PowerWater

Power and Water Corporation
Preliminary Business Case – Category A

PRD33134
Energy Management System
[redacted]

Proposed:

Jim McKay
A/Chief Engineer
Power Networks
Date: 6/2/2018

Approved:

Michael Thomson
Chief Executive & Chair
Investment Review Committee
Date: 23/02/2018

Endorsed:

Djuna Pollard
Executive General Manager
Power Networks
Date: 15/2/2018

Refer to email
Date: D2018/72353

Finance Review
Date: 06/02/2018

Refer to email
Date: D2018/64402

PMO QA
Date: 18/01/2018

1 RECOMMENDATION

It is recommended that the Chief Executive approve the EMS [redacted] Project for an estimated cost of [redacted] with a corresponding completion date of February 2023.

In addition, it is recommended that the Chief Executive approve expenditure up to [redacted] to proceed to the next approval gateway (Business Case Approval). Tasks include;

- Detailed technical specification development;
- Tender documentation development; and
- Detailed cost estimate, including seeking a delivery price offer from external suppliers via a competitive tender.

Note that budget is available for [redacted] in the 2020/21 Power Networks CAPEX budget.

Furthermore it should be noted that the project has a 95% likelihood of being delivered between [redacted]

2 PROJECT SUMMARY

Project Title:	EMS [redacted] Project		
Project No./Ref No:		**SAP Ref:**	
Anticipated Delivery Start Date:	July 2020	**Anticipated Delivery End Date:**	February 2023
Business Unit:	Power Networks		
Project Owner (GM):	Djuna Pollard	**Phone No:**	8985 8431
Contact Officer:	Jim McKay	**Phone No:**	8924 5204
Date of Submission:	23/02/18	**File Ref No:**	D2017/515221
Submission Number:		**Priority Score:**	
Primary Driver:	Renewal /Replacement	**Secondary Driver:**	Compliance
Project Classification:	Capital Category A		

2.1 Prior Approvals

Document Type	Sub Number	Approved By	Date	Capex Value
BNI	10072	Michael Thomson	29/05/2017	[redacted]

The BNI estimate was based on the costs recorded for the 2013/2014 EMS upgrade. The upgrade was undertaken using internal and contract resources. Additional investigations since the BNI was developed have identified that the proposed upgrade is expected to be a more complex project due to significant changes in the GE product.

3 INVESTMENT NEED

3.1 BACKGROUND

In 2008 the Power and Water Corporation (PWC) commissioned a General Electric (GE) Energy Management System (EMS). This system collects data pertaining to the operational state of the Northern Territory electricity networks and presents that data to control room operators who are responsible for the networks operation. The data collection, often referred to as Supervisory Control and Data Acquisition (SCADA), occurs in near-real-time and supports advanced network applications to assist operators in observing the state of the network and identify potential contingencies. A portion of the EMS also stores network state data for archival purposes.

The GE EMS was refreshed in 2013/14 and an overview drawing is attached in Appendix C.

The EMS is a fundamental tool for the Power Network Operator to efficiently manage the electricity network. A loss of EMS service reduces the ability of the Network Operator to quickly and efficiently:

- Perform remote switching to improve the safety of field staff
- Identify and respond to network outages
- Monitor the network for contingencies
- Perform switching for maintenance activities
- Record power system performance to maintain regulatory compliance
- Dispatch generation.

The key benefits to the Corporation of the Power Networks (PN) EMS are:

- Improved customer service as a result of real-time remote monitoring and control of the electrical network
- Reduced OPEX through more efficient business operation
- Reduced CAPEX through improved planning and optimisation of existing infrastructure.

At the completion of this project, the EMS will:

- be in a fully supported state for all hardware and software;
- be sized such that all hardware and database capacity, based on current expected growth, will be sufficient until the next planned upgrade/replacement;
- have reliability and availability requirements returned to specification; and
- have an improved cyber-security position.

In addition, the project will:

- implement the enhancements provided [redacted] software for both operational and support staff; and
- improve access to historical data required for network planning, asset management and regulatory reporting requirements.

