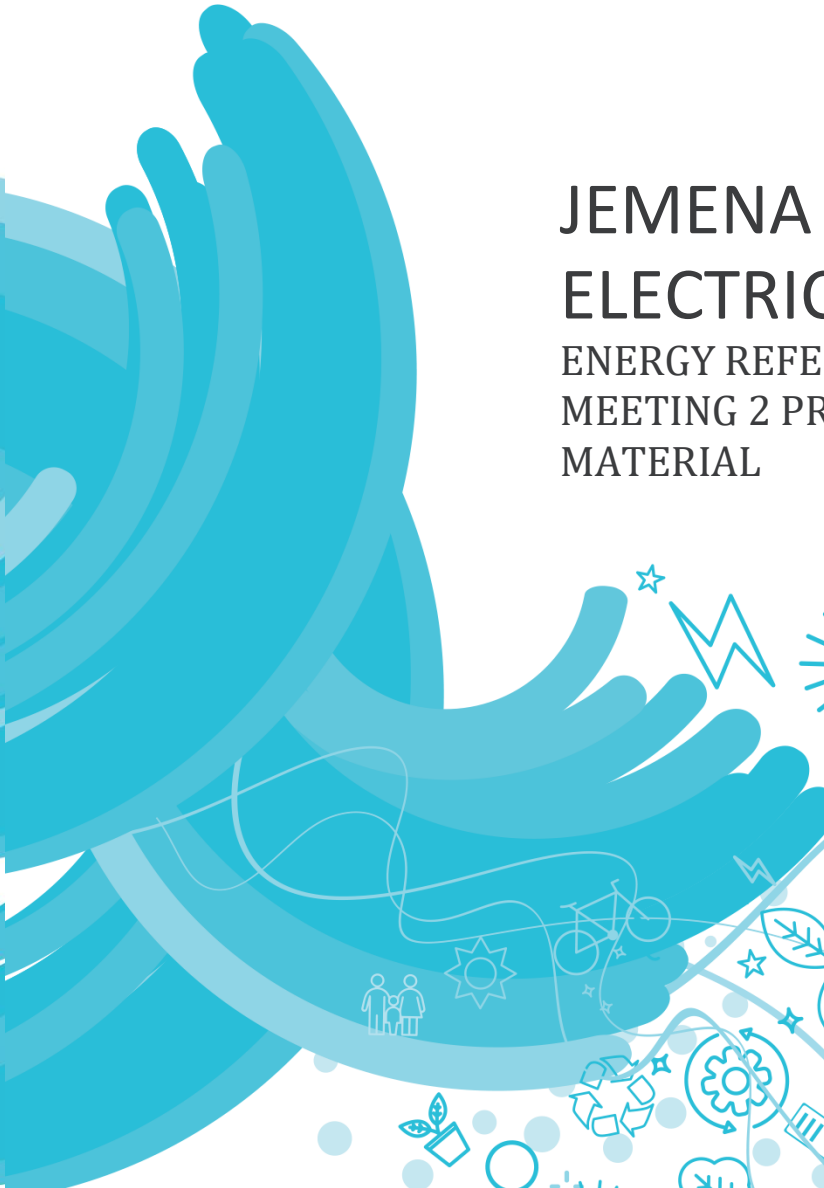




JEMENA ELECTRIC

ENERGY REFERENCE MEETING 2 PRESENTATION MATERIAL





“Jemena”
is an Aboriginal word
that means “to hear,
to listen and to think”



Acknowledgement of Country

Jemena acknowledges the Traditional Owners of the land on which we operate and recognises their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

Artwork is by Chern'ee Sutton a contemporary Indigenous artist from the Kalkadoon people from the Mount Isa area in Queensland.

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Abbreviations

Application Programming Interface	API
Australian Energy Market Commission	AEMC
Australian Energy Market Operator	AEMO
Australian Energy Regulator	AER
Consumer Energy Resources	CER
Distributed solar photovoltaic	DPV
Distribution Network Service Providers	DNSP
Energy Reference Group	ERG
Fault Location isolation and Service Restoration	FLISR
Guarantee Service Level	GSL
Information and Communication Technology	ICT
Rapid Earth Fault Current Limiter	REFCL
Jemena Electricity Networks	JEN
Major Event Days	MED
Momentary Average Interruption Frequency Index	MAIFI
National Electricity Objective	NEO
National Electricity Rules	NER
Outage Management System	OMS
Powerline Bushfire Safety Taskforce	PBST
Regulatory Information Notices	RINs
System Average Interruption Duration Index	SAIDI
System Average Interruption Frequency Index	SAIFI
Under Frequency Load Shedding	UFLS
Values of Customer Reliability	VCR
Essential Services Commission Victoria	ESCV

1. Network Performance

1.1 Greenhouse Gas Emissions

Reducing greenhouse gas emissions has become a critical part of business operations in Australia, with large organisations—including Jemena—now required to report emissions.¹ These trends are supported through community awareness and concerns and through government policy support.

In a recent change to the **National Electricity Objective (NEO)**—the overarching framework for establishing the design and operation of the National Electricity Market—we see a directive for participants in the electricity supply chain to now consider the greenhouse gas emissions in their investment decisions. Specifically, the National Electricity Law requires consideration of:

- the achievement of targets set by a participating jurisdiction—*
- (i) for reducing Australia's greenhouse gas emissions; or*
 - (ii) that are likely to contribute to reducing Australia's greenhouse gas emissions.”*

This change came about in 2023 and changes the way we think about investing in the network.

