

Appendix 4.18 ADMS business case

Revised regulatory proposal for the ACT electricity distribution network
2019–24

November 2018

Contents

Executive Summary.....	6
Benefits of the Full Upgrade	6
NPC of the Options.....	7
Context.....	8
Background	8
Function.....	8
Investment Objectives	8
ADMS Current State	9
Key Challenges.....	9
Key Failure Driver.....	9
Main Investment Driver.....	11
Cost savings.....	11
Enhanced functionality.....	11
Risk mitigation.....	13
Customer Expectations.....	14
Options Analysis	15
Options Overview.....	15
Option 1: Defer upgrade.....	17
Option 2: Minimal upgrade.....	19
Option 3: Full upgrade with additional modules	20
Other options considered but not feasible	22
Preferred Investment Option	23
Project Delivery Method	23
Schedule.....	24
Project Implementation Risks	25
Appendix 1: Risk assessment.....	26

Option 1: Defer upgrade.....	26
Option 2: Minimal upgrade	27
Option 3: Full upgrade with additional modules.....	28
Appendix 2: Project Tier Classification	29
Appendix 3: Forecast Methodology and Assumptions.....	31
Methodology	31
Assumptions.....	31
Economic assumptions.....	31
Operating cost assumptions	31
Capital cost assumptions	32
Appendix 4: Cost Differences to Deferral.....	35
Appendix 5: ICT Deep Dive Outcomes	36

Document Information

Project Name	Advanced Distribution Management System Submission Business Case
Project Number	IB 0073

Referenced Documents

Document

Project Title:	ADMS Regulatory Submission Business Case	Project No:	IB 0073
Category	Capital program		
Program			
Cost Savings (\$M)	\$5.05M*	Regulatory Funding	Yes
Capex (\$M)	\$11.21M	Project Risk Tier	Tier 1
Net Cost (\$M) (Cost less revenue/contribution)	\$11.21M	Estimated Start Date	1/07/2019
NPV (\$M) (Over 10 years)	\$3.54M**	Estimated Finish Date	28/06/2024
Strategic Alignment	Operational Technology and Innovation, Customer Service, Network Performance, Design, Control Room, Secondary Systems, Service Delivery, Strategic Planning.		

*Cost savings relative to project deferral over 10 years

**NPV calculated relative to project deferral

Executive Summary

Evoenergy utilises an Advanced Distribution Management System (ADMS) to allow for centralised management of the network including outage management and performance optimisation. The system has performed well, but currently faces several challenges including:

- Operating system platforms reaching end of extended operational life, introducing cyber security risks,
- Current hardware platforms reaching end of extended operational life, with the potential of a total ADMS outage,
- Limited capabilities (including power flow modelling) for Distributed Energy Resource (DER) capacity and minimising DER driven network augmentation,
- Lack of real time data for probabilistic planning.

The system is four versions behind the current solution. Upgrading the system and associated hardware will resolve these challenges and in addition, will provide the latest functionality resulting in customer and network benefits as described below.

Evoenergy considered 3 credible options for this upgrade path which were assessed against the capital efficiency objective and criteria. These options were:

- Option 1: Delay the full upgrade until the start of the next regulatory period;
- Option 2: Introduce a minimal upgrade within this regulatory period; or
- Option 3: Undertake a full upgrade this regulatory period.

Benefits of the Full Upgrade

The upgrade is expected to provide many benefits to Evoenergy and its customers, in line with customer expectations expressed in recent customer engagements held by Evoenergy. The benefits have been split into qualitative and quantitative benefits.

Qualitative Benefits

Key qualitative benefits from the ADMS Upgrade are:

- **Reduced Risk of System Failure** – The age of the current hardware and operating system results in an increased risk of failure, or cyber security attack, and therefore increased probability of Evoenergy having to operate without an ADMS
- **Reduced Augmentation Costs** – Greater visibility and control of the network will allow Evoenergy to make more informed decisions on network operation and allow for the deferral and/or avoidance of network growth capex and customer connection costs. Under Option 3 this benefit should be available from the end of the first regulatory period, although given the uncertainty on the level of deferment this has not been quantified.
- **Improved Customer Experience** – The full upgrade solution provides several customer benefits including:
 - Assistance in meeting and managing the expected demand for standard control services (small scale generation) to connect to the network with functionality to maximise the value to the customer by ensuring access to the network and minimising supply interruptions or damage from abnormal voltage levels. The ACT mandated requirements for new properties to have PV means that this issue is likely to be faced before many other jurisdictions.
 - Reduced risk of NECF breaches, as customer notifications will now be validated by the system.
 - Improved information from the OMS providing more accurate information on restoration times to customers.
 - Functionality allowing faster isolation of faults and restoration of supply to customers as more remotely controllable field devices are deployed.

Quantified Benefits

Compared to deferring the upgrade, Evoenergy is able to quantify several benefits that result in direct cost reduction that emerge in the 2019-2024 regulatory period and will continue to provide material benefits in the future. The benefits include:

- **Minimal Costs for Alignment of Network Models** – The enhanced GIS Importer module minimises the effort (resources) required to align the GIS/ADMS network models, saving \$500k per annum in capex.
- **Avoided DER and Transmission Modelling Costs** – \$400k per annum can be avoided once the EMS Module and DER functionality is implemented.
- **Avoided ADMS Fixes Cost** – Adopting an upgrade plan for the ADMS will remove the need to implement the annual fixes that are currently applied. This will avoid \$425k per annum during the currently regulatory period.
- **Reduced Cost of Hardware/Software Support** – The age of the ADMS hardware and software means that standard support packages are no longer available, which increases the cost to Evoenergy. The difference in the Hardware and Operating System support in the first year of the next regulatory period is almost \$100k.

As a result, the preferred option (option 3) represents the least cost option for Evoenergy to maintain an ADMS. This is demonstrated in the outcomes of an analysis on the Net Present Cost (NPC) of the options below.

NPC of the Options

A comparison was made of the NPC of the 3 options over a 10-year operating period (2 regulatory periods) considering Opex and Capex. This is shown in the table below along with the chart demonstrating how the costs are incurred over time.

Category	10 Year NPC \$M		
	Option 1	Option 2	Option 3
Operating Expenditure	\$ 7.28	\$ 7.03	\$ 7.03
Capital Expenditure	\$ 13.65	\$ 12.24	\$ 10.35
Total	\$ 20.92	\$ 19.28	\$ 17.39

Table 1 NPC over 2 Regulatory Periods

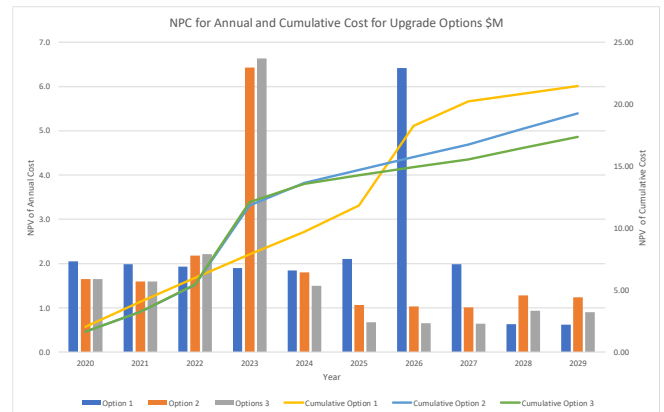


Figure 1 Timing of costs for Upgrade Options

During this regulatory period there is a requirement for \$11.2m of capital expenditure for Option 3. This Option has a NPV of \$3.54m over the 2 regulatory periods compared to Option 1.

Option 3 is recommended as it combines the lowest cost option with the quickest mitigation of obsolescence and cyber security risks. It is therefore the most prudent and efficient option in line with the Capital Expenditure Objectives.

Context

Background

The ADMS system is a software platform that allows the centralized management of Evoenergy's distribution network by drawing on the network and asset performance monitoring capabilities of smart metering, distributed network sensors, and distributed energy resources. The ADMS provides for automated outage identification, restoration, and performance optimisation of the network to drive efficiencies that benefit customers through a reliable supply of electricity at an efficient cost.

Evoenergy uses the *EcoStruxure* Advanced Distribution Management System (ADMS) built by Schneider Electric. The ADMS is a complex system involving the ADMS software, operating systems and workstation and server hardware. The currently installed version, v3.4.2, went live on 20th of February 2016.

Function

Evoenergy's ADMS solution includes SCADA, the Outage Management System (OMS), the Work Order Management System (WOMS – management of planned and unplanned outages), the User Interface (UI – for Control Room and Web-based users), Field Mobility and a broad set of advanced Distribution Management System (DMS) applications. The Evoenergy Control Room is the main user of the ADMS for network operations. However, the system is used throughout Evoenergy for day to day tasks (e.g. planning for network augmentation, design, SCADA, primary assets, commissioning, works delivery etc)

The function and key performance contribution areas include:

- Distribution Management System contributing to load flow, short circuit, protection device coordination studies;
- Outage Management System contributing to unplanned outages management;
- Work Order Management System contributing to planned work management, including customer notification;
- SCADA contributing to real time control of the network and power quality information; and
- Monitoring and control of network assets and network connected energy resources.

Investment Objectives

The ADMS investment objectives support the achievement of the overall asset management objectives of optimising the service delivery potential of assets and minimising lifecycle risks and cost. These objectives are embodied in the following strategic objectives.

- **Safety:**
Zero deaths or injuries to employees or the public
- **Reliability:**
Maintain unplanned SAIDI and SAIFI at the same level as the historical average, i.e. Unplanned SAIDI – 32.12 minutes/customer/year, and SAIFI – 0.619 interruptions/customer/year
- **Expenditure:**
Select investment options that minimise the overall net present cost of expenditure and economic risk, with a preference for realising medium term (10 year) benefits over long term (30 year) benefits
- **Risk management:**
Identify and manage the uncertainties that affect a business enterprise.

ADMS Current State

The current version of the ADMS is built on hardware that is now obsolete and difficult to repair, as well as Microsoft operating systems that are approaching the end of extended support during the 2019-24 regulatory control period. The ADMS software is also ageing and support and maintenance contract costs for the currently installed version will increase over time as the specialist skills required to maintain these systems become scarcer.