3.2 CURRENT EMS ASSETS AND STATUS

The EMS can be classified by its hardware and software components. The hardware can further be defined by the types of hardware and the software can be broadly defined by its functionality. Each of these classifications can be managed differently and typically have their own considerations. Table 1 – EMS Categories below shows a breakdown of the hardware types and software functionality.

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]				
[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]		[redacted]	[redacted]
[redacted]	[redacted]		[redacted]	[redacted]

A detailed condition report for the EMS assets is contained in Document D2017/569118.

The main findings of the condition report are as follows:

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[1] 2017_APUC_CORE_Platform_3.2_Roadmap.original

[redacted]

3.3 CURRENT AND EMERGING ISSUES

3.3.1 Software

[redacted]

[redacted]				
[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[2] See F2017/3944 – GE_e-terra_Modular_Upgrade_Roadmap_Tim_Hughes.original and 2017_APUC_CORE_Platform_3.2_Roadmap.original

[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]		[redacted]

[redacted]

[redacted]

[redacted]

B. Software Functionality

The EMS/SCADA system collects reliability and performance data from substations and the distribution network assets and this data is used to support the development of prudent investment decisions.

Access to the EMS historian data is also cumbersome and is currently limited to ‘approved’ users. No data exchange currently exists between the historian data and the corporate Business Intelligence tool.

In addition, data collected from substations and the distribution network is required for the AER reporting framework.

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]					
[redacted]	[redacted]	[redacted]	[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

[redacted]

3.4 Performance Issues

The production system is currently operating as expected with no known performance issues.

[redacted]

may result in an additional data transfer requirements further impacting on the performance of the [redacted]. See PSC Consultants report D2015/236165.

To satisfy the conditions of the Network Operator License data is to be kept for a minimum of 7 years. Capacity was expanded in 2016 to cater for projects not projected during the 2014 refresh planning. Storage capacity requirements for the EMS continue to grow as the electrical system expands and reporting requirements continue to expand.

3.5 Data Access

Access to the electrical network data is increasingly becoming important for planning, asset management and other users throughout Power Networks and the corporation. Provision of access to the historian is currently a cumbersome process requiring the establishment and management of each user and the requirement to install GE software on the users workstation. This is proving to be more problematic as the NTG outsourced provider develops stricter controls on its Standard Operating Environment.

The interface is also not user friendly and manipulation of data leads to significantly more effort than might be expected using a more modern historian or if data interchange with the corporate Business Intelligence tool was more readily supported.

The capacity to manipulate data for analysis is expected to be a continuing growth requirement as PN further matures its processes and systems.

3.6 Risk Analysis

Figure 1 - EMS Risk Analysis shows the current rating, inherent rating (in 2024, i.e. if no action is taken in the interim), and the residual (post-treatment) risk ratings associated with the condition of current EMS.

3.6.1 Current rating:

The Current rating (2017) is assessed to be 'Low' due to the majority of hardware and software being in support. Where software has been identified as [redacted], short term solutions are available to mitigate the risk of a major system failure which may result in extended EMS outages. However the long term viability of these options is limited and will over time increase the risk of a major EMS failure.