In addition to this driver for change, the Jemena group has set its own ambitious targets for net-zero emissions by 2050.²

Jemena Electricity Networks (JEN) does not participate in the more carbon intensive segments of the electricity supply chain—namely, fossil fuel electricity generation which contributes 46.2%³ of national greenhouse gas emissions for Australia—and therefore does not have significant greenhouse gas emissions to consider. However, there are two key areas of greenhouse gas emissions worth considering, these include:

- SF6 gases
- Line losses

In addition to these elements, JEN must also consider its investment decisions with respect to the new NEO requirements. The Australian Regulatory bodies are considering other changes necessary to support this change to the NEO:

- **Australian Energy Regulator (AER):**
 - Guidance on amended National Energy Objectives⁴ – a paper outlining how the AER will consider the requirements of the NEO in their own decisions.
- **Australian Energy Market Commission (AEMC):**
 - Rule change to include emissions reduction in the national energy rules.⁵ This change will direct businesses like JEN to consider its investments to address the NEO changes.

¹ National Greenhouse and Energy Reporting Act 2007 (NGER Act)

² <https://www.sustainability.jemena.com.au/environment-and-climate-change/>

³ <https://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Data-highlights/2021-22-published-data-highlights>

⁴ <https://www.aer.gov.au/system/files/AER%20-%20Guidance%20on%20amended%20National%20Energy%20Objectives%20-%20Final%20guidance%20note%20-%20September%202023.pdf>

⁵ <https://www.aemc.gov.au/news-centre/media-releases/draft-rule-change-include-emissions-reduction-national-energy-rules>

In addition to these rule changes, other related rule and law changes that seek to promote renewable forms of generation will have a direct and indirect impact on the way JEN invests and operates the network. Development of these new rules has begun, and we anticipate more changes to come.

We see that these community concerns and trends around the impacts of greenhouse gas emissions are now mainstream and a key reason for why we have focused our fundamental questions throughout 2026-31 price reset customer engagement focus on this theme:

How should Jemena prepare for a sustainable energy future while meeting customer and community needs today?

1.2 SF₆ gas

Sulphur hexafluoride (SF₆) gas is used extensively in high voltage equipment due to its excellent insulating and electric arc interrupting capability. It is, however, also the most potent greenhouse gas known to-date. Over a 100-year period, SF₆ is 23,500 times more effective at trapping infrared radiation than an equivalent amount of carbon dioxide (CO₂)⁶.

Jemena has high voltage overhead switchgear and outdoor circuit breakers that contain SF₆ gas. The SF₆ gas is normally contained within the high voltage equipment enclosure and will only escape to the environment if a leak develops.

Jemena's fleet of SF₆ equipment is well maintained and regularly checked to mitigate against leaks. We believe the amount of SF₆ gas leaked into the atmosphere is minimal.

For new equipment, Jemena is considering purchase of greenhouse friendly alternatives to SF₆. The non-SF₆ alternatives are available commercially but are approximately 20% to 30% more expensive. A new zone substation providing dedicated supply to a large new customer is being designed with a non-SF₆ gas high voltage switchgear. This development will provide Jemena staff the opportunity to develop a new capability in installing and operating this alternative apparatus, allowing Jemena to switch to non-SF₆ alternatives at a future date.

Consideration for the Energy Reference Group (ERG):

Should Jemena implement a ban of using SF₆ equipment for all new projects? Apart from the additional 20-30% increase in equipment cost, Jemena will also incur the operational costs in developing new equipment specifications, conduct equipment approval and update construction drawings.

⁶

[Sulphur Hexafluoride \(SF₆\) Basics | US EPA](#)

1.3 Line losses

Line losses is the loss of the electricity when travelling down powerlines. It occurs when the conveyance of electricity over long distances where the amount of electricity delivered at the end of the network is less than the amount injected into the beginning of the network. Losses occur for several technical reasons including high temperatures and the degree of conductivity of the electricity lines.

JEN's line losses are around 3.5% of total electricity delivered.⁷

Reducing line losses means more electricity generated can be used by customers and this helps with greenhouse gas reduction. With Jemena's line losses already at a relatively low level, we'll continue to look for opportunities for incremental improvement in the operation of our network to reduce line losses.

1.4 Network Performance - standards

The regulatory system contains "checks and balances" to ensure electricity distribution businesses do not have the adverse incentive to minimise capital and operational investments to the detriment of providing a reliable electricity supply and good customer services.

One mechanism within the regulatory toolkit to ensure this is the **Service Target Performance Incentive Scheme (STPIS)**. The STPIS rewards or penalises an electricity distribution based on their service performance to customers.

There are two key components of the STPIS:

- Network reliability performance measures how often and how long an average customer has experienced supply interruptions during the year; and
- Customer service performance measures the percentage of customer fault calls forwarded to the call centre are answered within a 30-second time window.

