Program of Works

2017 – 2022

Communication Network Supporting Infrastructure and Systems (PUBLIC VERSION)

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1 Summary

PROGRAM	Replace DC power supplies, antenna waveguides, radio dehydrators, and build portable generators
SERVICE DATE	On-going throughout period 2018 – 2022
LOCATION	Various locations of Victorian Network
VALUE	$ 8.22M

FY17/18	FY18/19	FY19/20	FY20/21	FY 21/22	Total
$487k	$1,683k	$2,840k	$1,423k	$1,786k	$8,219k

This works program document should be read in conjunction with the Communication Systems Asset Management Strategy[1] which provides details of the services offered, asset age and condition, key issues, requirements, and the strategies.

2 Program Scope

Supporting infrastructure and systems consist of power supplies, antenna equipment, towers, buildings, air conditioning systems, physical security, and operational support systems. This program of works concentrates on operational support systems, power supplies, air conditioners, and antenna equipment. The remaining assets are covered in other programs.

Most assets classified as supporting infrastructure have a long economic life compared to the communication network equipment. Whereas the majority of assets still have a “Remaining life” of greater than 50%, some assets fall in the C4 and C5 condition category.

C4 condition rated assets have a “Remaining Life” of 25% which implies that the assets are in worse than average condition. The manufacturers no longer support maintenance of the equipment and the sale of spares has stopped. The only spares available are those in the AusNet Services storage facilities.

The C5 assets have a “Remaining life” of 5% meaning the assets have reached end-of-economic life. The manufacturers no longer support maintenance and development of the equipment and spares are only obtained by salvaging parts from retired equipment. There is increasing lack of experience and skill to maintain the asset both within AusNet Services and externally.

In addition to considering “Remaining life” of assets, operational support systems require enhancements to cope with the requirements of an expanding communication network.

[1] AMS 10-56 Communication Systems

2.1 Scope

The works, depending on the infrastructure or system will include:

- Equipment design, installation and commissioning;
- Update asset management systems with new asset data as part of completion of works.

2.1.1 Operational Support Systems

- Design and build remote and out-of-band network for management of communication devices;
- Upgrade the Network Management Systems including individual element managers and the overarching network element manager;
- Establish a laboratory for testing equipment and new configurations.

2.1.2 Power Supplies

2.1.2.1. Generator

- Design and acquire 2 sets of portable generators;
- Design and establish connection facilities at all remote radio sites.

2.1.2.2. DC Battery Systems Replacement

- 40 sites with degraded battery systems;
- Install new battery banks;
- Replace battery chargers;
- Establish separate battery rooms at sites not meeting the battery standard;
- Decommission and remove old equipment.

2.1.3 Air Conditioning Systems Replacement

- Install new air conditioning systems at 50 sites;
- Decommission and remove old equipment.

2.1.4 Antenna System

2.1.4.1. Waveguide Connections

- Replace degraded waveguide connectors at 25 sites;
- Dispose old equipment.

2.2 Project Budget

	Amount $
Remote and out-of-band management of Comms devices	C-I-C
Network management systems upgrade	C-I-C
Network test laboratory	C-I-C
Diesel generator sets	C-I-C
DC battery systems replacements	C-I-C
Replacement of Air Conditioners at radio communications sites	C-I-C
Replace and standardise Waveguide connections	C-I-C
Total	**$8,219,000**

3 Project Drivers

Implementation of this program of work will enable AusNet Services to address the following business drivers:

3.1 Safety

- Industry leadership in safety performance:
  - Minimise electricity transmission network associated risks to employees, contractors and the general public by providing the necessary physical security and environmental conditions that will maintain the expected operation of assets at the sites.

3.2 People

- High performing leadership, capability and culture:
  - N/A.

3.3 Financial

- Sustainable earnings and security holder value growth:
  - Reduce the risk of widespread power outages caused by failure of communication assets.
- Expansive and accretive growth:
  - N/A.

3.4 Business and Asset

- Safe, resilient and reliable networks
  - Comply with the National Electricity Rules (NER) by ensuring:
    - Power transfers are not constrained because of unavailability of communication systems;
    - The system is available at all times except for short periods (up to 8 hours) of time for maintenance;
    - Data transfer from power stations and terminal stations meets Australian Energy Market Operator (AEMO) requirements.
- An efficient business model supported by intelligent, automated and integrated processes and systems:
  - The communications network continues to provide services that incorporate existing requirements while accommodating new technological evolution.
- Industry leadership and advocacy role in regulatory development:
  - N/A.

