

# Investment Evaluation Summary (IES)



## Project Details:

<b>Project Name:</b>	Replacement of High Voltage Switchgear in Ground Mounted Distribution Substations - Non Oil-Filled
<b>Project ID:</b>	00716
<b>Thread:</b>	Ground Mounted Substations
<b>CAPEX/OPEX:</b>	CAPEX
<b>Service Classification:</b>	Standard Control
<b>Scope Type:</b>	A
<b>Work Category Code:</b>	REHSW
<b>Work Category Description:</b>	Replace Ground Mtd HV Switchgear
<b>Preferred Option Description:</b>	Continue with the current replacement
<b>Preferred Option Estimate (Nominal Dollars):</b>	\$2,240,000

	17/18	18/19	19/20	20/21	21/22	22/23	23/24
<b>Unit (\$)</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Volume</b>	1	1	1	1	1	1	1
<b>Estimate (\$)</b>							
<b>Total (\$)</b>	\$280,000	\$280,000	\$280,000	\$280,000	\$280,000	\$280,000	\$280,000

## Governance:

<b>Project Initiator:</b>	Michael Healy	<b>Date:</b>	27/03/2015
<b>Thread Approved:</b>	David Ellis	<b>Date:</b>	02/11/2015
<b>Project Approver:</b>	David Ellis	<b>Date:</b>	02/11/2015

## Document Details:

<b>Version Number:</b>	1
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## Related Documents:

Description	URL
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REGMS and REHSW replacement strategy

[http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Ground%20Mounted%20Substations/Ground%20MTD%20Subs%20Supporting%20Documents/REGMS\\_%2B\\_REHSW\\_Replacement\\_Strategy\\_Spreadsheet.xlsx](http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Ground%20Mounted%20Substations/Ground%20MTD%20Subs%20Supporting%20Documents/REGMS_%2B_REHSW_Replacement_Strategy_Spreadsheet.xlsx)

# Section 1 (Gated Investment Step 1)

## 1. Background

TasNetworks owns and maintains 1892 high voltage ground mounted distribution substations on its network. These substations comprise the following construction types:

- Fence type
- Steel or fibreglass padmount (kiosk)
- Brick kiosk
- Building
- Vault integrated

Within these substations there are approximately twenty different makes and models of high voltage switchgear. The substations are supplied at both 11kV and 22 kV and range in size from 300kVA to 4500kVA.

These substations are actively managed and receive routine inspections and maintenance to maximise their service life. Many older substations were installed in the early 1960's and are near the end of their service life.

### 1.1 Investment Need

Failure of the assets within the substations, particularly the high voltage switchgear can result in significant disruption of supply has the potential to cause harm to both operational personnel and the public.

To manage these risks, the assets at the substations are replaced prior to an asset failure occurring. The asset replacement could be either partial replacement, or complete replacement of the substation.

The majority of the substations installed prior to 1990 use oil as the insulating medium in the high voltage switchgear. This type of switchgear is used at 224 of the older ground mounted substations. If failure occurs it presents a greater risk than other types of switchgear because the oil can become a fuel source making failures more dangerous for both operational personnel and operators and the public. To address this switchgear a replacement program exists for substations that contain oil-filled switchgear.

Asset replacement of other types of switchgear is also necessary due to the switchgear being deemed to be at end of life due (poor condition) or due to operational deficiencies e.g. single phase switching under fault conditions. To address the risk complete replacement of the substation occurs.

Figure 1 shows the consequences of a HV switchgear failure that had the potential to cause harm.



