Investment Evaluation Summary (IES)

Project Details:

Project Name:	OH System Asset Repair (Defects)
Project ID:	00695
Thread:	Overhead
CAPEX/OPEX:	OPEX
Service Classification:	Standard Control
Scope Type:	B
Work Category Code:	AROCO
Work Category Description:	OH System asset repair
Preferred Option Description:	Option 1 – Risk based rectification. This NPV analysis takes into consideration AROCO, RELSA and REHSA as a combined program.
Preferred Option Estimate (Nominal Dollars):	$0

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Unit ($)	$900	$900	$900	$900	$900	$900	$900	$900	$900	$900
Volume	3,117	3,117	3,117	2,109	2,109	2,109	2,109	2,109	2,109	2,109
Estimate ($)	$2,805,300	$2,805,300	$2,805,300	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100
Total ($)	$2,805,300	$2,805,300	$2,805,300	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100	$1,898,100

Governance:

Project Initiator:	Gary Carleton	**Date:**	26/03/2015
Thread Approved:	David Eccles	**Date:**	20/10/2015
Project Approver:	David Eccles	**Date:**	20/10/2015

Document Details:

Version Number:	1

Related Documents:

Description	URL
Investment Evaluation Summary AROCO RELSA REHSA.docx	http://teamzone.tnad.tasnetworks.com.au/asset-strategy/Shared%20Documents/DD17/Overhead%20Thread/AROCO%20RELSA%20REHSA%20Overhead%20System%20Asset%20Repair/Investment%20Evaluation%20Summary%20AROCO%20RELSA%20REHSA.docx
AROCO REHSA RELSA Volumes and Dollars.xlsx	http://teamzone.tnad.tasnetworks.com.au/asset-strategy/Shared%20Documents/DD17/Overhead%20Thread/AROCO%20RELSA%20REHSA%20Overhead%20System%20Asset%20Repair/AROCO%20REHSA%20RELSA%20Volumes%20and%20Dollars.xlsx
TasNetworks NPV AROCO RELSA REHSA.xlsm	http://teamzone.tnad.tasnetworks.com.au/asset-strategy/Shared%20Documents/DD17/Overhead%20Thread/AROCO%20RELSA%20REHSA%20Overhead%20System%20Asset%20Repair/TasNetworks%20NPV%20AROCO%20RELSA%20REHSA.XLSM

Section 1 (Gated Investment Step 1)

1. Background

This is a continuation of existing programs to proactively rectify asset defects in the overhead system. TasNetworks manages a distribution network of around 220,000 poles and 21,000km of overhead conductor.

TasNetworks employees are required under the Act to report substandard or defective installations when working in the vicinity. TasNetworks also proactively looks for substandard or defective installations through its asset inspection programs.

The distribution network is best characterised as a “rural, overhead” network. Most of the HV feeders and most of the LV network consist of overhead construction. Underground cable reticulation is restricted to central business districts, various subdivisions and commercial centres.

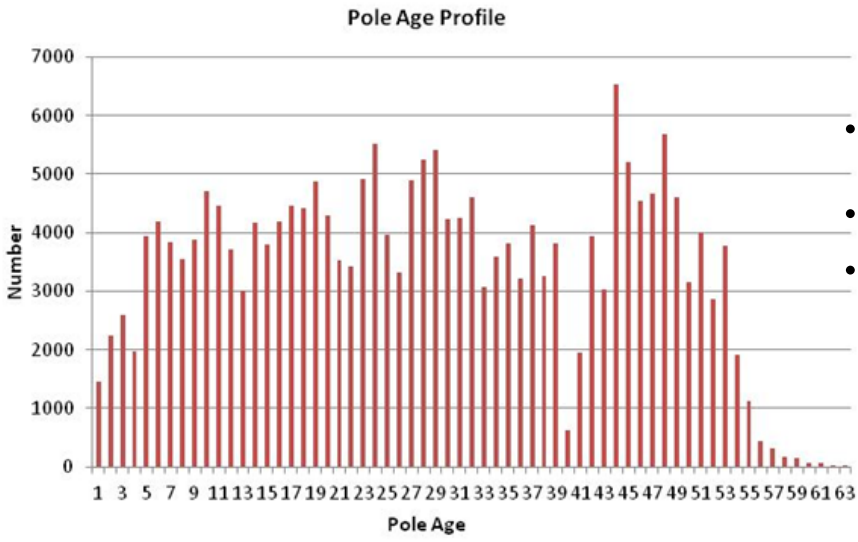
Outages on rural feeders generally have a greater impact upon reliability as rural distribution feeders tend to be lengthy (between 50 and 500 km) and of a radial nature with limited ability to interconnect with other adjacent rural distribution feeders. (REF: Annual Distribution Performance Report 2013-2014 Appendix A.) Consequently TasNetworks is vulnerable to asset failures causing impacts on its ability to provide service to customers.

