ABN 20 009 454 111

Audit Report

Horizon Power
2017 Network Quality and Reliability of Supply Performance Audit - Operation of Compliance Monitoring Systems

August 2017

Qualeng
Level 2, 231 Adelaide Terrace, Perth, Western Australia, 6000

executive summary

Under the Electricity Industry (Network Quality and Reliability of Supply) Code 2005 (the **Code**), Division 3, Section 26, Horizon Power is required to arrange for an independent audit of the operation of the systems that are in place to monitor its compliance with Part 2 of the Code or an instrument made under Section 14(3). In June 2017 Horizon Power commissioned Qualeng to carry out the audit in respect of the operation of its systems to cover the period 1 July 2016 to 30 June 2017.

Horizon Power supplies electricity services to 38 systems consisting of 32 Non-Interconnected (or islanded) Systems in regional towns and remote communities, three systems (Kununurra, Wyndham and Lake Argyle) connected through a transmission network in the East Kimberley, two rural systems associated with Esperance and Hopetoun, and the North West Interconnected System (**NWIS**) in the Pilbara. These systems supply the Kimberley, Pilbara, Gascoyne, Mid West and Southern Goldfields regions. In addition to its own power generation plant, Horizon Power also purchases electricity from third parties.

The audit was conducted between July and August 2017 and included:

- review of actions resulting from previous audit recommendations;
- identification and review of supporting documents;
- interview of key personnel;
- review and reporting on the evidence, data, reports and processes demonstrating the operation and performance of the systems.

The previous audit (2016) had found:

- no Code non-compliances;
- five Opportunities for Improvement (**OFI**), resulting recommendations were all actioned by Horizon Power during the audit period, some of the actions are still in progress;
- one observation was made in regard to an earlier long term non-compliance that was investigated by Horizon Power in the previous audit period (July 2015 to June 2016) without finding an effective solution, no further recommendation was recorded in the previous audit.

Horizon Power undertook actions in the audit period to address OFIs raised on Quality of (Electricity) Supply (**QoS**) and outage notifications. The actions included:

- The development of improved Power Quality (**PQ**) investigation procedures which make reference to QoS requirements of the Code;
- Deployment of improved meters capable of:
  - faster disconnection and reconnection;
  - measurement of PQ parameters specified in the Code;
- A pilot program of PQ testing which has been carried out in Broome to check compliance with the Code;
- A Business Case is under development to seek funding approval for implementation of the improvement program that will bring the operation into compliance with the Code.

In regard to outage notification:

- Two new guides have been prepared: the "Planned Outage Guide POF" and the "Planned Outage Guide EO" detailing the improved notification process;
- The process is being rolled out to all Horizon Power regions and uses SMS mobile phone messaging, e-mails and optionally, letters to a set template. Contact records are created through the application of the process and can be used to demonstrate compliance with the Code.

Some of the actions are still in progress.

Horizon Power has a number of systems that monitor its performance against the requirement of the Code:

- Monthly Asset Management Reports publish performance data in respect of power quality, supply interruptions over 12 hours, where frequency of interruptions is over 16 per customer per year, planned outages over 4 or 6 hours and duration of interruptions per customer over 4 years;
- Horizon Power currently relies on customer complaints to identify electricity supply quality issues;
- "Power Quality Investigations" deal with incidents and customer complaints due to electricity supply quality issues;
- the Trouble Call System (**TCS**) is used to manage and monitor faults through the SCADA system, customer calls and fault detection by field crews;
- customers with special health needs are registered and identified in the system;
- there are procedures for notification of planned outages; monitoring of the compliance of the notification process has been relying on customer complaints, this is being replaced by a system originally in use in Esperance as noted above;
- alternate power supplies are available to mitigate interruptions;
- remedial projects are initiated where regional systems are not performing.

Two observations were made in this audit, as improvement actions are already in progress

no non-compliance was recorded:

- Monitoring of compliance with the Code electricity supply quality requirements has relied on customer complaints to identify possible issues. This approach does not provide sufficient evidence to show 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 of the Code" (Code section 5(1)).

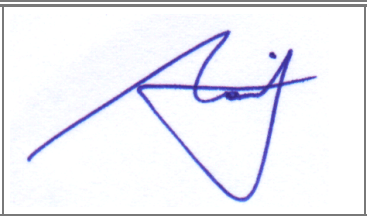
  In order to address this issue, during the audit period, Horizon Power investigated best industry practices and adopted a comprehensive plan to ensure compliance with the Code. A Business Case is to be prepared to define the development plan and analyse its costs and benefits.
- Monitoring of compliance of the notification process used to rely on customer complaints, this is being replaced by a system originally in use in Esperance which employs SMS mobile phone messaging, e-mails and optionally, letters to notify customers. Contact records are created and provide evidence of notification.

At the conclusion of the audit Qualeng has concluded that Horizon Power has made a thorough and concerted effort to review the requirements of the Code and improve its methodologies and operation in line with the findings of the previous audit. There have been actions on all of the OFIs and the single observation identified in the previous audit.

Based on the scope of the audit defined in section 26 of the Code and except for the observations noted above for which actions are in progress, the audit has found that the operation of Horizon Power's systems which monitor compliance with the requirements of the Code, was in compliance with the requirements of Part 2 of the Code, "Quality and Reliability Standards".

This report is an accurate representation of the findings and opinions of the auditors following the assessment of the client's conformance to nominated conditions. The report is reliant on evidence provided by other parties and is subject to limitations due to the nature of the evidence available to the auditor, the sampling process inherent in the audit process, the limitations of internal controls and the need to use judgement in the assessment of evidence. On this basis Qualeng shall not be liable for loss or damage to other parties due to their reliance on the information contained in this report or in its supporting documentation.