The existing ADMS implementation is not able to effectively model Distributed Energy Resources (DER), including the expected growth in customer investment resulting in a reduction of: consumption, embedded generation, storage and control of their electricity. This modelling is needed to support the customer's goals of independence, reliability, lower costs and environmental goals. It is essential to derive informed network operational and capital work decisions based on an effective network model that is able to consider all the DER that is connected to Evoenergy's electricity supply network along with scenarios of likely future DER connections.

Key Challenges

The key challenges associated with the current ADMS are the inability to maintain appropriate functionality, component interfaces, system integrity, and user interface requirements in a technologically evolving environment. The failure modes identified in Table 2 present safety, reliability, compliance, and security risks that undermine the integrity of systems that rely on the ADMS.

Addressing one key failure driver would result in the elimination of multiple failure modes and associated risk.

Table 2 – ADMS Failure modes and risk impacts

Failure Category	Failure description	Failure drivers	Failure mode	Risk impact
Functional	Failure to meet functional requirements	Dated software and hardware platforms across key components with dwindling support	Cyber security exposure, system malfunction	Inadvertent operation (safety) Unintended system outages (reliability)
Interface	Failure to communicate with associated components		System incompatibility, Communication breakdown, miscommunication, faulty communication	Prolonged system outages (reliability) Inappropriate system operation (contractual compliance)
Support	Inability to provide appropriate skills and equipment for defect repairs		Erosion of system integrity and functional certainty (hidden failures)	System hacking (security risk) Data leaks (legal compliance)

Key Failure Driver

The current version of the ADMS is running on:

- Windows Server 2008 and Windows 7 operating systems

- SQL 2008 database platform, and
- 2013 edition HP Blade servers and workstations.

These software and hardware platforms are obsolete with mainstream support of the operating system and software platforms having ended in January 2013 and January 2015 respectively. These systems are currently operating under extended support agreements that are coming to an end during the 2019-24 regulatory control period.

The HP Hardware has an end of life date of September 2018 and while Evoenergy is mitigating this risk through the extension of a support contract with HP, the cost of this service will rise.

The diminishing support for the software and hardware platforms (see Table 3 for component and impacts) will result in significant operating costs associated with ongoing maintenance and support. Cybersecurity and adherence to any mandated cybersecurity standard implemented in the Australian energy industry is also a key risk, and the continued availability and appropriate functioning of the ADMS is paramount in order to manage key system safety and reliability risks.

Table 3 – ADMS components and risk impacts

Component	Current	End of Support	Risk Summary
Hardware (Servers and Workstations)	2013 HP Blade servers and workstations	Sep-2018*	Increasing rate of hardware failures results in increasing maintenance costs. Scarcity of spare parts increases risk of ADMS becoming unavailable.
Server Operating System	Microsoft Server 2008	2023**	Unpatched operating system increases the likelihood of a successful cyber-attack.
Workstation Operating System	Microsoft Windows 7 (2009)	2023**	Unpatched operating system increases the likelihood of a successful cyber-attack.
Database Software	SQL Server 2008	Jul-2019	Unpatched database software increases the likelihood of a data breach and non-compliance with licence conditions, legislation and regulations.
ADMS Software	v3.4.2 (2013)	2018***	Out of date software more difficult to source technical support for, increasing costs and rising difficulty to apply fixes and modifications to meet changing regulatory and legislative requirements.

*Current maintenance and support contract with HP. Evoenergy will seek to negotiate an extension to this contract but extensions are expected to be short term (1-3 years) and the cost is expected to increase considerably.

**Extended Microsoft support (critical security patches)

***Contract with SE has been extended to 2021 and is expected to be supported by SE until at least 2024

Main Investment Driver

The fundamental drivers for this investment are to minimise costs to customers while maintaining compliance with statutory requirements to provide safe, reliable and cost-effective supply of electricity to customers. These drivers are consistent with the Capital Expenditure Objective and Capital Expenditure Criteria in the National Electricity Rules.

The cost of maintaining the current ADMS will rise and a number of costs can be avoided if the ADMS is upgraded and additional modules compatible with the latest ADMS software version are installed.

There are also additional features available in newer versions of the ADMS software that will enable Evoenergy to better manage its network in the future as DER penetration continues to rise and new demand response technologies become available. The v3.8 ADMS software will also enable Evoenergy to move towards a Distribution System Operator (DSO) model as outlined in the recent Open Energy Networks whitepaper.

There is also an increasing risk of a catastrophic failure of the ADMS due to the ageing systems if an upgrade is not progressed during the next regulatory period, including extremely high increases in cyber security risk, resulting in an inability for Evoenergy to manage their network.

Evoenergy's customers have been engaged throughout the development of the ADMS upgrade business case. The outcomes of recent ICT 'deep-dive' sessions held by Evoenergy as part of our customer engagement strategy showed customer support for the benefits that would accrue from an ADMS upgrade.

Cost savings

Evoenergy can benefit from cost savings by upgrading the ADMS. This includes reducing operating expenses for maintaining the current system, reducing the use of contractors and centralising modelling under a single platform.

The cost of maintenance and support contracts for the hardware and software that the ADMS is built on will increase as the components become more out of date. Spare parts for the hardware are difficult to obtain and using parts that are different to the original components is not possible for a complex system like the ADMS. This will result in the contract cost rising over time to compensate the vendor for the increased difficulty as well as an expected increase in hardware failure rates over time. The operating systems and availability of security patches for these is due to end in 2023, after which maintaining the security of the ADMS will become significantly more expensive.

As the current ADMS version used by Evoenergy does not have advanced GIS importer functionality, contractors have been sourced to manage the updating of the network GIS model within the ADMS and ensure it is aligned with Evoenergy's GIS network model. The upgraded ADMS comes with the option of an enhanced GIS Importer that will manage the GIS integration in a more efficient way. This will remove the need to have contractors to manage this process (a reduction of 50% in the effort required to manage the GIS integration) and will also improve the accuracy and reliability of the ADMS by ensuring the network GIS model is always up to date.

The upgraded ADMS will also be able to model distributed energy resources in the distribution network. This will reduce Evoenergy's costs of doing this modelling using separate systems and contractors.

Enhanced functionality

The upgraded ADMS is a key component of Evoenergy's development paths for the future direction of the network. This ADMS is key for pathways towards:

- Short- and long-term load flow modelling capabilities to assist network studies;
- Dynamic system asset ratings (transformers, line & cable);
- Optimised system topology to increase utilisation and reduce system losses, supporting probabilistic planning;
- Optimised demand management;
- Optimising network protection to improve reliability;

- Managing quality of supply issues caused by DER;
- Improving our customer applications, complaints and other function turn-around times to improve customer service; and
- Greater control of our RAB growth by constraining future system expansion with greater business intelligence to reduce the future commercial risks to the organisation

The upgraded ADMS will allow Evoenergy to take advantage of new features and capabilities that have been developed since the current ADMS was installed. While there are many small improvements that will increase the efficiency of using the ADMS for Evoenergy staff, these small improvements are difficult to quantify.

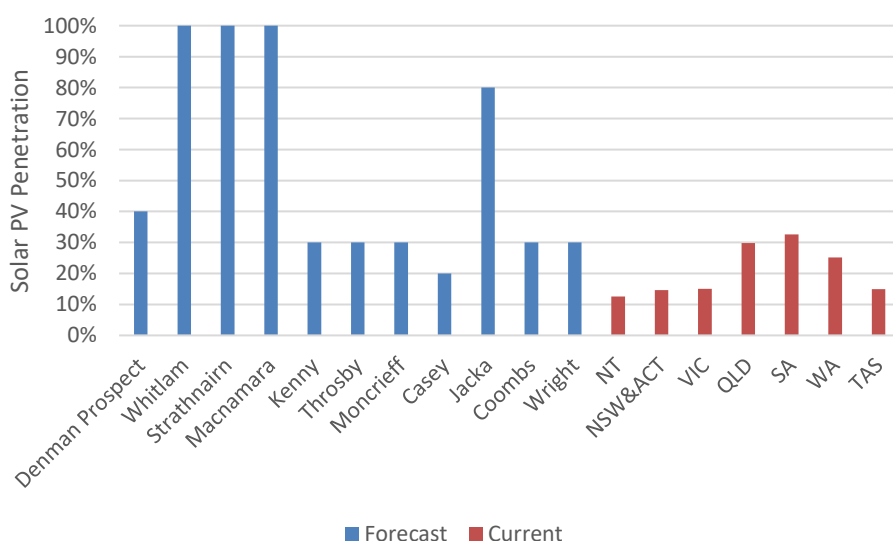
The ADMS upgrade will provide for additional benefit to flow from the proposed Distribution Substation Monitoring business case through integrating the data collected into the ADMS and undertaking more sophisticated load flow monitoring to plan for a better future network.

DER Modelling

The integration of DER modelling into the ADMS will enhance Evoenergy’s long-term network planning. Having this capability embedded in the ADMS will increase the accuracy of network planning and will reduce the amount of under and over investment in network capacity.

Although Evoenergy’s network presently has a low overall level of residential rooftop Solar PV penetration, there are parts of the network that are forecast to have world leading penetration rates over the medium-term horizon. This includes new suburban developments that have a mandated requirement for every property to have a solar PV installation. Batteries are also expected to feature heavily in some of these suburbs.

Figure 2 - Forecast Residential Solar PV Penetration of Selected ACT Suburbs and Current Solar PV Penetration by State



Source: Evoenergy, APVI Solar PV Installations and ABS Number of Households

Without the upgraded ADMS, Evoenergy will require workarounds and expensive outsourcing of modelling services to keep up with high DER penetration on parts of the distribution network. These ad-hoc workarounds are suboptimal and reduce Evoenergy’s flexibility to react as the market shifts.

Monitoring and Remote Control

The new version of the ADMS also includes the capability for the centralised system to communicate with remote network monitoring systems. Evoenergy is currently deploying OLTC-enabled distribution transformers to allow

management of voltage at the LV level to assist with predicted voltage issues in the areas with high PV penetration, and with investment in new peripheral devices Evoenergy will be able to remotely control DER connected to the network. These initiatives will benefit customers by ensuring they can utilise their DER investments, and increase the DER hosting capacity of the network. This capability is required for emerging network technologies such as DER orchestration and provides improved visibility in the low voltage network.

