Revised Regulatory Proposal

Supporting Information: Replace Three Phase Regulators (REGMR)

Aurora response to the AER's Draft Distribution Determination

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Table of contents

1. Introduction

Aurora provided the AER with its *Regulatory Proposal* on 31 May 2011 in accordance with the provisions of Chapter 6 of the *Rules*. Aurora also set out its answers to the Regulatory Information Notice (RIN) issued by the AER on 21 April 2011 in its response (*RIN Response*) of 31 May 2011.

The AER have reviewed Aurora's *Regulatory Proposal* and *RIN Response* and provided Aurora with the AER's *Draft Distribution Determination*, associated consultant's reports and AER models on 29 November 2011 in accordance with the provisions of Chapter 6 of the *Rules*.

Aurora provides its *Revised Regulatory Proposal* to the AER in response to the AER's *Draft Distribution Determination* in accordance with the provisions of Chapter 6 of the *Rules*. This document provides specific supporting information as an appended attachment to Aurora's *Revised Regulatory Proposal*

2. Replace Three Phase Regulators (REGMR)

2.1. Summary

In Aurora's *Regulatory Proposal*, Aurora proposed to replace five of the 13 three phase regulators that are over 45 years old within Aurora's distribution system. The aim of this program was to manage the risk of in-service failure associated with these assets.

The AER considers a more reasonable approach is to assume that the current failure rate will continue, consistent with the recent historical failure rate, and has reduced the volumes to two units over a five-year period.

Aurora has conducted a review of its ground mounted regulator fleet and performed calculations to determine the number of spares required to support the AER's proposed arrangements.

It is recommended that Aurora purchase the following spares:

1. One pair of 11 kV, 200 A single phase tanks;
2. One pair of 11 kV, 300 A single phase tanks;
3. Five pairs of 22 kV, 200 A single phase tanks; and
4. One pair of 22 kV, 300 A single phase tanks.

As Aurora currently does not have space in the existing bunded areas within its stores facilities, Aurora would also be required to extend the bunded area.

It is estimated that the cost of purchasing these spares is $550k and the cost of extending the bunded areas is $200k.

2.2. Background

In Aurora's Regulatory Proposal, Aurora proposed to replace five of the 13 three phase regulators that are over 45 years old within Aurora's distribution system. The aim of this program was to manage the risk of in-service failure associated with these assets.

The AER considers a more reasonable approach is to assume that the current failure rate will continue around the recent historical failure rate and has reduced the volumes to two units over a five-year period.

Aurora has conducted a review of its ground mounted regulator fleet and performed calculations to determine the number of spares required to support the AER's proposed arrangements.

The three phase regulator fleet can be divided into four types of regulators:

1. 11 kV, 200 A units;
2. 11 kV, 300 A units;
3. 22 kV, 200 A units; and

4 22 kV, 300 A units.

5 The number of units installed in the system is given in Table 1. It should be noted that these are not the actual size of the units installed, but number of units within each of the standardised sizes.

Table 1: Number of Three Phase Regulators in Aurora's Distribution System

	200 A	300 A
11 kV	9	4
22 kV	24	1

2.3. Spares Calculation

2.3.1. Methodology

To determine the number of three phase regulator spares Aurora may consider holding, AusGrid's method of calculating the probability of having a spare when needed (refer Section 3) was applied to Aurora's population of three phase regulators.

The three phase regulators were broken into four groups based on voltage and size (refer Section 2.2).

The failure rate was taken to range from two failures every five years to once every ten years.

The provisioning time for a regulator was taken to be six months.

The results are given in Table 2 and the full calculations can be found in Three Phase Regulator Spares Holdings Calculations (reference 1).

Table 2: Number of spares required for greater than 99.9% probability of having a spare when required

Regulator Type	Number in system	Number of spares required
11 kV, 200 A units	9	2-3
11 kV, 300 A units	4	1-2
22 kV, 200 A units	24	4-9
22 kV, 300 A units	1	0-1

It should be noted that Aurora no longer installs three phase regulator units, so any spares purchased would consist of a pair of single phase units to be connected in open-delta configuration to replace one three phase unit.

2.4. Operational Expenditure

It is anticipated that there would be a small increase in operational expenditure requirements associated with the management of spare regulators, such as periodic inspections for oil-leaks and oil tests.

2.5. Recommendation

As Aurora currently holds one pair of 11 kV, 200 A units and one pair of 22 kV, 200 A units at its Training Schools which can be removed from the School and used as a spare if necessary, it is recommended that Aurora purchase the following additional spares:

1. One pair of 11 kV, 200 A single phase tanks;
2. One pair of 11 kV, 300 A single phase tanks;
3. Five pairs of 22 kV, 200 A single phase tanks; and
4. One pair of 22 kV, 300 A single phase tanks.

As Aurora currently does not have space in the existing bunded areas within its stores facilities, Aurora would also be required to extend the bunded area. It is estimated that the cost of extending the bunded areas at Cambridge and Rocherlea storage facilities is approximately $100k per site.

It is estimated that the cost of purchasing these spares is $550k and the cost of extending the bunded areas is $200k.

2.6. References

1. Three Phase Spares Holding Calculations (NW-#30240827-V1)

3. Spares Availability Calculation

Based on the work presented by AusGrid at the Electricity Industry Plant Working Group, the following methodology is used to determine the probability of having a spare of a particular item available when required.

The information used to analyse spares requirements are:

- the reliability of the item;
- the installed population of the item;
- the probability of having a spare item available when required; and
- the provisioning period of the item (i.e. the lead time).

The relationship between these items can be described by:

$$P = \sum_{n=0}^{n=s} \left[\frac{R(-\ln(R))^n}{n!} \right]$$

Where:

P = probability of having a spare of a particular item available when required

S = number of spare parts carried in stock

R = composite reliability (probability of survival); $R=e^{-K\lambda T}$

K = installed population

λ = the failure rate of the item

T = provisioning of the item (lead time in years)

AusGrid's policy is to aim for greater than 99.9% probability of having a spare available.

4. Confidentiality

Aurora does not claim confidentiality over any section of this document: