a financial year the following MSS:
>
> (i) SAIDI limits; and
>
> (ii) SAIFI limits,
>
> (b) Exceedance of the same MSS limit (i.e. SAIDI limit or SAIFI limit) three financial years in a row is considered a "systemic failure" and constitutes a breach of the distribution authority.

4.2.2 Safety Net

The purpose of the service safety net is to 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. The distribution entity will ensure, to the extent reasonably practicable, that it achieves its safety net targets as specified in its Distribution Authority.

4.3 Discussions with customers

4.3.1 Summary of the Queensland Household Survey 2023

The Queensland Household Energy Survey (QHES) tracks customer perceptions and overall attitudes to electricity prices and power supply reliability, as well as energy use and energy efficiency behaviours, and interest in emerging energy-related technologies.

The QHES electricity sentiment from our customers states that:

- Safety should never be compromised – and it is an area where we could be 'smarter'.
- Electricity affordability remains a concern for many customers – both from a cost of living and a business competitiveness perspective
- Our customers want clear and concise information to help them make informed choices around their energy solutions and options available to manage energy costs.
- Our customers and communities value how we go about keeping the lights on, especially our response to severe weather events and other natural disasters.
- Interest in renewables and growing concerns around climate change is fuelling customer and

community expectations around the transition to a low carbon economy.
- The economic environment continues to bring 'energy inclusion and customer vulnerability' and 'economic resilience and jobs' to the foreground.

4.3.2 A Secure Supply – Keeping the Light On - Emergency Response

Queenslanders know that storms, cyclones, bushfires, floods and other disasters are beyond anyone's control. Customers' feedback on the natural disaster events we responded to continues to show we respond well when these events occur and that our contribution is important to communities in getting them back with their day-to-day lives quickly.

More than 240,000 customers lost power during the major floods and associated severe storms that occurred in Brisbane and across southern Queensland in early 2022. At its peak more than 57,000 customers were without electricity supply at any one time. Also, in Christmas night in December 2023 more than 130,000 customers were affected by severe storms on the Gold Coast. In response, Energex and Ergon Energy Network field crews and support teams were mobilised and worked tirelessly to safely restore network supply to all customers who could be safely reconnected. For example, during restoration works on the Gold Coast all available mobile generators have been immediately deployed at more than 50 sites across securing supply to approximately 4,000 impacted customers.

Despite the ongoing impact of natural disasters across the network, 61% of participants in the 2022 Queensland Household Energy Survey indicated they have a positive sense of security around their electricity supply.

The second phase of the Thriving Communities Partnership Queensland Chapter's Disaster Planning and Recovery Collaborative Research Project, which has built on the national virtual roundtable in late 2020, strengthened our understanding of the relationship between the experiences of individuals, first responders and front-line service providers. The research highlights the 'gatekeeper' role electricity plays to:

- action before and after a disaster
- how the communications across the journey influence response and recovery and
- provides a range of other insights.

During heatwaves and sustained hot weather events affecting especially southern regions of Queensland (typically in January and February), mobile generators are also required to support the shortage of capacity in some parts of the networks. Although distribution networks are designed and built to manage these low probability, high load hot days, there are pockets in the networks, where there is a need for standby mobile generators to manage loads during extreme hot days.

In growing high impact weather events, effective use of mobile generation becomes more critical, in parallel with continuous and transparent engagement with the local communities and customers. Efforts in the use of mobile generation in the areas affected by natural disasters are well accepted and recognised by communities, customers, local councils and the Queensland Government. Examples of messages of thanks from the Shareholder Ministers, Mayors and other organisations and positive media regarding Ergon's response efforts for bushfire, flood and cyclone events are included in Attachment 5.

These responses demonstrate the value that customers and stakeholders place on speedy power supply restoration and, by implication on funding any activities to improve response efforts.

4.3.3 A Secure Supply – Keeping the Light On – Reliability

General perceptions of Queensland's energy supply have continued to improve, with most customers agreeing that they have a reliable supply of energy.

Growing year-on-year, 70% of survey participants agreed they were provided with a 'reliable energy supply'. Sentiment that price and reliability are well balanced has also continued to increase in the 2023 Queensland Household Energy Survey.

Power outages have immediate customer and broader economic impacts. The quality of supply is also important to some customers. Some, however, especially those in the more rural and remote areas of our network, consider they are poorly serviced.

4.4 Counterfactual analysis (Base case)

4.4.1 Summary

The counterfactual arrangement to continue spending at previous levels for mobile generation fleet of Ergon Energy and Energex means there will be no upgrades, improvements and new units until end of this decade. All investments will be limited to maintaining and operating existing fleet of HV and LV mobile generation units, with no new units, no SWER mobile generation and load banks vital in supporting operation of mobile generation in the areas with high penetration of solar rooftop PV systems.

4.4.2 Deployment Trends – Ergon Energy

With only five HV and 32 LV mobile generators, and no SWER mobile generators and load banks to support operation of mobile generators in the areas with high penetration of PV systems, Ergon's capabilities to respond quickly and efficiently during planned, unplanned and emergency events in the networks are extremely limited. As an indicator, in the last five years total deployment rate of mobile generators in Ergon's networks was 3260, or on average 543 deployments per annum (Figure 3). With this rate, on average each of existing mobile generators was deployed 68 times annually since the calendar year of 2017.

Comparing planned and unplanned deployments of mobile generators, typical annual ratio is 9:1. So low unplanned use of mobile generators is expected given the unpredictable nature of unplanned outages and limitations in the quantity, locations and deployment times of units to support customers affected by unplanned interruptions.

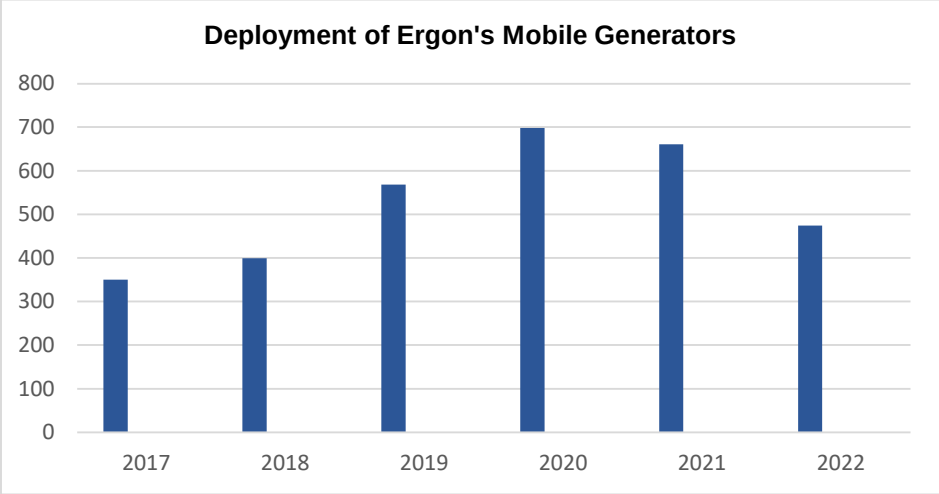


Figure 3 – Deployment of Mobile Generators in Ergon's Networks

4.4.3 Deployment Trends – Energex

As in Ergon's, the dominant use of mobile generators in Energex is in supporting planned outages.

For example, of 1,560 deployments in 2021, only 108 have been associated to unplanned deployment. Note that only LV generators are deployed during unplanned events. At the same time, four 500kV LV units and three HV 1250kVA generators were connected at Kilcoy Zone Substations to support loads during contingency conditions and planned works. Two HV sets were also deployed for Stradbroke bushfire contingency with additional of 4x500kV LV units during 2021 and 2022.

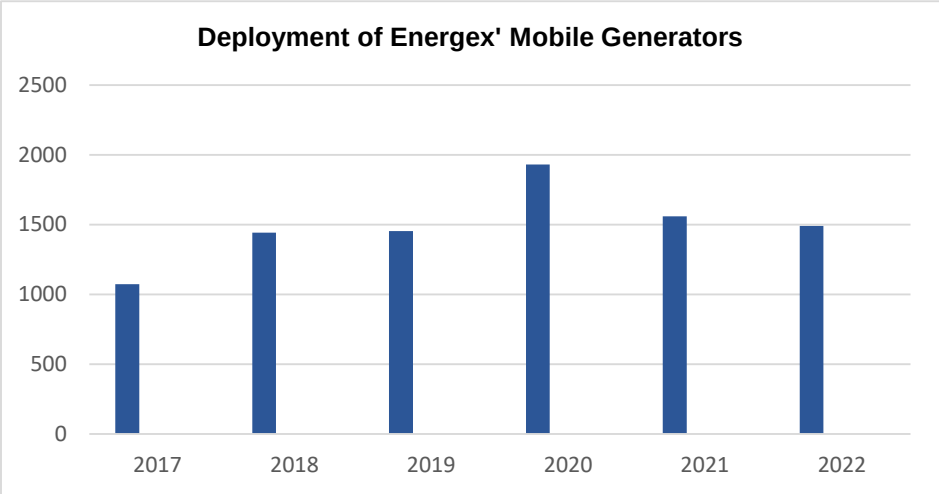


Figure 4 – Deployment of Mobile Generators in Energex' Networks

In 2022, there were 1330 planned and 168 unplanned deployments (no HV deployments for unplanned) with an average running time of 7 hours and 29 minutes. On that basis, considering capacity of one HV mobile generator and on average 250 served customers, estimated saving for the running time of 7.5 hours is approximately 110,000 customer minutes.

4.4.4 Lost Customer Minutes – Ergon Energy

Based on 2017/18-2021/2022 analysis of network reliability performances, Ergon network was impacted by 105,013 planned and 129,219 unplanned outages, resulted in the total loss of almost 1.5B customer minutes (Figure 5) and more than 1.85 million customer interruptions. Note that in the year of 2021/22, Ergon network was severely affected by the impact of cyclic atmospheric-oceanographic phenomena La Nina, which is evident in the trends of unplanned lost customer minutes.

In terms of Energy Not Supplied (ENS), based on the EB RIN 2021/22 (section 3.6.2) total ENS was >15.3GWh (~7GWh due to PLN and ~8.5GWh UNPL events), 10 feeders having ENS>100MWh.