Within the network reliability performance measure, there are three factors used to measure network reliability performance (these measures are also adopted nationally and internationally to allow benchmarking of reliability performance of electricity distribution companies):

- **System Average Interruption Duration Index (SAIDI)** - The average minutes 'off supply' that a customer could expect to be without electricity per year. The measure in STPIS relates to unplanned outages (excluding planned) where the electricity supply was interrupted for more than three minutes. SAIDI is calculated as the total unplanned customer minutes off supply divided by the total number of connected customers averaged over the year.
- **System Average Interruption Frequency Index (SAIFI)** - The average number of occasions per year when each customer could expect to experience an unplanned interruption. SAIFI is calculated as the total number of customer interruptions divided by the total number of connected customers averaged over the year. SAIFI excludes momentary interruptions of three minutes or fewer.
- **Momentary Average Interruption Frequency Index (MAIFI)** - The average total number of momentary interruptions (three minutes or less duration) that a customer could expect to experience in a year. MAIFI is calculated as the total number of customer interruptions of three

⁷ https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2022-23/distribution-loss-factors-for-the-2022-23-financial-year.pdf?la=en

minutes or less duration, divided by the total number of connected customers averaged over the year.

Targets are set by the AER for each regulatory control period, using averages of performance in the preceding five years. The network-wide targets are made up of sub-targets for different network types (CBD, urban, rural) to reflect the different supply characteristics and reliability performance expectations.

To ensure that the network performance targets are set to incentivise distribution businesses to invest against events within their reasonable control, the STPIS incorporates mechanism to exempt reliability performance from both service target setting and performance measurement during **Major Event Days (MED)** and other events that are beyond the control of the distribution business, such as outages in the electricity transmission network or directions from the **Australian Energy Market Operator (AEMO)** that restrict the distribution businesses ability to supply in parts of the electricity distribution network.

Reward and penalty rates associated with STPIS are set for each distribution business for the 5-year regulatory control period based on average customer energy consumption and **Values of Customer Reliability (VCR)**. VCR is determined and updated annually by the AER. The reward and penalty apply to the annual revenue JEN recovers from its customers through its network tariffs.

JEN's **Outage Management System (OMS)** accurately captures actual supply interruptions information experienced by its customers.

Apart from network reliability performance which measures what an average customer experiences, the **Victorian Essential Services Commission (ESCV)** has also applied a **Guarantee Service Level (GSL)** mechanism to ensure any customer is paid a GSL payment if their individual service level falls below a predetermined level.⁸

1.5 Network performance - actual

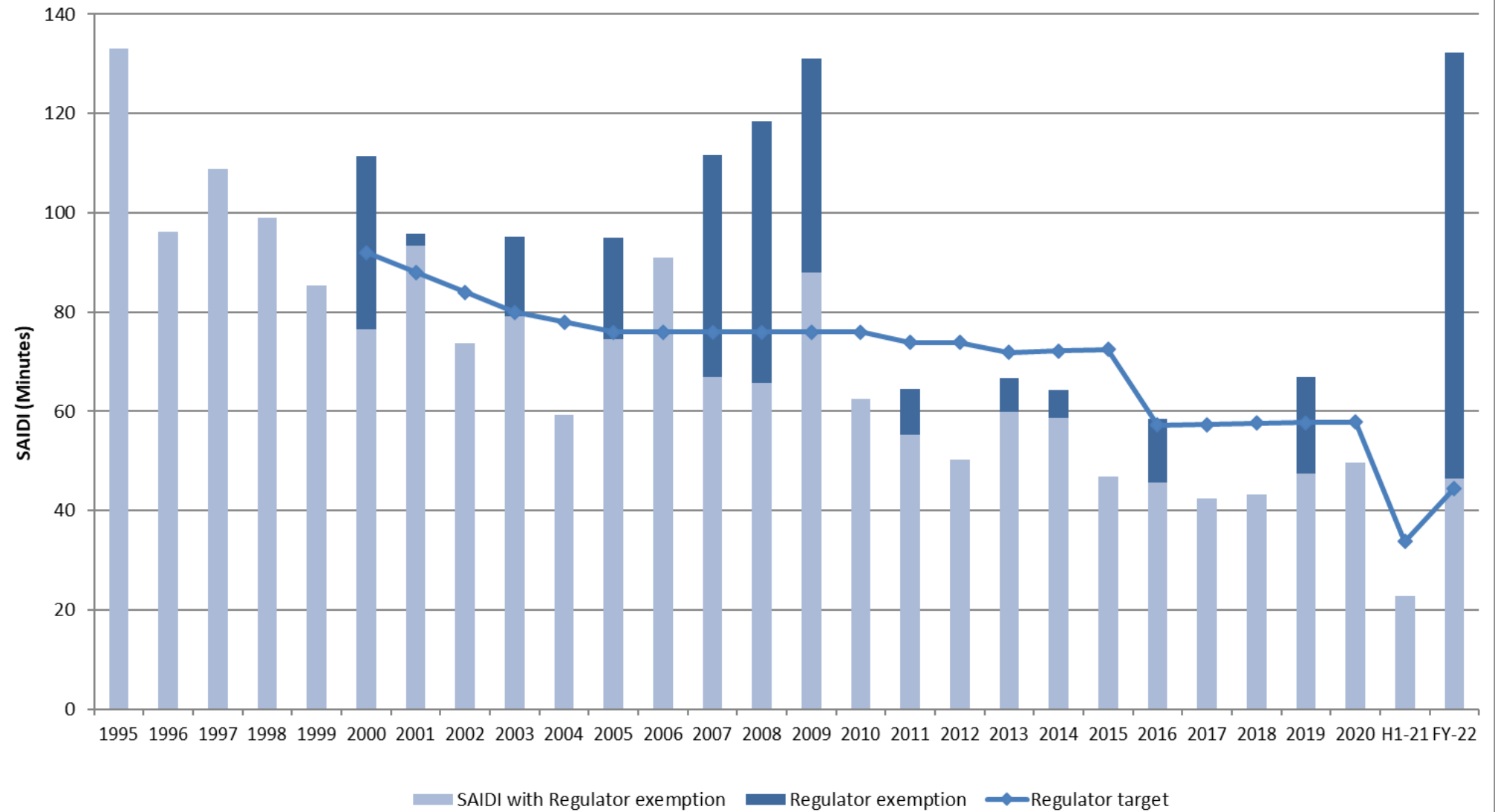
JEN places a significant emphasis on meeting the network performance targets. We set more stringent internal performance targets and report actual performance against STPIS targets every month.