Evoenergy currently has restricted visibility of the network without real time data modelling, and limited ability to provide DER coordination services or LV remote network operations. This limited functionality will prevent Evoenergy from taking advantage of future network investments that may present themselves to minimise both capital and operating expenditure and/or maximise the value of the investments our customers make on DER.

Integrated Distribution-Transmission Model

Evoenergy also intends to install the Energy Management System (EMS) add-on module for the upgraded ADMS. This module, which is available on the new ADMS version, will provide Evoenergy with a single Network Model to seamlessly operate and model the Transmission and Distribution Networks. The current ADMS implementation requires Evoenergy to maintain an external transmission model (Sincal) to perform Load Flow and Short Circuits studies on the Transmission Network. This effort could be significantly reduced if these studies could be performed in the ADMS, allowing Evoenergy to accommodate future increasing penetration of medium scale transmission connected generation. The external model complicates and introduces risk to Network Operations on the Transmission Network.

Risk mitigation

There is an increasing risk of a catastrophic failure of the ADMS due to the ageing systems if an upgrade is not progressed during the next regulatory period. An overview of these risks is covered in the Key Failure Driver section above and a detailed review into cyber security risks follows below.

Cyber Security Risks

One of the key risks associated with the continued operation of the current ADMS is the increased exposure to cyber security risks. The majority of these risks stems from the continued use of the Windows 7 and Windows Server 2008 operating systems. Extended support, which entails security patches for newly discovered vulnerabilities, will cease in January 2023 for both operating systems. Security patches are vital, especially for mission critical systems such as an ADMS.

A recent example involving operating systems vulnerabilities is the so called 'NotPetya' cyber-attack. Although the cyber-attack impacted thousands of computers worldwide, the most damaging result was when the core systems at shipping giant Maersk were infected. This resulted in the complete loss of the company's logistics system and resulted in an estimated loss of US\$300m. Microsoft quickly released patches that prevented further infections from the virus. However, if a similar event happened to an operating system that was no longer supported, which Evoenergy will be facing from 2023 onwards, a company would be exposed to continuous attack. If an upgrade process had sufficiently progressed then it may possible to undertake an emergency upgrade to the new operating system, otherwise there may be a need to plan to operate without an ADMS for an extended period of time.

According to the Australian Cyber Security Centre:

Once a vulnerability in an operating system, application or device is made public, it can be expected that malicious code (also known as malware) will be developed by adversaries within

48 hours. In fact, there are cases in which adversaries have developed malicious code within hours of newly-discovered security vulnerabilities¹

Evoenergy's planned upgrade path involves using the Windows 7 and Windows Server 2008 operating systems for 12-18 months after the end of extended support. For a portion of this time Evoenergy will be operating the new ADMS in parallel for testing so the overall impact of a significant security vulnerability in the operating systems would be mitigated if in an emergency Evoenergy could go-live with the upgraded ADMS prior to the completion of full testing.

Evoenergy, along with the wider Australian energy industry, has been putting an increased focus on cyber security. Evoenergy has taken part in industry wide initiatives to review cyber security and make changes to create a more secure energy system for the country.

Currently, Evoenergy has been identified as having a low level of cyber security maturity, however, the network is in the process of commissioning additional external reviews to identify opportunities to make improvements and reduce both the likelihood and consequence of a potential attack. A failure to maintain supported computer systems will prevent Evoenergy from advancing its cyber security maturity level.

Future investment in cyber security to improve Evoenergy's resiliency would have a reduced return if a critical system such as the ADMS was not able to be raised to an acceptable maturity level.

Customer Expectations

Evoenergy recently reengaged with consumers about the approach to ICT investment within Evoenergy's 2019-2024 regulatory proposal in the form of two 'deep-dive' sessions. Participants included members of Evoenergy's Energy Consumer Reference Council (ECRC). Pre-reading and content for presentations were drawn from Evoenergy's regulatory proposal. Spokespersons knowledgeable in the Australian Energy Market provided their perspectives at the event.

Feedback gathered during the deep dive has contributed to the consolidated body of work that makes up Evoenergy's regulatory proposal; it will also inform Evoenergy's future approach to ICT investment in the ACT electricity network.

The following feedback was provided on proposed investment in the ADMS:

- The expenditure is not unreasonable.
- The 10-year amortisation period is perhaps unrealistically long.
- It is important that consumers see benefits in return on investment from the upgraded ADMS.
- Data security is very important to consumers, both with respect to the ADMS and Evoenergy systems, but also the hardware that is installed in the home, for example, the security of internet/phone communications with meters.
- Consumers care about the impacts of potential failure of the ADMS if it is not upgraded.
- The significant growth in the need to collect and process consumption data is recognised.

In addition to the points raised there are a number of additional customers benefits. Customer connection costs can be minimised by an accurate model of the network so that augmentation at connection points is only required when absolutely necessary. The upgraded system would reduce the risk of future NEECF breaches as the latest

¹ https://acsc.gov.au/publications/protect/assessing_security_vulnerabilities_and_patches.htm

version more accurately identifies impacted customers and uses automated checks to ensure those customers are notified in a timely manner.

Options Analysis

Evoenergy has undertaken a bottom-up cost estimate of the three most credible alternative options to maintain the ADMS. These estimates incorporate both capital and operating expenditure due to the operating expenditure impacts associated with the alternative ADMS upgrade options.

The options analysis has been limited to the next two regulatory periods, a total of 10 years. This is considered reasonable for the assessment of IT systems, which have much shorter lifespans than network assets. A detailed description of the options analysis methodology is contained in Appendix 3: Forecast Methodology and Assumptions.

Additional options considered but not quantified are covered following the three credible options. This includes explanations for why the additional options are not able to be quantified or are not technically feasible options. These options have been included in this business case for completeness and for the removal of doubt that potentially credible options have not been assessed.

Options Overview

Evoenergy has quantified three credible options:

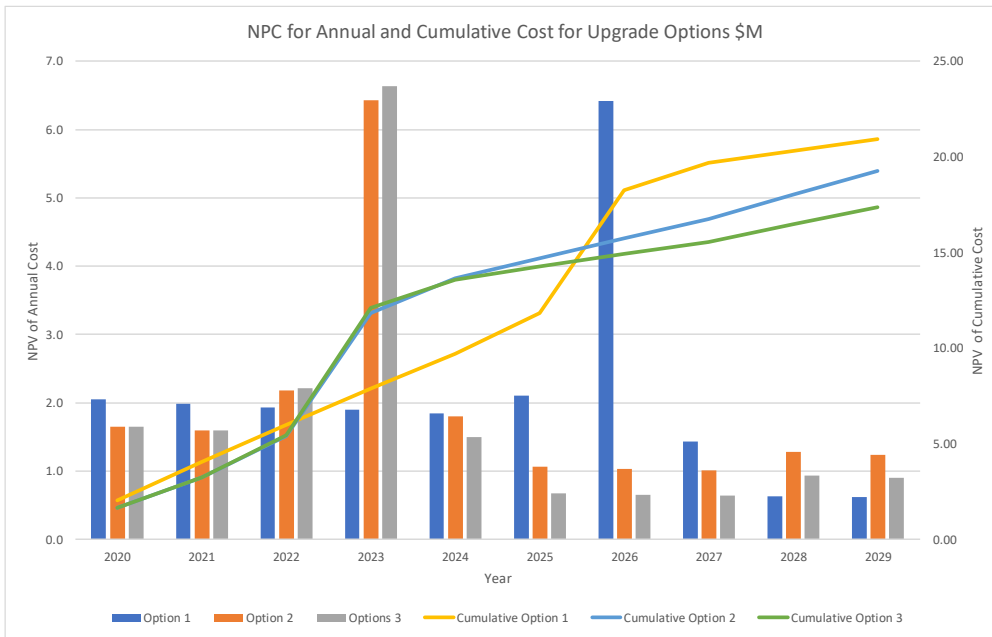
1. Defer upgrade: Defer the upgrade of the ADMS until the 2024-29 regulatory control period
2. Minimal upgrade: Upgrade the ADMS during the 2019-24 regulatory control period without additional features
3. Full upgrade with additional modules: Upgrade the ADMS during the 2019-24 regulatory control period with additional GIS Importer and EMS modules

A summary of the NPV of the three options and an illustration of how the costs are incurred over time are shown below.

Table 4 - Options Summary

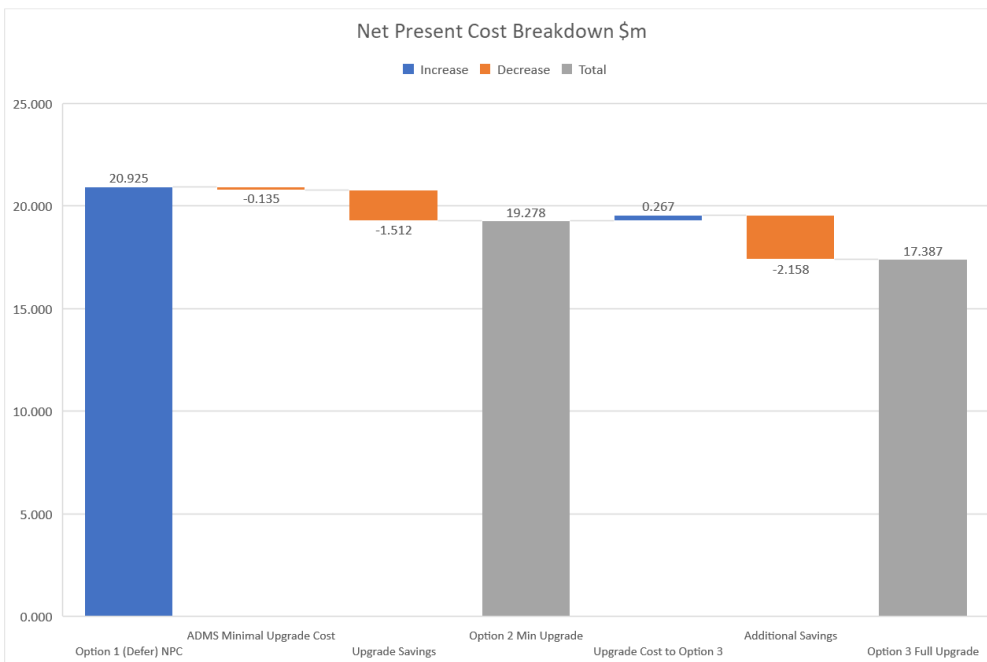
Option	10 Year Net Present Cost \$m	2019-24 Capital Expenditure \$m
Option 1: Defer upgrade	20.92	6,62
Option 2: Minimal upgrade	19.28	11.30
Option 3: Full upgrade with additional modules	17.39	11.21

Figure 3 Net Present Cost Build Up by Year



Analysis was also made of the relative NPC of the 3 options and this is shown in the chart below. The cost of the upgrade in Option 2 is less than option 1 due to reduced functionality and the earlier timing for this delivers \$1.5m of additional savings. Option 3 has a marginally higher cost for the full upgrade than Option 2, but delivers significant savings with over \$2.1m of additional benefit compared to Option 2 in the 10 year period.