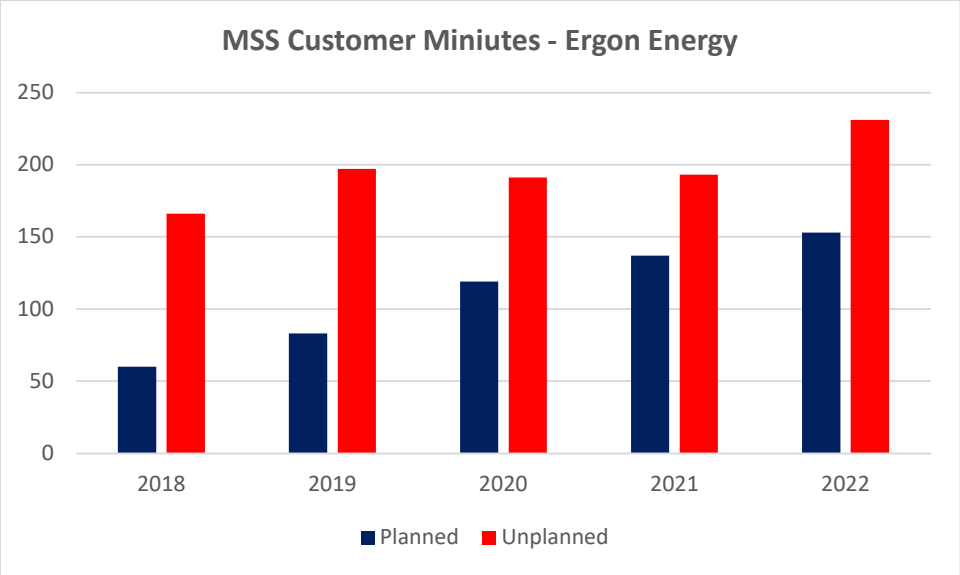


Figure 5 – MSS Customer Minutes in Ergon's Networks (in millions)

4.4.5 Lost Customer Minutes – Energex

Based on 2017-2022 analysis of network reliability performances, Energex network was impacted by 77,081 outages resulting in almost 800 million of lost customer minutes. Approximately 40,000 outages were related to planned and the rest of 37,000 to unplanned events.

However, comparing planned and unplanned customer minutes and customer interruptions, contribution of unplanned events is on average two times greater. For example, in 2022 characterised by the highest lost customer minutes since 2017 (mostly associated with the impact of atmospheric-oceanographic phenomena La Nina), of 185 million lost customer minutes 132 million were caused by unplanned outages (Figure 6). This is an indication of well organised management of planned works, as on other the side of severity of predominantly weather driven unplanned events.

From customer interruptions perspective, comparison is even more indicative, with unplanned outages typically exceeding planned events by several times.

From the perspective of Energy Not Supplied (ENS), Energex' ENS in the 2021/22 FY was ~6.6GWh (~2.3GWh due to PLN and ~4.3GWh UNPL events). On feeder levels, there 70 feeders with total ENS between 10 and 78MWh.

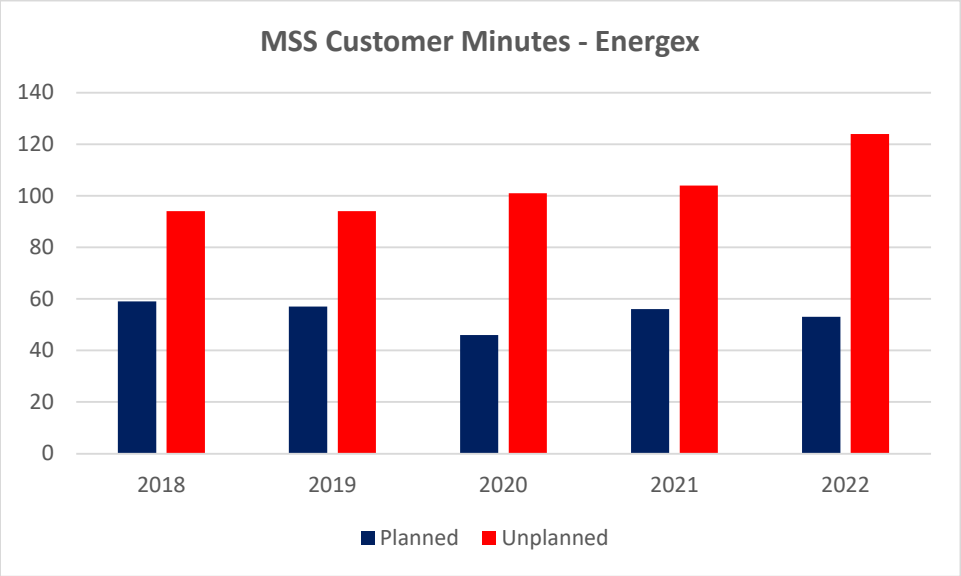


Figure 6 – MSS Customer Interruptions in Energex' Networks (in millions)

4.4.6 SWER Customers

Ergon Energy provides supply to regional Queensland, where there are almost 800 SWER schemes with more than 25,000 rural customers. It is one of the largest SWER networks in the world, with some of the SWER schemes with total length of approximately 1,000km. Operating such networks and maintaining good reliability and power quality performances of these networks, including timely restoration of supply, is one of the biggest challenges in Ergon Energy. This is additionally complicated as in Ergon Energy, there are no mobile generators for SWER networks.

For SWER networks, counterfactual scenario means practically no use of mobile generators to support restoration works in rural Queensland. From MSS perspective, contribution of SWER schemes is typically low, approximately 0.2%-0.3%, or over 220,000 lost customer minutes, and more than 1,000 customers interrupted (as in example of MSS performances in the Southern networks of Ergon, recorded in 2021/2022).

4.4.7 Load Banks and Solar PV Systems

Load banks are essential to ensure mobile generator continuously perform to required engine kW, which is required in the areas with high penetration of PV systems and frequent voltage distortions of special importance. A load bank develops an electrical load and serves to test and verify generator's rated output capabilities before it is deployed. A load bank "mimic" the real load a generator would see during an actual use scenario. The devices have different levels of load, which allows critical systems to be tested under a variety of conditions.

A novel use for load banks is also for renewable energy sources. Solar PV systems changes the shape of daily energy demand with the dip in the curve caused by lower energy demand at the time of the day because of domestic solar supplying household electricity needs (a "duck curve", Figure 7). Starting and stable operating mobile generators in such areas is one of the new challenges for mobile plants caused by renewables. As load banks produce an electrical load, they serve as

"moderators" for uninterrupted and stabilised operation of mobile generation in the areas with a high penetration of PV systems.

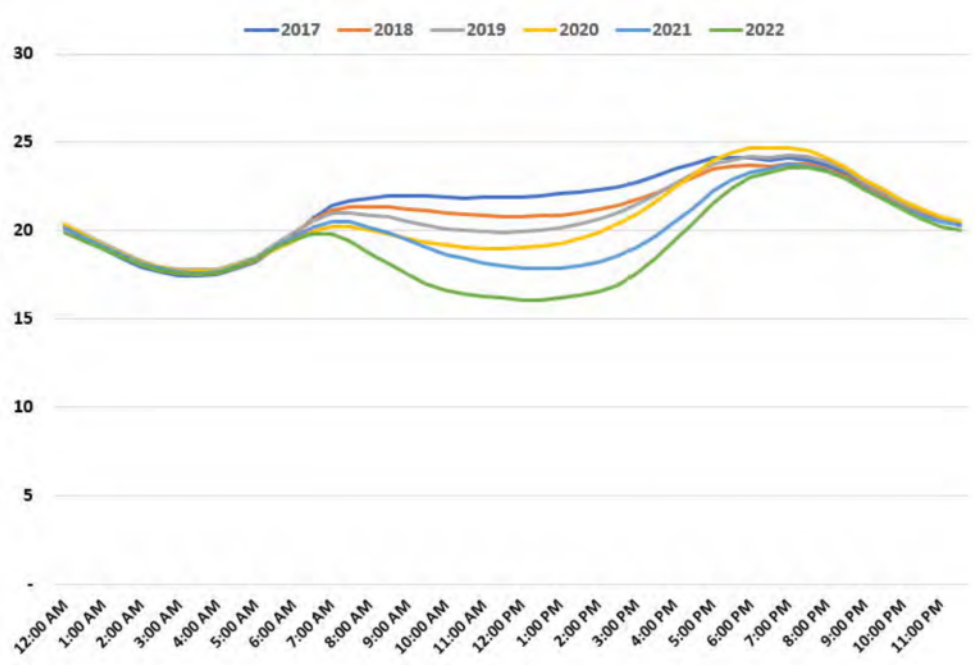


Figure 7 – Changes in demand by time of day in November since 2017

In EQL there are only three portable load banks located in Cairns (1MW) and Brisbane (500kW and 850kW). Mobile generators located in the five northern areas of Ergon Energy are served by single load bank in Cairns, as two Brisbane located load banks support operations of mobile generators in six Ergon's southern and six Energex' South-East Queensland areas. Considering the volume of rooftop PV systems in Ergon Energy's network (more than 216,000 by end of June 2022, with an average inverter capacity of around 4.8kVA), under counterfactual scenario there will be no load banks required for testing of the generator system's capabilities, commission, maintain and verification, as well as to support operation of existing fleet in the areas with high penetration of PV systems.

4.4.8 Future Climate

One of the riskiest aspects of the counterfactual arrangement (continue spending at previous levels) is climate change outlook, trends, and no historical spends in Ergon Energy in this category for any upgrades of existing mobile generators and new units.

As stated in the BOM State of the Climate 2022, new research in Australia and around the world, together with the IPCC's Sixth Assessment Report, enhance understanding of the state of Australia's future climate. In coming decades, Australia is projected to experience:

- Continued warming, with more extremely hot days and fewer extremely cool days.
- A further decrease in cool season rainfall in many southern and eastern regions
- Longer periods of drought on average in the south and east

- A longer fire season for the south and east, and an increase in the number of dangerous fire weather days
- More intense short-duration heavy rainfall events, even in regions where the average rainfall decreases or stays the same. This will lead to a complex mix of effects on streamflow, and associated flood and erosion risks, including increased risk of small-scale flash flooding.
- Fewer tropical cyclones, but a greater proportion projected to be of high intensity, with ongoing large variations from year to year. The intensity of rainfall associated with tropical cyclones is also expected to increase and combined with higher sea levels, is likely to amplify the impacts from those tropical cyclones that do occur
- Fewer east coast lows on average, particularly during the cooler months
- Ongoing sea level rise through this century and beyond, at a rate that varies by region. Recent research on potential ice loss from the Antarctic ice sheet suggests that a scenario of larger and more rapid sea level rise can not be ruled out
- More frequent extreme sea levels linked to coastal inundation and coastal erosion.
- Continued warming and acidification of surrounding oceans with consequent impacts on biodiversity and ecosystem processes
- Increased and longer-lasting marine heatwaves, which will further stress marine environments, such as kelp forests, and increase the likelihood of more frequent and severe bleaching events in coral reefs around Australia, including the Great Barrier Reef and Ningaloo Reef
- An increase in the risk of natural disasters from extreme weather, including ‘compound extremes’, where multiple extreme events occur together or in sequence, thus compounding their impacts.

