Jemena Electricity Networks (Vic) Ltd

Business Case

IT Business Case - 5-Minute Settlement

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Abbreviations

5MS	Five Minute Settlement
ACS	Alternative Control Services
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AMI	Advanced Metering Infrastructure
API	Application Programming Interface
B2B	Business to Business transactions
BI	Business Intelligence
BRS	Business Requirements Specification
CoE	The environment provided by the key vendor (Itron) for testing of changes to their product
ESC	Essential Services Commission (Victoria)
FRS	Functional Requirements Specification
GIS	Graphical Information Systems
GS	Global Settlements
IT	Information Technology
JEN	Jemena Electricity Networks (Vic) Ltd.
JSAP	JEN Corporate SAP
LNSP	Local Network Service Provider
MC	Metering Coordinator
MDMS	Meter Data Management System
MDP	Meter Data Provider
MSATS	Market Settlement and Transfer Solutions
MSI	Market Systems Integration
MP	Meter Provider
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
NMS	Network Management System
OMS	Outage Management Systems
OT	Operational Technology
RTS	Real Time Systems
SAD	Solution Architecture Design
SCS	Standard Control Services
UIQ	Utility IQ
VIC-AMI	Advanced Meter Installations in Victoria
WTN	WebMethods Trading Network

1. Background

1.1 Objective

The objective of this business case is for Jemena Electricity Networks (Vic) Ltd. (**JEN**) to comply with regulatory requirements associated with 5-Minute Settlement (**5MS**) and Global Settlements (**GS**) National Electricity Rules (**NER, Rule**) requirements while maintaining current service levels to our customers.

This business case outlines the options for meeting those objectives and makes a recommendation on the best approach to proceed.

1.2 Requirement

On the 28 November 2017, the Australian Energy Market Commission (**AEMC**) made a final rule to change the settlement period for the electricity spot price from thirty minutes to five minutes; the final rule will align operational dispatch and financial settlement at five minutes. The change takes place in stages and starts in 2021[1].

In addition to this change, on the 6 December 2018, the AEMC made a final rule that requires a move from a boundary load settlement to a global settlement framework for the demand side of the wholesale electricity market[2].

To give effect to these compliance requirements in the most efficient way possible, JEN must make changes to its metrology procedures, business process and Information Technology (**IT**). For efficiency reasons, both 5MS and GS requirements are being progressed as a single project referred to as 5MS.

1.3 Customer importance

The implementation of this program will ensure that JEN systems and processes remain compliant with NER and that we continue to meet our regulatory and licence obligations.

In delivering this project, JEN will support the customer benefits identified in the 5MS and GS rule changes to provide:

- improved price signals for more efficient generation and use of electricity
- improved price signals for more efficient investment in capacity and demand response technologies to balance supply and demand
- improved bidding incentives.

More specifically, if we do not implement this initiative, we will be unable to operate in the NEM. This approach will have a detrimental impact on JEN's customers, not only because the benefits of 5MS and GS cannot be realised, but also because the benefits of normal operations will cease.

1.4 The Role of JEN in the NEM

JEN is a Local Network Service Provider (**LNSP**) located in the Victorian Jurisdiction. JEN is subject to the obligations of the derogation associated with the implementation of the VIC-AMI meters[3] and is accredited as a Metering Provider (**MP**). In the context of obligations to undertake changes required to implement 5MS and GS, JEN has the roles of:

- LNSP - able to accept and process metering data associated with Type 1 to 4 and Type 7 metering.

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1 AEMC, *National Electricity Amendment (Five Minute Settlement) Rule 2017, 28 November 2017*

2 AEMC, *Rule determination, national electricity amendment (global settlement and market reconciliation) rule 2018*, 6 December 2018

3 AEMC, *Victorian Jurisdictional Derogation - Advanced Metering Infrastructure, Rule Determination*, 28 November 2013

- Metering Coordinator (**MC**) for Meter types VIC-AMI 5,6,7
- Meter Data Provider (**MDP**) for Meter types VIC-AMI Type 5,6.

The roles undertaken by JEN (LNSP, MDP, MP and MC) are all impacted by the implementation of 5MS and GS. Table 1–1 below outlines the number of metering installations and the various roles JEN plays.

Table 1–1: Number of meters and relevant JEN Role (as at the end of 2018)

Meter Type	Relevant JEN Role	Number of Installations
Type 1	LNSP	0
Type 2	LNSP	10
Type 3	LNSP	5
Type 4	LNSP	0
Type 5 (Including AMI-VIC)	LNSP,MC,MDP,MP	351,468
Type 6	LNSP,MC,MDP,MP	5,133
Type 7	LNSP,MC	~75,000 lights (managed as 30 NMIs)

Source: JEN

2. Scope of changes associated with 5MS

The AEMC has provided a high-level summary of the scope of changes required for 5MS for the various participant types in the NEM[4]. Given the roles that JEN has in the NEM, the relevant extracts from the document are as below.

	During the transition period	From 1 July 2021
Networks	Where necessary, update internal procedures and document Where necessary, upgrade/make changes to the following IT systems: ♦ Settlement ♦ Billing ♦ Reporting ♦ Data collection and storage ♦ Network planning system	With respect to billing for distribution services, calculate charges for distribution services from either metering data or settlements ready data for type 4 metering installations. *From 1 July 2021*, ensure that type 7 unmetered loads are calculated on a five minute basis.
Metering data providers	Where necessary upgrade/make changes to the following IT systems: ♦ Reporting ♦ Data collection and storage ♦ Meter data management system ♦ B2B e-hub	***By 1 July 2021***, ensure that type 1, 2 and 3 metering installations record and provide five minute data. ***By 1 July 2021***, ensure that any type 4 metering installations at a transmission network connection point or distribution network connection point, where the relevant financially responsible Market Participant is a Market Generator or Small Generation Aggregator, record and provide five minute data. ***By 1 December 2022 at the latest***, ensure that all new and replacement type 4 and type 5 meters installed from 1 December 2018 record and provide five minute data. ***By 1 December 2022 at the latest***, ensure that all new and replacement type 4A meters installed from 1 December 2019 record and provide five minute data. ***By 1 July 2021***, ensure that type 7 unmetered loads are calculated on a five minute basis.
Metering coordinators	***By 1 July 2021***, upgrade types 1, 2 and 3 metering installations to be capable of recording and providing five minute data. ***By 1 July 2021***, upgrade type 4 metering installations at a transmission network connection point or distribution network connection point, where the relevant financially responsible Market Participant is a Market Generator or Small Generation Aggregator, to be capable of recording and providing five minute data. *(continued over page)*	***By 1 December 2022*** at the latest, ensure that all new and replacement type 4 and type 5 metering installations installed from 1 December 2018 record and provide five minute data. ***By 1 December 2022*** at the latest, ensure that all new and replacement type 4A metering installations installed from 1 December 2019 record and provide five minute data.

[4] AEMC, *Five minute settlement Implementation Info sheet*, 28 November 2017

Metering coordinators (continued) 	***From 1 December 2018 to the commencement date,*** ensure that all new and replacement metering installations (other than type 4A metering installations) are capable of recording and providing five minute. ***From 1 December 2019 to the commencement date,*** ensure that all new and replacement type 4A metering installations are capable of recording and providing five minute data. Where necessary, upgrade/make changes to the following IT systems: ♦ Settlement ♦ Reporting ♦ Data collection and storage ♦ Meter data management system ♦ B2B e-hub	

An impact analysis exercise[5] to determine the impact on existing JEN systems and processes due to implementation of 5MS and GS has been undertaken based on the requirements identified through the Industry Working Groups and associated consultation processes. These have been considered in terms of:

- JEN IT systems impact
- JEN procedures impact.

2.1 JEN IT systems impact

JEN's existing IT systems and metering infrastructure have been designed to deliver 30-minute interval data as well as receive interval data in 15 and 30-minute intervals from the market, which is aligned to the longstanding industry approach. JEN is not currently capable of processing metrology data in smaller intervals; consequently, there are significant practical challenges and risks associated with operating and managing interval data in five-minute increments. One of the risks identified by JEN is successfully undertaking significant enhancements to our internal IT systems and processes while continuing with 'Business as Usual'.

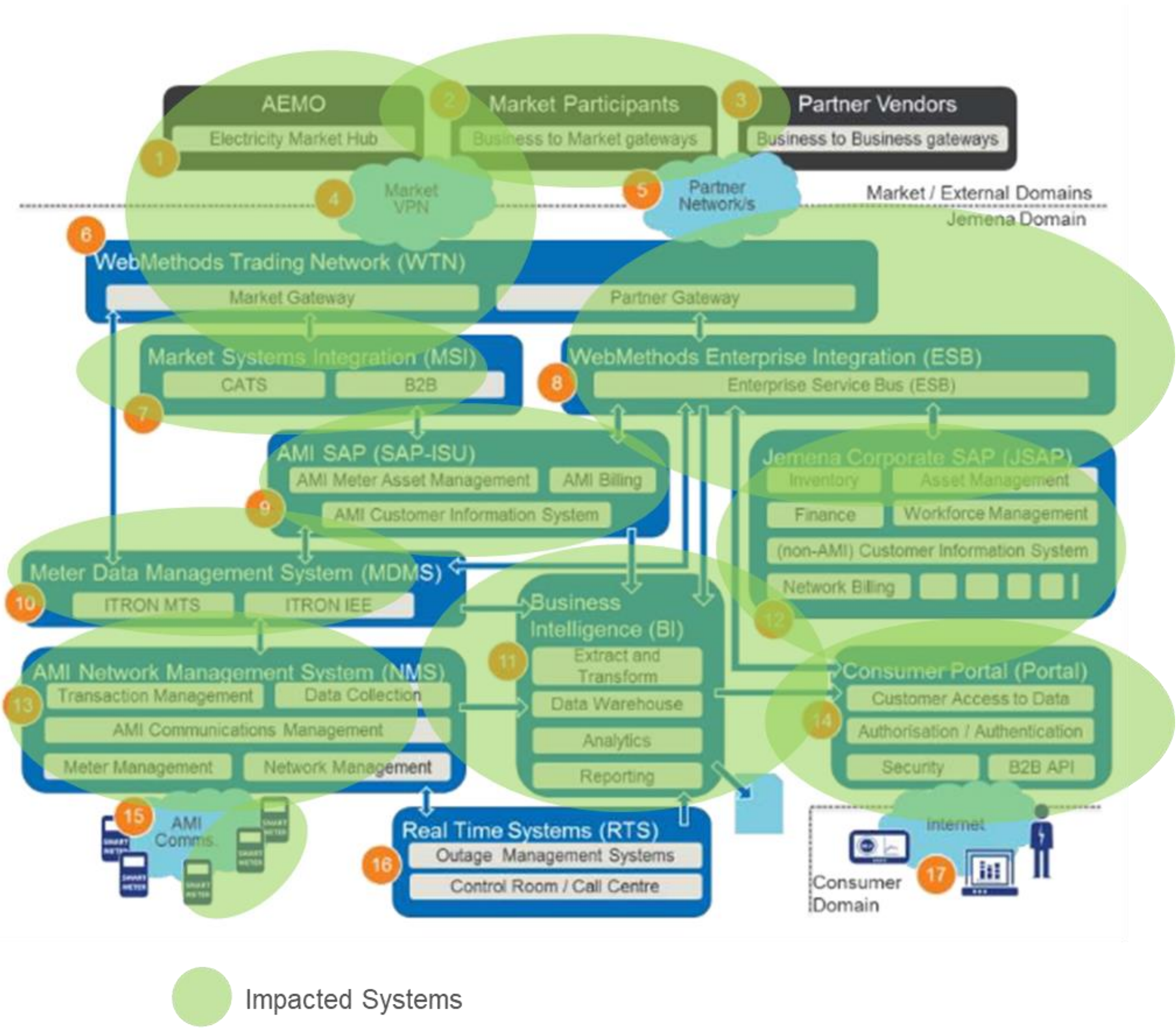
To comply with NER cl 11.103.4 (a), JEN will need to process six times as much meter data for customers/sites with a smart meter[6] (288 five-minute intervals instead of 48 half-hour intervals). This change will not only impact database growth but also the performance of processes such as meter read upload, billing and any extracts to data warehouses or analytics. Also, the network load will increase for consumers wanting to view their usage data via digital channels such as web and mobile.