Approvals

Representation	Name	Signature	Position	Date
Auditor:	M Zammit		Lead Auditor / Projects Director, Qualeng	3/08/2017

Issue Status

Issue No	Date	Description	Approved
1	2/8/2017	Final Issue	MZ
2	3/8/2017	Revised section 3.2.4, sub-sectn “Remediation’	MZ

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1 Objectives and Scope of Audit

1.1 Introduction

Horizon Power has an Electricity Integrated Regional Licence (EIRL2) (the **licence**) issued by the Economic Regulation Authority (the **Authority**) under Sections 7 and 15(2) of the Electricity Industry Act 2004 (WA) (the **Act**). Under the scope of the licence Horizon Power supplies electricity to approximately 100,000 residents and 10,000 businesses, including major industry. The services are provided to over 47,000 customer connections to an area of approximately 2.3 million square kilometres extending from the Kimberley in the North to Esperance, Norseman and Hopetoun in the South and including the Kimberley, Pilbara, Gascoyne, Mid West and Southern Goldfields regions in Western Australia.

Services are provided through 38 systems including 32 Non-Interconnected (or islanded) Systems in regional towns and remote communities, three systems (Kununurra, Wyndham and Lake Argyle) connected through a transmission network in the East Kimberley, two rural systems associated with Esperance and Hopetoun and the North West Interconnected System (**NWIS**). In addition to power generating plant in Carnarvon, Marble Bar, Nullagine, Kununurra and Wyndham, Horizon Power also owns generating plant that is managed by a third party and purchases electricity from third parties.

Under the terms of the Act Horizon Power is required to comply with the Electricity Industry (Network Quality and Reliability of Supply) Code 2005 (the **Code**). In accordance with Division 3 "Performance reporting", Section 26 "Annual report on monitoring systems" of the Code, Horizon Power is required to arrange for an independent audit of the operation of the systems that are in place to monitor its compliance with Part 2 of the Code or an instrument under Section 14(3).

In June 2017 Horizon Power commissioned Qualeng to carry out the Audit to cover the period 1 July 2016 to 30 June 2017.

The audit has been conducted and this report prepared in accordance with the Code.

1.2 Audit Objectives

The purpose of the Network Quality and Reliability of Supply (**NQRS**) audit is to assess and report on the operation of the systems implemented by the licensee to monitor its compliance with Part 2 of the Code or an instrument under section 14(3).

1.3 Audit Scope

Part 2 of the Code includes 4 Divisions:

1. Division 1, "Quality Standards" for compliance with requirements for quality of supply at the point of connection to the customer, in regard to voltage fluctuations and harmonic distortion.
2. Division 2, "Standards for the interruption of supply to individual customers" provides for the maintenance of supply and management of interruptions to customers, both in terms of the duration and number of interruptions. It includes for:
   - 2.1. Provision of supply with the minimum number and duration of interruptions.
   - 2.2. Consideration of providing alternative supply if the interruption is expected to be significant, its effect substantial or if the customer has special health needs that require continuous supply.
   - 2.3. Allowing planned interruptions if the customer is notified within a suitable time and where the duration does not exceed 6 hours, or 4 hours for temperatures over 30 C or north of the 26th parallel.
   - 2.4. Provides for the distributor to remedy the causes of interruptions or enter into alternative arrangements if the supply has been interrupted more than 12 hours continuously or more than 16 times in the prescribed 12 months and it is considered that the prescribed standard is unlikely to be met for the customer.
3. Division 3, "Standards for the duration of interruptions of supply in particular areas" provides that the average length of interruptions should not exceed 290 minutes in any area of the State, other than the Perth CBD and urban areas and 160 minutes for urban areas other than the Perth CBD (calculated as average of the yearly averages over 4 years).
4. Division 4, "Variations of obligations under this Part" provides for:
   - 4.1. review and approval by the Minister of alternative requirements and
   - 4.2. agreement between the transmitter/distributor and the customer of extensions and modifications to the standards.

The audit was carried out between July and August 2017.

On Horizon Power's behalf the following representatives participated in the audit, contributed to sourcing the documentation and providing evidence to the audit:

- Lorrie Di Cicco, Asset Services Delivery Review Manager (PSS);
- Layton Baker, Regional Manager Esperance;
- Peter Oldfield, Asset Manager Esperance;
- Noel Moyo, Asset Manager Port Hedland;
- Simon Duggan, System Manager (PSS);

- Gerald Chow, Data Management Officer (PSS);
- Steve Rose, Contract Electrical Engineer;
- Terry Absolon, Manager Customer Service.

The main auditing team members were Mr M Zammit, Lead Auditor and Mr S Campbell, Reviewer.

1.4 Audit Methodology

The audit followed in part the methodology defined in the Authority's "Audit and Review Guidelines: Electricity and Gas Licences", April 2014 including:

- preparation of an audit plan and risk assessment for Qualeng internal control;
- fieldwork; and
- reporting.

The audit proceeded through a documentation review, meetings and checks of processes. These were supported by additional queries to clarify aspects of Horizon Power policies and procedures.

1.5 Limitations and Qualifications

An audit provides a reasonable level of assurance on the effectiveness of control procedures, however there are limitations due to the nature of the evidence available to the auditor, the sampling process inherent in checking the evidence, the limitations of internal controls and the need to use judgement in the assessment of evidence.

1.6 Acronyms and Abbreviations

Abbreviation	Description
CAIDI	Customer Average Interruption Duration Index (ie. Duration of each interruption per customer over the year)
Code	Electricity Industry (Network Quality and Reliability of Supply) Code 2005
DNAR	District Network Access Request
ENMAC	Electricity Network Management and Control
EO	Electric Office
HP	Horizon Power

Abbreviation	Description
HPCC	Horizon Power Control Centre
HV	High Voltage
LS	Life Support
LV	Low Voltage
NQRS	Network Quality and Reliability of Supply
NWIS	North West Interconnected System
OBS	Observation
POF	Power on Fusion
PQ	Power Quality
PQI	Power Quality Investigation
PQIH	Power Quality Investigation Handbook
PQIM	Power Quality Investigation Manual
PSS	Power System Services
QoS	Quality of Supply (as defined in the Code)
SAIDI	System Average Interruption Duration Index (ie. total interruption duration per customer over the year)
SAIFI	System Average Frequency Index (ie. average number of interruptions per customer over the year)
SCADA	Supervisory Control and Data Acquisition
SWIS	South West Interconnected System
TCS	Trouble Call System
THD	Total Harmonic Distortion

2 Licensee's Response to Previous Audit Recommendations

2.1 Background

The previous quality and reliability of supply audit was completed in September 2016. This section reviews Horizon Power's progress on that audit recommendations as well as Horizon Power's planned actions to address any outstanding issues.

