Jemena Electricity Networks (Vic) Ltd.

IT Investment Brief – Digitising Network Switching

Non-recurrent – Maintaining existing services

Jemena
bringing energy to life

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Glossary

ADMS	Advanced Distribution Management System
Capex	Capital Expenditure
COWP	Capital and Operational Work Plan
Current Regulatory Period	The period covering 1 July 2021 to 30 June 2026
DMS	Distribution Management System
EAM	Enterprise Asset Management
EDCOP	Electricity Distribution Code of Practice
GIS	Geospatial Information System
ICT	Information and Communications Technology
Jemena	Refers to the parent company of Jemena Electricity Network
JEN	Jemena Electricity Network
JESA	Jemena Electricity Services Agreement
Next Regulatory Period	The period covering 1 July 2026 to 30 June 2031
NPV	Net Present Value
OI	Operational Instruction
OMS	Operational Management System
Opex	Operating Expenditure
RTS	Real Time Systems
RYxx	Regulatory year covering the 12 months to 30 June of year 20xx for years in the Next Regulatory Period. For example, RY25 covers 1 July 2024 to 30 June 2025
SOM	Switch Order Management
Totex	Total Expenditure

Digitising Network Switching

Objective	The objective of this initiative is to digitise the management of operational instructions and integrate digital switching processes and a non-verbal communication solution for field staff. Jemena Electricity Networks Vic Ltd. (JEN) has been committed to an enforceable undertaking with the Essential Services Commission (ESC) to implement a program of works aimed at mitigating these risks during the RY2021-26 period and must continue to invest to maintain this lower level of risk.		
Non-recurrent ICT sub-categorisation	☒ Maintaining existing services, functionalities, capability, and/or market benefits	☐ Complying with new/altered regulatory obligations/requirements	☐ New or expanded ICT capability, functions, and services
Background	**What is network switching** Network switching is a critical function that involves altering the flow of power through the network to manage faults, conduct maintenance, balance loads, and optimise operations. It is essential for ensuring the safety, reliability, and efficiency of the electrical grid, helping to minimise outages and maintain a consistent power supply to customers. **What is a switching incident** To safely grant crews access to the electricity network for both planned and unplanned work (known as network access), the network's operational state must be reconfigured through switching to de-energise the necessary sections. A switching plan may include numerous instructions, with each plan potentially spanning multiple pages, depending on network complexity and access requirements. A switching incident occurs when a switching operation leads to an unintended outcome. Such outcomes may include unplanned interruptions to customer power supply and/or an increased risk of harm to staff working on the network or to the public. Switching incidents are investigated to identify root causes, and the lessons learned can lead to corrective actions, which may include implementing new digital and process controls. The costs associated with these investigations along with potential legal actions, delays, and rescheduling of field construction work can range from an estimated $0.5 to $1.5 million[1]. If penalties are applied, the financial impact can be even higher. **Current approach to network switching** The current processes for preparing and executing network switching are manual and resource-intensive, involving lengthy lead times and repeated manual data entry across systems. These processes depend on an unsupported custom application, increasing the risk of errors that could lead to staff and customer safety concerns and unintended interruptions in electricity supply. Field operators adhere to strict operational instructions requiring high attention to detail, communicated through paper-based switching instructions and step-by-step phone verification with the control room. Control room network coordinators are responsible for the safe operation and continuous monitoring of the network, managing all network switching activities—including planned work, fault responses, and emergency actions in a 24/7 environment. Currently, these switching activities rely on outdated, paper-based processes combined with verbal communication (phone calls) and SCADA system operation. JEN's real time systems (Advanced Distribution Management System (ADMS), Distribution Management System (DMS), Outage Management System (OMS) and Switch Order Management (SOM)) provide a critical foundation for JEN's network information which underpins a wide range of operational functions including remote monitoring and control of the network, managing system outages, and improved planned and emergency event management.		

[1] Internally estimated value based on the cost of investigation, audit and rescheduling of works.

