AMS – Victorian Electricity Transmission Network

Diesel Generators (PUBLIC VERSION)

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1 Executive Summary

Diesel generators provide emergency, auxiliary 415 V AC supply at critical locations (terminal stations and communications sites) in the event of total loss of normal auxiliary supplies.

The majority of diesel generators located at terminal stations are provided for black start capability and those at remote communication sites are required to reduce the risks associated with the loss of critical network communication systems.

There are currently no major issues associated with the management of diesel generators.

Key asset management strategies:

- Continue with current maintenance and operational practices.
- Validate accuracy of diesel generator information as part of SAP migration close out activities.
- Develop and apply a quantitative condition assessment methodology.
- Economically replace diesel generators based on condition.
- Ensure adequate spare holding levels.

2 Introduction

2.1 Purpose

The purpose of this document is to define the asset management strategies for economic management of diesel generators in the Victorian electricity transmission network.

2.2 Scope

This asset management strategy applies to all diesel generators which provide emergency, auxiliary 415 V AC supply at critical locations (terminal stations and communications sites) in the event of total loss of normal auxiliary supply.

2.3 Specifications

The provision of diesel generators is determined after consideration of power supply requirements, the stability and reliability of the existing power supply system and the consequence of loss of power supply.

Design specifications[1] provide guidance on ensuring that selected generators are rated adequately and generate the required operating voltage (415V), frequency (50Hz) and phases (3 phase supply with neutral solid earth). Generator inspection and maintenance requirements are set in accordance with SMI 45-01-01A[2] which details maintenance tasks and frequencies required. Maintenance requirements set out in SMI 45-01-01A have been developed using a combination of manufacturer recommendations and maintenance specialist experience. Maintenance and inspection intervals for Diesel Generators are summarised in PGI 02-01-02[3].

[1] Station Design Manual Vol.2 Section.27 Generator – Diesel.

[2] Diesel generator overhaul.

[3] Plant guidance and information – summary of maintenance intervals (Transmission).

3 Asset Summary

3.1 Population

Diesel generators are installed in a number of critical stations and communication sites. There are a total of [C.I.C] diesel generator sets installed at [C.I.C] stations (including terminal stations, switching stations and communication sites). [C.I.C] is the only communication site with two diesel generator sets installed and [C.I.C] is the only terminal station with two sets installed.

Figure 1 provides the volume of diesel generators and their locations.

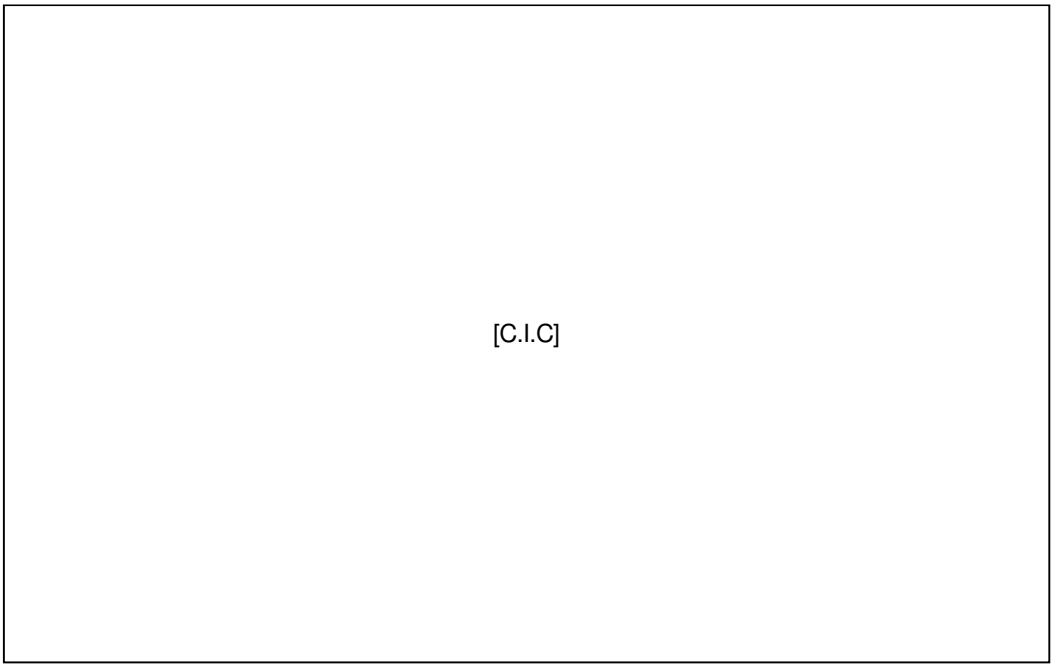

Figure 1 – Diesel Generator Locations

The majority of diesel generators located at terminal stations are provided for black start capability only. Generators at [C.I.C] are required to provide normal standby auxiliary supply to the stations as no alternative standby power supplies exist at these remote locations.