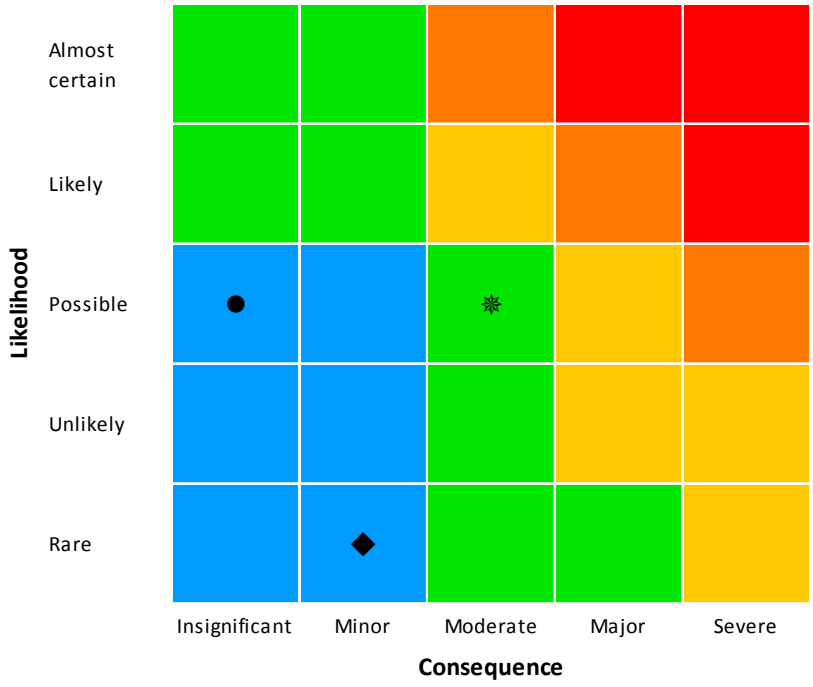
3.6.2 Inherent rating:

If the assets are not replaced by 2024, the risk of a major failure of either hardware or software [redacted] significantly increased. [redacted] Hardware repairs would be expected to take longer and the capacity to identify and resolve software bugs would also be limited and potentially lead to longer EMS outages affecting the capability of the Network Operator to manage and control the network. [redacted] is that it will take longer to repair the system. The inherent risk rating is therefore 'Medium'

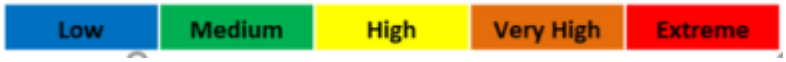
3.6.3 Residual rating:

The proposed project will bring all hardware and software into a supported state. Hardware failures will be readily fixed as replacement components will be available as well as vendor support for more complex issues. [redacted] Vendors will have support staff who are available and well trained with the products in use. The likelihood and consequence of an EMS outage will be considerably reduced when using in support hardware and software. The residual rating is therefore 'Low'.

Figure 1 - EMS Risk Analysis



Legend
- ● Current rating
- ❋ Inherent rating rating 2024 (do nothing)
- ◆ Residual rating 2024 (project completion)



The PBC summarises the proposed response to this impending risk.

4 STRATEGIC ALIGNMENT

This project aligns with the Power Networks Strategic Asset Management Plan and the SCADA & Communications Asset Management Plans and the Corporation's key result areas of operational performance and customer centric, where the goals are to be an efficient provider to services and delivering on customers' expectations.

5 TIMING CONSTRAINTS

This project will be completed during the 2019/2024 regulatory period. The project is planned to start in 2020 and be completed by 2023. [redacted]

In addition, to minimise any potential impact to the control room and SCADA technical staff as a result of the Outage Management System (OMS) project which is expected to be brought into service during 2018/2019, the EMS upgrade has been timed to allow the OMS to be bedded down.

The project addresses the risks as detailed in this paper and ensures the continued reliable operation of the EMS.

6 EXPECTED BENEFITS

Driver/ Objective	Benefit	Current State	Future State
Asset Renewal	Reduced asset failure. Improved management of the electrical network.	[redacted]	Vendor supported software and hardware. Reliability and availability specifications meet.
Service Improvement	Efficent management and operation of the Electrical Network	[redacted]	Vendor supported software and hardware.
Compliance	Capability to assist in meeting the regulatory reporting requirements	The capability and capacity to record and report on performance parameters for planning, asset managent and regulatory reporting requirements is difficult to manage and use.	Improved capturing, storage and access to all required data to assist in meeting business and regulatory compliance requirements

7 REQUIREMENTS

The requirements of this project are:

- Mitigate the risk to the operation of the network brought about by aging EMS infrastructure, application software [redacted].
- The implementation of the project to have minimal impact on the Power System Operator.
- Increase the EMS Historian query performance and data history capacity to cater for identified needs and other potential future needs.
- Improve the accessibility to Historian data for all levels of users throughout the corporation, including access by the corporate Business Intelligence tools.
- Improve the capacity to interface to 3rd parties such as other network users and internal systems (Outage Management System and/or Distribution Management System).
- Improve EMS client display performance.
- Minimise the whole-of-life support costs by maximising asset life and minimising the upgrade effort.
- Improve the EMS architecture to reduce the risk of maintenance activities effecting operational activities.
- To retire custom applications where new software versions are able to provide those functions.
- Improve the quality of EMS Design documentation, work procedures, including service restoration procedures.
- Minimise the whole-of-life costs by implementing feature enhancements during upgrades that improve maintenance efficiency.
- Implement a 'vanilla' vendor software solution with no or minimal software customisations by taking advantage of new application features that come with the new versions.
- Provide the full set of data required to fulfil the AER reporting needs for substations and the electrical network.
- Maintain current service levels through contracted support from hardware and software vendors. This means keeping the hardware and software within the specifications required by support contracts.
- Increased point count capacity to support the expected electrical network growth until 2028.

8 OPTIONS

8.1 Options Development

Consultants were commissioned to conduct an options study considering the replacement of the Energy Management System. After discussions with Power Networks' officers, the final report (D2017/518890) presented three options.

At the time of the options review, no [redacted]. Subsequent investigations have resulted in some changes to the original options findings and these are documented in an email (D2017/522191).

This options study included the development of cost estimates based on the consultants experience with EMS upgrade and replacement projects.

8.2 Option 1 – Deferral / Do Nothing

Summary

A Do-Nothing approach is not considered to be a viable alternative. Not replacing the EMS will result in:

- The application and operating system software being out of Vendor support; resulting in:
    - An increased risk of application or operating system 'bugs' resulting in a prolonged system outages;
    - [redacted]
- An increased risk of a prolonged equipment failure due to the lack of spares and vendor support for the hardware.

These risks expose the EMS to the potential of a long term outage which will affect the capability of the Network Operator to effectively manage the electrical network. This could result in outages and service disruptions and safety risks to operational staff required to manually operate the Electrical Network and the public.

8.2.1 What are the benefits of doing nothing?

The benefits of doing nothing can be summarised as follows:

- Minimise the impact of control room changes: PWC is currently implementing a new outage management system which is expected to be in service by 2018/2019. An EMS upgrade is similarly disruptive and allowing the OMS to be bedded down before starting the EMS upgrade will help minimize control room disruption.

8.2.2 What are the disadvantages of doing nothing?

The disadvantages of doing nothing can be summarised as follows:

- The increased risk of hardware or software failures as detailed below increases the risk of a system failure which could result in the loss of the

ability to manage the electrical network resulting in reduced levels of service and/or prolonged outages.

- EMS Vendor support is ending: [redacted]

[redacted]Workstation and Server Operating System [redacted]

- Alignment required with the nationally consistent AER reporting framework: The existing data collected from substations and the distribution network is only a subset of the complete AER data collection and reporting framework. This data must be collected and reported annually to the AER.

- Limited ability to manage Distributed Energy Resources: The NT electricity network comprises a wide range of distributed generators connected across the transmission, distribution and LV portions of the network. Over the coming regulatory period this is expected to expand significantly. By doing nothing, PWC has limited capability to adopt network planning or create short term or long term load and generation forecasts using existing standalone tools and the existing EMS system in this rapidly changing environment.

8.2.3 Option 1: Costs

The costs incurred by PWC under this option are

- the continued opex costs of supporting the existing EMS System which is approximately $0.46Myear; and

- additional costs associated with replacing or upgrading equipment and software as a result of failed components no longer in support.

[redacted]Option 2 – [redacted]

Option 2 proposes to [redacted]

- replacement of server hardware, workstations, and networking equipment;

- installation of all server and workstation Operating Systems with the currently recommended versions;
- installation of the latest release of the [redacted]
- implementation of a suitable historian to support the business needs; and
- replacement hardware sized for capacity and performance for 7 years.