Overhead feeders also have a high likelihood of causing bushfires. Of the numerous Black Saturday bushfires in Victoria in 2009, 4 of the catastrophic fires were caused by powerlines.

TasNetworks does not keep detailed records of its pole top hardware. However, as pole top hardware is generally installed new whenever a pole is replaced, pole age (as shown in Figure 1) serves as a reasonable proxy for poletop hardware age. While most poles have a life of around 45 to 50 years, the oldest poles in the system are over 60 years old.

Age, design, construction methods, fault currents, and environmental considerations such as proximity to coastlines and prevailing winds will all impact the service life of the pole top components.

Figure 1: Pole Age Profile



1.1 Investment Need

The drivers for this program are to:

- Maintain asset reliability and improve it in areas where reliability is consistently below target thresholds.
- Reduce risk of fire starts from asset failure
- Reduce risk to public safety from asset failure

Discussion of Drivers

Reliability:

The average frequency and duration of asset related outages has increased for the quarter when compared to the observed long-term average.

The contribution to SAIFI from asset related interruptions in the last quarter was 0.15 interruptions compared to the observed long-term average of 0.1. The contribution to SAIDI from asset related interruptions in the last quarter was 18.98 minutes compared to the observed long-term average value of 13.43 minutes per quarter.

There were 47 communities identified as poor performing as defined by the Tasmanian Electricity Code (TEC) for the twelve-month period ending on 31 December 2014. (REF: Regulatory Quarterly Performance Report 2014-2015 – Q2).

Fire Starts:

Routine maintenance and defect rectification on the overhead system play a critical role in reducing the risk of a fire starting from TasNetworks’ assets.

There is no history of powerlines in Tasmania starting catastrophic bushfires, however the experience in mainland Australia is that powerlines can start bushfires. Whilst the average number of bushfires started by powerlines is relatively low (1- 4% of all bushfires) (REF: Powerline Bushfire Safety Taskforce – Final Report 30 September 2011), inquiries into catastrophic bushfires in Victoria have

found that a disproportionate number have been started by powerlines.

Tasmania experiences an average of 3 Total Fire Ban (TFB) days a year, although some years, for example 2012/2013 – the year of the 'Dunalley Fires' - there were 11 TFB days.

From Reliabiltiy Centred Maintenance (RCM) analysis undertaken in 2012, TasNetworks identified 139 potential failure modes for its overhead assets, 58 of which are considered fire start risks. Assets are inspected from the ground on 5 yearly cycles, with around 2,700 defects (6 per 100 poles inspected) recorded every month, not including clearance defects. The aerial inspection program which commenced in 2014/2015 focusing on the High Bushfire Loss Consequence Zone (and at time of writing is planned to continue on a 5 yearly cycle also), found a total of 1700 defects (5 per 100 poles), all of which were considered to be potential fire start risks.

Faults from asset failure are a regular occurrence and cannot be avoided totally without unreasonable levels of expenditure. TasNetworks averages around 24 unplanned outages per day on the distribution network (including transient faults, but not including third party or customer installation faults), but on days where the average wind speed is over 50km/hour (total fire ban days occur on windy days), this rises to over 50 faults per day (REF: Fusesavers presentation – 2013 analysis of faults on high fire danger days, data covers 2008-2013). Therefore the likelihood of a fault occurring is higher on a TFBD compared to a regular day, and because of the wind and relative humidity the likelihood of any fault that does occur that causes sparks or releases of energy then causing a fire is also increased compared to normal.