The structure of the existing JEN IT environment is represented in Figure 2-1 (See **Error! Reference source not found.** for additional information regarding the Jemena systems). The JEN IT ecosystem is made up of several applications/infrastructure components that undertake particular functions associated with the collection (including receiving interval data from the market for large customers), storage, analysis and publishing of metering data.

5 Jemena, *An impact analysis document articulating the detailed impacts on IT systems, and business processes of the introduction of 5MS into JEN*. December 2019

6 Type 5 Vic-AMI meters.

Figure 2-1: Current JEN IT eco-system



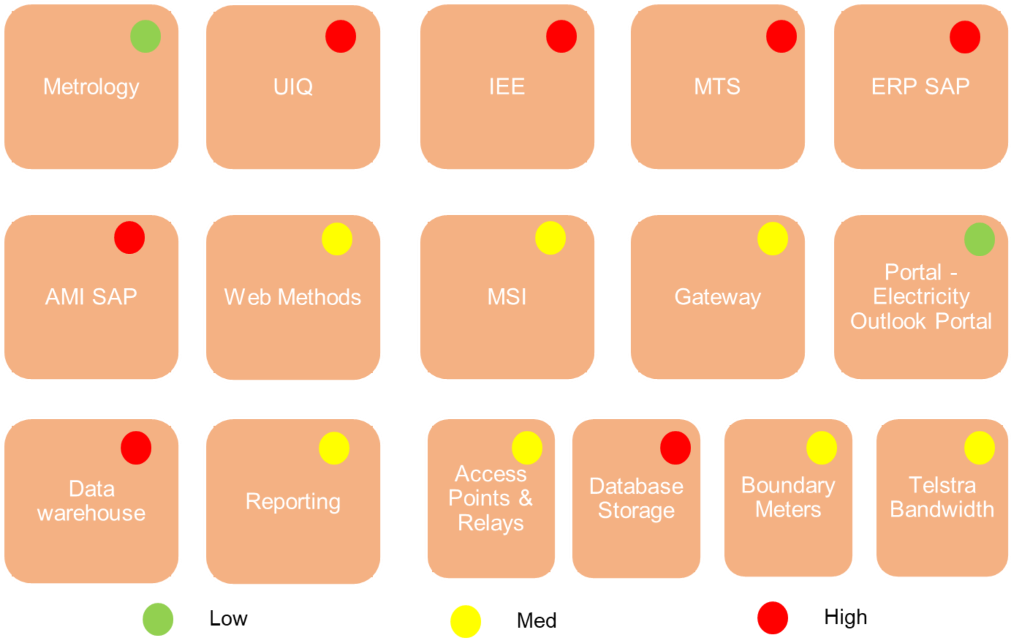
The impacts on the systems include:

- development, integration, testing and release of new and existing in-house and vendor-supplied modules to accommodate new functionality
- changes to meter firmware and communications modules to accommodate increased volumes of data and functionality changes
- increasing storage capacity in central metering systems to accommodate the increasing volume of data
- increasing communication capacity to ensure the timely transfer of increased data volumes
- increased processing power to process increased data volumes and associated analysis.

Of particular importance given the degree of integration of the systems is the testing that will be required to ensure the delivery of high-quality data for the end to end process from meter data collection in the field through to the provision of data to industry participants.

The impact on each system has been rated into High, Medium and Low based on the degree of change, associated effort, and the risk faced in achieving a successful implementation of the change within the required dates. The outcomes of this assessment are summarised in Figure 2-2.

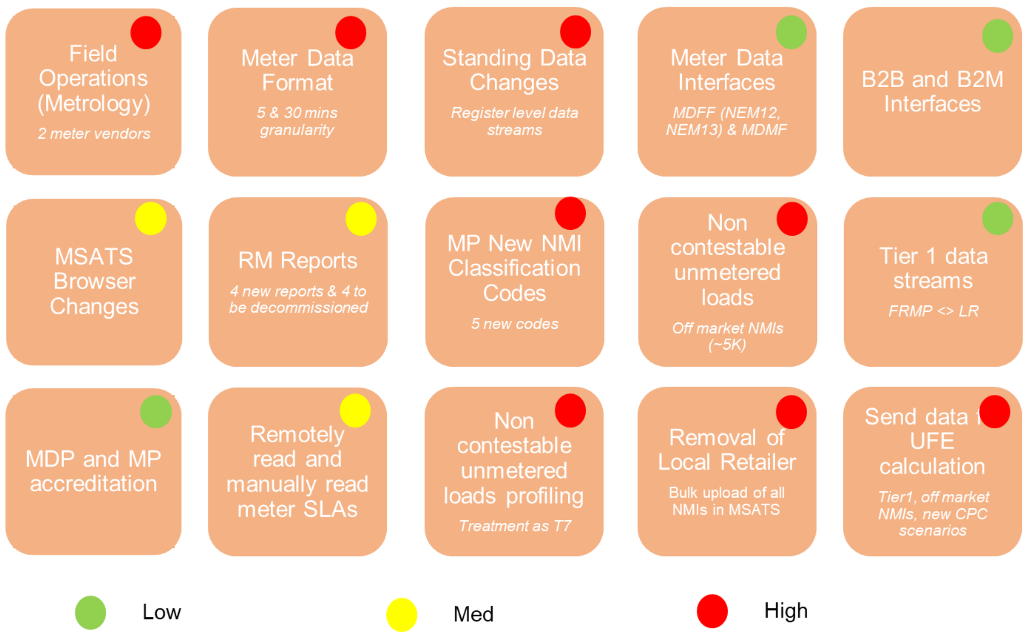
Figure 2-2: Impacts on IT systems



2.2 JEN procedures impact

Along with changes to the JEN IT eco-system, the impact analysis has identified several JEN metrology and associated procedures which require change. The effect of these changes has been grouped into High, Medium and Low based on the degree of change necessary to the existing systems and associated business processes.

Figure 2-3: Impact on internal operating procedures



3. Approach

3.1 Assessment of 5MS IT program infrastructure options

To meet the demands that the Rule change will place on JEN's IT systems, significant modifications across multiple technology platforms are required to build the capability to deliver five-minute settlement data to the market. In 2018 JEN assessed three options for the implementation of changes to the IT infrastructure, operating model and internal procedures to support the implementation of 5MS/GS. They were:

a) **Do nothing** This option involves undertaking no upgrades to IT systems and changes to JEN procedures. This option will result in JEN not meeting its compliance obligations as per National Electricity Amendment (Five Minute Settlement) Rule 2017 No. 15 (NER cl 11.103.4 (a)) that states that "The Metering Coordinator at a connection point must ensure that: all new or replacement metering installations (other than type 4A metering installations) installed between 1 December 2018 and the commencement date are capable of recording and providing trading interval energy data of 5 minutes."

b) **Enhance and upgrade existing technology solutions** This option involves leveraging the technology investments that were made as part of the implementation of AMI. Given the increase in data volumes, existing platforms will need to be reconfigured and enhanced. Discussions with vendors have also indicated that new versions of several modules of their metering systems will need to be deployed, and firmware on some meters upgraded. Existing procedures, processes, and the operating model would need to be incrementally updated. The overall objective of this option is to minimise the cost and risks of implementing new technologies into JEN.

c) **Develop a greenfield technology solution and new capability** This option involves identifying, assessing and implementing a unique end to end technology solution to enable JEN to execute 5-minute settlements. This approach will not only include replacing components of the IT ecosystem but also replacing communication infrastructure and making changes to meters in the field. This design will be required as existing AMI interfaces are based on proprietary vendor protocols which can require hardware modifications.

3.1.1 IT Infrastructure options analysis

An options analysis has been undertaken and is summarised in Table 3-1.

Table 3-1: Options analysis

Option	Advantages	Disadvantages
A - Do Nothing. Timing = 0 months. Cost = $0.	• Business as Usual (No Change to JEN's IT and Operational Technology (OT) Systems.	• An inability to comply with 5-minute settlement regulatory obligations. • Non-compliance with the ESC Electricity Distribution Code[7]. • Reputational damage to JEN. • A negative impact on market harmonisation.

[7] ESC, *Electricity Distribution Code version 9A*, August 2018

Option	Advantages	Disadvantages
B - Enhance and Upgrade Existing Technology Solutions. Timing = 22 – 29 months. Cost = $22M - $27M.	• Reduces implementation risk, given the upgrade to existing systems does not involve the installation of new large scale technologies. • Leverages existing capabilities and established relationships with vendors reducing uncertainty. • Lower integration risk as existing components is already integrated (from the meter to revenue). • Performance/capability of existing IT ecosystem known and support arrangements in place. • The vast majority of procedures and business process changes are an evolution of the existing processes, meaning comparatively less effort than starting over.	• Key vendors may not adhere to the timing or quality required by JEN. • New vendor modules may be required to be developed and implemented. • Optimisation of Network Communication Infrastructure is required. • Higher reliance on telecommunication companies and standards.
C - Greenfield Timing = > 36 months. Cost = $46M+.	• Implementing new and emerging utility and digital technologies to ensure secure, cost-effective, fast and resilient telemetry of energy usage data. • Introduces interoperable telecommunication and open source standards allowing increased ability to implement future NEM requirements. • Provides opportunities to implement new technologies such as cloud-based solutions increasing future flexibility to accommodate the change.	• Limited availability of alternative suppliers in the market. • Need for the establishment of contracts and relationships with new suppliers. • Current proprietary interdependencies between meters and processes would need to be addressed. • Changes required to business processes and procedures driven by new systems and technology. • Low product maturity from vendors and supplies for cloud-based offerings adding implementation risk. • Increased risk to the day to day operations of JEN during the transition to new technologies. • Requirement for a change to staff capacity and capability during the transition to a new technology environment. • Requires a long-term financial commitment to new hardware/software. • Higher cost of implementation. • Increased risk that compliance dates will not be met. • Under utilises the asset lives for existing metering assets, telecommunications and IT systems.