Figure 4 Net Present Cost Breakdown by Option



Option 3 is the preferred option as it has the lowest Net Present Cost. Proceeding with this option will result in lower customer bills and a safe and reliable electricity supply.

Detailed analysis of these options that underpin the Net Present Cost forecasts are presented in the sections below.

Option 1: Defer upgrade

This option defers all ADMS upgrade related expenditure to the 2025-29 regulatory period. Upgrade specific expenditure will be incurred between 2024/25 and 2026/27, with an estimated 10% during the first year and the last year and the remaining 80% during the second year.

Due to the three-year lead time to implement a new ADMS, this option requires the existing ADMS to continue operation until the end of 2026/27, with the upgraded ADMS taking over from 2027/28. The upgraded ADMS installed in this option includes the enhanced GIS Importer and EMS modules included in Option 3: Full Upgrade.

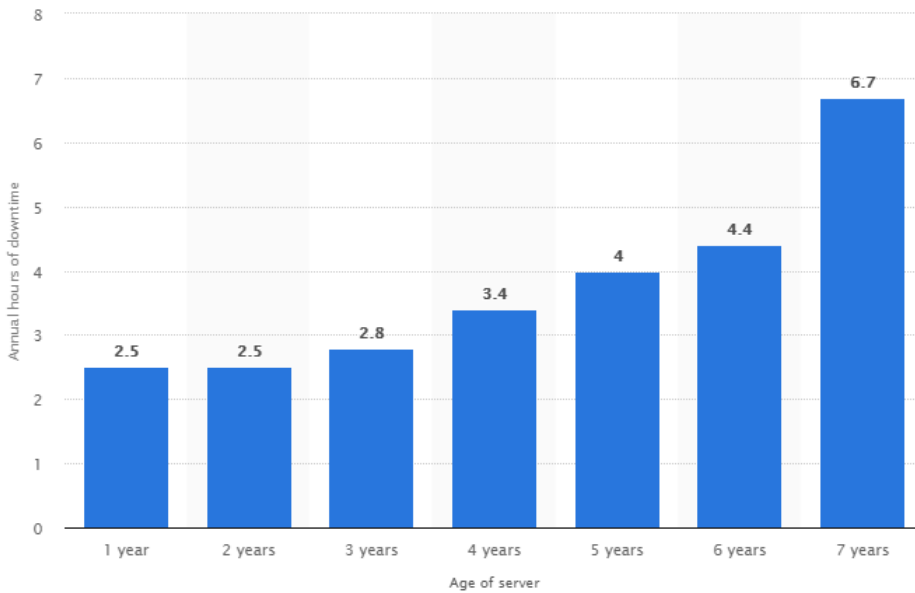
To continue operation of the current ADMS through to 2026/27 will require additional operating expenditure. This includes extended support and maintenance payments for the Microsoft Windows operating system, SQL software, and HP servers and workstations. ADMS software support and maintenance costs paid to Schneider Electric are also expected to rise as the v3.4.2 version becomes further out of date and more difficult to maintain.

Evoenergy will face heightened risks due to the outdated and obsolete systems used by the ADMS prior to the upgrade. Maintenance and support for the Windows operating system will not be provided by Microsoft after January 2023 and it will become extremely difficult to maintain the level of security expected for a sensitive system such as the ADMS without this support. Third-party providers may be able to fill some of the security and functionality gap left by the end of Microsoft extended support, but the cost is expected to be high. The security risk to the ADMS is alleviated by the fact it is not directly connected to the internet, although intrusion via the SCADA system and the Corporate Network is possible. The SCADA system will be a big threat from cybersecurity point of view as the DNP secure driver will be available only in the upgraded ADMS.

The ADMS will also require the use of obsolete hardware (workstations and servers) for a longer period of time. There is a risk that Evoenergy may not be able to source spare parts for hardware, which would risk the business being forced to operate without an ADMS for an extended period of time. The current rates of hardware failure are low, but even conservative forecasts for hardware failures to the end of 2026/27 will result in significant costs and risks. Rising failure rates have been factored in to the forecast cost of the Hardware Support and Maintenance contract, but this may fail to represent the risk of not being able to obtain spare parts and the impact on extended ADMS outages.

As evidenced in Figure 5, server failure rates (measured by downtime) grow exponentially as the hardware ages. Under this option, Evoenergy will continue to use servers until 14 years after the installation date and the risk is likely to continue to increase annually up until the upgrade. The likelihood of extended downtime based on a projection of the below failure rate would result in a significant risk to Evoenergy and our ability to serve customers with a safe and reliable electricity supply.

Figure 5 - Server Failure Rates by Age



Source: Statistica

The deferral of the ADMS upgrade will result in Evoenergy incurring capital costs for GIS, DER and Transmission modelling as well as ADMS fixes for a longer period of time. The GIS and DER/Transmission modelling costs can be avoided after the upgrade and the cost of ADMS fixes is expected to be avoided for a period of three years after the upgrade before resuming.

Evoenergy will continue to incur capital costs for the development and implementation of ADMS fixes to maintain the current ADMS during the 2019-24 period. Expenditure on fixes will be halted following commitment to an upgrade pathway as Evoenergy will strive to make do with the existing capabilities to avoid additional expenditure. In the deferral option this commitment occurs at the start of the 2025-29 period. This will reduce recurring capital costs from 2024/25 until the upgrade is complete. Following the upgrade, fixes are expected to be avoided for a period of three years due to the capabilities built into the upgraded ADMS. After three years Evoenergy will resume expenditure for fixes.

The table below shows a breakdown of the capital and operating costs that will be incurred by the ADMS program for this option.

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Capital costs	█	█	█	█	█	█	█	█	█	█	█
Operating costs	█	█	█	█	█	█	█	█	█	█	█
ADMS fixes	█	█	█	█	█	█	█	█	█	█	█
GIS	█	█	█	█	█	█	█	█	█	█	█
DER	█	█	█	█	█	█	█	█	█	█	█
Transmission	█	█	█	█	█	█	█	█	█	█	█
Total costs	█	█	█	█	█	█	█	█	█	█	█

The Net Present Cost of this option is \$20.9m with a total capital expenditure requirement during the 2019-24 regulatory control period of \$6.62m.

This option will require \$4.30m of operating expenditure during the 2019-24 regulatory control period. It will also result in higher operating and capital expenditure in the 2024-29 regulatory control period.

The level of non-quantified risk associated with this option is high (obsolete 14-year-old hardware; software and operating systems used for up to six years beyond extended support).

Option 2: Minimal upgrade

This option retains Evoenergy's planned ADMS upgrade rollout timeline for the upgraded ADMS to be installed during the 2019-24 regulatory control period, with upgrade specific expenditure occurring between 2021/22 and 2023/24. The upgrade specific expenditure will occur unevenly over this period, with an estimated 10% during each of the first and last years and the remaining 80% during 2022/23. The upgraded ADMS and associated cost savings will be available in 2024/25.

Due to the three-year lead time to implement a new ADMS, this option requires the existing ADMS to continue operation until the end of 2023/24, with the upgraded ADMS taking over from 2024/25. This option will minimise the upgrade related capital outlay as it does not include the enhanced GIS Importer and EMS modules included in Option 3: Full Upgrade.

To continue operation of the current ADMS through to 2023/24 will require additional operating expenditure. This includes extended support and maintenance payments for the Microsoft Windows operating system, SQL software, and HP servers and workstations. These additional costs will be avoided from 2024/25 onwards as the legacy ADMS's systems and hardware are no longer needed.

The current contract for ADMS software support and maintenance costs paid to Schneider Electric has been extended to 2020/21. The annual cost of this service may rise for the remaining years before the current ADMS can be upgraded as the v3.4.2 version becomes further out of date and more difficult to maintain. However, Evoenergy hopes to negotiate with Schneider Electric to include a continuation of the annual price adjustments in the current contract until the upgrade is complete as part of the agreement to go ahead with the upgrade using the proposed timeline.

Evoenergy will face heightened risks due to the outdated and obsolete systems used by the ADMS prior to the upgrade. Maintenance and support for the Windows operating system will not be provided by Microsoft after January 2023 and it will become extremely difficult to maintain the level of security expected for a sensitive system such as the ADMS without this support. Third-party providers may be able to fill some of the security and functionality gap left by the end of Microsoft extended support, but the cost is expected to be high. The security risk to the ADMS is alleviated by the fact it is not directly connected to the internet, although intrusion via SCADA systems is possible.

The ADMS will also require the use of obsolete hardware (workstations and servers) for a longer period of time. There is a risk that Evoenergy may not be able to source spare parts for hardware, which would risk the business being forced to operate without an ADMS for an extended period of time. The current rates of hardware failure are low, but hardware failures are forecast to increase prior to the retirement of the current ADMS under this option.

However, Evoenergy expects the level of hardware failures to be manageable within this timeframe with only a moderate exposure to additional risk. Rising failure rates have been factored into the forecast Hardware Support and Maintenance contract cost, but this may not fully reflect the risk of not being able to obtain spare parts. The cost does not include an allowance for the risk of the ADMS becoming unavailable due to a serious hardware failure that requires extensive repairs over a period of days to weeks.