Appendix 1 displays a list of diesel generators including size and manufacturer.

3.2 Age Profile

Although diesel generators have an expected life of 40 years[4], the average age of the diesel generator fleet is 29 years. 25% of these diesel generator sets have exceeded their expected operating life's minimal running times but effective maintenance procedures have assisted in keeping the units in good working order negating the need for replacement.

[4] AMS 10 – 101 Asset Life Evaluation.

The population of Diesel Generators range in age to approximately 62 years as shown in Figure 2.

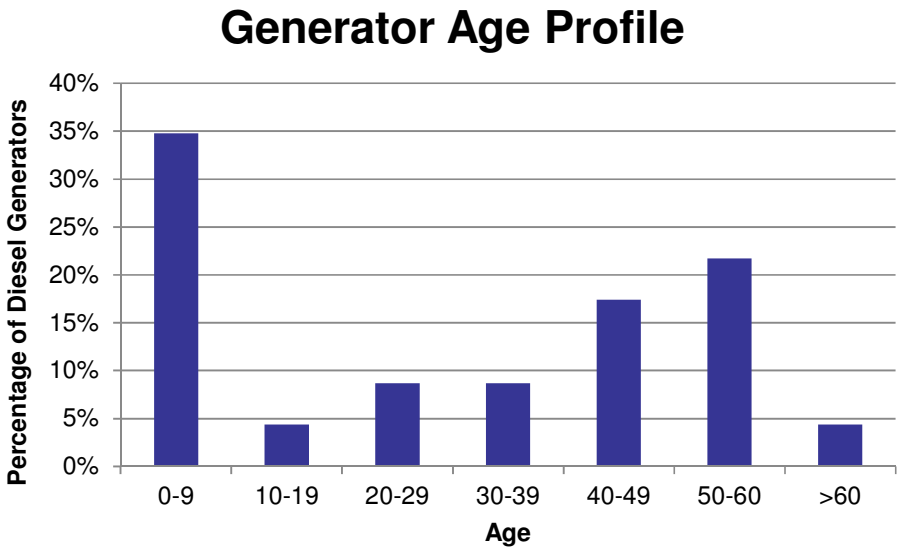

Figure 2 – Diesel Generator Age Profile

3.3 Performance

Diesel generator sets installed in stations are given a manual start and test run every month and an auto start and test run every six months. Those diesel generators installed in communication sites are given an auto start and test run every three months. The duration of the test run is usually about two hours.

Figure 3 illustrates that there has been an annual average of 22 scheduled maintenance (OMS) activities between 2006 and 2013[5]. The unscheduled maintenance (OMU) activities for the same period are approximately 14 which indicates that the scheduled activities are reducing the unexpected failures when the asset is in service.

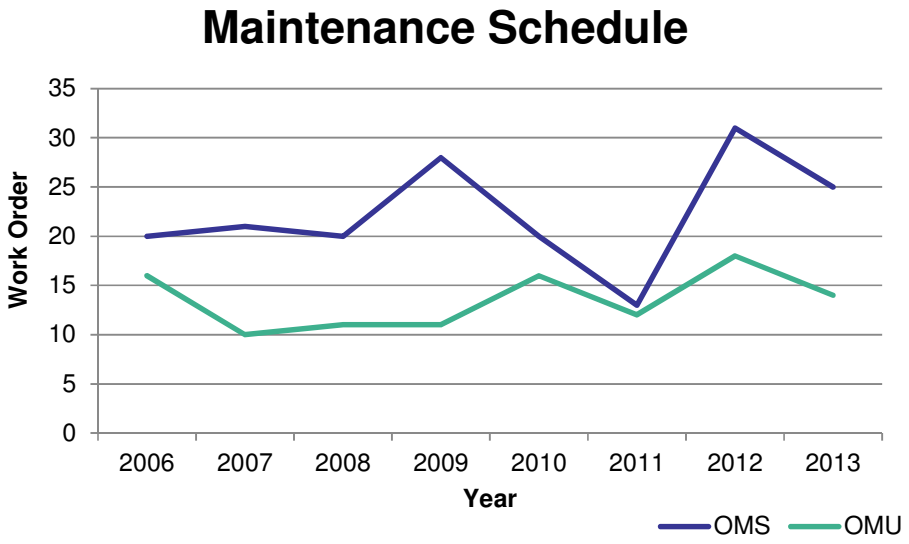

Figure 3 – OMS vs OMY Maintenance Schedule of Diesel Generators per year

The prominent causes of unscheduled maintenance include generator controls issues, low fuel tank levels, radiator hose leaks and oil leaks. These are detected either via sensing equipment which triggers automated alarms in SCADA or during scheduled maintenance activities.

Further analysis reveals that the majority of unscheduled maintenances are isolated to just a small number of stations as shown in Figure 4.