3.1.2 Recommended IT infrastructure option

Option A - Do Nothing has been discounted as it does not meet compliance requirements and therefore would not allow JEN to remain compliant with the ESC Electricity Distribution Code[7] nor maintain current services to customers, or comply with its existing or new regulatory obligations.

<u>Option C - Greenfield</u> Based on timing, risk, and cost considerations, this option is not seen as appropriate at this time. This option involves moving from the existing proprietary communications modules and data collection systems of our current vendor to an open platform which would allow the utilisation of evolving technologies and platforms. This approach would involve field visits to meters, the sourcing and implementation of meter communications modules, potentially new meters and the implementation and integration of new MDMS products at JEN. This option has been considered from a perspective of risk, cost, and timing.

Risk: An initial review of the market[8] indicates that at this time, there is no mature product offering a substantially stronger product set than that provided by the current vendor. The analysis showed that our current vendor was assessed as a leader in the area of Meter Data Management products, including in the adoption of new technologies.

As such, our assessment is that the benefits achieved by a greenfields implementation at this point would not outweigh the risks of undertaking such an implementation. The implementation of a new and untested solution is not seen as a prudent or efficient approach to implement 5MS. Previous industry experience in the implementation of AMI has highlighted the risks of utilising such untested solutions[9].

Cost: To provide a cost estimate for this option, JEN considered a project with a similar scope involving the deployment of meters, upgrades to communication and central IT infrastructure, along with the introduction of new business processes (implementation of AMI)[10]. To estimate the costs associated with the greenfields option, JEN took the rollout of the AMI program and escalated from 2008 to current dollar values for comparison. This approach resulted in a cost of $46M for the central IT systems alone. The analysis ceased at this point as the cost already far exceeded the alternative options. Had the analysis continued, additional costs would be included (for example, overheads, communications, field visits, etc.) and this would only make the comparative analysis worse. While some savings could be assumed from prior experience of rolling out AMI systems, it would not be in the magnitude to bring costs below the alternative options; mainly because the costs incurred by Jemena for the implementation of AMI have already been assessed as efficient by the AER.

Further, this option does not have a clear path for converging the greenfield and existing AMI system. It may require Jemena to maintain two solutions indefinitely (or would require a large integration project at a later date), further adding to the cost of this option.

Timing: This option requires a step change to the existing JEN environment. As such, there is less confidence with this option that the necessary adjustments can be achieved within the compliance time frames. Further, there is expected to be an additional lead time in the identification of technology solutions, negotiation of procurement contracts, and the establishment of new vendor relationships. Based on the experience from the AMI implementation, it would be expected that such a greenfields change to implement 5MS would take more than three years which is outside the compliance timeframes.

Greenfield implementation is not recommended as JEN believes it results in a higher cost implementation, would take longer to implement, and given the lack of mature products to meet this option, is higher risk than other options.

<u>Option B – Enhance and Upgrade existing technology solutions</u>

This option is Jemena's recommended approach as the incumbent market systems implemented for the introduction of AMI are considered fit for purpose and scalable to accommodate 5MS.

Risk: Considered low risk as it builds on the known capabilities of existing systems, and a relationship with the incumbent vendor.

Cost: Excluding the 'do nothing' option, this option is the least cost.

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8 Gartner*, ID: G00350702: Magic Quadrant for Meter Data Management* – 17 December 2018

9 AER – Final decision advanced metering infrastructure transition charges applications, December 2016. 'Given that the type of 3G modules which AusNet Services procured were a 'brand new product' which had yet to 'undergo proof of concept and prototype testing' we consider AusNet Services' did not act prudently in providing AMI services.'

10 AER, *Jemena – AMI transition charge application – Attachment 1 – AMI Charges Model*, 31 May 2016

Timing: This option provides the highest level of confidence in meeting the compliance timeframes, given that JEN is dealing with incremental change to an existing IT environment.

As part of this option, where aspects of new vendor offerings and advancements in technology can be adopted without adversely impacting cost, time and risk, they should be considered for introduction. The potential for this will be confirmed as the Solution Architecture Design (**SAD**), Business Requirements Specification (**BRS**), and Functional Requirements Specification (**FRS**) are finalised in the detailed planning phase of the project.

3.1.3 IT infrastructure implementation assumptions

The selection of Option B is based on the following IT implementation assumptions:

- that the vendors deliver a quality product on time
- that the AEMO related systems and processes are fit for purpose and are finalised on time
- that the existing infrastructure can meet the increased performance requirements or can be upgraded to meet the requirements within the current budget and time.

These assumptions will be validated during the detailed planning phase.

3.2 Delivery approach for 5MS program

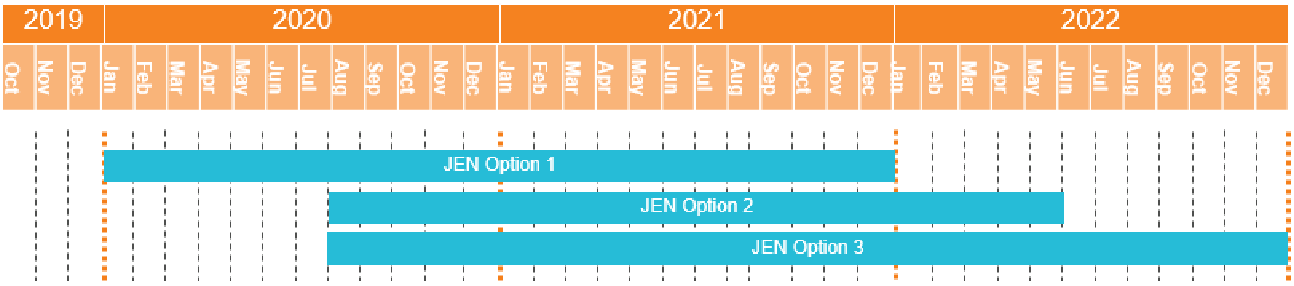
JEN is using a multi-stage delivery approach to implement changes to comply with 5MS obligations efficiently. This approach has been used to minimise delivery risk and efficiently manage the cost of implementation. The multi-stage delivery approach involves:

1. For 1 December 2018, we undertook the replacement and upgrade of Advanced Metering Infrastructure (**AMI**) metering fleet installations to ensure JEN's metering solution is capable of recording and providing five-minute data (Rule 11.103.4). In 2018, JEN completed a competitive tender process to select a high quality and cost-effective technology provider. As part of this process, we tested and implemented AMI meters capable of meeting the five-minute settlement requirements. This phase was completed successfully.
2. Throughout 2019 and aligning with AEMO's proposed program timeline, JEN actively participated in industry working groups and provided input through industry discussions and responses to draft determinations. This approach has supported the industry to finalise the requirements of 5-minute settlements and publish the new Business-2-Business (**B2B**) and Market Settlement and Transfer Solutions (**MSATS**) Metrology procedural changes. During this phase, JEN also undertook an impact analysis to determine changes required for IT systems and metering processes and procedures which allowed JEN to assess the potential delivery options for the 5MS program. A cost estimate for implementation options was developed, as well as determining the most appropriate implementation timeframes to balance the risk and cost associated with implementation.
3. From August 2020, JEN will execute a significant IT and AMI network upgrade project to ensure operational, functional and system readiness for 5-minute and global settlements. This change includes the ability to process and interpret 5-minute interval data, an uplift in infrastructure capacity to send and receive an increased number of transactions, and an increase of data storage and AMI network capacity. Further, changes to operational processes and procedures associated with 5MS will be completed. The objective is to undertake this work in a way that maintains our existing obligations and customer services. This approach will ensure JEN meets the expectation to provide and manage five-minute data no earlier than 1 July 2021 and no later than 1 December 2022 (NER, cl. 11.103.5) and ensure JEN can bill on receipt of 5-minute meter data from Type 1, 2, 3 & wholesale 4 meters; and generate and publish Type 7 meter data in five-minute intervals from 1 July 2021.

3.3 Evaluation of options for the timing of implementation

Three timing options have been considered for undertaking the implementation of the 5MS program, as outlined in Figure 3-1 below.