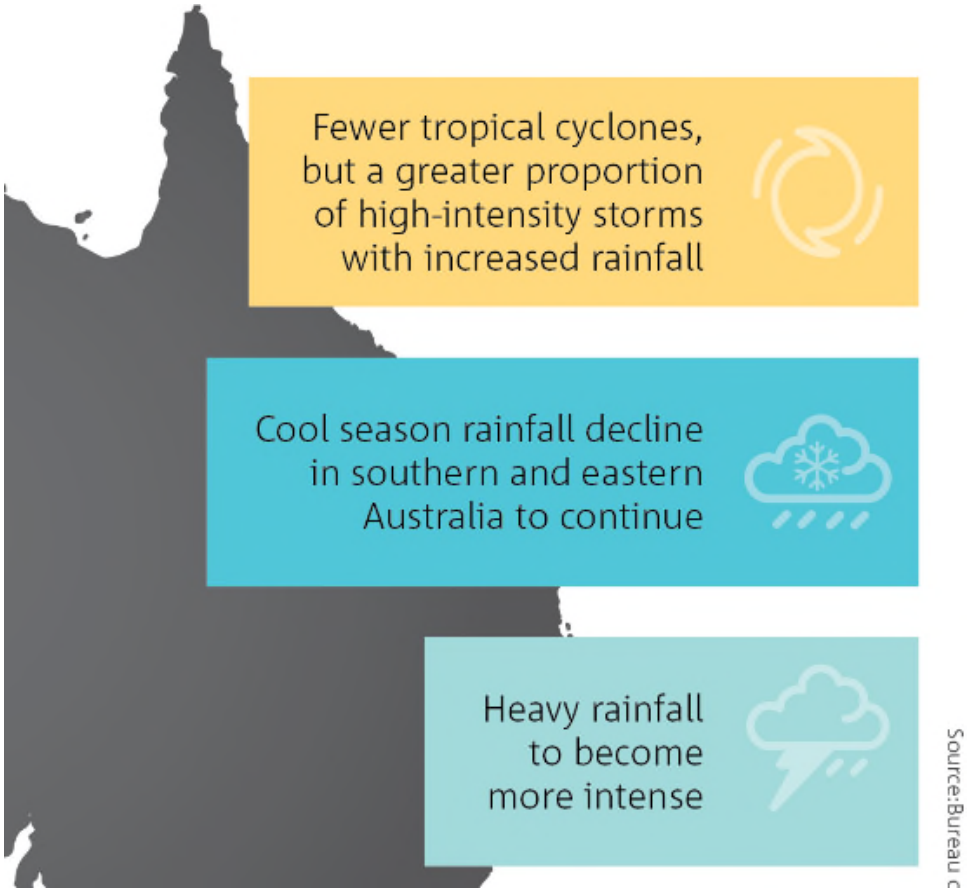


Figure 8 – Future climate projections for Queensland

(BOM-State of the Climate 2022)

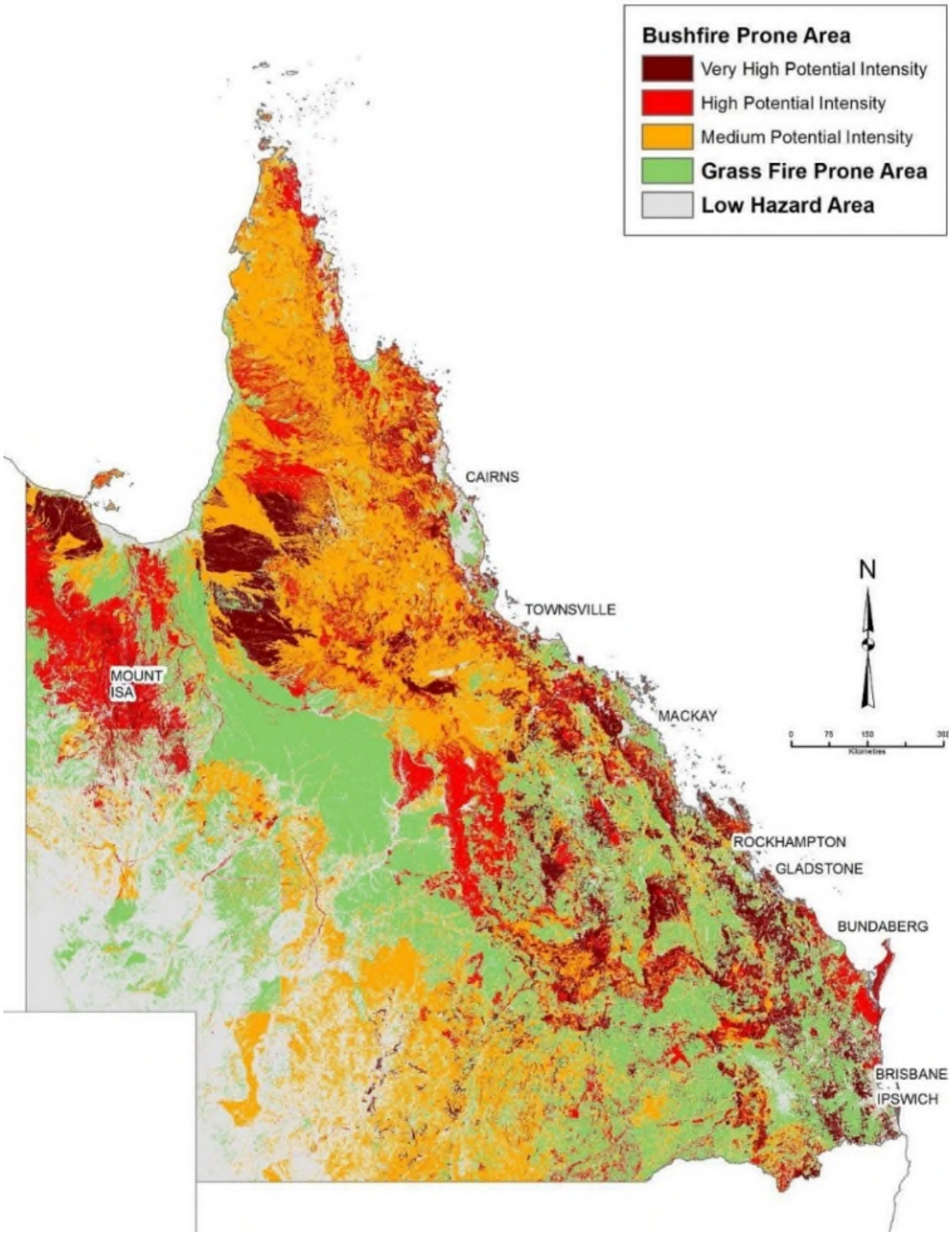


Figure 9 – Bushfire and Grassfire Prone Areas with Low Hazard Areas Ergon for Queensland

4.5 Networks in Bushfire and Flood Risk Areas

Since 2011, Queensland has been hit by more than 80 significant natural disasters resulting in significant power losses. Electricity supply is vital for community response and recovery in the aftermath of a disaster. Everything from disaster response coordination, communication, public lighting and safety, as well as the provision of health services, basic household operations and the economic recovery of our communities, relies on electricity to function effectively. This dependency, coupled with the vulnerability of electricity networks to a range of natural disasters, highlights the need to establish extended capabilities of Ergon's mobile generation.

The nature of electricity, as an essential community service, coupled with the vast geographical reach of our network and the number of Queenslander's who depend on us to power their lives, reinforces the critical need to enable faster disaster response and support the economic and social recovery of our communities. Due to limited number of existing mobile generators (only five HV Pegasus units) the resilience of Queensland's electricity distribution network, particularly in regional areas, can be greatly improved through the expansion of mobile generation capability for Ergon Energy and Energex.

Many of Queensland towns and cities are supplied by power lines located predominantly in the areas with high bushfire and flood risks. These feeders require the application of best practice asset management strategies to ensure the safe and reliable operation of our networks. The key components of our strategies are to ensure the safety of the community in the event of network fault, manage and minimise the risk to neighbouring assets, improve response times to outages and maintain customer supply to facilitate community recovery efforts following an event.

4.5.1 Ergon's High-risk Feeders

As noted, Ergon's distribution networks are complex, long and spread across vast rural areas of our state. More than 60% of Ergon's feeders belong to Long Rural (LR) and Short Rural (SR) categories (with the backbone length longer than 200km), as SR feeders provide supply for almost 70% of Ergon's customers. Some of the feeders with SWER schemes have total length even more than 1,000km.

In total, 797 Ergon feeders have been identified as having a measure of bushfire risk. Based on the natural disaster feeder risk categorisation, 135 distribution feeders (10.5%) have >10% of their total length categorised for bushfire risk rating with estimated more than 20,000 customers directly impacted. Some of the feeders in Mackay, North Queensland and Capricornia regions have risks >50%, as at the same time, there are lengths of feeders exposed to bushfire risks greater than 60km (e.g. Waterpark feeder in Yeppoon).

From a network reliability performance perspective, in the period 2017/18-2022/23 (based on the state on 31/12/2022) Ergon's distribution electricity networks have been impacted by 234 events reported in Outage Management Systems as "Fire-External". Outages impacting more than 10 customers have been analysed. They resulted in the loss of 12.6M customer minutes (0.75% of total lost CMIN during that period) and more than 48,000 customers impacted.

In regard to flood risk, there are 568 feeders classified as at risk from flood, with some of them also at risk of bushfire. as 294 feeders (23%) have >10% flood risk. Almost 3,600km of power lines, supplying ~40,000 customers, are exposed to flood risks, which is approximately 11% of the total length of feeders at flood risk.

In the period of 2017/18-2022/23 (YTD 31/12/2022), there were 107 events reported as flood related outages impacting >10 customers, with the loss of 8.7M customer minutes (0.51% of total CMIN) and approximately 20,000 customers affected.