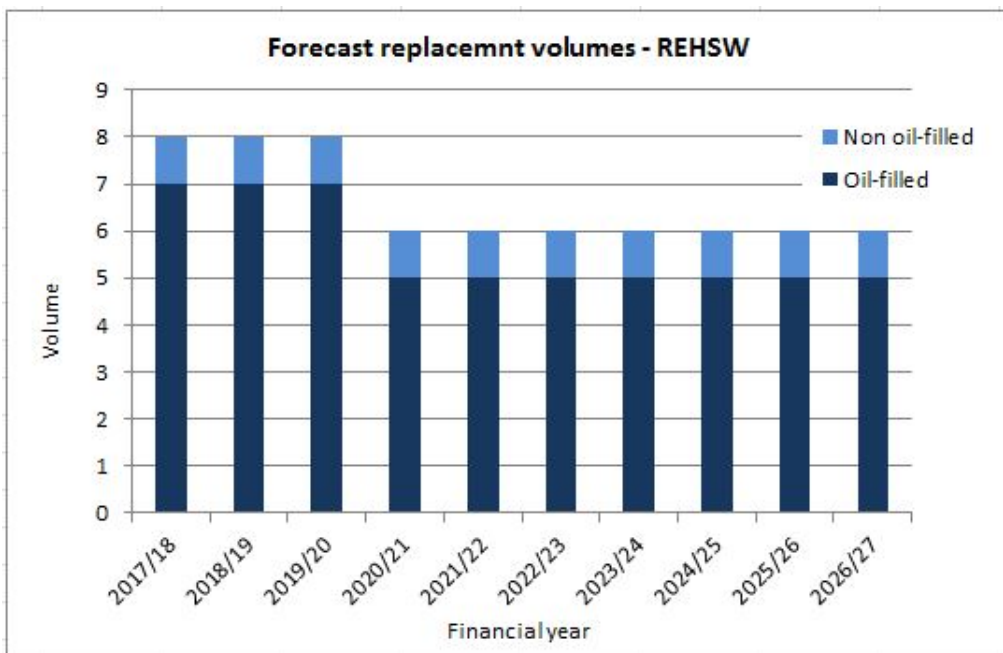
**Figure 1 - Epoxy spouts contained inside of RGB switchgear that has failed due to moisture and dust ingress**

The risks attributed to the concerning failure modes of the switchgear types are briefly detailed below.

- Oil-filled switchgear in fence and padmount type substations due to catastrophic failure poses a safety risk to the public due to exposure;
- Oil-filled switchgear in enclosures having a high risk of catastrophic failure and oil fuelling a substation fire;
- Gas insulated units having operating restrictions due to operational safety issues, this is due to single phase switching under fault conditions;
- Gas insulated units having insulation failure and subsequent flashovers due to a poorly designed epoxy spout.

Where the replacement of the switchgear is the most appropriate solution to address the risk of deficiency it is undertaken under the REHSW program.

This program allows for the replacement of the non oil-filled high voltage switchgear in one substation per annum.



**Figure 3 - Forecasted replacement volumes for REHSW split between oil and non-oil filled switchgear**

## 1.2 Customer Needs or Impact

TasNetworks continues to undertake a 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 it 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)
- Increase 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.

## 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

(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;

(4) Maintain the safety of the distribution system through the supply of standard control services.

## 2. Project Objectives

The objective is to replace defective high voltage switchgear to minimise safety risks to operational personnel and the public, and to ensure the current network performance levels are maintained.

## 3. Strategic Alignment

### 3.1 Business Objectives

The Asset Management Strategic Objectives are:

- Minimise the cost of asset management to a sustainable level
- No significant safety or environmental incidents.
- Maintain risk such that the residual risk level for all assets risks is “as low as reasonable practical” taking into consideration any expressed or implied duty of care.
- Achieve compliance with relevant legislative, regulative statutory requirements.

### 3.2 Business Initiatives

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 care for our assets, delivering safe and reliable networks services while transforming our business.
- Safety of our people and the community, while reliably providing network services, is fundamental to the TasNetworks business and remains our immediate priority

The strategic key performance indicators that will be impacted through undertaking this project are as follows:

- Prices for customers – lowest sustainable prices
- Zero harm – significant and reportable incidents
- Sustainable cost reduction – efficient operating and capital expenditure

## 4. Current Risk Evaluation

If a replacement program did not occur the safety risks for this type of switchgear if it was left to run to failure would be unacceptable. Letting the assets run to failure could result in catastrophic failures resulting a significant risk to operational personnel and the public.

The business risk associated with these assets has been evaluated by using the TasNetworks Risk Framework.

The level of risk identified was such that a treatment plan is required to reduce the risk down to a manageable level.