In Figure 1 below JEN's SAIDI performance since we started recording in 1995:⁹

⁸ ESCV, <https://www.esc.vic.gov.au/sites/default/files/documents/COD%20-%20Electricity%20Distribution%20Code%20of%20Practice%20%28version%202%20-%20updated%29%20-%202020230428.pdf>, section 14.

⁹ For the purposes of this chart, regulatory exemption means the criteria outlined in the STPIS for measure beyond the distribution businesses control such as transmission outages or AEMO directives.

Figure 1 – Historical unplanned SAIDI network performance (CY 1995-FY2022)¹



For the current regulatory control period (financial years 2021-2026), JEN's unplanned SAIDI performance has been better than regulatory target except in FY22 which was slightly above the regulatory performance target due to more severe weather days and an earthquake. However, the actual performance (excluding regulatory exemptions) was better than in 2019 and 2020 by 2% and 7%, respectively.

Network SAIFI was 0.70 and was the lowest since 1995. The high SAIFI performance occurred, in part, due to JEN's investment in an advanced distribution automation system called **Fault Location Isolation and Service Restoration (FLISR)** – refer case study below.

SPOTLIGHT ON:



FLISR (Fault Location Isolation and Service Restoration) Enhancements

In March 2022 we commenced using state-of-the-art network restoration technology across our electricity distribution network. Following extensive trialling over more than a year, the Fault Location, Isolation, and Service Restoration (FLISR) system is now communicating real time information about our high-voltage electricity network back to the control room.



The FLISR system helps to restore power faster via the latest in automation technology and will limit electricity outages to a much smaller area than previously. To do this, the technology analyses information in real time across our network to quickly determine the location of faults and automatically isolate that particular section of the network. In some cases, FLISR will automatically restore customer power while making the

network safe for any further necessary repairs. Historically, this analysis has been a manual process that required numerous checks before supply could be safely restored. These checks are now undertaken by FLISR, meaning that customer power in unaffected areas can be rapidly restored.

The FLISR system is the latest and most innovative tool in our toolkit to help us manage the safety and reliability of electricity supply across our network and is helping us achieve our goal of improving supply reliability by 30 per cent by 2023. While we won't always be able to avoid supply interruptions, FLISR is enabling us to minimise their impact when they do happen.