The recommendations arising from the previous report and the confirmation and status of actions determined in this audit have been summarised in the following table.

2.2 PROGRESS OF ACTIONS FROM 2016 AUDIT

The following table lists the recommendations made in the 2016 Audit and records progress of any actions.

Item No	Code Ref	Requirement	Findings	2016 Recommendations and Opportunities for Improvement	Status
		Systems to monitor compliance with:			
1	Div 1, Sec. 5 - 7	**Quality and Reliability standards, voltage fluctuations, harmonics:** A transmitter and a distributor must, so far as is reasonably practicable, ensure that electricity supplied by the transmitter or distributor 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 including voltage fluctuation (flicker) and harmonics.	The "Power Quality Investigation Handbook" is a high level procedure on how to follow the process for "power quality" investigations. It lists applicable legislative and regulatory requirements, however it makes no reference to the Network Quality and Reliability of Supply (**NQRS Code** or **Code**). Horizon Power documentation should provide guidance to testing and investigations related to network quality, including for compliance with the Code Quality of Supply (**QoS**) standards.	**1/2016.** (**OFI**) There must be guidance, in Horizon Power documents, for electricity supply quality investigations to examine the compliance with the Quality of Supply (**QoS**) compatibility limits of the Code (Those limits have been set to prevent damage to customer equipment and there should be more awareness of the requirements). Where legislation and regulations are listed, the Code should be included.	A review and update of the PQI Handbook has been undertaken: • Reference to the Network Quality and Reliability of Supply (**NQRS Code** or **Code**) has been included. Reference to the Code has also been included in the PQI Manual. Horizon Power has taken a concerted approach to address the monitoring of QoS, in particular: • there has been an in depth review of industry practices, both in WA and interstate; • solutions have been sought from research bodies to suit Horizon Power's network; • meters that are suitable for measuring flicker and

Item No	Code Ref	Requirement	Findings	2016 Recommendations and Opportunities for Improvement	Status
					harmonics are being deployed; • reactive PQ monitoring has been commenced in Broome. **CLOSED**
2			The process provided by the Flicker Allocation Manual and the Harmonics Allocation Manual does not include for testing or monitoring a customer installation. Customers installations not meeting the allocated limits may then affect other customers supplies in breach of the requirements of the Code.	**2/2016.** (**OFI**) Review and update the process and documentation to ensure compliance with the Code.	The testing and monitoring of customer installations has been included in the PQI Manual. **CLOSED**
3			The procedures for the measurement of electricity supply quality in the field, in terms of voltage fluctuations (flicker) and harmonics, do not have sufficient details to instruct or guide the field crews	**3/2016.** (**OFI**) Document a procedure for measurement of electricity supply quality in the field, to comply with the QoS Code requirements.	Procedures for the measurement of electricity supply quality in the field, in terms of voltage fluctuations (flicker) and harmonics, including operational limits, causes, effects and solutions, have been included in the PQI Manual. **CLOSED**
4			There was insufficient evidence to show that the monitoring process	No recommendations made.	There has been a concerted approach to address this issue: • Engagement with the

Item No	Code Ref	Requirement	Findings	2016 Recommendations and Opportunities for Improvement	Status
			implemented by Horizon Power ensured that electricity supplied to a customer's electrical installations, as measured at the point of connection of those installations to the network, at all times complied with the standards prescribed by sections 6(2) and 7 of the Code. No records were available of flicker or harmonics measurements at customers connections. No evidence was available to show that incidents investigated had been analysed for flicker or harmonics compliance. during the audit.	A recommendation was open since the 2011-12 period to provide monitoring of compliance of electricity supply quality in respect of flicker and harmonics at customer connections. Horizon Power has assessed options and concluded that at this point solutions are too costly.	University of Wollongong Australian Power Quality & Reliability Centre to provide a guidance report for the development of a PQ monitoring program. This investigative process has resulted in the following: • Development of a staged roll-out for a proactive PQ analyser program, being: ▫ Stage 1 – 1 device to each MV distribution bus (~22 total); ▫ Stage 2 – Assessment of Stage 1 leading to devices to ~1% of distribution transformer LV terminals; ▫ Stage 3 – Assessment of Stage 1 & 2 leading devices to ~1% to end of LV feeders; • Development of a reactive PQ program, being: ▫ Develop the HP PQ Investigation Manual; ▫ Deployment of PQ analysers to regions (~10-12 devices) for customer initiated investigations

Item No	Code Ref	Requirement	Findings	2016 Recommendations and Opportunities for Improvement	Status
					• Business Case Part A is under development to seek funding approval for implementation. **CLOSED**

5			• Conclusions from incident testing are not clear in the available documentation:
			  • Incident INCD-12001-v resulted in the comment: "loggers to be installed ASAP". Loggers were installed and incident closed however there was no update on the causes of the incident and closure of the incident was recorded but results were not evident;
			  • 4 causes were noted as "Unknown"
			  • 1 cause was shown as "Undefined".
				4/2016. (**OFI**) The process for incident investigation and monitoring of the incident logging process needs to be strengthened:
				  • the follow-up/recording system needs to be improved so that there is clear understanding of causes and reasons for closure of incidents.
					The PQI Handbook procedure has been reviewed to:
					• include for the saving of PQ investigation data and results report;
					• include updating the TCS Fault Report comments with PQ investigation findings;
					• align with the Asset Management Plan (**AMP**).
					CLOSED

6	Div 2, Sec. 11	**General standard of reliability** System to monitor compliance with: • maintaining the supply with a minimum number and	• The system monitoring that notifications are sent to customers 72 hours prior to outages relies on customer complaints for highlighting non-compliance. As	**5/2016.** (**OFI**) The process of monitoring adherence to the process of notification should be strengthened through the annual internal	A customer notification process has been developed based on the Esperance region methodology and documented in two guides: the "Planned Outage Guide POF" and the "Planned Outage

Item No	Code Ref	Requirement	Findings	2016 Recommendations and Opportunities for Improvement	Status
		duration of interruptions. • providing 72 hour advance notification of planned interruptions.	indicated by outage complaint figures this is not an effective measure of compliance. Except for the Esperance office, there is insufficient evidence to show that the system implemented to provide notifications at least 72 hours before each planned outage is monitored effectively.	auditing of a sample of work packages, where some regions may be reviewed on a random rotational basis.	Guide EO". The process is being rolled out to all Horizon Power regions. The process uses Power on Fusion to gather the customer contact information, then MS Outlook to send electronic customer notifications. These notifications are retrievable from Outlook for compliance with the Code requirements. **CLOSED**

3 Key Findings

3.1 System to manage compliance with Part 2, Division 1, Quality Standards (sec. 5 to 8)

Requirement: The Licensee is required to have systems in place to monitor compliance with:

- quality of supply requirements of the electricity supply at the point of connection to the customer, both in terms of voltage fluctuations (flicker) and harmonic distortion and
- disconnection of customer where there is a possibility of damage to the customer installation.