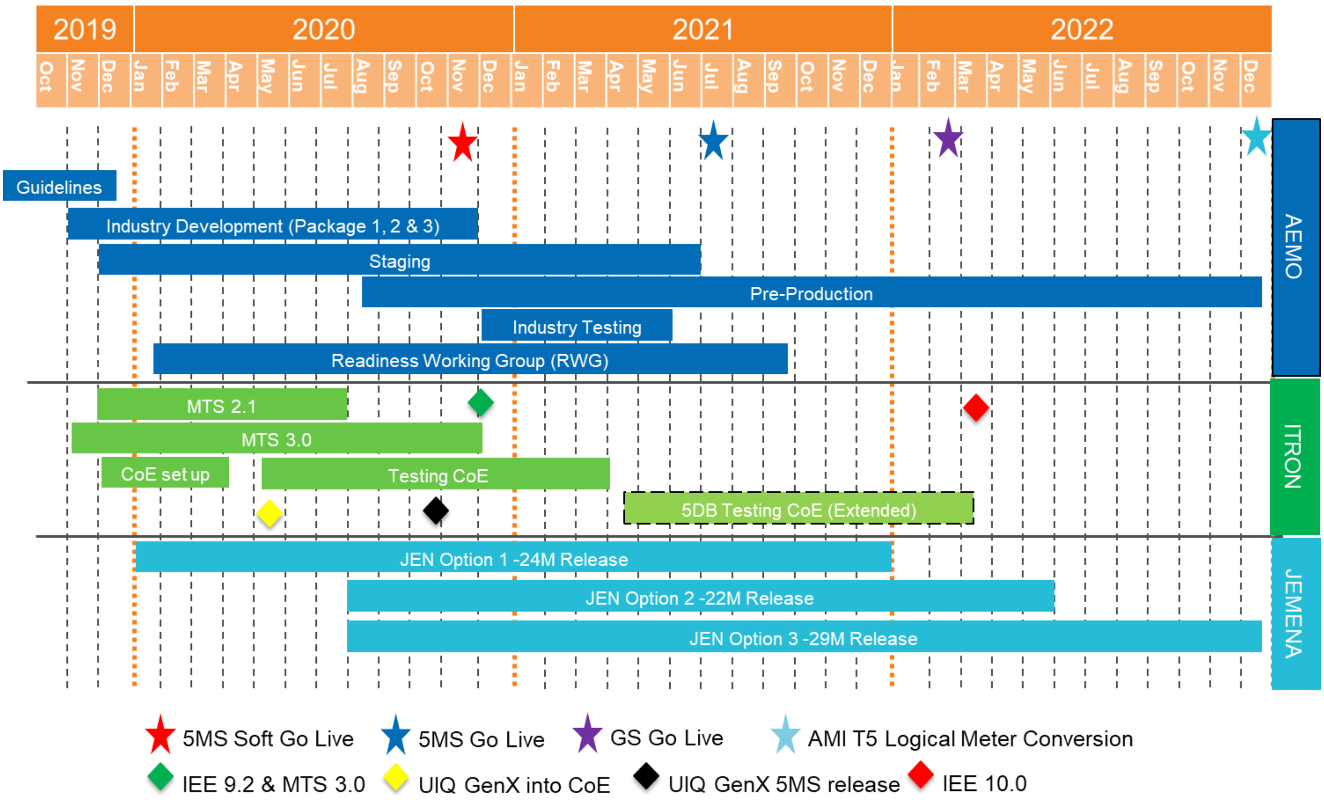
Figure 3-1: High-level timing options chart



Critical considerations in the selection of the option used by JEN relate to the interdependencies with the AEMO program and the availability of technology components from vendors. From a risk perspective, the objective is to find the balance between moving too early where the AEMO and vendor components may not be sufficiently stable and running too late where there is an insufficient contingency in the schedule to deal with issues that occur close to the compliance dates.

Figure 3-2 below shows the timing interdependencies of critical activities and milestones across AEMO, Itron (our key vendor) and JEN that were considered when determining the implementation timing option to be adopted.

Figure 3-2: Dependencies with JEN timing options



The table below provides a summary of the advantages and disadvantages of the three timing options for the implementation of 5MS / GS.

Table 3-2: Timing option description

<table>
<tr><th>Option</th><th>Advantages</th><th>Disadvantages</th></tr>
<tr><td>Option 1: Commence January 2020 – Finish December 2021.
Cost = $22.4M.
A 24-month program commencing in January 2020 with a single release on 1 July 2021.
The majority of the work completed before 31 December 2020.</td><td>Results in the lowest cost due to lower overheads and impacting core systems once.
Allows for maximum participation in Industry Testing, reducing the integration risk with other participants.
Provides continuity between phases of the project, allowing essential resources to move directly onto the implementation phase.
Provides scheduling contingency before compliance dates.</td><td>Has the risk that AEMO consultations and procedures may not be completed.
Has a considerable risk that IT vendors software releases may not be available or adequately tested in this timeframe.
Has a risk that reworks will be required based on the testing (internal and market) outcomes.</td></tr>
<tr><td>Option 2: Commence August 2020 – Finish May 2022.
Cost = $22.6M.
A 22-month program commencing in August 2020 with two releases:
Release one on 1 July 2021 to be able to receipt 5-minute reads (i.e. minimum change)
Release two on 1 February 2022 for the remainder of scope.
The majority of the work takes place after 1 January 2021.</td><td>Better aligned with vendor software releases and AEMO consultation timeframes, resulting in a reduced risk that the vendor and AEMO software will not be available when required for the JEN program.
Provides scheduling contingency before compliance dates.</td><td>Has reduced participation in Industry Testing, necessitating a need for Bilateral Testing.
Delays the commencement of activities associated with detailed planning and finalisation of technical architecture and functional requirements until August 2020.</td></tr>
<tr><td>Option 3: Commence August 2020 – Finish December 2022.
Cost = $26.9M.
A 29-month program commencing in August 2020 with three releases:
Release one on 1 July 2021 to be able to receipt 5-minute reads (i.e. minimum change).
Release two on 1 February 2022 for GS.
Release three on 1 December 2022 for the remainder of scope (5MS AMI).
The majority of the work takes place after 1 July 2021.</td><td>Provides focus on each of the three significant deliverables.
Spreads effort over a more extended period reducing the potential for resource contention with other projects.</td><td>Results in the highest cost and risk due to increased overheads and impacting core systems three times.
Has minimal participation in Industry Testing, necessitating a need for Bilateral Testing.
Delays activities associated with detailed planning and finalisation of technical architecture and functional requirements until August 2020.</td></tr>
</table>

JEN has undertaken a rigorous approach to forecasting required expenditure. This has been based on an understanding of the scope of the changes required to its systems and the number of resources needed to undertake these changes. The costs are discussed in further detail in Section 6.

3.3.1 Timing options risk

When considering a preferred timing option, key factors include, (i) vendor delivery performance and risk, (ii) market risks, (iii) project risks, and (iv) costs:

- Option 1 is considered **Medium** risk as vendor offerings may not be available or have a high number of defects in early 2020 – leading to additional costs and delays due to rework
- Option 2 has a **Low** risk as the vendor offerings are expected to be more robust at this stage, and there is the schedule contingency to address issues should unforeseen issues arise
- Option 3 is considered **High** risk as the completion date of December 2022 represents the final AEMO date for compliance – leaving no schedule contingency should unexpected problems arise.

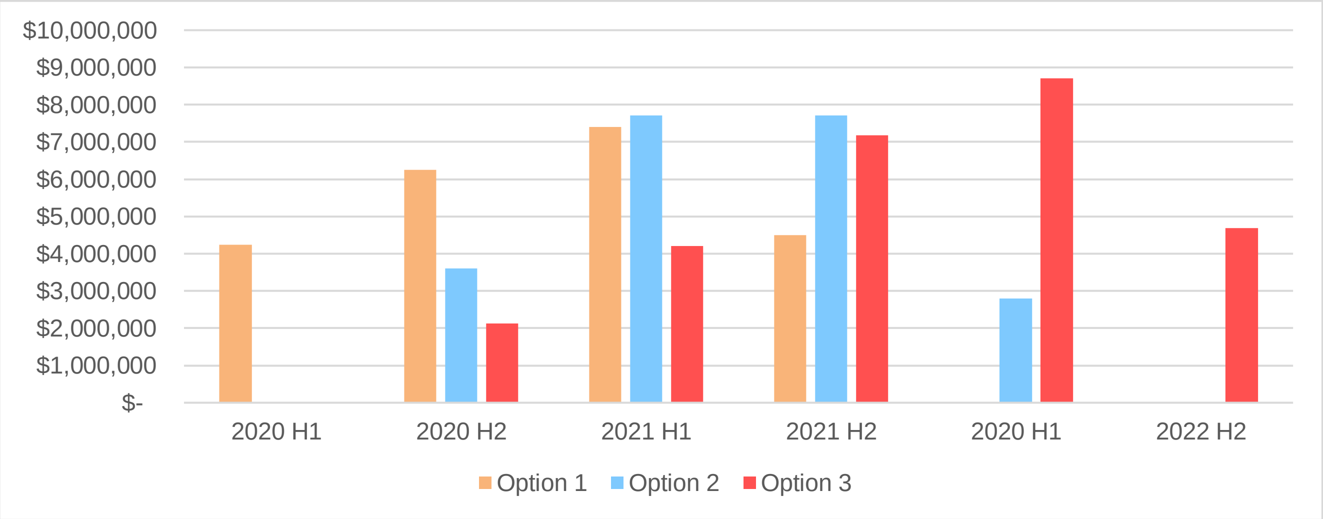
Table 3–3 and Figure 3-3 summarise the significant differences associated with the timing of the financing for the three options.

Table 3–3: Detailed timing of funding for the three options

Option	Start Date	End Date	Expenditure To Date ($ nominal, dollars)		Forecast Expenditure ($ June 2021, dollars)						
			CY18	CY19	CY20 H1	CY20 H2	CY21 H1	CY21 H2	CY22 H1	CY22 H2	Total CY20-22
1	Jan 20	Dec 21 (24m)	723,337	440,247	4,248,552	6,255,541	7,400,692	4,498,177	0	0	**22,402,962**
2	Aug 20	May 22 (22m)	723,337	440,247	0	3,835,760	7,479,365	8,253,235	2,994,063	0	**22,562,422**
3	Aug 20	Dec 22 (29m)	723,337	440,247	0	2,121,942	4,205,576	7,174,613	8,704,324	4,685,497	**26,891,951**

Note: For the avoidance of doubt, 2018 and 2019 expenditure is not included in the forecast totals and is the same across all options.

Figure 3-3: Timing of funding for the three options ($ June 2021, dollars)



3.3.2 Recommended timing option

After taking into account the various considerations, including cost, risk and dependence on vendor and market systems and schedules, we assessed the optimal combination to decide on which option to pursue. The differences between the assessment criteria for each of the three options are summarised in Figure 3-4 below.

Figure 3-4: Assessment criteria for each of the three options

	Option 1	Option 2	Option 3
Compliance with mandate	Yes	Yes	Yes
Cost	$22M	$22M	$26M
Relative Risk	Medium	Low	High
Fit with AEMO timeline	Good	Average	Poor
Fit with vendor timelines	Unknown	Yes	Yes
		Recommended	

3.3.3 Timing assumptions

In adopting Option 2 of the implementation timing options, the following assumptions have been made:

- The project will not be adversely affected by vendor readiness and engagement or AEMO readiness and engagement
- The project will not be impacted by any non-5MS/GS industry or compliance changes required that will have a direct or indirect impact on the 5MS/GS systems
- The project will not be affected by other projects in respect of the availability of subject matter experts to advise on the effects of 5MS and GS changes on JEN business processes and technology.