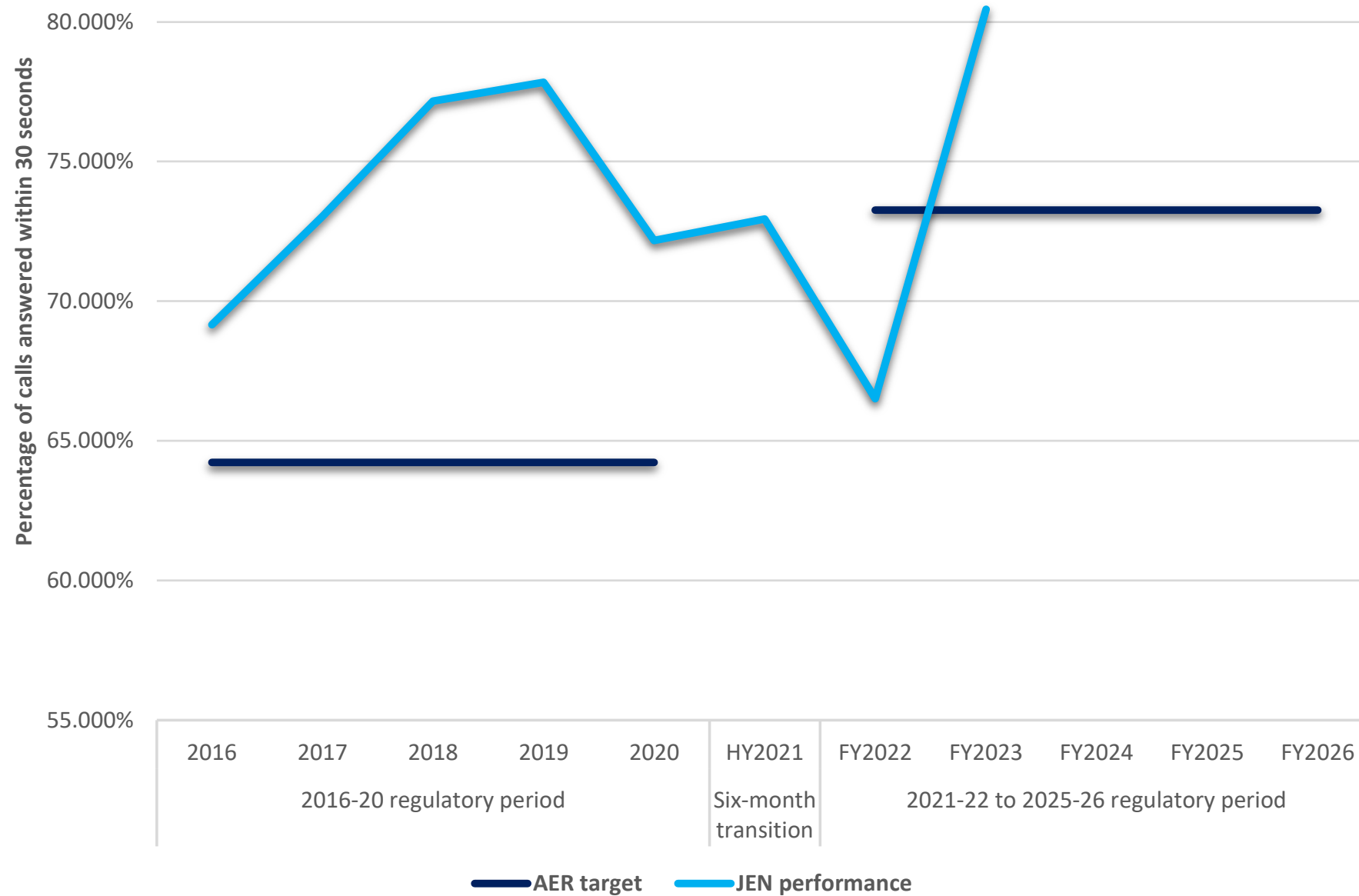
JEN's customer service performance against the STPIS target is set out in the table below:

Table 1 - STPIS customer service financial year 2022-23

Measure	Actual	Target	Variance
Telephone answering	80.453%	73.263%	7.190%

The STPIS Customer Service performance measure outcome in Table 1 shows a favourable variance of less than 10 per cent compared with JEN's target for 2022-23. Figure 2 below outlines JEN's telephone answering performance between 2016 and 2022-23.

Figure 2 – JEN’s historical telephone answering performance.



Source: AER final decisions and JEN annual reporting Regulatory Information Notices (RINs)

1.6 Network performance - approach

Based on customer survey results, JEN believes that its network performance is meeting customers' expectations and is proposing to invest to maintain existing performance, a continuation of the approach that is taken for the current regulatory control period.

Considerations for the Energy Reference Group:

The current STPIS scheme measures average customer experience. JEN is aware that there are customers who are receiving worse network performance because of their locality and network characteristics. Should JEN propose investment to improve network performance for these customers?

As mentioned in briefing pack for meeting #1, AECOM's climate change study concludes that while Jemena's assets are less affected by extreme weather events compared with other Victorian DNSPs, there are still local areas of exposure that could be impacted and require specific management strategies. The current STPIS design with MED exclusion mechanism may not justify JEN investment for these high impact low probability events. Customers will nevertheless experience extended supply interruptions for these events. Should JEN invest to improve network performance for these extreme weather events?

2. Cyber security

Cybersecurity risks continue to challenge companies in Australia and across the critical infrastructure sector. In 2022 cyber incidents reported to the Australian Cyber Security Centre have seen the utility sector move into the top 10 of reported incidents.

Information and Communication Technology (ICT) is a primary enabler of Jemena's ability to operate a safe and reliable electricity network. Advancements in the Technology areas of data analytics, cloud adoption and smart networks are quickly transforming how assets and ICT processes can be managed. However, these changes also expose the network to an increased threat of cyberattack.

Business change and transformation is an inevitable reality as networks seek to apply data-driven decision making enabling smarter networks and a digitised ecosystem to meet customer and mobility demands. Data and digitisation require systems to be integrated delivering on-demand customer information, analytics and automation.

Digitisation and cloud adoption have shifted away from traditional ICT perpetual licensing and owner-operator models from the past. Technology services are now hosted externally and maintained by external third parties. This interdependency and reliance on third parties create blind spots and increase the potential for ICT exposure and exploitation by cyberattacks.