3.5 Customer

- A highly developed customer service capability:
  - N/A.

4 Overview

Communication network supporting infrastructure and systems assets are an essential part of the communication network. Whereas these assets do not transmit or receive communication signals, they are used to provide suitable environments and services required for the safe operation of the communication devices. Supporting infrastructure and systems include:

- Antenna towers and associated attachments;
- Site buildings and fencing;
- DC systems which include batteries, chargers and distribution boards;
- Standby generators;
- Air conditioning systems;
- Reticulation cabling and connectors;
- Network management systems and applications; and
- Test laboratory.

The majority of communication sites are unmanned and therefore require appropriate physical security systems to avoid theft, vandalism or sabotage. However, some sites have been identified as lacking the appropriate physical security systems given their remote nature.

Battery systems are designed to provide backup power supply in the event of loss of mains power for at least 48 hours. Apart from degradation of batteries related to age, it has been observed that at some sites battery capacity does not comply with the 72-hour uptime stipulated for remote sites in the Station Design Manual Volume 6.

As fixed diesel generator systems reach economic end-of-life, the assets will be decommissioned and instead of replacement, portable diesel generator sets will be introduced to be used in cases of emergencies.

5 Risk Evaluation

5.1 External Risks

5.1.1 Political, Regulatory and Statutory

- Breach of power system operational requirements;
- Failure to provide data for the energy market operations.

5.1.2 Technology

- Inability to get spares for maintenance because vendor has ceased manufacture of the products.

5.2 Internal Risks

5.2.1 Process and Services

- Increased resources to maintain ageing assets.

5.2.2 Strategy

- Failure to align with corporate asset replacement strategy leading to increased operational costs (repair on failure).

5.2.3 Stakeholder Management

- Customer services which include corporate communications, remote access, and monitoring become unavailable because of network failure consequently affecting the output of the workforce.

5.3 Summary Risk Assessment

The risks associated with network technology assets in condition C5 are summarised as follows:

- Failure to operate the power system protection devices;
- Inability to acquire spares when equipment fails;
- Increase in resource requirements;
- Missing service availability targets.

The risk evaluation, using the AusNet Services Risk Matrix[2] (Corporate Risk Management Framework V3.0 RM 001-2006), is shown in Appendix A – Table 1.

The figure below shows the current risk level and risk level after completion of the program of works.

[2] AusNet Services Risk Management Framework – RM 001-2006.