Excluding the GIS Importer and EMS modules from the ADMS upgrade will result in Evoenergy continuing to incur capital costs for GIS and DER/Transmission modelling following the upgrade.

Evoenergy will also benefit from a reduction in the cost of ADMS fixes. All expenditure on fixes will be avoided following commitment to an upgrade pathway as Evoenergy will strive to make do with the current capabilities to avoid additional expenditure. This will reduce recurring capital costs from 2019/20 until the upgrade is complete. Following the upgrade, fixes are expected to be avoided for a period of three years due to the capabilities built into the upgraded ADMS. After three years Evoenergy will resume expenditure for fixes.

The table below shows a breakdown of the capital and operating costs that will be incurred by the ADMS program for this option.

The Net Present Cost of this option is \$19.28m with a total capital expenditure requirement during the 2019-24 regulatory control period of \$11.30m. This option will also require \$4.30m of operating expenditure during the 2019-24 regulatory control period but will result in reduced operating expenditure in future periods.

The level of non-quantified risk associated with this option is medium (obsolete 11-year-old hardware; software and operating systems used for up to three years beyond extended support; reduced long-term ADMS capability).

Option 3: Full upgrade with additional modules

This option retains Evoenergy’s planned ADMS upgrade rollout timeline for the upgraded ADMS to be installed during the 2019-24 regulatory control period, with upgrade specific expenditure occurring between 2021/22 and 2023/24. The upgrade specific expenditure will occur unevenly over this period, with an estimated 10% during each of the first and last years and the remaining 80% during 2022/23. The upgraded ADMS and associated cost savings will be available in 2024/25.

Due to the three-year lead time to implement a new ADMS, this option requires the existing ADMS to continue operation until the end of 2023/24, with the upgraded ADMS taking over from 2024/25. This option includes additional cost saving investments to install the enhanced GIS Importer and EMS modules.

To continue operation of the current ADMS through to 2023/24 will require additional operating expenditure. This includes extended support and maintenance payments for the Microsoft Windows operating system, SQL software, and HP servers and workstations. These additional costs will be avoided from 2024/25 onwards as the legacy ADMS’s systems and hardware are no longer needed.

The current contract for ADMS software support and maintenance costs paid to Schneider Electric has been extended to 2020/21. The annual cost of this service may rise for the remaining years before the current ADMS can be upgraded as the v3.4.2 version becomes further out of date and more difficult to maintain. However, Evoenergy hopes to negotiate with Schneider Electric to include a continuation of the annual price adjustments in the current

contract until the upgrade is complete as part of the agreement to go ahead with the upgrade using the proposed timeline.

Evoenergy will face heightened risks due to the outdated and obsolete systems used by the ADMS prior to the upgrade. Maintenance and support for the Windows operating system will not be provided by Microsoft after January 2023 and it will become extremely difficult to maintain the level of security expected for a sensitive system such as the ADMS without this support. Third-party providers may be able to fill some of the security and functionality gap left by the end of Microsoft extended support, but the cost is expected to be high. The security risk to the ADMS is alleviated by the fact it is not directly connected to the internet, although intrusion via SCADA systems is possible.

The ADMS will also require the use of obsolete hardware (workstations and servers) for a longer period of time. There is a risk that Evoenergy may not be able to source spare parts for hardware, which would risk the business being forced to operate without an ADMS for an extended period of time. The current rates of hardware failure are low, but hardware failures are forecast to increase prior to the retirement of the current ADMS under this option. However, Evoenergy expects the level of hardware failures to be manageable within this timeframe with only a moderate exposure to additional risk. Rising failure rates have been factored in to the forecast Hardware Support and Maintenance contract cost, but this may not fully reflect the risk of not being able to obtain spare parts. The cost does not include an allowance for the risk of the ADMS becoming unavailable due to a serious hardware failure that requires extensive repairs over a period of days to weeks.

The enhanced GIS Importer and EMS modules for the ADMS are included in this option. Evoenergy will realise a reduction in ongoing capital (GIS contractor services) and operating (DER/Transmission modelling) costs following the upgrade. Some savings will be realised during 2023/24 while the upgraded ADMS is operating in parallel with the current ADMS.

Evoenergy will also benefit from a reduction in the cost of ADMS fixes. All expenditure on fixes will be avoided following commitment to an upgrade pathway as Evoenergy will strive to make do with the current capabilities to avoid additional expenditure. This will reduce recurring capital costs from 2019/20 until the upgrade is complete. Following the upgrade, fixes are expected to be avoided for a period of three years due to the capabilities built into the upgraded ADMS. After three years Evoenergy will resume expenditure for fixes.

The table below shows a breakdown of the capital and operating costs that will be incurred by the ADMS program for this option.

[Redacted Table]

The Net Present Cost of this option is \$17.39m, with a total capital expenditure requirement during the 2019-24 regulatory control period of \$11.21m. This option will also require \$4.30m of operating expenditure during the 2019-24 regulatory control period but will result in reduced operating and capital expenditure in future periods.

The level of non-quantified risk associated with this option is medium (obsolete 11-year-old hardware; software and operating systems used for up to three years beyond extended support).

Other options considered but not feasible

These options were considered but are not feasible due to the reasons outlined here. They have not been quantified as they were identified as non-credible options

Immediate ADMS Upgrade

- This option would minimise Evoenergy's risk exposure by ensuring servers and workstations are not operating using the Windows 7/Windows Server 2008 operating systems after extended support has ceased. Obsolete and difficult to repair and replace hardware would also be retired sooner.
- Evoenergy don't wish to be one of the first companies to test ADMS v3.8 with a material change to the SCADA engine included in this upgrade.

Hardware/OS/database upgrade only

- This option would address Evoenergy's risk exposure by replacing the components of the ADMS most at risk during the 2019-24 regulatory control period
- This option is not feasible as the current ADMS version (v3.4.2) can only run on the current configuration of servers, operating systems and database software.

ADMS software upgrade only

- This option would reduce Evoenergy's costs by upgrading to a newer ADMS with additional cost saving features, including the GIS Importer and EMS modules, while minimising expenditure by avoiding the replacement of hardware.
- The new ADMS version (v3.8) cannot run on the current hardware, operating system and database configuration Evoenergy is using for the currently installed ADMS version

Staged upgrade

- This option would reduce delivery risk and allow opportunities to re-evaluate the investment in light of new information before proceeding with later investment stages.
- No staged options are available for Evoenergy's ADMS configuration. The investment must be done all at once as the Evoenergy ADMS is a single interdependent system. Evoenergy has also observed other networks have lost control of costs and failed to deliver on time with staged ADMS approaches.

Permanent deferral

- This option would minimise capital expenditure by retaining the existing ADMS for all future years instead of only deferring the expenditure.
- It is not reasonable to forecast the long-term support and maintenance costs for the existing ADMS, including supporting software and hardware. Risk exposure and growth in direct costs to maintain the system are reasonably expected to grow exponentially over time.

Alternative ADMS vendor

- This option would allow Evoenergy to reduce ongoing ADMS expenditure by sourcing a cheaper alternative vendor by going to market
- Extremely expensive due to need to rebuild all ADMS systems and retrain staff with no known additional benefits

- Schneider Electric's EcoStruxure ADMS has been named best ADMS for four years by Gartner. EcoStruxure ADMS technology received the highest scores for all three targeted use cases: improved outage response, optimized grid operations and distributed energy resource management².

Preferred Investment Option

Option 3, Full Upgrade with additional modules, has been identified as the preferred investment strategy. It involves an \$11.21m capital investment to upgrade the ADMS during the 2019-24 regulatory control period with additional cost saving add-on modules included. The preferred investment option satisfies the main investment driver of meeting the NER capital expenditure objectives to act as a prudent and efficient operator as it has a NPV of \$3.54m compared to the base option. It also assists in providing safe, reliable and cost-effective supply of electricity to customers. It addresses the main investment objectives as follows:

Safety:

The proposed investment supports the safety performance objective of zero deaths or injuries to employees or the public by reducing the risk associated with inadvertent ADMS operations.

Reliability:

The proposed investment supports the reliability performance objective of maintaining historical SAIDI and SAIFI performance levels by reducing the risk associated with unintended system outages and prolonged system outages due to a loss of ADMS functionality requiring the business to work under business continuity plans.

Expenditure:

The proposed investment has been identified as the lowest net present cost option and achieves the objective of minimising overall net present cost and economic risk.

Risk:

The proposed investment addresses the one key failure driver and the risk associated with multiple failure modes.

Project Delivery Method

Evoenergy follows the PRINCE2 methodology for Project Delivery in the Asset Information Systems section.

Before any project commences, it goes through a rigorous governance process through submission to the Operational Technology Governance Forum (OTGF) for approval to undertake scoping and creation of a full business case. At this stage a mandate is provided to the selected project manager to produce a business case.

Business Cases go through standard Evoenergy approval processes as defined via Approval Delegations.

After business case approval the Delivery Project commences.

Delivery is managed through stages with each stage having entry and exit criteria that must be met to move forward.

At stage gates the project board is convened and the project manager is required to demonstrate that the current stage is complete, that the next stage is adequately planned, that project benefits remain preserved and that expenditure continues to be in line with the budget.

² <https://www.schneider-electric.com.au/en/work/products/product-launch/adms-gartner/>

Where projects are not on track or identify changes that would be prudent to implement, the project manager produces an exception report that highlights all relevant details and convenes a project board that decides how to move forward i.e. approve the change request, stop the project or request further information before progressing.

Where change requests are raised to deliver additional functionality, this change will be funded from the management reserve that is controlled by the project board.

Where variations occur as a result of risks eventuating and becoming issues, the funding for these variations is accessed from the project contingency that has been set up specifically to fund risk events.

Evoenergy uses various approaches for software and system delivery, Waterfall, Agile and a hybrid of Waterfall and Agile. The approach is agreed at the time of the business case and the Project Manager develops his delivery schedule, stages and stage gates based on the approach. Project Assurance is undertaken by the Program Delivery Manager for smaller projects and by an externally hired assessor for the larger projects.