4. Implementation

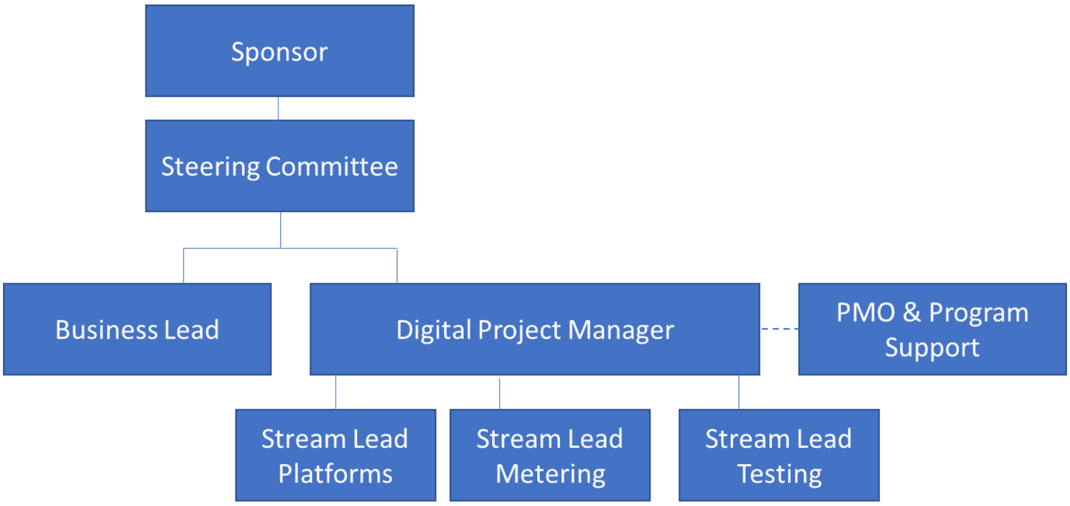
4.1 Program Governance Structure

The project will be managed as a Jemena Digital project given the degree of IT change associated with the project.

A steering committee will govern the project made up of General Managers from impacted business units. The steering committee will meet monthly to review status and to provide guidance to the project team.

Figure 4-1 below outlines the governance structure associated with the project.

Figure 4-1: High-level project governance structure

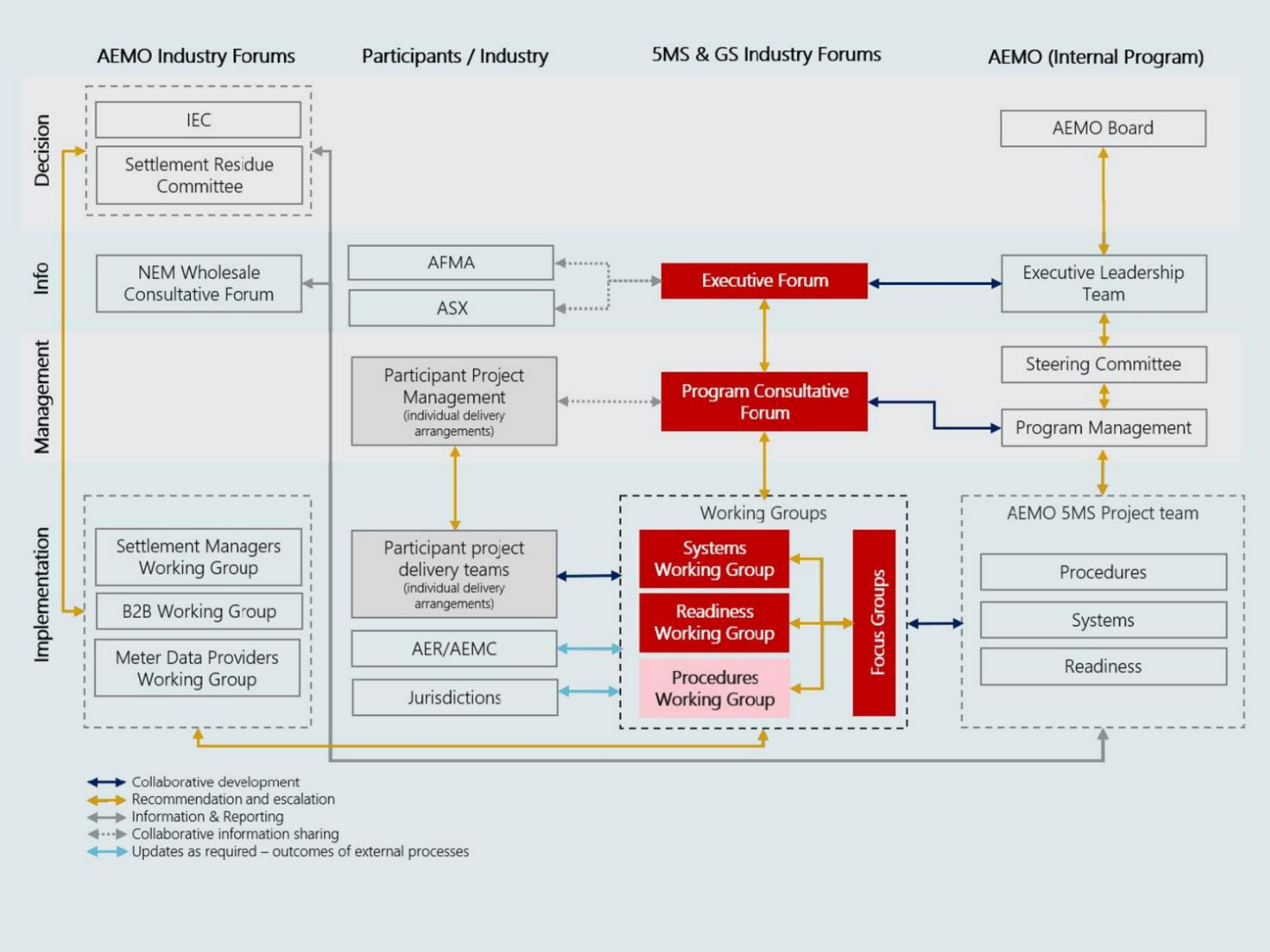


Impacted business units will contribute SME's as required to attend industry workshops and participate in the process of determining the necessary changes to market procedures and digital systems to support 5MS/GS. The impacts to JEN will be communicated to stakeholder groups, including regulatory and the EDPR team to allow them to prepare for the implementation of 5MS/GS.

The implementation of 5MS/GS has touchpoints with 5MS/GS specific industry working groups, existing industry working groups, and the project governance structure of each of the market participants. These interactions lead to a complex set of governance interactions that can impact on the success of the JEN 5MS/GS project unless appropriate engagement is in place. To this end, it is a high priority that the project is represented on the appropriate AEMO and industry working groups.

The current industry governance structure is as follows outlined in Figure 4-2.

Figure 4-2: Current industry governance structure



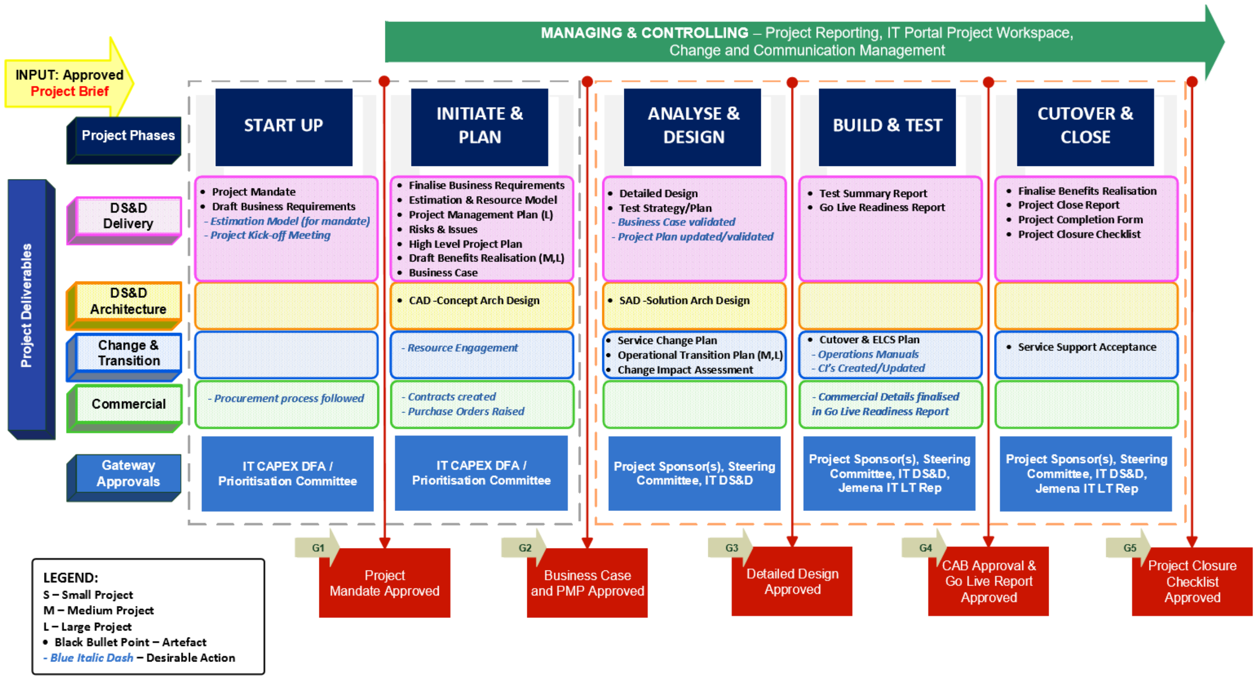
Additional information around the role of the various working groups can be found at the AEMO website[11].

4.2 Methodology

The 5MS/GS project is seen as a large project and consequently is subject to the Jemena IT PMO Project Management Lifecycle & Governance framework as outlined in Figure 4-3 below.

[11] AEMO, Website Five Minute Settlement and Global Settlement.

Figure 4-3: IT project management and governance framework



4.3 Implementation Risks

There are several risks associated with the implementation of 5MS/GS. These have been rated as per Jemena's Risk Management Framework, as outlined in Jemena's Risk Management Manual. As per the Risk Management Framework, actions to mitigate the identified risks have been identified, and a residual risk following successful application of the mitigation actions has been determined.

Relevant extracts of the Risk Management Framework used as inputs to the rating of the risks, outlined in Table 4-1, have been included in Appendix B.

Table 4-1: Implementation risks

Ref	Risk	Mitigation action	Residual Risk	Impact If Risk Realised
1	Lack of capable contract resources to undertake the required work are available given the timing/magnitude of changes across the energy industry.	- Early Identification of critical capabilities required. - Identify critical resources as early as possible and lock in availability.	Moderate	- Impact on the quality and timeliness of outcomes of the implementation phase and consequential benefits realisation.