3.1.1 Quality of Supply - System/Process (sections 5 - 7)

The audit had found that there has been a change in Horizon Power's approach to monitoring the quality of electricity supply (**QoS**) leading in an improvement in the way QoS is monitored and controlled.

Through interviews of staff and review of documentation the audit found that:

- there is a process for monitoring power quality issues, the process relies on the customer making a call to Horizon Power Call Centre and the Call Operator recording the call or complaint as a Power Quality (**PQ**) incident, the process then follows a fault finding process in the field which fixes the fault and in most cases identifies the cause of the incident;
- this process is being revised to improve the compliance with the Code requirements, this has been done through:
  - the creation of a new document, the Power Quality Investigation Manual", (**PQIM**) , number HPC-5DG-07-0001-2017, and the updating of the "Power Quality Investigation Handbook" (**PQIH**) both of which address compliance with the Code;
  - the introduction and use of meters that have the capability of measuring flicker and harmonics in accordance with the Code;
  - there is higher staff awareness of Code requirements.

Documents have been prepared or revised to control the monitoring process and are now at stakeholder review and sign-off which are due to be completed on 28 July 2017:

- The PQIH contains the process flows, procedures and business rules that control the business in relation to the Power Quality Investigation (**PQI**) process, including the tasks and responsibilities of functions and departments inside the business and the integration of data for consistency across the systems of Horizon Power. The PQIH has been updated recently and is at final sign-off stage.
- The PQIM records the procedure for investigating customer notified power quality issues. It

includes information on:

- how to approach any investigation;
- the legislation and applicable limits;
- equipment that should be used;
- the procedure for testing;
- how to assess the results;
- a number of PQ cases, symptoms, possible causes and solutions.

Steps that Horizon Power takes to manage and monitor the operation of the system in terms of the quality of supply:

- before connecting large customers and customers with disturbing loads, a calculation is performed to determine whether voltage fluctuations at the customer connection will exceed a set limit which ultimately would result in fluctuations in excess of the Code limits, the process is referred to in the PQIM;
- PQ incident data is reported in monthly "Asset Management Reports" (**AMR**) which are published on Powerlink, Horizon Power's dashboard. The data includes all types of power quality data, of which QoS (as specified in the Code) is a component;
- Spreadsheet “0382 AMR Quality PQI Complaints” lists incidents that have been investigated.

At this point the process is still driven by customer complaints, so that the process is reactive and customers are the primary source for monitoring power quality.

A number of non conformances and opportunities for improvement had been raised in the past in regard to the process. This audit has noted that a proactive approach has been adopted by Horizon Power for monitoring power quality across the network. In brief the main actions that have been undertaken include:

- in depth review of industry practices, both in WA and interstate;
- solutions have been sought from the University of Wollongong to suit Horizon Power's network;
- meters that are suitable for measuring flicker and harmonics are being deployed;
- reactive PQ monitoring has been commenced in Broome;
- a Business Case is in preparation to address the implementation of a plan for addressing QoS and install permanent metering with suitable capability where necessary.

Evidence of Voltage Fluctuation (Flicker) and Harmonic Distortion Measurement and Monitoring

Discussion with the Asset Manager - Port Hedland showed that PQ Investigations are performed in response to customers PQ complaints:

- Once a complaint is received and is assessed as a PQ fault job, it is recorded in the Trouble Call System (**TCS**) and a fault type code allocated by the call centre operator;
- One investigation was reviewed, showing that there had been an investigation in response to a customer complaint. The testing was carried out between January and February 2017, starting on the 17 January. The meter traces did not show any anomaly and a meeting was held with the customer to explain the results of the test;
- A 0382 AMR Quality Complaint was investigated in Karratha as a “Voltage Fluctuation” in August 2016, (INCD 22551-v of 19/8/2016). All connections were checked and data logger installed. No issues were found and the customer made aware of the findings through a meeting. Incident was closed in October 2017;
- in Broome the first set of direct in field monitoring was carried out, the audit sighted recordings for:
  - Kanagae North, between 15/3 and 22/3/2017;
  - Planigale TX, between 7/2 and 13/2/2017;
  - Robinson East, between 27/3 and 6/4/2017.

The audit has made the following observation:

- The new system process documented in the PQI Handbook and the PQI Manual is designed to provide the monitoring of QoS, which will determine compliance of the electricity supply with the requirements of the Code. At this point the delivery of the program is still in progress and will be subject to a Business Case submission for full implementation.

3.1.2 Duty to Disconnect if Quality of Supply may Lead to Damage (section 8)

Horizon Power has procedures in place documenting the process of disconnections:

- The PQI Handbook contains procedures for the field crews to disconnect customer electrical connections when the customer's electrical equipment is found to be faulty in accordance with the Technical Rules;
- Field instructions are available for the isolation of faults and the disconnection of customer electrical equipment when it is found to be faulty.

No instances were found of customer installation being disconnected because of QoS.

3.1.3 Summary of electricity quality of supply monitoring findings

The following findings have been made on the operation of systems, processes and practices dealing with monitoring the quality of supply:

Table 1: Systems to monitor compliance with requirements for quality of supply

Site	Flicker (Pst < 1.0; Plt < 0.8)	Harmonics (THD < 8%)	Customer Complaints or Faults Related to PQ
All	▸ Reactive system. Initial measurements available from pilot test program in Broome.	▸ Reactive system. Initial measurements available from pilot test program in Broome.	None of the PQ Incidents or customer complaints were assessed as electricity supply quality incidents related to the Code.

Findings:

No non-compliance findings were made.

One observation was recorded:

- The new process documented in the PQI Handbook and the PQI Manual is designed to provide the monitoring of QoS and assess compliance of the electricity supply with the requirements of the Code. At this point the delivery of the program is still in progress and will be subject to a Business Case submission for full implementation.

3.2 System to manage compliance with Part 2, Division 2, Standards for Interruption of Supply

The Licensee has to comply with requirements for the management of interruptions to customers, both in term of the duration and number of interruptions. The requirements are for the Licensee to:

- Maintain the supply with the minimum number and duration of interruptions.
- Reduce the effects of interruptions; provide alternative supply if the proposed interruption is expected to be significant, its effect substantial or if the customer has special health needs that require continuous supply.
- Ensure that where interruptions are planned, where practicable the customer is notified within a suitable time and the duration does not exceed 6 hours, or 4 hours for temperatures over 30 C or north of the 26th parallel.
- Remedy the causes of interruptions or enter into alternative arrangements if the supply has been interrupted more than 12 hours continuously or more than 16 times in the prescribed 12 months and it is considered that the prescribed standard is unlikely to be met for the customer.

3.2.1 Maintain the supply with a minimum number and duration of interruptions (Sec. 9)

Requirement: The licensee must establish systems to monitor compliance with the requirement to ensure, so far as is reasonably practicable, that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum.

Horizon Power has systems and procedures in place to monitor that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum. Through discussions with the Asset Services Delivery Review Manager, the Data Management Officer and review of documentation the audit has found that:

- monitoring of supply to customers it tracked via key performance indicators on interruptions, such as SAIDI, SAIFI and CAIDI[1] over the period, which are published in monthly AMRs; the AMRs show:
  - reliability data (SAIDI, SAIFI and CAIDI) reported against prescribed limits;
  - non-performing feeders identifying transmission and distribution lines that under-perform compared to targets;
  - statistics for long duration interruptions and where customers are interrupted more than the prescribed limit.
- the reports data is polled from information recorded in the TCS system and entered into Horizon Power's work management system Ellipse.

1 ie. the average total duration of outages for each customer served, the number of interruptions that a customer experiences and the average length of each interruption per customer respectively

- there is a process for analysing the data reported and identifying assets and causes of poor performance. The analysis leads to the definition of projects aimed at fixing those area and improving the operation of the network;
- Annual Reports outline the projects selected to improve quality and reliability of supply;
- Contingency plans such as the "Esperance Network Contingency Plan" and the "Pilbara Network Contingency Plan" provide the information to assist in the restoration of power supplies in emergencies. These plans are used in conjunction with Crisis Management Plans which include strategies for mitigation of loss of supply.

In addition:

- the "Asset Management Policy", "Asset Management Strategy and Systems" and the "Asset Management Plan" outline the process and systems that are used to maintain and minimise customer interruptions to a minimum;
- the "Critical Customer Procedure (HP_3159928)" defines customer categories which enable the prioritisation of electricity supply to critical customers;
- Horizon Power is relying on social media to increase interaction with customers;
- on-call availability officers are available in regional offices to facilitate customer contact.

Summary:

Table 2: Systems to monitor compliance with requirement to maintain supply and to maintain the occurrence and duration of interruptions to a minimum

Site	Procedures dealing with outages	Systems and Procedures monitoring performance
All	Yes	Yes

3.2.2 Reduction of effects of interruptions and provision for alternative supplies for proposed interruptions (Sec. 10)

Requirement: The licensee must establish systems to monitor compliance with its duty to reduce the effect of any interruptions, consider providing alternative supply for proposed interruptions if the interruption is greater than 4 or 6 hours, or there is a substantial effect on the business or there are special health needs customers.

Reduce the effect of any interruptions

As reported at section 3.2.1 Horizon Power has systems and procedures in place to monitor that the supply of electricity to a customer is maintained and the effect of any interruptions is kept to a minimum. Through discussions with the Asset Services Delivery Review Manager, Data Management Officer and review of documentation the audit has found that:

- monitoring of supply to customers it tracked via interruption key performance indicators such as SAIDI, SAIFI and CAIDI published in monthly AMRs;
- the AMRs also report:
  - data on non-performing feeders identifying transmission and distribution lines that under-perform compared to targets;
  - statistics for long duration interruptions (interruptions over 12 hours) and where customers are interrupted more than the prescribed limit (more than 16 interruptions per year);
  - the number of planned outages over 4 or 6 hours duration (as applicable) by region compared to the previous period;
  - the number of outstanding Incidents over 7 day old in TCS;
- there is increased use of social media to connect to the community and receive feedback on performance;
- an on-call officer is available in districts such as Esperance to improve communication with customers;
- contingency plans and a crisis management plans are available to reduce the effect of interruptions on customers;
- work activities are subject to regular review by the Asset Managers who set the timeline for activities to be completed; regular meetings ensure that the progress of tasks is monitored and that staff is made aware of the timeline;
- From August 2017 AMRs will have live data which will allow more accurate reporting.

Statistics were generally comparable to the previous period. Once the effect of events outside of Horizon Power control were removed from the SAIDI figures the performance of the 2016-17 period was better than the previous period.

There was a significant improvement in the closure of incidents year on year.

Provision of Alternative Supply, Special Health Needs Customers and Commercially Sensitive Loads

There is a system for monitoring that the supply to critical customers such as businesses and Life Support Customers is maintained or appropriately managed when outages occur.

Discussion with Horizon Power's staff showed that outage procedures include mitigation of the interruption through:

- using alternative electricity supply, such as using alternative feeders;
- using Independent Power Providers (**IPP**) or
- mobile equipment to provide alternative power generation.