Public Safety:

TasNetworks' distribution assets interface with the public every day. Assets are located outside schools, hospitals, shops, across paddocks and at bus stops. Asset defects if left unrectified have the potential to cause death or injury to a person, for example through broken hardware falling from a pole top, or electrocution through accidental contact with assets

Other Considerations

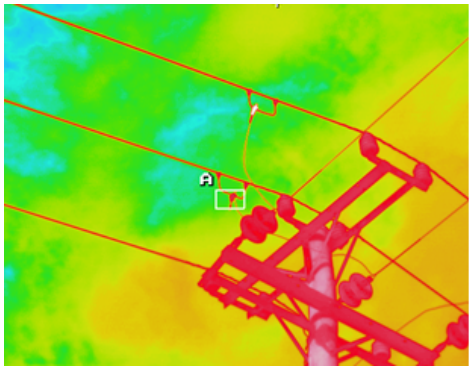
Improved Inspection Practices

In 2014/2015 for the first time TasNetworks started inspecting its assets from the air. This provided a previously hidden view of the network that showed many assets were in worse condition than previously thought. In particular there was a spike in decayed timber crossarms reported, as these tend to rot on top while remaining intact on the underside, making it difficult to detect from ground patrols. Aerial inspections are done on a five year cycle. There is expected to be an increase in overhead maintenance over the next five years (2015/2016 – 2020/2021), following the first round of aerial inspections as these will pick up defects that have gone undetected for many years. The second round of aerial inspections is expected to yield a much lower volume of maintenance work.

Figure 2: The same pole seen from the ground and from the air

TasNetworks has also commenced thermal imaging of its network, which is proactively identifying loose or faulty connections before they turn into major events like pole or ground fires.

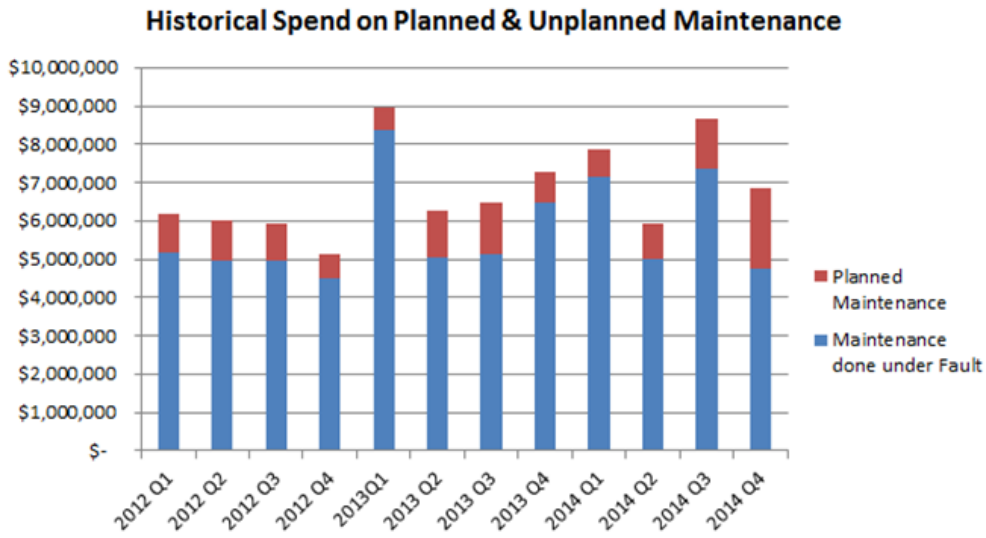
Figure 3: A Live Line Clamp through a thermal imaging camera and a normal camera



Spend on Fault Rectification

TasNetworks spends around $23m per year on fault rectification. This includes the cost of labour, materials, and operating costs associated with stand down of overtime staff. In comparison, the expenditure on planned maintenance has historically been less than $4m per year. The total expenditure over the last few years on planned and unplanned (fault) maintenance is shown in Figure 4.

Figure 4: Historical Spend on Planned and Unplanned Maintenance



1.2 Customer Needs or Impact

TasNetworks continues to undertake consumer engagement as part of business as usual and through the Voice of the Customer program. This engagement seeks in depth feedback on specific issues relating to:

- how its prices impact on its services
- current and future consumer energy use
- outage experiences (frequency and duration) and expectations
- communication expectations
- STPIS expectations (reliability standards and incentive payments)
- Increasing understanding of the electricity industry and TasNetworks

Consumers have identified safety, restoration of faults/emergencies and supply reliability as the highest performing services offered by TasNetworks.

Consumers also identified that into the future they believe that affordability, green, communicative, innovative, efficient and reliable services must be provided by TasNetworks.