This is the least cost option that fulfills the project requirements and this option will [redacted] 'fully supported' status for both software and hardware.

8.3.1 What are the benefits of [redacted]

The following benefits [redacted] can be summarised as follows:

- System software support remains current: This option allows for the provision of fully supported EMS applications for the duration of the upcoming reset period.
- System hardware support remains current: This option provides fully supported hardware for the duration of the upcoming reset period.
- System hardware is specified to remove current known performance issues and to be sufficient for the duration of the upcoming reset period.
- The [redacted]
- Improved access to asset data to assist the development of prudent investment decisions.
- The existing data collected from substations and the distribution network is only a subset of the complete AER data collection and reporting framework. This data must be collected and reported annually to the AER. [redacted]
- Leverages the knowledge and skills operators and maintenance staff have developed to operate and manage this system. The majority of the configuration data and the in-house knowledge the users have developed will be reusable, however some changes will require some level of training and re-configuration.

8.3.2 What are the disadvantages of [redacted] system?

The disadvantages of [redacted] can be summarised as follows:

[redacted]

[redacted] Training and configuration tools: [redacted]

[redacted] the corporation to access Network data. It is cumbersome to manage with each user requiring access to be individually setup [redacted]

8.3.3 Option 2: Costs

The estimated costs incurred by PWC under this option are [redacted]

8.4 Option 3 – [redacted] EMS

Option 3 proposes [redacted] SCADA/EMS platform. The installation would be conducted on a turn-key basis and would encompass:

- replacement of server hardware, workstations and networking equipment;
- installation of all server and workstation operating systems to the latest release;
- installation of the [redacted] software product;
- provision of a suitable historian or interface to the corporate historian, should one be established;
- replacement hardware sized for capacity and performance for 7 years, and

[redacted]

[redacted] What are the benefits of [redacted]

The following benefits of a [redacted] can be summarised as follows:

- System software support remain current: This option allows for the provision of fully supported EMS applications for the duration of the upcoming reset period.

- System hardware support remains current: This option provides fully supported hardware for the duration of the upcoming reset period.

- System hardware is specified to remove current known performance issues and to be sufficient for the duration of the upcoming reset period.

- Improved access to asset data to assist the development of prudent investment decisions.

[redacted]

[redacted] A system that has been designed and developed using current development tools and integrating functionality [redacted]

[redacted]

- The existing data collected from substations and the distribution network is only a subset of the complete AER data collection and reporting framework. This data must be collected and reported annually to the AER. The necessary AER requirement and expansion of data collection can be incorporated into the one project.

8.4.2 What are the disadvantages of [redacted]

The disadvantages of [redacted] can be summarised as follows in order of most important to least important:

[redacted]

[redacted]

[redacted] Training and configuration tools: [redacted]

[redacted] Operator acceptance [redacted]

8.4.3 Option 3: Costs

The estimated costs incurred by PWC under this option are [redacted]

8.5 Analysis

An analysis of the non-cost attributes for each option has been completed using the multi-criteria analysis method. The attributes are selected considering major risks and priorities to achieve Project Objectives. An economic analysis of the three options was undertaken and is included in Appendix A. A weighting is allocated to each, totalling 100%. Each attribute is given a score out of 5 (from 1 – Fails to satisfy, to 5 – exceeds requirements); the score is then multiplied by the relevant weighting to give the weighted score that is summarised in the table below.

8.5.1 Evaluation Summary

Weighted Scores:

	Project Objectives			Technical & System Risk			Stakeholder Risk			Env. Risk		Commercial
Criteria	**Reduced Risk of Asset Failure**	**Improved Reporting**	**Supports future system growth**	**User Acceptance**	**Management and Support Tools**	**Integration Capability**	**Safety**	**Community Impact**	**Approvals**	**Environmental Impact**	**Approvals**	**NPV/C**
Weighting (%)	10	5	10	5	5	10	10	10	5	5	5	20
Option 1	0.1	0.05	0.1	0.15	0.1	0.1	0.2	0.1	0.1	0.15	0.15	1
Option 2	0.4	0.15	0.3	0.2	0.2	0.2	0.3	0.3	0.15	0.15	0.15	0.6
Option 3	0.4	0.15	0.3	0.15	0.2	0.2	0.3	0.3	0.15	0.15	0.15	0.4

Option 1: Deferral/Do Nothing 2.30

Option 2: [redacted] 3.10

Option 3[redacted] 2.85

8.5.2 Preferred Option

The preferred Option 2 has a weighted score of 3.10 out of 5. This is the highest weighted score out of all the options.

This option best fulfils the project objectives of asset renewal. This option will cater for and support the reporting needs of the AER to be met.

There is expected to be minimal disruption to the continued monitoring and operation of the electrical network as the existing system will remain operational until full User Acceptance Testing is completed.

8.5.3 Cost Benefit Analysis

Option 1 (Deferral) has a weighted score of 2.30 out of 5. Option 1 has a lower cost base than Option 2, but this is not a feasible solution as it does not address the risk of the obsolete software and hardware and is not recommended.

9 PROJECT OUTLINE

9.1 Project Description

The EMS project comprises [redacted]

9.1.1 Scope Inclusions

The following items represent the key scope inclusions: -

- replacement of EMS hardware (Servers, Workstations, Networking Equipment, Security Appliances, Data backup hardware and Distribution Training System) to address the limited life of the current hardware.;
- migration to a new operating system (addressing the obsolescence of the current operating system);
- migration of EMS software and applications to the current versions to ensure the EMS is 'in support';
- installation of a current suite of SCADA/EMS applications as required to effectively manage the Electrical Network and meet the compliance obligations of Power Networks. Applications may include the selected vendors historian application;
- training for operators and technical staff; and
- De-commissioning of the existing EMS system and migration of assets, users and data.

9.1.2 Scope Exclusions

No scope exclusions have been identified.

9.1.3 Assumptions

Assumptions have been included in the Options analysis (D2017/522191).

9.1.4 Dependencies

No dependencies have been identified. The scope of dependencies would be identified in a preliminary design as part of the Business Case development.