Through interviews of Horizon Power's staff in regard to the management of Life Support Customers the audit found that:

- there is a documented process (as shown in the "Customer – C9.8 Life Support Customers" work flow) for registering customers in need of Life Support on the basis of doctor confirmation. Life Support (**LS**) Customer information is reviewed to ensure that new customers are added to the 'Life Support' Register. Advice of changes to the list is then circulated to all stakeholders;
- a process ensures that outage planning includes the task of tracing the network branch that will be isolated and checking for LS Customers that will be affected;
- District Network Access Request (**DNAR**) are used to check if "Critical or Sensitive" customers are affected by the outage.
- LS customers are contacted by telephone to ensure that they will be able to have continuous electricity supply or make alternative arrangements;
- notifications are sent out on three days advance notice as a minimum, either by SMS text messaging, e-mail or carded, some of the notifications may be by telephone call and are repeated until contact is made;
- applicable website is updated with details of outages;
- the "Critical Customer Procedure" defines critical customers on a sliding scale matrix, starting with "Very Critical" Customers, such as Major Hospitals and Sewerage Treatment Plants, rated as category C1 and requiring longer advance notification of an upcoming outage. Special Health Needs Customers are also identified in the procedure.

Summary

Table 3: Systems to monitor compliance with duty to reduce the effect of interruptions and provide alternative supply for planned interruptions

Site	Reduce the Effect of Interruptions	Alternative Supply	Special Health Needs Customers
All	Yes	Yes	Identified

3.2.3 Planned interruptions acceptable if less than 4 or 6 hours and if notified (Sec. 11)

Requirement: The licensee must establish systems to monitor compliance with the requirement to maintain planned outages not exceeding 4 or 6 hours and providing notifications at least 72 hours before each planned outage.

Horizon Power has a system to manage and monitor planned outages and advance notification of those outages.

Planned Outages Not Exceeding 4 or 6 Hours

Through review of documentation and interviews of the Asset Services Delivery Review Manager and the Asset Manager Port Hedland and Asset Manager Esperance the audit found:

- work activities are subject to regular review by the Asset Managers who set the timeline for activities to be completed; regular meetings ensure that the requirements are understood, that the progress of tasks is monitored and that staff is made aware of the activity timeline;
- the “Project Tracking Sheet for Pilbara” was examined showing the list of projects that are tracked with the Delivery Teams, the timeline includes the date for card drops to be done, if applicable;
- compliance with the planned outage duration requirements of the Code is monitored in monthly updates of AMRs, in data provided by the "0387 AMR Planned Outages Outside Charter" report which lists outages exceeding 4 or 6 hours per town and District, as totals and individually by outage;

Over the audit period the number of “Planned Outages Outside of Charter” (exceeding 4 or 6 hours) were slightly higher than last year's total (116 in 2016 - 2017 compared to 100 in the previous period).

Planned Outage Notifications

Horizon Power has implemented improvement actions to strengthen the process of customer notification of planned outages. Previously the systems relied primarily on customer complaints to identify non-compliance. The improvement in the process has been achieved through the following actions:

- development of reference guides for the management of customer notifications, these include:
  - Planned outage - Customer Notification Reference Guide POF Version”, (POF = Power On Fusion)
  - Planned outage – Customer Notification Reference Guide EO Version”, (EO = Electric Office);
- implementation of the new notification process.

The notification process is supported by the “Critical Customer Procedure” which defines the critical customers in a sliding scale matrix, starting with “Very Critical” Customers such as Major Hospitals, Sewerage Treatment Plants, as the top rated category which requires longer notification periods

Through examination of the new procedures and discussions with the Asset Managers and Asset Services Delivery Review Manager the audit found that:

- the new guides describe the entire process for preparation for a planned outage and recommend that up to 2 notifications are to be provided to each premise subject to a planned outage by means of:
  - an SMS notification preferably, or an e-mail if mobile phone information is not available;
  - optionally a standard Australia Post letter on the “Planned outage notification template letter”;
- the guides are supported by the “Planned Outage Impact Qlikview Report”;
- forms are used to advise appropriate departments of impending outage, the “Rural Outage Notification Request” and the “Town Works Notification Request” are in use in Esperance;
- an email is sent to the Corporate Communications team to inform them of the planned outage details so that impact map can be provided as well as listing of the impacted roads.

The audit examined examples of:

- “Planned Power Interruption” Forms (for East Pilbara), including a trace of the network to be affected by the outage which was extracted from Electric Office system. This system auto generates a list of meters and customers affected, including Critical Customers; Port Hedland is still using drop-cards for notifications, however it will switch to SMS and e-mail notification as per the new guides in the 2017-18 FY;
- “Rural Outage Notification Request” (for Esperance) which included the traceable list of customers contacted by SMS and by telephone call.

Summary

Table 4: Systems to monitor compliance with planned outages not exceeding 4 or 6 hours and providing notifications at least 72 hours before each planned outage

Site	Notification ≥ 72 hours prior	Duration ≤ 4h or 6h (as practicable)
All	▸ Guides have been released for the implementation of a new notification process across the network. At present there is still a mixture of 'carded' notifications and electronic notification using SMS telephone messaging, e-mails and optionally, letters. Esperance records of notifications are traceable. Action is in place to improve the monitoring of notifications in other areas.	Monitored 116 planned outages > 4 or 6 hours

Findings:

One observation was recorded:

- Action to improve monitoring of notification of customers, through SMS/ e-mails/ letter in line with Esperance Regional Office procedures, is in progress.

3.2.4 Significant interruptions (over 12 hours duration or more than 16) to small use customers (Sec.12)

Requirement: The licensee must establish systems to monitor compliance with the requirement to remedy the causes of interruptions or make alternative arrangements where significant interruptions (duration over 12 hours or more than 16 interruptions in the preceding year) occurred for small use customers and where the Licensee considers that the prescribed standard (9 years out of 10) is unlikely to be met.

The audit found that Horizon Power has a system for monitoring compliance with the requirements to monitor significant interruptions and remedy the causes or make alternative arrangements so that the prescribed standard is met.