Ref	Risk	Mitigation action	Residual Risk	Impact If Risk Realised
2	Other internal projects impact on the availability of JEN resources (including SMEs) to support the project.	- Work with the steering committee to ensure appropriate resources are available. - Part-time engagement of multiple resources to ensure continuity of knowledge of requirements. - Highlight any resource conflicts early and escalate through the governance process as required to address conflict.	Low	- Delays in project delivery, impacting ability to progress implementation phase, meet compliance dates and consequential benefits realisation. - Impact on the quality and timeliness of outcomes of the implementation phase and consequential benefits realisation.
3	Slow or inaccurate responses from vendors impacts the quality of outcomes.	- Work with vendors to understand uncertainties. - Work with other industry participants to present a standard message to vendors. - Involve vendor representation in the project team.	Moderate	- Delays in delivery of functional requirements, technical requirements and business case, impacting ability to progress implementation phase and consequential benefits realisation.
4	5MS/GS changes may need to be delivered in parallel with application upgrades from vendors.	- Ongoing communication of anticipated impacts to vendors. - Communication of AEMO and JEN delivery schedules to vendors. - Project planning and ongoing impact assessment of 5MS/GS changes.	Low	- Additional complexity to the implementation phase due to the management of external dependencies. - JEN will be dependent on vendor delivery of changes to meet schedule. - If vendors updates delayed significantly, JEN could miss compliance dates or implement inadequate systems impacting operational areas.
5	Delays / late changes in AEMO deliverables impacts the ability to finalise the details of JEN requirements.	- Active involvement in AEMO working groups, consultations and forums. - Close liaison with other industry participants. - We are building in contingency into the project schedule to accommodate critical dependencies.	Low	- Additional complexity to the implementation phase due to the management of external dependencies. - JEN will be dependent on AEMO delivery of changes to meet schedule.
6	The Victorian Government may remove the current derogation in favour of DBs and open the Victorian market to competition.	- Continue to stage the investment in 5MS/GS. Ensure expenditure is incurred efficiently, balancing risks and other relevant considerations.	Moderate	- Investment in 5MS/GS will have a limited payback period. - Planning for 5MS/GS increased infrastructure requirements will need to be balanced against the

Ref	Risk	Mitigation action	Residual Risk	Impact If Risk Realised
		- Ensure Regulation team continues to be involved in 5MS/GS planning.		plan to wind down of the Vic meter fleet.
7	The breadth of changes involved destabilises the JEN digital environment.	- Detailed planning, testing and active change management.	Low	- Impact on the broader operations of JEN, with considerable impact on customers.
8	There is a strong interdependency between industry participants. Failure of JEN counterparty will impact JEN ability to deliver outcomes.	- Active engagement with counterparties. Transparency of readiness through AEMO readiness report. - Timely interaction with third parties to address issues.	Low	- If counterparties are delayed significantly in their equivalent implementation programs, JEN could miss compliance dates or implement inadequate systems impacting operational areas.

4.4 Benefits

Implementation of 5MS project results in two significant advantages, these are:

1. regulatory compliance
2. maintain customer services.

Table 4-2: Implementation benefits

Number	Benefit	Description
1	Regulatory Compliance	The implementation of this program will ensure that our systems and processes remain compliant with the ESC Electricity Distribution Code[7] and that we continue to meet our regulatory obligations. In delivering this initiative, JEN will support the Rule requirement to provide: • improved price signals for more efficient generation and use of electricity • improved price signals for more efficient investment in capacity and demand response technologies to balance supply and demand • improve bidding incentive.
2	Maintain Customer Services	The introduction of 5MS will have an impact on current customer services and will open up the possibility of providing additional value to customers. As an example, the Customer Portal is integrated into the market systems environment and provides a self-service interactive consumer interface to energy data. The provision of five-minute data will improve the level of information and data available to customers, and allows Jemena to enhance information services to customers over time. Of particular relevance is recommendation number 1 in the Community Consultation Report[12] that ‘Jemena should improve the information available to customers and the ease of access to smart meter data.’

[12] JEN – *Capire Att 02-02 Community Consultation Report* - 20200131 - Public.

5. Scope of Work

Table 5-1 provides a high-level summary of what activities are in and out of scope for the 5MS project.

Table 5-1: Scope of work

Item No.	In & Out of Scope	Activity or deliverable
IS-1	In-Scope: Participate, inform and guide in the AEMO consultation process whereby 5MS & GS changes to procedures and systems will be determined and to identify opportunities to minimise implementation costs for 5MS / GS at JEN while exploring opportunities to add value to customers and JEN.	Participation in workshops, consultation responses.
IS-2	In-Scope: Building on the impact analysis already undertaken, undertake detailed analysis and design activities to document the technical and business requirements required by JEN to implement 5MS & GS obligations.	Impact assessment, SAD, BRS, FRS.
IS-3	In-Scope: Undertake readiness activities to participate in the industry, and Itron CoE related testing to ensure a fit for purpose delivery of JEN changes.	Testing Strategy, Test Plan (Industry testing), Test Plan (Itron CoE).
IS-4	In-Scope: Identify broader JEN benefits and opportunities associated with the implementation of 5MS / GS.	Opportunities, Plan and Analysis, Benefits Realisation Plan.
IS-5	In-Scope: Undertake end to end AMI network optimisation review and planning.	Infrastructure, Environments Database and AMI OT Network Strategy.
IS-6	In-Scope: Configuration, testing and implementation of system enhancements together with market testing for systems as documented in Appendix A.	JEN configured and tested systems ready for go-live.
IS-7	In-Scope: Updates/development of associated JEN procedures.	Updated metrology and other 5MS/GS related procedures.
IS-8	In-Scope: Post-implementation review to identify lessons learned.	Lessons learned report to be funnelled into future projects.
OS-1	Out of scope: Implementation of non-5MS/GS related compliance changes.	Not applicable.

6. Project Costs

The capital expenditure under the recommended option for this project is justified on the basis that:

- it is necessary to enable JEN to comply with obligations regarding the delivery of 5-minute data and that it continues to deliver it safely, securely, and energy reliability and data accuracy are managed for all customers. Tasks are aligned with both customer and market expectations. They are timed to ensure costs remain prudent and efficient.
- it supports the government policy direction to provide customers with direct access to more granular market data and information on energy usage via a central authority[13]. It also supports and aligns with feedback provided from customers[14] to be better informed on how they consume energy and provide a baseline for behavioural change and cost reduction.

6.1 Cost Forecast Substantiation

The costs of the project have been estimated based on the experience gained from similar market-based projects such as the 'Power of Choice' and AMI, other metering system upgrade projects, experience with vendors of software impacted by this change and other large internal projects. As well as a bottom-up assessment of tasks and resources by each phase of the project, and the use of standard rate cards, the estimate has also undergone a top-down reasonableness check across internal subject matter experts.

A summary of the capital and timing of expenditure is outlined in Table 6-1 below.

Table 6-1: Forecast project costs & timing of expenditure of preferred option (June 2021, dollars)

Start Date	End Date	CY2020		CY2021		CY2022		Total
		H1	H2	H1	H2	H1	H2	
Aug 2020	May 2022	0	3,835,760	7,479,365	8,253,235	2,994,063	0	22,562,422

A large part of the IT capital expenditure for the upgrade of the IT systems is allocated to standard control services (**SCS**). The allocation is based on what capital expenditure we would prudently spend on our SCS IT systems if we were not performing a metering coordinator role and the balance allocated to alternative control services (**ACS**). Table 6-2 shows the capital expenditure split between SCS and ACS.

Table 6-2: Forecast project cost split between SCS and ACS ($ June 2021, dollars)

Project name	Project ID[15]	CY2020 H2	CY2021 H1	CY2021 H2	CY2022 H1	CY2022 H2
5-Minute Meter Reading & Global Settlement Phase 3 (ACS)	ITE2001	158,923	0	0	0	0
5-Minute Meter Reading & Global Settlement Phase 3 (SCS)	ITE2002	3,676,837	0	0	0	0
5-Minute Meter Reading & Global Settlement Phase 3 (ACS)	ITEH01	0	513,007	583,629	0	0
5-Minute Meter Reading & Global Settlement Phase 3 (SCS)	ITEH02	0	6,966,358	7,669,605	0	0
5-Minute Meter Reading & Global Settlement Phase 4 (ACS)	ITEH06	0	0	0	419,376	0

13 ACCC, Website - Consumer data right (CDR).

14 JEN – *Capire Att 02-02 Community Consultation Report* - 20200131 - Public.

15 JEN – RIN – Support – *IT Capex Forecast Model* – 20200131 – Public.

5-Minute Meter Reading & Global Settlement Phase 4 (SCS)	ITEH07	0	0	0	2,574,687	0
Total		**3,835,760**	**7,479,365**	**8,253,235**	**2,994,063**	**0**

The attachment "*JEN – RIN – Support – IT Investment Brief – 5-Minute Settlement – 20200131 – Public*" links this business case to the Technology Plan.

7. Regulatory Considerations

JEN has assessed the project in the context of several regulatory considerations; Table 7-1 summarises the outcomes.

Table 7-1: Regulatory considerations

Justification	Explanation
Safety	Safety must not be compromised when implementing changes to comply with this new NER obligation.
Maintaining supply to existing customers	Supply must not be compromised when implementing changes to comply with this new NER obligation.
Managing integrity of service risk	Reliability must not be compromised when implementing changes to comply with this new NER obligation.
Regulatory or obligation	JEN has an obligation under changes to Rule 11.103.4 and Rule 11.103.5. • The Rule (11.103.4) states that the Metering Coordinator at a connection point must ensure that all new or replacement metering installations installed from 1 December 2018 are capable of recording and providing trading interval energy data, i.e. the DNSPs must ensure the meters can achieve the 5-minutes interval data recording and sending the data to the NEM. • The Rule (11.103.5) states that the Metering installations do not have to be configured to record and provide trading interval energy data before 1 December 2022. In other words, the meters installed from 1 December 2018 can continue sending 30-minute interval data until such time (after 1 July 2021 and before 1 December 2022) the DNSPs remotely reconfigures (toggles, switches, changes, swaps) the 30-minute interval to 5-minute interval. • On 6 December 2018, the Commission made a final rule that requires a move to a global settlement framework for the demand side of the wholesale electricity market. The change to global settlement will treat all retailers equally by allocating a share of '"unaccounted for energy" to all retailers in a distribution area. It will also enable the Australian Energy Market Operator (AEMO) to reconcile the market entirely. The global settlements framework fully commences on 6 February 2022. • The rule sets out a detailed design for global settlements, including the level at which unaccounted for energy is allocated, how to allocate unaccounted for energy, and how to treat virtual transmission nodes and unmetered loads within global settlements.
Net present value benefit	The AEMC's rule changes outline the net benefits. The most efficient implementation cost has been identified to deliver the benefits to be realised.

Appendix A
Impacted JEN IT Systems

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A1. Impacted JEN IT ecosystem components

JEN has undertaken an Impact Analysis, to determine what elements of the JEN IT ecosystem is impacted by the implementation of the Rules associated with 5MS/GS Program. The analysis shows that the 5MS/GS Program requires changes to almost all JEN systems, including (but not limited to) those listed below. Figure A1-1 provides a representation of how these systems interact.