For the ADMS upgrade the following stages are expected to be include in the project delivery plan.

START UP – which will include the appointment of the Project Manager, the drafting of the initial Business Case and the creation and population of the project management artefacts including risk registers, procurement plan, and establishment of project board and outline of project approach.

INITIATION – activities include mobilise the project team, develop requirements and run a tender process and develop the full detailed business case before progressing through to the DELIVERY phase of the project.

DELIVER – it is expected that there will be multiple stages in the Delivery phase of the project with each stage gate providing information that will inform the project board and allow them to decide whether or not the benefits are preserved based on progress.

CLOSURE – at the end of the delivery stages, there is a CLOSURE phase which includes deployment and handover to support as well as Benefits Realisation handover. The project sponsor and senior users who have been on the journey through the project then take on the responsibility of ensuring that the benefits are fully exploited by the organisation. Throughout phases and stages, lessons learned are collated to ensure that continuous improvement is rolled into future projects ensuring that projects are both economic and prudent.

BENEFITS REALISATION – is expected to continue in BAU for as long as defined in the original business case.

Schedule

Option 3: Full Upgrade is the option that enables Evoenergy to best meet the current and future customer expectations and mitigates the business risks, while ensuring prudent expenditure and value for money. The initiatives by financial year for this option are listed as follows:

- FY 19-20 – Quarterly hot fixes for the existing ADMS application
- FY 20-21 – Quarterly hot fixes for the existing ADMS application
- FY 21-22 – Quarterly hot fixes for the existing ADMS application and commencement of Detailed Design, Data Migration and Enhancements Development for the ADMS upgrade design phase
- FY 22-23 – Quarterly hot fixes for the existing ADMS application, and commencement of the Implementation, Testing and Parallel Operation of the ADMS upgrade
- FY 23-24 – Quarterly hot fixes for the existing ADMS application, Go-Live with upgraded ADMS

Project Implementation Risks

Risk Statement	Impact	Likelihood	Consequence	Rating	Treatment	Likelihood	Consequence	Rating
		Untreated				Untreated		
IF Insufficient resources are available to perform the work	THEN there will be project delays resulting in change to schedule and budget	Likely	Major	High	Source and contract suitable resources Assign Internal resources and ensure that their positions are backfilled	Unlikely	Major	Medium
IF schedule is overly optimistic	THEN there will be project delays resulting in change to schedule and budget	Likely	Major	High	Schedule assurance and external review at time of detailed business case. Ongoing external reviews on regular basis	Unlikely	Major	Medium
IF there is a high turnover of staff/resources on the project team	THEN there will be project delays resulting in change to schedule and budget a a result of additional training, onboarding and familiarisation with project	Possible	Major	High	Conduct team building, project assurance to include check on project culture, hire appropriate leadership for the project.	Unlikely	Major	Medium
IF Friction occurs between the project team and the vendors/consultants	THEN there will be changes to scope, budget or schedule as a result of miscommunication	Possible	Major	High	Ensure contract is created with appropriate contract mangement tasks. Manage contract.	Unlikely	Major	Medium
IF Contractor fails	THEN Project will be delayed and there will be significant cost impacts	Possible	Severe	High	Check references and ensure that supplier is financially sound	Rare	Severe	Medium

Appendix 1: Risk assessment

Option 1: Defer upgrade

Risk Statement	Impact	Likehood	Consequence	Rating	Treatment	Likehood	Consequence	Rating
		Untreated				Treated		
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	THEN Evoenergy is at significant risk of a Cyber Security attack (including full loss of network visibility and control) as OS vulnerabilities cannot be patched.	Possible	Severe	High	Request additional indefinite Microsoft support for OS. This may not be agreed to by Microsoft and will have a significant cost.	Rare	Severe	Medium
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	The Evoenergy will likely become non-compliant with any mandated Cyber Security standard (NERC CIP equivalent) implemented in the Australian Energy market.	Likely	Major	High	Request an exclusion from the standard, this would be unlikely to be granted particularly given Evoenergy's role in supplying critical public service and defense infrastructure.	Likely	Major	High
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	Any identified system issues as the result of ADMS and OS interactions requiring Microsoft intervention will not be possible.	Unlikely	Severe	High	Request additional indefinite Microsoft support for OS. This may not be agreed to by Microsoft and will have a significant cost.	Unlikely	Severe	High
ADMS Hardware becomes unsupported in September 2018.	Hardware defects arise resulting in loss of core ADMS functionality.	Possible	Severe	High	Negotiate extended HP support or 3rd party hardware support. Provision additional cold / warm standby servers.	Possible	Severe	High
Inability to operate from the backup site for more than 24 hours, or in regular business hours (due to inability to update network model, Simulate and approve Switching Plans and Support all Web Services and client volumes needed in regular business operation).	No upgrades which take more than 12-24 hours can be undertaken without significant disruption to business operation.	Almost Certain	Moderate	High	Accept the risk as mitigating this requires the installation and provisioning of a significant number of additional services.	Almost Certain	Moderate	High
The Gap between the latest ADMS release available in the market and Evoenergy's version of the ADMS continues to grow.	The support quality diminishes to resolve defects. Cost of support increases both for system maintenance and support as well as the implementation of system enhancements.	Almost Certain	Major	Very High	Risk is accepted as Schneider cannot be forced to support an obsolete software version to the same level of quality and efficiency as their latest versions.	Almost Certain	Major	Very High
The inability of the current ADMS version to model Energy Storage, forecast generation from Distributed Energy Resources (DER), include DER dispatch in Demand Management functions and include DERs and generation in closed loop optimisation algorithms.	Evoenergy is not able to model and therefore formulate technical responses and strategies to mitigate the negative impacts of Energy Storage, and to leverage these for Power Quality, upstream demand reduction and for DSO operation.	Almost Certain	Major	Very High	Risk will have to be accepted as Schneider have already indicated that they will not backport significant schema changes from newer to older versions.	Almost Certain	Major	Very High
Current version of ADMS does not support DNP3 Secure.	Evoenergy remains reliant on VPN tunnels to facilitate secure connection to each DNP3 end point, increasing the time and cost of each new installation and increasing the maintenance overhead for existing connections. This will then prevent the realisation of the Secondary Systems strategy of achieving DNP3 secure support.	Almost Certain	Moderate	High	Accept risk as Schneider have already confirmed they will not backport DNP3 secure support to V3.4.2.	Almost Certain	Moderate	High
Inability to integrate the current ADMS version with the Schneider Energy Management System (Generation and Transmission management).	Operational risk and inefficiencies in having only a read only transmission view, with all Transmission operations needing to take place in Zone Substation Views. Inability to run holistic planning and optimisation algorithms incorporating Transmission connected generation sources. Continued reliance on maintenance of Sincal model and license for Transmission studies.	Almost Certain	Moderate	High	Risk is accepted as Schneider have already indicated they cannot backport EMS integration to V3.4.2.	Almost Certain	Moderate	High
No support for difference files and introduction of network model changes as part of switching plan execution.	Inefficiencies in the ADMS model management activities result in the need for an additional 2 contracted FTEs.	Almost Certain	Moderate	High	Implement the customisation of the GIS Importer at Version 3.4.2. This has previously been quoted by Schneider as being over one year of effort at a cost >\$1M and will require	Rare	Moderate	Low

Option 2: Minimal upgrade

Risk Statement	Impact	Likelihood	Consequence	Rating	Treatment	Likelihood	Consequence	Rating
		Untreated				Treated		
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	THEN Evoenergy is at significant risk of a Cyber Security attack (including full loss of network visibility and control) as OS vulnerabilities cannot be patched.	Possible	Severe	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Severe	Medium
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	The Evoenergy will likely become non-compliant with any mandated Cyber Security standard (NERC CIP equivalent) implemented in the Australian Energy market.	Likely	Major	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Major	Medium
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	Any identified system issues as the result of ADMS and OS interactions requiring Microsoft intervention will not be possible.	Unlikely	Severe	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Severe	Medium
ADMS Hardware becomes unsupported in September 2018.	Hardware defects arise resulting in loss of core ADMS functionality.	Possible	Severe	High	Upgraded ADMS will be installed on new Hardware which will be in support.	Rare	Severe	Medium
Inability to operate from the backup site for more than 24 hours, or in regular business hours (due to inability to update network model, Simulate and approve Switching Plans and Support all Web Services and client volumes needed in regular business operation).	No upgrades which take more than 12-24 hours can be undertaken without significant disruption to business operation.	Almost Certain	Moderate	High	Accept the risk as mitigating this requires the installation and provisioning of a significant number of additional services.	Almost Certain	Moderate	High
The Gap between the latest ADMS release available in the market and Evoenergy's version of the ADMS continues to grow.	The support quality diminishes to resolve defects. Cost of support increases both for system maintenance and support as well as the implementation of system enhancements.	Almost Certain	Major	Very High	Upgraded ADMS version will reduce the gap between the latest on the market ADMS version and that used at Evo Energy, lowering the likelihood of cost increases and the impact of functionality differences.	Rare	Major	Medium
The inability of the current ADMS version to model Energy Storage, forecast generation from Distributed Energy Resources (DER), include DER dispatch in Demand Management functions and include DERs and generation in closed loop optimisation algorithms.	Evoenergy is not able to model and therefore formulate technical responses and strategies to mitigate the negative impacts of Energy Storage, and to leverage these for Power Quality, upstream demand reduction and for DSO operation.	Almost Certain	Major	Very High	Upgraded ADMS will model Energy Storage and have a suite of forecast, dispatch and optimisation functions leveraging DER and other generation sources.	Rare	Major	Medium
Current version of ADMS does not support DNP3 Secure.	Evoenergy remains reliant on VPN tunnels to facilitate secure connection to each DNP3 end point, increasing the time and cost of each new installation and increasing the maintenance overhead for existing connections. This will then prevent the realisation of the Secondary Systems strategy of achieving DNP3 secure support.	Almost Certain	Moderate	High	Upgraded ADMS will support DNP3 Secure.	Rare	Moderate	Low
Inability to integrate the current ADMS version with the Schneider Energy Management System (Generation and Transmission management).	Operational risk and inefficiencies in having only a read only transmission view, with all Transmission operations needing to take place in Zone Substation Views. Inability to run holistic planning and optimisation algorithms incorporating Transmission connected generation sources. Continued reliance on maintenance of Sinclair model and license for Transmission studies.	Almost Certain	Moderate	High	Risk is accepted as Schneider have already indicated they cannot backport EMS integration to V3.4.2.	Almost Certain	Moderate	High
No support for difference files and introduction of network model changes as part of switching plan execution.	Inefficiencies in the ADMS model management activities result in the need for an additional 2 contracted FTEs.	Almost Certain	Moderate	High	Implement the customisation of the GIS Importer at Version 3.4.2. This has previously been quoted by Schneider as being over one year of effort at a cost >\$1M	Rare	Moderate	Low