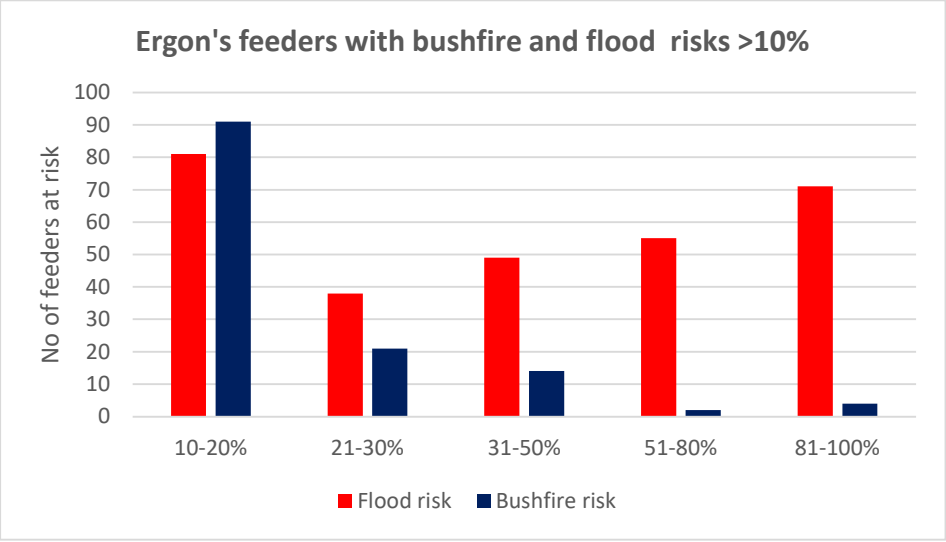


Figure 10 – Ergon's feeders with flood and bushfire risk greater than 10%

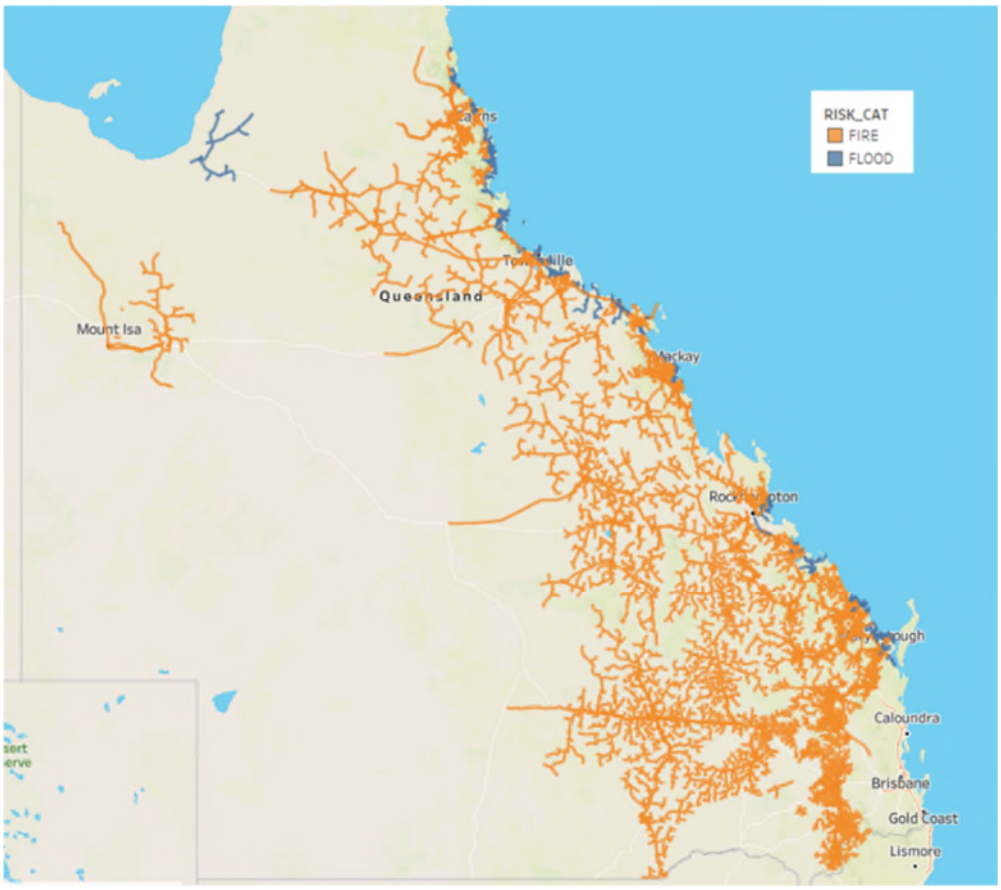


Figure 11 – Ergon distribution powerlines at risk of fire and flood

4.5.2 Energex' High-risk Feeders

Energex' distribution feeder flood risks profile is very much different compared to Ergon's, dominantly due to shorten lengths, higher feeder densities around the main river courses and specific categorisation especially of feeders in the CBD of Brisbane all exposed to extreme flood risks recorded typically in the periods of approximately 10-15 years. In Outage Management Systems feeders in the CBD are separated by switching zones, consequently presenting one feeder with numerous codes associated with numbers of switching units. In result, the list of Energex' feeder segments with flood risk of 100% exceed 1,100.

In 2022 due to the impact of La Nina phenomena, Brisbane was hit even twice in a short period of time. Over a 14-day period, South-East Queensland experienced an unprecedented severe weather event which delivered prolonged intense rainfall throughout the region and resulted in significant flooding, amounting to a natural disaster on a scale in some areas which has never been seen before. This event cause major damage to and / or destruction of a large number of network assets, including substations, transformers, powerlines and pillars across Energex' distribution network, and resulted in over 246,000 customers losing electricity supply.

The severity of the flooding is demonstrated in the Figure 12 which shows the summation of average duration of minutes of supply interruptions experienced by customers, including major event day and other exclusions, relative to previous large events.

Figure 12 – Average duration of minutes of outages, including major event day and other exclusions in Energex' networks (2013-2022)

Regarding bushfire risk, again using the same codification of Energex' feeders, 117 feeders/sections have been classified with the risk of 100%. It means that full lengths of these feeders are exposed to bushfire risk. Note that the lengths at 100% risk are short, in average approximately 220m.

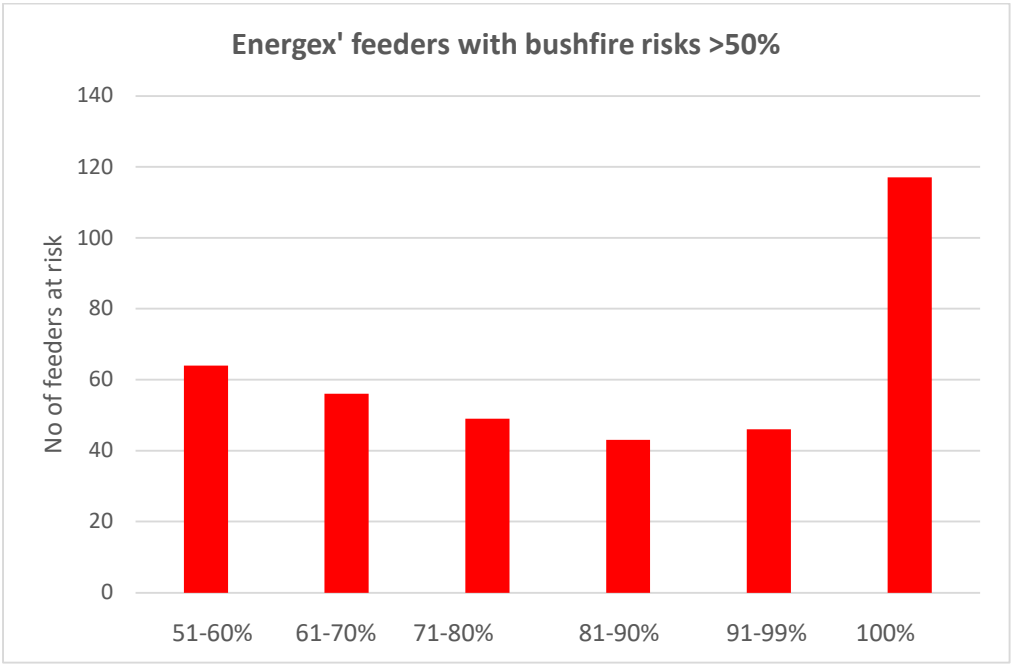


Figure 13 – Energex' feeders with bushfire risk greater than 50%

4.6 Risk Analysis

The practice of deploying mobile generators has provided valuable when responding to emergency conditions and to provide relief on the network where performance limits are threatening to exceed regulated MSS targets.

However, with the current state of generation fleets in both DNSPs and their over-utilisation operationally, Ergon and Energex can only continue to provide limited support to a restricted number of customers. To answer this demand, Pegasus / HV mobile generators are required to be placed permanently on standby, for which the equipment was not specifically designed for.

Therefore, the main risks associated with not progressing with the Project are:

1. Sustained and continued power supply interruptions will be experienced by customers in natural disaster areas across the state due to the lack of HV injection points and additional mobile generation to aid them
2. Currently there are five Ergon's Pegasus units available state-wide, three located in Cairns and one in Mackay and Toowoomba. The journey time to deploy the units to site can be significant, depending on the departure depot where the units are required within the state and their accessibility during a natural disaster. Pegasus units can be transported at speeds between 70-75 km/h on average. This transportation speed estimate is significantly reduced where access through natural disaster areas becomes impeded. Transporting these units across long distances, requires adherence to strict legislation for drivers of Heavy Vehicles, which includes compulsory rest periods, which in-turn exacerbates delays in deploying our currently limited fleet.
3. Due to long distances typical for Ergon's networks sometimes more than 12 hours can elapse, from the request for a unit, until its arrival at the required location. This is followed by a 3–6 hour set up time. Most emergency response timeframes require a Pegasus unit to supply <1MVA within the timeframe of 48 hour in rural areas. Deployment is possible anywhere in the state using this timeframe. Increasing the number of generator units, positioned at strategic locations, can reduce deployment time and improve power restoration timeframes. Reducing transportation delays can reap significant benefits for communities impacted by disasters and otherwise facing prolonged power outages.
4. The alternative to purchasing an additional CTX unit is to hire mobile generators. This has significant implications for deployment times and presents as a lost opportunity for increased efficiency, as follows:
    a. Customised CTX will be kept with their Pegasus Units and travel together for simple deployment
    b. Purchased CTX unit can be customised to allow for faster installation and connection to the network - 3-6 hours as opposed to 8-12 hours of hire generators
    c. Rental generators are limited by hire companies by their location and availability is not guaranteed
    d. A larger fleet of generators provides additional operational flexibility in planning and operating networks during emergency conditions, as well as builds additional resilience to better support Queensland communities.
5. Increased demand for large 1250kVA generators has further increased the potential risk of a suitable unit being available to provide disaster support, as they are increasingly being utilised to support operational requirements. For example, periodically one or more Pegasus units are required for very long periods of time, to provide power supply to remote and

isolated areas (such as Thursday Island), while addressing catastrophic failure of existing diesel power stations.

6. Our existing fleet of Pegasus mobile generation is ageing and will require significant refurbishment works in the coming years, further adding to the risk of a unit being out of service for extended times. In particular, the two units located in Mackay and Toowoomba which serve our networks in Central and Southern regions of Queensland (Figure 14), are at increasing risk of becoming unserviceable and not being available for deployment when required.
7. The continued exceedance of unplanned network performance limits, significantly exacerbated by a multiplication effect with poor weather, adds further risk. The current system requires solar support which incurs additional performance degradation, while at the same time, making the network susceptible to higher outage rates
8. Tying up a Pegasus emergency response unit for network support work during 2020-2025 regulatory period. Limited availability of these units has shown to delay the restoration of power supply during emergency conditions
9. The additional ongoing support costs that are incurred over a three- to five-year deployment of a unit to maintain / repair equipment which is not designed for long-term standby operations.

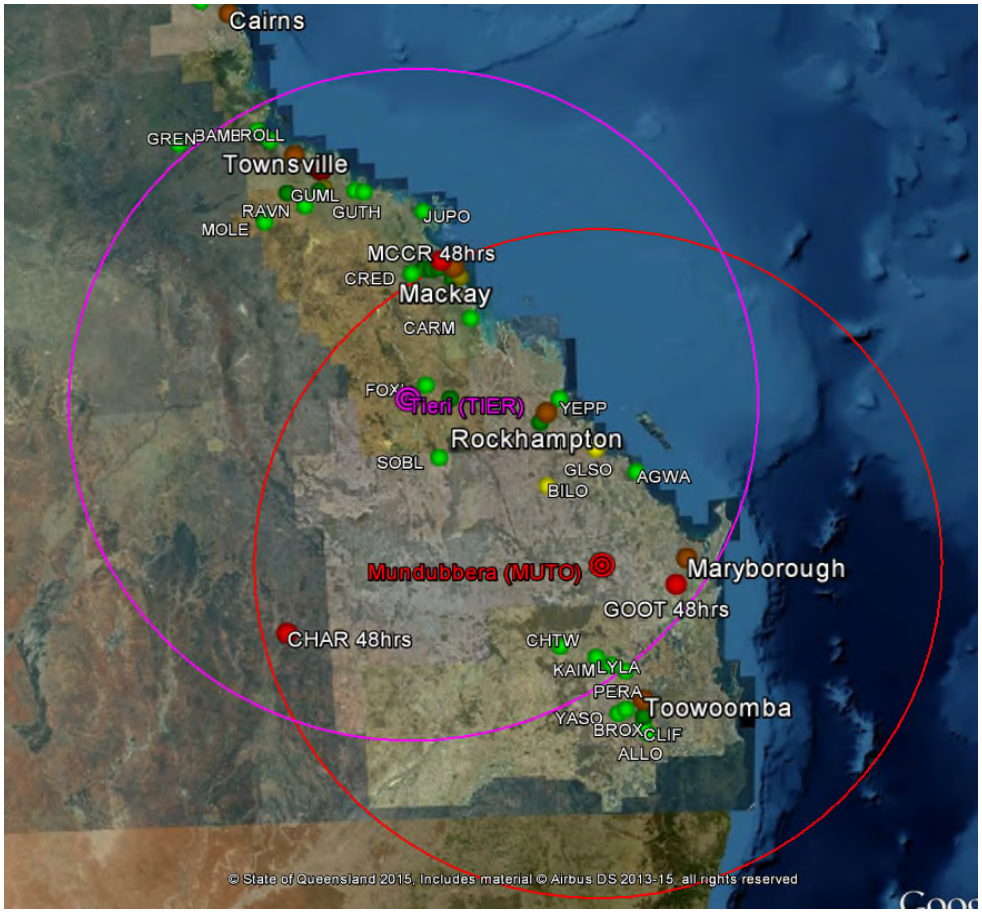


Figure 14 – Deployment area of two mobile generators located in Mackay and Toowoomba

A risk assessment based on different “Natural Disaster” risk scenarios has been conducted using the EQL Network Risk Assessment Framework. The current level of risk to both networks is moderate and multiple impacts are further described in table below.

Table 1 Current Residual Risk

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score
Natural disaster (bushfire / flood) impacts distribution area resulting in an interruption to customer supply of > 12 hours	Customer	3 *(> 12 Hours)*	4 *(Likely)*	***12 (Moderate)***
Natural disaster (bushfire / flood) impacts distribution area resulting in an interruption to >5,000 customers	Customer	3 *(5,000 Customers)*	4 *(Likely)*	***12 (Moderate)***
Natural disaster (bushfire / flood) impacts distribution area resulting in disruption to essential services (e.g. hospitals, sewage etc)	Customer	4 *(Interruption to essential services)*	4 *(Likely)*	***16 (Moderate)***
Natural disaster (bushfire / flood) impacts distribution area resulting in inability to remotely control an Ergon substation	Business	3 *(Inability to remotely control Ergon substation)*	4 *(Likely)*	***12 (Moderate)***
Natural disaster (bushfire / flood) impacts distribution area leading to the hire of mobile generation units and a significant impact on restoration equating to business impact >$500,000	Business	3 *(Significant impact on restoration equating to business impact >$500,000)*	4 *(Likely)*	***12 (Moderate)***

5 OPTIONS ANALYSIS

5.1 Option 1

5.1.1 Summary

Option 1 recommends an increase of mobile generation fleet of Ergon Energy and Energex by 6 HV Pegasus, 2 HV-CTX and 6 load banks, with LV mobile generators of 10 for Ergon and 4 for Energex considered. In addition, this option proposes to have six SWER mobile generators are specific to Ergon, and the trial of the first HV mobile battery unit in Energex' networks. Total estimated cost of Option 1 is $17.9m for Ergon, and $14.5m for Energex.

5.1.2 Assumptions

The last time mobile generators had been purchased in Ergon's and Energex' networks more than ten years ago. There are no recent cost estimates and, to get reasonable accurate unit costs, old specifications from Mobile Generation department and Banyo Workshop (for Pegasus and CTX) and market prices (for LV and SWER mobile generators, Load Banks and mobile battery unit) have been obtained. Operating and maintenance costs are projected at 2.5% of CAPEX, and fuel cost $2/litre.

5.1.3 Costs

Table 2 Cost overview for Option 1

NPV		Year 1 [2025/26]	Year 2 [i2026/27]	Year 3 [2027/28]	Year 4 [2028/29]	Year 5 [2029/30]
CapEx	Ergon	$5,931,857	$7,712,857	$3,445,000	$0	$0
	Energex	$6,250,947	$5,398,096	$2,268,956	$0	$0
	Total (EQL)	**$10,097,150**	**$15,958,334**	**$5,545,000**	**$0**	**$0**
OpEx	Ergon	$150,471	$350,686	$440,291	$440,291	$440,291
	Energex	$105,562	$318,846	$371,823	$371,823	$371,823
	Total (EQL)	**$256,033**	**$669.532**	**$812,114**	**$812,114**	**$812,114**
TotEx	Ergon	$6,082,328	$8,063,543	$3,885,291	$440,291	$440,291
	Energex	$6,356,509	$5,716,942	$2,640,779	$371,823	$371,823
	Total (EQL)	$12,438,837	$13,780,485	$6,526,070	$812,114	$812,114
Benefits	Ergon	**$321,114**	**$1,412,902**	**$1,926,685**	**$1,926,685**	**$1,926,685**
	Energex	**$253,809**	**$1,522,852**	**$1,607,455**	**$1,607,455**	**$1,607,455**
	Total (EQL)	**$574,923**	**$2,935,754**	**$3,534,140**	**$3,534,140**	**$3,534,140**

5.1.4 Benefits

Understanding customer and network benefits and contribution of mobile generation in the business economics is a complex matter. It is a subject of many variables, like location and the nature of the fault, number of impacted customers, generator running time, its load and overall performances during contingency conditions, etc. In addition, HV generators can be connected to HV feeders (11kV or 22kV) and in single or multiple arrangements to 11kV buses at zone substations. Assessment of benefit for these two scenarios is different, as well as analysis of LV generators typically serving smaller communities. At the same time, SWER mobile generators will support rural networks characterised by small customer densities (typically less than 100 customers). As such, their importance is more evident in social and economic improvement of small local rural communities, than from benefit/cost analysis perspective.

It is also important to notice that load banks are not generators and do not have the same monetary benefits in the NPV profile. It is the reason why the contribution of load banks is not aggregated in the saving of energy not supplied in NPV analysis and limited to the supporting role of generators to achieve benefits.

Between two submissions, there are three key differences. In Ergon's it is recommended first time to use mobile generators in SWER networks due to the spread of these schemes in rural Queensland. As in Energex' there are only two SWER schemes, this category of assets is not included in the submission.

In terms of LV mobile generators, considering customer densities four Energex' units have same size of 500kVA, as ten Ergon's units will have a range of size between 150 and 500kVA. In the NPV analyses, an average cost of these units has been applied. With additional units, Energex' mobile fleet will have in total 50 LV MGs, and Ergon's 48.

The last difference is related to the trial of mobile battery energy storage system M-BESS in Energex' networks. In successful, it will open the door for more mobile battery units beyond 2030 which may also be utilised to support networks during the "Green" Olympic & Para-Olympic Games in Brisbane in 2032.

5.1.5 Common Benefits

Common benefits from additional mobile generators can be applied to both networks and can be include the following improvements:

- Restorations become more effective and efficient allowing faster power supply reconnections during natural disaster events.
- Approximately four times more customers may see improved restoration of power supply during natural disasters and network contingency conditions. For example, currently in average, on one Ergon's HV mobile generator there are 102,000 customers, as estimated improved "serving rate" for one HV MG is ~24,000 customers. At the same time, if this proposal is implemented, in Energex number of customers per single HV MG will be reduced in average from 340,000 to approximately 154,000. Note, this is not the number of customers who may see improvement, just a mathematical summary of the current and proposed rate of customers per one HV MG to demonstrate increased deployment flexibility.

- Increased efficiency, productivity and prudency of overall business management and assist in the planning of future network operations, maintenance and planned programme of works.
- Reduced duration of planned outages during different planned works on the network
- Communities would experience quicker economic recoveries and the return of local services to help sustain businesses while reducing social impacts.
- Increased operational flexibility in managing networks during emergency conditions.
- Supporting Safety Net obligations
- Supporting contingency works in the network, including at zone substations, when one power transformer is out of service
- Improved safety – having new mobile generators provides additional benefits
- Support microgrid operation, especially on LR and SR feeders, during emergency conditions
- Increase the range of solutions available to manage risks on individual feeder sections located in high risks areas.
- Supporting strategic rationale, like:
    - Effective market - the expansion of the fleet will ensure Ergon Energy and Energex can continue to offer vital emergency response support to restore supply to vulnerable communities during and after natural disasters.
    - Efficient service - having additional mobile generation units will reduce outage response times and accelerate our communities economic and social recovery. Distribution of units available across the state will accelerate deployment and help to meet growing community expectations associated with power restoration following natural disaster events.
- Meeting our commitments to support customers and vulnerable communities in accordance with our commitments under the Energy Charter's guiding values which include:
    - Putting customers at the centre of our business and the energy system
    - Providing energy safely, sustainably and reliably
    - Improving customer experience
    - Supporting customers facing vulnerable circumstances
- Aligning our people to a shared vision, with a focus on customers and communities in which we operate
- Avoided Reputational Risk - For the purpose of this Project, reputational risk has not been monetised, however it does exist and is significant given the communities and organisations involved.
- Improved regulatory/legislative compliance.