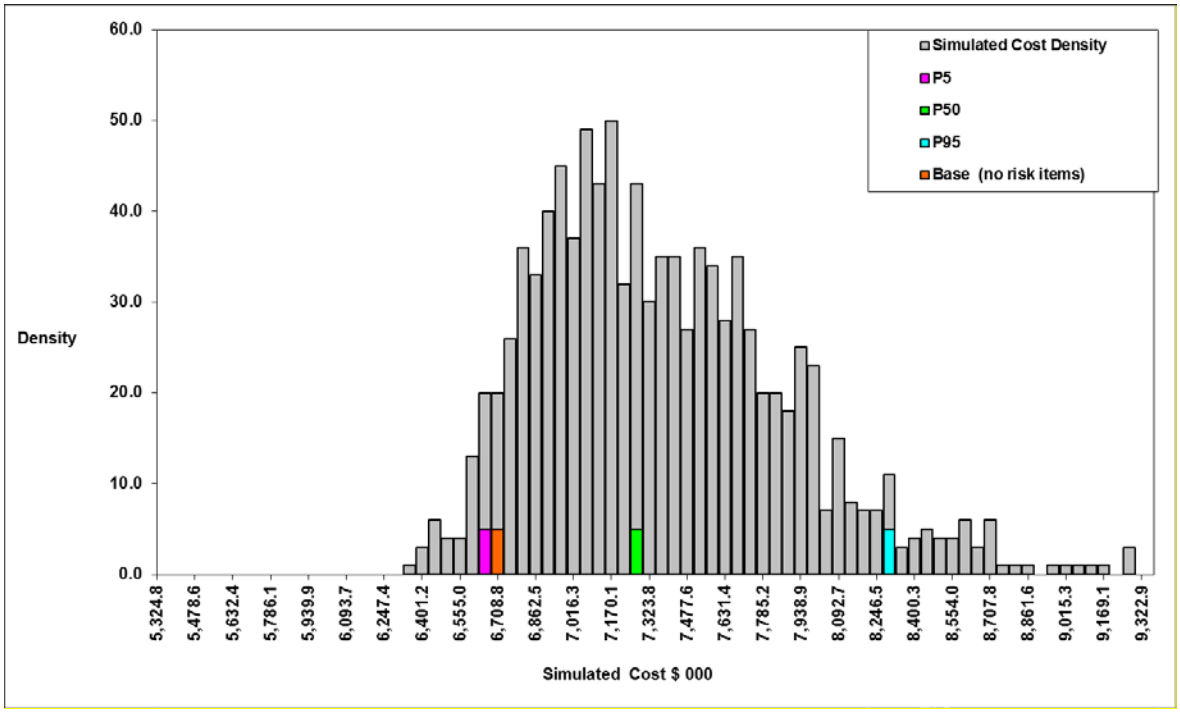
9.1.5 Key Stakeholders

Key Stakeholder	
Internal – Governance Stakeholders	Executive General Manager Power Networks
	Chief Engineer
	Group Manager Asset Management
Internal – Design Stakeholders	Senior Manager Networks Development and Planning
	Manager Major Projects
	Senior Manager Network Assets
	Manager SCADA & Communications
	General Manager System Control
	Real Time Operations Manager – System Control
	Operations Support Co-ordinator SCADA – DMS – System Control
External – Authorities	Utilities Commission / Australian Energy Regulator

9.2 Capital Cost

A risk adjusted cost estimate (RACE) was conducted on the preferred option based on latest design, scope and cost information.

Based on the analysis, the project has a 90% likelihood of being delivered between [redacted]



9.2.1 Base Capital Cost

Table 1 – Base Capital Cost Estimate

[redacted]

9.2.2 Risk and Contingency

The current estimate has been developed largely based on PWC and consultant estimates considering previous experience with similar works. The contingency amount, calculated as the P_{95} value minus the expected P_{50} value, is currently [redacted]

9.3 Estimated Operating Cost Impact

The average annual maintenance cost for the EMS based on the previous three years is $0.46M per annum. The costs are comprised of planned, unplanned and preventative maintenance.

The expected maintenance cost for the upgraded EMS is expected to be similar.

9.4 Project Milestones

Project Phase (end)	Investment Planning	Project Development	Commitment	Implementation	Review
Original Plan (BNI)	May 2017	March 2019	July 2019	June 2020	Dec 2020
Current Forecast	May 2017	Jul 2020	Jul 2021	Sep 2021	Feb 2023
Actual Completion	May 2017				

10 RISK MANAGEMENT AND COMPLIANCE

A preliminary risk register has been established to address project risk. This is included in Appendix B. This register will form the basis of the Project Risk Register into the project delivery phase. The register will be regularly reviewed and updated as required to ensure all identified risks are managed as the project progresses.

10.1 Technical and System Issues

[redacted] not expected to result in any significant technical issues. [redacted] an EMS product that may have a slightly different look and feel for the System Control Operators. The overall functionality will be the same, however different ways of presentation of information and how to operate controllable devices may result. This may take some time for the Operators to become familiar with.

The EMS will utilise similar hardware to that already in use for the existing EMS, [redacted]

The existing GE EMS will remain in operation until the new system is tested and User Acceptance has been completed. Training for both operator and technical support staff will be provided as part of the project.

11 PROJECT IMPLEMENTATION

This project is to be managed by the Power Networks' Project Management group. It is planned that the project will be delivered using the "Design and Construct" (D&C) methodology through an external contractor.

Testing and commissioning will be managed by Power Networks' SCADA and Communications group.

It is expected that all the equipment and software will be procured through the D&C contract, with detailed specifications provided by PWC.