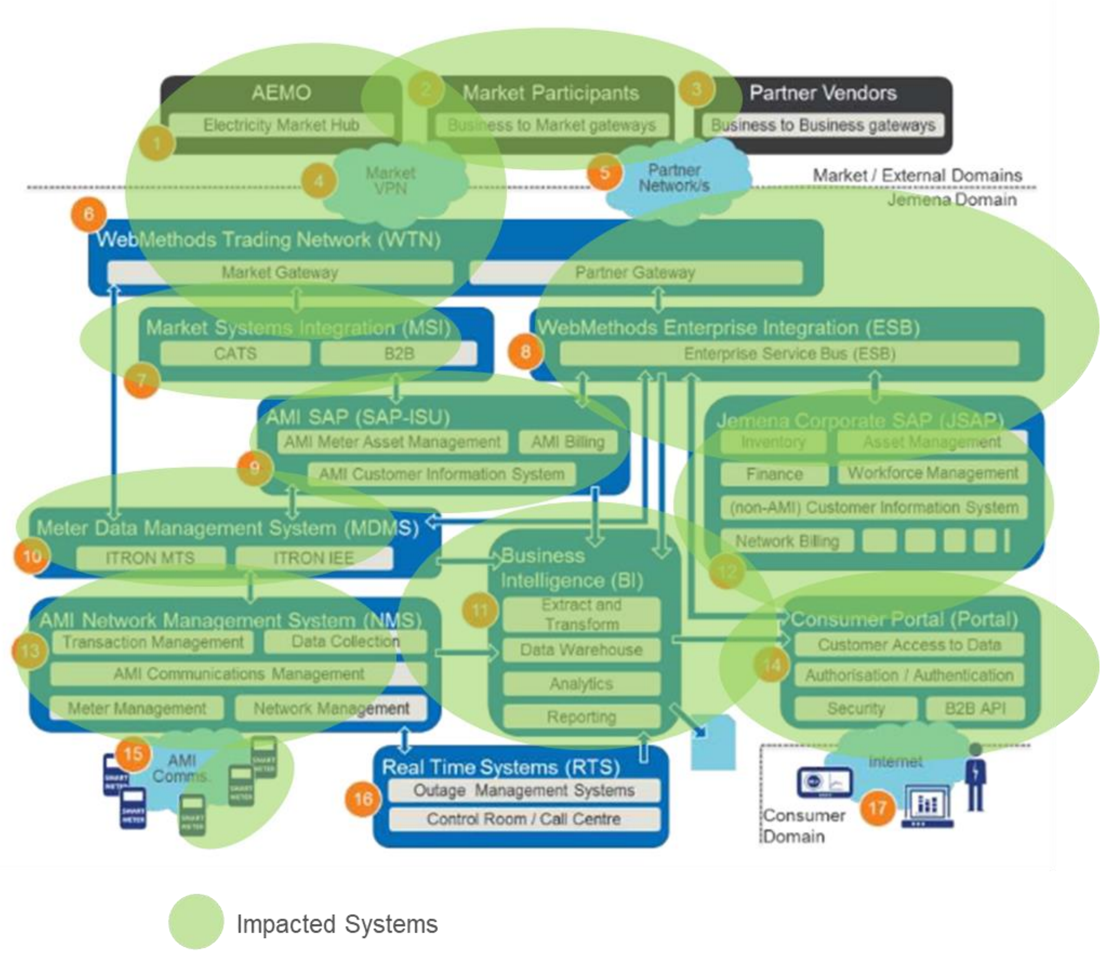
Table A1–1: Impact on JEN IT ecosystem

Application	High Level Impacts
Metrology Impact	Metrology lifecycle testing of L&G and Secure meter variants End to end testing with various interfacing applications, i.e. UIQ, IEE, MTS, SAP Logical conversion of meters installed post 1st December 2018
UIQ	Maintenance of additional 48-meter program ids for Secure and L&G variants Increase in no of intervals from 48 to 288 Update to the subset of UIQ reports Additional field infrastructure (Access Point and Relays) may be required Maintain current SLA of reading all meters as part of mid-night run Adhere to SLAs for manually read interval meters Substantial increase in no of files outputted from UIQ to IEE (~350 to ~600)
IEE	Performance testing cycle to consume additional load generated by UIQ Update N data streams to E & B streams Receipt of 5 min meter data for Type 1 – 4 and Type 7 by 1st July 2021 Receipt of 5 min meter data for AMI Type 5 meters installed post 1st December 2018 by 1st December 2022 Accommodate new NMI classification codes (BULK, DWHOSAL, NCONUML, NREG, XBOUNDARY)
MTS	Change in file format sent to AMEO for interval reads (MDMF to MDFF) Replace Net transactions with register level transactions sent to AEMO Change in UOM and transaction group Accumulation reads sent to market in an MDMF or MDFF format Increase in file size from 1MB to 10MB Supply Tier 1 basic read & non-contestable un-metered site reads to AEMO Profile and supply unmetered non-contestable NMI data to market Treatment of Local Retailer to GLOPOOL
SAP	Assign NMI to unmetered non-contestable devices (one to one and one to many) Change in CATS transactions (4000 & 4051) to replace N data stream with a register data stream Accommodate new NMI classification codes (BULK, DWHOSAL, NCONUML, NREG, XBOUNDARY) Treatment of Local Retailer to GLOPOOL
SAP HANA	Consume additional consumption data points from UIQ and IEE (17M to 103M) Update to UIQ and IEE reports Regression impact - Test all business reports which consumes interval data and derives net or aggregated or time-bound consumption usage reports for customers
Reconciliation Reports	De-commission and update existing RM reports Introduce new RM reports

Application	High Level Impacts
Customer Portal	Download data function to accommodate 288 intervals instead of 48 Interval data references to be updated to reflect 288 intervals
Enterprise Systems Bus /MSI/Gateway	Handle SO and updates from a meter vendor (L&G and Secure) Increased A2A volumes Increased file size for market delivery Handle different file size constraints for interval data transfer vs Service Orders
Infrastructure	Review database storage requirements Review bandwidth allowance for shipping data from meters to UIQ Rollout boundary meters as required Review data warehouse and data lake capability to consume additional data points

The structure of the existing JEN IT environment is represented in Figure A1–1 and provides a representation of how these systems interact. In summary, the JEN ecosystem is made up of several applications/infrastructure components that undertake particular functions associated with the collection, storage, analysis and publishing of metering data. The application integration, business process integration and B2B partner integration is provided via the WebMethods product.

Figure A1–1: JEN IT ecosystem



The table below provides a cross-reference to the orange reference numbers in Table A1–2.

Table A1–2: JEN systems description

Ref No	System	System Functional Purpose
1	AEMO – Market systems	AEMO and all JEN to market host AEMO market systems transactions are carried through the electricity market hub (e.g. MSATS & CATS).
2	Market Participant – Systems	Market participants registered and accredited by AEMO to transact through the electricity market hub are external (or ring-fenced) parties.
3	Partner & Vendor Systems	JEN leveraged external partner business provides goods and services through Business to Business gateways. The type of connectivity to JEN is dependent on the commercial, technical and trust relationship of the partner.
4	Market VPN Network	A virtual private market trading networks only registered and accredited market participants are connected to the AEMO hosted market systems cloud.
5	Partner Network/s	Partner networks and systems may be hosted internally, externally or in virtual networks. The security zone and relationship is dependent on the commercial, technical and trust relationship of the partner.

Ref No	System	System Functional Purpose
6	WebMethods Trading Network (**WTN**)	The trading network provides an external-facing service bus for market-based transactions as a middleware interface. The trading network is a managed environment with all transactions being logged, monitored, transformed (as required), packaged, acknowledged and delivered with the quality of service, i.e. guaranteed delivery). The trading network services the market gateways and partner networks, e.g. data link and transport layers).
7	Market Systems Integration (**MSI**)	MSI supports market integration logic and the JEN implementation of CATS B2B. MSI initially processes market transactions and B2B requests through predefined sequential function automation logic. MSI thus provides an integration function between the market gateway and market systems. Straight through and near real-time processing capability is provided by MSI.
8	WebMethods Enterprise Integration (**ESB**)	The Enterprise Service Bus provides a common platform for internal integration between enterprise (and market) systems so that systems each application can interact with each other using a standard managed interface.
9	AMI SAP (SAP-ISU)	AMI SAP is a standalone instance of SAP dedicated to AMI metering customers and AMI metering assets. SAP ISU is the industry-specific utility SAP solution. AMI SAP provides functions of Meter Asset Management, AMI Billing and AMI Customer Information. AMI SAP is the only system that supports AMI meters and solution. AMI SAP is used exclusively for JEN AMI customers (Includes Type 5 AMI, excluded all Type 1-4, Legacy Type 5, 6, 7 and unmetered customers).
10	Meter Data Management System (**MDMS**)	The Meter data management systems are the authoritative meter data store for all versions of interval data collected and stored. The MDMS is collectively a hybrid solution of Itron IEE and Itron MTS.
11	Business Intelligence (**BI**) (SAP HANA)	The JEN Market Systems Business Intelligence solution is a big data analytics platform for managing customer, market and metering systems. Most market systems have exported data transformed, and stored in a central data warehouse, BI systems run scheduled and ad hoc process to analyse and prepare data views for scheduled and ad hoc reporting.
12	JEN Corporate SAP (**JSAP**)	Corporate SAP is the JEN enterprise-wide enterprise resource planning solution. Concerning market systems, JSAP provides the following functions; Inventory management, Asset Management, Finance, Workforce Management, (non-AMI) Customer Information System, Network Billing. The May 2016 JSAP system includes an instance of SAP ISU servicing all non-AMI metering and customer information systems.
13	AMI Network Management System (**NMS**)	AMI NMS also is known as UtilityIQ (**UIQ**) the Network Management System is the head end system managing the AMI mesh radio network. The NMS functions include transaction management, data collection, AMI Communications Management, Meter Management, Network Management for 327,000 AMI meters.
14	Consumer Portal (**Portal**)	The Portal—also referred to as Electricity Outlook—is a web-based graphical user interface portal for customer access to data and analytics. The portal is integrated into the market systems environment and provides a self-service interactive consumer interface to energy data. A key aspect to the Portal is the integration into the market systems environment for authorisation, security, historical meter data, data warehouse and a market-facing B2B application programming interface (**API**).
15	Advanced Metering Infrastructure Communications	The AMI Mesh radio communication network is a proprietary 'last-mile' communications infrastructure to and between AMI integrated AMI meters (Network Interface Cards), pole-mounted relays, pole-mounted access points using a 3G telco based backhaul to the two data centres (Primary and DR).