JEN's preparation and management of switching instructions (SIs) is not fully transitioned into the ADMS ecosystem. Currently, SIs are prepared in two different systems (OI Writer and SOM). OI Writer is a custom in-house application. Once the SIs are prepared using these tools, they are managed via a manual paper-based process, which has been refined over 50+ years. This process manages the ongoing updates to SIs prior to execution of the switching activities via checking activities. Execution of SIs are managed and coordinated by the control room in conjunction with direct contact with field operators via telephone calls and reference to paper based SIs.

These methods can cause miscommunication and reduce situational awareness among control room staff and field operators, potentially leading to errors during switching activities.

Following the switching process, operators must undertake a number of data capture activities (including recording customer on/off times) creating possible inaccuracies that potentially impact regulatory reporting, and the network data JEN holds.

This current approach is reflective of the improvements that JEN has made to the network switching process during the current 2021-26 regulatory period

During the current regulatory period, JEN undertook several initiatives to enhance the planned outage process, including:

- Implementing additional system changes to improve customer notifications and controls.
- Providing greater visibility of network data to support decision-making in outage planning.
- Conducting training to raise awareness of Electricity Distribution Code of Practice (EDCOP) obligations among staff involved in the planned outage process.
- Undertaking data cleansing activities to align physical and digital network data.

However, despite these improvements, in August 2024, JEN encountered a significant incident that underscored the existing risks. While following manual, paper-based processes, switching steps were mistakenly executed out of sequence, resulting in an unplanned outage affecting approximately 3,000 customers, including life support customers. This incident posed a potential safety risk to field operators, caused unplanned disruptions for customers, and threatened the integrity of JEN's assets, highlighting the inherent risk in the current process.

Despite these improvements, network switching remains a complex process with a high risk of error

Over time, without progressive and continuous improvement in automating and digitising controls within the outage management process, the risk of switching incidents will continue to grow and JEN has assessed this untreated risk level as 'Extreme' (see Attachment A).

In the current regulatory period (2021-2026), a network switch misidentification during a planned outage led to an un-notified power loss for 49 JEN customers, including one life support customer. In response, JEN committed to an enforceable undertaking with the Essential Services Commission (ESC) to implement a program of works aimed at mitigating these risks[2]. JEN is on track to fulfill these commitments by the end of the 2021-2026 period.

As JENs capex program increases the number of planned outages will increase, leading to a higher risk of network switching incidents

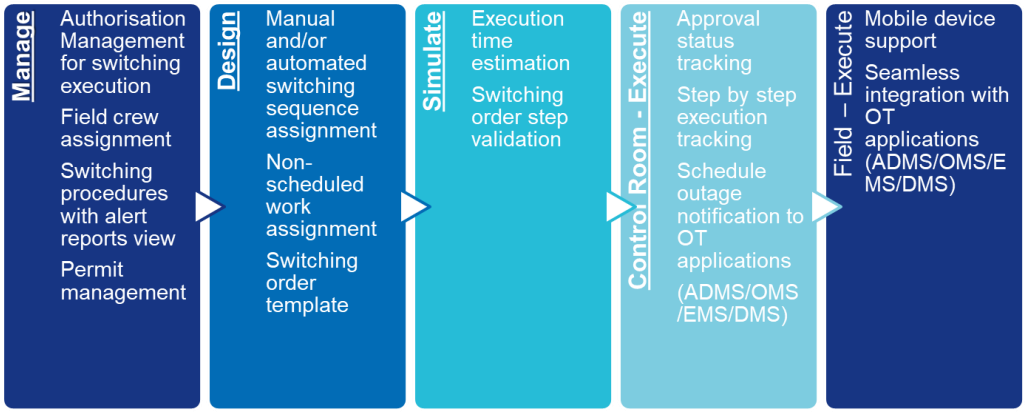
JEN's program of work has increased in the 2021-2026 regulatory period by approximately 16% per annum and it is planned to continue to increase by 56% over the forthcoming regulatory period. This program of work increases the number of switching activities needed, which in turn leads to an increase in the risk of errors in the preparation and execution of our planned outage processes.