In terms of generated energy, based on the tunning time and load output of five existing HV generators in 2021 and 2022 calendar years, it is estimated that if Option 1 is supported, Ergon will be able to provide annually approximately 100,000 MWh of additional electricity in the areas affected by outages. It is around two times greater than the current output in these years.

5.1.6 Economics of Natural Disasters

On the economic cost of natural disasters, little is known about accurate figures, especially from the perspective of electricity supply. In the outline of cost framework, as per [21], network disruption is classified as indirect cost. It impacts public services, agriculture chain, business disruption, alternative accommodation, clean-up activities and overall operation of emergency and relief organisations. As reference, the 2018 International Federation Red Cross and Red Crescent Societies' World Disasters Report found Australia's damage bill over the past decade came in a

$37B, ranking our country as the 10th in terms of the cost of natural disasters. Of all disaster types, with 28% of total loss floods are second most costly contributor, as bushfires with 17% also contribute significantly [24].

5.1.7 Benefits of the Mobile Battery Unit Trial

The main reasons why it is recommended to trial M-BESS in Energex' networks are to get expertise in deploying, connecting and operating mobile battery systems in the network, understand charging regimes and functioning in different loading conditions. Also, to increase the knowledge of maintenance requirements.

Currently, mobile battery units are not widely in use across the world. In Australia, for example these units limited to a very small size (few kVAs) can be rarely seen only at the construction sites. As such, this trial will be the very first to test integration and operation of mobile battery units in distribution networks.

Strategically, it is expected that access to the diesel in the future will be limited. Also, mobile battery energy storage will support the net zero transition.

During operation, the mobile battery will be grid forming and therefor able to provide grid stability services during contingency conditions.

It is also possible the trial to create opportunities for new business models in managing mobile plants. For example, to collaborate with retailers and battery equipment suppliers to increase industry knowledge and leverage learnings from existing projects which can be shared with other DNSPs.

The trial will require a range of resources, however much of the effort will take places as business-as-usual activities. The project will develop a small-dedicated project team to ensure trial success.

The mobile battery unit technology exists and there are few suppliers available worldwide. It is expected that the trial will focus on integration, installation, and control systems. Experiences in the installation and management of network battery systems will additionally support processing the trial. In summary, there is a high likelihood of success. If successful, the solution will help achieve "Climate Positive" status for Olympic and Paralympic Games in Brisbane in 2032.

The mobile battery will impact people and capability across Energex and Ergon Energy. Through this project a series of training and development activities will be undertaken in order to ensure that employees are ready in adopting another technology in the renewable energy transition which can also support the Queensland Governments Renewable Energy and Jobs Plan.

5.1.8 Risks

An assessment of the Residual Planned (Target) risk has determined that the risk remaining is reduced from moderate to low.

Table 3 Planned Residual Risk

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score
Natural disaster (bushfire / flood) impacts distribution area resulting in an interruption to customer supply of > 12 hours	Customer	3 *(> 12 Hours)*	2 *(Very Unlikely)*	***6 (Low)***
Natural disaster (bushfire / flood) impacts distribution area resulting in an interruption to >5,000 customers	Customer	3 *(5,000 Customers)*	2 *(Very Unlikely)*	***6 (Low)***
Natural disaster (bushfire / flood) impacts distribution area resulting in disruption to essential services (e.g. hospitals, sewage etc)	Customer	4 *(Interruption to essential services)*	2 *(Very Unlikely)*	***8 (Low)***
Natural disaster (bushfire / flood) impacts distribution area resulting in inability to remotely control an Ergon substation	Business	3 *(Inability to remotely control Ergon substation)*	2 *(Very Unlikely)*	***6 (Low)***
Natural disaster (bushfire / flood) impacts distribution area leading to the hire of mobile generation units and a significant impact on restoration equating to business impact >$500,000	Business	3 *(Significant impact on restoration equating to business impact >$500,000)*	2 *(Very Unlikely)*	***6 (Low)***

For untreated risks cores and scenarios please refer Table 12.

5.2 Option 2

5.2.1 Summary

Option 2 recommends an increase of mobile generation fleet of Ergon Energy by 12 HV Pegasus units, four HV-CTX, 20 LV and 12 SWER mobile generators and 12 load banks at the total estimated cost of $34.18M. Note, this option is a reduced version of suggestions received by area managers of Operations in Energy Queensland.

In Energex, Option 2 recommends an increase of mobile generation fleet of Ergon Energy by 12 HV Pegasus units, four HV-CTX and eight LV mobile generators and 12 load banks. As in the case of Option 1, it still recommends testing a single HV mobile battery unit in the period 2027/28-2029/30.

Total estimated cost of Energex' Option 2 is $26.9M

5.2.2 Assumptions

Same assumptions as in Option 1 have been applied for Option 2.

5.2.3 Costs

Table 4 Cost overview for Option 2

NPV		Year 1 [2025/26]	Year 2 [i2026/27]	Year 3 [2027/28]	Year 4 [2028/29]	Year 5 [2029/30]
CapEx	Ergon	$5,931,857	$7,712,857	$3,445,000	$0	$0
	Energex	$6,250,947	$5,398,096	$2,268,956	$0	$0
	Total (EQL)	**$10,097,150**	**$15,958,334**	**$5,545,000**	**$0**	**$0**
OpEx	Ergon	$150,471	$350,686	$440,291	$440,291	$440,291
	Energex	$105,562	$318,846	$371,823	$371,823	$371,823
	Total (EQL)	**$256,033**	**$669.532**	**$812,114**	**$812,114**	**$812,114**
TotEx	Ergon	$6,082,328	$8,063,543	$3,885,291	$440,291	$440,291
	Energex	$6,356,509	$5,716,942	$2,640,779	$371,823	$371,823
	Total (EQL)	$12,438,837	$13,780,485	$6,526,070	$812,114	$812,114
Benefits	Ergon	**$321,114**	**$1,412,902**	**$1,926,685**	**$1,926,685**	**$1,926,685**
	Energex	**$253,809**	**$1,522,852**	**$1,607,455**	**$1,607,455**	**$1,607,455**
	Total (EQL)	**$574,923**	**$2,935,754**	**$3,534,140**	**$3,534,140**	**$3,534,140**

5.2.4 Benefits

All benefits identified for Option 1 are applicable to Option 2. Certainly, as Option 2 simply doubles the number of mobile plants the benefits increase.

5.2.5 Risks

Risk assessment results of Option 2 are low, same as for Option 1.

5.3 Economic Analysis

5.3.1 Cost summary 2025-30

Table 5 CAPEX cost summary 2025-30

Option	2025-26	2026-27	2027-28	2028-29	2029-30	Total 2025-30
Counterfactual (Base)	$0	$0	$0	$0	$0	$0
1	$12,438,837	$13,780,485	$6,526,070	$812,114	$812,114	$31,600,484
2	$20,705,714	$33,252,521	$10,557,306	$1,567,306	$1,567,306	$61,100,968

5.3.2 NPV analysis

For the purpose of the Project two options have been analysed for both DNSPs:

Table 6 Two options - Ergon

Option / new assets	HV Pegasus	HV-CTX	LV MG	SWER MG	Load Banks	Cost ($M)
Option 1	6	2	10	6	6	$17.09M
Option 2	12	4	20	12	12	$34.18M

Table 7 Two options – Energex

Option / new assets	HV Pegasus	HV-CTX	LV MG	Load Banks	Mobile Battery (Trial)	Cost ($M)
Option 1	6	2	4	6	1	$14.51M
Option 2	12	4	8	12	1	$26.92M

Under Option 1 it is planned to manufacture internally six HV Pegasus and two HV-CTX units for both DNSPs, purchase 10 LV and six SWER mobile generators for Ergon and four LV MGs for Energex. Also, it is recommended to include a trial of mobile battery unit in Energex.

Option 2 practically is doubling new assets, except mobile battery (as it is a trial).

Assessment of socio-economic cost of energy-not-supplied is a difficult task and includes different variables and factors impacting different categories of our communities. For example, economic losses of individual households due to prolonged interruption of power supply vary between properties. They are depended upon localities and size of properties, nature (farms, pumps …), seasonality, frequency and duration of outages, loss of electrical equipment, etc. In parallel, private or public enterprises have different loss profile and may have impact on the national economy, especially if their national and international competitiveness is affected.

Considering these variables, NPV analysis of studied options is limited on two measurable and reportable parameters - Energy Not Supplied (ENS) NS and Guaranteed Service Levels (GSL) payments.

5.3.3 Application of Energy Not Supplied in the NPV Analysis (Benefit 1)

To calculate ENS savings in NPV analysis, the following data for the 2021/22 financial year and method have been applied:

1. Evaluation term = When the longest life asset retires
2. Regulated Real pre-tax Weighted Average Cost of Capital (WACC) = 3.5%
3. Use EB RIN 3.6.2 Energy Not Supplied (ENS) Data
4. Select UNPLANNED Outages only
5. Identify outages on Urban Feeders that are longer than 4 hours
6. Identify outages on Short Rural and Long Rural Feeders that are longer than 6 hours
7. Verify total ENS for UR>4hrs, SR/LR>6hrs
8. Estimate the improvement of total ENS recorded in step [7] applying 2.5% improvement from the first generators and diminishing return from further generation
9. Calculate the MWh improvement from step [6]
10. Multiple ENS MWh improvement by the VR=$42,000
11. Fuel consumption rate is estimated at 150 l/hr during full generator capacity
12. Cost of diesel $2/l.

5.3.4 Application of Guaranteed Service Levels in the NPV Analysis (Benefit 2)

Guaranteed Service Levels are specified under close 7 of the Distribution Authority. The GLS include Reliability Duration as one of the compliances. With more than 6,000 counts in Ergon and almost 3,800 in Energex in the Financial Year (FY) of 2022, and total GSL value of $750,484 (~95% of total Ergon's payment in the FY 2022) and $465,496 (>50% of Energex total payment), reliability is the most dominant category.