Ref No	System	System Functional Purpose
	Network (AMI Comms)	
16	Real-Time Systems (**RTS**)	The RTS environment includes a suite of applications used by network operations to efficiently manage the primary infrastructure assets including but not limited to SCADA (Supervisory Control & Data Acquisition), Outage Management Systems (**OMS**), Distribution Management Systems (DMS), Graphical Information Systems (**GIS**), and Outage web.
17	Consumer Domain	The Consumer domain represents the extension and direct interaction of market systems with the consumer from the distribution network service provider.
18	New Connections Portal	The new connection portal provides a web-based Service order management tool for raising and managing customer-initiated work orders.

Appendix B
JEN Risk Management Framework

B1. Risk Management Framework

B1.1 Risk Management Key Principles

The Risk Management approach at SGSPAA is underpinned by the following fundamental principles consistent with AS/NZS ISO 31000:2009.

Risk management:

- creates and protects the value
- is an integral part of all organisational processes
- is part of decision making
- explicitly addresses uncertainty
- is systematic, structured and timely
- is based on the best available information
- is tailored
- takes human and cultural factors into account
- is transparent and inclusive
- is dynamic, iterative and responsive to change
- facilitates continual improvement of the organisation.

Additionally, SGSPAA is committed to ensuring that risk management is embedded in the business operations and culture by encouraging the adoption of the following risk management approach:

- everyone is a risk manager
- the business owns risks
- Risk Management is embedded in normal business processes
- Risk Management provides early warning enabling mitigation
- risks are considered through both a top-down and bottom-up approach.

The individuals who come face to face with risk at SGSPAA are SGSPAA's Personnel. Hence, all SGSPAA Personnel should be able to participate actively in the risk management process.

B1.2 Risk Analysis

Risk analysis consists of determining the consequences and their likelihood for identified risk events, taking into account the presence (if any) and the effectiveness of any existing controls. Factors affecting likelihood and consequences are identified, and low impact risk can be eliminated from further analysis. These risks are to be documented to provide evidence of completeness.

Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences can occur. Existing risk controls and their effectiveness should be taken into account.

While the majority of risk analysis techniques mathematically combine (usually by multiplication) the level of consequence with the likelihood of occurrence, it is important that all risks also be closely examined purely in terms of their consequence and their likelihood. Some risks have such a significant consequence that even though their likelihood is ‘rare’ they should still be addressed.

B1.3 Consequence Analysis

Consequence analysis determines the nature and type of impact which could occur, assuming that a particular event situation or circumstance has occurred. Consequence analysis can vary from a simple description of outcomes to detailed quantitative modelling or vulnerability analysis.

Impacts may have a low consequence but high likelihood, or a high consequence and low likelihood, or some intermediate outcome. In some cases, it is appropriate to focus on risks with potentially very large issues, as there are often of most significant concern to Management. In other cases, it may be essential to analyse both high and low consequence risks separately. For example, a frequent but low-impact (or chronic) problem may have significant cumulative or long-term effects. Also, the treatment actions for dealing with these two distinct kinds of risks are often quite different, so it is useful to analyse them separately.

A rating is assigned to each risk based on the consequences described. Primarily, this rating will be determined by comparing the level of risk with the established criteria using the agreed Risk: Consequence Descriptions Table B1-1 as a guide.

Table B1-1 Risk: Consequence descriptions

Rating	Description[1]	Financial: EBITDA / CashFlow	Financial: Recoverable Value[3]	Operational	Health, Safety & Environment	Employee	Regulatory & Compliance	Brand / Reputation / Stakeholders
5 Catastrophic	Potential disastrous impact on SGSPAA strategies or operational activities. Widespread stakeholder concern / interest.	> 6% of EBITDA[2] (> $50M). Imminent liquidity / cash flow problem – 100% utilisation of undrawn credit facilities & cash at bank.	*> 5% or $500M of Recoverable Value of SGSPAA's Assets*	Loss of electricity supply to 2 Zone Substations >24 Hrs <u>or</u> >15% Customers (49,000) >24 Hrs. Loss of gas supply to > 20% Customers (220,000). Business interruption for > 30 days (network / pipelines).	1 or more fatalities (staff, contractors or member(s) of the public). Significant destruction of key internal asset or third party property. Harm to the natural environment and/or cultural heritage that cannot be remediated[4].	Skill set/ capability of >35% of business critical roles lost within a 6 month period	Major regulatory restrictions and/or govt. interventions. Possible loss of licence to operate. Frequent regulatory or policy violations / breaches Major litigation, with a possibility of punitive damages. Significant fines, prosecutions and jail terms possible.	Sustained and hostile public campaign. Reputation impacted with majority of key stakeholders. Sustained and critical stakeholder criticism.
4 Major	Significant impact on SGSPAA strategies or operational activities. Significant stakeholder concern / interest.	3-6% of EBITDA ($25M - $50M). Liquidity / cash flow may be adversely affected – 100% utilisation of undrawn credit facilities.	*3-5% or $300 - $500M of Recoverable Value of SGSPAA's Assets*	Loss of electricity supply to > 2 % Customers (6,500) >24 Hrs. Loss of gas supply to > 1% Customers (11,000). Business interruption for 7 - 30 days (network / pipelines / offices).	Total permanent disability (staff or contractors). Multiple hospitalisations, permanent disability and/or life threatening injuries affecting member(s) of the public. Significant damage to internal assets or third party property. Harm to the natural environment and/or cultural heritage with remediation difficult (multi-year management).	Skill set/ capability of 20 – 35% % of business critical roles lost within a 6 month period	Regulatory investigations or govt. review. Some regulatory or policy violations / breaches. Litigation involving significant senior management time. Major fines or penalties and prosecutions possible.	Significant adverse public attention and/or heightened concern from stakeholders. Reputation impacted with significant number of stakeholders. Significant stakeholder criticism/negativity.
3 Severe	Moderate impact on SGSPAA strategies or operational activities. Moderate stakeholder concern / interest.	1-3% of EBITDA ($8M - $25M). Liquidity / cash flow may be affected – 50% utilisation of undrawn credit facilities.	*1-3% or $100- $300M of Recoverable Value of SGSPAA's Assets*	Loss of electricity supply > 1% Customers (3,200) > 24 Hrs. Loss of gas supply to > 0.1% Customers (1,100). Business interruption for 1 - 7 days (network / pipelines / offices).	Single permanent partial disability (staff or contractors). Medical aid required for member(s) of the public. Some loss of or damage to third party property. Harm to the natural environment and/or cultural heritage that can be remediated (<1 year management).	Skill set/ capability of 10-20% of business critical roles lost within a 6 month period	Regulator requires formal explanations & remedial action plans. Fines or penalties from legal issues, breaches / non-compliances.	Persistent public scrutiny. Reputation impacted with some stakeholders. Some stakeholder concern/negativity.
2 Serious	No material impact on SGSPAA, issues are dealt with internally.	0.1-1% of EBITDA ($1M - $8M). Liquidity / cash flow impact absorbed under normal operating conditions – 25% utilisation of undrawn credit facilities.	*0.1-1% or $10-$100M of Recoverable Value of SGSPAA's Assets*	Loss of electricity supply to > 1% Customers (3,200) > 6 Hrs. Loss of gas supply to > 100 Customers or any contract customer. Business interruption for 1 day (network / pipelines / offices).	Medical treatment injury or lost time injury (staff or contractors). On-site first aid to a small number of member(s) of the public, lost time. Harm to the natural environment and/or cultural heritage requiring minimal remediation (at the time of impact).	Skill set/ capability of 5 – 10% of business critical roles lost within a 6 month period	Isolated regulatory or policy violations / breaches. Fines or penalties possible.	Sporadic, adverse media/public attention. Limited adverse reputational impact. Minor stakeholder complaints.
1 Minor	Negligible impact on SGSPAA, issues are routinely dealt with by operational areas.	< 0.1% of EBITDA (< $1M). Negligible impact on liquidity / cash flow.	*< 0.1% or $10M of Recoverable Value of SGSPAA's Assets*	Loss of electricity supply to <1,000 Customers up to 6 Hrs. Loss of gas supply to > 5 residential customers. Business interruption for a few hours (offices only).	Minimal impact on health & safety (staff, contractors or member(s) of the public). Harm to the natural environment and/or cultural heritage requiring no active remediation and/or able to self-remediate.	Skill set/ capability of <5% of business critical roles lost within a 6 month period	General regulatory queries. No violations / breaches, fines or penalties.	Negligible media/public attention, reputational impact and/or little or no stakeholder interest.

1 "Consequence description" is likely to over-ride the defined loss limits, where loss can occur unexpectedly over a short time.
2 EBITDA refers to the budgeted or forecast Group Earnings Before Interest, Taxes, Depreciation and Amortisation for the relevant period.
3 Use this measure for risk events with recurring / multi-year and potential asset valuation impacts, where the EBITDA impact for a given year is not appropriate.
4 Relevant considerations include harm to the environment and/or cultural heritage such that they could not be reinstated or returned to the natural or comparable state (e.g., the loss of biodiversity or the destruction/desecration of cultural heritage items).

B1.4 Likelihood Analysis

Risks are assessed by assigning a likelihood rating (i.e. how likely is it that the organisation will be exposed to each risk?). Consideration should be given to:

- the anticipated frequency of the event occurring
- the working environment
- the procedures and skills currently in place
- staff commitment, morale and attitude
- history of previous events.

Table B1–2 provides a guide to the assessment of likelihood.

Table B1–2: Risk: Likelihood descriptions

Likelihood Descriptions		Guide
5 **Almost Certain**	Event is **expected** to occur in most circumstances	• Expected to occur once (or more) within 1 year, or • > 75% probability of occurrence, or • Has occurred recently and likely to occur again.
4 **Likely**	Event will **probably** occur in most circumstances	• Will probably occur at some time within the next 2 years, or • 51% - 75% probability of occurrence, or • Has a history of occurrence or could be difficult to control due to some external influences.
3 **Possible**	Event **should** occur at some time	• Might occur at some time within the next 5 years, or • 26% - 50% probability of occurrence.
2 **Unlikely**	Event **could** occur at some time	• Could occur at some time within the next 10 years, or • 5% - 25% probability of occurrence.
1 **Rare**	Event **may** occur only in exceptional circumstances	• Improbable occurrence only in exceptional circumstances (i.e. may only occur in more than 10 years), or • < 5% probability of occurrence.

B1.5 Risk Rating

Table B1-3 below provides a matrix of the risk rating by combining the consequence and likelihood of each risk.

The governance for the management of risks in Jemena is determined by the identified Risk Rating.

Table B1–3: Risk matrix

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