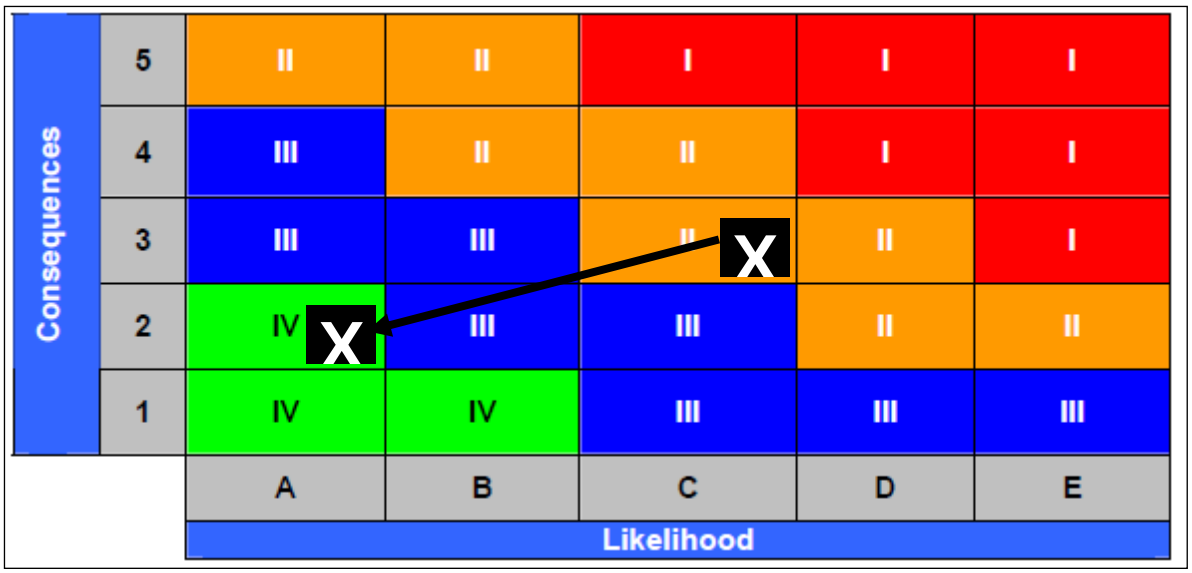

Figure 1 – Risk level before and after Program of Works

6 Options

The program is evaluated with the following options:

Option 1 Business as Usual

Option 2 Replace on Failure

Option 3 Planned Replacement of Deteriorated Equipment

6.1 Option 1 – Business as Usual

The "Business as Usual" option operates and maintains existing assets until repairs are not possible and the assets are abandoned:

- Run assets to failure and abandon
- Employ rare resources to maintain the assets

6.2 Option 2 – Replace on Failure

Operate and maintain existing assets to a point where repairs are not possible and the asset is replaced with a similar type:

- Run asset to failure and then replace;
- Like for like replacement of failed asset;
- Employ rare resources to maintain assets.

6.3 Option 3 – Planned Replacement of Deteriorated Assets

Plan replacement program on an economic timetable:

- Replace assets when maintenance costs are projected to become uneconomical;
- Consider current and future requirements;
- Select most appropriate technology.

7 Options Analysis

7.1 Option 1 – Business as Usual

This option fails to address the key business drivers in section 3. The 'Business as Usual' approach exposes AusNet Services to significant financial and regulatory risks which arise from:

- Gradual increase in operational and maintenance costs.
- Repeated communication network outages.
- Potentially significant financial liabilities and high electricity consumer costs associated with loss of electricity supply.

7.2 Option 2 – Replace on Failure

- Increasing communication network outage frequency which affects network availability.
- Operational and maintenance costs increase for in-service equipment and reduce for replaced equipment.
- High capital expenditures over prolonged period because of high unplanned replacement costs.

7.3 Option 3 – Planned Replacement of Deteriorated Equipment

This option addresses the key business drivers in section 3.

- Enables an economic asset management program which optimises resource allocation.
- Maintains the current level of communication network availability and safety.
- No step change to operational and maintenance costs.
- Modern network elements and equipment can be introduced in an appropriate environment.
- Good corporate image.

8 Financial Analysis

The options have been analysed using the corporate NPV model. The benefits and costs of each option are based on an estimate from the corporate risk model. Option 3 "Planned Replacement" achieves the greatest benefit for the lowest capital cost when compared with option 2.

		Economic Least Cost Analysis				Financial Return		
	Analysis of Investment Options ($'000s)	PV Capital Cost	PV Opex Costs	PV Community Costs & Benefits	Total PV Cost	NPV including Reg Return (post tax)	PV Cost Ratio	PV of Incentive / (Penalty)
1	Business As Usual	-	(5,217)	(21,938)	**(27,155)**	-	1.00	-
2	Replace on Failure	(10,592)	(1,996)	(8,140)	**(20,727)**	229	2.41	-
3	**Planned Replacement of Ageing Equipment**	**(7,443)**	**-**	**-**	**(7,443)**	**151**	**1.43**	**-**
4		-	-	-	**-**	-	-	-
5		-	-	-	**-**	-	-	-

All figures are in $000's unless otherwise stated.

8.1 Option 1 – Business as Usual

Business as Usual option eventually leads to complete loss of the communication network and failure to operate the electricity network.

PV of Capex and Opex	• No CAPEX however substantial level of OPEX to maintain the assets until complete failure.
PV of Community Costs & Benefits	• Loss of communications could lead to loss of supply, delays in restoration of an outage, or even a system black. Such an incident will lead to increased scrutiny from the regulator, undue press coverage and loss of stakeholder confidence in the company. The community costs arise from calculating Value of Customer Reliability (VCR) and include corporate reputation.