[2] ESC, Jemena Electricity Networks (VIC) Ltd. failure to notify customers of a planned interruption undertaking 2024 | Essential Services Commission - https://www.esc.vic.gov.au/electricity-and-gas/market-performance-and-reporting/electricity-and-gas-company-enforceable-undertakings/jemena-electricity-networks-vic-ltd-acn-064-651-083-failure-notify-customers-planned-interruption

	To ensure this does not lead to perverse customer outcomes, it is essential that JEN continues to prudently invest in removing manual steps where high risk remains and maintains compliance with our safety and reliability obligations. **Industry trends indicate that distribution utilities are digitising high risk network switching activities** Transitioning to a single, integrated, outage management solution aligns with industry trends, particularly the adoption of ADMS by distribution utilities, which includes the digitisation of switching activities[3]. This initiative also recommends implementing a non-verbal communication platform for control room and field staff, ensuring clear and consistent instructions during network switching operations. This enhancement increases safety and reduces risks associated with these activities, providing standard functionality typical of Mobile Workforce Management solutions integrated with ADMS, Geospatial Information System (GIS), and Enterprise Asset Management (EAM), as indicated by Gartner.[4] The need for systemised, digital processes has become critical, especially with rising staff attrition in the electricity industry, which results in a loss of experienced personnel.
Customer Importance	This initiative will enhance JEN's Network Operations by improving real-time awareness of the dynamic status of the electricity network and the locations of staff working on it, particularly during switching operations and fault management. This improvement will deliver the following benefits for our customers: • **Reduced risk of unintended supply loss**: minimising the likelihood of accidental interruptions during planned outage activities. • **Lower impact of momentary interruptions and faults**: reducing the frequency and impact of brief interruptions and faults, enhancing overall service quality. • **Improved fault and emergency response**: enabling faster, more accurate response to faults and emergencies, reducing hazard risks in the field. • **Accurate and detailed real-time information**: improving the precision and depth of information shared with field crews to keep them better informed in rapidly changing situations, which in turns leads to a better customer service. • **Increased safety in network operations**: elevating safety measures for staff, customers, and the public through improved control and monitoring. • **Continued realisation of benefits delivered in the current period:** JEN has made improvements necessary to maintain the reduced risks in the current period (as detailed in the background section). Continued investments ensure maximum value is realised from these investments. By implementing this initiative, JEN will significantly improve operational safety and customer communication, while also reducing risks associated with manual processes.
Key Considerations	The solution to enable digital switching relies on the use of existing real-time systems and integrating them with non-verbal communication capabilities. The capability footprint covered by these options is as follows.

[3] Gartner, Hype Cycle for Utility Industry IT, 2023 ADMS - https://www.gartner.com/en/doc/792461-hype-cycle-for-utility-industry-it-2023

[4] Gartner, Market Guide for Mobile Workforce Management Solutions for Power and Utilities, 2024 - https://www.gartner.com/reviews/market/mobile-workforce-management-software-for-utilities



How costs were derived

The effort and costs for implementing our preferred option (Option 2) have been estimated based on JEN's previous experience, as well as specific cost estimations provided by a third-party vendor.

This initiative assumes a blended team of internal and external resources, with external resources supplying specialised skills in control room tools—a capability not available internally. The capex component includes costs for development, testing, and new licenses for the Mobility Platform during implementation. These estimates are based on initial discussions with a vendor and their current licensing model.

The opex component covers costs for internal resources who will focus on change management and training associated with transitioning from manual, paper-based processes, to a fully digital solution. The implementation will require extensive change management efforts, involving multiple areas such as the control room, operational planning and field teams. Processes and procedures will need to be aligned, and training activities will be targeted and reinforced over time to embed knowledge and support the transition from long-established paper-based processes, developed over 50+ years, to a digital platform.

Ongoing recurrent step opex costs are incremental costs allocated for the ongoing maintenance of the new platform.