Option 3: Full upgrade with additional modules

Risk Statement	Impact	Likelihood	Consequence	Rating	Treatment	Likelihood	Consequence	Rating
		Untreated				Untreated		
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	THEN Evoenergy is at significant risk of a Cyber Security attack (including full loss of network visibility and control) as OS vulnerabilities cannot be patched.	Possible	Severe	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Severe	Medium
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	The Evoenergy will likely become non-compliant with any mandated Cyber Security standard (NERC CIP equivalent) implemented in the Australian Energy market.	Likely	Major	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Major	Medium
ADMS Operating System (Windows Server 2008R2, Windows 7) becomes unsupported in 2020.	Any identified system issues as the result of ADMS and OS interactions requiring Microsoft intervention will not be possible.	Unlikely	Severe	High	Upgraded ADMS will use Windows Server 2016 or later and Windows 10 which will remain in support for the next Regulatory Period.	Rare	Severe	Medium
ADMS Hardware becomes unsupported in September 2018.	Hardware defects arise resulting in loss of core ADMS functionality.	Possible	Severe	High	Upgraded ADMS will be installed on new Hardware which will be in support.	Rare	Severe	Medium
Inability to operate from the backup site for more than 24 hours, or in regular business hours (due to inability to update network model, Simulate and approve Switching Plans and Support all Web Services and client volumes needed in regular business operation).	No upgrades which take more than 12-24 hours can be undertaken without significant disruption to business operation.	Almost Certain	Moderate	High	Full upgrade of ADMS architecture results in ability to operate from backup site indefinitely.	Rare	Moderate	Low
The Gap between the latest ADMS release available in the market and Evoenergy's version of the ADMS continues to grow.	The support quality diminishes to resolve defects. Cost of support increases both for system maintenance and support as well as the implementation of system enhancements.	Almost Certain	Major	Very High	Upgraded ADMS version will reduce the gap between the latest on the market ADMS version and that used at Evo Energy, lowering the likelihood of cost increases and the impact of functionality differences.	Rare	Major	Medium
The inability of the current ADMS version to model Energy Storage, forecast generation from Distributed Energy Resources (DER), include DER dispatch in Demand Management functions and include DERs and generation in closed loop optimisation algorithms.	Evoenergy is not able to model and therefore formulate technical responses and strategies to mitigate the negative impacts of Energy Storage, and to leverage these for Power Quality, upstream demand reduction and for DSO operation.	Almost Certain	Major	Very High	Upgraded ADMS will model Energy Storage and have a suite of forecast, dispatch and optimisation functions leveraging DER and other generation sources.	Rare	Major	Medium
Current version of ADMS does not support DNP3 Secure.	Evoenergy remains reliant on VPN tunnels to facilitate secure connection to each DNP3 end point, increasing the time and cost of each new installation and increasing the maintenance overhead for existing connections. This will then prevent the realisation of the Secondary Systems strategy of achieving DNP3 secure support.	Almost Certain	Moderate	High	Upgraded ADMS will support DNP3 Secure.	Rare	Moderate	Low
Inability to integrate the current ADMS version with the Schneider Energy Management System (Generation and Transmission management).	Operational risk and inefficiencies in having only a read only transmission view, with all Transmission operations needing to take place in Zone Substation Views. Inability to run holistic planning and optimisation algorithms incorporating Transmission connected generation sources. Continued reliance on maintenance of Sincal model and license for Transmission studies.	Almost Certain	Moderate	High	Full upgrade scope includes EMS integration.	Rare	Moderate	Low
No support for difference files and introduction of network model changes as part of switching plan execution.	Inefficiencies in the ADMS model management activities result in the need for an additional 2 contracted FTEs.	Almost Certain	Moderate	High	Full upgrade includes difference files and optimised model management capability.	Rare	Moderate	Low

Appendix 2: Project Tier Classification

Financial				
Total cost (budget)	>\$1.1m	\$550k - \$1.1m	\$100k - \$550k	<\$100k
	<input checked="" type="radio"/> Very High	<input type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Commercial				
Customer Contribution, Pricing and Contracts	Fixed Price; Pain/Gain Arrangement; Non-standard contracts	Fixed price per block/ICRT; Non-standard contracts	Cost plus; Standard connection agreements	Standard connection agreements; Miscellaneous regulated charges; Not applicable
	<input checked="" type="radio"/> Very High	<input type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Strategic importance	Affects core corporate or energy networks strategy, of key executive interest, or key AER influence	Affects some aspects of corporate strategy or key elements of energy networks strategy	No direct impact on corporate strategy and moderate impact of energy networks strategy	No direct impact on corporate strategy and minimal impact on energy networks strategy
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
External visibility	Highly visible to government, public and/or large customer groups	Highly visible to some customers and/or interest groups	Moderate external visibility	Minimal external visibility
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Work Type				
Work Type	Augmentation, and; Large scale: Customer Initiated; Contestable; Relocation; Operational Technology; Facilities Refurbishments	Moderate scale: Customer Initiated; Contestable; Relocation; Operational Technology; Facilities Refurbishments Major scale: Asset Replacement	Planned Maintenance; Unplanned Maintenance; and, Minor scale: Customer Initiated; Contestable; Relocation; Alternate Control Quoted Services; Operational Technology; Facilities Refurbishments & Fit-outs	Standard Control; Overhead; Alternate Control Fee Based Services; Facilities Maintenance and <i>Minor Scale:</i> Asset Replacement <i>*includes all operational projects</i>
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low

Technical				
Problem clarity and Requirements Volatility	Problem or opportunity is unclear/ambiguous/undefined Requirements poorly understood, volatile and/or largely undefined	Objectives defined and problem and/or opportunity undefined Basic requirements understood, some change expected	Objectives defined and problem or opportunity is understood Basic requirements understood, minor change expected	Clear business objectives, easily understood problem or opportunity Basic requirements are understood, straightforward and/or flexible
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Technical complexity and Safety	Solution likely to use immature, unproven or complex technologies or work practices	Solution likely to use technology or work practices which is proven but is new to ActewAGL	Solution likely to use existing well understood technologies or work practices	Solution uses existing standardised technologies, work practices or routine and standard processes
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Operational				
Project duration	>12 months	6-12 months	3-6 months	0-3 months
	<input checked="" type="radio"/> Very High	<input type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Urgency	Aggressive, fixed/inflexible deadline	Moderate degree of urgency	Some degree of urgency	Flexible schedule, subject to other BAU priorities
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Management Complexity	Major program of work dependencies on project completion; project largely externally delivered; project involves multiple sites and coordination of multiple skills sets and non dedicated resources	Significant program of work dependencies on project completion; project delivered through a combination of external and internal resources; project involves several sites and/or coordination of several skills sets and/or non dedicated resources	Some program of work dependencies on project completion; project internally delivered with some reliance on civil works; project involves a single site and a single or a set of standard skills sets (plant operator, fitter; linesman, site lead) and/or dedicated resources	Nil or minor program of work dependencies on project completion; project internally delivered; project involves a single site and a single skill set and/or dedicated resources
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Dependencies	Overall project success depends largely on external factors; significant external dependencies on project success	Some project objectives depend on external factors; some external dependencies on project success	Minor external influence; minor external dependencies	Nil external influence or dependencies
	<input type="radio"/> Very High	<input checked="" type="radio"/> High	<input type="radio"/> Medium	<input type="radio"/> Low
Calculated Project Tier Classification	Tier 1			

Appendix 3: Forecast Methodology and Assumptions

Evoenergy has quantified the costs of maintaining the ADMS to determine the least cost option.

Methodology

Evoenergy has modelled the total financial cost of the ADMS upgrade to calculate the Net Present Cost of maintaining its ADMS capability under three alternative credible investment scenarios. This approach was selected after careful consideration of quantifying future risks and benefits and electing a more conservative economic modelling approach of forecasting costs that are highly certain, in lieu of forecasting prospective benefits and risks that may be open to debate.

The methodology of this business case does not extend to justifying the use of an ADMS, as the business case for an ADMS at Evoenergy has been previously approved, and the ADMS has been in operation at Evoenergy since 2014.

The quantitative business case does not include the benefit of a significant reduction in risk, in particular cyber security risk that an ADMS upgrade would provide. Cyber security risk can result in a number of impacts, but most noticeably an attack on the ADMS could result in the entire network being shut-down for an extended period of time followed by a complete loss in trust in the ADMS and the network operating in contingency mode with additional staffing requirements and reduced reaction times until a new ADMS is installed.

Assumptions

Economic assumptions

The quantification of the business case covers the period from financial year 2019/20 through to 2028/29. This covers the entirety of the next two regulatory control periods.

All values presented are in real 2018/19 Australian dollars and a real discount rate of 4% has been applied to calculate the Net Present Cost value.

Operating cost assumptions

Hardware support and maintenance

Hardware support and maintenance costs cover the cost of continuing a contract for maintaining the servers and workstations that underpin the ADMS. The contract is with HP, the original equipment manufacturer of the hardware.

The current cost of the contract is \$53k per annum. This contract is currently due to be renewed and for the purposes of this business case and extension to 2020/21, the current contract terms have been used.

The current contract has features of an insurance contract. The level of work so far undertaken by HP since the establishment of the ADMS has amounted to less than 20 hours due to the low number of failures that have occurred. The main purpose of the contract is to provide assurance to Evoenergy that in the event of a hardware failure the vendor will take the risk of sourcing replacement parts to ensure the continuity of the ADMS.