8.2 Option 2 – Replace on Failure

Replace on fail option will eventually replace all the degraded assets however; costs will be high because unplanned mobilisation attracts higher rates compared to planned mobilisation rates. The communications network will have long outages which could impact electricity supply.

PV of Capex and Opex	• Opex Costs are high for in-service assets but will reduce as the degraded assets are gradually phased out. Unplanned mobilisation costs typically attract a 40% premium.
PV of Community Costs & Benefits	• Loss of communications could lead to loss of supply or delays in restoration of an outage. Undue press coverage and loss of stakeholder confidence in the company. Until all degraded assets are replaced this potential loss still exists.

8.3 Option 3 – Planned Replacement

The planned replacement option targets equipment that is likely to fail first and minimises the possibility of outages.

PV of Capex and Opex	• No step change in OPEX.
PV of Community Costs & Benefits	• This option will avoid the costs associated with the Business as Usual option.

9 Recommended Action

Option 3 Planned Replacement of deteriorated equipment is recommended.

10 Reference Documents

- Electricity Safety Act.
- Occupational Health & Safety Act – provision of safe work environment.
- AEMC National Electricity Rules (version 72).
- AMS – Victorian Electricity Transmission Network – Communications Systems (AMS 10-56).
- AMS – Victorian Electricity Transmission Network – Asset Life Evaluation (AMS 10-101).
- Asset Management Strategy for the Victorian Electricity Transmission Network (AMS 10-01).

Appendix A: Risk Register Template

Entity/Project: _____ **Facilitator:** Aloysius Nainhabo **Date:** _____

RISK IDENTIFICATION			RISK TREATMENT			RISK ANALYSIS						
						Residual Risk				Target Risk		
Risk	Causes	Impacts	Controls (Current)	RCE	Treatment Actions (Future)	Conseq Rating	Like. Rating	Residual Risk Rating	Project Financial Exposure (Residual)	Conseq Rating	Like. Rating	Target Risk Rating
Power system protection operational requirements fail during a fault condition	Failure of communication network resulting in failure to transfer Protection signaling between stations	Regulation/Compliance: • Breach of regulatory requirement resulting in investigation and directive issued Reputation • adverse national press reporting over several days Customer: • Loss of supply	Regular Maintenance	Partially Effective	Develop and implement replacement program for C5 condition assets	3	C	Level II		1	B	Level IV
Inability to get spares when equipment fails	Manufacturer stopped production of parts. Equipment classified as	Regulation/Compliance: • Breach of regulatory requirement resulting in investigation and directive	Regular contact with manufacturers	Partially Effective	Develop and implement replacement program for C5	3	C	Level II		1	B	Level IV

RISK IDENTIFICATION			RISK TREATMENT			RISK ANALYSIS						
						Residual Risk				Target Risk		
Risk	Causes	Impacts	Controls (Current)	RCE	Treatment Actions (Future)	Conseq Rating	Like. Rating	Residual Risk Rating	Project Financial Exposure (Residual)	Conseq Rating	Like. Rating	Target Risk Rating
	obsolete	issued Reputation • adverse national press reporting over several days Customer: • Loss of supply			condition assets							
Increase in resource requirements	• Increasing equipment failure rate • Costs of repair on failure is comparatively higher than planned repair	Financial • Increase in OPEX cost	Monitoring equipment failure rates and maintenance frequency	Partially Effective	Alignment with corporate Asset Replacement Strategy	2	C	Level III		1	B	Level IV
Missing service availability targets	• Frequent failures • Capacity constraints	Regulation/Compliance: • Breach of regulatory requirement resulting in investigation and directive issued Customer:	Monitoring equipment failure rates and maintenance frequency	Partially Effective	Develop and implement replacement program for C5 condition assets taking into consideration future requirements	3	C	Level II		1	B	Level IV

RISK IDENTIFICATION			RISK TREATMENT			RISK ANALYSIS						
						Residual Risk				Target Risk		
Risk	Causes	Impacts	Controls (Current)	RCE	Treatment Actions (Future)	Conseq Rating	Like. Rating	Residual Risk Rating	Project Financial Exposure (Residual)	Conseq Rating	Like. Rating	Target Risk Rating
		• Failure of the energy market People • Reduced efficiency of corporate applications										

Table 1 – Risk Evaluation Table