Options

JEN has considered 3 alternatives to delivering the capability articulated above:

(1) Do nothing (continue current work practices) – not recommended
(2) Single vendor platform – recommended
(3) Multi-vendor platforms – not recommended

Option 1: Do Nothing (continue current work practices)

Description

No action is taken to automate the management of switching and manual processes remain in place. Additional manual work and oversight will be required in order not to increase the risk of possible harm to JEN staff and customers.

Benefits

There are no benefits associated with this option. Doing nothing only avoids immediate capital expenditure outlined in option 2.

Risks

Risks associated with this option are:

- As the volume of planned network outages increases, there are associated safety concerns with the manual process used currently, driven by risk of manual errors.

- The manual switching process is time intensive, which puts us at risk of not being able to complete the required number of planned outages, in line with JENs network program.
- As detailed in the background section, safety improvements made during the 2021-26 period to JEN's outage management process period may be lost due to the increased volumes of planned outages, relating to more complex energy connections.
- JEN would continue to use a custom in-house application (OI writer), relying on specialised knowledge, which we risk losing if employees leave JEN.
- Without modern systems and processes, JEN could risk employee retention and hiring as employees would be operating in a more complex environment.

During the current regulatory period the "Extreme" risk rating of planned outages has been managed through the introduction of controls (refer Background section) reducing the likelihood of "Possible" to "Unlikely" achieving a residual risk rating of "High".

Taking a "do nothing" approach will increase the likelihood to Possible thus the overall risk back to "Extreme" due to the ongoing growth of the program of work and thus the number of planned outages.

With the program of work forecast to continue to increase by 56% over the forthcoming regulatory period, continued reliance on manual, paper-based processes increases the risk of switching incidents.

Risk Ratings Matrix

Likelihood		Consequence				
		1	2	3	4	5
		Minor	Serious	Severe	Major	Catastrophic
5	Almost Certain	Moderate	High	Extreme	Extreme	Extreme
4	Likely	Moderate	Significant	High	Extreme	Extreme
3	Possible	Moderate	Moderate	Significant	High	Extreme
2	Unlikely	Low	Low	Moderate	Significant	High
1	Rare	Low	Low	Moderate	Moderate	Significant

The cost of the extreme event through investigation, audit, legal action, delay and cost of work rescheduling and necessary rectification at the time of the event will be in the range of $0.5-1.5M for each incident.

Additional manual work and oversight will be required in order not to increase the risk of possible harm to JEN staff and customers.

Summary

This option is not recommended as we do not consider that it reflects good industry practice due to the increased risks outlined above, and the regression of improvements delivered in the current period.