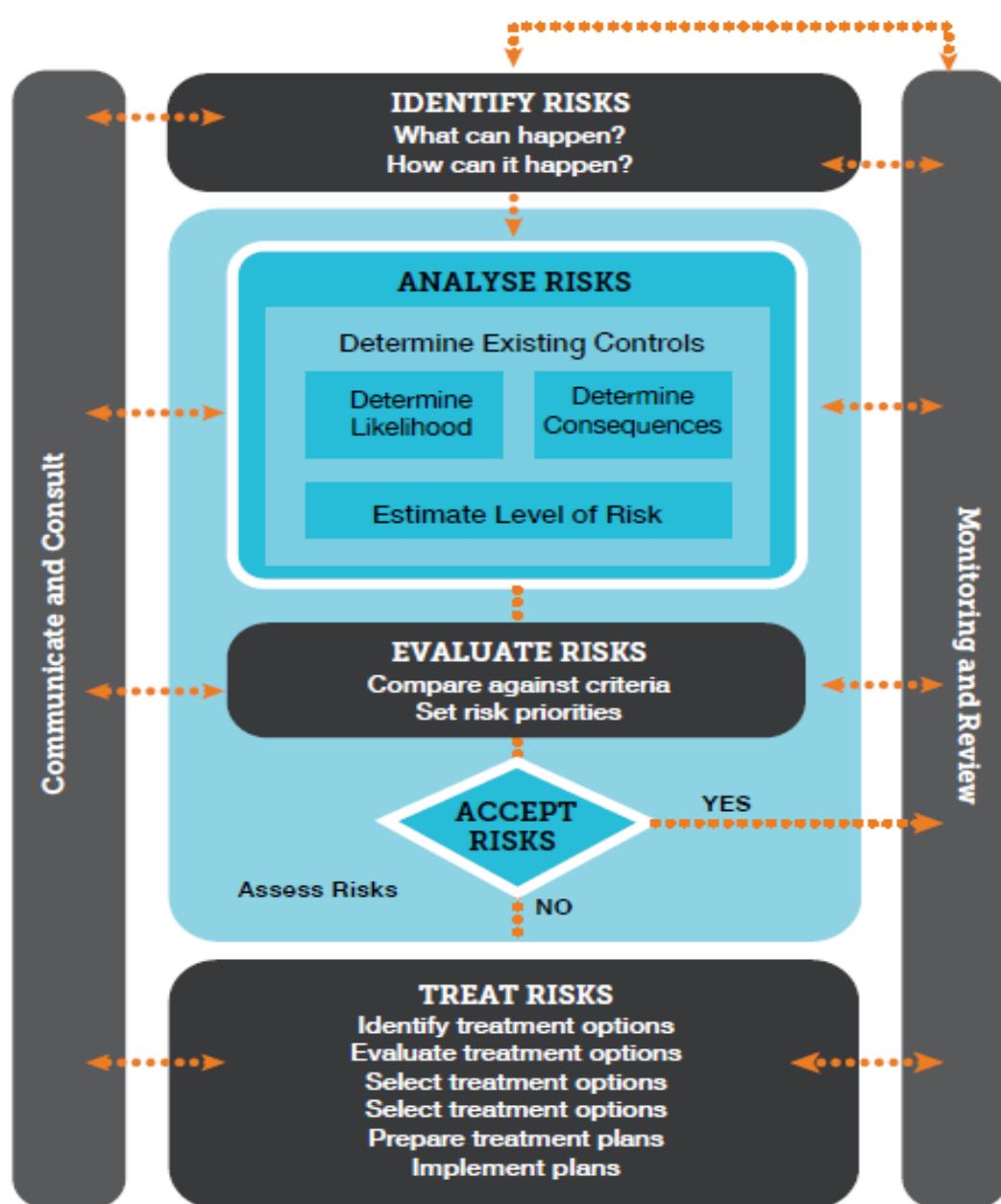
As Jemena changes its ICT products and services (e.g., introducing a new public **Application Programming Interface (API)**, or network devices required to operate physical equipment remotely), it will require new and different cybersecurity capabilities as new vulnerabilities are introduced.

To meet customer expectations for safe and reliable electricity supply and to meet obligations such as the Security of Critical Infrastructure Act 2018 regarding cybersecurity of critical infrastructure. Jemena must continue to invest in systems to identify, protect, detect, respond and recover from cyberattacks. This requires investments in new capabilities to ensure cyber defences are in place to combat exposure to sophisticated cyber threats and attackers.

3. Bushfire Risks, Mitigation and Insurance

JEN incorporates risk management as an integral part of its business operations and strategic planning. JEN recognises this is a prudent approach to managing the electricity network. Risk management, including risk evaluation, treatment and documentation, is undertaken in a systematic manner in conformance with AS/NZS ISO 31000:2009. An outline of the risk management approach adopted by JEN is depicted in the figure below.

Figure 3 – Jemena Risk Management Policy



All risk management activity within the company is governed by the Jemena Risk Management Policy. It is recognised that complete elimination of risks is neither practical nor gives the best outcome to the customers and community JEN serves. However, it remains important for all credible risks to be identified, evaluated and appropriately managed. These operational risks are effectively and efficiently managed to ensure that they are mitigated to an acceptable level.