### 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
Network Performance	Failure of switchgear that results in impact to network disruption and loss of customer supply.	Likely	Minor	Medium
Safety and People	Failure of switchgear that results in injury or fatality to operational personnel or the public.	Unlikely	Severe	High

## Section 1 Approvals (Gated Investment Step 1)

<b>Project Initiator:</b>	Michael Healy	<b>Date:</b>	27/03/2015
<b>Line Manager:</b>		<b>Date:</b>	
<b>Manager (Network Projects) or Group/Business Manager (Non-network projects):</b>		<b>Date:</b>	
[Send this signed and endorsed summary to the Capital Works Program Coordinator.]			

<b>Actions</b>			
<b>CWP Project Manager commenced initiation:</b>		<b>Assigned CW Project Manager:</b>	
<b>PI notified project initiation commenced:</b>		<b>Actioned by:</b>	



## Section 2 (Gated Investment Step 2)

### 5. Preferred Option:

The preferred solution is to replace the high voltage switchgear with new switchgear.

Replacement would occur when the switchgear presents a significant business risk or has reached end of life. Based on historical experience the switchgear would reach end of life at approximately 50 years of age.

#### 5.1 Scope

Replacement of defective switchgear with new switchgear.

A prioritised replacement of oil-filled switchgear will be undertaken based on the individual risk of each installation. The assessment of risk is done in accordance with TasNetworks' Risk Framework.

The replacement of a teh switchgear s usually driven by the risk associated with the increased probability of an asset failure occurring and the consequences of the failure e.g. safety risk to operational personnel and the public, network disruption and environmental impact.

Each substation identified for replacement is prioritised based on an assessment against the following criteria:

- Risk to safety i.e. level of exposure e.g. enclosure type, location
- Criticality of the installation
- Condition
- Compliance
- Age

The rate of replacement is as follows:

Financial year	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Volume	1	1	1	1	1	1	1	1	1	1

#### 5.2 Expected outcomes and benefits

The benefits of this option are:

- Reduction in safety risk associated with switching from 'high' to a manageable level of 'low' in a timely manner.
- It maintains the reliability of the network as poor condition assets are replaced.
- Reduces the environmental risk from an oil-filled asset.
- Reduces OPEX expenditure.
- Align with TasNetworks risk framework.

#### 5.3 Regulatory Test

Not applicable

## 6. Options Analysis

## 6.1 Option Summary

Option description	
Option 0	Do nothing
Option 1 (preferred)	Continue with the current replacement

## 6.2 Summary of Drivers

Option	
Option 0	<p>To do nothing will not address the safety risks concerning this type of switchgear, a do nothing approach would see assets run to failure, which with the assets present failure mode of exploding means a high operator and public safety risk.</p> <p>This option will also result in an increased number of faults reducing the performance of the network.</p>
Option 1 (preferred)	<p>Replace high voltage switchgear with modern switchgear at the current level of replacement.</p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Reduces safety risk to a manageable level</li> <li>• Shift from reactive to proactive – decrease in unplanned outages</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Capital expenditure needed</li> </ul> <p>This is the lowest cost option to reduce the business risks to manageable.</p>

## 6.3 Summary of Costs

Option	Total Cost (\$)
Option 0	\$1,688,943
Option 1 (preferred)	\$2,240,000

## 6.4 Summary of Risk

Replacement of defective switchgear when it's identified will reduce the risks down to a manageable level.

## 6.5 Economic analysis

Option	Description	NPV
Option 0	Do nothing	\$0
Option 1 (preferred)	Continue with the current replacement	\$0

### 6.5.1 Quantitative Risk Analysis

Nil

### **6.5.2 Benchmarking**

Other DNSP's also have asset replacement programs for their high voltage switchgear to minimise the safety risk this type of equipment presents to the public and to also maintain network reliability.

### **6.5.3 Expert findings**

Nil

### **6.5.4 Assumptions**

Nil

## Section 2 Approvals (Gated Investment Step 2)

<b>Project Initiator:</b>	Michael Healy	<b>Date:</b>	27/03/2015
<b>Project Manager:</b>		<b>Date:</b>	

<b>Actions</b>			
<b>Submitted for CIRT review:</b>		<b>Actioned by:</b>	
<b>CIRT outcome:</b>			