Regulatory Audit Of Compliance Reporting For The Ord Hydro Transmission Network

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1. Executive Summary

Pacific Hydro Pty Ltd (Pacific Hydro) on behalf of Ord River Dam Hydro Partnership[1] engaged Sinclair Knight Merz (SKM) to undertake an independent audit and report on the operation of the systems that were in place for monitoring compliance with the quality and reliability standards as defined in the Reliability Code[2], and in accordance with section 26(1) of that code. The audit and report were to be specific to the Ord Hydro generation and transmission system located in the north east of Western Australia and specific to the 1 July 2005 – 30 June 2006 reporting year.

In undertaking the independent audit and producing this report, SKM has visited the Ord Hydro power station and reviewed associated control and monitoring facilities. SKM has also inspected the Ord 132 kV switch yard and control building (OSY), the Kununurra 132 kV switchyard and control building (KNX) and the control / operations room in the Kununurra township. We have additionally interviewed one of the two site operators at Kununurra and held numerous discussions with Pacific Hydro personnel based in both Melbourne and Perth. SKM has also reviewed numerous event logs, SCADA log of events, the Power Station Log of Events, correspondence between Pacific Hydro and each of the two customers supplied by the system, Power Purchase agreements and other documents either requested by SKM or independently provided by Pacific Hydro.

In undertaking this audit and drawing the conclusions that we have, SKM has acted independently, and exercised sound engineering judgement and our knowledge and experience in the electricity industry both within Australia and off shore. Pacific Hydro co-operated fully with SKM during this audit.

In reviewing the Pacific Hydro report [3]on the Ord Hydro quality and reliability, SKM understands that the sources of data used by Pacific Hydro were the Power Station Logs and copies of Faxed incident reports that were issued to each of Argyle Diamond Mine and Horizon Power (previously Western Power) (as appropriate) after an incident on the network. These reports have been structured by the site superintendents to align with the reporting requirements required of the Power Purchase Agreements (PPAs) for each of Argyle Diamond Mine and Horizon Power.

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[1] The Ord River Dam Hydro Partnership consists of North Western Energy Pty Ltd, Pacific Hydro Group Two Pty Ltd and Energis Australia Pty Ltd, all of which are wholly-owned subsidiaries of Pacific Hydro Pty Ltd. The partnership is collectively referred to as “Pacific Hydro” in this document.

[2] Western Australian “Electricity (Network Quality and Reliability) Code 2005

[3] Network Quality and Reliability Of Supply - Annual Report 2005/6: Pacific Hydro Pty Ltd

Neither of these PPAs align with the reporting requirements required by the Reliability Code as the PPAs were agreed long before the Reliability Code was enacted.[4]

In auditing the performance of the remote Ord Hydro system, SKM has researched the operation of appropriate network elements as recorded in SCADA output summary file. Pacific Hydro advised that these records have generally been retained (archived) for the life of the network,. SKM did not identify any missing SCADA records for the audit period.

SKM chose the SCADA data as an accurate, chronological record of plant operations, and have based our audit and conclusions on same. SKM is not aware of any missing SCADA records that impacted on this audit.

The difference in source data chosen for the reliability reporting had an impact on the statistics determined. In general, the approach adopted by Pacific Hydro could be described as conservative, stating a lower reliability than SKM's determination.

SKM summarised findings of the reliability of the Ord Hydro system for 2005 / 06 are as shown in the table below:

Reliability Statistics 2005 / 06

Statistic – Forced Outages	Pacific Hydro Report	SKM Findings
Number of Incidents / events	15	8
Number of feeder outages	15	13
Total number of minutes without supply (all events included)	1,476	455
Total number of minutes without supply (excluded events omitted)	317	273
Average duration of interruptions per customer (minutes)	98.4	21
Average % of time energy was supplied to customers	99.94%	99.95%

Note: discrepancies occurred due to the source data selected, differences in interpretation between outages and events

SKM recommends that the SCADA summary data be used as the basis of future performance reports by Pacific Hydro.

[4] Western Australian "Electricity (Network Quality and Reliability) Code 2005

2. Introduction

Pacific Hydro on behalf of Ord River Dam Hydro Partnership engaged SKM in 2007 to undertake 'an independent audit, and report on, the operation of the systems that the transmitter or the distributor had in place for measuring its compliance with Part 2 or an instrument made under section 14(3) of the Reliability Code[5]. In undertaking this audit, SKM visited the Ord Hydro operations centre at Kununurra, the point of common coupling substation to the Horizon distribution network (KNX) and the Ord Hydro generation facility on the Ord River. We also interviewed the site superintendent, (1 of 2 relief superintendents) who, amongst other things, is responsible for monitoring operating and reporting on the performance of the facilities.

SKM notes that Pacific Hydro holds an integrated regional licence for the activities it undertakes in supplying the Argyle Diamond Mine (ADM) and Horizon Energy (previously Western Power) from the Ord Hydro power station (which Pacific Hydro also own and operate under this licence), and interconnecting transmission system. An integrated regional licence as defined in section 4(1)(e) of the Electricity Industry Act provides for both the generation and transmission of electricity[6]. As the Reliability Code[7] defines an interruption as a loss of electricity supply[8], SKM is of the view that events on both the transmission network and those with in the generation station that have the effect of interrupting the supply of electricity are to be reported for reliability performance purposes.

2.1 Historical Reporting Requirements

Ord Hydro was established to supply the majority of the electricity supply needs of the Argyle Diamond Mine (ADM), and Western Power Corporation (now Horizon Power). Western Power Corporation (Western Power) was the distribution utility that supplied the Kununurra township in north east Western Australia at the time.

Power Purchase Agreements (PPA's) were established between Pacific Hydro and each of the ADM and Western Power. Each of these PPA's contained electricity supply conditions required of

[5] Western Australian "Electricity (Network Quality and Reliability) Code 2005 Division 3, section 26(1) page 17

[6] Western Australian "Electricity Industry Act 2004 Reprint 1:The Act as at 16 June 2006 page 5

[7] Western Australian "Electricity (Network Quality and Reliability) Code 2005

[8] Western Australian "Electricity (Network Quality and Reliability) Code 2005 page 2

Pacific Hydro. Pacific Hydro reports annually to each customer on its performance in accordance with contract conditions.

The PPA's were established in 1994 with a validity period expiring in 2021 (unless terminated earlier).

Of the two customers Ord Hydro supplies, ADM represents approximately 66% of load requirements.

Annual reporting requirements were structured around penalty or liability clauses defined in the PPA's and generally related the percentage of energy supplied to each customer annually compared to the total contracted amount for the year.

2.2 Code Reporting Requirements

The Reliability Code came into effect on 1 January 2006 and is quite prescriptive with respective to performance monitoring and recording. Clause 23 requires 'a transmitter or distributor must take such steps as are reasonably necessary to monitor the operation of the network to ensure compliance with-

(1) the provisions of Part 2 (Quality and reliability standards) or an instrument made under section 14(3); and

(2) A transmitter or distributor must keep such records … for at least 5 years after the date … the report is published'

3. Reporting Systems Installed

The reporting requirements of the Reliability Code[9] came into operation from 1 January 2006. It is of note, that in February 2007, when SKM visited the site, the reporting requirements required by the PPA's remained the reporting regime followed by the site superintendents, with the reporting requirements required by the Reliability Code not well known. All performance reports sighted by SKM were based on the reporting requirements required by the two respective PPA's.

These PPA's are primarily focused on the volume of energy supplied to each customer annually, rather than the quality and reliability of the supply. As such, attention to the recording and reporting of system and network performance issues not directly related to PPA reporting requirements did not seem to have always been diligently addressed, or not addressed at all.

3.1 Quality Standards

3.1.1 Code Requirements

The Reliability Code requires the transmitter to "ensure that the electricity supplied … to a customer's electrical installations, as measured at the point of connection of those installations to the network, at all times complies with the standards prescribed by sections 6(2) and 7."[10] Section 6(2) relates to voltage fluctuations and section 7 relates to Harmonic content.

3.1.2 Ord Hydro Position

Under the terms and conditions of the respective PPA's, Pacific Hydro is required to meet certain voltage fluctuation standards but Pacific Hydro is not required to report to either ADM nor Horizon Power, on quality of supply issues. As such, Pacific Hydro does not have installed (either at the Ord Hydro switch yard or the point of connections) and has never had installed equipment to monitor harmonics content and voltage fluctuations.