This project specifically addresses the requirements of consumers in the areas of:

• safety, restoration of faults/emergencies and supply reliability

• affordability, green, communicative, innovative, efficient and reliable services

Customers will continue to be consulted through routine TasNetworks processes, including the Voice of the customer program, the Annual Planning Review and ongoing regular customer liaison meetings.

1.3 Regulatory Considerations

This project is required to achieve the following capital and operational expenditure objectives as described by the National Electricity Rules section 6.5.7(a) and 6.5.6(a). 6.5.7 (a) Forecast capital expenditure (1) meet or manage the expected demand for standard control services over that period; (2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services; (3) to the extent that there is no applicable regulatory obligation or requirement in relation to: (i) the quality, reliability or security of supply of standard control services; or (ii) the reliability or security of the distribution system through the supply of standard control services, to the relevant extent: (iii) maintain the quality, reliability and security of supply of standard control services; and (iv) maintain the reliability and security of the distribution system through the supply of standard control services; and (4) maintain the safety of the distribution system through the supply of standard control services. Forecast operating expenditure 6.5.6 (a) (1) meet or manage the expected demand for standard control services over that period; (2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services; (3) to the extent that there is no applicable regulatory obligation or requirement in relation to: (i) the quality, reliability or security of supply of standard control services; or (ii) the reliability or security of the distribution system through the supply of standard control services, to the relevant extent: (iii) maintain the quality, reliability and security of supply of standard control services; and (iv) maintain the reliability and security of the distribution system through the supply of standard control services; and (4) maintain the safety of the distribution system through the supply of standard control services.

2. Project Objectives

To undertake asset repairs to the overhead system to reduce the risk of fire starts, harm to the public, and to maintain network reliability.

3. Strategic Alignment

3.1 Business Objectives

Strategic and operational performance objectives relevant to this project are derived from TasNetworks 2014 Corporate Plan, approved by the board in 2014. This project is relevant to the following areas of the corporate plan:

- We understand our customers by making them central to all we do.
- We enable our people to deliver value.
- We care for our assets, delivering safe and reliable networks services while transforming our business.

3.2 Business Initiatives

The business initiatives that relate to this project are as follows:

- Safety of our people and the community, while reliably providing network services, is fundamental to the TasNetworks business and remains our immediate priority
- We care for our assets to ensure they deliver safe and reliable network services
- We will transform our business with a focus on developing an appropriate approach to the management and allocation of risk

- The strategic key performance indicators that will be impacted through undertaking this project are as follows:
- Customer engagement and service – customer net promoter score
- Price for customers – lowest sustainable prices
- Zero harm – significant and reportable incidents
- Network service performance – meet network planning standards
- Network service performance – outcomes under service target performance incentive schemes
- Sustainable cost reduction – efficient operating and capital expenditure

4. Current Risk Evaluation

Do nothing is not an acceptable option to TasNetworks' risk appetite. The level of risk identified above is such that a treatment plan is required to reduce the risks to a tolerable level, in line with TasNetworks’ Risk Management Framework.

4.1 5x5 Risk Matrix

TasNetworks business risks are analysed utilising the 5x5 corporate risk matrix, as outlined in TasNetworks Risk Management Framework.

Relevant strategic business risk factors that apply are follows:

Risk Category	Risk	Likelihood	Consequence	Risk Rating
Customer	Disruption to customers from declining network reliability	Possible	Minor	Low
Environment and Community	Asset failure results in bushfire with some loss to property	Possible	Major	High
Environment and Community	Asset failure results in catastrophic bushfire with widespread loss of property and potential fatality	Unlikely	Severe	High
Financial	Excessive payout of reliability incentive schemes (STPIS, GSL, NCEF) from declining network reliability	Unlikely	Moderate	Medium
Financial	Asset failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events	Unlikely	Severe	High
Financial	Wider asset damage results from a minor fault not being rectified (e.g an unfixed broken tie causes a pole fire, contact with a low conductor pulls poles down)	Likely	Minor	Medium
Regulatory Compliance	Increased number of unplanned outages leads to frequent NCEF breaches	Possible	Moderate	Medium
Reputation	Asset failure results in bushfire with significant media coverage	Possible	Moderate	Medium
Reputation	Asset failure results in catastrophic bushfire with significant media coverage	Unlikely	Major	Medium
Safety and People	Asset failure results in injury or death to member of the public	Unlikely	Severe	High

Section 1 Approvals (Gated Investment Step 1)

Project Initiator:	Gary Carleton	**Date:**	26/03/2015
Line Manager:		**Date:**	
Manager (Network Projects) or Group/Business Manager (Non-network projects):		**Date:**	
[Send this signed and endorsed summary to the Capital Works Program Coordinator.]			