To calculate Reliability Duration related GSL savings in NPV analysis, the following data and method have been applied:

Ergon Energy

1. Annual payment for Reliability Duration is calculated as average figure of $1.0M for the period 2017-2022
2. Most of GSL payments were made to customers connected to Long Rural and Short Rural feeders
3. Considering base location of generators, deployment times, position of connections points, topology of LR and SR feeder categories and the presence of switching devices, benefit is projected as 10% of the total annual GLS value, or approximately $100,000 of potential saving per annum
4. That benefit is applied at end of the regulatory period when the full capacity of the new mobile units will be available (2029/2030)
5. For the following years a conservative annual growth index of 1% (based on the increase of connections), has been assumed.

Energex

1. Annual payment for Reliability Duration is calculated as average figure of $1.69m for the period 2017-2022
2. Most of GSL payments were made to customers connected to Short Rural (>73%), and rest to Urban feeders
3. Considering location of generators (mostly in Brisbane) and connections points, customer and feeder density, as well as topology of SR and UR feeder categories in Energex'

compact networks and quicker deployment, benefit is calculated as 20% of the total annual GLS value, or approximately $169,000 of potential saving per annum

4. That benefit is applied at end of the regulatory period when the full capacity of the new mobile units will be available (2029/2030)
5. For the following years a conservative annual growth index of 1% (based on the new connections), has been assumed.

5.3.5 NPV Results and Probability Analysis

Based on the above-mentioned methodology, the NPV analysis of two investigated options has resulted in the Net NPV summarised in Tables 9 (Ergon Energy) and 10 (Energex).

Table 8 NPV analysis – Ergon

NPV Summary-ERGON	Option 1	Option 2
Capex NPV	-$15,407,450	-$30,814,901
Opex NPV	-$5,990,158	-$11,950,578
Benefit NPV	$21,955,713	$39,520,283
Net NPV	**$558,105**	**-$3,245,196**

Table 9 NPV analysis – Energex

NPV Summary - ENERGEX	Option 1	Option 2
Capex NPV	-$13,080,698	-$24,325,988
Opex NPV	-$5,258,302	-$9,804,330
Benefit NPV	$18,584,263	$32,713,635
Net NPV	**$245,262**	**-$1,416,683**

Applying simulation mode in the NPV analysis and considering 2.5% as base outage improvement rate, as shown in Figure 15, probability of Ergon's positive $558,105 NPV result is approximated to 56% (it is also probability of $245,262 NPV positive result).

This outcome is reflective given the nature of unplanned outages (i.e. type and variety of triggers and dispersed locations) and factors impacting deployment regimes of mobile generators.

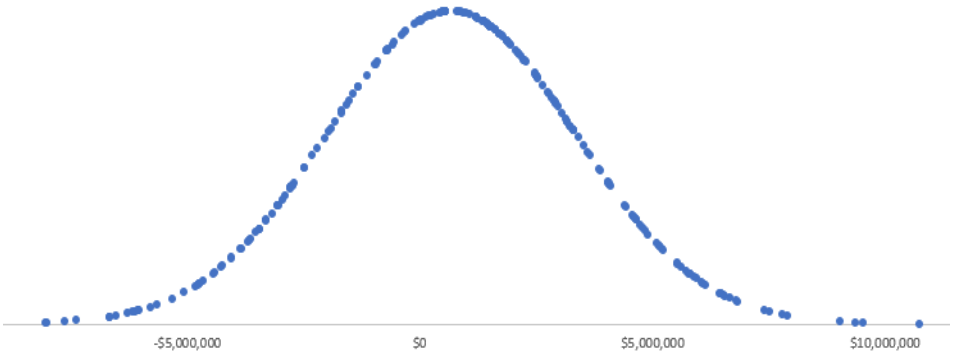


Figure 15 – Probability of NPV Result – Ergon Energy

5.4 Optimal Timing / Optimal Volume

Preferred timing and volume for Option 1 is to purchase all HV and LV mobile generators and load banks for both DNSPs in the first FY, and SWER generators and mobile battery in 2026/27. However, based on advice from Grid Investments group in Energy Queensland, it is recommended to balance timing and volume between three first years of the 2025-2030 regulatory period.

Table 10 Purchasing Timing and Volume

Option 1 – Ergon	25/26	26/27	27/28	28/29	29/30	Total
Pegasus	3	3				6
HV-CTX	2					2
LV MG		5	5			10
Load Banks		6				6
SWER MG		3	3			6
Option 1 – Energex	**25/26**	**26/27**	**27/28**	**28/29**	**29/30**	**Total**
Pegasus	3	3				6
HV-CTX		2				2
LV MG		4				4
Load Banks		6				6
Mobile battery			1			1

Any delays in getting HV and LV mobile generators and load banks may cause problems in supporting networks and customers during planned and unplanned works and different weather and contingency events. Delays by one year for SWER MGs and mobile battery trial may be tolerated.

6 RECOMMENDATION

It is recommended to extend Ergon's and Energex' mobile generation capability, based on Option 1 as described in section 5.1 of this Business Case.

It is also recommended to commence internal preparations for manufacturing HV Pegasus and HV-CTX units, and explore market optimum opportunities for SWER mobile generators, load banks and mobile battery energy storage system.

Table 11 Options Analysis Scorecard

Criteria	Option 1 12 Pegasus, 4 HV-CTX, 14 LV and 6 SWER mobile generators, 12 load banks and one mobile battery (Preferred)	Option 2 24 Pegasus, 8 HV-CTX, 14 LV and 6 SWER mobile generators, 12 load banks and one mobile battery
Net Present Value	$803,367	-$4,661,879
Investment cost (TCO)**	$34,962,388	$67,650,153
Investment Risk	High	Extreme
Benefits	High	High
Delivery time	36 months	36 months
Detailed analysis – Benefits	This option will deliver a lower investment cost of $34.96M and $3.3M p/a financial benefits (over 2025/26-2039/40 period) due to use of additional mobile generation capabilities to support the regulatory requirements. 36-month delivery timeframe is required for optimum balance of CAPEX funds and internal production capabilities.	Option 2 is the least onerous in terms of total investment cost, condensed delivery and negative NPV result.
Detailed analysis – Risks	Twelve Pegasus and four HV-CTX units will be manufactured internally. To avoid risks in their production it is recommended to commence preparations on time. There is a risk that limited sizes of SWER mobile generators will be available in the market.	Manufacturing 24 Pegasus and 8 HV-CTX units in two years (2025/26-2026/27) will be a challenge. There is a risk that limited sizes of SWER mobile generators will be available in the market.
Detailed analysis - Advantages	• Restorations become more effective • More customers will see improved restoration of supply during natural disasters and network contingency conditions • Communities would experience quicker economic recoveries and the return of local services to help sustain businesses while reducing social impacts • Increased operational flexibility in managing networks during emergency conditions • Overall estimated reliability improvement of extended MG capabilities • Increased efficiency, productivity and prudency of overall business management and assist in the planning of future network operations, maintenance and planned programme of works …	Option 2 is a viable option presenting increased advantages. However, factors such as high investment and ongoing costs limit the option's long-term value to EQL.

APPENDICES

Appendix 1: Alignment with the National Electricity Rules

Table 12 Recommended Option's Alignment with the National Electricity Rules

NER capital expenditure objectives	Rationale
A building block proposal must include the total forecast capital expenditure which the DNSP considers is required in order to achieve each of the following (the capital expenditure objectives):	
6.5.7 (a) (1) meet or manage the expected demand for standard control services over that period	With almost 50 new mobile assets, capabilities of Energex and Ergon Energy in planning and operating generators to meet legislative and regulatory requirements will significantly increase.
6.5.7 (a) (2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;	Additional mobile generation plants will increase capabilities of Energex and Ergon Energy to comply with regulatory obligations, especially in regard to improved management of planned outages during network and customer connection works, natural disaster responses and during network contingency events
6.5.7 (a) (3) to the extent that there is no applicable regulatory obligation or requirement in relation to: (i) the quality, reliability or security of supply of standard control services; or (ii) the reliability or security of the distribution system through the supply of standard control services, to the relevant extent: (iii) maintain the quality, reliability and security of supply of standard control services; and (iv) maintain the reliability and security of the distribution system through the supply of standard control services	Additional mobile generation plants will improve and increase operational capabilities of Energex and Ergon Energy regarding each of the clauses 6.5.7(a)(3)
6.5.7 (a) (4) maintain the safety of the distribution system through the supply of standard control services.	With additional mobile plants, this investment will increase resilience in the areas impacted by natural disasters and support Energex' and Ergon's networks during contingency conditions, heatwaves and the shortfall of capacity.
NER capital expenditure criteria	**Rationale**
The AER must be satisfied that the forecast capital expenditure reflects each of the following:	
6.5.7 (c) (1) (i) the efficient costs of achieving the capital expenditure objectives	Option 1 for both DNSPs is recommended as lower cost of several options discussed with Operations and Mobile Generation teams.
6.5.7 (c) (1) (ii) the costs that a prudent operator would require to achieve the capital expenditure objectives	Positive NPV results for both DNSPs and optimally balanced needs for new HV and LV mobile plants demonstrate prudence of Option 1. Also, in the NPV assessment more conservative methodology has been applied, considering only 2.5% of unplanned outage savings and 1% customer growth.

NER capital expenditure objectives	Rationale
6.5.7 (c) (1) (iii) a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives	In general, the demand forecast is not a primary factor behind this investment. However, periodic load increases in parts of the networks, like in the case of extreme temperatures, contributing to new system peaks, impact security and reliability of power grids. From that perspective, this investment provides additional opportunity (and flexibility) to manage load growth more effectively.