Through review of documentation and discussion with the Asset Services Delivery Review Manager and

the Data Management Officer the audit found:

- monitoring of interruptions over 12 hours duration is performed through collecting data received in TCS and the work management system Ellipse. The data is analysed in spreadsheet reports and then reported in monthly AMRs;
- the AMRs report on:
  - SAIDI, SAIFI and CAIDI Fault by cause Chart;
  - data is collected in “0386 AMR Customers Affected” which reports on the customers interrupted for over 12 hours on a monthly basis, by district and Year to Date (**YTD**);
  - “0416 AMR Customers 16 Interruptions” reports on the customers interrupted over 16 times in the year by district and YTD;
- graphs displaying main modes of failures by month and YTD are displayed on the Horizon Power intranet;
- the Asset Service Delivery group reviews the data and analyses trends to determine faults and action plan for remediation of faults;
- an example of improvement has been the replacement of wooden cross arms with steel cross arms and use of 33 kV insulators, this has resulted in reduction of arching across the cross arms and consequent reduction of fires.

Horizon Power reports the end of year figures in the "Code report - Network Quality and Reliability of Supply". At the end of the audit period there were a total of 1663 premises interruptions over 12 hours compared to 681 in the previous period.

Over the audit period there were 106 instances of premises that experienced more than 16 interruptions compared to 268 in the previous period.

Remediation

One of the performance indicators reported in the AMRs is "Performing Systems". The AMRs have identified that there were 32 performing systems out of a total of 38 at the end of the audit period, an improvement over the 28 of the previous period.

Other performance indicators such as "Customers with more than 16 interruptions" and "Average Total Length of All Interruptions of Supply to Customer Premises" have also shown improvement while there has been a drop in performance for indicators such as "Supply Interruptions over 12 hours" and "Planned Outages Outside Charter.

There were a number of projects between 2016 and 2017 to improve the reliability and supply of electricity to customers including:

- upgrades in Kununurra back-up power station in November 2016, the back-up station is designed to automatically start generating power when there is an interruption in the supply from the IPP to significantly reduce the duration of generation outages at the primary power station;
- the advanced metering project, to automate meter reading, disconnections and reconnections, to provide faster reconnection and faster and improved fault identification.

In addition to the strategic programs of improvement, emergency responses and crisis management resulted in assessments of the effectiveness of the emergency actions including:

- identification of “lessons learnt”;
- good and poor aspects of the response;
- possible improvement actions.

Summary

Table 5: Systems for monitoring compliance with interruption duration not to exceed 12 hours

Site	2017 > 12 hours	9 Years out of 10 (≤ 12 hours)	Causes of Interruption Remedied / Alternative Arrangements
		Compliance	
All	1663 premises affected	Not available	Major causes were identified for interruptions > 12h. Main contributors to interruptions were identified and alternative arrangements implemented.

Table 6: Systems for monitoring compliance with interruption frequency not to exceed 16 per customer per period

Site	2017 > 16#	9 Years out of 10 (≤16#)	2016 > 16#	Causes of Interruption Remedied / Alternative Arrangements
		Compliance		
All	106 premises	Not available	268 premises	Major causes were identified; there is evidence of remediation.

3.3 System to manage compliance with Part 2, Division 3, Standards for the duration of interruption of supply in particular areas (Sec. 13)

Requirement: The licensee must establish systems to monitor compliance with the Code requirement to ensure that the average total length of interruptions per customer for the four years up to the current year for areas other than the Perth CBD do not exceed 160 minutes in urban areas or 290 minutes in any other area of the State.

There is a process for monitoring compliance with the requirement to ensure that the average length of interruptions to customer premises for the four years up to the current year does not exceed 290 minutes. The process uses the AMR reports to provide a continuous view over the performance of the entire network down to individual townships. The reports are published monthly, they include targets for each town which, if achieved, will result in compliance with the Code requirements.

The overall four year average is 338 minutes for the four years up to 30 June 2017, which is higher than the Code stipulates but an improvement over last year's figure of 359 minutes. The figure is inclusive of interruptions due to external factors outside of Horizon Power's control. The figure for the 12 month audit period is 234 minutes which is an improvement from the previous period figure of 284 minutes.

Horizon Power also calculates the length of interruptions per customer excluding major external events such as storms, cyclones, floods, fires, vehicle, vandalism etc and defines the resulting data as "Normalised Data". Horizon Power views the normalised data as a measure of network performance which is within its control. In this audit period the following major events occurred:

- fire at Fitzroy Crossing on 2 December 2016;
- flooding at Yungngora between the 23 and 27 December 2016;
- storms at Bidyadanga on 17 March 2017.

Once the external causes were removed from the audit period the duration of interruptions improved from 234 to 126 minutes (compared to last period figure of 199 minutes).

Summary

Table 7: Systems to monitor compliance with requirement for interruption not to exceed 290 minutes average per customer over 4 years.

Site	2017 (≤ 290 m)	4 Year Average (Avg over 4 years ≤ 290 min)
	For reference only	Figures have been calculated over 4 years up to 2017.
All sites	234	338

3.4 Provisions may be excluded or modified by agreement with customers (Sec 15)

Requirement: A customer and a transmitter or a distributor may agree in writing that a provision of this Part is excluded or modified in relation to the supply of electricity by the transmitter or distributor to the customer and the agreement must set out the matters that the parties consider are the advantages and disadvantages.

Horizon Power has developed an “Energy Supply Agreement for large enterprise customers” and established this agreement with a limited number of customers to manage and interrupt the supply, of necessary, in accordance with the agreement. This results in benefits to Horizon Power by allowing demand management and provides a financial benefit to customers.

4 Audit Summary and Recommendations

Under Section 26 "Annual report on monitoring systems" of the Code, Horizon Power is required to arrange for an independent audit of the operation of the systems that are in place to monitor its compliance with Part 2 of the Code. or an instrument under Section 14(3).

The audit has found that Horizon Power's systems monitoring compliance with Part 2 of the Code are in general compliance with the requirements of the Code.

The previous audit (2015 - 2016) resulted in no non-compliances, five "Opportunity for Improvement", five recommendation and one observations.

This audit (2017) has found that all the actions arising from the recommendations have been progressed satisfactorily and the recommendations have been closed.

Previous audits had found non-compliances and Opportunities for Improvement (**OFI**) both in respect of the Quality of Supply (**QoS**) and interruptions. The 2017 audit found that actions are in place to rectify or improve the current operation. In regard to QoS the following actions are in progress:

- Improved procedures making reference to QoS requirements of the Code;
- Deployment of improved meters capable of:
  - faster disconnection and reconnection;
  - measurement of Power Quality (**PQ**) parameters specified in the Code;
- A pilot program of PQ testing has been carried out in Broome to check compliance with the Code;
- A Business Case is under development to seek funding approval for implementation of the improvement program that will bring the operation into compliance with the Code.