Actions			
CWP Project Manager commenced initiation:		**Assigned CW Project Manager:**	
PI notified project initiation commenced:		**Actioned by:**	

Section 2 (Gated Investment Step 2)

5. Preferred Option:

The preferred solution is risk based maintenance: routine inspection of overhead assets, repairs prioritised on risk posed to public safety, fire start and network reliability.

5.1 Scope

The work to be undertaken shall be repairs to defective Overhead Network Assets. The distribution network can be described as having a large volume of low value assets, many of which fail with minimal consequence. This program aims to focus on those that if they were to fail in service, would have consequences (e.g critical assets, fire risks, etc). Tasks under this program are generated by the various asset inspection programs (AIOHS Overhead Structures inspection and monitoring, AIOFD OH Feeder Auditing & Inspection, AIOTI OH System Thermal Inspection) and are prioritised for actioning based on the severity of the defect and its location geographically and in the network with regards to the three driving criteria:

- Reliability
  - Network robustness – the defects or asset components that contribute the most to failures under fault are targeted for additional maintenance.
  - Asset criticality – faults on poles with switchgear, transformers, poles on feeder trunks servicing large numbers of customers, etc, as well as assets which may be more difficult to repair under fault (e.g poles with complicated pole top configurations, poles that are difficult to access, etc) have a bigger impact on outage durations and STPIS penalties than other less critical assets, are prioritized for planned maintenance work.
- Risk of fire start
  - Targets those defects that if left unrectified may cause sparks or releases of energy that could potentially result in a fire.
  - Fire start defects are prioritized in areas where the surrounds increase the likelihood of a fire starting, for example in bushland areas, or dry grassy areas. The High Bushfire Loss Consequence Zone is prioritised, as well as other high risk areas such as the East Coast and the Tasman Peninsula.
- Risk to safety
  - Targets those defects that if left unrectified may result in death or injury to a person, for example through broken hardware falling from a pole top, or electrocution through accidental contact with assets.
  - Safety risk defects are prioritised in areas subject to human access, e.g urban areas, farms with working equipment, etc.

There are a number of RIN cost categories that address overhead asset repair. This IES covers all three.

- Overhead Asset Repair (AROCO): covers the simple high volume, low complexity tasks where no or minimal design or engineering input is required. The projected volume is 3100 per year, with a standard unit rate of $900/task.
- Replace LV Crossarms (RELSA): the asset renewal of decayed timber crossarms on the LV network. Crossarms have been separated out into an independent renewal program in order to realise delivery efficiencies. The projected volume is around 1000 per year, with a standard unit rate of $2000/task.
- Replace HV Feeders (REHSA): covers small volume, higher complexity tasks, when the nature of the defect(s) necessitates a wider solution taking into account the surrounding feeder and the best long term solution for that section of the network. Usually design is required, and/or some engineering support. The projected volume is 40 per year, with an average cost per project of $15,000.

There is an existing backlog of around 3500 defects. New inspection programs commenced in 2014/2015 and expanded in 2015/2016 (such as AIOFD Aerial Inspections) have increased the volume of defects that are reported. This program runs in parallel to any large scale planned renewal work on specifically targeted feeders.

5.2 Expected outcomes and benefits

The expected outcome of this program is a reduction in risk to TasNetworks from fire starts and public safety risks, and no increase in the number and duration of unplanned outages.

5.3 Regulatory Test

6. Options Analysis

Option description	
Option 0 - Do Nothing	Do nothing. All overhead assets are run to failure. Repairs are only done under fault and only to resume supply.
Option 1	Risk based maintenance: overhead assets are inspected routinely, and reported defects are analyzed for the risk they pose to public safety, fire start and network reliability, and prioritized for repairs. Defects that do not pose a risk are allowed to run to failure.

6.1 Option Summary

Option description	
Option 0	Option 0 - Do Nothing
Option 1 (preferred)	Option 1 – Risk based rectification. This NPV analysis takes into consideration AROCO, RELSA and REHSA as a combined program.