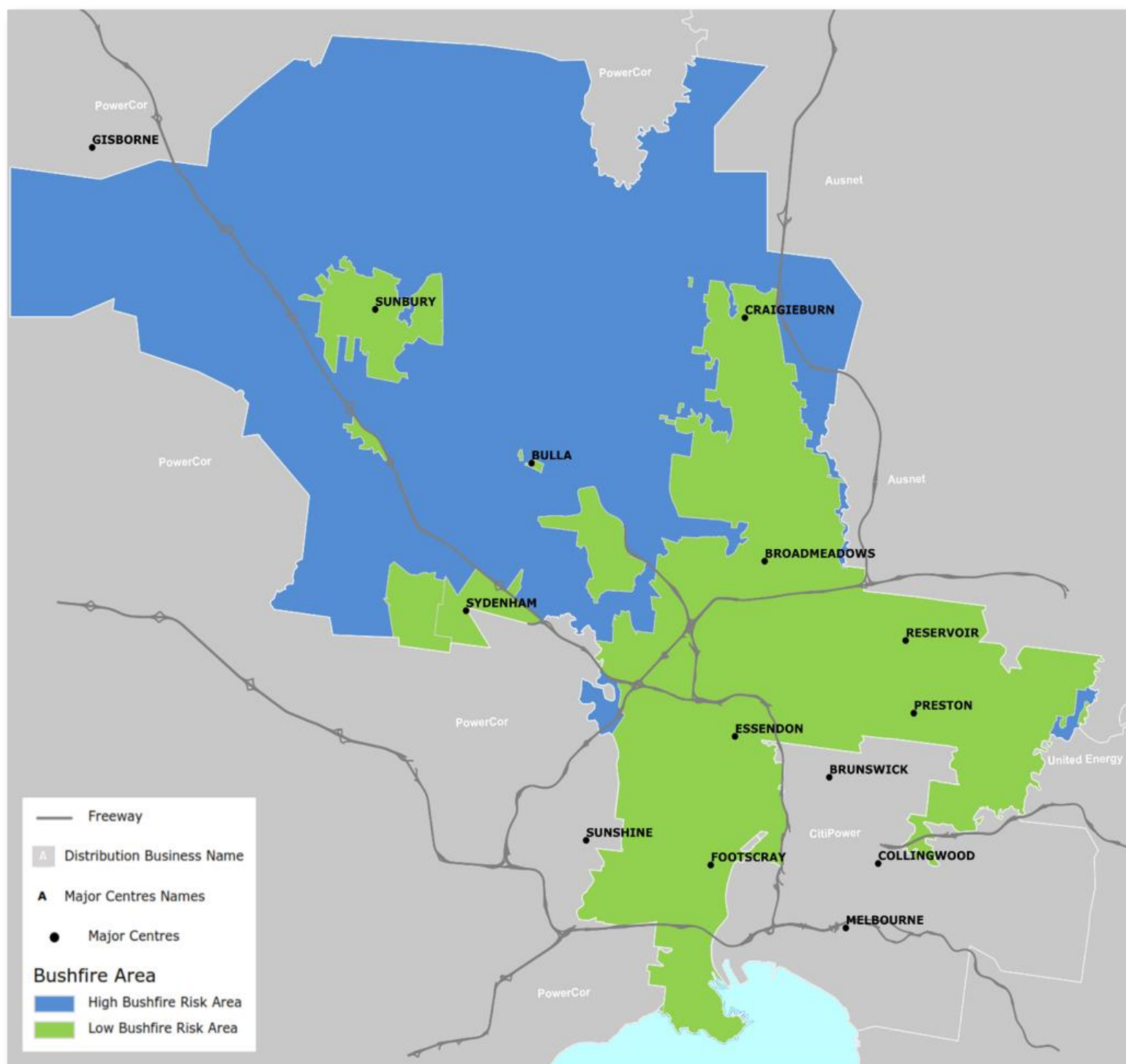
Risks are assessed using risk criteria tables. Risk Action Plans are developed to plan, monitor and report on the implementation of identified treatment actions.

The table below provides a snapshot of the risks that have either extreme, high or significant rating:

Table 2 – Extreme, High and Significant Risks

Risk Rating and Number	Risk
Extreme (0)	N/A
High (0)	N/A
Significant (10)	Accidental connection with switch wire
	Electric shock due to inadequate earthing
	Potential for injury or damage caused by a bushfire start
	Potential for electric shock
	Third-party damage of JEN assets due to incorrect underground cable records
	Potential for encroachments by third parties
	Broken neutrals in services cables or mains neutrals
	Potential for bushfire start
	Failure of service cable and associated equipment (roller clamps, dog bones, red lead services)
	Decision to allow running intelligent electronic devices (IED) to failure

JEN operates a predominantly overhead electricity distribution network and some of the assets are located in high bushfire risk areas.

Figure 4 – Jemena Distribution Areas by Bushfire Risk Rating

The risk of fire starts by JEN assets is significant and real and must be managed to as *low as practicable* using both technological and operational approaches. The Ash Wednesday bushfire in 1983 and the Black Saturday bushfire in 2009 remind us of the devastation caused by bushfires to human lives and properties.

In addition to the historical and present risks, it is estimated that climate change will have an impact on the number and severity of bushfires in the future due to:

- An increase in the number of extreme fire risk days.

- The potential changes to bushfire risk areas; and
- The potential lengthening of the fire seasons.

A significant new body of knowledge has been generated by electric arc ignition tests carried out under the direction of the **Powerline Bushfire Safety Taskforce (PBST)** which has helped Jemena to consider further preventative measures. The PBST was set up by the Victorian Government to implement the recommendations of the Victoria Bushfire Royal Commission into the 2009 Black Saturday Bushfire. JEN is considering a number of initiatives in the new regulatory control period, leveraging on the findings of the PBST, to minimise fire start risks by its assets:

- Continue to deliver the existing well established and effective bushfire mitigation strategies.
- Monitor the potential lengthening of the gazetted fire season as a result of climate change and any impact that this may have on the ability to deliver works programs, particularly vegetation management and maintenance services.
- Install **Rapid Earth Fault Current Limiter (REFCL)** (resonant earthing) more broadly to further reduce fault current in high exposure bushfire substations. (Note, JEN has successfully commissioned a mandated, high performance REFCL in its Coolaroo (COO) Zone Substation in early 2023).
- Identify and prune or remove trees that lie outside of the compliance clearance area but remain a risk of contacting overhead lines.
- Implementation of engineering solutions such as asset relocation and replacement in order to achieve electric line clearance regulatory compliance when clearing of vegetation is not feasible; and
- Retire low voltage bare overhead main conductors.

The measures noted above focus on risk identification and prevention, which are extremely important aspects of risk mitigation, however, we also need to consider remediation in the unfortunate event that a bushfire does arise due to ignition from JEN assets. Remediation considerations include:

- Rapid response to re-establishing electricity supply in the event the fire damage the electricity network.
- Prioritising supply restoration to sensitive load and life support customers.
- Insurance to cover the costs of damage claims by affected parties.

Considerations for the Energy Reference Group:

Would you like JEN to invest more in reducing the risk of bushfire starts by electricity assets?

There may be a question of equity here. Significant bushfire risks are only present in high bushfire risks areas. Many of the established inner suburban areas served by JEN are in the low bushfire risk areas. Current investments into bushfire risk mitigation are borne by all JEN customers. Should customers living in high bushfire risk areas be paying for JEN's bushfire risk mitigation expenditure?

4. Grid Security and Risk Identification

Similar to many other electricity distribution networks globally, JEN is faced with operating in a rapidly changing energy landscape. The disruptive impacts on distribution networks, particularly those triggered by the distributed renewable energy transition, are changing the way electricity networks are used by customers.

Distributed Energy Resources (DER) are continuing to increase in numbers and will ultimately become a crucial resource in the future to support and manage within the distribution network, but first, we need to work with the resources in a coordinated way so as not to disrupt the stability of the grid. Already JEN has seen strong growth in network-connected, passive¹⁰ **distributed solar photovoltaic (DPV)** system installations by its customers, and this is likely to continue well into the future. Other emerging, potentially more active DER technology (including customer and community storage, and electric vehicles), present further challenges and opportunities for network operation and management.

With this challenge comes an increasing proportion of the overall power system generation being located within the distribution network. Hence, power system security will become increasingly important and complex for JEN to manage on behalf of AEMO and our customers.

AEMO expects the net minimum demand¹¹ to fall below its minimum acceptable operating threshold within the next two years in Victoria. This poses challenges for AEMO in its role in maintaining power system security, for two key stability elements:

- Supply-Demand Balance – An oversupply of DPV generation that cannot be controlled by AEMO, can cause the power system to collapse; and
- **Under Frequency Load Shedding (UFLS)** – the existing load-shedding control scheme, triggered upon a loss of generation event, will become ineffective when the load blocks are “diluted” by the presence of DPV, and can cause the power system to collapse.

From a distribution network perspective, the risks posed by DPV relate to voltage and thermal constraint caused by reverse power flows, particularly in the Low Voltage networks. On this point, the Electricity Distribution Code of Practice is standard which Jemena must comply with to support the overall grid security.

AEMO has primary responsibility for power system security (i.e., Grid Stability) under **National Electricity Rules (NER)** Clause 4.3.1. To support this requirements, **Distribution Network Service Providers (DNSP)** (including Jemena) must respond to an AEMO directive under NER Clause 4.3.3. These powers and obligations contribute towards ensuring the stability of the national electricity system.

In recent times, several key events have taken place around grid security:

- AEMO has exercised its powers. In August 2021, AEMO issued a directive to Jemena and the other Victorian DNSPs, to identify and implement measures to restore power system security from threats caused by increased levels of uncontrolled DPV within their respective networks.

¹⁰ Passive meaning, the appliance is not controlled, and is always on.

¹¹ Minimum demand is the lowest amount of network demand experienced at any point in time.

- Prompted by this event, the DER and System Security Working Group was established in October 2021 between the Victorian Government Department of Energy, Environment and Climate Action (DEECA), AEMO and the Victorian DNSPs to collaboratively address the issues associated with DER and system security. This working group's mandate is critical to ensure the security of the grid.
- More recently DEECA has mandated that Victorian DNSPs adopt an emergency DPV Backstop capability on all new and modified DPV systems to allow DPV output to be monitored and curtailed at times required by AEMO to maintain power system security. Stage 1 of this initiative will apply to all new and replacement distributed solar systems between 200kVA to 30MVA and was gazetted in October 2023. Stage 2 will apply to systems below 200kVA from 1 Jul 2024 onwards. This is an attempt to address the risk of supply-demand balance as outlined above.

To address the risk to the current UFLS, AEMO and DEECA require DNSPs to implement a distributed, granular UFLS control scheme with dynamic load blocks.

The challenges for JEN to implement measures to counter grid security risks are multi-folds:

- There is only a short timeframe for the solutions to be implemented.
- Any interim solution will need to be designed with long-term future in mind.
- The future is a bit “fuzzy” particularly relating to evolving equipment and data communication standards.

Jemena is considering distribution network risks through several initiatives as described in its Future Network Strategy. Details will be covered in future ERG meetings.

GridTalk.com.au