In regard to the interruptions, there has been a change in the approach to customer notifications, using the process in place in Esperance as the basis for developing new guides and processes:

- Two new guides have been prepared: the “Planned Outage Guide POF” and the “Planned Outage Guide EO”;
- The process is being rolled out to all Horizon Power regions and uses SMS mobile phone messaging, e-mails and optionally letters to a set template. Contact records are created through the application of the process and can be used to demonstrate compliance with the Code.

The audit has found no non-compliances, two observations were made and are noted in Table 8 below which provides a summary of the findings and recommendations. The table rates the various element as complying (✔), non-complying (✖), actions in progress, observations or OFIs.

Throughout the audit it was evident that staff were aware of the Code requirements and there was commitment to improvement of the system compliance.

Based on the scope of the audit defined in section 26 of the Code, Qualeng has found that the system and processes within Horizon Power are in compliance with the requirements of Part 2 of the Code, "Quality and Reliability Standards".

Table 8: Systems Compliance Summary

Code Division, Section	Code Requirement	Evidence of System	Evidence of Process	Operation of the System ▸ Findings / Observations	Recommended Corrective Actions / Opportunities for Improvement (OFI)
	General system Systems monitoring compliance with the requirements of the Code.	✔	✔	Operation of the systems which monitor Horizon Power's compliance with the Network Quality and Reliability of Supply Code (the **Code**), satisfies the Code requirements except for findings of non-compliance reported below.	

Code Division, Section	Code Requirement	Evidence of System	Evidence of Process	Operation of the System ▸ Findings / Observations	Recommended Corrective Actions / Opportunities for Improvement (OFI)
Div 1, Sec. 5 - 7	System to monitor compliance with quality and Reliability standards: voltage fluctuations, harmonics.	✔	✔	System still relies on monitoring through customer complaints, however plans have been developed to monitor installations through new procedures, testing programs and equipment. This action is in progress and will be subject to a Business Case. The “Power Quality Investigation Handbook”, a high level procedure on how to follow the process for “power quality” investigations has been updated. It lists applicable legislative and regulatory requirements. The “Power Quality Investigation Manual” records the procedure for investigating customer notified power quality issues including information on equipment and on how to find causes of power quality faults and solutions. A Business Case is in preparation to address the implementation of a plan for addressing Quality of Supply (**QoS**) and install metering with suitable capability where necessary.	

Code Division, Section	Code Requirement	Evidence of System	Evidence of Process	Operation of the System ▸ Findings / Observations	Recommended Corrective Actions / Opportunities for Improvement (OFI)
				One observation was recorded: ▸ (**OBS**) The new process documented in the PQ Guides is designed to provide the monitoring of QoS and assess compliance of the electricity supply with the requirements of the Code. At this point the delivery of the program is still in progress and will be subject to a Business Case submission for full implementation.	
Div 1, Sec. 8	System to monitor compliance with duty to disconnect if damage may result due to electricity supply quality.	✔	✔	The PQI Handbook includes directions for the field crews to disconnect customer electrical connections when the customer's electrical equipment is found to be faulty Fault responses are documented. Field Instruction covers disconnection where fault is due to customer.	
Div 2, Sec. 9	System to monitor compliance with maintaining the supply and minimise the number and duration of interruptions.	✔	✔	Procedures and processes are in place to monitor and to attend to faults and interruptions and restore supply as early as possible. Monthly reports are in place to monitor compliance.	

Code Division, Section	Code Requirement	Evidence of System	Evidence of Process	Operation of the System ▸ Findings / Observations	Recommended Corrective Actions / Opportunities for Improvement (OFI)
Div 2, Sec. 10	System to monitor compliance with reduction of effects of any interruption and consideration of alternative supplies for proposed interruptions where it affects business or special health needs customers	✔	✔	Monthly reports are in place to monitor compliance. Priority of crews attending interruptions is to restore supply. Alternative supply is used to reduce the effect of interruptions. There is a formal system for monitoring and managing special health needs customers and critical customers.	
Div 2, Sec. 11	System to monitor compliance with length (less than 4 or 6 hours) and notifications for planned interruptions.	✔ ✔	✔ ✔	There is a system for monitoring length of proposed interruptions. Monthly reports are in place to monitor compliance. Planned outages lasting over 4 or 6 hours (as applicable) are reported and causes identified. The audit noted that during the audit period Horizon Power relied primarily on customer complaints to identify notification non-compliance. Horizon Power is implementing improvement actions to strengthen the process of customer notification of planned outages through “Planned outage - Customer Notification Reference Guides”. The process follows the Esperance Regional Office procedure and uses SMS, e-mail and letters where required. A document trail of customer contacts is created. ▸ (**OBS**) The audit noted that during the audit period Horizon Power relied	

Code Division, Section	Code Requirement	Evidence of System	Evidence of Process	Operation of the System ▸ Findings / Observations	Recommended Corrective Actions / Opportunities for Improvement (OFI)
				primarily on customer complaints to identify non-compliance of its notification system. Actions are in progress to improve the monitoring of the notification system by following the procedures of Esperance Regional Office.	
Div 2, Sec. 12	System to monitor compliance with limiting significant interruptions to small use customers (≤ 16 times or ≤ 12 Hours) and to provide remedial action where breaches occur.	✔	✔	A system is in place to monitor the number of interruptions greater than 12 hours or where the frequency of interruptions exceeds 16.	
		✔	✔	Remedial actions have been taken to remove some of the causes of major interruptions.	
Div 3, Sec. 13	System to monitor compliance with standards for the duration of interruption of supply in particular areas (≤ 30, 160, 290 min)	✔	✔	There are systems in place to monitor compliance. Monthly reports monitor the duration of interruptions. The average over four years is 338 min which is above the 290 min limit. Removal of major event days reduces the figure to acceptable levels which implies that external factors have affected Horizon Power's performance.	
Div. 4, Sec. 15	Systems to monitor compliance with provisions may be excluded or modified by agreement	✔	✔	Complies.	