6.2 Summary of Drivers

Option			
Option 0	**Maintain/Improve Reliability**	**Reduce Risk of Fire Starts**	**Reduce Risk to Public Safety**
	Reliability levels will not be maintained.	Poses an unacceptable risk of fire start from asset failure. Leaves the Business very exposed in the event of a fire.	Poses an unacceptable risk to public safety from asset failure. Leaves the Business very exposed in the event of an injury.
Option 1 (preferred)	**Maintain/Improve Reliability**	**Reduce Risk of Fire Starts**	**Reduce Risk to Public Safety**
	Targets the defects or asset components that contribute the most to failures under fault. Targets critical assets.	Targets fire start risk defects, in bushland or dry grassy areas and the High Bushfire Loss Consequence Zone.	Targets the defects that pose a risk to public safety, in areas with human traffic.

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1 (preferred)	$0

6.4 Summary of Risk

Residual Risk

Risk Category	Risk	Likelihood	Consequence	Residual Risk Rating
Financial	Asset failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events	Rare	Severe	Medium
Customer	Disruption to customers from declining network reliability	Unlikely	Minor	Low
Regulatory Compliance	Increased number of unplanned outages leads to frequent NCEF breaches	Unlikely	Minor	Low
Reputation	Asset failure results in bushfire with significant media coverage	Unlikely	Moderate	Medium
Environment and Community	Asset failure results in bushfire with some loss to property	Unlikely	Major	Medium
Safety and People	Asset failure results in injury or death to member of the public	Rare	Severe	Medium

The worst risks in the Financial, Reputation and Environment & Community categories all relate to a bushfire starting from an asset failure. The programs described in this IES are part of a suite of controls used to mitigate bushfire risk. The residual risk in Table # does not reflect the total residual risk resulting from all the controls (which include operational controls, e.g reclosers set to "one shot to lockout" on high fire danger days; and asset design measures, e.g installing LV ABC in bushfire risk areas). TasNetworks Bushfire Management Strategy provides the details of all the control measures associated with preventing bushfire starts. The risk appetite to bushfire is to manage the risk to as **low as reasonably practical**.

The risks that do not relate to bushfire are within TasNetworks' risk appetite which states:

- Customer: we have a **low appetite** for risking the trust our customers place in us by not delivering on our commitments to our customers.
- Regulatory Compliance: where there are clearly demonstrated benefits to our customers and shareholders, we have a **limited to moderate appetite** for taking a risk-based approach to non-compliance where the breaches are technical in nature, the ultimate consequences are negligible, any financial sanction does not exceed the cost of compliance, and no damage is sustained to our relationship with the regulator.

Public Safety: We have **no appetite** for death or serious injury of members of the public caused by our activities or operations and we aim to manage the risk of a death or serious injury to as **low as reasonably practical**.

6.5 Economic analysis

Option	Description	NPV
Option 0	Option 0 - Do Nothing	$0
Option 1 (preferred)	Option 1 – Risk based rectification. This NPV analysis takes into consideration AROCO, RELSA and REHSA as a combined program.	-$14,872,935

6.5.1 Quantitative Risk Analysis

N/A

6.5.2 Benchmarking

6.5.3 Expert findings

6.5.4 Assumptions

Assume same volume per year for asset inspectors for AROCO. Assume 60% overlap with for Crossarms/RELSA with aerial inspections in future years. Assume volume from aerial inspections same for 5 yrs then 50% of original for following years. Assume backlog is worked through over next 5 years also. Assume unit rate for AROCO tasks is $900. Assume unit rate for crossarm/RELSA tasks are $2000. Assume REHSA jobs will have an average cost of $15,000. Historical spend on unplanned maintenance includes all costs journalled under Fault cost categories (EMDAA, EMDST, EMMAJ, EMRES and EMRST). Faults on the non-overhead parts of the network (e.g substations or underground cables) have not been separated and are included in the numbers in Figure 4. Historical spend on planned maintenance includes all costs journalled under the cost categories AROCO, RELSA and REHSA, but do not include the line items for capitalised fault costs that have been journalled across to these categories from the fault budget.

Section 2 Approvals (Gated Investment Step 2)

Project Initiator:	Gary Carleton	**Date:**	26/03/2015
Project Manager:		**Date:**	

Actions			
Submitted for CIRT review:		**Actioned by:**	
CIRT outcome:			