Discussions with site personnel indicated that measurements of power system quality are not undertaken. The only exception to this would be generator protections systems that are designed to protect against excessive voltage swings, but operations of this protection are not recorded (unless an interruption to supply occurs).

SKM noted that Pacific Hydro is in the process of installing voltage recording equipment for each of the supply feeders but does not have actions or plans to install harmonic content monitoring

[9] [9] Western Australian "Electricity (Network Quality and Reliability) Code 2005

[10] [10] Western Australian "Electricity (Network Quality and Reliability) Code 2005 Part 2 Section 5.1 page 4

equipment in the future. Neither voltage monitoring nor harmonic content recording equipment were installed during the regulatory reporting period.

3.1.3 SKM's Comment

SKM does not consider it uncommon that quality of supply monitoring equipment is not installed on a customer's point of connection. This equipment is expensive and could be seen as unnecessarily increasing the cost of connection of new loads should it be required.

Usual industry practice would see a utility (transmission or distribution) install quality of supply monitoring equipment at a consumer's point of connection only upon receipt of a specific quality of supply complaint from the consumer. Often this equipment is installed temporarily, and only then for the time required to investigate the quality of supply complaint.

Discussions with Ord Hydro site personnel indicated that no quality of supply complaints had been received from either ADM or Western Power / Horizon Power since power was first made available, though there were no hard records to confirm same.

3.2 Reliability Standards

3.2.1 Code Requirements

The Reliability Code is slightly less prescriptive in defining reliability requirements. This is expected due to the number and type of events that can impact supply reliability.

The general standard of reliability is defined as requiring a transmitter or distributor to "**so far as is reasonably practicable**, ensure that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum."[11] (Bold by author).

The Reliability Code further requires that a transmitter or distributor must "so far as is reasonably practicable, reduce the effect of any interruption on a customer."[12], and that "a transmitter or distributor must consider whether the transmitter or distributor should supply electricity by alternative means to a customer who will be affected by a proposed interruption ….."[13].

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[11] Western Australian "Electricity (Network Quality and Reliability) Code 2005 Division 2 Section 9, page 6

[12] Western Australian "Electricity (Network Quality and Reliability) Code 2005 Division Section 10 (1) PAGE 6

[13] Western Australian "Electricity (Network Quality and Reliability) Code 2005 Division 2 Section 10 (2) page 6

3.2.2 Ord Hydro Position

It should be noted that the electricity supply regime Pacific Hydro operates in, was defined in PPA's established some 12 or more years ago. It should also be noted that the Pacific Hydro operates a remote and isolated network. The PPA's do not offer the respective customer (ADM and Horizon Power) a secure supply. To the contrary, the PPA's require the customers to provide supplementary or back up electricity in the event of a loss of supply from the Ord Hydro network. The PPA's also require the customers to supplement the Ord Hydro generation capacity under certain conditions.

One of these conditions requires ADM to operate its diesel generators all the time to provide spinning reserve.

3.2.2.1 Reporting Systems

All supply monitoring and recording of the electricity network associated with the Ord Hydro system is installed at the power station, not at the customers' terminals as required by the Reliability Code. Given that the length of transmission lines to ADM and Western Power are in the order of 95 kms and 45 kms respectively, this can be considered to accurately reflect the electricity supply received at the customer's terminals.

The Ord Hydro power station and associated transmission system was commissioned in 1996. As a relatively new and modern system, it is equipped with a SCADA system for the remote monitoring and operation of the system. System events such as CB (circuit breaker) open and close events are recorded in the SCADA system in real time.

A summary output file of SCADA events is generated during the conversion of the raw SCADA log files into CSV format. These files are generally archived on a regular basis. From interrogation of the daily SCADA data and analysis of the events of the day, the operators also produce a Power Station Log. The log is in the form of a table which simply records the date, event description and a generic event heading. The operators also produce summary reports on the events as required to the customers affected.

All records for the period 1 July 2005 to 30 June 2006 were identified and reviewed by SKM.

SKM understands that the Power Station Log and event summary reports were the base source of information used by Pacific Hydro to produce the "Network Quality and Reliability of Supply Report"[14].

[14] Network Quality and Reliability Of Supply - Annual Report 2005/6: Pacific Hydro Pty Ltd

3.2.3 SKM Comment and Review

SKM has reviewed the report published by Pacific Hydro on the operation of the Ord Hydro electricity system as required by Schedule 1 of the Reliability Code. We have also reviewed the (Ord Hydro) Power Station Log for the period 1 July 2005 to 30 June 2006 the raw CSV files of SCADA records for the same period (that could be located), the event reports issued to the customers after each incident, and a summary table of system events used in the development of the "Network Quality and Reliability of Supply Report"[15].

As the SKM review referenced the raw SCADA log files as the primary source of data, we are of the view that this review would be of a greater level of accuracy than reliance upon the Power Station Logs and event summary reports solely (as was accepted by Pacific Hydro). This statement is made noting that the Power Station Log and the Notification of Incident report are each designed to meet the reporting requirements contained in the PPAs. It is of note, that in February 2007, when SKM visited the site, the reporting requirements required by the PPA's remained the reporting regime followed by the site superintendents . As such, attention to the detail required of the Reliability Code was not expected.

In summary, SKM found that for the period 1 July 2005 to 30 June 2006, Pacific Hydro:

- Correctly identified all events that resulted in an interruption of supply to either of the network customers;
- Used a conservative approach in determining system / customer minutes without supply, resulting in the total outage time for the year being overstated by some 28% on average;
- Recorded an incident that caused an interruption of supply to the 2 feeders as 2 events. SKM considers this as 1 event that effected the 2 feeders;
- Have counted all interruption events and durations inclusive of excluded events. SKM is of the view that excluded events should not be included for each of event count and duration statistics.
- Excluded an outage that according to the SCADA information, should have been included.

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SKM recommends that the SCADA summary data be used as the basis of future performance reports by Pacific Hydro Pty Ltd.

Appendix A Documents Reviewed

In undertaking this assignment, SKM was provided with and reviewed the following documents:

- Network Quality and Reliability Of Supply - Annual Report 2005/6: Pacific Hydro Pty Ltd;
- Western Australian "Electricity (Network Quality and Reliability) Code 2005;
- Power Station Log – Ord Hydro Pty Ltd dated 27 February 2007 prepared by Mick Hanns
- Extracts from the PPA between Ord Hydro Pty Ltd and Argyle Diamond Mine
- Extracts from the PPA between Ord Hydro Pty Ltd and Western Power
- Western Power Corporation Power Purchase Agreement Annual Reconciliation 2005/06
- Western Power Corporation Power Purchase Agreement Annual Reconciliation 2004/05
- Argyle Diamonds Power Purchase Agreement Block Reconciliation16/10/04 – 15/04/2005
- Ord Hydro Pty Ltd Monthly Operations Log – July 2006
- Ord Hydro Pty Ltd Monthly Operations Log – December 2006
- Ord Hydro Pty Ltd Monthly Operations Log – January 2007
- Ord Hydro Pty Ltd, 2006/07 Energy Sales
- Correspondence between Ord Hydro Pty Ltd and Argyle Diamond Mines Pty Ltd dated 11 April 2005 regarding reconciliation of of electricity supply
- Undated correspondence between Ord Hydro Pty Ltd and Porizon Power regarding the flooding of the Ord Hydro Power station
- SLD's of the Argyle Diamond Mines's 132kV switchyard;
- SLD of the Ord Hydro Project HV System;
- SLD of the Kununurra 132 kV switchyard;
- SCADA CSV file of daily event log for the period 01/01/2005 30/06/2006 with the exception of the period 9 February 2005 to May 24 inclusive (many reviewed);
- Energy & Control Systems Pty Ltd report "SCADA Event Data description – 13 March 2007"
- Energy & Control Systems Pty Ltd report "SCADA Event Data description – 14 March 2007"
- Ord Hydro Pty Ltd - various Faxed reports "Notification of Interruption between 14 January 2002 and 1 October 2006 (many reviewed);
- Spreadsheet: Appendix A provided by Pacific Hydro Pty Ltd
- Spreadsheet: SUMMARY.csv
- Spreadsheet: SUMMARY2.csv