Option 2: Single vendor platform

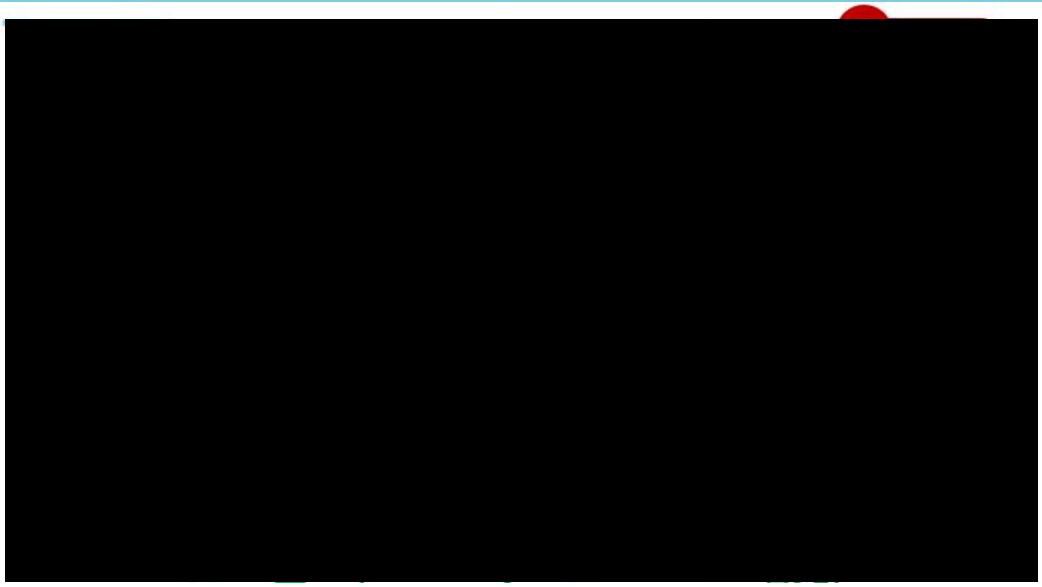
Description

This option outlines the automation of management of switching activities in the control room and establishment of non-verbal communications with the field using the existing ADMS platform suite.

A key outcome of this initiative will be to establish digital management of the switching steps and inbuilt digital safety logic, providing clear instructions between field staff and the control room during switching operations of the network, driving increased safety and reducing risks of undertaking these activities.

Improvements will focus on the following capability areas, as shown in the figure below, using JEN's current vendor platform:

1. Improvement in the switching order management and OMS capabilities.
2. Network model data.
3. Mobile Application capabilities to enable non-verbal communication to the field.



Based on early discussions with [redacted] this initiative assumes the current vendor [redacted] has the capability to support the implementation of the required functionality thus achieving a single integrated platform solution, which has been indicated by conversations with the vendor.

Costs

JEN's costs for this option are outlined in the table below.

$2024	RY27	RY28	RY29	RY30	RY31
Digital capex	[redacted]				
Non-recurrent opex	[redacted]	[redacted]		[redacted]	
Recurrent-step opex				[redacted]	[redacted]
Total opex	[redacted]	[redacted]		[redacted]	
Total	[redacted]				[redacted]0

[redacted]

Benefits

This option will continue to maintain the reduced risk profile achieved during the current regulatory period, which were delivered under JEN's compulsory undertaking with the ESC (i.e. with likelihood of *Unlikely,* equalling a risk rating of *High).*

Likelihood		Consequence				
		1	2	3	4	5
		Minor	Serious	Severe	Major	Catastrophic
5	Almost Certain	Moderate	High	Extreme	Extreme	Extreme
4	Likely	Moderate	Significant	High	Extreme	Extreme
3	Possible	Moderate	Moderate	Significant	High	Extreme
2	Unlikely	Low	Low	Moderate	Significant	High
1	Rare	Low	Low	Moderate	Moderate	Significant

This option will sustain the reduced risk level, despite challenges such as:

- A more complex control room operating environment.

- An expanded work program requiring additional planned outages, estimated at 36%.
- A higher likelihood of unplanned outages due to extreme weather events.

The following benefits will be realised by consolidating switching instruction management into an integrated toolset and digitising the process of writing and checking switching instructions, whilst also establishing non-verbal digital communication methods between field and control room staff during execution of switching:

- Improvements in efficiency, visibility and awareness of critical operational activities.
- Improved accuracy and detail of real-time information communicated to customers and field crews and prevention of errors through inbuilt digital safety logic.
- JEN would discontinue the use of a custom in-house application (OI Writer), reducing risks related to security, data integrity, and functionality. This also mitigates dependency on specialized knowledge that could be lost if key employees leave JEN.
- Transitioning to a fully digital solution, supported by JEN's current real-time systems vendor will reduce the risk of human error associated with paper-based processes and verbal communication between control room and field staff.
- Ability to continue to meet customer expectations of accessible communication, digitisation and automation described in the Customer Importance section above.
- Reduced risk of impact from planned outage interruptions by reducing the number of possible impacted customers should there be an error.

Risks

The implementation of this option is dependent on the 'Real Time Systems (RTS) Lifecycle Upgrade', a critical internal JEN project, which is currently targeted to complete late 2025 - early 2026 and involves the lifecycle upgrades to the control room systems that monitor and control the network in real time. This introduces the risk of delay in commencing the program should the upgrade take longer than expected to deliver.