As the hardware continues to age, failures are expected to rise. At the same time, sourcing replacement parts will become more difficult due to equipment obsolescence. It is not possible to replace servers with modern equivalents due to the complex nature of the ADMS software, so repair or replacement of failed parts of individual servers is most likely, which requires specialist skills and experience not contained within Evoenergy's internal staff.

From 2021/22 onwards, the ongoing cost of the support and maintenance contract is difficult to determine due to the factors outlined above. Evoenergy has assumed a conservative cost escalation of 10% per annum, which is significantly lower than the expected increase in number of hardware failures but also reflects the low number of failures that Evoenergy has observed with the hardware in the past.

Following the upgrade of the ADMS hardware, the cost of the support and maintenance contract is expected to revert to the current figure.

ADMS support and maintenance

ADMS support and maintenance covers the cost of the support and maintenance contract Evoenergy holds with Schneider Electric. Support and maintenance services from Schneider Electric are necessary to avoid Evoenergy incurring additional costs from recruiting additional staff with the specific skills required to provide in depth support for the ADMS. The contract also includes patching of the ADMS software.

Evoenergy has extended its contract with Schneider Electric until 2021. This provides Evoenergy with pricing certainty until this date. Evoenergy has conservatively assumed that the cost of this contract will continue to escalate at 2.1% per year in line with the annual escalation rate in the current contract.

If Evoenergy further delayed the upgrade of the ADMS, and therefore required support for an increasingly out-of-date ADMS version for which fewer Schneider Electric staff and other industry experts will continue to retain expertise in, the cost would increase at a greater rate than the current contract escalation. However, for the purposes of this business case Evoenergy has not speculated on additional cost growth.

Operating system and database support and maintenance

Operating system and database support and maintenance covers the cost of Evoenergy's support contract with Microsoft. This contract provides Evoenergy additional support for operating system and database software as well as including the cost of licences, which are paid annually as opposed to an upfront cost.

Extended support for the Windows 7 and Windows Server 2008 operating systems used by the ADMS was due to end in 2020. Microsoft have previously stated additional support would be available for Windows Server 2008 until January 2023 at additional cost. Microsoft has in the past three months announced that similar extended support would also be provided for Windows 7.

Evoenergy has not yet received a price quote from Microsoft for additional extended support. It is expected that the cost would increase each year as the final end date approaches. For simplicity, Evoenergy has assumed the cost will be flat for the three-year period from 2019/20 to 2021/22 at double the current contract cost. From 2023 onwards, Evoenergy has assumed that the cost will increase by a further 50%.

Following the upgrade of the ADMS the cost of this contract is expected to revert to the current contract cost.

Capital cost assumptions

DER and Transmission modelling costs

DER and Transmission modelling costs cover the cost of modelling DER and Transmission on Evoenergy's distribution network for network planning purposes. Evoenergy forecasts annual costs of \$400k for DER and Transmission modelling.

The current ADMS implementation also requires Evoenergy to maintain an external transmission model (Sincal) to perform Load Flow and Short Circuits studies on the Transmission Network. This effort could be significantly reduced if these studies could be performed in the ADMS, allowing Evoenergy to accommodate future increasing penetrations of medium scale transmission connected generation. The external model complicates and introduces risk to Network Operations on the Transmission Network.

The forecast used in this business case is conservative as it assumes no escalation in cost over time. The cost would be expected to rise as DER penetration in the network increases, exposing Evoenergy to rising power quality and reverse power flow problems that require modelling.

The upgraded ADMS will provide Evoenergy with DER and Transmission modelling capabilities. The cost of this service is expected to fall to zero after the upgrade occurs. During the final year of the operation under the current ADMS the cost of DER and Transmission modelling will fall to \$50k as the upgraded ADMS will be operating in parallel and then shifting to full operation during the year.

GIS contractors

GIS contractors covers the cost of the third-party contractors that are hired by Evoenergy to update the Network Model contained in the ADMS with Evoenergy's Network Model. As this work involves the Network Model, it is classified as capital expenditure.

The current cost of GIS contractors is \$500k per annum. Evoenergy has conservatively assumed that this cost will not increase over time. This is in addition to two direct Evoenergy employees.

The upgraded ADMS will have the optionality to install an additional module, the enhanced GIS importer. This module simplifies the process of integrating the ADMS with network GIS systems to eliminate the requirement for GIS contractors. If the enhanced GIS Importer module is installed in the upgraded ADMS, the full cost of GIS contractors will be avoided. During the final year of the operation under the current ADMS the cost of GIS contractors will fall to \$100k as the upgraded ADMS will be operating in parallel and then shifting to full operation during the year.

ADMS Fixes

ADMS fixes includes the cost of changes to the ADMS software to meet emerging Evoenergy requirements, such as in response to changes to legislation, industry regulation or rules. Software changes are extremely risky due to the possibility of introducing bugs and even small modification (such as to change a drop-down list) require extensive testing.

Evoenergy has an annual cost of \$425k for ADMS fixes. If the ADMS is upgraded, Evoenergy will halt all fixes during the regulatory period in which the upgrade occurs. For the options where the ADMS is upgraded during the 2019-24 period no fixes will occur after the 2018/19 year. For the deferral option ADMS fixes will continue until the 2023/24 year.

Following the upgrade of the ADMS it is assumed fixes can be avoided for a period of three years as the additional capabilities of the upgraded software are expected to negate the need for fixes. Following the three-year period, the cost of ADMS fixes will resume.

ADMS upgrade – supplier costs

ADMS upgrade – supplier costs cover the cost of all third-party involvement in the upgrade of the ADMS. This includes the provision of hardware, software and labour. As per the rollout schedule for the ADMS upgrade, the rollout will be spread over three years with 10% of the cost incurred in the first and third years and the remaining 80% during the second year.

Prices for this have been provided by Evoenergy's ADMS vendor. Evoenergy was provided with three prices, one for the minimal upgrade only, one for the full upgrade with additional EMS and enhanced GIS Importer modules bundled and a price for the additional modules as a separate cost (without a bundles discount).

Evoenergy has assumed that if the ADMS upgrade is delayed beyond the 2019-24 regulatory control period, the bundle discount will not be available, and the cost of the full upgrade will be the cost of the minimal upgrade plus the separate cost of the additional modules.

Evoenergy has conservatively opted not to escalate the cost of the upgrade over time if it is deferred.

ADMS upgrade – internal staff costs

ADMS upgrade – internal staff costs cover the cost of all internal staff assigned to the ADMS upgrade project. As per the rollout schedule for the ADMS upgrade, the rollout will be spread over three years with 10% of the cost incurred in the first and third years and the remaining 80% during the second year.

Evoenergy has estimated these costs for both a minimal upgrade and the full upgrade. Unlike the supplier costs item, an additional cost saving has not been included if the upgrade is not deferred.

Appendix 5: ICT Deep Dive Outcomes

Evoenergy ICT Deep Dive Outcomes

Wednesday 8 August and Thursday 16 August 2018

Purpose

Information and communications technology (ICT) is evolving at a rapid pace resulting in many opportunities and challenges. Evoenergy is seeking to exploit these opportunities to improve the safety, reliability and affordability of electricity to end-use consumers.

Evoenergy recently revisited consumer conversations about our approach to ICT investment within Evoenergy's 2019-2024 regulatory proposal. This 'deep dive' was conducted over two sessions to allow for a more considered approach to the topic and to better enable Evoenergy to respond to consumer questions. Participants included members of Evoenergy's Energy Consumer Reference Council (ECRC). Pre-reading and content for presentations were drawn from Evoenergy's regulatory proposal. Spokespersons knowledgeable in the Australian Energy Market provided their perspectives at the event.

Feedback gathered during the deep dive will contribute to the consolidated body of work that makes up Evoenergy's regulatory proposal; it will also inform Evoenergy's future approach to ICT investment in the ACT electricity network.

Conclusions

After both working sessions, the following key outcomes were concluded by participants in the Evoenergy Deep Dive on ICT:

- Evoenergy's approach to ICT should take into consideration:
 - The establishment of an overarching ICT Vision that supports the Mission of the organisation. This Vision could be to strive for a 'smaller, lighter, faster, cheaper' approach to management of the network.
 - Investing in research and education, particularly in partnership with local tertiary education intuitions.
 - The importance of future-proofing operations, particularly with respect to the possible transition away from traditional gas uses within the ACT.
 - A sharper focus on benefits to consumers from investment in ICT.
 - Evoenergy's capacity to share technological innovation through continued contact and engagement with other distribution businesses.
- Evoenergy's movement towards a 'smart network' should take into consideration:
 - That price is not always the only driver to change behaviour. There are many people who will not be bothered, or don't have the capacity, to focus on the savings gained by shifting use from one period in the day to another.
 - Opportunities to gather usage and generation data directly from the consumer, rather than through an energy retailer.
 - Implications of smarter energy networks within the home, or across neighbourhoods, rather than just the broader distribution network.

- The following feedback was provided on proposed investment in the Advanced Distribution Management System (ADMS):
 - The expenditure is not unreasonable.
 - The 10 year amortisation period is perhaps unrealistically long.
 - It is important that consumers see benefits in return on investment from the upgraded ADMS.
 - Data security is very important to consumers, both with respect to the ADMS and Evoenergy systems, but also the hardware that is installed in the home, for example, the security of internet/phone communications with meters.
 - Consumers care about the impacts of potential failure of the ADMS if it is not upgraded.
 - The significant growth in the need to collect and process consumption data is recognised.
- With respect to demand management:
 - Consumers want to understand the overall benefit to the community of reducing the impact of 'peaks' in energy usage.
 - Consumers encourage Evoenergy to consider supporting customers to invest in batteries, perhaps through subsidies.
 - Some consumers do not want to be forced to have a 'smart' meter and do not understand whether any potential benefits outweigh costs.

Please contact Giuliana Baggoley, Evoenergy Consumer Engagement Manager on 0459 873 434 to request copies of presentations and papers.

Feedback from our consumers is welcome at any time and best directed to Giuliana Baggoley at the number above, or by emailing consumerfeedback@evoenergy.com.au