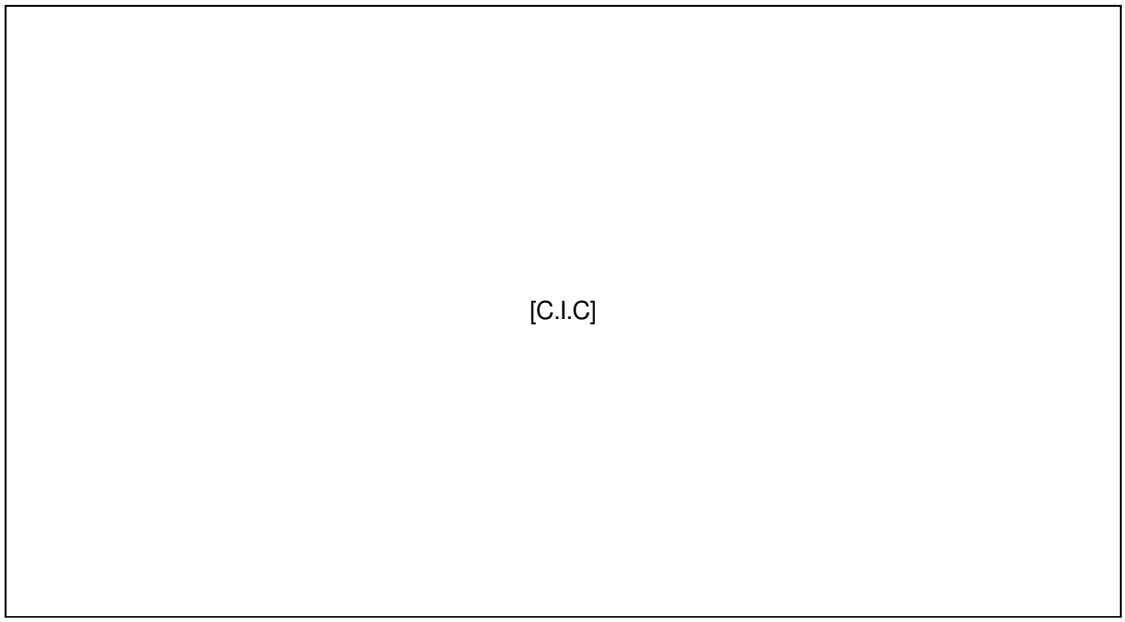

Figure 4 – Maintenance schedule per location

[C.I.C] were the worst performing sites with 49 and 30 unscheduled maintenance activities respectively.

[C.I.C] was the worst performing site with 49 unscheduled maintenance activities, followed by [C.I.C] with 30 and 28 unscheduled maintenance activities respectively.

3.4 Condition

The population of diesel generators are ageing and maintenance activities are completed to ensure they are operational. A quantitative condition assessment is currently being developed to establish a generator specific condition. However, a qualitative ranking shows that [C.I.C] are in the worst condition.

The diesel generator at [C.I.C] is the first of these scheduled for planned replacement.

4 Risk Assessment

Risks associated with diesel generators can be assessed in terms of safety and response to emergency situations.

4.1 Formal Safety Assessment

Diesel generators do not present significant health and safety or financial risks. AusNet Services performs formal safety assessments[5] on the transmission network as part of the ESMS. Level II safety risks are the highest ranking risks identified as part of the formal safety assessments. Diesel generators do not relate to any current level II safety risks.

4.2 Emergency Response

The transmission network contingency plan is updated annually and endorsed by the Asset Management Committee (AMC). The plan details steps which would be required in response to catastrophic damage to the transmission network. Existing diesel generators are not discussed in the plan however the possible need for portable generator sets is described briefly.

Portable diesel generators could be required to establish a contingency protection and control scheme following the unlikely loss of an entire terminal station control building. In this case a containerised quantity of pre-designed, wired and constructed modular protection schemes would be used. A portable DC and AC supplies container with battery chargers and facilities to hook up a diesel generator would be required to provide power to the containerised scheme.

[5] ESMS 20-02 Formal Safety Assessment.

5 Key Issues

There are currently no major issues associated with diesel generators. Minor issues associated with the population include

- Faulty generator controls which fail to start or stop the unit on command.
- Fuel tanks may require replenishment triggering reactive maintenance.
- Diesel generators may require Bunding to capture diesel or oil leaks.
- No economic assessments on age based replacement of diesel generators has been performed considering ongoing maintenance costs as a driver.

6 Strategies

- Continue with current maintenance and operational practices.
- Validate accuracy of diesel generator information as part of SAP migration close out activities.
- Develop and apply a quantitative condition assessment methodology.
- Economically replace diesel generators based on condition.
- Ensure adequate spare holding levels.

Appendix 1 – List of Diesel Generators

Equipment Number	Location	Description	Manufacturer	Installation Date
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]
[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]	[C.I.C]

Additionally there are [C.I.C] that are not owned by AusNet Services. However, AusNet Services is responsible for their ongoing maintenance and operation.