11.1.1 Resourcing Requirements (to next gateway)

Resource Type/Role	How Many?	Internal/ External?	Anticipated Start Date	Duration Required	Allocation (% time or # hrs/days/ wks/mths)
Project Manager	1	External	Jul 2020	12 months	30%
Senior SCADA Engineer	1	External	Jul 2020	12 months	100%

12 FINANCIAL IMPACT

12.1 Funding Arrangements

The project will span over the 2019-24 regulatory period.

This project is currently included in the 2018/19 SCI budget for a total approved sum [redacted]

12.2 Capital Expenditure

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]		[redacted]	[redacted]	[redacted]		[redacted]
[redacted]		[redacted]	[redacted]	[redacted]		[redacted]

12.2.1 Variance Coverage

The current forecast aligns with Power Networks capital works plan and the current SCI.

12.3 Incremental Operating Expenditure

Ongoing costs for the EMS are related to operation and maintenance and are forecast to remain similar to that currently required for the GE EMS.

APPENDIX A

FINANCIAL ANALYSIS

Introduction

The purpose of this analysis is to provide details of the options analysis for the project to [redacted] the Energy Management System.

Table A1 below outlines the estimated capital expenditure for options 1, 2 and 3. Option 1 (do nothing) had no capital expenditure, but was included in the analysis for its ongoing annual operating expenditure implication unless the project is undertaken.

Table A1 – Estimated Capital Expenditure

Option	Capex – Base Costs ($M)
Option 1: Deferral / Do Nothing	[redacted]
Option 2: Upgrade existing GE EMS product	[redacted]
Option 3: Replace existing EMS (open tender)	[redacted]

Assumptions

In modelling the options, technical, economic and cost parameters were included. The technical and cost data was provided by Power Networks and the economic data and analysis were sourced from Pricing and Economic Analysis (PEA). Base cost capital expenditure was based on the consultant's feasibility study.

In the assumptions, all costs exclude GST or other government charges.

The common variables employed in the Discounted Cash Flow model are presented in Table A2 below. These variables are consistent with the 2019-24 Regulatory Proposal to the AER and are considered appropriate for use in the detailed commercial analysis.

Table A2 – Common Variables

Variables	
Nominal Pre-Tax WACC	[redacted]
CPI (up to 2019-20)	[redacted]
CPI (remainder of project life)	[redacted]

Time Horizon of the project	5 years

Option 1 – Do Nothing

The analysis for this option does not require any capital expenditure and it is expected the current average operational cost of $458,000 per annum will continue into the future.

Commercial analysis of Option 1 (do nothing) was not undertaken as it is not considered to be a viable alternative due to the risks highlighted in the business case.

Option 2 – [redacted] ***EMS product***

[redacted]

Option 3 – [redacted] ***EMS*** [redacted]

[redacted]

Least cost analysis

Based on the DCF analysis undertaken and excluding the 'Do nothing' option the least cost option is Option 2. This option is [redacted] less in Net Present Cost (NPC) terms than option 3. This is summarised in Table A3 below.

Table A3 – Net Present Cost of Options

Option	NPC ($M)
Option 1 – Do nothing	[redacted]
Option 2 – Upgrade	[redacted]
Option 3 – Open Tender	[redacted]

Tariff Cover

This project CAPEX (2021/22 and 2022/23 expenditure) will be submitted as part of the 2019 Regulatory Proposal to the AER. The AER's Final Determination will provide the approved level of net capital expenditure for the 2019-24 period. In so far as the Regulated Networks annual capital expenditure program remains at this level (or lower), Networks will earn a guaranteed rate of return through standard control service charges until the commencement of the next regulatory control period in 2024-25.

References

PRD33134 NPC 2017-18

PWC Ref: D2017/563041

PRD33134 – RACE Model Option 2

PWC Ref: D2017/563038

PRD33134 – RACE Model Option 3

PWC Ref: D2017/569119

APPENDIX B

PRELIMINARY RISK REGISTER

Refer:

PRD33134 Risk Analysis Energy Management System Replacement

PWC Ref: D2017/515068

[redacted]

[redacted]