Whilst estimates for the delivery of this initiative is based on the learnings from the previous implementation of business capability with the [redacted], there is a risk that new or altered capability delivered through the RTS upgrade may require additional effort to configure or extend where needed thus additional effort and cost would be required. We will manage this risk by ensuring the same internal staff who are [redacted] subject matter experts are also part of the RTS upgrade.

Summary

This option is the recommended option, as it maintains the current vendor stack of products with less risk of integration errors. We consider it reflects good industry practice given the benefits and risks outlined above. Furthermore, it provides the lowest sustainable cost.

Option 3: Multi-vendor platforms

Description

This option is the same as option 2, however it will look to deliver part of the solution capabilities using JEN's current vendor, [redacted] and deliver non-verbal communication via a mobile application provided by a different vendor solution.

Scope to be delivered [redacted]

- Improvement in the switching order management.
- OMS capabilities.

- Network model data.

Scope to be delivered using a 3rd party platform:

- Mobile Application capabilities to enable non-verbal communication to the field.
- Integration into the current ADMS as well as other enterprise integration platforms as required.

Costs

JEN's costs for this option are outlined in the table below.

$2024	RY27	RY28	RY29	RY30	RY31
Digital capex	[redacted]				
Non-recurrent opex	[redacted]	[redacted]		[redacted]	[redacted]
Recurrent-step opex			[redacted]	[redacted]	[redacted]
Total opex	[redacted]	[redacted]			
Total	[redacted]				

[redacted]

Benefits

The benefits of this option are the same as option 2. In addition, the new system for communications can readily be decoupled from the existing stack, supporting simpler future upgrades and migration paths for this component.

Risks

The risks for this option are the same as the risks for option 2 however additional risks emerge.

- There is risk related to the delivery of the 3rd party vendor platform for non-verbal communications. The delivery may be more complex and take longer to deliver than expected thus additional costs may be incurred.
- Effort for the implementation of the 3rd party toolset is assumed to be similar to the implementation of the equivalent toolset from [redacted] however additional costs have been assumed to build the respective integration between toolsets and as noted above will introduce additional risks.

Summary

This option is not recommended as it adds complexity and risk to control room software architecture and introducing a new product into the current platform requires additional integrations, adds new points of failure and increases costs of maintenance. The additional benefits of this option are not substantial enough to justify these risks. Furthermore, it does not provide the lowest sustainable cost.

<table>
<tr><td>Options Summary</td><td>The table below summarises the quantitative and qualitative differences between the analysed options.
<table>
<tr><th>$2024</th><th>Capex</th><th>Opex</th><th>Totex</th><th>NPV</th><th>Residual Risk</th></tr>
<tr><td>Option 1</td><td>Not applicable</td><td>Not applicable</td><td>Not applicable</td><td>Not applicable</td><td>Extreme</td></tr>
<tr><td>Option 2</td><td>[redacted]</td><td></td><td>[redacted]</td><td>[redacted]</td><td>High</td></tr>
<tr><td>Option 3</td><td>[redacted]</td><td></td><td>[redacted]</td><td>[redacted]</td><td>High</td></tr>
</table></td></tr>
<tr><td>What We Are Recommending</td><td>JEN recommends Option 2 as we consider that it best reflects good industry practice and provides the lowest sustainable cost.</td></tr>
<tr><td>Dependencies on other Investment Briefs</td><td>This solution is dependent on new planned devices (for example substations, switches) to exists as an object in the ADMS which is planned to be delivered by the Dynamic Network Planning with Automation Project (see Attachment JEN – RIN – Support - ICT Investment Brief – Dynamic Network Planning with Automation). The proposed solution will enable the information from the design into various ADMS models so that they can be available to be utilised during the digital switching activities on restoration.</td></tr>
<tr><td>Relationship to ICT Capital Forecast</td><td>The supporting modelling for this investment brief is contained in the following model: JEN – IT Investment Brief – Digitising Network Switching – Costs and Benefits Analysis Model.</td></tr>
</table>

Attachment A

[redacted]

[redacted]

Risk Ratings Matrix

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