Appendix 2: Reconciliation Table

Table 13 Reconciliation

Expenditure	DNSP	2025-26	2026-27	2027-28	2028-29	2029-30	2025-30
Expenditure in business case $m, direct 2022-23	Ergon	$5,931,857	$7,712,857	$3,445,000	-	-	**$17,089,714**
	Energex	$6,250,947	$5,398,096	$2,268,956	-	-	**$14,458,000**

Appendix 3: Change Impacts

Table 14 System Change Impacts

ID	System	Impact	Rating
001	HV Pegasus and HV-CTX units (Ergon and Energex	Internal production and testing of 12 Pegasus and four HV-CTX units (if internal production is not possible, external service providers will require to be contacted)	Medium
002	Base location, logistics and accessories	For addition al mobile plants adequate spaces in base locations, logistics and accessories in both DNSPs are required	Medium

Table 15 People & Process Change Impacts

ID	Unit / Team	Impact	Rating
003	New standards and processes	Development of new standards and processes for SWER mobile generation, portable load banks and mobile battery trial is required in Fleets/Mobile Generation, Banyo Workshop and Cairns Microgrid Test facility	Medium
004	Trainings	Fleet/Mobile Generation and Operations staff in both DNSPs will require training on the new devices (SWER mobile generators and remotely controlled load banks)	Medium

Table 16 Technology Change Impacts

ID	Technology change	Impact	Rating
005	Mobile Battery	Research and development for the trial of mobile battery energy storage system	Medium

Appendix 4: Strategic Alignment

Alignment to Energy Queensland's Strategic Framework

This investment aligns with the following Energy Queensland 'Enable' building blocks:

Table 17 Alignment to 'Enable' Building Blocks

'Enable' Building Blocks	How this investment contributes	Impact
1. Safety The safety of our people, customers and communities is our first priority	This investment provides staff in Fleet/s Mobile Generation and Operations targeted access to safety insights relevant to their jobs	Medium
2. Keep the lights on We will design, build and maintain a safe and reliable electricity network	During natural disasters and extreme weather events, restorations become more effective and efficient, allowing faster power supply reconnections	High
3. Financial sustainability We will ensure funds spent are done so prudently and we will grow our revenue streams	Through reduced Energy Not Supplied during planned and unplanned outages, and improved GSL portfolio, it is expected that our revenue streams to grow. In addition, communities would experience quicker economic recoveries and the return of local services to help sustain businesses while reducing social impacts	Medium
4. People & Culture Continue to build a capable & productive workforce to ensure we deliver EQL's electric life ambition.	This investment aligns our people and culture to a shared vision, improves their capabilities in operating multiple mobile plants and new mobile technologies, like SWER mobile generators, portable remotely controlled load banks and mobile battery energy systems.	Medium

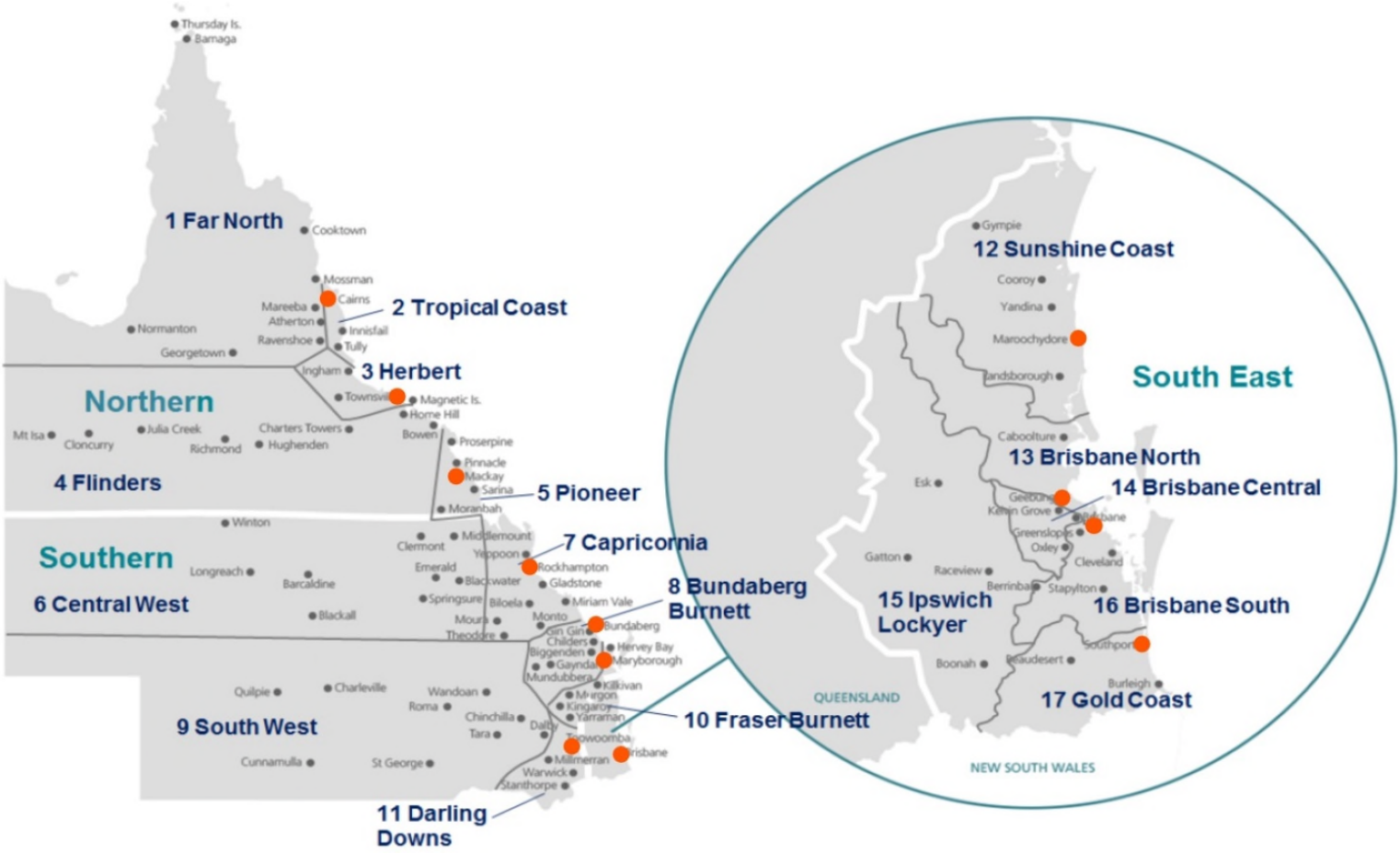
Regulatory and Compliance Obligations (If Applicable)

The proposed investment addresses the following regulatory and compliance obligations.

Table 18 Alignment to Regulatory/Compliance Obligations

Regulatory/ Compliance Obligation	How this investment contributes to compliance	Implication	Residual Risk Level
MSS	Support Planned and Unplanned MSS SAIDI outcomes	More effective and frequent use of mobile plants during planned and unplanned events reducing MSS SAIDI	Sustainable to Minor
Safety Net	Support networks with Safety Net risks	More effective and frequent use of mobile plants for restoration of supply following an N-1 Safety Net	Sustainable to Minor

Appendix 5: Location of Mobile Generators



Appendix 6: Photos of Mobile Plants

Ergon's HV Pegasus mobile generator

Energex' HV mobile generator

Use of mobile generators during the storm restoration on the Gold Coast (December 2023)

CTX Unit – Caged transformer, NULEC recloser and generator

LV mobile generators

Load bank

HV mobile battery units

Appendix 8: Glossary

Term	Definition
The Act	The Electricity Act 1994
AER	Australian Energy Regulator - The AER regulates wholesale and retail energy markets, and energy networks, under national energy legislation and rules .
AO	Area of Operations - An AO is a geographical area under the control of one Operations Lead in the response and recovery effort following a disruptive event.
CSR (Cascading and Systemic Risk)	A set of systemic risks that stem from the consequence of the direct impact of a hazard – materializing as a chain, or cascade, of impacts. Cascading and systemic risks are often compounding and impact a whole system, including people, infrastructure, the economy, societal systems and ecosystem
CAPEX	Capital Expenditure
CBD (Energex)	A feeder supplying predominantly commercial, high-rise buildings, supplied by a predominantly underground network containing significant interconnection and redundancy when compared to urban areas
Climate Risk-informed Actions	Actions which guide decision makers to develop effective solutions under conditions of future climate uncertainty.
CTX	Caged Transformer – Mobile generation unit consisting of caged transformer and recloser, mobile generator, fuel cube and associated equipment
Distribution Authority	Authorities No. D07/98 held by ENERGEX Limited and Authority No. D09/99 held by Ergon Energy Corporation Limited
DLF	Defined Flood Levels
Disaster	A disaster is a serious disruption in a community, caused by the impact of an event, that requires a significant coordinated response by the State and other entities to help the community recover from the disruption (*definition: Disaster Management Act 2003, Section 13*)
Disaster Risk	The potential loss of life, injury, or destroyed or damaged assets caused by a disaster, which could occur to a system, society or a community
Disaster Risk Reduction	Disaster risk reduction is aimed at preventing new disasters, reducing existing disaster risk and managing residual disaster risk, all of which contribute to strengthening resilience and therefore work toward the achievement of sustainable development

Emergency	A sudden and unexpected event that disrupts the normal operating functions, capabilities, resource and/or people of the organisation and requires an immediate response to prevent escalation of its scale or severity
Green-Blue Infrastructure	Green-Blue Infrastructure is infrastructure reduces risk of hazards for a particular community or communities, by delivering a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services
GSL	Guaranteed Service Levels
Long Rural Feeder (Ergon)	Feeder which is not an urban feeder or isolated feeder and has a total feeder route length of greater than 200km.
Interruption	Loss of electricity supply to either customer or asset (outage).
M-BESS	Mobile Battery Energy Storage System
Natural Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic or environmental losses and impacts (National Disaster Risk Reduction Framework). As predicated by a Natural Hazard
Natural Hazard	A natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation
NEL	National Electricity Law
NER	National Electricity Rules
NOMAD	Mobile substation capable of injecting high voltage to large areas of the network.
OPEX	Operational Expenditure
Pegasus	Mobile generator capable of injecting high voltage into a select area of the network
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management
Restoration plan	Prioritised feeder section plan to restore the network

Risk	Potential impact on objectives (either losses or opportunities) due to a particular event, hazard or scenario. Risk is the product of likelihood and consequence.
SAIDI	System Average Interruption Duration Index - Is the sum of the duration of each sustained customer interruption (in minutes) divided by the total number of distribution customers (averaged over the financial year).
SAIFI	System Average Interruption Frequency Index - The total number of sustained customer interruptions divided by the total number of distribution customers (averaged over the financial year).
Significant Incident	Any occurrence affecting an EQL response and the community – including severe injury or loss of life involving EQL staff or the public, loss or damage affecting EQL or community property, and related matters involving EQL which are likely to attract media or public response.
Single Wire Earth Return (SWER)	SWER is a single-wire transmission line which supplies single-phase to remote areas. Its distinguishing feature is that the earth is used as the return path for the current, to avoid the need for a second wire (or neutral wire) to act as a return path.
Short Rural Feeder	Feeder which has a total feeder route length less than 200km and is not an urban feeder or isolated feeder.
STPIS	Service Target Performance Incentive Scheme - Ergon and Energex submit data about unplanned SAIDI and SAIFI on an annual basis, relative to its performance under the AER's DNSP STPIS. The scheme rewards or penalises a DNSP, in the form of an increment or reduction on Annual Revenue Requirement
Urban Feeder	A feeder which is not a CBD feeder and has a three-year average maximum demand over the three-year average feeder route length greater than 0.3MVA/km